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Adama Science and Technology University

Undergraduate Programs
Course Catalog

May, 2022
ASTU, Adama,
Ethiopia

We are dedicated to innovative knowledge!

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Introduction

1.1 Background of ASTU

Adama Science and Technology University (ASTU) has formulated a vision of being the first choice in Ethiopia and a premier center of excellence in applied sciences and technology in Africa by 2030. As a higher education institution, ASTU has set itself core responsibilities, with a focus on regionally and nationally relevant teaching-learning programs, problem-solving research projects, and community-based services. In recent years, the university has taken great strides towards establishing itself as an innovative university and accomplishing its institutional vision, missions, and values.

VISION

ASTU aspires to be the first choice in Ethiopia and the premier center of excellence in applied science and technology in Africa by 2030.

MISSION

M1: Produce ethical and internationally competent graduates in applied science and technology through quality education.

M2: Conduct problem solving research.

M3: Provide demand driven community service.

M4: Serve as center for innovative knowledge and technology transfer.

Towards this end, Adama Science and Technology University (ASTU) established seventeen (17) relevant undergraduate programs of study that suits student's individual requirements. With a selection of any of this ASTU programs, the students can design their own curriculum that fit their personal interest and that prepares them for a dynamic world. ASTU also provides a comprehensive list of double Major/minor and Fast Track programs that the students can take along with the courses in their primary major programs to broaden their knowledge and multiple career options, for early graduation and/or being admitted into a graduate program.

The course catalog is an informational guide to Adama Science and Technology University students to explore the entire course list organized by area of interest as well as by type of program. The information in this catalog is subject to change and should not be considered as

binding. Catalog changes are possible for a number of reasons, including periodic review of academic programs, curricula, and course offerings by the university. Students are encouraged to frequently consult their departments or academic advisors in order to get informed about possible changes in this catalog.

ASTU Undergraduate Programs by Schools

➤ **School of Applied Natural Science**

Departments/Programs under SoANS

- Applied Biology
- Applied Chemistry
- Applied Geology
- Applied Mathematics
- Applied Physics
- Industrial Chemistry
- Pharmacy

➤ **School of Electrical Engineering and Computing (SoEEC)**

Departments/Programs under SoEEC

- Computer Science and Engineering (CSE)
- Electronics and Communication Engineering (ECE)
- Electrical Power and Control Engineering (EPCE)
- Software Engineering (SWE)

➤ **School of civil engineering and Architecture (SoCEA)**

Departments under SoCEA

- Architecture
- Civil Engineering program
- Water Resource Engineering program

➤ **School of Mechanical, Chemical and Materials Engineering**

Departments under SoMCME

- Chemical Engineering
- Mechanical Engineering
- Material Sciences and Engineering

Curriculum

The undergraduate program curricula of ASTU are prepared by benchmarking internationally recognized universities in the world such as POSTECH and KAIST, the prominent science and technology universities in South Korea. Currently, all the undergraduate curricula are revised as per the principle of curriculum accreditation of ABET accord.

Unique features of UG Curriculum

Flexibility of the curriculum

ASTU allows its students to design their own curriculum that fit their personal interest and future plan unlike other universities in Ethiopia. This has been realized by introducing a number of ways of course selection. To this end, the structure of the course is categorized as major, basic, general and free elective courses which in turn can be divided into compulsory and electives.

Dual major/minor

The new curriculum has also additional unique feature that gives an opportunity to outstanding undergraduate students to receive double major or minor in the time frame specified to complete their major degree. This allows them to be well-placed for multiple career options.

Fast track

The curriculum also allows outstanding students to register for the fast track program to enable students for early graduation or being admitted into a graduate program so that both BSc and MSc degrees can be earned in less time than would be possible if taken separately.

1. School of Applied Natural Science

1.1 Applied Biology

General information

I. Duration of study

Normal modality

Regular: a 4-year program divided into 8 semesters

Extension program: 5-year program divided into 15 semesters (including summer)

II. Course category

NO	Course category	Course level	Adjusted program credit	Percentage from the total for major course	
1	General	Mandatory	University required	27	---
2	Basic	Mandatory	School required	27	---
3	Basic	Mandatory	Department required	6	---
4	Major	Mandatory	Department required	45	---
		Elective		35	---
		Subtotal		80	---
5	Free electives			3	---
		Total		145	80.00%

Course category: General/ university required

Course Name: Communicative English Skills (EnLa 1001)

Credit Hour: 3

Prerequisite: None

Course description (Synopsis):

Communicative English Skills is a course where students learn what they need to know for a career in science context. The course gives students the language, information, and skills they need to study science context. It also provides students the language appropriate for studying science context and real work situations as it comprises unique sections such as: ‘it’s my job’ wherein real people talk about their work in science context , ‘listening’ whereby students are exposed to situations related to science context , technical explanations, and interviews, ‘reading’ whereby students meet a variety science context based texts, and the ‘writing section’ which is designed to let students compose short reports on different activities.

Course category: General/ university required

Course Name: Basic Writing Skills (EnLa-1002)

Credit Hour: 3

Prerequisite: Communicative English Skills (EnLa 1001)

Course description (Synopsis):

Basic Writing Skills course aims at developing students’ basic writing skills in science context. The course gives students the language writing skills they need to study science. It contains sentence level writing: sentence structure, sentence types sentence combinations, common sentence errors (fragment, run on, comma splices, misplaced modifier, dangling modifier, faulty parallelism, faulty reference of pronoun, faulty agreement and shifts); paragraph level writing: the essence of a paragraph, components of a paragraph (topic sentence, supporting sentences, concluding sentence), characteristics of effective paragraph (unity, coherence and completeness)

and the steps in writing a paragraph and types of a paragraph; essay level writing: structure of an essay, thesis statement and supporting paragraphs, types of essays and techniques of essay development.

Course category: General/ university required

Course Name: Introduction to Civics and Ethics (LART 1001)

Credit Hour: 3

Prerequisite: None

Course description (Synopsis):

It is now become clear that Ethics and Citizenship Studies has become not only a field of specialization in itself but has also been attracting leaders who envision instilling democracy on a nun shakable ground within their own society. Autoscore, Ethics is a system of moral principles which involves systematizing, defending and recommending concepts of rights and wrong behavior. It affects how people make decisions and lead their lives. Citizenship, on its part, is a legal status of individuals within a given state. It embodies the legal and political relationship between citizens and state, underlining the reciprocal relationship between the two. This course is designed with the aim of equipping learners with necessary ethical qualities and civic competences while dealing with issues that affect their society at all levels and human in general.

The course starts with unfolding the notions, principles and theories of ethics which can shape human attitude, action and behavior in making moral judgments. Next, the course introduces learners to the nature, mutual interactions and historical evolutions of society, state, government and citizenship. It also elucidates issues pertaining to political governance such as constitution, democracy, and human rights in some details. To enable learners, grasp basic knowledge of political, economic and social dynamics of international system in today's globalized world, the course also introduces international relations and foreign policy and other major contemporary global issues. In light of this, the course does not present mere theoretical knowledge, but also practical knowledge of accentuating art of governing and protecting national interest in today's complex world.

Course category: General/ university required

Course Name: Logic and Critical thinking (LART 1002)

Credit Hour: 3

Prerequisite: None

Course description (Synopsis):

The main goal of the course is to improve critical and logical reasoning skills. Students will see how our ordinary intuitions on good or bad reasoning can be articulated explicitly in formal systems, and gain a new ability to evaluate arguments and reasoning they encounter every day with rigorous logical concepts and tools.

As to the subject matter, it introduces systematic methods of reasoning, such as argument, deduction, induction, syllogistic, and propositional logic.

Course category: General/ university required

Course Name: Introduction to Economics (SOSC2002)

Credit Hour: 3

Prerequisite: None

Course description (Synopsis):

This course provides a general introduction to economics combining elements of micro and macro fundamentals. The main objective of this course is to introduce and acquaint students with the preliminary principles (theories) and knowledge of economics and the application of economic theories (principles) in the actual world; the daily activities of the households, firm business or any other form of enterprises at micro levels. Students will also be able to contextualize the key macroeconomic variables and policy instruments.

Specifically, the course introduces students with theory of consumer behaviors, production, and cost of production. In these theories how decisions are made by different economic agents will be discussed. Furthermore, the course covers different characteristics of perfect and imperfect market structure. Lastly the course tries to introduce basic macroeconomic concepts such as national income accounting, unemployment, inflation, fiscal and monetary policy instruments.

Course category: General/ university required

Course Name: General Psychology and Life Skills (LART 2002)

Credit Hour: 3

Prerequisite: None

Course description (Synopsis):

Psychology is a science of human cognitive processes and behaviors. This course is designed to give students an overview of what psychological science has discovered about human behaviors and mental processes throughout human history. Students will gain an understanding of the psychological phenomena that occur in daily life as well as the practical applications of psychological knowledge. Upon completing the course, students shall be able to demonstrate a basic knowledge of the science of psychology.

Specifically, the course general psychology is concerned with discussing perspectives in psychology and basic psychological concepts such as sensation and perception, learning, personality, motivation, emotion, and basic life skills (intrapersonal, interpersonal, social and academic skills). Emphasis will be given to both theoretical and practical implications of these concepts to effectively function as individual and team in a community.

Course category: General/ university required

Course Name: Physical fitness and conditioning I (SpSc1011)

Credit Hour: 0 cr.hr

Prerequisite: None

Course description (Synopsis):

This course will provide the students with basic concepts of the five components of health-related physical fitness (cardiovascular, muscular strength and endurance, flexibility, and body composition), hypokinetic disease and general principles of training. It is mainly practical oriented. As a result, the students will be exposed to various exercise modalities, sport activities, minor and major games, and various training techniques as a means to enhance health related physical fitness components. In addition, they will develop the skills to assess each component of fitness and will practice designing cardiovascular, muscular strength and endurance, and flexibility programs based on the fitness assessment. The course serves as an introduction to the role of exercise in health promotion, fitness, performance including the acute and chronic responses of the body to exercise.

Course category: General/ university required

Course Name: Physical fitness and conditioning II (SpSc 1022)

Credit Hour: 0 cr.hr

Prerequisite: SpSc 1011

Course description (Synopsis):

This course is designed to acquaint freshman engineering and applied natural science students with the nature and scope of different ball games.

It emphasizes the value of establishing lifelong fitness using ball games as a means and focuses on the fundamental of volley ball, hand ball, basketball and football as a life time leisure activity also focuses on the development of personalized approach to healthy active living through participation in a variety of ball games that have the potential to engage students' interest throughout their lives. Again, the courses enable the participants enjoying practice and acquire proper technique and strategies associated with the ball games mentioned above and learn rules governing the game.

Course category: General/ university required

Course Name: Geography of Ethiopia and the Horn (LART 1004)

Credit Hour: 3

Prerequisite: None

Course description (Synopsis):

This course covers a brief description on the location, shape and size of Ethiopia as well as basic skills of reading map, the physical background and natural resource endowment of Ethiopia and the Horn which includes its geology and mineral resources, topography, climate, drainage and water resources, soil, fauna and flora. It also deals with the demographic characteristics of the country and its implications on economic development.

Course category: General/ university required

Course Name: History of Ethiopia and the Horn (LART 1003)

Credit Hour: 3

Prerequisite: None

Course description (Synopsis):

This course describes why history is important, how history is studied and introduces the region Ethiopia and the Horn. It treats human evolution, Neolithic Revolution, settlement patterns as

well as religion and religious processes in Ethiopia and the Horn. Based on these historical backgrounds, the course describes states, external contacts, economic formations and achievement in terms of architecture, writing, calendar, and others to the end of the 13th century. Historical processes including states formation and power rivalry, trade, external relation, threats and major battles, centralization and modernization attempts, Italian occupation, and socio-economic conditions from 1800 to 1941 makes central position in the modern history of the region.

Course category: General/ university required

Course Name: Entrepreneurship and Business Development (SOSC5003)

Credit Hour: 3

Prerequisite: None

Course description (Synopsis):

This interdisciplinary course in general is designed to introduce students to the concept of sustainable entrepreneurship, a manageable process that can be applied across careers and work settings. It focuses on building entrepreneurial attitudes and behaviors that will lead to creative solution within community and organizational environments. This course is designed to prepare individuals for ownership of their own innovative business, and assist start-ups to function more effectively, increase the chances of new business success, enhance profitability, and increase employment. More specifically, the course provides students with an introduction to the concepts and skills necessary to successfully commercialize new products and services. Entrepreneurship is not just about starting a business. It is also about identifying good opportunities and then creating, communicating, and capturing value from those opportunities; including innovation in a corporate context. It will also teach students the skills to analyses business opportunities, and articulate them as a compelling business description, and pitch to an audience of investors, customers, or business partners. It focuses on building entrepreneurial attitudes and behaviors that will lead to creative solution within community and organizational environments.

Course category: Basic mandatory courses

Course Name: Fundamental of Organic Chemistry (Chem2231)

Credit Hour: 3

Prerequisite: General Chemistry

Course description (Synopsis):

The course helps the students to be familiar with the various biological molecules, synthetic compounds, polymers and their roles, functions, functional groups, chemical and physical properties so that they will apply to their different fields like Pharmacy, Biology, Medicine, Clinical Chemistry, Human Anatomy and the like. The course covers Chemical Bonding; Inductive, Steric and Resonance Effects; Functional Groups in Organic Chemistry; Stereochemistry; Classes of Organic Reactions: Substitution, Elimination, Addition and Rearrangement Reactions, Chemistry of Aromatic Compounds; Carbonyl Reactions; and Introduction to biological molecules.

Course category: Basic mandatory courses

Course Name: Fundamental of Analytical Chemistry (Chem2103)

Credit Hour: 3

Prerequisite: General Chemistry

Course description (Synopsis):

The course is designed to make the students develop competencies of chemical analysis, by using the various chemical techniques such as gravimetric, titrimetric, spectroscopic, electroanalytical and Chromatographic techniques. As a result, the students, after completion of the course, will develop the competency to carry out chemical analysis in various fields such as: chemical industry, agriculture, environmental chemistry, clinical chemistry, medicine, pharmaceutical industries and others.

Course category: Basic mandatory courses

Course Name: General Biology (Biol1001)

Credit Hour: 3

Prerequisite: None

Course description (Synopsis):

This course is designed to provide the general knowledge of Biology for all prescience students. The course, as a basic requirement, mainly discuss the historical background of life formation, the variety of life, briefing the chemical building blocks of life, cellular biology, aspects of homeostasis, cellular respiration & photosynthesis, organisms & their environment, fundamentals of microbial lives and biotechnology and the basics of genetics.

Course category: Basic mandatory courses

Course Name: General Biology practice (Biol1001)

Credit Hour: 3

Prerequisite: None

Course description (Synopsis):

This course is designed to provide the general knowledge of Biology for all prescience students. The course, as a basic requirement, mainly discuss the historical background of life formation, the variety of life, briefing the chemical building blocks of life, cellular biology, aspects of homeostasis, cellular respiration & photosynthesis, organisms & their environment, fundamentals of microbial lives and biotechnology and the basics of genetics.

Course category: Basic mandatory courses

Course Name: Applied Mathematics I(Math1103)

Credit Hour: 3

Prerequisite: None

Course description (Synopsis):

This course covers Basic concepts of limit and continuity, derivatives &their applications, Integration and their applications.

Course category: Basic mandatory courses

Course Name: Applied Mathematics II (Math 1104)

Credit Hour: 3

Prerequisite: Applied Mathematics I (Math 1103)

Course description (Synopsis):

This course covers inverse functions, derivatives of inverse functions, techniques of integration focusing on trigonometric substitution and partial fractions, Trapezoidal rule and Simpson's rule, arc length, indeterminate forms, sequences, series and power series.

problems. This course covers integer programming, deterministic dynamic programming, inventory models, forecasting models, decision making, Queuing Theory, and Simulation Models.

Course category: Basic mandatory courses

Course Name: Basic Statistics for Applied Science (Math1106)

Credit Hour: 3

Prerequisite: None

Course description (Synopsis):

This is include: History of statistics, Meaning of statistics; Methods of data collection; Methods of data presentation; Measures of location; Measures of variation; Moments, skewness and kurtosis; terminologies in probability; Counting Techniques; definition of Probability (approaches to probability); Probability distributions; Sampling and Sampling Distribution of the mean and proportion; Elementary description of the tools of statistical inference: Basic concepts; Estimation: (Point and Interval) for the population mean and proportion; Hypothesis testing on the population mean and proportion; Simple linear regression, correlation and rank correlation.

Course category: Basic mandatory courses

Course Name: General Chemistry (Chem1102)

Credit Hour: 3

Prerequisite: None

Course description (Synopsis):

The course is designed to study Properties, units and measurements; the composition of matter, chemical reactions, reactions stoichiometry, atomic structure and the periodic table, the chemical bond, structure of molecules, properties of solutions, chemical equilibria, introduction to functional groups and their typical reactions.

Course category: Basic mandatory courses

Course Name: General Chemistry Practice (Chem1104)

Credit Hour: 1

Prerequisite: None

Course description (Synopsis):

The course is designed to give basic understanding and concepts of measuring mass, and volumes by using cylinder and burette, experimental errors, systematic and random errors, significant digits/figures, beam balance, mean, mean deviation, Bunsen burner, luminous

and non-luminous flame, physical and chemical changes, properties and reaction of substances, diffusion rates, kinetic theory of gases, Graham's law of diffusion, percentage of water of hydration, calculating equivalent weight; basic laboratory operations such as recrystallization, simple distillation, fractional distillations and steam distillations.

Course category: Basic mandatory courses

Course Name: General Physics (Phys1103)

Credit Hour: 3

Prerequisite: Knowledge in Higher Secondary Physics

Course description (Synopsis):

At the end of this course students are expected to be acquainted with basic concepts in different branches of physics, identify the connection between them and explain the common phenomena. They will also develop skills of solving problems.

Course category: Basic mandatory courses

Course Name: General Physics Practice (Phys1111)

Credit Hour: 1

Prerequisite: Knowledge in preparatory level physics

Course description (Synopsis):

This course deals with the physics practical's related to the course General Physics and helps the students very much in explaining physical concepts.

Course category: Basic mandatory courses

Course Name: Introduction to Emerging Technologies (CSEg1102)

Credit Hour: 3

Prerequisite: None

Course description (Synopsis):

This course will enable students to explore current breakthrough technologies in the areas of Artificial Intelligence, Internet of Things and Augmented Reality, Data Science and other technologies that have emerged over the past few years. Besides helping learners become literate in emerging technologies, the course will prepare them to use technology in their respective professional preparations.

Course category: Major compulsory courses

Course Name: Cell Biology (Biol2201)

Credit Hour: 3

Prerequisite: General Biology (Biol1001)

Course description (Synopsis):

This course is designed to introduce students about the structure and functions of cells that also operate at higher levels of life, the historical back ground regarding the discovery of cells and the development of the cell theory, cellular morphology (shape and size of cells), the levels of cellular organization as well as the different types of cells (prokaryotic Vs eukaryotic). Methods in the study of cells, the structure and function of the cell membrane, transport mechanisms across membranes, compartments within the cell (organelles), enzymes and their mode of action, and biochemical path ways such as cellular respiration and photosynthesis will be also treated in detail. The course also gives some insights about the cell cycle and some abnormalities in the division of cells by taking cancer as an example.

Course category: Major compulsory courses

Course Name: Biochemistry (BIOL2202)

Credit Hour: 3

Prerequisite: Cell Biology (Biol2201)

Course description (Synopsis):

Biochemistry is the chemistry of the substances and processes occurring in living cells and tissues. This subject forms the basis of virtually all of the biological sciences, and many exciting discoveries made in this area have contributed to our understanding of life, the solving of medical problems, and to the discovery and production of safe and effective drugs. Course is including: the structure of biomolecules, and how they interact in essential processes and pathways in our cells; the actions of enzymes, and how they can be inhibited by drugs; genetic engineering and molecular biology.

Course category: Major compulsory courses

Course Name: Ecology and Field study (Biol2203)

Credit Hour: 3

Prerequisite: General Biology (Biol1001)

Course description (Synopsis):

The course deals with definition of ecological terms, description and discussion of ecological parameters at the level of population, community and ecosystems. It also covers topics on the effect of biotic and abiotic factors on organisms and their adaptive response to such challenges.

The course deals with different biomes of the world, biodiversity conservation and the different ecosystems of Ethiopia. Besides, the theoretical part, students will visit a selected natural environment, learn how to write and present a report on the natural environment and will engage themselves in a mini-project of field observation for few days that will reinforce understanding the concepts and principles what they have studied in class.

Course category: Major compulsory courses

Course Name: introduction to Biotechnology (Biol2204)

Credit Hour: 3

Prerequisite: Cell Biology (Biol2201)

Course description (Synopsis):

The Introduction to Biotechnology course is designed to help the students to understand about basics of biotechnology, scope, importance and application in various fields such as health, agriculture, industry and environment. Biosafety issues in handling living organisms/microorganisms will also be dealt.

Course category: Major compulsory courses

Course Name: General Entomology (Biol3205)

Credit Hour: 3

Prerequisite: None

Course description (Synopsis):

Entomology is both a basic and an applied science which deals with the study of insects (and also related arthropods) and their effects upon the health, economy, and welfare of humankind. The course mainly focuses on the study of insects: insect external structures (morphology), insect anatomy and physiology; classification; insect ecology; elementary techniques of collection and preservation.

Course category: Major compulsory courses

Course Name: Human Anatomy and Physiology (Biol.2206)

Credit Hour: 3

Prerequisite: Biol1101

Course description (Synopsis):

This course is designed to provide an introduction to the human anatomy and physiology which acquaints the learners with basic knowledge on the overall structures and functions of human body. Study of human anatomy and physiology enables students to have fundamental and crucial understanding about how life is maintained. The fundamental knowledge from this course is also helpful to those who are ardent to pursue a healthy life style, critically evaluate information presented in advertisements, or understand information presented to them by health care professionals. Emphasis is given to topics such as body organization (cytology; histology); homeostasis; the integumentary, skeletal, muscular and nervous systems; and special senses, among others. Laboratory work includes dissection of specimens, microscopic study of anatomy, studies on human anatomical charts, and related experiments.

Course category: Major compulsory courses

Course Name: Principles of Genetics (Biol3207)

Credit Hour: 3

Prerequisite: Plant Biology (Biol2208)

Course description (Synopsis):

The course deals with the essence and definition of plant tissue culture. The techniques employed in plant tissue culture, and its importance in improvement of plant production and ensuring food security will be dealt in detail. Environmental degradation and loss of plant species are endangering human survival. In an effort to sustainably use our resources, conserving those plants which are endangered and those that need long time for seed germination and regeneration need to be multiplied using technologies. Student will also learn the general protocols regarding transgenic plant and algae, and also discuss the possible production of the high value bio-product from plant and algae and its relation to commercialization. The course comprises introductory plant biology followed by plant biotechnology. Selected topics include Plant anatomy, development and life cycle, Plant cell and plant cell wall, Plant cell signalling and gene regulation, Plant hormones, Plant carbohydrate and lipid metabolism, Plant tissue culture, Transformation of plants or plant cells, Stress, pathogen and herbicide tolerance, Improved nutritional content and functional foods, Phytol-remediation, Forest biotechnology,

Plants as green factories: production of plastics, fats/oils, fibres, proteins and biofuels, GMO-regulations.

Course category: Major compulsory courses

Course Name: Plant Biology (Biol2208)

Credit Hour: 3

Prerequisite: None

Course description (Synopsis):

Plant biology is the study of the diversity, morphological and taxonomical characteristics of different economically important Algae and plants. The course provides basic plant sciences including growth, development and reproduction of algae, bryophytes, gymnosperms and angiosperms. It also highlights plant identification and cellular observations of the different groups important for survival.

Course category: Major compulsory courses

Course Name: General Microbiology (Biol3209)

Credit Hour: 3

Prerequisite: General Biology (Biol1001)

Course description (Synopsis):

This course covers basic concepts on the fundamental principles of microbiology and provide introduction to the morphology, diversity, physiology and biochemistry, classification and metabolism genetics, ecology, applications and pathogenicity of microbe's will be discussed.

Course category: Major compulsory courses

Course Name: Animal Biology (Biol2210)

Credit Hour: 3

Prerequisite: General Biology (Biol1001)

Course description (Synopsis):

This course is designed to provide an introduction to the animal biology which acquaints the learners with basic knowledge on the overall the science of animal kingdom. Study of animal biology enables students to have fundamental and crucial understanding about how animals evolved and diversified. The fundamental knowledge from this course is also helpful to those who are dedicated to pursue the study animal biology, critically evaluate structural, physiological, and molecular similarities and differences of organisms and summarize the impacts of human population, technology and related activities to the applied biology. This course includes principles of evolution, taxonomy, phylogeny, morphology of major animal phyla. It also includes the study of animal diversity, emphasizing the characteristics and classifications of major phyla, animal architecture and animal ecology. The loss of animal diversity and conservation and the interaction of human population and technology will also be covered.

Course category: Major compulsory courses

Course Name: Research Methods and Scientific Writing (Biol3211)

Credit Hour: 2

Prerequisite: None

Course description (Synopsis):

The course deals with the basic components of research process: problem identification, developing proposals, data collection, data analysis, and reporting/scientific writing. It also addresses ethical issues in research; intellectual property rights and plagiarism.

Course category: Major compulsory courses

Course Name: Principles of Parasitology (Biol3212)

Credit Hour: 3

Prerequisite: Animal Biology (Biol2210)

Course Description (Synopsis):

Brief introduction to parasitism, introduction to parasites of man and his domestic animals: lifecycle, mode of transmission, and pathogenesis of the common protozoan and helminths parasites. In addition, the course tries to give brief explanation on diagnosis, treatment, prevention and control approaches of both protozoan and helminthic infections.

Course category: Major compulsory courses

Course Name: Fisheries and Aquatic Ecology (Biol4215)

Credit Hour: 3

Prerequisite: None

Course description (Synopsis):

With its primary focus on freshwater ecosystems, this course will cover important issues in aquatic ecology, including: the physical, chemical, and biological properties of freshwater ecosystems (primarily lakes and rivers) and techniques used in research of freshwater ecosystems. First, the ways lakes are formed by geological and other events (wind, landslide, meteoric, biogenic, man-made) are described. The water molecule and some of its implications for lake ecology are listed. Light and heat, photosynthesis, stratification and mixing, water movement and lake classification are covered. The chemical environment in lakes is constituted of dissolved gases (Oxygen, Carbon dioxide), nutrients (phosphorous, nitrogen, silica), salts (ions) which determine the salinity, alkalinity, pH, re-dox potential and productivity level of water bodies. Methods of measurement of chemical parameters and their implication in lake ecology will be discussed. The course then describes the biological communities of bacterio-plankton, phytoplankton, zooplankton, macrophytes, benthos and fish and their zonation in lakes,

rivers and wetlands. The main categories of organisms involved in global fisheries and their biological characteristics, principles of fish population dynamics, data collection, stock assessments and ecosystem effects of fisheries, and the interaction of fish within their communities, namely through the lenses of predation and competition will be treated. The interactions between the different producers and consumers in lakes, and the flow of energy in the food web with emphasis on the grazer and detrital food chains and the microbial loop will be covered. Brief mention of river and reservoir distinctiveness and ecology, with flora and fauna and food web types in each. Wetlands will be introduced with their classification in Ethiopia, either from hydrological or spatial points of view. Finally, the effects of anthropogenic impacts on inland water with emphasis on Ethiopian lakes and rivers as well as practical experience in giving management recommendations, based on population analyses, will be covered for long-term sustainable exploitation of aquatic resources.

Course category: Major compulsory courses

Course Name: Evolutionary Biology (Biol4215)

Credit Hour: 3

Prerequisite: Principles of Genetics (Biol3207)

Course description (Synopsis):

Pre-Darwinian views about the origin of life on earth and the age of the earth and the life on it; the origin of the earth, the primitive atmosphere of the earth, pre-biotic formation of organic molecules; the origin of protocells and the development of cellular and higher forms of life on earth; evidence for evolution; the mechanisms (theories) of evolution; genetic variation as raw material for evolution and how genetic variation (polymorphism) is maintained in populations; evolutionary forces that change gene frequencies and thus bring about evolutionary changes; speciation, its mode and pace; mechanisms that keep gene pools of different species from merging together; sequence divergence between homologous genes and homologous proteins and phylogenetic inferences from the degree of divergence; human evolution.

Course category: Major elective (Restricted)

Course Name: Ethnobiology (Biol3301)

Credit Hour: 2

Prerequisite: None

Course description (Synopsis):

Ethnobiology is the scientific study of dynamic relationships among peoples, biota, and environments. It employs botanical, zoological, ecological, anthropological, linguistic other fields to study the complex the complex set of relationships of the biota with the present and past human societies. It further examines contemporary issues such as traditional versus commercial property rights to genetic and ecological diversity and medicinal plants, conservation and traditional society and sustainable development.

Course category: Major elective (Restricted)

Course Name: Conservation Biology (Biol3303)

Credit Hour: 2

Prerequisite: Ecology and Field Study (Biol2203)

Course description (Synopsis):

Conservation biology is an interdisciplinary science that focuses on conservation of biological diversity at genetic, species and ecosystem levels. The course will focus on the following topics: the historical background underpinning the current conservation movement, the values of biodiversity and ecosystem services, and threats to biodiversity due to human impacts and techniques used in studies of conservation biology, current issues in conservation biology, ecological concepts that are utilized in conservation management practices and conservation status in Ethiopia, the role of international conventions, national policy and institutions in implementing conservations and the future directions of conservation biology.

Course category: Major elective (Restricted)

Course Name: Developmental Biology (Biol3305)

Credit Hour: 3

Prerequisite: General Biology (Biol1001)

Course description (Synopsis):

How does a complex, multicellular organism arise from a single cell? How do cells differentiated and developed? What are the medical consequences of abnormal embryonic development? How does regeneration occur? How has evolution modified developmental programs to produce different body plans? These are some of the central questions in the field of developmental biology. This course serves as an introduction to current concepts and experimental approaches in this rapidly advancing field. Topics in the course include cell and development, differential gene expression, cell signaling, cell movements, tissue morphogenesis, stem cells, human development, and regeneration. The course examines the genes and signaling pathways that control development and the role that mis-regulation of these pathways plays in human disease.

Course category: Major elective (Restricted)

Course Name: Principles of Taxonomy and Systematics (Biol3307)

Credit Hour: 3

Prerequisite: None

Course description (Synopsis):

Taxonomy helps to arrange the highly diversified forms of life into groups according to their degree of relationships for an easy description and understanding. The course emphasizes on essential aspects related to taxonomy, principles, procedures, and rules of taxonomy, rules of botanical and zoological nomenclatures.

Course category: Major elective (Restricted)

Course Name: Applied Microbiology (Biol3302)

Credit Hour: 3

Prerequisite: General Microbiology (Biol3209)

Course description (Synopsis):

The course covers the historical development of food microbiology (food and microorganisms) and provides basic principles of food safety, spoilage, preservation. Food infections and intoxications, fermentation; definition and scope of industrial microbiology, microorganisms of industrial importance and their products, primary and secondary metabolites, fermentation media in industry, screening of industrial microorganisms, strain improvement and selection, starter culture development, methods and types of fermentation (batch and continuous culture), bioreactors; important microorganisms of water pollution: wastewater treatment, downstream processing; role of microorganisms in agriculture (soil, nutrient recycling); medical and veterinary importance of microbes.

Course category: Major elective (Restricted)

Course Name: Applied Entomology (Biol3304)

Credit Hour: 3

Prerequisite: General Entomology (Biol3205)

Course description (Synopsis):

The course mainly focuses on ecological, economical and medical importance of insects. Economically important crop insect pests and vectors of human and animal diseases; types of

damages insects may cause to their hosts and available control options to reduce or avoid the damages; apterygote and Endo pterygote crop insect pests of economic importance and methods of survey and loss assessment of the insect damages; feeding specializations of insects and adaptation of their mouth parts to such specializations; arthropod orders of major public and animal health importance and their survey methods; insect pest control measures and introduction of beneficial insects; field based demonstrations and Integrated Pest Management (IPM), apiculture, sericulture in Ethiopian context.

Course category: Major elective (Restricted)

Course Name: Molecular Biology (Biol3306)

Credit Hour: 3

Prerequisite: Principles of Genetics (Biol3207)

Course description (Synopsis):

This course addresses a detailed description of the structure and function of genetic material (DNA and RNA). DNA replication; transcription, the genetic code, translation/gene expression in prokaryotes and eukaryotes, gene regulation. Gene mutations and repair; transposons; bacterial genetics,

Molecular scissors/restriction enzymes; DNA polymorphism; molecular techniques (DNA extraction, electrophoresis, amplification-PCR, sequencing, cloning) and their application in various fields of biology.

Course category: Major elective (Restricted)

Course Name: Plant physiology (Biol3308)

Credit Hour: 3

Prerequisite: Plant Biology (Biol2208)

Course description (Synopsis):

Plant physiology is designed to provide student with comprehensive exposure to the subject of plant science focusing mainly on physiology and biochemistry. Essential compounds, namely plant hormones involved in growth regulation and development of plants will be emphasized.

Course category: Major elective (Restricted)

Course Name: Introduction to Biomedical Sciences (Biol3310)

Credit Hour: 3

Prerequisite: None

Course description (Synopsis):

This course is an introduction to human biology and the science of medicine. Drawing upon basic biological and chemical concepts, it introduces the recent advances in biomedical technologies such as gene therapy, stem cell therapy, animal cloning, and nano biotechnology. Students explore the intricate anatomical and physiological mechanisms underlying normal human function. Students then investigate homeostatic imbalances that cause diseases. Students will also learn how these state-of-art biomedical technologies are applied to the prevention and treatment of various diseases including cancer, chronic hepatitis, and diabetes.

Course category: Major elective (Restricted)

Course Name: Immunology (Biol4311)

Credit Hour: 3

Prerequisite: Cell Biology (Biol2201)

Course description (Synopsis):

This course will introduce students to the principles of immunology which includes development and components of the immune system. The course deals with the basic knowledge on the role of innate and adaptive immunity in protecting the body against different infections, with depth emphasis on humoral and cellular immunity. The course will elaborate major immune components such as the immunoglobulin structure, antigen-antibody binding, antigen presentation, B cell, T cell receptors, T cell activation and effector functions. The role of cytokines, phagocytic cell function, immune responses to infectious organisms and tumors, autoimmune diseases, allergies, and immune deficiencies will also be emphasized. Students will explore the applications of immunology to modern diagnostics and therapeutics.

Course category: Major elective (Restricted)

Course Name: Introduction to Microbial Biotechnology (Biol4313)

Credit Hour: 3

Prerequisite: General Microbiology (Biol3209) and Introduction to Biotechnology (Biol2204)

Course description (Synopsis):

This course introduces students to Microbial and Cell Biotechnology, Microbial growth and kinetics, the use of microbes to generate useful products, Biologics/Biopharmaceuticals, microbial degradation of wastes (bioremediation), microbial enzymes, antibiotics, and hormones (insulin), and the development of microbial strains that are highly efficient at catabolizing natural organic compounds or synthetic chemical compounds. Microbial biotechnology addresses microbial genome engineering in order to optimize the metabolism for specific purposes. The subject also introduces students to the commercial aspects of biotechnology.

Course category: Major elective (Restricted)

Course Name: Animal Behavior (Biol4315)

Credit Hour: 2

Prerequisite: Animal Biology (Biol2210)

Course description (Synopsis):

This course provides basic information about the biology of behavior, behavioral ecology, and basic behavior, genetic basis of behavior, development of learned behavior and evolution of behavior.

Course category: Major elective (Restricted)

Course Name: Introduction to Basic Bioinformatics (Biol4317)

Credit Hour: 3

Prerequisite: None

Course description (Synopsis):

This course provides a broad perspective of Bioinformatics as applied to life sciences. In this subject the students will develop deep understanding of the most significant breakthroughs in Bioinformatics especially in Molecular Biology arena with an emphasis on the Bioinformatics tools. Students will get the ability to investigate and analyze the theory and the application of bioinformatics for the retrieval, analysis, sharing and use of biological data and information from databases.

Course category: Major elective (Restricted)

Course Name: Pharmacology (Biol4319)

Credit Hour: 3

Prerequisite: None

Course description (Synopsis):

Pharmacology is the study of drug actions on living systems - where they act, what they do, how they are metabolized, and how they exert toxic effects. Understanding all of this requires studying drug actions at levels ranging from the single molecule to the whole organism. Pharmacology is therefore a very broad discipline, taking in aspects of molecular biology, chemistry, physiology and neuroscience. This course examines both the actions of current drugs and the development of new drugs. The pharmaceutical industry is the research sector. People work in related industries - highlighting the wide range of potential career opportunities for graduates.

Course category: Major elective (Restricted)

Course Name: Introduction to Genetic Engineering (Biol4221)

Credit Hour: 2

Prerequisite: Principles of Genetics (Biol3207)

Course description (Synopsis):

Genetic Engineering is the applied aspects of Molecular Biology which is the very basis of all living species. Molecular Biology deals with the molecular basis of biological or genetic specificity. It has three components: Biochemistry, Genetics & Cell Biology. Broadly Genetic Engineering means the manipulation of genes under controlled laboratory conditions. Gene cloning which includes the isolation and characterization of single genes and reintroduction and expression of these genes into cells of same or different species is the main focus of Genetic

Engineering. Overview of genetic engineering concepts and specific applications of genetic engineering to medicine, agriculture, law, and society will be discussed. This course will focus mainly on DNA Isolation and purification, Vector system, Restriction enzymes and ligation, Genetic engineering techniques: PCR and Electrophoresis, sequencing DNA and hybridization (southern blot, northern blot, and western blot), DNA library, Recombinant DNA: transformation, selection and recombinant expression, shotgun cloning, PCR cloning, transposon mutagenesis, cDNA cloning, Genetic engineering on plant and animal, Transgenic product: Bioethics and controversy.

Course category: Major elective (Restricted)

Course Name: Principle of Animal Biotechnology (Biol4323)

Credit Hour: 2

Prerequisite: Animal Biology (Biol2210)

Course description (Synopsis):

This course deals with the fundamental principles of animal biotechnology and its application. It includes the basic description of different areas of Animal Biotechnology such as Artificial insemination, IVF, Reproductive and Therapeutic Cloning; Transgenic animal production and application; rumen biotechnology, molecular markers in animal breeding and genetics. Students will get familiarized with the different approaches to generate transgenic animals for various applications. The concept of transfer of new genes in animal cells and animal cloning along with gene therapy and its significance will be imparted to the students.

Course category: Major elective (Restricted)

Course Name: Principle of Plant Biotechnology (Biol4312)

Credit Hour: 3

Prerequisite: Plant Biology (Biol2208)

Course description (Synopsis):

The course deals with the essence and definition of plant tissue culture. The techniques employed in plant tissue culture, and its importance in improvement of plant production and ensuring food security will be dealt in detail. Environmental degradation and loss of plant species are endangering human survival. In an effort to sustainably use our resources, conserving those plants which are endangered and those that need long time for seed germination and regeneration need to be multiplied using technologies. Student will also learn the general protocols regarding transgenic plant and algae, and also discuss the possible production of the high value bio-product from plant and algae and its relation to commercialization. The course comprises introductory plant biology followed by plant biotechnology. Selected topics include Plant anatomy, development and life cycle, Plant cell and plant cell wall, Plant cell signaling and gene regulation, Plant hormones, Plant carbohydrate and lipid metabolism, Plant tissue culture, Transformation of plants or plant cells, Stress, pathogen and herbicide tolerance, Improved nutritional content and functional foods, Phyto-remediation, Forest biotechnology, Plants as green factories: production of plastics, fats/oils, fibers, proteins and biofuels, GMO-regulations.

Course category: Major elective (Restricted)

Course Name: Introduction to Ecotoxicology (Biol4314)

Credit Hour: 3

Prerequisite: Ecology and Field Study (Biol2203)

Course description (Synopsis):

The overall objective is to provide an introductory overview of the field of toxicology covering the basic principles, target organ toxicity, the toxicity of a limited group of compounds, and an introduction to modern molecular toxicology.

Course category: Major elective (Restricted)

Course Name: Enzymology (Biol4316)

Credit Hour: 3

Prerequisite: None

Course description (Synopsis):

The Enzymology course is designed to help the students to understand about the enzymes and their importance as they are involved in almost all the physiological/biological reactions.

Course category: Major elective (Restricted)

Course Name: Principles of Cytogenetics (Biol4318)

Credit Hour: 2

Prerequisite: Introduction to Genetic Engineering (Biol4218)

Course description (Synopsis):

Brief historical background about the development of the discipline; levels of complexity of prokaryotic and eukaryotic chromosomes in terms of genome size and organization; molecular components of the eukaryotic chromosomes; packaging of DNA into eukaryotic chromosomes; chromosomes in genetic transmission (mitosis and meiosis); important morphological features of eukaryotic chromosomes; major chromosome bandings and their applications; chromosome numerical and structural changes, origins and consequences; main attributes of karyotypes, applications and evolution of karyotypes.

Course category: Major elective (Restricted)

Course Name: Virology (Biol4220)

Credit Hour: 3

Prerequisite: General Microbiology (Biol3209)

Course description (Synopsis):

The course is designed for a biologist to provide basic knowledge of viral genomic organization and their importance in human, animal and plant health. The course provides an insight to general characteristics, structure, and replication of viruses; viral classification; types of viral diseases; address selective and unusual virus-like agents (i.e. prion, viroid, virion etc.) which are of important viral pathogens; provide a contemporary understanding of how viruses are built,

how they infect and replicate in host cells, how they spread, evolve and cause disease, and how infection of a host can be prevented; The course will focus primarily on human and animal viruses; role of bacteriophages and plant viruses to combat human and animal diseases; use of viruses for medical research and biotechnology(i.e. role of viruses in Recombinant DNA technology); explain new “hot” trends in Virology, including: virus-based gene therapy; modern advances in vaccinology and “oncolytic” viruses to treat cancers; emerging viruses and potential bioterrorism agents.

Course category: Major elective (Restricted)

Course Name: Mycology (Biol4322)

Credit Hour: 2

Prerequisite: General Microbiology (Biol3209)

Course description (Synopsis):

This course will give students an appreciation of the diversity of fungi within microbial world. It will illustrate the principal structural features and biology of different fungi. Traditional and molecular systematics, physiology, cellular organization, life history strategies, reproduction and dispersal, roles of fungi in ecosystems, fungal symbioses, plant and animal pathogens, predaceous fungi, biological control, fungal food fermentations, plant pathogens, mycotoxins and food spoilage, pharmaceuticals, fungi in biofuels and conversions, fungus-insect and fungus-insect-plant interactions. Microscopic characteristics for identification of micro fungi will be covered in the overall context of the course. Eukaryotic cells, and enable students to handle microorganisms in a safe and competent fashion.

1.2 Applied Chemistry

General information

I. Duration of study

Normal modality

Regular: a 4-year program

Extension program: 5-year program

II. Course category

NO	Course category		Course level	Credit requirement
1	General	Mandatory	University required	27
2	Basic	Mandatory	School required	27
3	Major	Mandatory	Department required	52
		Elective		36
		Subtotal		88
4	Free electives			3
	Total			145

Course category: General/University required

Course Name: General Psychology and life skills (LART 2002)

Credit Hour: 3

Prerequisite: None

Course description (Synopsis):

Psychology is a science of human cognitive processes and behaviors. This course is designed to give students an overview of what psychological science has discovered about human behavior and mental processes throughout human history. Students will gain an understanding of the psychological phenomena that occur in daily life as well as the practical applications of psychological knowledge. Upon completing the course, students shall be able to demonstrate a basic knowledge of the science of psychology.

Specifically, the course general psychology is concerned with discussing perspectives in psychology and basic psychological concepts such as sensation and perception, learning, personality, motivation, emotion, and basic life skills (intrapersonal, interpersonal, social and academic skills). Emphasis will be given to both theoretical and practical implications of these concepts to effectively function as individual and team in a community.

Course category: General/University required

Course Name: Geography of Ethiopia and the Horn (LART 1004)

Credit Hour: 3

Prerequisite: None

Course description (Synopsis):

This course covers a brief description on the location, shape and size of Ethiopia as well as basic skills of reading map, the physical background and natural resource endowment of Ethiopia and the Horn which includes its geology and mineral resources, topography, climate, drainage and water resources, soil, fauna and flora. It also deals with the demographic characteristics of the country and its implications on economic development.

Course category: General/University required

Course Name: History of Ethiopia and the Horn (LART 1003)

Credit Hour: 3

Prerequisite: None

Course description (Synopsis):

This course describes why history is important, how history is studied and introduces the region Ethiopia and the Horn. It treats human evolution, Neolithic Revolution, settlement patterns as well as religion and religious processes in Ethiopia and the Horn. Based on these historical backgrounds, the course describes states, external contacts, economic formations and achievement in terms of architecture, writing, calendar, and others to the end of the 13th century. Historical processes including states formation and power rivalry, trade, external relation, threats and major battles, centralization and modernization attempts, Italian occupation, and socio-economic conditions from 1800 to 1941 makes central position in the modern history of the region.

Course category: General/University required

Course Name: Introduction to Civics and Ethics (LART 1001)

Credit Hour: 3

Prerequisite: None

Course description (Synopsis):

It is now become clear that Ethics and Citizenship Studies has become not only a field of specialization in itself but has also been attracting leaders who envision instilling democracy on a nun shakable ground within their own society. Autoscore, Ethics is a system of moral principles which involves systematizing, defending and recommending concepts of rights and wrong behavior. It affects how people make decisions and lead their lives. Citizenship, on its part, is a legal status of individuals within a given state. It embodies the legal and political relationship between citizens and state, underlining the reciprocal relationship between the two. This course is designed with the aim of equipping learners with necessary ethical qualities and civic competences while dealing with issues that affect their society at all levels and human in general.

The course starts with unfolding the notions, principles and theories of ethics which can shape human attitude, action and behavior in making moral judgments. Next, the course introduces learners to the nature, mutual interactions and historical evolutions of society, state, government and citizenship. It also elucidates issues pertaining to political governance such as constitution, democracy, and human rights in some details. To enable learners grasp basic knowledge of political, economic and social dynamics of international system in today's globalized world, the course also introduces international relations and foreign policy and other major contemporary global issues. In light of this, the course does not present mere theoretical knowledge, but also practical knowledge of accentuating art of governing and protecting national interest in today's complex world.

Course category: General/University required

Course Name: Entrepreneurship and Business Development (SOSC5003)

Credit Hour: 3

Prerequisite: None

Course description (Synopsis):

This interdisciplinary course in general is designed to introduce students to the concept of sustainable entrepreneurship, a manageable process that can be applied across careers and work settings. It focuses on building entrepreneurial attitudes and behaviors that will lead to creative solution within community and organizational environments. This course is designed to prepare individuals for ownership of their own innovative business, and assist start-ups to function more effectively, increase the chances of new business success, enhance profitability, and increase employment.

More specifically, the course provides students with an introduction to the concepts and skills necessary to successfully commercialize new products and services. Entrepreneurship is not just about starting a business. It is also about identifying good opportunities and then creating, communicating, and capturing value from those opportunities; including innovation in a corporate context. It will also teach students the skills to analyze business opportunities, and articulate them as a compelling business description, and pitch to an audience of investors, customers, or business partners. It focuses on building entrepreneurial attitudes and behaviors that will lead to creative solution within community and organizational environments.

Course category: General/University required

Course Name: Communicative English (EnLa -1001)

Credit Hour: 3

Prerequisite: None

Course description (Synopsis):

Communicative English Skills is a course where students learn what they need to know for a career in science context. The course gives students the language, information, and skills they need to study science context. It also provides students the language appropriate for studying science context and real work situations as it comprises unique sections such as: **‘it’s my job’** wherein real people talk about their work in science context , **‘listening’** whereby students are exposed to situations related to science context , technical explanations, and interviews, **‘reading’** whereby students meet a variety science context based texts, and the **‘writing section’** which is designed to let students compose short reports on different activities.

Course category: General/University required

Course Name: Introduction to Economics (SOSC2002)

Credit Hour: 3

Prerequisite: None

Course description (Synopsis):

This course provides a general introduction to economics combining elements of micro and macro fundamentals. The main objective of this course is to introduce and acquaint students with the preliminary principles (theories) and knowledge of economics and the application of economic theories (principles) in the actual world; the daily activities of the households, firm business or any other form of enterprises at micro levels. Students will also be able to contextualize the key macroeconomic variables and policy instruments.

Specifically, the course introduces students with theory of consumer behavior, production, and cost of production. In these theories how decisions are made by different economic agents will be discussed. Furthermore, the course covers different characteristics of perfect and imperfect market structure. Lastly the course tries to introduce basic macroeconomic concepts such as national income accounting, unemployment, inflation, fiscal and monetary policy instruments.

Course category: General/University required

Course Name: Basic Writing Skills (EnLa1002)

Credit Hour: 3

Prerequisite: Communicative English Skills (EnLa 1001)

Course description (Synopsis):

Basic Writing Skills course aims at developing students' basic writing skills in science context. The course gives students the language writing skills they need to study science. It contains *sentence level writing*: sentence structure, sentence types sentence combinations, common sentence errors (fragment, run on, comma splices, misplaced modifier, dangling modifier, faulty parallelism, faulty reference of pronoun, faulty agreement and shifts); *paragraph level writing*: the essence of a paragraph, components of a paragraph (topic sentence, supporting sentences, concluding sentence), characteristics of effective paragraph (unity, coherence and completeness) and the steps in writing a paragraph and types of a paragraph; *essay level writing*: structure of an essay, thesis statement and supporting paragraphs, types of essays and techniques of essay development.

Course category: General/ university required

Course Name: Physical fitness and conditioning I (SpSc1011)

Credit Hour: 0 cr.hr

Prerequisite: None

Course description (Synopsis):

This course will provide the students with basic concepts of the five components of health-related physical fitness (cardiovascular, muscular strength and endurance, flexibility, and body composition), hypokinetic disease and general principles of training. It is mainly practical oriented.

As a result, the students will be exposed to various exercise modalities, sport activities, minor and major games, and various training techniques as a means to enhance health related physical fitness components. In addition, they will develop the skills to assess each component of fitness and will practice designing cardiovascular, muscular strength and endurance, and flexibility programs based on the fitness assessment. The course serves as an introduction to the role of exercise in health promotion, fitness, performance including the acute and chronic responses of the body to exercise.

Course category: General/ university required

Course Name: Physical fitness and conditioning II (SpSc 1022)

Credit Hour: 0 cr.hr

Prerequisite: SpSc 1011

Course description (Synopsis):

This course is designed to acquaint freshman engineering and applied natural science students with the nature and scope of different ball games.

It emphasizes the value of establishing lifelong fitness using ball games as a means and focuses on the fundamental of volley ball, hand ball, basketball and football as a life time leisure activity also focuses on the development of personalized approach to healthy active living through participation in a verity of ball games that have the potential to engage students' interest throughout their lives. Again, the courses enable the participants enjoying practice and acquire proper technique and strategies associated with the ball games mentioned above and learn rules governing the game.

Course category: Basic Mandatory

Course Name: General Chemistry (Chem1102)

Credit Hour: 3

Prerequisite: None

Course description (Synopsis):

The course is designed to study Properties, units and measurements; the composition of matter, chemical reactions, reactions stoichiometry, atomic structure and the periodic table, the chemical bond, structure of molecules, properties of solutions, chemical equilibria, introduction to functional groups and their typical reactions.

Course category: Basic Mandatory

Course Name: Practical General Chemistry (Chem1104)

Credit Hour: 1

Prerequisite: None

Course description (Synopsis):

The course is designed to give basic understanding and concepts of measuring mass, and volumes by using cylinder and burette, experimental errors, systematic and random errors, significant digits/figures, beam balance, mean, mean deviation, Bunsen burner, luminous and non-luminous flame, physical and chemical changes, properties and reaction of substances, diffusion rates, kinetic theory of gases, Graham's law of diffusion, percentage of water of hydration, calculating equivalent weight; basic laboratory operations such as recrystallization, simple distillation, fractional distillations and steam distillations

Course category: Basic Mandatory

Course Name: Applied Mathematics I (Math1103)

Credit Hour: 3

Prerequisite: None

Course description (Synopsis):

This course covers Basic concepts of limit and continuity, derivatives & their applications, Integration and their applications

Course category: Basic Mandatory

Course Name: Applied Mathematics II (Math1104)

Credit Hour: 3

Prerequisite: Applied Mathematics I (Math 1103)

Course description (Synopsis):

This course covers inverse functions, derivatives of inverse functions, techniques of integration focusing on trigonometric substitution and partial fractions, Trapezoidal rule and Simpson's rule, arc length, indeterminate forms, sequences, series and power.

Course category: Basic Mandatory

Course Name: Basic Statistics for Applied Science (Math1106)

Credit Hour: 3

Prerequisite: None

Course description (Synopsis):

This is include: History of statistics, Meaning of statistics; Methods of data collection; Methods of data presentation; Measures of location; Measures of variation; Moments, skewness and kurtosis; terminologies in probability; Counting Techniques; definition of Probability (approaches to probability); Probability distributions; Sampling and Sampling Distribution of the mean and proportion; Elementary description of the tools of statistical inference: Basic concepts; Estimation: (Point and Interval) for the population mean and proportion; Hypothesis testing on the population mean and proportion; Simple linear regression, correlation and rank correlation.

Course category: Basic Mandatory

Course Name: General Physics (Phys1103)

Credit Hour: 3

Prerequisite: Knowledge in Higher Secondary Physics

Course description (Synopsis):

At the end of this course students are expected to be acquainted with basic concepts in different branches of physics, identify the connection between them and explain the common phenomena. They will also develop skills of solving problems.

Course category: Basic Mandatory

Course Name: Introduction to Computing (CSEg1101)

Credit Hour: 3

Prerequisite: None

Course description (Synopsis):

In this course the basic techniques of computational problem solving will be covered by using computational thinking while writing small and medium sized programs, mapping problems into computational frameworks emphasizing on scientific problems, understanding problems and formulation of problems based on the elective programming language (using python). The course includes the concepts and techniques of data structure, input/output, flow control and incidental program, and by using a systematic division of problem solution and concept of module, to solve problems in numerical value field and non-numerical value field with program experiment.

Course category: Basic Mandatory

Course Name: Introduction to Emerging Technologies (CSEg1102)

Credit Hour: 3

Prerequisite: None

Course description (Synopsis):

This course will enable students to explore current breakthrough technologies in the areas of Artificial Intelligence, Internet of Things and Augmented Reality, Data Science and other technologies that have emerged over the past few years. Besides helping learners become literate in emerging technologies, the course will prepare them to use technology in their respective professional preparations.

Course category: Major Mandatory

Course Name: Analytical Chemistry (Chem2211)

Credit Hour: 3

Prerequisite: General Chemistry

Course description (Synopsis):

The course is designed to make the students develop competencies of chemical analysis, by using the various chemical techniques such as gravimetric and/or titrimetric techniques. The course familiarizes the students with statistical evaluation of analytical data. As a result the students, after completion of the course, will develop the competency to carry out chemical analysis in various fields such as chemical industry, agriculture, environmental chemistry, clinical chemistry, medicine, pharmaceutical industries and others.

Course category: Major Mandatory

Course Name: Practical Analytical Chemistry (Chem2213)

Credit Hour: 1

Prerequisite: General Chemistry

Course description (Synopsis):

The course is designed to make the students to develop competencies of chemical analysis by using various practical classical techniques in both qualitative and quantitative analyses and basic principles of gravimetric and titrimetric techniques and statistical analysis of laboratory data. As a result, the students, after completion of the course, will develop the competency to carry out chemical analysis in various fields such as chemical industry, agriculture, environmental chemistry, clinical chemistry, medicine, pharmaceutical industries and others.

Course category: Major Mandatory

Course Name: Instrumental Analysis (Chem2212)

Credit Hour: 3

Prerequisite: Analytical Chemistry

Course description (Synopsis):

The course is designed to make the students develop competency in basic instrumental methods of analysis. The course will familiarize the students with the basic knowledge of instrumentations like in gas chromatography, high performance liquid chromatography, supercritical fluid chromatography, size exclusion chromatography, ion exchange chromatography, electrophoresis, potentiometry, conductometry, coulometry, electrogravimetry, voltammetry which are applicable in various fields like, toxicology, environmental science, pharmaceuticals, quality controlling, chemical industry, clinical chemistry, medicine and the like.

Course category: Major Mandatory

Course Name: Practical Instrumental Analysis (Chem2214)

Credit Hour: 1

Prerequisite: Instrumental Analysis

Course description (Synopsis):

The course is designed to make the students to develop competencies of chemical analysis by using various practical techniques like chromatography (TLC, PC, GC, and HPLC) and electroanalytical methods (Potentiometry, Voltammetry, Conductometry, Coulometry, Electrogravimetry, Electrophoresis and Refractive index). The course familiarizes the students with statistical evaluation of analytical data. As a result, the students, after completion of the course, will develop the competency to carry out chemical analysis in various fields such as chemical industry, agriculture, environmental chemistry, clinical chemistry, medicine, pharmaceutical industries and others.

Course category: Major Mandatory

Course Name: Analysis of Real Sample (Chem3214)

Credit Hour: 2

Prerequisite: Instrumental Analysis and Practical Organic chemistry II

Course description (Synopsis):

The course is designed to make the students develop the competency to analyze real samples based on what they have already learnt. The course will familiarize the students with the techniques of sampling, storage, and analysis of real samples; learn the analytical methods and skills of sampling and operation. It covers Systematic analysis of real samples: sampling, preservation and preparation of samples for the determination of major and trace elements; inorganic compounds (speciation); organic compounds; biological samples; food and beverages; water and waste water samples; soils and related samples.

Course category: Major Mandatory

Course Name: Inorganic Chemistry I (Chem2221)

Credit Hour: 3

Prerequisite: None

Course description (Synopsis):

In this course students will also learn atomic structure, periodic trends, chemical bonding, Acid-base theory and solvent system, chemistry of main group elements; chemistry of hydrogen, s-block, p-block and noble gases; compounds of main group elements: synthesis, reactions and applications.

Course category: Major Elective

Course Name: Introduction to spectroscopy (Chem3312)

Credit Hour: 3

Prerequisite: Instrumental Analysis

Course description (Synopsis):

The course is designed in order to make the students to develop the principles of instrumental methods of analysis, and their applications. Basically, the course enables students to apply basic concepts of analytical methods based on the interaction of electromagnetic radiation with matter; with main focus on atomic and molecular spectroscopic techniques. Atomic absorption and atomic emission methods are to be elaborated. Ultraviolet and visible spectroscopy, infrared spectroscopy, nuclear magnetic resonance spectroscopy are the core molecular spectroscopic techniques while molecular fluorescence and phosphorescence methods are to be elaborated in molecular emission part of the course. Furthermore, the course will familiarize the students with the basic knowledge of instrumentations of spectroscopy techniques.

Course category: Major Mandatory

Course Name: Inorganic Chemistry II (Chem2222)

Credit Hour: 3

Prerequisite: Instrumental Analysis

Course description (Synopsis):

Introduction to the basic principles of modern inorganic chemistry; the course emphasizes the combination, structure, synthesis and reactivity of inorganic compounds, and especially transition metal complexes. It includes ligand field theory of transition metal compounds, their spectroscopic/thermodynamic properties, periodicity of elements, the molecular symmetry, group theory, structures, bonding, electronic spectra, acid-base chemistry and reaction mechanisms, solid-state chemistry, and solution chemistry.

Course category: Major Mandatory

Course Name: Practical Inorganic Chemistry I (Chem2224)

Credit Hour: 1

Prerequisite: Inorganic Chemistry I

Course description (Synopsis):

This course emphasizes on Synthesis, Isolation, Characterization, and the chemical properties of variety of inorganic compounds.

Course category: Major Mandatory

Course Name: Practical Inorganic Chemistry II (Chem3223)

Credit Hour: 1

Prerequisite: Inorganic Chemistry I

Course description (Synopsis):

This course emphasizes on Synthesis, Isolation, Characterization, and the chemical properties of variety of inorganic compounds.

Course category: Major restricted Elective

Course Name: Inorganic Materials Chemistry (Chem3322)

Credit Hour: 3

Prerequisite: None

Course description (Synopsis):

An introduction to typical inorganic materials, with an emphasis on crystalline materials (Discussion of crystalline structures) and how their material properties can be understood based on the constituent atoms, crystal structure and electronic structure. Includes basics of crystallography, and notions of how crystal structures are built up from the concepts of close-packing and of the linking of polyhedral. Method of preparation of solids. Defects and non-stoichiometry, and some discussion of specific structure types with reference to advanced material properties.

Course category: Major restricted Elective

Course Name: Organometallic chemistry (Chem3321)

Credit Hour: 3

Prerequisite: None

Course description (Synopsis):

This course deals with a range of aspects of the organometallic's chemistry including theoretical background, basic concept, important organometallic reactions, and synthetic applications. In general, the course covers the organometallic chemistry of main-group and transition metals, and their relevance to organic synthesis and homogeneous catalysis.

Course category: Major restricted Elective

Course Name: Catalytic Chemistry (Chem3324)

Credit Hour: 3

Prerequisite: None

Course description (Synopsis):

This course is designed to introduce graduate students in Chemistry and Chemical Engineering to fundamental concepts of heterogeneous catalysts and to illustrate various aspects of homogeneous and heterogeneous catalysis research. Topic includes: Catalytic activities of transition metal systems, Heterogeneous Catalysis, Catalytic cycles, Ligand systems.

Course category: Major restricted Elective

Course Name: Introduction to Solid State Chemistry (Chem4321)

Credit Hour: 3

Prerequisite: Inorganic Chemistry II

Course description (Synopsis):

Basic principles of chemistry are applied to the description of structure-property relationships in the solid state. Connections among electronic structure, chemical bonding, and crystal structure of a variety of materials are developed. Attention is given to characterization of local and extended arrangements in crystalline and amorphous solids, including metals, ceramics, and semiconductors. Lectures are supported by examples of "real world" applications drawn from industrial practice and emerging technologies.

Course category: Major restricted Elective

Course Name: Bioinorganic Chemistry (Chem3331)

Credit Hour: 3

Prerequisite: None

Course description (Synopsis):

This course is designed to discuss the role of metal ions in biological processes observed in biological systems. Metalloid-biomolecules which will be discussed in detail include metalloproteins for electron transport, oxygen binding, and metal transport and storage, metalloenzymes for various functions of hydronation, redox-reaction, and isomerization, and non-proteins for photo-redox and metal-ion transport and storage. The role of metal in medicine and environment as well as synthetic model approach to metallobiomolecules will be also emphasized.

Course category: Major Mandatory

Course Name: Organic Chemistry I (Chem2231)

Credit Hour: 3

Prerequisite: General Chemistry

Course description (Synopsis):

Carbon can form covalent bonds with itself and other elements to create a mind-boggling array of structures. Organic Chemistry I deal primarily with the basic principles to understand the structure and reactivity of organic molecules. Emphasis is on substitution and elimination reactions and chemistry of the carbonyl group. The course deals with historical background of Organic Chemistry; Bonding, Structure and Reactivity; Functional groups (Nomenclature, physical and chemical properties), Stereochemistry: Chirality and Optical activity; Stereoisomerism; Configuration: Cahn-Ingold-Prelog sequence rules for assigning configuration, Introduction to major classes of Organic Reactions: Substitution Reactions, Elimination reactions, Addition reactions; Rearrangement reactions.

Course category: Major Mandatory

Course Name: Organic Chemistry II (Chem2232)

Credit Hour: 3

Prerequisite: Organic Chemistry I

Course description (Synopsis):

This course designed to make students aware of organic reactions and mechanisms in detail and depth. It elaborates Chemistry of aromatics, amine, carbonyl compounds, carboxylic acid and its derivatives, and oxidation-reduction reactions. In addition, Chemistry biological molecules such as carbohydrates, amino acids, peptides, lipid, and nucleic acids are introduced to address basic concepts about natural product Chemistry.

Course category: Major Mandatory

Course Name: Practical organic chemistry II (Chem3233)

Credit Hour: 2

Prerequisite: Organic Chemistry I and Practical Instrumental Analysis

Course description (Synopsis):

This course is designed to give basic understanding to esterification reactions; acetylation of aniline; p-nitroaniline from acetanilide; azo dyes and the dying process, oxidation of alkyl arenes; synthesis using the aldol condensation, Friedel-Crafts reaction; and the Diels-Alder reaction. The students will also able to perform physical characterization of organic compounds: preliminary examination, melting point, boiling point, specific gravity, index of refraction of liquids; separation of mixtures; classification of organic compounds by solubility; preparation of derivatives; use of spectroscopic methods for structure determination.

Course category: Major Restricted Elective

Course Name: Physical Organic Chemistry (Chem3332)

Credit Hour: 3

Prerequisite: Organic Chemistry II and Physical Chemistry II

Course description (Synopsis):

Physical Organic Chemistry is a discipline of organic chemistry that focuses on the relationship between chemical structures and reactivity, in particular, applying experimental tools of physical chemistry to the study of organic molecules. The course deals with correlation of structure with reactivity; linear free energy relationships and energetics, kinetics and methods of establishing reaction mechanisms. The course elaborates the chemistry of reactive intermediates including carbocations, carbanions, free radicals, carbenes and nitrenes and applies the principles in mechanism and synthesis of some organic molecules. It also deals with the application of the basic principles of Frontier Orbital Theory in various types of pericyclic reactions including electrocyclic reactions, cycloaddition and sigma tropic rearrangements. Furthermore, the course is intended to apply the concepts of molecular spectroscopy in elucidation of some organic molecules.

Course category: Major Restricted Elective

Course Name: Protein Chemistry (Chem4335)

Credit Hour: 3

Prerequisite: Chem2231 (Organic Chemistry I), Chem2232 (Organic Chemistry II)

Course description (Synopsis):

This course's aim is to explain structure and basic biochemistry of proteins, biophysical methods to investigate proteins. Enzyme mechanism of action, how drugs inactivate enzymes will be covered. Other subjects include protein folding diseases, antibody's structure and their mechanism of action.

Course category: Major Restricted Elective

Course Name: Synthetic Organic Chemistry (Chem4331)

Credit Hour: 3

Prerequisite: None

Course description (Synopsis):

Synthetic Organic Chemistry is a discipline of organic chemistry which is related to the chemical science involving in the construction of specific chemical compounds from simple compounds. The course deals with the aspect of a planned sequent route resulting in products with desired activity. This course proves that synthetic process permits synthesis of naturally occurring compounds with actual structure or once needed with structural variation to enhance desired characteristics. This course is designed to prepare students to deal with complex organic reactions and to plan and synthesize various organic compounds as well as complexes with optimal use of resources and available technology. The course describes that fine chemical used as fuels, pesticides and herbicides, diagnostics and medical devices, vitamins, perfumes, cosmetics, fabrics and all sorts of high-technology materials used in televisions, computers and other information technologies, and transportation and space machines are also product of organic synthesis.

Course category: Major Restricted Elective

Course Name: Medicinal Chemistry (Chem4332)

Credit Hour: 3

Prerequisite: None

Course description (Synopsis):

This course covers fundamental features of modern medicinal chemistry topics in the areas of theoretical aspects of drug action, structure-activity relationships, design and synthesis of drug molecules in major therapeutic categories, and drug delivery technology.

Course category: Major Restricted Elective

Course Name: Natural Product Chemistry (Chem3334)

Credit Hour: 3

Prerequisite: None

Course description (Synopsis):

The course deals with building blocks, biological reactions and their mechanism involved in biosynthesis of various classes of secondary metabolites. The chapters are subdivided according to building blocks involved in biosynthesis of natural products as acetate pathway, shikimate pathway, mevalonate and deoxy xylulose phosphate pathway, and alkaloids (amino acid, non-amino acid and mixed pathway biosynthesized). In addition, the role of secondary metabolites in plant/animal, plant/plant and plant/microbe ecological interactions will also be discussed under chemical ecology section. Biosynthesis path leading to various classes of natural products such as fatty acids, prostaglandins, anthraquinones and naphthoquinones, coumarins, lignans, flavonoids (chalcones, flava's, flavones, flavanones, Isoflavones, Isoflavones, Isoflavanones, pterocarpans, rotenoids, auronones, stilbenes, anthocyanins etc.), terpenoids, and alkaloids (amino acid, non-amino acid and mixed path biosynthesized) will be covered. The course tries to discuss the biosynthesis origin of high proportion of those natural products currently used in medicine or their structural analogues.

Course category: Major Mandatory

Course Name: Biochemistry (Chem3253)

Credit Hour: 3

Prerequisite: Chem2231 (Organic Chemistry I), Chem2232 (Organic Chemistry II)

Course description (Synopsis):

Biochemistry deals with complete understanding of the molecular levels of the chemical process associated with living cells. The scope of the subject is providing biochemical facts and the principles to understand metabolism of nutrient molecules in physiological and pathological conditions. It is also emphasizing on genetic organization of mammalian genome and hetero & autocatalytic functions of DNA.

Course category: Major Restricted Elective

Course Name: Organic structure analysis (Chem4333)

Credit Hour: 3

Prerequisite: Organic Chemistry I & II

Course description (Synopsis):

Organic structure analysis covers modern and advanced methods of elucidation of the structures of organic molecules, including NMR, MS, UV and IR. The major emphasis of this course is on structure determination by way of interpreting the data (generally in the form of a spectrum or spectra) that each method provides. The course helps to prove a structure of an unknown that's given in instrumental analysis or advanced lab. The course will also include a couple of lectures looking at what type of software is available on the world wide web for organic structure elucidation.

Course category: . Major Mandatory

Course Name: Physical Chemistry I (Chem2242)

Credit Hour: 3

Prerequisite: General Chemistry

Course description (Synopsis):

This course covers ideal and real gases, Zeroth's Law of Thermodynamics; First Law of thermodynamics, Thermochemistry, second Law of Thermodynamics, third law of thermodynamics, chemical equilibrium, phase equilibrium, solutions.

Course category: Major Mandatory

Course Name: Quantum Chemistry (Chem3242)

Credit Hour: 3

Prerequisite: Physical Chemistry II, Applied Mathematics I and Applied Mathematics II

Course description (Synopsis):

Experimental foundation of Chemistry; The Schrödinger equation; Operators in quantum mechanics; Solution of Schrodinger equation for some simple systems; Atomic structure; Molecular structures; chemical bond; molecular spectroscopy.

Course category: Major Restricted elective

Course Name: Statistical Thermodynamics and Surface Chemistry (Chem4341)

Credit Hour: 3

Prerequisite: Physical Chemistry III (Quantum Chemistry)

Course description (Synopsis):

Introduction to statistical thermodynamics, Terminology and basic concepts, Distribution function, Surface chemistry: Interfacial structure, Surface tension and surface free energy, Methods of surface tension measurement, Nature and thermodynamics of Liquid-Gas interface, the surface tension of solution, the two-dimensional ideal gas laws, adsorption at the solid, Solution interface.

Course category: Major Mandatory

Course Name: Practical Physical Chemistry I (Chem3241)

Credit Hour: 1

Prerequisite: None

Course description (Synopsis):

Solubility, phase rule, partition coefficient, transition temperature and freezing point, Conductance, Electrochemistry, kinetics of reaction Thermochemistry.

Course category: Major Mandatory

Course Name: Practical Physical Chemistry II (Chem3243)

Credit Hour: 1

Prerequisite: Practical Physical Chemistry I

Course description (Synopsis):

Kinetic of Reaction, Spectroscopy, Computational software, adsorption, surface tension, viscosity.

Course category: Major Restricted Electives

Course Name: Industrial Chemistry I (Chem3351)

Credit Hour: 3

Prerequisite: None

Course description (Synopsis):

Industrial chemistry is the manufacturing art concerned with the transformation of matter into useful materials in useful amounts. This industrial chemistry I covers different topics, which includes introduction to processes and processes variables, unit operations, material balance and energy balance. Water in the chemical industry; basic chemical industrial processing.

Course category: Major Restricted Electives

Course Name: Industrial chemistry II (Chem4352)

Credit Hour: 3

Prerequisite: None

Course description (Synopsis):

This Industrial chemistry II course deals with more of basic organic chemistry and polymer chemistry concepts for example the course cover the following organic industrial processes like coal petroleum chemistry, main petrochemicals, sugar, oils and fats, detergents, paper, foodstuff, pharmaceuticals, agrochemicals, dye stuff, leather basic organic products and polymer chemistry such as synthetic and artificial plastics, rubber and fibers.

Course category: Major Mandatory

Course Name: Environmental Chemistry (Chem3251)

Credit Hour: 3

Prerequisite: Analytical chemistry

Course description (Synopsis):

Environmental Chemistry offers a rigorous introduction on the chemical principles that govern the reactions, transport, effects and fates of chemical species in water, soil, and air. The first unit discusses and familiarizes students with the various divisions of the environment and explains the possible consequences of the effects of technology and man's activities on the chemical composition and properties of the natural environment; The course will pay special consideration to basics of atmospheric chemistry; aquatic chemistry; and soil chemistry; pollution of air, water and soil.

Course category: Major Restricted Elective

Course Name: Elements of the Chemical Industry (Chem4351)

Credit Hour: 3

Prerequisite: None

Course description (Synopsis):

The chemical industry is highly globalized producing thousands of chemicals from a wide variety of raw materials by means of different technologies for diverse end use sectors. Industrial chemistry deals with commercial production of chemicals and related products through transformation of materials and energy into useable products resulting in economic growth and improvement of life. This course provides students the foundation to try and bridge the gap between classical chemistry and chemistry as is applied in industry. In order to do so, the course starts with providing an understanding of the structure of the industry and proceeding through the role and application of catalysts and principles of green chemistry in different processes, basic understanding of flow diagrams, introduction to unit operations and unit processes, and reactor designs for chemical reactions.

Course category: Major Mandatory

Course Name: Research Methods and Scientific Writing (Chem3252)

Credit Hour: 2

Prerequisite: None

Course description (Synopsis):

Conducting Research enables students to grow both professionally and personally in ways that are not possible through traditional classroom and laboratory/workshop instruction. Hence the course introduces the language of research, the elements of research process, review chemical literature and writing and reporting of findings.

1.3 Applied Physics

General information

I. Duration of study

Normal modality

Regular: a 4-year program

Extension program: 5 years

II. Course category

NO	Course category		Course level	Credit requirement	Percentage from the total
1	General	Mandatory	University required	27	18.62 %
4	Basic	Mandatory	School (SoANS) required	30	20.68 %
	Major	Mandatory	Department required	52	35.86 %
		Elective		33	22.75 %
		Subtotal		85	
	Free electives			3	2.06 %
	Total			145	

Course category: General/ university required

Course Name: Entrepreneurship and Business Development (SOSC5003)

Credit Hour: 3

Prerequisite: None

Course description (Synopsis):

This interdisciplinary course in general is designed to introduce students to the concept of sustainable entrepreneurship, a manageable process that can be applied across careers and work settings. It focuses on building entrepreneurial attitudes and behaviors that will lead to creative solution within community and organizational environments. This course is designed to prepare individuals for ownership of their own innovative business, and assist start-ups to function more effectively, increase the chances of new business success, enhance profitability, and increase employment.

More specifically, the course provides students with an introduction to the concepts and skills necessary to successfully commercialize new products and services. Entrepreneurship is not just about starting a business. It is also about identifying good opportunities and then creating, communicating, and capturing value from those opportunities; including innovation in a corporate context. It will also teach students the skills to analyze business opportunities, and articulate them as a compelling business description, and pitch to an audience of investors, customers, or business partners. It focuses on building entrepreneurial attitudes and behaviors that will lead to creative solution within community and organizational environments.

Course category: General/ university required

Course Name: Communicative English Skills (EnLa 1001)

Credit Hour: 3

Prerequisite: None

Course description (Synopsis):

Communicative English Skills is a course where students learn what they need to know for a career in science context. The course gives students the language, information, and skills they need to study science context. It also provides students the language appropriate for studying science context and real work situations as it comprises unique sections such as: **‘it’s my job’** wherein real people talk about their work in science context , **‘listening’** whereby students are exposed to situations related to science context , technical explanations, and interviews, **‘reading’** whereby students meet a variety science context based texts, and the **‘writing section’** which is designed to let students compose short reports on different activities.

Course category: General/ university required

Course Name: Basic Writing Skills (EnLa-1002)

Credit Hour: 3

Prerequisite: Communicative English Skills (EnLa 1001)

Course description (Synopsis):

Basic Writing Skills course aims at developing students' basic writing skills in science context. The course gives students the language writing skills they need to study science. It contains sentence level writing: sentence structure, sentence types sentence combinations, common sentence errors (fragment, run on, comma splices, misplaced modifier, dangling modifier, faulty parallelism, faulty reference of pronoun, faulty agreement and shifts); paragraph level writing: the essence of a paragraph, components of a paragraph (topic sentence, supporting sentences, concluding sentence), characteristics of effective paragraph (unity, coherence and completeness) and the steps in writing a paragraph and types of a paragraph; essay level writing: structure of an essay, thesis statement and supporting paragraphs, types of essays and techniques of essay development.

Course category: General/ university required

Course Name: Introduction to Civics and Ethics (LART 1001)

Credit Hour: 3

Prerequisite: None

Course description (Synopsis):

It is now become clear that Ethics and Citizenship Studies has become not only a field of specialization in itself but has also been attracting leaders who envision instilling democracy on a nun shakable ground within their own society. Autoscore, Ethics is a system of moral principles which involves systematizing, defending and recommending concepts of rights and wrong behavior. It affects how people make decisions and lead their lives. Citizenship, on its part, is a legal status of individuals within a given state. It embodies the legal and political relationship between citizens and state, underlining the reciprocal relationship between the two. This course is designed with the aim of equipping learners with necessary ethical qualities and civic competences while dealing with issues that affect their society at all levels and human in general.

The course starts with unfolding the notions, principles and theories of ethics which can shape human attitude, action and behavior in making moral judgments. Next, the course introduces learners to the nature, mutual interactions and historical evolutions of society, state, government and citizenship. It also elucidates issues pertaining to political governance such as constitution, democracy, and human rights in some details. To enable learners grasp basic knowledge of political, economic and social dynamics of international system in today's globalized world, the course also introduces international relations and foreign policy and other major contemporary global issues. In light of this, the course does not present mere theoretical knowledge, but also practical knowledge of accentuating art of governing and protecting national interest in today's complex world.

Course category: General/ university required

Course Name: Logic and Critical thinking (LART 1002)

Credit Hour: 3

Prerequisite: None

Course description (Synopsis):

The main goal of the course is to improve critical and logical reasoning skills. Students will see how our ordinary intuitions on good or bad reasoning can be articulated explicitly in formal systems, and gain a new ability to evaluate arguments and reasoning they encounter every day with rigorous logical concepts and tools.

As to the subject matter, it introduces systematic methods of reasoning, such as argument, deduction, induction, syllogistic, and propositional logic.

Course category: General/ university required

Course Name: Introduction to Economics (SOSC2002)

Credit Hour: 3

Prerequisite: None

Course description (Synopsis):

This course provides a general introduction to economics combining elements of micro and macro fundamentals. The main objective of this course is to introduce and acquaint students with the preliminary principles (theories) and knowledge of economics and the application of economic theories (principles) in the actual world; the daily activities of the households, firm business or any other form of enterprises at micro levels. Students will also be able to contextualize the key macroeconomic variables and policy instruments.

Specifically, the course introduces students with theory of consumer behavior, production, and cost of production. In these theories how decisions are made by different economic agents will be discussed. Furthermore, the course covers different characteristics of perfect and imperfect market structure. Lastly the course tries to introduce basic macroeconomic concepts such as national income accounting, unemployment, inflation, fiscal and monetary policy instruments.

Course category: General/ university required

Course Name: General Psychology and Life Skills (LART 2002)

Credit Hour: 3

Prerequisite: None

Course description (Synopsis):

Psychology is a science of human cognitive processes and behaviors. This course is designed to give students an overview of what psychological science has discovered about human behavior

and mental processes throughout human history. Students will gain an understanding of the psychological phenomena that occur in daily life as well as the practical applications of psychological knowledge. Upon completing the course, students shall be able to demonstrate a basic knowledge of the science of psychology. Specifically, the course general psychology is concerned with discussing perspectives in psychology and basic psychological concepts such as sensation and perception, learning, personality, motivation, emotion, and basic life skills (intrapersonal, interpersonal, social and academic skills). Emphasis will be given to both theoretical and practical implications of these concepts to effectively function as individual and team in a community.

Course category: General/ university required

Course Name: Physical fitness and conditioning I (SpSc1011)

Credit Hour: 0 cr.hr

Prerequisite: None

Course description (Synopsis):

This course will provide the students with basic concepts of the five components of health-related physical fitness (cardiovascular, muscular strength and endurance, flexibility, and body composition), hypokinetic disease and general principles of training. It is mainly practical oriented. As a result, the students will be exposed to various exercise modalities, sport activities, minor and major games, and various training techniques as a means to enhance health related physical fitness components. In addition, they will develop the skills to assess each component of fitness and will practice designing cardiovascular, muscular strength and endurance, and flexibility programs based on the fitness assessment. The course serves as an introduction to the role of exercise in health promotion, fitness, performance including the acute and chronic responses of the body to exercise.

Course category: General/ university required

Course Name: Physical fitness and conditioning II (SpSc 1022)

Credit Hour: 0 cr.hr

Prerequisite: SpSc 1011

Course description (Synopsis):

This course is designed to acquaint freshman engineering and applied natural science students with the nature and scope of different ball games.

It emphasizes the value of establishing lifelong fitness using ball games as a means and focuses on the fundamental of volley ball, hand ball, basketball and football as a life time leisure activity also focuses on the development of personalized approach to healthy active living through participation in a verity of ball games that have the potential to engage students' interest throughout their lives. Again, the courses enable the participants enjoying practice and acquire proper technique and strategies associated with the ball games mentioned above and learn rules governing the game.

Course category: General/ university required

Course Name: Geography of Ethiopia and the Horn (LART 1003)

Credit Hour: 3

Prerequisite: None

Course description (Synopsis):

This course covers a brief description on the location, shape and size of Ethiopia as well as basic skills of reading map, the physical background and natural resource endowment of Ethiopia and the Horn which includes its geology and mineral resources, topography, climate, drainage and

water resources, soil, fauna and flora. It also deals with the demographic characteristics of the country and its implications on economic development.

Course category: General/ university required

Course Name: History of Ethiopia and the Horn (LART 1004)

Credit Hour: 3

Prerequisite: None

Course description (Synopsis):

This course describes why history is important, how history is studied and introduces the region Ethiopia and the Horn. It treats human evolution, Neolithic Revolution, settlement patterns as well as religion and religious processes in Ethiopia and the Horn. Based on these historical backgrounds, the course describes states, external contacts, economic formations and achievement in terms of architecture, writing, calendar, and others to the end of the 13th century. Historical processes including states formation and power rivalry, trade, external relation, threats and major battles, centralization and modernization attempts, Italian occupation, and socio-economic conditions from 1800 to 1941 makes central position in the modern history of the region.

Course category: Basic

Course Name: General Physics for pre-science (Phys1113)

Credit Hour: 3

Prerequisite: Knowledge in Higher Secondary Physics

Course description (Synopsis):

At the end of this course students are expected to be acquainted with basic concepts in different branches of physics, identify the connection between them and explain the common phenomena. They will also develop skills of solving problems.

Course category: Basic

Course Name: General Physics (Phys1101)

Credit Hour: 3

Prerequisite: Knowledge in Higher Secondary Physics

Course description (Synopsis):

This course provides science students with the basic concepts of physics that enable them to understand describe and explain natural phenomena. Emphasis is laid on general principles and fundamental concepts in measurements, mechanical and thermal interactions, fluid mechanics, electromagnetism, oscillations and waves with applications of physics in various fields of science. Permitting the students to voice and defend their own opinions and enhancing the students' commitment to individual study and acquiring knowledge. Active involvement of learners is required at each phase. This is done through questioning and answering, reflection, reporting, solving problems associated with the respective topics.

Course category: Basic

Course Name: Practical General Chemistry (Chem1104)

Credit Hour: 1

Prerequisite: None

Course description (Synopsis):

The course is designed to give basic understanding and concepts of measuring mass, and volumes by using cylinder and burette, experimental errors, systematic and random errors, significant digits/figures, beam balance, mean, mean deviation, Bunsen burner, luminous and non-luminous flame, physical and chemical changes, properties and reaction of substances, diffusion rates, kinetic theory of gases, Graham's law of diffusion, percentage

of water of hydration, calculating equivalent weight; basic laboratory operations such as recrystallization, simple distillation, fractional distillations and steam distillations.

Course category: Basic

Course Name: General Chemistry (Chem1102)

Credit Hour: 3

Prerequisite: None

Course description (Synopsis):

The course is designed to study Properties, units and measurements; the composition of matter, chemical reactions, reactions stoichiometry, atomic structure and the periodic table, the chemical bond, structure of molecules, properties of solutions, chemical equilibria, introduction to functional groups and their typical reactions.

Course category: Basic

Course Name: G Basic Statistics for Applied Science (Math1106)

Credit Hour: 3

Prerequisite: None

Course description (Synopsis):

At the end of the course students are expected to: •have a broad knowledge of the basic understanding of statistical techniques demonstrated through principles of data collection, descriptive statistics, linear regression, correlation, computation and data analysis; •identify different techniques of sampling and understand the methods of data collection, organization, presentation, analysis and interpretation; •differentiate among common types of data, and summarize and display them appropriately; •learn some desirable properties of averages and

measures of variation; •have basic skills in exploratory data analysis and problem solving. This is include: History of statistics, Meaning of statistics; Methods of data collection; Methods of data presentation; Measures of location; Measures of variation; Moments, skewness and kurtosis; terminologies in probability; Counting Techniques; definition of Probability (approaches to probability); Probability distributions; Sampling and Sampling Distribution of the mean and proportion; Elementary description of the tools of statistical inference: Basic concepts; Estimation: (Point and Interval) for the population mean and proportion; Hypothesis testing on the population mean and proportion; Simple linear regression, correlation and rank correlation.

Course category: Basic

Course Name: Mechanics and Heat (Phys2201)

Credit Hour: 3

Prerequisite: General Physics for prescience.

Course description (Synopsis):

This course is designed to provide the fundamental knowledge of Physics as a basic requirement for Applied Physics students. It mainly discusses: Kinematics of particle, Particle Dynamics, Work and Energy, Impulse and Momentum, Rotation of Right Bodies, Simple harmonic motion, Fluid Mechanics. Upon understanding this course, the students will have the knowledge on fundamental physics that will be used in different applied science and engineering fields for technological applications.

Course category: Basic

Course Name: Electromagnetism (General Physics II) ((Phys 2213))

Credit Hour: 3

Prerequisite: Knowledge in General Physics – I

Course description (Synopsis):

Upon understanding this course, the students will have the knowledge on fundamental physics that will be used in different applied science and engineering fields for technological applications.

Course category: Basic

Course Name: Electromagnetism practice (Phys2214)

Credit Hour: 1

Prerequisite: General Physics II

Course description (Synopsis):

Upon understanding this course, the students will have the knowledge on fundamental physics that will be used in different applied science and engineering fields for technological applications.

Course category: Major mandatory

Course Name: Classical mechanics I (Phys2201)

Credit Hour: 3

Prerequisite: None

Course description (Synopsis):

The main topics to be included in this course are: Coordinate Systems and Coordinate Transformation, Velocity and Acceleration in Generalized Coordinates, Particle. Dynamics, Position, Time and Velocity Dependent Forces, Simple Harmonic Oscillator, Damped and Forced Oscillations, Conservative Forces and Potential Energy, Conservation of Energy, LaGrange and Hamiltonian Formalism and Their Application.

Course category: Major mandatory

Course Name: Electronics I (Phys2206)

Credit Hour: 3

Prerequisite: Electromagnetism.

Course description (Synopsis):

Review of Energy band theory, Network theories and Equivalent circuits. PN Junction and the Diode Effect, Circuit, Applications of Ordinary Diodes, Bipolar Junction Transistor (BJT) Common Emitter Amplifier, Common Collector Amplifier, Common Base Amplifier. Junction Field Effect Transistor (JFET), JFET Common Source Amplifier, JFET Common Drain Amplifier. The Insulated-Gate Field Effect Transistor. Multiple Transistor Circuits. Open-Loop Amplifiers, Ideal Amplifier, Approximation Analysis, Open-Loop Gain, Number Systems, Boolean Algebra, Logic Gates, Combinational Logic. Multiplexers and Decoders. Schmitt Trigger, Two-State Storage Elements, Latches and Un-Clocked Flip-Flops. Clocked Flip-Flops, dynamically clocked Flip-Flops, One-Shot Registers. Transducers, Signal Conditioning Circuits, Oscillators, Radio Signals, Laboratory sessions on Selected Electronic Circuits

Course category: Major mandatory

Course Name: Basic electronics Practice (Phys2216)

Credit Hour: 1

Prerequisite: Basic Electronics

Course description (Synopsis):

Experimental observations form the basis for new hypotheses, and also test scientific theories. It is therefore essential that all Physicists understand the experimental method and develop the ability to make reliable measurements. This course provides a broad foundation in experimental Physics.

Course category: Major mandatory

Course Name: Experimental physics II (Phys2214)

Credit Hour: 1

Prerequisite: General Physics II.

Course description (Synopsis):

Experimental observations form the basis for new hypotheses, and also test scientific theories. It is therefore essential that all Physicists understand the experimental method and develop the ability to make reliable measurements. This course provides a broad foundation in experimental physics.

Course category: Major mandatory

Course Name: Modern Physics Practice (Phys2218)

Credit Hour: 1

Prerequisite: Modern Physics

Course description (Synopsis):

Experimental observations form the basis for new hypotheses, and also test scientific theories. It is therefore essential that all Physicists understand the experimental method and develop the ability to make reliable measurements. This course provides a broad foundation in experimental Physics.

Course category: Major mandatory

Course Name: Quantum Mechanics I (Phys3221)

Credit Hour: 3

Prerequisite: Modern Physics

Course description (Synopsis):

Quantum mechanics is fundamental theoretical framework in describing microscopic systems. The course contains Origin and Development of Quantum Mechanics, Mathematical Foundation of Quantum Mechanics, Operator Algebra, The Schrodinger and Heisenberg Equations, and the Harmonic Oscillator.

Course category: Major mandatory

Course Name: Modern Physics (Phys2208)

Credit Hour: 3

Prerequisite: General Physics

Course description (Synopsis):

The rationale of this course is to introduce students to the basic ideas of modern physics with emphasis on the Theory of Special Relativity, identification of the limitations of classical mechanics and the development of quantum mechanics, the wave particle duality and the atomic structure.

Course category: Major mandatory

Course Name: Statistical Physics I (Phys3231)

Credit Hour: 3

Prerequisite: General Physics

Course description (Synopsis):

This course contains the following contents: Features of Macroscopic Systems, Basic Probability Concepts, Statistical Description of Systems of Particles, Thermal Interactions, Microscopic Theory and Macroscopic Measurements, Canonical Distribution, Thermodynamic Interactions.

Course category: Major mandatory

Course Name: Nuclear physics I (Phys3205)

Credit Hour: 3

Prerequisite: Electromagnetism and Quantum mechanics

Course description (Synopsis):

This course has been designed so as to give the students the introductory ideas about the nucleus and the phenomena of radioactivity and theoretical models that describe the atomic nucleus. It also includes; nuclear reactions, elementary particle interactions, Force and energies inside the nucleus.

Course category: Major mandatory

Course Name: Solid State Physics I (Phys3202)

Credit Hour: 3

Prerequisite: Knowledge in General Physics – I & II and Higher Secondary Physics.

Course description (Synopsis):

This course is intended to introduce students to the basic ideas that underlie solid state physics, with emphasis on the behavior of electrons in crystalline structures, particularly in materials that are metallic. The other contents are X-ray diffraction, Binding Energy in Crystals, Thermal properties of solids, Dielectric properties of solid, Magnetic properties of solids, The free electron Fermi gas.

Course category: Major mandatory

Course Name: Introduction to Computational Physics (Phys3204)

Credit Hour: 3

Prerequisite: General Physics I

Course description (Synopsis):

In this course learners needs to understand FORTRAN and different numerical methods. The content includes: Fortran Programing, Linear algebra, Methods for determinations of zeros, Numerical integration, numerical differentiation, Monte Carlo Method.

Course category: Major mandatory

Course Name: Linear Algebra (Math 2201)

Credit Hour: 3

Prerequisite: none

Course description (Synopsis):

This course deals with finite dimensional real vector spaces and linear transformations. It is an essential prerequisite for the proper comprehension of many branches of mathematics. Linear Algebra is also the ideal subject to introduce the student to the higher level of abstraction practiced in modern mathematics today.

Course category: Basic

Course Name: Numerical Techniques (Math2102)

Credit Hour: 3

Prerequisite: Linear Algebra

Course description (Synopsis):

The Course is designed to develop the basic concepts in identifying sources of errors and error estimations, solving applied modeled Algebraic, Transcendental and systems of linear equations in different areas of science classically and using computer applications. It also enables students to identify and use the Forward, Backward, Average, Central difference and Shift Operators. Moreover, find the value of unknown function between two known values using different methods of interpolations, and find the derivative of unknown function at a given known point and between two known points using different methods. Finally, find the definite integral of functions those are difficult to find anti derivatives easily using different numerical methods and obtain the definite integral of a given functions given as a discrete set of values and solve ordinary Differential Equations using different Numerical methods. This course discusses basic concepts in error estimation, solutions of non-linear equations, solutions of system of linear equations and non-linear equations, finite differences, numerical interpolations, Eigen values and Eigen vectors, numerical differentiation and numerical integration and Numerical solution of Ordinary differential equations.

Course category: Major mandatory

Course Name: Nuclear physics practice (Phys3214)

Credit Hour: 2

Prerequisite: Nuclear Physics I

Course description (Synopsis):

Experimental observations form the basis for new hypotheses, and also test scientific theories. Based on this fact this course is designed to do selected experiments in Atomic and Nuclear Physics: Study of Properties of Geiger Muller Counter, Statistics of Nuclear Counting (Poisson Statistics), Absorption of γ and β rays (Efficiency for β counting), Zeeman Effect, Photoelectric Effect and Condensed Matter Physics: Determination of Specific Charge of the electron, Photovoltaic Energy Conversion, Hall Effect, X-Ray Diffraction.

Course category: Major mandatory

Course Name: Applied optics practice laboratory (Phys3213)

Credit Hour: 2

Prerequisite: Knowledge in Modern Optics

Course description (Synopsis):

This lab course includes a quick review over the basic instruments like Travelling microscope, Spectrometer, Laser etc. along with ten experiments. All the experiments dealt here covers the applications of optical physics principles in the areas like diffraction, dispersion, interference and polarization.

Course category: Major mandatory

Course Name: Applied Optics (Phys2201)

Credit Hour: 3

Prerequisite: None

Course description (Synopsis):

Review of Electromagnetic Waves, Reflection from Plane Parallel Film, Multiple Beam Interference, Intensity Function, Multilayer Films, Fresnel Diffraction, Double Slit, Representation of Vibration in Light, Polarization of Light, Polarization Techniques, Interference of Polarized Light, Absorption and Scattering, Double 116 Refraction, Propagation of Light in Crystals, Optical Activity, Laser, Rate Equation, Fundamentals of Fiber Optics and Nonlinear Optics.

Course category: Major mandatory

Course Name: Mathematical Methods of Physics-I (Phys2205)

Credit Hour: 3

Prerequisite: Knowledge in General Mathematics– I & II

Course description (Synopsis):

This course deals with the mathematical techniques that are most frequently used in Physics and gives experience in their use and application to the students. Emphasis is placed on the use of mathematical techniques rather than their rigorous proof. Mathematical methods of physics is useful for the consideration of linear and non-linear, direct and inverse problems for physical relevant processes over time- and space- varying media under certain initial, boundary, transition conditions etc.

Course category: Major mandatory

Course Name: Electrodynamics I (Phys3211)

Credit Hour: 3

Prerequisite: Knowledge in General Physics for pre-science mechanics and basic mathematics.

Course description (Synopsis):

This course deals with classical electrodynamics applying differential and integral calculus. It also addresses electric and magnetic phenomenon in material medium including boundary

problems. The primary goal of this course is to strength the mathematical skills and knowledge of electrodynamic phenomena which is required in the other fields.

Course category: Major Mandatory

Course Name: Mathematical Methods of Physics-II (Phys3306)

Credit Hour: 3

Prerequisite Knowledge in General Mathematics– I & II

Course description (Synopsis):

This course deals with the mathematical techniques that are most frequently used in Physics like Vector matrices, Vector Calculus, Fields and gradients, Complex variables, etc and gives experience in their use and application to the students. Emphasis is placed on the use of mathematical techniques rather than their rigorous proof.

Course category: Major Elective

Course Name: Radiation physics I (Phys4306)

Credit Hour: 3

Prerequisite: Nuclear Physics I

Course description (Synopsis):

Radiation physics has a key role in the application of nuclear physics such as medical, industry, research field, Security, space activities: through the concept of radioisotopes, its interaction with matter and its mechanisms of detection. Therefore, this course is intended to give students a fundamental understanding of the physical principles underlying in radiation sources, interaction mechanisms with matter and detection.

Course category: Major Elective

Course Name: Physics of Electronics Devices (Phys4303)

Credit Hour: 3

Prerequisite: Basic Electronics

Course description (Synopsis):

This course prepares students to understand one of the practical aspects of physics in materials science. It is aimed at to exercise the students on developing new technologies in the field of electronic devices.

Course category: Major Elective

Course Name: Introduction to Medical Physics (Phys4332)

Credit Hour: 3

Prerequisite: Nuclear Physics I

Course description (Synopsis):

Today Medical physics has a key role in the medical sector: through the concept of radioisotopes, its interaction with matter and its mechanisms of detection. Therefore, this course is intended to give a fundamental understanding on the application of medical and radiation physics in medicine, for students having inclination toward health physics and Medicine.

Course category: Major Mandatory

Course Name: Introduction to Nano science (Phys4203)

Credit Hour: 3

Prerequisite: None

Course description (Synopsis):

Introduction to the theoretical and experimental concepts of the emerging field of nanotechnology. Prepare students from a wide range of disciplines for career or higher studies in

areas involving nanotechnology. Inherently interdisciplinary in nature, bridges across physics, chemistry, and computer science. Covers the emerging role of nanostructure materials for current and future application in the field of electronics, energy, textile, and medicine.

Course category: Major Elective

Course Name: Geophysics (Phys4318)

Credit Hour: 3

Prerequisite: General Physics for pre-science

Course description (Synopsis):

The course expected to provide students with the basic knowledge and covers Gravity: gravitational potential and equipotential surfaces; The Earth's shape and normal gravity; Isostasy; Seismology: Stress and strain, Mechanical response of rocks to deformation; earth processes; physical principles; elasticity and seismic waves; Seismic wave velocity variations within Earth, Geomagnetism: magnetic character of continental and oceanic crust. Heat Flow:

Course category: Major Elective

Course Name: Exploration Geophysics (Phys4320)

Credit Hour: 3

Prerequisite: General Geophysics

Course description (Synopsis):

This course provides students with the fundamental knowledge on: Basic principles and applications of geophysical exploration; Overview of the different geophysical methods; The magnetic field of the Earth, Magnetometers: Data presentation and qualitative interpretation;

Two- and three-layer reflection and refraction problems including inclined layers, Applications, Field procedure, Fundamentals of seismic instrumentation.

Course category: Major Elective

Course Name: Nuclear Physics and Nuclear Reactor Materials (Phys4312)

Credit Hour: 3

Prerequisite: Nuclear physics I

Course description (Synopsis):

Hence this course is intended to provide students with background on basic nuclear physics and the types, functions and properties of materials used in nuclear reactors and their response to reactor environment.

Course category: Major Elective

Course Name: Introduction to Quantum Information and Computation (Phys4321)

Credit Hour: 3

Prerequisite: Quantum Mechanics

Course description (Synopsis):

This course mainly deals with the following contents. Introduction and Foundation, Measurement and Evolution, Quantum Entanglement, Sources and Implications of Quantum Features, Quantum Information Theory.

Course category: Major Elective

Course Name: Quantum Optics (Phys4319)

Credit Hour: 3

Prerequisite: Quantum Mechanics

Course description (Synopsis):

This course contains the following contents: Quantum Description of Radiation, Quantum Distribution Functions, Squeezed states, Cavity Mode Dynamics with a squeezed Vacuum, Interaction of Radiation with a Two-Level Atom.

Course category: Major Elective

Course Name: Solid State Physics – II (Phys4301)

Credit Hour: 3

Prerequisite: Knowledge in General Physics – I & II, Higher Secondary Physics and Solid-State Physics - I

Course description (Synopsis):

This course will help students to work on their senior project on some applications of the area. The content includes: The free electron theory of metals, Band theory of solids, Electrical properties, Metals, Insulators, Semi- conductors and Super-conductors. Semiconductor Physics.

Course category: Major Elective

Course Name: Quantum Mechanics II (Phys4323)

Credit Hour: 3

Prerequisite: Modern Physics and Quantum Mechanics I

Course description (Synopsis):

The rationale of this course is to acquaint students with application of the Schrodinger to different quantum mechanical systems, discuss interactions responsible for the electronic structure of atoms, apply different approximation methods and verify scattering theory and introduce the basics of cold atomic gases.

Course category: Major Elective

Course Name: Introduction to Fiber optics and Non-linear optics (Phys4302)

Credit Hour: 3

Prerequisite: Knowledge in Modern Optics

Course description (Synopsis):

This course is intended to provide basic concepts of optical fibers in communication field and also various nonlinear optical materials for frequency generation. It is structured in such a way that the learner has to go through the activities as prescribed for maximum attainment. This course helps to appreciate and apply different fiber optical material and NLO material in instrumentation and research.

Course category: Major Elective

Course Name: Semiconductor Physics (Phys4321)

Credit Hour: 3

Prerequisite: Knowledge in General Physics – I & II and Solid-State Physics

Course description (Synopsis):

This course is intended to provide basic concepts of semiconducting materials. It is structured in such a way that the learner has to go through the activities as prescribed for maximum attainment.

Course category: Major Elective

Course Name: Classical Mechanics II (Phys2222)

Credit Hour: 3

Prerequisite: Classical mechanics I

Course description (Synopsis):

Dynamics of System of Particles, Center of Mass, Collisions, Scattering, Conservation. Theorems, Rigid Body Motion, Euler Angles, Principle of Virtual Work, Small Oscillations, Coupled Systems and Normal Modes, Wave Propagation, Wave Equation, Reflection, Transmission, Interference and Polarization.

Course category: Major Elective

Course Name: Laser Physics (Phys4307)

Credit Hour: 3

Prerequisite: None

Course description (Synopsis):

The course begins with a description of various types of plasmas and a discussion of some basic plasma parameters, such as the Debye length and the plasma frequency. Following a discussion of charged particle motion in electromagnetic fields, progressively more detailed models of plasmas are presented, starting with a dielectric description of cold plasma and moving on to the magnetohydrodynamic and kinetic descriptions. Additional topics may be added as time allows. Students are required to give a presentation to the class on a plasma physics topic related to the course.

Course category: Major Elective

Course Name: Introduction to Meteorology (Phys4328)

Credit Hour: 3

Prerequisite: None

Course description (Synopsis):

Course category: Major Elective

Course Name: Atmospheric Physics (Phys4326)

Credit Hour: 3

Prerequisite: General Physics I

Course description (Synopsis):

It gives students an introduction to understand the structure, composition and dynamics of the atmosphere. It is designed to explore the physical processes which occur in the space environment. Theories of solar wind propagation and its interaction with the earth are developed. It uses the single particle dynamics, magnetohydrodynamic (MHD) and fluid theories and kinetic approaches. It provides a brief revision of key elements of electromagnetic theory. MHD will be developed and applied, with application of kinetic theory to areas where MHD breaks down. The reasons why space plasma physics is important for modern day life will be discussed. The magnetospheres of other planets will be compared to Earths.

Course category: Major Elective

Course Name: Sustainable Sources of Energy (Phys4313)

Credit Hour: 2

Prerequisite: None

Course description (Synopsis):

This course provides an introduction to energy source and renewable energy resources, with a scientific examination of the energy field and an emphasis on alternate energy sources and their technology and application. The assessment of current and potential future energy systems is covered. It includes topics on resources, extraction, conversion, and end-use, with emphasis on meeting regional and global energy needs in the 21st century in a sustainable manner. The course will explore society's present needs and future energy demands, examine conventional energy sources and systems, including fossil fuels and nuclear energy, and then focus on alternate, renewable energy sources such as solar, biomass (conversions), wind power, geothermal, and hydro.

Course category: Major

Course Name: Cloud Physics (Phys4330)

Credit Hour: 3

Prerequisite: General Physics I

Course description (Synopsis):

Course category: Major Elective

Course Name: Astronomy I (Phys4322)

Credit Hour: 3

Prerequisite: Knowledge in General Physics – I & II and Higher Secondary Physics.

Course description (Synopsis):

This course is designed to provide the general knowledge of Physics and as a basic requirement and mainly discusses: Birth and evolution of stars, The solar system, Solar system exploration, Space age solar system Practical's (I). Upon understanding this course, the students will have the knowledge on astronomy and physics to understand and explore the neighboring universe (Solar system) that might be used in different scientific and technology applications.

Course category: Major Elective

Course Name: Astronomy II ((Phys 4346))

Credit Hour: 3

Prerequisite: Knowledge in General Physics – I & II and Higher Secondary Physics

Course description (Synopsis):

This course is designed for Physics undergraduate students with the aim of familiarizing learners with life and death of stars, white dwarfs, neutron stars and black holes. It is designed to provide the general knowledge of Physics and as a basic requirement, mainly discusses: Galaxies, quasars and active galaxies, modern cosmology, creation and fate of the universe extragalactic astronomy, the physics of early universe. Upon understanding this course, the students will have the knowledge on astronomy and physics to understand and explore the universe that might be used in different science and technology applications.

Course category: Major Elective

Course Name: Electrodynamics II (Phys4313)

Credit Hour: 3

Prerequisite: Electrodynamics I

Course description (Synopsis):

This course is designed to provide the general knowledge of Physics and as a basic requirement, mainly discusses: Electrodynamics before Maxwell, Maxwell's Equations, Conservation Laws, Potential and Fields, Radiation, Covariant Formulation of Electrodynamics. Upon completion of this course, the student will have good understanding of basic theories in classical electrodynamics.

Course category: Major Elective

Course Name: Plasma Physics (Phys4308)

Credit Hour: 3

Prerequisite: Knowledge in General Physics – I & II and basic electrodynamics fluid mechanics

Course description (Synopsis):

This course contains description of various types of plasmas and a discussion of some basic plasma parameters, such as Debye length and plasma frequency. The primary goal of this course is to present the basic principles and main equations of plasma physics at an introductory level which will provide base to the students for higher study and research in areas like plasma processing, space physics, astrophysics, controlled fusion physics etc.

1.4 Applied Geology

General information

I. Duration of study

Normal modality

Regular: 4-year program

Extension program: 5- year program

II. Course category

NO	Course category		Course level	Credit requirement	Percentage from the total
1	General	Mandatory	University required	27	18.62%
2	Basic	Mandatory	School required	27	18.62%
			Program required	3	2.07%
3	Major	Mandatory	Department required	64	44.14%
		Elective		21	14.48%
4	Free electives	100%		3	2.07%
				145	100%

Course category: General/ university required

Course Name: Communicative English (ENG-1011)

Credit Hour: 3

Prerequisite: None

Course description (Synopsis):

Communicative English Skills is a course where students learn what they need to know for a career in science context. The course gives students the language, information, and skills they need to study science context. It also provides students the language appropriate for studying science context and real work situations as it comprises unique sections such as: **‘it’s my job’** wherein real people talk about their work in science context , **‘listening’** whereby students are exposed to situations related to science context , technical explanations, and interviews, **‘reading’** whereby students meet a variety science context based texts, and the **‘writing section’** which is designed to let students compose short reports on different activities.

Course category: General/ university required

Course Name: Basic Writing Skills (ENG-1022)

Credit Hour: 3

Prerequisite: Communicative English Skills (ENG 1011)

Course description (Synopsis):

Basic Writing Skills course aims at developing students’ basic writing skills in science context. The course gives students the language writing skills they need to study science. It contains *sentence level writing*: sentence structure, sentence types sentence combinations, common sentence errors (fragment, run on, comma splices, misplaced modifier, dangling modifier, faulty parallelism, faulty reference of pronoun, faulty agreement and shifts); *paragraph level writing*: the essence of a paragraph, components of a paragraph (topic sentence, supporting sentences, concluding sentence), characteristics of effective paragraph (unity, coherence and completeness) and the steps in writing a paragraph and types of a paragraph; *essay level writing*: structure of an essay, thesis statement and supporting paragraphs, types of essays and techniques of essay development.

Course category: General/ university required

Course Name: Introduction to Ethics and Citizenship Studies (LAR 1011)

Credit Hour: 3

Prerequisite: None

Course description (Synopsis):

This course is designed for undergraduate students with the aim of familiarizing learners to the essence of ethics and citizenship rights and responsibilities. It will help students to acquire a necessary ethical qualities and civic competences while dealing with issues that affect their society at all levels, country and human in general. The course starts with unfolding the notions, principles and theories of ethics which can shape our attitude, action and behavior in making moral judgment. Next, the course introduces learners to the nature, mutual interactions and historical evolutions of society, state, government and citizenship. It also elucidates issues pertaining to political governance such as constitution, democracy, and human rights in some details. To enable learners grasp basic knowledge of political, economic and social dynamics of international system in today's globalized world, the course also introduces international relations and foreign policy and other major contemporary global issues. In light of this, the course does not present mere theoretical knowledge, but also practical knowledge of accentuating art of governing and protecting national interest in today's complex world.

Course category: General/ university required

Course Name: Logic and Critical thinking (LAR 1012)

Credit Hour: 3

Prerequisite: None

Course description (Synopsis):

The main goal of the course is to improve critical and logical reasoning skills. Students will see how our ordinary intuitions on good or bad reasoning can be articulated explicitly in formal systems, and gain a new ability to evaluate arguments and reasoning they encounter every day with rigorous logical concepts and tools. As to the subject matter, it introduces systematic methods of reasoning, such as argument, deduction, induction, syllogistic, and propositional logic.

Course category: General/ university required

Course Name: General Psychology (Psyc 1011)

Credit Hour: 3

Prerequisite: None

Course description (Synopsis):

Psychology is a science of human cognitive processes and behaviors. This course is designed to give students an overview of what psychological science has discovered about human behavior and mental processes throughout human history. Students will gain an understanding of the psychological phenomena that occur in daily life as well as the practical applications of psychological knowledge. Upon completing the course, students shall be able to demonstrate a basic knowledge of the science of psychology.

Course category: General/ university required

Course Name: Physical fitness and conditioning I(SpSc 1011)

Credit Hour: 0 cr.hr

Prerequisite: None

Course description (Synopsis):

This course is design to acquaint students with the nature and knowledge of physical fitness for better health. This course is also encompassing health-related physical fitness components which are important for better life and health. This health- related physical fitness includes cardio-respiratory endurance, muscular strength, muscular endurance and flexibility. In addition to health-related fitness components, this course is also deal with the high lights of basic gymnastic activities.

Course category: General/ university required

Course Name: Physical fitness and conditioning II (SpSc 1022)

Credit Hour: 0 cr.hr

Prerequisite: SpSc 1011

Course description (Synopsis):

This course is designed to acquaint freshman engineering and applied natural science students with the nature and scope of different ball games. It emphasizes the value of establishing lifelong fitness using ball games as a means and focuses on the fundamental of volley ball, hand ball, basketball and football as a life time leisure activity also focuses on the development of personalized approach to healthy active living through participation in a verity of ball games that have the potential to engage students' interest throughout their lives. Again, the courses enable the participants enjoying practice and acquire proper technique and strategies associated with the ball games mentioned above and learn rules governing the game.

Course category: General/ university required

Course Name: Entrepreneurship and Business Development (SOS-412)

Credit Hour: 3

Prerequisite: None

Course description (Synopsis):

This course is designed to prepare individuals for ownership of their own innovative business, and assist start-ups to function more effectively, increase the chances of new business success, enhance profitability, and increase employment. The course also provides students with an introduction to the concepts and skills necessary to successfully commercialize new products and services. Entrepreneurship is not just about starting a business. It is also about identifying good opportunities and then creating, communicating, and capturing value from those opportunities; including innovation in a corporate context. This course will teach students the skills to analyses business opportunities, and articulate them as a compelling business description, and pitch to an audience of investors, customers, or business partners. It focuses on building entrepreneurial

attitudes and behaviors that will lead to creative solution within community and organizational environments.

Course category: General/ university required

Course Name: Introduction to Economics (SOS-31)

Credit Hour: 3

Prerequisite: None

Course description (Synopsis):

This course provides a general introduction to economics combining elements of micro and macro fundamentals. The first part of the course focuses on partial equilibrium aspects of theories of consumer behavior, producer behavior as well as on the arrangements and implications of different market structures. It will also cover the neoclassical theory of product and/or service pricing for perfectly competitive, monopolistic, introduction to oligopoly. The second part will discuss elements of macroeconomics that revolve around issues of measurement of aggregate economic activities: National Income Accounting, Fluctuation in economic activities, unemployment, and inflation, and policy Instruments: fiscal and monetary policy. Emphasis will also be given to sources, consequences and policy responses to economic fluctuations. In the first part the course commences by highlighting the underlying assumptions behind each theory followed by in-depth analyses of the decisions of economic units subject to resource constraints in an effort to realize their respective objectives assuming the prevalence of market clearing situation.

Finally, students will be able to contextualize the key analytical instruments with stylized facts from the Ethiopian economy.

Course category: General/University required

Course Name: Geography of Ethiopia and the Horn (LART 1004)

Credit Hour: 3

Prerequisite: None

Course description (Synopsis):

This course covers a brief description on the location, shape and size of Ethiopia as well as basic skills of reading map, the physical background and natural resource endowment of Ethiopia and the Horn which includes its geology and mineral resources, topography, climate, drainage and water resources, soil, fauna and flora. It also deals with the demographic characteristics of the country and its implications on economic development.

Course category: General/University required**Course Name: History of Ethiopia and the Horn (LART 1003)****Credit Hour: 3****Prerequisite: None****Course description (Synopsis):**

This course describes why history is important, how history is studied and introduces the region Ethiopia and the Horn. It treats human evolution, Neolithic Revolution, settlement patterns as well as religion and religious processes in Ethiopia and the Horn. Based on these historical backgrounds, the course describes states, external contacts, economic formations and achievement in terms of architecture, writing, calendar, and others to the end of the 13th century. Historical processes including states formation and power rivalry, trade, external relation, threats and major battles, centralization and modernization attempts, Italian occupation, and socio-economic conditions from 1800 to 1941 makes central position in the modern history of the region.

Course category: Basic**Course Name: Introduction to Computing (CSEg 1101)****Credit Hour: 3****Prerequisite: None****Course description (Synopsis):**

In this course the basic techniques of computational problem solving will be covered by using computational thinking while writing small and medium sized programs, mapping problems into computational frameworks emphasizing on scientific problems, understanding problems and formulation of problems based on the elective programming language (using python). The course includes the concepts and techniques of data structure, input/output, flow control and incidental program, and by using a systematic division of problem solution and concept of module, to solve problems in numerical value field and non-numerical value field with program experiment.

Course category: Basic

Course Name: Introduction to Emerging Technologies (CSEg1102)

Credit Hour: 3

Prerequisite: None

Course description (Synopsis):

This course will enable students to explore current breakthrough technologies in the areas of Artificial Intelligence, Internet of Things and Augmented Reality, Data Science and other technologies that have emerged over the past few years. Besides helping learners become literate in emerging technologies, the course will prepare them to use technology in their respective professional preparations.

Course category: Basic

Course Name: Applied Mathematics I (Math1103)

Credit Hour: 3

Prerequisite: None

Course description (Synopsis):

This course covers Basic concepts of limit and continuity, derivatives & their applications, Integration and their applications.

Course category: Basic

Course Name: Applied Mathematics II (Math 1104)

Credit Hour: 3

Prerequisite: Applied Mathematics I (Math 1103)

Course description (Synopsis):

This course covers inverse functions, derivatives of inverse functions, techniques of integration focusing on trigonometric substitution and partial fractions, Trapezoidal rule and Simpson's rule, arc length, indeterminate forms, sequences, series and power series.

problems. This course covers integer programming, deterministic dynamic programming, inventory models, forecasting models, decision making, Queuing Theory, and Simulation Models.

Course category: Basic

Course Name: Basic Statistics for Applied Science (Math1106)

Credit Hour: 3

Prerequisite: Applied Mathematics I (Math 1103)

Course description (Synopsis):

This is include: History of statistics, Meaning of statistics; Methods of data collection; Methods of data presentation; Measures of location; Measures of variation; Moments, skewness and kurtosis; terminologies in probability; Counting Techniques; definition of Probability (approaches to probability); Probability distributions; Sampling and Sampling Distribution of the mean and proportion; Elementary description of the tools of statistical inference: Basic concepts; Estimation: (Point and Interval) for the population mean and proportion; Hypothesis testing on the population mean and proportion; Simple linear regression, correlation and rank correlation.

Course category: Basic

Course Name: General Biology (Biol1001)

Credit Hour: 3

Prerequisite: None

Course description (Synopsis):

This course is designed to provide the general knowledge of Biology for all prescience students. The course, as a basic requirement, mainly discuss the historical background of life formation, the variety of life, briefing the chemical building blocks of life, cellular biology, aspects of homeostasis, cellular respiration & photosynthesis, organisms & their environment, fundamentals of microbial lives and biotechnology and the basics of genetics.

Course category: Basic mandatory

Course Name: General Biology Practices (Biol1003)

Credit Hour: 1

Prerequisite: None

Course description (Synopsis):

The course is designed to give basic biology practical activities for freshman students joining School of Applied Natural Science. The course covers biological safety rules, basic biological equipment, investigative exercises on generalized plant and animal cells; parts and functions of a compound microscope and its operation; testing for biologically important molecules, factors which action of enzymes, diffusion and osmosis, separation leaf pigments using paper chromatography method, preparation of culture microbial culture media, isolation techniques of pure bacterial culture, smear preparation and staining techniques to study microorganisms, stages of mitotic and meiotic cell division, Collection and preservation of plant and insect specimens will be discussed during in this practical course.

Course category: Basic

Course Name: General Physics (Phys1103)

Credit Hour: 3

Prerequisite: Knowledge in Higher Secondary Physics

Course description (Synopsis):

At the end of this course students are expected to be acquainted with basic concepts in different branches of physics, identify the connection between them and explain the common phenomena. They will also develop skills of solving problems.

Course category: Basic

Course Name: General Physics practice (Phys1111)

Credit Hour: 1

Prerequisite: Knowledge in preparatory level physics

Course description (Synopsis):

This course deals with the physics practical's related to the course General Physics and helps the students very much in explaining physical concepts.

Course category: Basic

Course Name: General Chemistry (Chem1102)

Credit Hour: 3

Prerequisite: None

Course description (Synopsis):

The course is designed to study Properties, units and measurements; the composition of matter, chemical reactions, reactions stoichiometry, atomic structure and the periodic table, the chemical bond, structure of molecules, properties of solutions, chemical equilibria, introduction to functional groups and their typical reactions.

Course category: Basic

Course Name: Practical General Chemistry (Chem1104)

Credit Hour: 1

Prerequisite: None

Course description (Synopsis):

The course is designed to give basic understanding and concepts of measuring mass, and volumes by using cylinder and burette, experimental errors, systematic and random errors, significant digits/figures, beam balance, mean, mean deviation, Bunsen burner, luminous and non-luminous flame, physical and chemical changes, properties and reaction of substances, diffusion rates, kinetic theory of gases, Graham's law of diffusion, percentage of water of hydration, calculating equivalent weight; basic laboratory operations such as recrystallization, simple distillation, fractional distillations and steam distillations.

Course category: Basic Supportive Module

Course Name: Fundamental of Physical Chemistry (Chem2242)

Credit Hour: 4

Prerequisite: General Chemistry

Course description (Synopsis):

Kinetic molecular theory; Chemical Equilibrium; Phase equilibrium; Colligative properties; Non-electrolytic Solutions; Electrolyte Solutions; First Law of Thermodynamics; Thermochemistry; The Second Law of Thermodynamics; The third law of thermodynamics; Electrochemistry; Chemical Kinetics; Basic Quantum Chemistry.

Course category: Major mandatory

Course Name: General Geology (Geol2201)

Credit Hour: 4

Prerequisite: None

Course description (Synopsis):

The course aims to provide students with a general introduction to the geological science, the planet Earth, the Earth materials, as well as the physical and historical processes of the Earth. It also introduces students with basic concept of simplified topographic and geologic maps and their cross-sections; and with varieties of representative mineral, rock and fossil specimens. The course will serve as a basis for many of the geology courses. Also introduce the students with basic knowledge of the different landforms and geomorphological processes that are involved in the formation and reshaping of these landform features of the earth.

Course category: Major mandatory

Course Name: Crystallography and Mineralogy (Geol2203)

Credit Hour: 3

Prerequisite: None

Course description (Synopsis):

The course exposes the students to basic concepts of minerals, crystals, lattice, symmetry elements, growth and geometry, to provide students with concepts of mineralogy, including mineral properties, classification and structure types. It also familiarizes the students with the chemistry and structure of rock forming minerals; and provides basic information on economic

and industrial uses of minerals. It provides the necessary knowledge and skills on the techniques of mineral identification. It also serves as a foundation to the other petrology courses.

Course category: Major mandatory

Course Name: Practical Crystallography and Mineralogy (Geol2213)

Credit Hour: 1

Prerequisite: Geol2203

Course description (Synopsis):

Practical laboratories will strengthen students understanding of the concepts in crystallography and mineralogy. The main objective of this course is to explain and demonstrate symmetry elements in the crystal models; to demonstrate how to identify the crystal classes and symmetry in crystal models; to demonstrate microscope and its procedure for use; and provides skills and knowledge on how to identify minerals on the basis of their physical and optical properties; and help students to acquaint with the use of the polarized light microscope. This practical course is directly related to the lectures and is aimed at illustrating the features described in the lectures.

Course category: Major mandatory

Course Name: Palaeontology (Geol2205)

Credit Hour: 2

Prerequisite: None

Course description (Synopsis):

To introduce the following: the history of life on Earth; the preservation of animals and plants as fossils and methods of studying them; the morphology and classification of the main groups of invertebrate animals with emphasis on those of geological importance; the science of paleo

botany; the stratigraphical importance of fossils including microfossils; comparison of living organisms with their fossil relatives. To provide students with the aptitude to the classification and to the systematic recognition of some of the main groups of fossil organisms.

Course category: Major mandatory

Course Name: Practical Paleontology (Geol2215)

Credit Hour: 1

Prerequisite: Geol2205

Course description (Synopsis):

Identification of major fossil phyla's; demonstrate the conditions of fossil preservation; morphology of the various invertebrate phyla and plant remains; microscopic observation of selected animal and plant microfossils (radiolarians, foraminifers, diatoms, pollen etc.) and methods of extraction and preparation of slides; use of microfossils in bio-stratigraphy and paleo-environment studies.

Course category: Major mandatory

Course Name: Stratigraphy and Sedimentology (Geol2202)

Credit Hour: 3

Prerequisite: Geol2201 and Geol2205

Course description (Synopsis):

The course aims to provide students with a general introduction to the basic principles of stratigraphy and broad information on Earth's history; to provide the basic concepts of the spatial and temporal relationships among rock formations, stratigraphic correlations, depositional environment and evolution; to introduce students with the evolution of the Earth's lithosphere, atmosphere, hydrosphere and biosphere; to briefly introduce students with Ethiopian stratigraphic succession. The course will serve as a basis for other geology courses such as (petrology) and structural geology) courses explaining the origin of Sedimentary, Igneous and

Metamorphic rocks that make up the crust of the Earth are essential part of a geosciences training. Knowledge of sedimentary petrology is a key in understanding of the different types of sedimentary rocks, the way how they are formed and where they are formed. These enable to further understand the natural resources associated with sedimentary rocks. The course is to equip students with basic knowledge of sedimentary petrology and its application in the investigation of the different natural resources that are found associated with these types of rocks.

Course category: Major mandatory

Course Name: Practical Stratigraphy and Sedimentary (Geol2212)

Credit Hour: 1

Prerequisite: Geol2202

Course description (Synopsis):

The course includes: Sediment Analysis: Grain size, statistical measures and their significance in interpretations; Carbonates; Chemical's sediments; Organic Sedimentary rocks, Macro- and microscopic studies of sedimentary rocks.

Course category: Major mandatory

Course Name: Structural Geology and Tectonics (Geol2204)

Credit Hour: 3

Prerequisite: Geol2201

Course description (Synopsis):

The course aims to provide students with the basic concepts of deformation of rocks, and of the mechanisms and causes of deformation; to familiarize students with how to appreciate, describe and record geological structures in the field; to enable students how to evaluate, analyze and interpret structural data and incorporate it into regional synthesis of an area.

Course category: Major mandatory

Course Name: Field Geology Report Writing and Mapping Techniques (Geol2206)

Credit Hour: 3

Prerequisite: None

Course description (Synopsis):

The course aims to introduce students with the concepts and components of topographic and geologic maps and cross-sections as well as the basic techniques of geological mapping. The course introduces students with the aerial photography and its interpretation, and basics of drawing. To introduce students to the historical development of geological sciences and the role of fieldwork in geology. To introduce students with the basic skills of fieldwork planning, surveying and sampling techniques, field data recording, communication through field report writing and presentation. The course will serve as a basis for other geology courses such as mapping courses.

Course category: Major mandatory

Course Name: Remote Sensing and GIS (Geol 2208)

Credit Hour: 3

Prerequisite: None

Course description (Synopsis):

The course aims to introduce the students with basic knowledge with an understanding and skill on how to processes and interpret different remotely sensed images/data for geosciences application; to introduce the students to the basic principles and applications of GIS data handling, processing and visualizations.

Course category: Major mandatory

Course Name: Igneous Petrology (Geol3201)

Credit Hour: 2

Prerequisite: Geol2201 & Geol2203

Course description (Synopsis):

The integration of descriptive and interpretative petrology is the main aim of igneous petrology work. This course is intended to give students a broader understanding of igneous rock types/classifications and their origin and mode of emplacements as well as the tectonic environments that enables the formation of various types of igneous rocks. And the lab session introduces igneous rocks (plutonic and volcanic) in hand specimen and thin section. It further elucidates the different physical parameters of igneous rocks in a lab set up. Practical session includes: Review of rock forming minerals; classification of igneous rocks; (based on mineralogical, texture and modal classifications).

Course category: Major mandatory

Course Name: Practical Igneous Petrology (Geol3211)

Credit Hour: 1

Prerequisite: Geol3201

Course description (Synopsis):

The integration of descriptive and interpretative petrology is the main aim of igneous petrology practical work. The lab course introduces igneous rocks in hand specimen and thin section. It further elucidates the different physical parameters of igneous rocks in a lab set up. Practical course includes: Review of rock forming minerals; classification of igneous rocks; (based on mineralogical, texture and modal classifications); Review of crystal optics; Petrographic properties of the most important igneous rocks, Petrography aspects of volcanic rocks, plutonic rocks; Interpretation of igneous textures; Compositional variation in magmatic rocks.

Course category: Major mandatory

Course Name: Field Work Project I (Mapping Sedimentary Terrain) (Geol3203)

Credit Hour: 2

Prerequisite: Geol2201, Geol2202, Geol2206

Course description (Synopsis):

The course aims to provide students with the necessary knowledge, skill and attitude to plan and carry out independent geological mapping of a sedimentary area including outcrop description, sample collection and study, measurement/ evaluation/ interpretation of structures, preparation of maps and cross sections, reconstruction of geologic history as well as production of a geological report.

Course category: Major mandatory

Course Name: Environmental Geology (Geol3207)

Credit Hour: 2

Prerequisite: None

Course description (Synopsis):

The course aims to introduce geology students to the broader issues of global environmental challenges facing the human society. The students will get opportunity of Introduction to geologic hazards affecting humankind; emphasis on earthquakes, volcanism, floods and landslides.

Course category: Major mandatory

Course Name: Metamorphic Petrology (Geol3202)

Credit Hour: 2

Prerequisite: Geol2201

Course description (Synopsis):

The course aims to provide students with the fundamental concepts on metamorphic processes and mineral reactions, metamorphic rocks, their textures and mineral assemblages; introduce students with the metamorphism of sedimentary and igneous rocks at different P-T conditions. The course will serve as a supplement to the Practical Metamorphic Petrology and as a basis for the Mapping Metamorphic Terrain course.

Course category: Major mandatory

Course Name: Practical Metamorphic Petrology (Geol3212)

Credit Hour: 1

Prerequisite: Geol3202

Course description (Synopsis):

The course aims to provide students with the necessary knowledge and skill to describe texture, fabric and mineral paragenesis various metamorphic rocks in hand-specimen and thin-section; and to enable them interpret and reconstruct the environment of formation and evolution of metamorphic rocks. The course will serve as a supplement to the Metamorphic Petrology and as a basis for the Mapping Metamorphic Terrain course.

Course category: Major mandatory

Course Name: Field Work Project II (Mapping Igneous Terrain) (Geol3204)

Credit Hour: 1

Prerequisite: Geol2204, Geol3201

Course description (Synopsis):

The course aims to provide students with the necessary knowledge, skill and attitude to plan and carry out independent geological mapping of an igneous terrain including outcrop description, sample collection and study, measurement/ evaluation/ interpretation of structures, preparation of maps and cross sections, reconstruction of geologic history as well as production of a geological report.

Course category: Major mandatory

Course Name: Geochemistry (Geol3206)

Credit Hour: 3

Prerequisite: None

Course description (Synopsis):

Geochemistry has become a very interdisciplinary science, and learning geochemistry provides the student an opportunity to integrate and synthesize knowledge learned in many different science courses into a holistic approach to the study of earth. This course aims to trace the geochemical development of the Earth from the origins of the solar system to the present planetary system and to cover the fundamentals of geochemistry in order to understand the natural system. To teach fundamentals of analytical techniques in geochemistry, with emphasis on techniques for samples in solution, or that can be put into solution. Practical applications are stressed.

Course category: Major mandatory

Course Name: Principles of Hydrogeology (Geol3208)

Credit Hour: 3

Prerequisite: None

Course description (Synopsis):

To introduce the principles of physical hydrogeology and the description of aquifers; to transfer fundamental knowledge needed in a complete groundwater resources evaluation.

Course category: Major mandatory

Course Name: Fundamentals of soil and Rock Mechanics (Geol3210)

Credit Hour: 3

Prerequisite: Geol2204

Course description (Synopsis):

Upon successful completion of the course, the student should acquire the following knowledge:

- Developed competence in the principle of soil and rock mechanics and application in engineering practice
- Ability to list the relevant engineering properties of soil and rocks, their characteristics and describe the factors which control these properties
- Apply laboratory methods of determining the properties of soil and rocks

Ability to apply soil and rock mass engineering classification systems to predict their engineering properties and understand their limitations.

Course category: Major mandatory

Course Name: Field Work Project III (Mapping Metamorphic Terrain) (Geol4201)

Credit Hour: 2

Prerequisite: Geol2201, Geol2206, Geol3202

Course description (Synopsis):

The course aims to provide students with the necessary knowledge, skill and attitude to plan and carry out independent geological mapping of a metamorphic area including outcrop description, sample collection and study, measurement/ evaluation/ interpretation of structures, preparation of maps and cross-sections, reconstruction of geologic history as well as production of a geological report.

Course category: Major mandatory

Course Name: Economic Geology (Geol4203)

Credit Hour: 3

Prerequisite: Geol3206

Course description (Synopsis):

The course introduces the students with the basic principles of economic geology and origin of mineral deposits; mode of formation of the deposits and mineral and country rock association. It briefly discusses the different ore deposits models; it highlights the comparison between similar deposits globally and plate tectonics and associated mineral deposits.

Course category: Major mandatory

Course Name: Seminar 1 (Geol4205)

Credit Hour: 1

Prerequisite: None

Course description (Synopsis):

Course category: Major mandatory

Course Name: Groundwater Exploration and Development (Geol4301)

Credit Hour: 3

Prerequisite: Geol3208

Course description (Synopsis):

To give students the knowledge and skills in groundwater exploration and development.

Course category: Major mandatory

Course Name: Introduction to Hydro geochemistry and pollution (Geol4303)

Credit Hour: 3

Prerequisite: None

Course description (Synopsis):

The chemical properties of water are as important as physical properties and available quantity for most of its uses. Water quality, which involves the type and amount of substance dissolved in the water. In this course students will reinforce and expand fundamental skills Hydro geochemistry to better understand groundwater processes and solve problems natural groundwater system. Theoretical, analytical and conceptual explanations of Hydro geochemistry will be developed and employed. This course aims at enhancing student's skills and knowledge of groundwater chemistry and quality monitoring through various aspects all over the world.

Course category: Major mandatory

Course Name: Research Methods in Geosciences (Geol4209)

Credit Hour: 2

Prerequisite: None

Course description (Synopsis):

To gear students towards undertaking substantial independent research projects in areas of geosciences and produce research proposals of their own.

Course category: Major mandatory

Course Name: Mineral Exploration and Resource Evaluation (Geol4207)

Credit Hour: 2

Prerequisite: None

Course description (Synopsis):

The course aims to provide the students with basic knowledge and skills on the prospecting and exploration of mineral resources; and with the basic understanding of the occurrence of mineral deposits in space and time.

Course category: Major mandatory

Course Name: Senior Research Project (Geol4202)

Credit Hour: 3

Prerequisite: Geol4205, Geol4213

Course description (Synopsis):

The course aims to give senior students the opportunity of undertaking an independent research project in Earth Sciences, in an area of interest to the students, under the supervision of a member of staff. Students will acquire and interpret datasets, using them to solve an Earth

Science problem. Students will also present the results of their own scientific research orally and in poster form to an audience of staff and peers.

Course category: Major mandatory

Course Name: Volcanology and Geothermal Resources (Geol4302)

Credit Hour: 3

Prerequisite: Geol3201

Course description (Synopsis):

Volcanology and Geothermal Resources is the basic course which helps students to study the earth and its hidden geothermal resource. Geothermal energy is an important and promising alternative energy resource that has shown continual growth throughout this century. The course is designed to give students detail knowledge about volcanology and the associated resources and geothermal energy.

Course category: Major mandatory

Course Name: Mining Geology (Geol4306)

Credit Hour: 3

Prerequisite: Geol4203 & Geol4215

Course description (Synopsis):

Proper exploitation and utilization of natural resources is one of the important needs of the Society. It demands for proper acquaintance with the procedures of exploitation. The course introduces the students to the basic knowledge in the application of various mining methods: production and auxiliary activities in mining and problems associated with them, and on comparison of exploration and mining methods used in different countries.

Course category: Major mandatory

Course Name: Geology and Geologic Resources of Ethiopia (Geol4204)

Credit Hour: 3

Prerequisite: None

Course description (Synopsis):

Proper exploration, exploitation and utilization of the mineral oil, natural gas and water resources of Ethiopia require the knowledge of the geological set up of the country. The course is designed to introduce students the different geological formations and associated resources of the country.

Course category: Major mandatory

Course Name: Petroleum and Coal Geology (Geol3301)

Credit Hour: 3

Prerequisite: Geol2202 & Geol2205

Course description (Synopsis):

This course unit aims to provide students with a general introduction in the field of petroleum and coal geology and understanding, investigation and exploitation of these natural resources; understanding on the occurrence of different types of fossil fuel deposits in Ethiopia and the world; basic knowledge on the nature, composition and maturation of coals and oils; and skills on the technological applications in the exploration of hydrocarbon resources.

Course category: Major mandatory

Course Name: Quaternary Geology (Geol3303)

Credit Hour: 3

Prerequisite: None

Course description (Synopsis):

The course aims to introduce students with the Quaternary history of the Earth in general and that of Ethiopia in particular. Emphasis is given to the evaluation / interpretation of Quaternary.

Course category: Major mandatory

Course Name: Petroleum Exploration (Geol3304)

Credit Hour: 3

Prerequisite: None

Course description (Synopsis):

This course unit aims to provide students with a general introduction in the field of petroleum exploration and production, the type of drilling components, drilling fluids, Reservoir characterization and calculations. This course unit will also aim to provide students with a general introduction of the use of biotic component in petroleum exploration, fundamental of nonconventional petroleum resources, and prospects and probabilities of petroleum resources and reserves with special emphasis to Ethiopian occurrences.

Course category: Major mandatory

Course Name: Engineering Geology (Geol4305)

Credit Hour: 3

Prerequisite: Geol3214

Course description (Synopsis):

After successful completion of the course, students will acquire sufficient knowledge on impacts of geological processes and features on engineering foundations; students will acquire the necessary knowledge and skill to prepare engineering geological maps for eventual use in civil engineering projects. To increase students' knowledge of engineering application of geology. Principles of engineering geological mapping and terrain evaluation, Engineering Geological investigations: elements and phases of investigations, site exploration methods, sampling techniques, laboratory and in-situ tests; Geological factors during the planning and construction of structures like buildings, dams, reservoirs, roads, bridges and underground excavations;

Impact of subsurface water on engineering works and controlling methods; Engineering Geology and environment: hazardous earth processes influencing engineering works: Landslides, Earthquakes, volcanoes, Subsidence, expansive soils; Dams and dam sites, types of dams, investigation of dam sites; reservoirs, types of reservoirs, investigation of reservoir sites; embankment dams, types, their zoning and selection, stability analysis, embankment details, design specification and construction of filter, specification and quality control of earthworks, construction materials etc; underground structures, investigation of tunnels and underground caverns, geological conditions and tunnelling; tunnelling in soft and hard ground, methods of tunnelling, stability and tunnel support analysis, supporting mechanisms and ground settlement.

Course category: Core Elective/focused Area Module

Course Name: Geohazard Assessment (Geol4307)

Credit Hour: 3

Prerequisite: Geol3210, Geol3207

Course description (Synopsis):

After successful completion of the course, students will acquire sufficient knowledge on hazardous earth processes influencing engineering works such as Landslides, Earthquakes, volcanoes, Subsidence, expansive soils; flood and other earth related problems and their impacts on different engineering structures like buildings, dams, reservoirs, roads, bridges and underground excavations. We will investigate hazardous phenomena, their prediction and mitigation. Topics to include: earthquakes, volcanoes, tsunamis and weather/ climate. Provides a foundation in basic geological hazards related to science, suitable for use in teaching, communications, policy, and emergency management careers.

Course category: Core Elective/focused Area Module

Course Name: Industrial Minerals, Rocks, and Gems (Geol4308)

Credit Hour: 3

Prerequisite: Geol4203, Geol4215

Course description (Synopsis):

Fundamental understanding of mining and processing aspects of industrial minerals and rocks and gemstones is necessary as “Our entire society rests upon and is dependent upon our water, our forests, and our minerals. How we use these resources influences our health, security, economy, and well-being”. The course seeks to foster an appreciation of industrial minerals and rocks and gems, both aesthetically and scientifically. Specifically, the course seeks to explain how scientific information about origin, environment, and history can be inferred from data on industrial minerals, rocks and gemstones. Presents a general perspective on the distribution of Earth’s, non-metallic, industrial and gems, both geographically and geologically.

Course category: Major Mandatory**Course Name: Exploration Geophysics (Geol3302)****Credit Hour: 3****Prerequisite: Geol3205****Course description (Synopsis):**

Exploration geophysics is an applied branch of geophysics and economic geology that uses various physical methods such as seismic, gravitational, magnetic, electrical and electromagnetic methods on the Earth's surface to determine the physical properties of the sub-surface, along with the anomalies in them. The significant of this subject is to identify or infer the presence and location of commercially valuable geological deposits, such as mineral ore; fossil fuels and other hydrocarbons; geothermal reservoirs; and groundwater reservoirs.

Course category: Core Elective/focused Area Module**Course Name: Exploration Geochemistry (Geol4304)****Credit Hour: 3****Prerequisite: Geol3206****Course description (Synopsis):**

The course aims to provide an overview of geochemical surveys and basic geochemical processes in geological environment and enable the student how to collect geochemical information in the field, organize sample materials and ensure appropriate quality control in the process in any exploration projects.

Course category: Core Elective/focused Area Module

Course Name: Digital image Processing and GIS (Geol4312)

Credit Hour: 3

Prerequisite: Geol2208

Course description (Synopsis):

In this we study different satellites, platforms, sensors and orbital characteristics and their role in getting the remote sensing data. Capable to process different digital image pre-processing and enhancement technique. Understand the advantage of remote sensing and GIS techniques in different application such as mineral prognostic, ground water prospecting geological hazards etc.

Course category: Core Elective/focused Area Module

Course Name: Environmental Impact Assessment (EIA) (Geol4310)

Credit Hour: 3

Prerequisite: Geol2208

Course description (Synopsis):

The course introduces basic foundation of EIA and its importance for project planning and design, find ways and means to reduce adverse impacts, shape projects to suit the local environment and present the predictions and options to decision-makers. Specific topics can include Definition, Basic Concepts, Principles, philosophical, methodological and institutional approaches of EIA, environmental risk assessment, steps in EIA, methods of conducting EIA.

1.5 Applied Mathematics

General information

I. Duration of study

Normal modality

Regular: 4-year program

Extension program: 5 years

II. Course category

NO	Course category		Course level	Credit requirement	Percentage from the total
1	General	Mandatory	University required	27	18.62%
2	Basic	Mandatory	School required	27	18.62%
			Program required	3	2.07%
3	Major	Mandatory	Department required	64	44.14%
		Elective		21	14.48%
4	Free electives	100%		3	2.07%
				145	100%

Course category: General/ university required

Course Name: Entrepreneurship and Business Development (SOSC5003)

Credit Hour: 3

Prerequisite: None

Course description (Synopsis):

This interdisciplinary course in general is designed to introduce students to the concept of sustainable entrepreneurship, a manageable process that can be applied across careers and work settings. It focuses on building entrepreneurial attitudes and behaviors that will lead to creative solution within community and organizational environments. This course is designed to prepare individuals for ownership of their own innovative business, and assist start-ups to function more effectively, increase the chances of new business success, enhance profitability, and increase employment.

More specifically, the course provides students with an introduction to the concepts and skills necessary to successfully commercialize new products and services. Entrepreneurship is not just about starting a business. It is also about identifying good opportunities and then creating, communicating, and capturing value from those opportunities; including innovation in a corporate context. It will also teach students the skills to analyze business opportunities, and articulate them as a compelling business description, and pitch to an audience of investors, customers, or business partners. It focuses on building entrepreneurial attitudes and behaviors that will lead to creative solution within community and organizational environments.

Course category: General/ university required

Course Name: Communicative English Skills (EnLa 1001)

Credit Hour: 3

Prerequisite: None

Course description (Synopsis):

Communicative English Skills is a course where students learn what they need to know for a career in science context. The course gives students the language, information, and skills they need to study science context. It also provides students the language appropriate for studying science context and real work situations as it comprises unique sections such as: **‘it’s my job’** wherein real people talk about their work in science context , **‘listening’** whereby students are exposed to situations related to science context , technical explanations, and interviews, **‘reading’** whereby students meet a variety science context based texts, and the **‘writing section’** which is designed to let students compose short reports on different activities.

Course category: General/ university required

Course Name: Basic Writing Skills (EnLa-1002)

Credit Hour: 3

Prerequisite: Communicative English Skills (EnLa 1001)

Course description (Synopsis):

Basic Writing Skills course aims at developing students' basic writing skills in science context. The course gives students the language writing skills they need to study science. It contains sentence level writing: sentence structure, sentence types sentence combinations, common sentence errors (fragment, run on, comma splices, misplaced modifier, dangling modifier, faulty parallelism, faulty reference of pronoun, faulty agreement and shifts); paragraph level writing: the essence of a paragraph, components of a paragraph (topic sentence, supporting sentences, concluding sentence), characteristics of effective paragraph (unity, coherence and completeness) and the steps in writing a paragraph and types of a paragraph; essay level writing: structure of an essay, thesis statement and supporting paragraphs, types of essays and techniques of essay development.

Course category: General/ university required

Course Name: Introduction to Civics and Ethics (LART 1001)

Credit Hour: 3

Prerequisite: None

Course description (Synopsis):

It is now become clear that Ethics and Citizenship Studies has become not only a field of specialization in itself but has also been attracting leaders who envision instilling democracy on a nun shakable ground within their own society. Autoscore, Ethics is a system of moral principles which involves systematizing, defending and recommending concepts of rights and wrong behavior. It affects how people make decisions and lead their lives. Citizenship, on its part, is a

legal status of individuals within a given state. It embodies the legal and political relationship between citizens and state, underlining the reciprocal relationship between the two. This course is designed with the aim of equipping learners with necessary ethical qualities and civic competences while dealing with issues that affect their society at all levels and human in general.

The course starts with unfolding the notions, principles and theories of ethics which can shape human attitude, action and behavior in making moral judgments. Next, the course introduces learners to the nature, mutual interactions and historical evolutions of society, state, government and citizenship. It also elucidates issues pertaining to political governance such as constitution, democracy, and human rights in some details. To enable learners grasp basic knowledge of political, economic and social dynamics of international system in today's globalized world, the course also introduces international relations and foreign policy and other major contemporary global issues. In light of this, the course does not present mere theoretical knowledge, but also practical knowledge of accentuating art of governing and protecting national interest in today's complex world.

Course category: General/ university required

Course Name: Logic and Critical thinking (LART 1002)

Credit Hour: 3

Prerequisite: None

Course description (Synopsis):

The main goal of the course is to improve critical and logical reasoning skills. Students will see how our ordinary intuitions on good or bad reasoning can be articulated explicitly in formal systems, and gain a new ability to evaluate arguments and reasoning they encounter every day with rigorous logical concepts and tools.

As to the subject matter, it introduces systematic methods of reasoning, such as argument, deduction, induction, syllogistic, and propositional logic.

Course category: General/ university required

Course Name: Introduction to Economics (SOSC2002)

Credit Hour: 3

Prerequisite: None

Course description (Synopsis):

This course provides a general introduction to economics combining elements of micro and macro fundamentals. The main objective of this course is to introduce and acquaint students with the preliminary principles (theories) and knowledge of economics and the application of economic theories (principles) in the actual world; the daily activities of the households, firm business or any other form of enterprises at micro levels. Students will also be able to contextualize the key macroeconomic variables and policy instruments.

Specifically, the course introduces students with theory of consumer behavior, production, and cost of production. In these theories how decisions are made by different economic agents will be discussed. Furthermore, the course covers different characteristics of perfect and imperfect market structure. Lastly the course tries to introduce basic macroeconomic concepts such as national income accounting, unemployment, inflation, fiscal and monetary policy instruments.

Course category: General/ university required

Course Name: General Psychology and Life Skills (Psyc 1011)

Credit Hour: 3

Prerequisite: None

Course description (Synopsis):

Psychology is a science of human cognitive processes and behaviors. This course is designed to give students an overview of what psychological science has discovered about human behavior and mental processes throughout human history. Students will gain an understanding of the

psychological phenomena that occur in daily life as well as the practical applications of psychological knowledge. Upon completing the course, students shall be able to demonstrate a basic knowledge of the science of psychology.

Specifically, the course general psychology is concerned with discussing perspectives in psychology and basic psychological concepts such as sensation and perception, learning, personality, motivation, emotion, and basic life skills (intrapersonal, interpersonal, social and academic skills). Emphasis will be given to both theoretical and practical implications of these concepts to effectively function as individual and team in a community.

Course category: General/ university required

Course Name: Physical fitness and conditioning I (SpSc1011)

Credit Hour: 0 cr.hr

Prerequisite: None

Course description (Synopsis):

This course will provide the students with basic concepts of the five components of health-related physical fitness (cardiovascular, muscular strength and endurance, flexibility, and body composition), hypokinetic disease and general principles of training. It is mainly practical oriented.

As a result, the students will be exposed to various exercise modalities, sport activities, minor and major games, and various training techniques as a means to enhance health related physical fitness components. In addition, they will develop the skills to assess each component of fitness and will practice designing cardiovascular, muscular strength and endurance, and flexibility programs based on the fitness assessment. The course serves as an introduction to the role of exercise in health promotion, fitness, performance including the acute and chronic responses of the body to exercise.

Course category: General/ university required

Course Name: Physical fitness and conditioning II (SpSc 1022)

Credit Hour: 0 cr.hr

Prerequisite: SpSc 1011

Course description (Synopsis):

This course is designed to acquaint freshman engineering and applied natural science students with the nature and scope of different ball games.

It emphasizes the value of establishing lifelong fitness using ball games as a means and focuses on the fundamental of volley ball, hand ball, basketball and football as a life time leisure activity also focuses on the development of personalized approach to healthy active living through participation in a verity of ball games that have the potential to engage students' interest throughout their lives. Again, the courses enable the participants enjoying practice and acquire proper technique and strategies associated with the ball games mentioned above and learn rules governing the game.

Course category: General/ university required

Course Name: Geography of Ethiopia and the Horn (LART 1003)

Credit Hour: 3

Prerequisite: None

Course description (Synopsis):

This course covers a brief description on the location, shape and size of Ethiopia as well as basic skills of reading map, the physical background and natural resource endowment of Ethiopia and the Horn which includes its geology and mineral resources, topography, climate, drainage and water resources, soil, fauna and flora. It also deals with the demographic characteristics of the country and its implications on economic development.

Course category: General/ university required

Course Name: History of Ethiopia and the Horn (LART 1004)

Credit Hour: 3

Prerequisite: None

Course description (Synopsis):

This course describes why history is important, how history is studied and introduces the region Ethiopia and the Horn. It treats human evolution, Neolithic Revolution, settlement patterns as well as religion and religious processes in Ethiopia and the Horn. Based on these historical backgrounds, the course describes states, external contacts, economic formations and achievement in terms of architecture, writing, calendar, and others to the end of the 13th century. Historical processes including states formation and power rivalry, trade, external relation, threats and major battles, centralization and modernization attempts, Italian occupation, and socio-economic conditions from 1800 to 1941 makes central position in the modern history of the region.

Course category: Basic

Course Name: Applied Mathematics I (Math1103)

Credit Hour: 3

Prerequisite: None

Course description (Synopsis):

This course is designed to provide the students some basic understanding about different mathematical methods that are typically used in field of applied sciences. Students will use the acquired knowledge to solve mathematics related problems to be encountered in sciences or job career.

This course covers basic concepts of limit and continuity, derivatives & their applications, Integration and their applications

Course category: Basic

Course Name: Applied Mathematics II (Math1104)

Credit Hour: 3

Prerequisite: Applied Mathematics I (Math 1103)

Course description (Synopsis):

This course is designed to provide the students some basic understanding about different mathematical methods that are typically used in field of applied sciences. Students will use the acquired knowledge to solve mathematics related problems to be encountered in sciences or job career.

The course covers inverse functions, derivatives of inverse functions, techniques of integration focusing on trigonometric substitution and partial fractions, Trapezoidal rule and Simpson's rule, arc length, indeterminate forms, sequences, series and power series.

Course category: Basic

Course Name: Basic Statistics for Applied Science (Math1106)

Credit Hour: 3

Prerequisite: None

Course description (Synopsis):

At the end of the course students are expected to:

- have a broad knowledge of the basic understanding of statistical techniques
- demonstrated through principles of data collection, descriptive statistics, linear regression, correlation, computation and data analysis;
- identify different techniques of sampling and understand the methods of data collection, organization, presentation, analysis and interpretation;
- differentiate among common types of data, and summarize and display them appropriately;
- learn some desirable properties of averages and measures of variation;

- have basic skills in exploratory data analysis and problem solving.

This is include: History of statistics, Meaning of statistics; Methods of data collection; Methods of data presentation; Measures of location; Measures of variation; Moments, skewness and kurtosis; terminologies in probability; Counting Techniques; definition of Probability (approaches to probability); Probability distributions; Sampling and Sampling Distribution of the mean and proportion; Elementary description of the tools of statistical inference: Basic concepts; Estimation: (Point and Interval) for the population mean and proportion; Hypothesis testing on the population mean and proportion; Simple linear regression, correlation and rank correlation.

Course category: Basic

Course Name: General Physics (Phys1103)

Credit Hour: 3

Prerequisite: Knowledge in Higher Secondary Physics

Course description (Synopsis):

At the end of this course students are expected to be acquainted with basic concepts in different branches of physics, identify the connection between them and explain the common phenomena. They will also develop skills of solving problems.

Course category: Basic

Course Name: General Physics Practice (Phys1111)

Credit Hour: 1

Prerequisite: Knowledge in preparatory level physics

Course description (Synopsis):

This course deals with the physics practical's related to the course General Physics and helps the students very much in explaining physical concepts.

Course category: Basic

Course Name: General Chemistry (Chem1102)

Credit Hour: 3

Prerequisite: None

Course description (Synopsis):

The course is designed to study Properties, units and measurements; the composition of matter, chemical reactions, reactions stoichiometry, atomic structure and the periodic table, the chemical bond, structure of molecules, properties of solutions, chemical equilibria, introduction to functional groups and their typical reactions.

Course category: Basic

Course Name: Practical General Chemistry (Chem1104)

Credit Hour: 1

Prerequisite: None

Course description (Synopsis):

The course is designed to give basic understanding and concepts of measuring mass, and volumes by using cylinder and burette, experimental errors, systematic and random errors, significant digits/figures, beam balance, mean, mean deviation, Bunsen burner, luminous and non-luminous flame, physical and chemical changes, properties and reaction of substances, diffusion rates, kinetic theory of gases, Graham's law of diffusion, percentage of water of hydration, calculating equivalent weight; basic laboratory operations such as recrystallization, simple distillation, fractional distillations and steam distillations.

Course category: Basic

Course Name: General Biology (Biol1001)

Credit Hour: 3

Prerequisite: None

Course description (Synopsis):

This course is designed to provide the general knowledge of Biology for all prescience students. The course, as a basic requirement, mainly discuss the historical background of life formation, the variety of life, briefing the chemical building blocks of life, cellular biology, aspects of homeostasis, cellular respiration & photosynthesis, organisms & their environment, fundamentals of microbial lives and biotechnology and the basics of genetics.

Course category: Basic

Course Name: General Biology Practices (Biol1003)

Credit Hour: 1

Prerequisite: None

Course description (Synopsis):

The course is designed to give basic biology practical activities for freshman students joining School of Applied Natural Science. The course covers biological safety rules, basic biological equipment, investigative exercises on generalized plant and animal cells; parts and functions of a compound microscope and its operation; testing for biologically important molecules, factors which action of enzymes, diffusion and osmosis, separation leaf pigments using paper chromatography method, preparation of culture microbial culture media, isolation techniques of pure bacterial culture, smear preparation and staining techniques to study microorganisms, stages

of mitotic and meiotic cell division, Collection and preservation of plant and insect specimens will be discussed during in this practical course.

Course category: Basic

Course Name: Introduction to Computing (CSEg 1101)

Credit Hour: 3

Prerequisite: None

Course description (Synopsis):

In this course the basic techniques of computational problem solving will be covered by using computational thinking while writing small and medium sized programs, mapping problems into computational frameworks emphasizing on scientific problems, understanding problems and formulation of problems based on the elective programming language (using python). The course includes the concepts and techniques of data structure, input/output, flow control and incidental program, and by using a systematic division of problem solution and concept of module, to solve problems in numerical value field and non-numerical value field with program experiment.

Course category: Basic

Course Name: Introduction to Emerging Technologies (CSEg1102)

Credit Hour: 3

Prerequisite: None

Course description (Synopsis):

This course will enable students to explore current breakthrough technologies in the areas of Artificial Intelligence, Internet of Things and Augmented Reality, Data Science and other technologies that have emerged over the past few years. Besides helping learners become literate in emerging technologies, the course will prepare them to use technology in their respective professional preparations.

Course category: Basic

Course Name: Fundamentals of Programming (CSEg1104)

Credit Hour: 3

Prerequisite: Introduction to Computing

Course description (Synopsis):

The course is designed to introduce structured programming in C++ by providing an overview of programming concepts, on creating and working computer programs in C++. It will address fundamental concepts of program analysis, design, coding, testing and development. It includes introduction to computer programming; programming paradigms; algorithms and problem-solving; introduction to data structures and Programming constructs. The course is designed on how to solve business and scientific problems through the technique of structured programming. It will prepare students for focused studies in any programming language.

Course category: Major mandatory

Course Name: Fundamentals of Database Systems (CSE2206)

Credit Hour: 4

Prerequisite: None

Course description (Synopsis):

A database system is a collection of data with its managements system. Database systems discusses issues related with a data such as, approaches of compiling data/information, manipulating data, keeping data safely, accessing data and concurrent process.

Course category: Major mandatory

Course Name: Linear Algebra (Math 2201)

Credit Hour: 3

Prerequisite: None

Course description (Synopsis):

This course deals with finite dimensional real vector spaces and linear transformations. It is an essential prerequisite for the proper comprehension of many branches of mathematics. Linear Algebra is also the ideal subject to introduce the student to the higher level of abstraction practiced in modern mathematics today.

Course category: Major mandatory

Course Name: Logic and Set Theory (Math 2203)

Credit Hour: 3

Prerequisite: None

Course description (Synopsis):

Introduces axiomatic set theory and elementary mathematical logic. Since set theory and logic form the foundation of mathematics and are greatly intertwined, after reviewing elementary mathematical logic and proof methods an informal approach to sets is first reviewed. Set theory includes the basic axioms and definitions. Basic laws are derived rigorously using methods of logic. Further topics for introducing modern advanced mathematics include properties of numbers, sets and relations, equivalence relations, functions and cardinality.

Course category: Major mandatory

Course Name: Discrete mathematics (Math2207)

Credit Hour: 3

Prerequisite: None

Course description (Synopsis):

This course addresses the topics in elementary counting principles, elementary probability theory, recurrence relation together with generating functions and fundamental concepts in graph theory in comprehensive manner.

Course category: Major mandatory

Course Name: Modern Algebra I (Math 3206)

Credit Hour: 3

Prerequisite: Logic and Set theory (Math2203)

Course description (Synopsis):

This course introduces undergraduate students of Mathematics majors to basic concepts of algebraic structures such as groups, rings, fields, maps between these structures and their substructures.

Course category: Major mandatory

Course Name: Linear Optimization (Math2208)

Credit Hour: 3

Prerequisite: Linear Algebra (Math2201)

Course description (Synopsis):

The course aims to provide a method to **optimize** operations within certain constraints. It is **used** to make processes more efficient and cost-effective. Some areas of application for **linear programming** include food and agriculture, engineering, transportation, manufacturing and energy

This course deals with linear programming, geometric and simplex methods, duality theory and further variations of the simplex method, sensitivity analysis, interior point methods, transportation problems, and theory of games. sensitivity analysis, interior point methods, transportation problems, and theory of games.

Course category: Major mandatory

Course Name: Numerical Analysis I (Math 3201)

Credit Hour: 3

Prerequisite: Linear Algebra(Math2201)

Course description (Synopsis):

The Course is designed to develop the basic concepts in identifying sources of errors and error estimations, solving applied modeled Algebraic, Transcendental and systems of linear equations in different areas of studies classically and using computer applications. It also enables students to identify and use the Forward, Backward, Average, Central difference and Shift Operators. Moreover, find the value of unknown function between two known values using different methods of interpolations, and find the derivative of unknown function at a given known point and between two known points using different methods. Finally, find the definite integral of functions those are difficult to find anti derivatives easily using different numerical methods and obtain the definite integral of a given functions given as a discrete set of values.

This course discusses basic concepts in error estimation, solutions of non-linear equations, solutions of system of linear equations and non-linear equations, finite differences, numerical interpolations, numerical differentiation and numerical integration.

Course category: Major mandatory

Course Name: Ordinary Differential Equations and Applications (Math 2206)

Credit Hour: 3

Prerequisite: Calculus of Functions of Several Variables (Math 2205)

Course description (Synopsis):

This is an introductory course on differential equations. Most real-world problem is described by mathematical formulations, which is called mathematical modelling. The vast majority of mathematical models are formulated in terms of differential equations (Ordinary/ Partial). Here, the course aimed to introduce about theory and techniques for solving Ordinary Differential Equations (ODEs) and its applications in Applied Science and various engineering disciplines. For example, differential equations can describe how population change, how heat moves, how springs vibrate, how radioactive material decays, and much more. The course topics include first order and higher order ordinary differential equations, power series solution, the Laplace Transform and its inverse, and system of ODEs.

Course category: Major mandatory

Course Name: Calculus of Function of Several Variable (Math 2205)

Credit Hour: 3

Prerequisite: Applied Mathematics II (Math1104)

Course description (Synopsis):

The course aims to explore the fundamental ideas and methods of vector calculus, the examination of constrained maxima and minima using Lagrange multipliers and the integration of elementary functions of several variables. It aims to enable students to understand the extension from one variable to several variables of basic concepts such as continuity, differentiability and integration. Furthermore, the course aims to strengthen the ability to apply mathematical concepts like partial differentiation and multiple integrals in computing some important quantities which will appear in applications, such as directional derivatives, gradient,

the area and volume of physical bodies, the center of mass of some rigid body, fluid dynamics and electromagnetism.

This course covers the topics in vector valued functions, functions of several variables, their derivatives and integrals with applications, and calculus of vector fields: green's theorem, line and surface integrals, Stake's theorem, and Divergence theorem.

Course category: Major mandatory

Course Name: Analysis I (Math3205)

Credit Hour: 3

Prerequisite: Calculus of Function of Several Variables (Math2205)

Course description (Synopsis):

This course provides sophomores in mathematics with a thorough background in mathematical analysis. Topics include real number system, sequences, open sets, closed sets, connected sets, compact sets, limits and continuity of functions, differentiation, the mean value theorem, the intermediate value theorem, Riemann integration, sequences and series of functions.

Course category: Major mandatory

Course Name: Complex Variables (Math3203)

Credit Hour: 3

Prerequisite: Calculus of function of Several Variables (Math2205)

Course description (Synopsis):

The course aims to develop the basic ideas on fundamental properties of complex variable system and acts as a bridge connection between mathematics and real-world applications (engineering and scientific problems). This involves the fields of different ion and integration of complex variable functions, analytic functions and their properties, series representation and the

importance of residues in analysis, conformal mappings and Mobius Transformation. By this the students are able to understand the basic laws and implement this knowledge to analyses wherever possible.

Course category: Major mandatory

Course Name: Partial Differential Equations (PDEs) (Math3206)

Credit Hour: 3

Prerequisite: Ordinary Differential Equations and Applications (Math2202)

Course description (Synopsis):

The course introduces students to the concepts and analytical methods for solving partial differential equations. It builds on the previous core mathematics courses to develop more advanced ideas in differential and integral calculus.

This course discusses basic concepts of partial differential equations (PDE), some techniques of solutions of first order PDE, Fourier series, second order PDE, analytical methods of solutions and modelling using PDEs.

Course category: Major mandatory

Course Name: Mathematical Modeling (Math4203)

Credit Hour: 3

Prerequisite: Partial Differential Equation (Math3206)

Course description (Synopsis):

The course aims at providing a concise mathematical formulation of characteristic problems of real life with emphasis on quantitative aspects of the problems. It develops the basic concepts and methods in modelling focusing on forecasting relevant solutions to specified area problems.

This course covers basic concepts and methods in modeling, dimensional analysis, graphical methods and applications, approximation and testing, Eulerian and Lagrangian modeling, consecutive equations, applications (growth and decay models, population growth model, interacting species, traffic flow, diffusion and population.

Course category: Major mandatory

Course Name: Probability Theory and Distribution (Math2204)

Credit Hour: 3

Prerequisite: Basic Statistics for Applied Science (Math1106)

Course description (Synopsis):

One of the main aims of this course is to prepare advanced undergraduates and beginning graduate students in the probability theory and distributions with emphasis on interdisciplinary applications. It also forms the fundamental basis for many other areas in the mathematical sciences including modern optimization methods and risk modeling. Probability theory and distribution is used to present the basic principles of random variables and random processes needed in applications such as signal processing, digital communications, speech processing, data modeling, genetics, finance etc. It covers cumulative distribution functions, common probabilities & distributions, expectations, variances, moment generating functions, covariance and correlations, joint and conditional distributions, marginal and conditional densities, independence random variables, distributions of functions of random variables and applications for the continuous and discrete cases.

Course category: Major mandatory

Course Name: Statistical Method with Computer (Math3202)

Credit Hour: 3

Prerequisite: Basic statistics for Applied Science (Math1106)

Course description (Synopsis):

This course covers sampling distribution of the Variance, Difference between means, Difference between proportions and ratio of variances; Inference about the variance (confidence interval and hypothesis testing); Comparison of two sample means, proportions and ratio of variances; Sample size in comparative studies; One-way ANOVA and Fisher's least significant difference; Chi-square tests of association; Introduction to statistical computing (Using MINITAB, SPSS, R & SAS Software's); Statistical data analysis and interpretation: descriptive and inferential analysis , linear regression, ANOVA; Writing and reporting results of analyses.

Course category: Major mandatory

Course Name: Internship I (Math3200)

Credit Hour: P/F

Prerequisite: None

Course description (Synopsis):

This internship is important to create interactions among the students, the academic advisor, and the organization supervisor. The internship can also serve as a bridge between the traditional academic setting and the practical world. Moreover, for students, the internship offer the potential for valuable learning opportunities outside the standard classroom, for the academic institution (the university), it offers a rich array of opportunities to foster faculty (school) development. Generally, the internship can foster a useful relationship between the host organization and the academic institution, one in which both parties benefit through shared knowledge, resources and goals.

Finally, after completing 2nd year, students go for internship (practical work) to the industries/companies/ organizations for 8-weeks.

Course category: Major mandatory

Course Name: Seminar I (Math4207)

Credit Hour: 1

Prerequisite: None

Course description (Synopsis):

In this seminar course, the student will select or an mathematics topics guided by his/her advisor. The student will independently study the topic, understand it, write and present for demonstrating his/her understanding. It is expected that, the topic will help the student in his final undergraduate research project. Help the student in his final undergraduate research project.

Course category: Major mandatory

Course Name: Undergraduate Research (Math4206)

Credit Hour: 3

Prerequisite: Research Methods in Mathematics

Course description (Synopsis):

Students in their final semester will do research project under the direction of their undergraduate advisors. Topics selection and the sketch of proposal writing will be done in the course “Research Methods in Mathematics”.

Course category: Major mandatory

Course Name: Seminar II (Math4208)

Credit Hour: 1

Prerequisite: Semester I

Course description (Synopsis):

In this seminar course, the student will be provided some advanced applied mathematics topics by his advisor. The content and the level will be different for seminar I. Similar to seminar I, the student will independently study the topic, understand it, write and present for demonstrating his understanding. It is expected that; the topic will help the student in his final undergraduate research project.

Course category: Major Elective

Course Name: Advanced Calculus of Several Variables (Math3306)

Credit Hour: 3

Prerequisite: Analysis I (Math3205)

Course description (Synopsis):

Advanced Calculus of Several Variables provides a conceptual treatment of multivariable calculus. It emphasizes the interplay of geometry, analysis through linear algebra, and approximation of nonlinear mappings by linear ones, basic theory of the topology of n -space, limits, continuity and differentiation of functions of several variables, inverse and implicit function theorems, and integration.

This course covers the topics in Euclidean n -space and transformation; the topology on \mathbb{R}^n ; limit and continuity of transforms, topological spaces, connectedness and compactness, differentiation of real valued functions in \mathbb{R}^n ; Vector valued functions; inverse function theorem, implicit function theorem, integration in \mathbb{R}^n .

Course category: Major Elective

Course Name: Elementary Number Theory (Math 4305)

Credit Hour: 3

Prerequisite: None

Course description (Synopsis):

This course introduces undergraduate students of mathematics majors to the basic concepts of elementary number theory such as divisibility, prime numbers, Diophantine equations and congruence's.

Course category: Major Elective

Course Name: Modern Algebra II (Math 4302)

Credit Hour: 3

Prerequisite: Modern Algebra I (Math 2206)

Course description (Synopsis):

This course is a continuation of Modern Algebra I and deals with more advanced topics, such as Slow theory, field extensions, Galois theory and applies the basic concepts algebraic structures to solve some practical problems in mathematics using group theory, field theory and also introducing students to some computational algebra if time permits.

Course category: Major Elective

Course Name: Combinatorial Theory (Math4315)

Credit Hour: 3

Prerequisite: Discrete Mathematics (Math2207)

Course description (Synopsis):

This course emphasizes on the topics of counting arguments, partially ordered sets, generating functions and their application in counting, and graphs and its applications.

Course category: Major Elective

Course Name: Theory and application of Transforms (Math4311)

Credit Hour: 3

Prerequisite: Partial Differential Equations (Math 3206)

Course description (Synopsis):

The course aims to develop the basic ideas of the **powerful mathematical tools**- plays inevitable role in solving equations such as ordinary and partial differential equations, integral and integro-differential equations and problems arising in applied science and engineering.

This course deals with Laplace transforms, Fourier transforms, Conformal Mapping, Overview of function of complex variables and Z transforms and their applications.

Course category: Major Elective

Course Name: Fourier Analysis and Application (Math4310)

Credit Hour: 3

Prerequisite: Partial Differential Equation (Math3206)

Course description (Synopsis):

This course covers Definition of Fourier series, Basic properties of Fourier series, Fourier series of odd and even functions, Half Range Fourier series, Fourier expansions in general intervals, Parsal's formula, Complex Fourier series, Fourier integrals, Fourier transforms, Properties of Fourier transform, Convolution theorem, Applications (Heat conduction, Vibrations of a string, Transmission lines).

Course category: Major Elective

Course Name: Topology (Math4304)

Credit Hour: 3

Prerequisite: Analysis I (Math3205)

Course description (Synopsis):

The course aims to study the continuity along with the properties that are preserved through deformation, twisting, and the stretching of an object. Through topology, two objects that can be continuously deformed to be identical are considered to be the same object. Topology is the name given to the subject in which mathematicians observe how objects behave after certain experiments are performed, and why they behave the way they do. Topology can be seen in something as simple as the way a pendulum of a clock swings.

This course covers topics in Basic general topological properties and concepts, including topologies, open sets, closed sets, compactness and connectedness, separation axioms for Hausdorff spaces, regular spaces and normal spaces, and countability. Basic properties of metric spaces and various metrization theorems are studied as well.

Course category: Major Elective

Course Name: Analysis II (Math4321)

Credit Hour: 3

Prerequisite: Analysis I(Math3205)

Course description (Synopsis):

This course equips sophomores in mathematics with a further background in mathematical analysis. Topics include series of functions, uniform continuity, double series, uniform convergence, differentiation of sequences and series of functions, integration of sequences and series of functions, special functions, Hilbert space, Fourier series, orthogonality, completeness, transformations, the inverse function theorem, the implicit function theorem, vector analysis, multiple integration, line integration, and some basic concepts of differentiable manifolds.

Course category: Major Elective

Course Name: Mathematical Mechanics (Math3320)

Credit Hour: 3

Prerequisite: Partial Differential Equations (math3206)

Course description (Synopsis):

The course aims to develop the basic ideas and models based on fundamental laws of physics and acts as a bridge connecting mathematics and physics. This involves the fields of vector calculus, Tensor calculus, physical properties of materials (solids, fluids and gases), forces among particles and their effects. By translating the physical problems in to mathematical symbols (conservative laws) leads to mathematical system of governing differential equations. With suitable approximations and assumptions above problems reduced to simple form to compute by mathematical tools and analyzed wherever possible.

This course discusses review of basic concepts of vector calculus, Basics of Tensor analysis, conservation of matter (Solids, fluids and gases) and properties, types of forces in fluid field, solids and their effects, conservative laws and equations of motion.

Course category: Major Elective

Course Name: Financial mathematics (Math4313)

Credit Hour: 3

Prerequisite: Probability Theory and Distribution (Math2204)

Course description (Synopsis):

This course is an introduction to quantitative tools used in pricing financial derivatives. Hence, it is mainly about mathematics. It is a simple and heuristic introduction to mathematical concepts that have practical use in financial markets. Such an introduction requires stochastic methods which is logic behind asset pricing. Asset prices are obtained from conditions that preclude arbitrage opportunities.

This course includes derivatives, options, swaps, arbitrage theorem, and asset pricing model, martingales and calculus concept in stochastic environment.

Course category: Major Elective

Course Name: Differential Geometry (Math4308)

Credit Hour: 3

Prerequisite: Calculus of function of several variables (Math 2205)

Course description (Synopsis):

Classical Differential Geometry is the study of curves and surfaces in the plane and 3-D space. Indeed, the basic ingredients of differential geometry are multi-variable calculus, linear algebra and differential equations. Though at graduate level, one also requires a great deal of topology, analysis and algebra, our purposes are to use calculus to describe certain properties of curves and surfaces. Some gems along the way are: minimal surfaces, the Gauss-Bonnet Theorem and Stokes' Theorem with proofs as formalization of one's visual

thinking. Topics include local theory of curves, Gauss maps and the curvature of surfaces, intrinsic geometry, and the global geometry of surfaces.

Course category: Major Elective

Course Name: Financial Mathematics and Stochastic Models (Math4316)

Credit Hour: 3

Prerequisite: Financial Mathematics (Math4313)

Course description (Synopsis):

This course introduces derivative pricing in discrete and continuous time, beginning with measure-theoretic probability and stochastic processes with an emphasis on martingale. The course also covers the concept of trading in discrete and continuous time, The Binomial Model, and pricing and hedging both European and American Options. The course also covers key stochastic processes such as Brownian Motion, Stochastic Calculus including the Ito integral, the Black-Scholes Model, and Levy processes. These concepts are then applied to the pricing of derivatives as prelude to discussion on interest rate and risk modeling. The course expands the student knowledge on quadratic variations, proving martingale property, deriving and proving Ito Doebelin, and understand the first and second fundamental theorem of finance.

Course category: Major Elective

Course Name: Computer Simulations in Financial Mathematics (Math4306)

Credit Hour: 3

Prerequisite: Financial Mathematics (Math 4313)

Course description (Synopsis):

Financial mathematics programme aims to prepare highly qualified professionals who will address issues related to the globalisation of financial markets, the development of financial transactions, the increasing complexity of portfolio investments, the expansion of the labour market and the development of the banking.

Financial mathematics focuses on the mathematical properties and relations between concepts and elements related to the structure of financial and currency markets in inflation processes analysis, investment and other economic activities. Specialists in the field measure economic activity using currency as the general means of exchange mediation. Experts in financial mathematics are able to analyze and forecast market developments and the feasibility of financial transactions.

Computer simulation is the process of mathematical modeling performed on a computer, which is, designed to predict the behavior of the outcome of a real-world or physical system which is necessary to implement pricing, hedging, trading and risk management tools.

This course introduces mathematical models for various financial derivatives and discusses Dynamics of Derivative Prices, Asset pricing and applications to derivatives, Bonds and Interest Rate Derivatives. It also deals with computations and their numerical solutions.

Course category: Major Elective

Course Name: Nonlinear optimization (Math 4301)

Credit Hour: 3

Prerequisite: Linear Optimization (Math2208)

Course description (Synopsis):

The course is designed to involve minimizing or maximizing a nonlinear objective function subject to bound constraints, linear constraints, or **nonlinear** constraints, where the constraints can be inequalities or equalities. It will address fundamental principles of KKT condition for non-constraint programming

This course covers basic notions of convex analysis, nonlinear optimization, discrete optimization, graph theory, and network optimization.

Course category: Major Elective

Course Name: Numerical Analysis II (Math 3308)

Credit Hour: 3

Prerequisite: Numerical Analysis I (math 3201)

Course description (Synopsis):

The main objective/purpose of this course is to deal with approximation theory of functions, numerical methods for initial value and boundary value problems, matrix eigenvalue problems. It is used as a practically applicable tool for science and engineering problems (arising from physics, biology, chemistry, mathematics, technology...). to obtain approximate solutions when analytic methods are difficult. Students will be able to apply basics of approximation methods of functions and numerical methods for solving science and engineering models related to IVP, BVPs of ODEs and PDEs, Eigen value problems. The course deals with approximation theory of functions, numerical methods for initial value and boundary value problems, methods for solving differential equations and eigenvalue problems and numerical solutions of PDE by Finite Difference Methods. Students will be able to apply basics of approximation methods of functions and numerical methods for solving science and engineering models related to IVPs and BVPs of ODEs and PDEs. (Arise from physics, biology, chemistry, mathematics, technology...).

Course category: Major Elective

Course Name: Operations Research (Math 3302)

Credit Hour: 3

Prerequisite: Linear Optimization (Math 2208)

Course description (Synopsis):

The course aims to reduce “Muddy” business problems into well-defined mathematical constructs, while also defining expected behavior and goals. It tries to empower decision making in areas where efficient allocation of scarce resources is prime concern-whether it be capital, human effort, time and other resources.

This course covers integer programming, deterministic dynamic programming, inventory models, forecasting models, decision theory, queuing systems, and simulation modeling.

Course category: Major Elective

Course Name: Transformation Geometry (Math4318)

Credit Hour: 3

Prerequisite: None

Course description (Synopsis):

This course covers group of transformations, Affine Geometry, orthogonal transformations, orientation preserving transformations, representation of orthogonal transformations, similarity transformations, Affine transformations, and projective transformations.

Course category: Major Elective

Course Name: Computational Geometry and Computer Graphics (Math 4309)

Credit Hour: 3

Prerequisite: Calculus of Functions of Several Variable (Math 2205)

Course description (Synopsis):

The aim of this course is to introduce mathematical methods and theories to describe curves and surfaces in space. This may include an introduction to Computational Geometry, Line Segment Intersection, Polygon Triangulation, Linear Programming and Orthogonal Range Searching. Student will able to apply and create new logics for their own algorithms from this course. The students will apply their algorithms to some applications of computer-aided design and computer graphics. In this course mathematical methods and theories are introduced, to describe the curves and the surfaces in space. This may include an introduction to Computational Geometry, Line Segment Intersection, Polygon Triangulation, Linear Programming and Orthogonal Range Searching. Student will able to apply and create their own basics of the algorithms from this course. Also, students can apply some applications to computer-aided design and computer graphics.

Course category: Major Elective

Course Name: Information Mathematics (Math 4314)

Credit Hour: 3

Prerequisite: Elementary Number Theory (Math 4305)

Course description (Synopsis):

This course aims to introduce the information theory and coding theory. Indeed, the course is focused on to introduce the concepts of Shannon's information theory, computation theory, complexity theory, Hoffman code entropy, data compression, error correcting codes, cryptography, and information security. After learning this course, students can able to apply the various concepts, logics and algorithms of this course to the different applications arise in engineering as well as in sciences.

This course introduces Shannon's information theory, computation theory, complexity theory, Hoffman code entropy, data compression, error correcting codes, cryptography, and information security.

Course category: Major Elective

Course Name: Mathematical Software (Math 3304)

Credit Hour: 3

Prerequisite: None

Course description (Synopsis):

The aim of this course is to introduce students with the basics of mathematical software (such as MATLAB and or Mathematica) to broaden their computer skills and knowledge for science and engineering problem solving. Students will be able to apply basics of the software / MATLAB tools to solve specific problems in linear and or nonlinear systems, with codes applicable in science and engineering models in (physics, biology, chemistry, mathematics, technology...). This may include basic introductions, simple math operations, direct methods and or numerical techniques, plots and graphs, integrations and differentiations and simple programs for a particular application.

In this course some mathematical software (such as MATLAB and or Mathematica is introduced. This may include basic introductions, simple math operations, direct methods and or numerical techniques, plots and graphs, integrations and differentiations and simple programs for a particular application. Students will be able to apply basics of the software / MATLAB tools to solve specific problem in linear and or nonlinear systems, with codes applicable in science and engineering models (from physics, biology, chemistry, mathematics, technology...).

Course category: Major Elective

Course Name: Cryptography (Math4324)

Credit Hour: 3

Prerequisite: Elementary Number Theory (Math4305)

Course description (Synopsis):

This course covers the basic knowledge in understanding and using cryptography. The main focus is on definitions, theoretical foundations, and rigorous proofs of security, with some programming practice. Topics include classical cryptosystems, symmetric cryptosystems, DES, AES, public key cryptosystems, digital signature, communication protocols, cipher system, methods and types of attack, information theory, stream ciphers, block ciphers, public key ciphers, authentication, identification and information theory.

Course category: Major Elective

Course Name: Statistical Modeling (Math4303)

Credit Hour: 3

Prerequisite: Probability Theory and Distribution (Math2204)

Course description (Synopsis):

Basic concepts of statistical modeling, Principles of statistical modeling, Family of statistical models, Theoretical and empirical considerations. Simple applications of statistical models in real problems. Statistical methods to be addressed are probability distributions, regression analysis, logistic regression, multivariate, exploratory and confirmatory factor analysis. **MINITAB** and **RSoftware** will be used.

Course category: Major Elective

Course Name: Regression Analysis (Math4312)

Credit Hour: 3

Prerequisite: Probability Theory and Distribution (Math2204)

Course description (Synopsis):

Simple linear regression: parameter estimation and model fitting; model checking (R-square, residual plot PP- plot); prediction; inference about parameters; linear correlation and inference about correlation coefficient; The multiple linear regression: model assumptions, model fitting; R-square; partial correlation coefficients; model diagnostics, partitioning sum of squares, ANOVA table construction, test of hypothesis, prediction, dummy variables; effects of departures from model assumptions; forward and backward procedures.

Course category: Major Elective

Course Name: Applied Spatial Statistics (Math4322)

Credit Hour: 3

Prerequisite: Statistical Inference (Math3310)

Course description (Synopsis):

Basic concepts; exploratory data modeling and analysis of point patterns, lattice data, image data; Geo statistics: random fields, variograms, autocorrelation; spatial linear interpolation(kriging), some illustrations from areas of environmental science, agriculture and forestry, demography, medicine, public health, mining, petroleum engineering, natural resources, geography; Applications using R Software.

Course category: Major Elective

Course Name: Statistical Quality Control (Math4317)

Credit Hour: 3

Prerequisite: Probability Theory and Distribution (Math2204)

Course description (Synopsis):

This course is about the use of modern statistical methods for quality control and improvement. It is designed to introduce students the most common statistical methods for statistical quality control. The course gives an idea for students about the technical methods for achieving success in quality control and improvement for many organizations such as for manufacturers, distributors, transportation companies, financial services, health care providers and government agencies, and offers guidance on how to successfully implement these methods.

This course covers: The Meaning of Quality and Quality Improvement; Basic methods of statistical process control; Other statistical process monitoring and control techniques; Acceptance sampling; Reliability and Life testing; Ethiopian experience in Statistical quality control.

Course category: Major Elective

Course Name: Mathematical Statistics (Math4307)

Credit Hour: 3

Prerequisite: Probability Theory and Distribution (Math2204)

Course description (Synopsis):

This course is an interdisciplinary nature and is designed for a one-semester course in probability and statistics, with basic calculus as a prerequisite. The purpose of the course is that the student develops knowledge and gain basic skills in statistical models in order to handle the stochastic variations and also be familiar with some data analysis methodologies, which are based on probability theory. One of the main aims of this course is to prepare advanced undergraduates and beginning graduate students in the theory of statistics with emphasis on interdisciplinary applications.

This course covers basic theories for statistical methodologies and applications to engineering and applied sciences. Topics include basic theories of probability, random variables, probability distributions and their inter-relationship, average and variance, variable transformations, sampling distributions, estimation and hypothesis testing, the law of large numbers, two-dimensional distributions, decision making, linear models, and nonparametric methods.

Course category: Major Elective

Course Name: Time Series Analysis (Math4319)

Credit Hour: 3

Prerequisite: Probability Theory and Distribution (Math2204)

Course description (Synopsis):

The course is designed to introduce the theory and methods of time series analysis. This course gives the basic concepts of the four classifications of time series analysis (description, explanation, prediction and control) occurring in a variety of fields, ranging from economics to engineering, and methods of analyzing time series constitute an important area of statistics. It enables students to apply various time series models in practice such as in a) Economic time series b) Physical time series c) Marketing time series d) Demographic time series e) Process control.

This course covers: Definition and concepts; Objectives; Time series data, Components of time series analysis; Additive and multiplicative models; Tests of randomness; Constant mean model, estimation methods; Linear trend estimation using moving average, Least squares, Exponential smoothing methods; Seasonal variation, estimation using simple average, moving average, dummy variable, exponential smoothing; Cyclical variation; Introduction to Box-Jenkins models: Stationary, Autoregressive (AR), Moving Average (MA), Autoregressive Moving Average (ARMA), ARIMA models; Forecasting Methods.

Course category: Major Elective

Course Name: Statistical Inference (Math3310)

Credit Hour: 3

Prerequisite: Probability Theory and Distribution (Math 2204)

Course description (Synopsis):

This course covers definition, basic concepts and properties of a point estimator; Sufficiency, Completeness, exponential family of distributions; Parametric point estimation, methods of finding point estimates: unbiased estimation, method of moments, maximum likelihood and Bayesian; Parametric interval estimation, Confidence interval, Method of finding interval estimates: pivotal quantity method and large sample asymptotic distributions, some applications; Tests of hypotheses: basic concepts, Most powerful test, Neyman-Pearson lemma, Generalized likelihood ratio test, uniformly most powerful test, monotone likelihood ratio, unbiased test, applications: tests on the mean, the variance, several means, several variances; chi-square tests; relationship between tests and confidence intervals; Sequential test: sequential probability ratio test and some of its properties; Introduction to non-parametric methods: inference concerning the empirical distribution, quintiles and equality of two distributions.

1.6 Industrial chemistry

General information

I. Duration of study

Normal modality

Regular: 4-year program

Extension program: 5 years

II. Course category

NO	Course category		Course level	Credit requirement	Percentage from the total
1	General	Mandatory	University required	27	18.6 %
2	Basic	Mandatory	School required	27	18.6 %
3	Major	Mandatory	Department required	67	46.2 %
		Elective		21	14.5 %
		Subtotal		88	60.7 %
4	Free electives			3	2.0 %
	Total			145	

Course category: General/University required

Course Name: General Psychology and life skills (LART 2002)

Credit Hour: 3

Prerequisite: None

Course description (Synopsis):

Psychology is a science of human cognitive processes and behaviors. This course is designed to give students an overview of what psychological science has discovered about human behavior and mental processes throughout human history. Students will gain an understanding of the psychological phenomena that occur in daily life as well as the practical applications of psychological knowledge. Upon completing the course, students shall be able to demonstrate a basic knowledge of the science of psychology.

Specifically, the course general psychology is concerned with discussing perspectives in psychology and basic psychological concepts such as sensation and perception, learning, personality, motivation, emotion, and basic life skills (intrapersonal, interpersonal, social and academic skills). Emphasis will be given to both theoretical and practical implications of these concepts to effectively function as individual and team in a community.

Course category: General/University required

Course category: General/ university required

Course Name: Geography of Ethiopia and the Horn (LART 1003)

Credit Hour: 3

Prerequisite: None

Course description (Synopsis):

This course covers a brief description on the location, shape and size of Ethiopia as well as basic skills of reading map, the physical background and natural resource endowment of Ethiopia and the Horn which includes its geology and mineral resources, topography, climate, drainage and water resources, soil, fauna and flora. It also deals with the demographic characteristics of the country and its implications on economic development.

Course category: General/ university required

Course Name: History of Ethiopia and the Horn (LART 1004)

Credit Hour: 3

Prerequisite: None

Course description (Synopsis):

This course describes why history is important, how history is studied and introduces the region Ethiopia and the Horn. It treats human evolution, Neolithic Revolution, settlement patterns as well as religion and religious processes in Ethiopia and the Horn. Based on these historical backgrounds, the course describes states, external contacts, economic formations and achievement in terms of architecture, writing, calendar, and others to the end of the 13th century. Historical processes including states formation and power rivalry, trade, external relation, threats and major battles, centralization and modernization attempts, Italian occupation, and socio-economic conditions from 1800 to 1941 makes central position in the modern history of the region.

Course category: General/University required

Course Name: Introduction to Civics and Ethics (LART 1001)

Credit Hour: 3

Prerequisite: None

Course description (Synopsis):

It is now become clear that Ethics and Citizenship Studies has become not only a field of specialization in itself but has also been attracting leaders who envision instilling democracy on a nun shakable ground within their own society. Autoscore, Ethics is a system of moral principles which involves systematizing, defending and recommending concepts of rights and wrong behavior. It affects how people make decisions and lead their lives. Citizenship, on its part, is a legal status of individuals within a given state. It embodies the legal and political relationship between citizens and state, underlining the reciprocal relationship between the two. This course is designed with the aim of equipping learners with necessary ethical qualities and civic competences while dealing with issues that affect their society at all levels and human in general.

The course starts with unfolding the notions, principles and theories of ethics which can shape human attitude, action and behavior in making moral judgments. Next, the course introduces

learners to the nature, mutual interactions and historical evolutions of society, state, government and citizenship. It also elucidates issues pertaining to political governance such as constitution, democracy, and human rights in some details. To enable learners grasp basic knowledge of political, economic and social dynamics of international system in today's globalized world, the course also introduces international relations and foreign policy and other major contemporary global issues. In light of this, the course does not present mere theoretical knowledge, but also practical knowledge of accentuating art of governing and protecting national interest in today's complex world.

Course category: General/University required

Course Name: Entrepreneurship and Business Development (SOSC5003)

Credit Hour: 3

Prerequisite: None

Course description (Synopsis):

This interdisciplinary course in general is designed to introduce students to the concept of sustainable entrepreneurship, a manageable process that can be applied across careers and work settings. It focuses on building entrepreneurial attitudes and behaviors that will lead to creative solution within community and organizational environments. This course is designed to prepare individuals for ownership of their own innovative business, and assist start-ups to function more effectively, increase the chances of new business success, enhance profitability, and increase employment.

More specifically, the course provides students with an introduction to the concepts and skills necessary to successfully commercialize new products and services. Entrepreneurship is not just about starting a business. It is also about identifying good opportunities and then creating, communicating, and capturing value from those opportunities; including innovation in a corporate context. It will also teach students the skills to analyze business opportunities, and

articulate them as a compelling business description, and pitch to an audience of investors, customers, or business partners. It focuses on building entrepreneurial attitudes and behaviors that will lead to creative solution within community and organizational environments.

Course category: General/University required

Course Name: Communicative English (EnLa -1001)

Credit Hour: 3

Prerequisite: None

Course description (Synopsis):

Communicative English Skills is a course where students learn what they need to know for a career in science context. The course gives students the language, information, and skills they need to study science context. It also provides students the language appropriate for studying science context and real work situations as it comprises unique sections such as: **‘it’s my job’** wherein real people talk about their work in science context , **‘listening’** whereby students are exposed to situations related to science context , technical explanations, and interviews, **‘reading’** whereby students meet a variety science context based texts, and the **‘writing section’** which is designed to let students compose short reports on different activities.

Course category: General/University required

Course Name: Introduction to Economics (SOSC2002)

Credit Hour: 3

Prerequisite: None

Course description (Synopsis):

This course provides a general introduction to economics combining elements of micro and macro fundamentals. The main objective of this course is to introduce and acquaint students with the preliminary principles (theories) and knowledge of economics and the application of economic theories (principles) in the actual world; the daily activities of the households, firm

business or any other form of enterprises at micro levels. Students will also be able to contextualize the key macroeconomic variables and policy instruments.

Specifically, the course introduces students with theory of consumer behavior, production, and cost of production. In these theories how decisions are made by different economic agents will be discussed. Furthermore, the course covers different characteristics of perfect and imperfect market structure. Lastly the course tries to introduce basic macroeconomic concepts such as national income accounting, unemployment, inflation, fiscal and monetary policy instruments.

Course category: General/University required

Course Name: Basic Writing Skills (EnLa1002)

Credit Hour: 3

Prerequisite: Communicative English Skills (EnLa 1001)

Course description (Synopsis):

Basic Writing Skills course aims at developing students' basic writing skills in science context. The course gives students the language writing skills they need to study science. It contains *sentence level writing*: sentence structure, sentence types sentence combinations, common sentence errors (fragment, run on, comma splices, misplaced modifier, dangling modifier, faulty parallelism, faulty reference of pronoun, faulty agreement and shifts); *paragraph level writing*: the essence of a paragraph, components of a paragraph (topic sentence, supporting sentences, concluding sentence), characteristics of effective paragraph (unity, coherence and completeness) and the steps in writing a paragraph and types of a paragraph; *essay level writing*: structure of an essay, thesis statement and supporting paragraphs, types of essays and techniques of essay development.

Course category: General/ university required

Course Name: Physical fitness and conditioning I (SpSc1011)

Credit Hour: 0 cr.hr

Prerequisite: None

Course description (Synopsis):

This course will provide the students with basic concepts of the five components of health-related physical fitness (cardiovascular, muscular strength and endurance, flexibility, and body composition), hypokinetic disease and general principles of training. It is mainly practical oriented.

As a result, the students will be exposed to various exercise modalities, sport activities, minor and major games, and various training techniques as a means to enhance health related physical fitness components. In addition, they will develop the skills to assess each component of fitness and will practice designing cardiovascular, muscular strength and endurance, and flexibility programs based on the fitness assessment. The course serves as an introduction to the role of exercise in health promotion, fitness, performance including the acute and chronic responses of the body to exercise.

Course category: General/ university required

Course Name: Physical fitness and conditioning II (SpSc 1022)

Credit Hour: 0 cr.hr

Prerequisite: SpSc 1011

Course description (Synopsis):

This course is designed to acquaint freshman engineering and applied natural science students with the nature and scope of different ball games.

It emphasizes the value of establishing lifelong fitness using ball games as a means and focuses on the fundamental of volley ball, hand ball, basketball and football as a life time leisure activity also focuses on the development of personalized approach to healthy active living through

participation in a variety of ball games that have the potential to engage students' interest throughout their lives. Again, the courses enable the participants enjoying practice and acquire proper technique and strategies associated with the ball games mentioned above and learn rules governing the game.

Course category: Basic Mandatory

Course Name: General Chemistry (Chem1102)

Credit Hour: 3

Prerequisite: none

Course description (Synopsis):

The course is designed to study Properties, units and measurements; the composition of matter, chemical reactions, reactions stoichiometry, atomic structure and the periodic table, the chemical bond, structure of molecules, properties of solutions, chemical equilibria, introduction to functional groups and their typical reactions.

Course category: Basic Mandatory

Course Name: Practical General Chemistry (Chem 1104)

Credit Hour: 1

Prerequisite: none

Course description (Synopsis):

The course is designed to give basic understanding and concepts of measuring mass, and volumes by using cylinder and burette, experimental errors, systematic and random errors, significant digits/figures, beam balance, mean, mean deviation, Bunsen burner, luminous and non-luminous flame, physical and chemical changes, properties and reaction of substances, diffusion rates, kinetic theory of gases, Graham's law of diffusion, percentage

of water of hydration, calculating equivalent weight; basic laboratory operations such as recrystallization, simple distillation, fractional distillations and steam distillations.

Course category: Basic Mandatory

Course Name: Introduction to Computing (CSEg 11011)

Credit Hour: 3

Prerequisite: None

Course description (Synopsis):

In this course the basic techniques of computational problem solving will be covered by using computational thinking while writing small and medium sized programs, mapping problems into computational frameworks emphasizing on scientific problems, understanding problems and formulation of problems based on the elective programming language (using python). The course includes the concepts and techniques of data structure, input/output, flow control and incidental program, and by using a systematic division of problem solution and concept of module, to solve problems in numerical value field and non-numerical value field with program experiment.

Course category: Basic Mandatory

Course Name: Fundamentals of Programming (CSEg1104)

Credit Hour: 3

Prerequisite: Introduction to Computing

Course description (Synopsis):

The course is designed to introduce structured programming in C++ by providing an overview of programming concepts, on creating and working computer programs in C++. It will address fundamental concepts of program analysis, design, coding, testing and development. It includes introduction to computer programming; programming paradigms; algorithms and problem-solving; introduction to data structures and Programming constructs. The course is designed on

how to solve business and scientific problems through the technique of structured programming. It will prepare students for focused studies in any programming language.

Course category: Basic Mandatory

Course Name: Introduction to Emerging Technologies (CSEg1102)

Credit Hour: 3

Prerequisite: None

Course description (Synopsis):

This course will enable students to explore current breakthrough technologies in the areas of Artificial Intelligence, Internet of Things and Augmented Reality, Data Science and other technologies that have emerged over the past few years. Besides helping learners become literate in emerging technologies, the course will prepare them to use technology in their respective professional preparations.

Course category: Major Mandatory

Course Name: Analytical Chemistry (Chem2211)

Credit Hour: 3

Prerequisite: General Chemistry

Course description (Synopsis):

The course is designed to make the students develop competencies of chemical analysis, by using the various chemical techniques such as gravimetric and/or titrimetric techniques. The course familiarizes the students with statistical evaluation of analytical data. As a result, the students, after completion of the course, will develop the competency to carry out chemical

analysis in various fields such as chemical industry, agriculture, environmental chemistry, clinical chemistry, medicine, pharmaceutical industries and others.

Course category: Major Mandatory

Course Name: Practical Analytical Chemistry (Chem2213)

Credit Hour: 1

Prerequisite: General Chemistry

Course description (Synopsis):

The course is designed to make the students to develop competencies of chemical analysis by using various practical classical techniques in both qualitative and quantitative analyses and basic principles of gravimetric and titrimetric techniques and statistical analysis of laboratory data. As a result, the students, after completion of the course, will develop the competency to carry out chemical analysis in various fields such as chemical industry, agriculture, environmental chemistry, clinical chemistry, medicine, pharmaceutical industries and others.

Course category: Major Mandatory

Course Name: Instrumental Analysis (Chem2212)

Credit Hour: 3

Prerequisite: Analytical Chemistry

Course description (Synopsis):

The course is designed to make the students develop competency in basic instrumental methods of analysis. The course will familiarize the students with the basic knowledge of instrumentations like in gas chromatography, high performance liquid chromatography, supercritical fluid chromatography, size exclusion chromatography, ion exchange

chromatography, electrophoresis, potentiometry, conductometry, coulometry, electrogravimetry, voltammetry which are applicable in various fields like, toxicology, environmental science, pharmaceuticals, quality controlling, chemical industry, clinical chemistry, medicine and the like.

Course category: Major Mandatory

Course Name: Practical Instrumental Analysis (Chem2214)

Credit Hour: 1

Prerequisite: Instrumental Analysis

Course description (Synopsis):

The course is designed to make the students to develop competencies of chemical analysis by using various practical techniques like chromatography (TLC, PC, GC, and HPLC) and electroanalytical methods (Potentiometry, Voltammetry, Conductometry, Coulometry, Electrogravimetry, Electrophoresis and Refractive index). The course familiarizes the students with statistical evaluation of analytical data. As a result, the students, after completion of the course, will develop the competency to carry out chemical analysis in various fields such as chemical industry, agriculture, environmental chemistry, clinical chemistry, medicine, pharmaceutical industries and others.

Course category: Major Mandatory

Course Name: Industrial Analysis of Real Sample (Chem3214)

Credit Hour: 2

Prerequisite: Instrumental Analysis and Practical Organic chemistry

Course description (Synopsis):

The course is designed to make the students develop the competency to analyze real samples based on what they have already learnt. The course will familiarize the students with the techniques of sampling, storage, and analysis of real samples; learn the analytical methods and skills of sampling and operation. It covers Systematic analysis of real samples: sampling, preservation and preparation of samples for the determination of major and trace elements; inorganic compounds (speciation); organic compounds; biological samples; food and beverages; water and waste water samples; soils and related samples.

Course category: Major Mandatory

Course Name: Inorganic Chemistry I (Chem2221)

Credit Hour: 3

Prerequisite: General Chemistry

Course description (Synopsis):

In this course students will also learn atomic structure, periodic trends, chemical bonding, Acid-base theory and solvent system, chemistry of main group elements; chemistry of hydrogen, s-block, p-block and noble gases; compounds of main group elements: synthesis, reactions and applications.

Course category: Major Mandatory

Course Name: Inorganic Chemistry II (Chem2222)

Credit Hour: 3

Prerequisite: Inorganic Chemistry I

Course description (Synopsis):

Introduction to the basic principles of modern inorganic chemistry; the course emphasizes the combination, structure, synthesis and reactivity of inorganic compounds, and especially transition metal complexes. It includes ligand field theory of transition metal compounds, their spectroscopic/thermodynamic properties, periodicity of elements, the molecular symmetry, group theory, structures, bonding, electronic spectra, acid-base chemistry and reaction mechanisms, solid-state chemistry, and solution chemistry.

Course category: Major Mandatory

Course Name: Practical Inorganic Chemistry I (Chem2224)

Credit Hour: 1

Prerequisite: Inorganic Chemistry I

Course description (Synopsis):

This course emphasizes on Synthesis, Isolation, Characterization, and the chemical properties of variety of inorganic compounds

Course category: Major Mandatory

Course Name: Practical Industrial Inorganic Chemistry (Chem3223)

Credit Hour: 1

Prerequisite: Practical Inorganic Chemistry I, Inorganic Chemistry I

Course description (Synopsis):

This course emphasizes on Synthesis, Isolation, Characterization, and the chemical properties of variety of inorganic compounds.

Course category: Major Mandatory

Course Name: Organic Chemistry I (Chem2231)

Credit Hour: 3

Prerequisite: General Chemistry

Course description (Synopsis):

Carbon can form covalent bonds with itself and other elements to create a mind-boggling array of structures. Organic Chemistry I deal primarily with the basic principles to understand the structure and reactivity of organic molecules. Emphasis is on substitution and elimination reactions and chemistry of the carbonyl group.

The course deals with historical background of Organic Chemistry; Bonding, Structure and Reactivity; Functional groups (Nomenclature, physical and chemical properties), Stereochemistry: Chirality and Optical activity; Stereoisomerism; Configuration: Cahn-Ingold-Prelog sequence rules for assigning configuration, Introduction to major classes of Organic Reactions: Substitution Reactions, Elimination reactions, Addition reactions; Rearrangement reactions.

Course category: Major Mandatory

Course Name: Organic Chemistry II (Chem2232)

Credit Hour: 3

Prerequisite: Organic Chemistry I

Course description (Synopsis):

This course designed to make students aware of organic reactions and mechanisms in detail and depth. It elaborates Chemistry of aromatics, amine, carbonyl compounds, carboxylic acid and its derivatives, and oxidation-reduction reactions. In addition, Chemistry biological molecules such

as carbohydrates, amino acids, peptides, lipid, and nucleic acids are introduced to address basic concepts about natural product Chemistry.

Course category: Major Mandatory

Course Name: Practical organic chemistry (Chem2234)

Credit Hour: 1

Prerequisite: General Chemistry and Introduction to Chemistry Practice

Course description (Synopsis):

The course is designed to give basic understanding and concepts of practical organic chemistry. It covers not only identification of organic compounds but also transformation of one functional group to another. Emphasis will also be given to separation and purification techniques such as filtration, recrystallization, distillation, and chromatography. The students will also be able to perform basic biochemistry experiments.

Course category: Major Mandatory

Course Name: Practical Industrial organic chemistry (Chem3233)

Credit Hour: 2

Prerequisite: Organic Chemistry I and Practical Instrumental Analysis, Practical Organic Chemistry

Course description (Synopsis):

This course is designed to give basic understanding to esterification reactions; acetylation of aniline; p-nitroaniline from acetanilide; azo dyes and the dying process, oxidation of alkyl arenes; synthesis using the aldol condensation, Friedel-Crafts reaction; and the Diels-Alder reaction. The students will also be able to perform physical characterization of organic compounds: preliminary examination, melting point, boiling point, specific gravity, index of refraction of liquids; separation of mixtures; classification of organic compounds by solubility; preparation of derivatives; use of spectroscopic methods for structure determination.

Course category: Major Elective

Course Name: Physical Organic Chemistry (Chem3332)

Credit Hour: 3

Prerequisite: Organic Chemistry II and Physical Chemistry II

Course description (Synopsis):

Physical Organic Chemistry is a discipline of organic chemistry that focuses on the relationship between chemical structures and reactivity, in particular, applying experimental tools of physical chemistry to the study of organic molecules. The course deals with correlation of structure with reactivity; linear free energy relationships and energetics, kinetics and methods of establishing reaction mechanisms. The course elaborates the chemistry of reactive intermediates including carbocations, carbanions, free radicals, carbenes and nitrenes and applies the principles in mechanism and synthesis of some organic molecules. It also deals with the application of the basic principles of Frontier Orbital Theory in various types of pericyclic reactions including electrocyclic reactions, cycloaddition and sigma tropic rearrangements. Furthermore, the course is intended to apply the concepts of molecular spectroscopy in elucidation of some organic molecules.

Course category: Major Elective

Course Name: Synthetic Organic Chemistry (Chem4331)

Credit Hour: 3

Prerequisite: Organic Chemistry II

Course description (Synopsis):

Synthetic Organic Chemistry is a discipline of organic chemistry which is related to the chemical science involving in the construction of specific chemical compounds from simple compounds. The course deals with the aspect of a planned sequent route resulting in products with desired activity. This course proves that synthetic process permits synthesis of naturally occurring compounds with actual structure or once needed with structural variation to enhance desired characteristics. This course is designed to prepare students to deal with complex organic reactions and to plan and synthesize various organic compounds as well as complexes with optimal use of resources and available technology. The course describes that fine chemical used as fuels, pesticides and herbicides, diagnostics and medical devices, vitamins, perfumes, cosmetics, fabrics and all sorts of high-technology materials used in televisions, computers and other information technologies, and transportation and space machines are also product of organic synthesis.

Course category: Core Module

Course Name: Biochemistry (Chem3253)

Credit Hour: 3

Prerequisite: Chem2231 (Organic Chemistry I), Chem2232 (Organic Chemistry II)

Course description (Synopsis):

Biochemistry deals with complete understanding of the molecular levels of the chemical process associated with living cells. The scope of the subject is providing biochemical facts and the principles to understand metabolism of nutrient molecules in physiological and pathological conditions. It is also emphasizing on genetic organization of mammalian genome and hetero & autocatalytic functions of DNA.

Course category: Major mandatory

Course Name: Physical Chemistry I (Chem2242)

Credit Hour: 3

Prerequisite: General Chemistry

Course description (Synopsis):

This course covers ideal and real gases, Zeroth's Law of Thermodynamics; First Law of thermodynamics, Thermochemistry, second Law of Thermodynamics, third law of thermodynamics, chemical equilibrium, phase equilibrium, solutions.

Course category: Major mandatory

Course Name: Physical Chemistry II (Chem3241)

Credit Hour: 3

Prerequisite: Physical Chemistry I

Course description (Synopsis):

The course covers electrolyte solutions, Electrochemical Cell, interfacial electrochemistry, Transport phenomenon, Kinetic theory of gases and Chemical Kinetics.

Course category: Major mandatory

Course Name: Practical Physical Chemistry (Chem3241)

Credit Hour: 1

Prerequisite: none

Course description (Synopsis):

Solubility, phase rule, partition coefficient, transition temperature and freezing point, Conductance, Electrochemistry, kinetics of reaction Thermochemistry.

Course category: Major mandatory

Course Name: Practical Industrial Physical Chemistry (Chem3243)

Credit Hour: 1

Prerequisite: Practical Physical Chemistry

Course description (Synopsis):

Kinetic of Reaction, Spectroscopy, Computational software, adsorption, surface tension, viscosity.

Course category: Major mandatory

Course Name: Environmental Chemistry (Chem3251)

Credit Hour: 3

Prerequisite: Analytical chemistry

Course description (Synopsis):

Environmental Chemistry offers a rigorous introduction on the chemical principles that govern the reactions, transport, effects and fates of chemical species in water, soil, and air. The first unit discusses and familiarizes students with the various divisions of the environment and explains the possible consequences of the effects of technology and man's activities on the chemical composition and properties of the natural environment; The course will pay special consideration to basics of atmospheric chemistry; aquatic chemistry; and soil chemistry; pollution of air, water and soil.

Course category: Major mandatory

Course Name: Research Methods and Scientific Writing (Chem3252)

Credit Hour: 2

Prerequisite: none

Course description (Synopsis):

Conducting Research enables students to grow both professionally and personally in ways that are not possible through traditional classroom and laboratory/workshop instruction. Hence the course introduces the language of research, the elements of research process, review chemical literature and writing and reporting of findings.

Course category: Basic mandatory

Course Name: Applied Mathematics I (Math1103)

Credit Hour: 3

Prerequisite: none

Course description (Synopsis):

This course covers Basic concepts of limit and continuity, derivatives & their applications, Integration and their applications.

Course category: Basic mandatory

Course Name: Applied Mathematics II (Math 1104)

Credit Hour: 3

Prerequisite: Applied Mathematics I (Math 1103)

Course description (Synopsis):

This course covers inverse functions, derivatives of inverse functions, techniques of integration focusing on trigonometric substitution and partial fractions, Trapezoidal rule and Simpson's rule, arc length, indeterminate forms, sequences, series and power series.

problems. This course covers integer programming, deterministic dynamic programming, inventory models, forecasting models, decision making, Queuing Theory, and Simulation Models.

Course category: Basic mandatory

Course Name: Basic Statistics for Applied Science (Math1106)

Credit Hour: 3

Prerequisite: none

Course description (Synopsis):

This is include: History of statistics, Meaning of statistics; Methods of data collection; Methods of data presentation; Measures of location; Measures of variation; Moments, skewness and kurtosis; terminologies in probability; Counting Techniques; definition of Probability (approaches to probability); Probability distributions; Sampling and Sampling Distribution of the mean and proportion; Elementary description of the tools of statistical inference: Basic concepts; Estimation: (Point and Interval) for the population mean and proportion; Hypothesis testing on the population mean and proportion; Simple linear regression, correlation and rank correlation.

Course category: Basic mandatory

Course Name: General Physics (Phys1103)

Credit Hour: 3

Prerequisite: Knowledge in Higher Secondary Physics

Course description (Synopsis):

At the end of this course students are expected to be acquainted with basic concepts in different branches of physics, identify the connection between them and explain the common phenomena. They will also develop skills of solving problems.

Course category: Core Module

Course Name: Elements of the Chemical Industry (Chem3255)

Credit Hour: 3

Prerequisite: Knowledge in Higher Secondary Physics

Course description (Synopsis):

The chemical industry is highly globalized producing thousands of chemicals from a wide variety of raw materials by means of different technologies for diverse end use sectors. Industrial chemistry deals with commercial production of chemicals and related products through transformation of materials and energy into useable products resulting in economic growth and improvement of life. This course provides students the foundation to try and bridge the gap between classical chemistry and chemistry as is applied in industry. In order to do so, the course starts with providing an understanding of the structure of the industry and proceeding through the role and application of catalysts and principles of green chemistry in different processes, basic understanding of flow diagrams, introduction to unit operations and unit processes, and reactor designs for chemical reactions.

Course category: Core Module

Course Name: Elements of the Chemical Industry (Chem3255)

Credit Hour: 3

Prerequisite: None

Course description (Synopsis):

The chemical industry is highly globalized producing thousands of chemicals from a wide variety of raw materials by means of different technologies for diverse end use sectors. Industrial chemistry deals with commercial production of chemicals and related products through transformation of materials and energy into useable products resulting in economic growth and improvement of life. This course provides students the foundation to try and bridge the gap between classical chemistry and chemistry as is applied in industry. In order to do so, the course starts with providing an understanding of the structure of the industry and proceeding through the role and application of catalysts and principles of green chemistry in different processes, basic understanding of flow diagrams, introduction to unit operations and unit processes, and reactor designs for chemical reactions.

Course category: major elective

Course Name: Introduction to Industrial Materials (Chem 4257)

Credit Hour: 3

Prerequisite: None

Course description (Synopsis):

This course is designed to introduce graduate students in Chemistry to typical materials applied in industries for varieties of applications. The composition, structure, properties and applications of most fundamental materials of organic and inorganic nature will have to be explored. Discussion includes various types of metals, alloys, composites, glass, ceramics, plastics, polymers, cement and concrete materials.

Course category: major elective

Course Name: Advanced Industrial Materials (Chem 4256)

Credit Hour: 2

Prerequisite: None

Course description (Synopsis):

Advanced Materials are pertinent for industry because recent developments in the field have given rise to a number of new materials that have the potential to significantly impact products, processes and services. This course is trying to bring awareness to students about the advanced materials and their Industrial applications. The advanced materials include carbon nanotubes, fullerenes, fullerides, Advanced composites for aircraft industries, Chemical sensors, Bio sensors, Electrochemical sensors, Ceramic capacitors, Membrane reactor materials, nanostructures electro catalysts, Electronic polymers, Advanced polymers- High temperature-fire resistant polymers, Metal- metal oxide nanoparticles, nanowires, nanomachines and quantum dots- Applications in biomedical, cosmetics, agricultural, environmental and energy sectors.

Course category: major elective

Course Name: Agrochemicals and Fertilizers (Chem4367)

Credit Hour: 2

Prerequisite: None

Course description (Synopsis):

The course on manures, fertilizers and agrochemicals will give a broad idea about the manures, importance of manures, different types of manures, sources, compost preparation, methods, benefits and their role in sustaining soil productivity. This course deals with organic chemistry as prelude to agrochemicals- Diverse type of Agrochemicals-Botanical Insecticides-Pyrethrum-Synthetic pyrethroids. Synthetic organic insecticides-Major classes- synthesis and properties of some important insecticides under each class. Herbicides-Major Classes-Synthesis and properties of 2,4-d, atrazine, glyphosate, butachlor and benthiocarb. Fungicides-Major classes synthesis and properties of carbendazim, carboxin, captantridemorph and copper oxy chloride- insecticides act-plant growth regulators.

Fertilizers-Classification-Manufacturing processes and properties of major nitrogenous, phosphatic potassic and complex fertilizers- their fate and reactions in the soil-Secondary and micronutrient fertilizers-Amendments. Biofertilizers and their advantage-Fertilizer control order-Fertilizer storage.

Course category: major elective

Course Name: Fermentation and Brewery Industries (Chem4353)

Credit Hour: 2

Prerequisite: None

Course description (Synopsis):

To make students acquainted with principles of using of microorganisms in fermentation process. Attain knowledge of production equipment in fermentation industry, application of microorganisms and enzymes in technological operation, substrate preparation and control of fermentative process and isolation of products. Substantial time is devoted to particular fermented products -- spirits industry, yeast industry, brewing industry- History and overview of Industrial Brewing, Beer origin, classification and beer styles, Basic raw materials of brewing, Overview of world and Ethiopian brewing scenario.

Course category: major elective

Course Name: Extractive metallurgy (Chem4352)

Credit Hour: 3

Prerequisite: None

Course description (Synopsis):

Metallurgy has been transformed into a modern science as a result of developments in chemistry and chemical engineering and is an important sector for any country's economic growth. This course provides students with basic knowledge of extractive metallurgy beginning with a review of minerals, properties included, and ores used as raw material, and mineral processing through to select detailed extractive metallurgy processes for the production of ferrous and nonferrous metals.

Course category: major elective

Course Name: Nuclear and radiation chemistry (Chem4362)

Credit Hour: 3

Prerequisite: Organic Chemistry II or Physical Chemistry II

Course description (Synopsis):

Radiation chemistry today is responsible for major progress not only in the understanding of the elementary chemical events resulting from the interaction of high-energy photons or particles with matter but also many important greener industrial processes and products spanning across diverse end use sectors. This course introduces students to the fundamentals (primary phenomena and mechanisms) of this exciting and highly specialized area through a review of the atom, its constituents and their energies, radioactive isotopes and decay products, high energy particles and photons, and interaction of radiation with matter.

Course category: major elective

Course Name: Polymer Science I: Polymerization (Chem3364)

Credit Hour: 3

Prerequisite: Organic Chemistry II; Physical Chemistry II; or Inorganic Chemistry II

Course description (Synopsis):

Polymers belong to the class of soft materials, made from many types of natural organic and inorganic materials, semi-synthetic and synthetic materials. Their development has transformed the way we live and continually does so. In order to understand their nature, this course provides students with a basic knowledge of the structure, polymerization and characteristics of these materials, starting with a review of atomic and molecular structure and proceeding through basic elements of the chemical synthesis mechanisms and kinetics, structure, morphology and thermal transitions. It is also anticipated that students in other disciplines who want to obtain an overview of the science and engineering of these materials would want to take this course.

Course category: major elective

Course Name: Polymer science II - Recycling (Chem4365)

Credit Hour: 3

Prerequisite: Polymer Science I: Polymerization

Course description (Synopsis):

Polymer products are indispensable to society because of their easy processability into various shapes, low cost, lightweight, and durability over conventional products. But the irony is that some of the advantages make polymeric materials a threat to the environment mainly due to that polymer products are of the “use and throw” type. One of the ways to alleviate the serious ill effects of polymers and considered important is polymer recycling. This is because all other alternatives are

either extremely dangerous or economically unviable. This course introduces students to recycling practices for a broad class of polymers that exist in a circular economy “recycle and reuse” for a sustainable environment. The course reviews some important recycling processes such as mechanical, chemical, dissolution, thermochemical, catalytic and cracking. The Eco profiles of resultant recycles and the different additives used in recycling technologies are also reviewed.

Course category: major elective

Course Name: Textile processing I: Chemistry (Chem3362)

Credit Hour: 3

Prerequisite: Organic Chemistry or Physical Chemistry

Course description (Synopsis):

The production and processing of textiles is a vibrant and highly diversified sector such that there is no one single correct way to perform textile wet processing. Each industry has its own character, depending largely on the type of equipment and type of fabric it processes. This makes the selection of operating parameters specific and having to select from several options to achieve the desired end-product. This course introduces students to fabric preparation processes through a review of the fundamentals of mechanical and process parameters, the underlying chemistry behind each process, the chemistry of the fiber/chemical interaction, the chemistry of the various classes of chemical auxiliaries and the unit operations involved.

Course category: major elective

Course Name: Textile processing II: Finishing (Chem4363)

Credit Hour: 3

Prerequisite: Textile processing I: Chemistry

Course description (Synopsis):

The production and processing of textiles is a vibrant and highly diversified sector such that there is no one single correct way to perform textile wet processing. Each industry has its own character, depending largely on the type of equipment and type of fabric it processes. This makes the selection of operating parameters specific and having to select from several options to achieve the desired end-product. This second course in textile processing introduces students to fabric finishing processes through a review of the mechanical and chemical finishing processes and their aspects, and different chemistries

involved in the preparation of fabrics with different functional finishes for durability, water repellency, antifouling, flame retardancy, antipilling and antistatic characteristics.

Course category: major elective

Course Name: Petroleum and Gas Industry (chem4354)

Credit Hour: 3

Prerequisite: none

Course description (Synopsis):

The development of petro-chemical and refining industries in the country has made it compulsory for the Industrial chemist to understand important aspects of petroleum refining and petrochemical technology. Petroleum refining as well as petrochemical industries constitute a major part of chemical sector. Every industrial chemist has to invariably handle the enormous consumption of petroleum products, their diversity and increasing applications. Industrial chemist has to apply the relevant concepts for operating petroleum refinery or petrochemical plant in a smooth and safe manner. Beside this, a chemist must be aware about the various properties of petroleum fractions as well as petrochemicals. Hence, this course has been designed to develop such expertise and skills.

Course category: major elective

Course Name: Industrial Pharmaceutical Chemistry (chem3354)

Credit Hour: 3

Prerequisite: none

Course description (Synopsis):

Course category: major elective

Course Name: Introduction to Industrial Biotechnology (chem3366)

Credit Hour: 3

Prerequisite: none

Course description (Synopsis):

The course introduces bioreactors, its types, operation methods and provides an experimental demonstration of the same. Strategies to obtain higher yields, design of the reactors and production of biofuels from microbes are thoroughly explained. Students are introduced to various disciplines such as biotechnology, food technology, and pharmaceutical industries. The course discusses the existing bioprocess applications such as wine and cheese making, antibiotics and vaccines etc. The course majorly focusses on the applications and allows students to gain practical knowledge rather than mere theory. Major bottlenecks for the operation of biochemical industries will be discussed.

Course category: major elective

Course Name: Food Chemistry (chem4361)

Credit Hour: 3

Prerequisite: none

Course description (Synopsis):

This course will introduce the basic principle and their application in food chemistry (food industry). The students will learn how the components in food affect the quality and safety. You will gain an understanding of how water, carbohydrates, lipids, proteins, vitamins, and minerals in foods; biochemical and functional properties, enzymes, food additives (emulsifiers, pigments, colors, flavors, preservatives, and sweeteners) and texture related to properties in food systems and are modified during processing.

Course category: major elective

Course Name: Quality Control (Chem XXXX)

Credit Hour: 3

Prerequisite: none

Course description (Synopsis):

Quality management is the act of overseeing all activities and tasks needed to maintain a desired level of excellence. This includes the determination of a quality policy, creating and implementing quality planning and assurance, and quality control and quality improvement. The main idea of this course is to introduce the main principles of business and social excellence, to generate knowledge and skills of students to use models and quality management methodology.

Course category: Core Module

Course Name: Industrial waste management ()

Credit Hour: 3

Prerequisite: none

Course description (Synopsis):

This subject deals with the pollution from major industries and methods of controlling the same. The student is expected to know about the polluting potential of major industries in the country and the methods of controlling the same.

Course category: Core Module

Course Name: Chemical Reaction Engineering (Chem3256)

Credit Hour: 3

Prerequisite: none

Course description (Synopsis):

The objectives of the course are to introduce the student to Chemical Engineering methods such as unit operations, systems of unit operations, design, and the broad variety of fields where Chemical Engineering principles and methods are important.

Course category: Core Module**Course Name: Industrial safety and Chemical pollution (Chem4252)****Credit Hour: 3****Prerequisite: none****Course description (Synopsis):**

To make students acquainted with principles of using of microorganisms in fermentation process. Attain knowledge of production equipment in fermentation industry, application of microorganisms and enzymes in technological operation, substrate preparation and control of fermentative process and isolation of products. Substantial time is devoted to particular fermented products -- spirits industry, yeast industry, brewing industry- History and overview of Industrial Brewing, Beer origin, classification and beer styles, Basic raw materials of brewing, Overview of world and Ethiopian brewing scenario.

Course category: major elective**Course Name: Heavy and Fine Chemical Industries (Chem3352)****Credit Hour: 3****Prerequisite: none****Course description (Synopsis):**

Students will learn the fundamental concept of heavy and fine chemical industry, classification of chemical industry, Manufacture of raw materials, type and properties of Industrial Gases, Mineral acids, Cement Industries, Ceramic Industries, Glass Industries and Paint Industries.

Course category: major elective

Course Name: Nano chemistry (Chem4356)

Credit Hour: 3

Prerequisite: General Chemistry

Course description (Synopsis):

Students will learn the fundamental concept of nanotechnology and nanoscience. Study how to synthesis nanomaterials and nanoparticles, nanowire, thin film and combined structures of such nanomaterials as well as their unique properties. Furthermore, students will learn the different characterization techniques of nanomaterials and their diverse applications including plasmonic, nano sensor, catalysis, biomaterial, mechanics, and fuel cell.

Course category: major elective

Course Name: Sugar production and Process Industry (Chem4355)

Credit Hour: 3

Prerequisite: none

Course description (Synopsis):

The **sugar industry** subsumes the production and processing. It covers different source for production of sugar and describe about by-products of sugar industry.

Course category: major elective

Course Name: Cosmetics Industry (Chem3356)

Credit Hour: 3

Prerequisite: none

Course description (Synopsis):

The **cosmetic industry** describes the industry that manufactures and distributes cosmetic products. It contains different ingredients for production different types of cosmetics.

Course category: major elective

Course Name: Pulp and paper Production and Process Industry (Chem4357)

Credit Hour: 3

Prerequisite: none

Course description (Synopsis):

Pulp and paper Industry course designed to deliver the most comprehensive overview available in the industry of today's pulping and papermaking technology. It covers the wood and chips, pulp mill operations, chemical recovery, recycling, stock preparation, pulp and paper quality, and environmental aspects topics.

Course category: major elective

Course Name: Rubber and Resin Industry (Chem4354)

Credit Hour: 3

Prerequisite: none

Course description (Synopsis):

Rubber and Resin Industry course contain different topics and use to familiarize students with the different types and grades of rubber, their properties, ingredients, processing techniques, applications and different type of resin.

Course category: major elective

Course Name: Leather Industry (Chem3358)

Credit Hour: 3

Prerequisite: none

Course description (Synopsis):

This course aims at introducing the fundamentals of chemistry and technology of leather manufacture. The topics covered include, hide and skin structure; curing; hide and skin proteins; tannery operation; beam house; delimiting, bating and pickling; chrome, vegetable and synthetic tanning; dyeing; bat liquoring; drying; finishing of leather.

1.7 Pharmacy program

General information

I. Duration of study

Normal modality

Regular: 5-year program

Continuing:

Fast Track modality: For Dual major/minor and fast track the calculation for minimum and maximum cr. Hrs. shall be according to dual major/minor and fast track guideline article 1.2/a.

II. Course category

NO	Course category		Course level	Credit requirement	Percentage from the total
1	General	Mandatory	University required	27	18.62%
2	Basic	Mandatory	School required	27	18.62%
			Program required	3	2.07%
3	Major	Mandatory	Department required	64	44.14%
		Elective		21	14.48%
4	Free electives	100%		3	2.07%
				145	100%

Course category: General/University required

Course Name: General Psychology and life skills (LART 2002)

Credit Hour: 3

Prerequisite: None

Course description (Synopsis):

Psychology is a science of human cognitive processes and behaviors. This course is designed to give students an overview of what psychological science has discovered about human behavior

and mental processes throughout human history. Students will gain an understanding of the psychological phenomena that occur in daily life as well as the practical applications of psychological knowledge. Upon completing the course, students shall be able to demonstrate a basic knowledge of the science of psychology.

Specifically, the course general psychology is concerned with discussing perspectives in psychology and basic psychological concepts such as sensation and perception, learning, personality, motivation, emotion, and basic life skills (intrapersonal, interpersonal, social and academic skills). Emphasis will be given to both theoretical and practical implications of these concepts to effectively function as individual and team in a community.

Course category: General/University required

Course Name: Geography of Ethiopia and the Horn (LART 1004)

Credit Hour: 3

Prerequisite: None

Course description (Synopsis):

This course covers a brief description on the location, shape and size of Ethiopia as well as basic skills of reading map, the physical background and natural resource endowment of Ethiopia and the Horn which includes its geology and mineral resources, topography, climate, drainage and water resources, soil, fauna and flora. It also deals with the demographic characteristics of the country and its implications on economic development.

Course category: General/University required

Course Name: History of Ethiopia and the Horn (LART 1003)

Credit Hour: 3

Prerequisite: None

Course description (Synopsis):

This course describes why history is important, how history is studied and introduces the region Ethiopia and the Horn. It treats human evolution, Neolithic Revolution, settlement patterns as well as religion and religious processes in Ethiopia and the Horn. Based on these historical backgrounds, the course describes states, external contacts, economic formations and achievement in terms of architecture, writing, calendar, and others to the end of the 13th century. Historical processes including states formation and power rivalry, trade, external relation, threats and major battles, centralization and modernization attempts, Italian occupation, and socio-economic conditions from 1800 to 1941 makes central position in the modern history of the region.

Course category: General/University required

Course Name: Introduction to Civics and Ethics (LART 1001)

Credit Hour: 3

Prerequisite: None

Course description (Synopsis):

It is now become clear that Ethics and Citizenship Studies has become not only a field of specialization in itself but has also been attracting leaders who envision instilling democracy on a nun shakable ground within their own society. Autoscore, Ethics is a system of moral principles which involves systematizing, defending and recommending concepts of rights and wrong behavior. It affects how people make decisions and lead their lives. Citizenship, on its part, is a legal status of individuals within a given state. It embodies the legal and political relationship between citizens and state, underlining the reciprocal relationship between the two. This course is designed with the aim of equipping learners with necessary ethical qualities and civic competences while dealing with issues that affect their society at all levels and human in general.

The course starts with unfolding the notions, principles and theories of ethics which can shape human attitude, action and behavior in making moral judgments. Next, the course introduces learners to the nature, mutual interactions and historical evolutions of society, state, government and citizenship. It also elucidates issues pertaining to political governance such as constitution, democracy, and human rights in some details. To enable learners grasp basic knowledge of

political, economic and social dynamics of international system in today's globalized world, the course also introduces international relations and foreign policy and other major contemporary global issues. In light of this, the course does not present mere theoretical knowledge, but also practical knowledge of accentuating art of governing and protecting national interest in today's complex world.

Course category: General/University required

Course Name: Entrepreneurship and Business Development (SOSC5003)

Credit Hour: 3

Prerequisite: None

Course description (Synopsis):

This interdisciplinary course in general is designed to introduce students to the concept of sustainable entrepreneurship, a manageable process that can be applied across careers and work settings. It focuses on building entrepreneurial attitudes and behaviors that will lead to creative solution within community and organizational environments. This course is designed to prepare individuals for ownership of their own innovative business, and assist start-ups to function more effectively, increase the chances of new business success, enhance profitability, and increase employment.

More specifically, the course provides students with an introduction to the concepts and skills necessary to successfully commercialize new products and services. Entrepreneurship is not just about starting a business. It is also about identifying good opportunities and then creating, communicating, and capturing value from those opportunities; including innovation in a corporate context. It will also teach students the skills to analyze business opportunities, and articulate them as a compelling business description, and pitch to an audience of investors, customers, or business partners. It focuses on building entrepreneurial attitudes and behaviors that will lead to creative solution within community and organizational environments.

Course category: General/University required

Course Name: Communicative English (EnLa -1001)

Credit Hour: 3

Prerequisite: None

Course description (Synopsis):

Communicative English Skills is a course where students learn what they need to know for a career in science context. The course gives students the language, information, and skills they need to study science context. It also provides students the language appropriate for studying science context and real work situations as it comprises unique sections such as: **‘it’s my job’** wherein real people talk about their work in science context , **‘listening’** whereby students are exposed to situations related to science context , technical explanations, and interviews, **‘reading’** whereby students meet a variety science context based texts, and the **‘writing section’** which is designed to let students compose short reports on different activities.

Course category: General/University required

Course Name: Introduction to Economics (SOSC2002)

Credit Hour: 3

Prerequisite: None

Course description (Synopsis):

This course provides a general introduction to economics combining elements of micro and macro fundamentals. The main objective of this course is to introduce and acquaint students with the preliminary principles (theories) and knowledge of economics and the application of economic theories (principles) in the actual world; the daily activities of the households, firm business or any other form of enterprises at micro levels. Students will also able to contextualize the key macroeconomic variables and policy instruments.

Specifically, the course introduces students with theory of consumer behavior, production, and cost of production. In these theories how decisions are made by different economic agents will be discussed. Furthermore, the course covers different characteristics of perfect and imperfect market structure. Lastly the course tries to introduce basic macroeconomic concepts such as national income accounting, unemployment, inflation, fiscal and monetary policy instruments.

Course category: General/University required

Course Name: Basic Writing Skills (EnLa1002)

Credit Hour: 3

Prerequisite: Communicative English Skills (EnLa 1001)

Course description (Synopsis):

Basic Writing Skills course aims at developing students' basic writing skills in science context. The course gives students the language writing skills they need to study science. It contains *sentence level writing*: sentence structure, sentence types sentence combinations, common sentence errors (fragment, run on, comma splices, misplaced modifier, dangling modifier, faulty parallelism, faulty reference of pronoun, faulty agreement and shifts); *paragraph level writing*: the essence of a paragraph, components of a paragraph (topic sentence, supporting sentences, concluding sentence), characteristics of effective paragraph (unity, coherence and completeness) and the steps in writing a paragraph and types of a paragraph; *essay level writing*: structure of an essay, thesis statement and supporting paragraphs, types of essays and techniques of essay development.

Course category: General/ university required

Course Name: Physical fitness and conditioning I (SpSc1011)

Credit Hour: 0 cr.hr

Prerequisite: None

Course description (Synopsis):

This course will provide the students with basic concepts of the five components of health related physical fitness (cardiovascular, muscular strength and endurance, flexibility, and body composition), hypokinetic disease and general principles of training. It is mainly practical oriented.

As a result, the students will be exposed to various exercise modalities, sport activities, minor and major games, and various training techniques as a means to enhance health related physical fitness components. In addition, they will develop the skills to assess each component of fitness and will practice designing cardiovascular, muscular strength and endurance, and flexibility programs based on the fitness assessment. The course serves as an introduction to the role of exercise in health promotion, fitness, performance including the acute and chronic responses of the body to exercise.

Course category: General/ university required

Course Name: Physical fitness and conditioning II (SpSc 1022)

Credit Hour: 0 cr.hr

Prerequisite: SpSc 1011

Course description (Synopsis):

This course is designed to acquaint freshman engineering and applied natural science students with the nature and scope of different ball games.

It emphasizes the value of establishing lifelong fitness using ball games as a means and focuses on the fundamental of volley ball, hand ball, basketball and football as a life time leisure activity also focuses on the development of personalized approach to healthy active living through participation in a variety of ball games that have the potential to engage students' interest throughout their lives. Again, the courses enable the participants enjoying practice and acquire

proper technique and strategies associated with the ball games mentioned above and learn rules governing the game.

Course category: Basic Mandatory

Course Name: Human Anatomy and Physiology - I (Biol2011)

Credit Hour: 3

Prerequisite: None

Course description (Synopsis):

This course is designed to impart fundamental knowledge on the structure and functions of the various systems of the human body. It also helps in understanding both homeostatic mechanisms. The subject provides the basic knowledge required to understand the various disciplines of pharmacy.

Course category: Basic Mandatory

Course Name: Biochemistry (Biol2041)

Credit Hour: 3

Prerequisite: None

Course description (Synopsis):

Biochemistry deals with complete understanding of the molecular levels of the chemical process associated with living cells. The scope of the subject is providing biochemical facts and the principles to understand metabolism of nutrient molecules in physiological and pathological conditions. It is also emphasizing on genetic organization of mammalian genome and hetero & autocatalytic functions of DNA.

Course category: Basic Mandatory

Course Name: Biology (Biol2013)

Credit Hour: 2

Prerequisite: None

Course description (Synopsis):

To learn and understand the components of living world, structure and functional system of plant and animal kingdom.

Course category: Basic Mandatory

Course Name: Fundamentals of Physical Chemistry (Chem2043)

Credit Hour: 3

Prerequisite: None

Course description (Synopsis):

This course deals with various fundamental aspects of physical chemistry like Thermodynamics; Thermochemistry; Electrochemistry; Chemical Kinetics; Basic Quantum Chemistry which are required for pharmacy students to understand the higher-level courses.

Course category: Basic Mandatory

Course Name: Chemistry of Natural Products (Chem2045)

Credit Hour: 3

Prerequisite: None

Course description (Synopsis):

The course covers some selected topics in natural products chemistry. The goal is to acquaint students to the basic evidences, which are results of observations carried out over generations that are in use to chemically characterize natural products of primary and secondary metabolism.

It also realizes that the same reactions organic chemists know so well are apparently only mimics of what occurs naturally.

Course category: Basic Mandatory

Course Name: Organic Chemistry - II (Chem2042)

Credit Hour: 3

Prerequisite: Organic Chemistry – I (Chem2041)

Course description (Synopsis):

This course deals with general methods of preparation and reactions of some organic compounds. Reactivity of organic compounds is also studied here. The syllabus emphasizes on mechanisms and orientation of reactions. This course also imparts knowledge on stereochemical aspects of organic compounds and organic reactions, important named reactions, chemistry of important hetero cyclic compounds. It also emphasizes on medicinal and other uses of organic compounds.

Course category: Basic Mandatory

Course Name: Inorganic Chemistry (Chem2044)

Credit Hour: 3

Prerequisite: None

Course description (Synopsis):

This course deals with the monographs of inorganic drugs and pharmaceuticals

Course category: Basic Mandatory

Course Name: Chemometrics (Chem2046)

Credit Hour: 2

Prerequisite: None

Course description (Synopsis):

The course aims to provide students with the ability to design a chemical-analytical methodology from sampling to data analysis, starting from the design of experiments to arrive at the correct processing of data and presentation of the final technical report.

Course category: Basic Mandatory

Course Name: Epidemiology (Pharm2054)

Credit Hour: 2

Prerequisite: None

Course description (Synopsis):

This course is designed to equip students with the basic concepts of epidemiology (definition of epidemiology), communicable disease epidemiology, measures of disease occurrence, establishment of disease causation, epidemiological study designs, outbreak investigation and management, screening in disease control and epidemiological surveillance.

Course category: Basic Mandatory

Course Name: Pharmacognosy and Phytochemistry (Pharm3133)

Credit Hour: 3

Prerequisite: None

Course description (Synopsis):

This course involves the fundamentals of Pharmacognosy like scope, classification of crude drugs, their identification and evaluation, phytochemicals present in them and their medicinal properties.

Course category: Basic Mandatory

Course Name: Integrated Physical Pharmacy and Pharmaceutics-I (Pharm3121)

Credit Hour: 4

Prerequisite: Introduction to Pharmacy & Pharmaceutical Calculations (Pharm2121)

Course description (Synopsis):

The design of the course is based on the integration of the study of physico-chemical principles of pharmacy with the formulation and preparation of pharmaceutical dosage forms. The integration is done within each main class of pharmaceutical dosage forms. The study of the physico-chemical principles of pharmacy serves as a prologue to the materials covered in each section. The main focus of this course is the application of the knowledge of the physico-chemical principles of pharmacy to the rational formulation, compounding, quality control, packaging and storage of pharmaceutical dosage forms.

Course category: Basic Mandatory

Course Name: Pharmacology-I (Pharm3111)

Credit Hour: 4

Prerequisite: Human Anatomy and Physiology – I (Biol2011), Human Anatomy and Physiology – I (Biol2012)

Course description (Synopsis):

This course is designed to enable graduate Pharmacists describe drugs used for treatment, diagnosis and prevention of diseases. Upon completion of this course, students will be able to explain the pharmacological actions, mechanism of actions, adverse reactions, therapeutic uses

and pharmacokinetics of drugs affecting the nervous system, respiratory system, gastrointestinal system and autacoids. In addition to attending class room sessions, students will have the opportunity to work in Pharmacology Laboratory and will be able to practice selected basic experimental demonstration.

Course category: Basic Mandatory

Course Name: Medicinal Chemistry-I (Pharm3141)

Credit Hour: 4

Prerequisite: Organic Chemistry – I (Chem2041) & Organic Chemistry – II (Chem2042)

Course description (Synopsis):

Medicinal chemistry is the application of chemistry in the context of human medicine. In this course students will gain an appreciation for the drug development process, together with brief introduction to the drug discovery and designing methods, and also deals with the chemistry of various class of drugs that act on different systems and organs of human body, which includes drugs acting on; autonomic nervous system, drugs acting on the central nervous system, Histamine and histamine antagonists, non-narcotic analgesics and drugs used in gout; cardiovascular drugs; pesticides; expectorants and antitussives; nonsteroidal and steroidal hormones, local and general anesthetics. The course is designed to provide an in-depth scientifically grounded and clinically relevant medicinal chemistry learning experience for pharmacy students.

Course category: Basic Mandatory

Course Name: Pharmaceutical Analysis-I (Pharm3143)

Credit Hour: 4

Prerequisite: None

Course description (Synopsis):

This course covers pharmaceutical quality control aspects, various titrimetric methods such as acid base, argentometric complexometric, non-aqueous and miscellaneous titrimetry methods. Besides, it gives also the student theoretical knowledge on applications of biological, radiochemical and electrochemical techniques in quality control of pharmaceuticals. The course has 16 weeks of practical classes in which different titrimetric methods will be studied as employed in the estimation of the constituents of drugs included in the national drug list.

Course category: major Mandatory

Course Name: Pharmacology-II (Pharm3112)

Credit Hour: 4

Prerequisite: Pharmacology I (Pharm3111)

Course description (Synopsis):

This course is a continuation of Pharmacology I. It is designed to enable graduate Pharmacists describe drugs that are not addressed in Pharmacology I and are used for treatment, diagnosis and prevention of diseases. Up on completion of this course, students will be able to explain the pharmacological actions, mechanism of actions, adverse reactions, therapeutic uses and pharmacokinetics of clinically useful drugs. In addition to attending class room sessions, students will have the opportunity to work in Pharmacology Laboratory and will be able to practice selected basic experimental demonstration.

Course category: major Mandatory

Course Name: Applied Toxicology (Pharm3114)

Credit Hour: 4

Prerequisite: Pharmacology-I (Pharm3111)

Course description (Synopsis):

The course covers general principles of toxicology; routes and types of exposure to toxicants, with reference to pesticides, air pollutants, organic solvents and vapors, heavy metals, household

chemicals and drugs. Principles and methods of testing for toxicity are discussed together with forensic toxicology. There is an introduction to occupational and regulatory toxicology, the poison center, general and specific measures to be taken during poisoning. Each student undertakes a project on a case of drug overdose management.

Course category: major Mandatory

Course Name: Medicinal Chemistry-II (Pharm3142)

Credit Hour: 4

Prerequisite: Medicinal Chemistry-I (Pharm3141)

Course description (Synopsis):

Medicinal Chemistry II is a continuation of medicinal chemistry I & covers; chemotherapeutic agents which includes antiseptics and disinfectants, preservatives, antifungal agents, urinary tract anti-infectives, antitubercular and antileprotic agents, topical agents, antiviral agents, antiprotozoal drugs, anthelmintics, antiscabies & unipedicular agents, sulfonamides, antibiotics & anticancer drugs; and products of biotechnology.

Course category: major Mandatory

Course Name: Pharmaceutical Analysis-II (Pharm3144)

Credit Hour: 3

Prerequisite: Pharmaceutical Analysis -I (Pharm3143)

Course description (Synopsis):

The course deals with the applications of important instrumental analytical techniques such as Spectro-chemical methods including UV- Visible, atomic absorption, flame spectroscopy, mass

spectroscopy and nuclear magnetic resonance spectroscopy; chromatographic methods including Gas Chromatography and High-Performance Liquid Chromatography in quality controls of pharmaceutical products. The course has 16 weeks of practical classes in which different instrumental analytical techniques will be studied as employed in the estimation of the constituents of drugs included in the national drug list.

Course category: major Mandatory

Course Name: Integrated Physical Pharmacy and Pharmaceutics-II (Pharm3144)

Credit Hour: 3

Prerequisite: Integrated Physical Pharmacy and Pharmaceutics-I (Pharm3121)

Course description (Synopsis):

The design of the course is based on the integration of the study of physico-chemical principles of pharmacy with the formulation, preparation and stabilization of semisolid and solid pharmaceutical dosage forms. In line with this, the course deals with scientific principles related to thermodynamic and electrical properties of colloidal systems, and diffusion and dissolution theories associated with drug release kinetics from dosage forms. The module is also designed to enable students apply these theories and principles for the formulation and production of semisolid and solid dosage forms in the practical compounding sessions and thereafter during their professional career. The principles of drug degradation mechanisms, rate and kinetic theories of chemical reactions are also included for their application in the determination of product shelf-life and stability studies. The applications of pharmaceutics in cosmetics, overview of radiopharmaceuticals and veterinary dosage forms are also included.

Course category: major Mandatory

Course Name: Complementary and Alternative Medicine (Pharm3131)

Credit Hour: 1

Prerequisite: none

Course description (Synopsis):

The course is designed in such a way that the trainee gets well acquainted with the various alternative and complementary medicine practices including the Ethiopian traditional medicine. In addition, the trainee will be able to understand and make use of complementary medicine in primary health care.

Course category: Basic Mandatory

Course Name: Immunological and Biological Products (Biol4021)

Credit Hour: 2

Prerequisite: Pharmaceutical Microbiology (Biol2022)

Course description (Synopsis):

This course designed to introduce the student the application of biotechnology in drug discovery and development. This course comprehends the role of genetic engineering and allied technologies that have underpinned the development of a range of pharmaceutical products of modern biotechnology, collectively termed biopharmaceuticals (mainly immunological and biological products) that can be used in the pharmaceutical care of a patient. The emphasis will be to understand the application of recombinant DNA derived drugs (immunological and biological products) in pharmaceutical care of a patient. It also deals with handling of immunological and biological products and with the different therapeutic approaches such as gene therapy, antisense therapy, cell therapy and immunological principles (immunotechnology) that are used in prevention and diagnosis of diseases.

Course category: Basic Mandatory

Course Name: Health service management and policies (Pharm4061)

Credit Hour: 2

Prerequisite: Pharmaceutical Microbiology (Biol2022)

Course description (Synopsis):

This course is designed to give the student a basic concept of public health services management. It begins by introducing the trainee to the lay and professional concept of health. It then goes on to deal with factors affecting health. It will also give students the knowledge about the relationship of health and development, health systems, Primary health care and health for all, definition and applicability to public health of subjects taught under public health, identifying community health problems, indicators of health status of a population, and major strategies of improving public health in developing countries.

Course category: Major Mandatory

Course Name: Practical Pharmacognosy Techniques and Experiments (Pharm4131)

Credit Hour: 2

Prerequisite: Pharmacognosy and Phytochemistry (Pharm3133)

Course description (Synopsis):

The main purpose of this course is to impart the students the knowledge of identification of herbal products, various techniques used in the extraction and isolation of active principles from crude drugs.

Course category: Major Mandatory

Course Name: Industrial Pharmacy - I (Pharm4121)

Credit Hour: 3

Prerequisite: Integrated physical pharmacy and pharmaceuticals-I (Pharm3121) & Integrated physical pharmacy and pharmaceuticals-II (Pharm3122).

Course description (Synopsis):

Course enables the student to understand and appreciate the influence of pharmaceutical additives and various pharmaceutical dosage forms on the performance of the drug product.

Course category: Major Mandatory

Course Name: Biopharmaceutics and Clinical Pharmacokinetics (Pharm4123)

Credit Hour: 3

Prerequisite: Pharmacology I (Pharm3111) & Pharmacology II (Pharm3112)

Course description (Synopsis):

This module deals with mechanisms of drug absorption, effect of pH on drug absorption and the pH partition principle, role of dosage forms in the absorption of drugs, bioavailability and bioequivalence, factors affecting bioavailability, and evaluation of the bioavailability of a drug. It also deals with the pharmacokinetics aspect of drug molecules i.e. how drugs are absorbed, distributed, metabolized and eliminated in the body. This is essential for pharmacists to provide patients the appropriate drug regimen that will reduce the chance of under-treatment, inadvertent poisoning, and dose related adverse effects.

Course category: Major Mandatory

Course Name: Integrated therapeutics-I (Pharm4151)

Credit Hour: 3

Prerequisite: Pharmacology I (Pharm3111) & Pharmacology II (Pharm3112)

Course description (Synopsis):

This course is designed to introduce the pharmacy student to the study of integrated therapeutics. It will provide introductory information designed to assist the student to begin understanding the rationale upon which many drug therapy decisions are based. Principles, concepts, processes, and skills in pharmacotherapy will be emphasized. Therapeutic topics and case studies will be used to provide students with the opportunity to apply these skills. This course will also enable students to understand and interpret the common diagnostic tests. Gastrointestinal disorders will be addressed in the therapeutics section.

Course category: Major Mandatory

Course Name: Pharmacoepidemiology (Pharm4153)

Credit Hour: 2

Prerequisite: Epidemiology (Pharm2054)

Course description (Synopsis):

The goal of the course is to introduce pharmacoepidemiology and drug safety and research application for post-marketing drug safety surveillance. The course will describe how to develop a research protocol and conduct research, describe various health care data sources used for research, and discuss how pharmacoepidemiology contribute to pharmacy practice, such as, drug utilization review, assessment of drug therapy, and adverse drug reaction monitoring. A series of case studies from thalidomide to cisapride to cerivastatin will be also discussed in class. Students can have a better understanding of Pharmacoepidemiologic research, drug safety regulatory, pregnancy registry, and risk management.

Course category: Major Mandatory

Course Name: Industrial Pharmacy - II (Pharm4122)

credit Hour: 3

Prerequisite: Industrial Pharmacy – I (Pharm4121)

Course description (Synopsis):

This course is designed to impart fundamental knowledge on pharmaceutical product development and translation from laboratory to market.

Course category: Major Mandatory

Course Name: Integrated Therapeutics-II (Pharm4152)

credit Hour: 3

Prerequisite: Integrated Therapeutics-I (Pharm4151)

Course description (Synopsis):

This course is a continuation of Integrated therapeutics-I. The purpose of this course is to provide didactic framework for the therapeutic management of a number of common diseases, including renal diseases, cardiovascular diseases, pulmonary diseases, musculoskeletal diseases, and Eye and ENT. With a thorough background established in physiology, pharmacology, pharmacokinetics and other courses in the curriculum, the goal of this course is to prepare students to develop rational drug therapy plans for patients, identify conditions for monitoring pharmacotherapy in patients, and identify conditions associated with these common diseases that require referral.

Course category: Major Mandatory

Course Name: Drug informatics (Pharm4154)

credit Hour: 2

Prerequisite: Integrated Therapeutics-I (Pharm4151), computer literacy

Course description (Synopsis):

This course is designed to provide pharmacy students with an overview of drug information resources used in healthcare system. Students will learn the advantages and disadvantages of primary, secondary, and tertiary literatures and will also gain experience of extracting information from these types of literature. The students will learn how to evaluate the biomedical literature using a systematic approach and will assess the statistical analyses reported to determine whether the interpretation and conclusions are valid. Students will also have a hands-on training at the Drug Information Center, SOP on the various computer-based drug information resources.

Course category: Major Mandatory

Course Name: Pharmacy practice-I (Pharm4156)

credit Hour: 3

Prerequisite: Integrated Therapeutics-I (Pharm4151)

Course description (Synopsis):

This course provides an extended theoretical discussion on pharmacy practice in class and visit of various pharmacy settings: community and hospital pharmacies, pharmaceutical industry, drug regulatory body, research institutes, drug supply and distribution agencies, and pharmacy associations. The course enables the student to comprehend the duties and responsibilities of various settings of pharmacy practice. It also prepares the student to develop good working relationships with other health care professionals, and participate in public health education.

Course category: Major Mandatory

Course Name: Pharmacy law and ethics (Pharm4162)

credit Hour: 2

Prerequisite: None

Course description (Synopsis):

The course offers topics on principles of ethical decision making, health professional patient relationship, frameworks for ethical analysis, ethical theories, ethical principles and moral values, and ethical codes, laws, regulations and directives pertaining to pharmaceutical services internationally and in Ethiopia, product registration and licensing requirements, regulations related to narcotic and psychotropic drugs. Case-study practice scenarios will also be presented to allow students make pharmaceutical care decisions based upon ethico-legal reasoning.

Course category: Major Mandatory

Course Name: Communication skills for pharmacists (Pharm4062)

credit Hour: 2

Prerequisite: None

Course description (Synopsis):

This course will prepare the young pharmacy student to interact effectively with doctors, nurses, dentists, physiotherapists and other health workers. At the end of this course the student will get the soft skills set to work cohesively with the team as a team player and will add value to the pharmaceutical business.

Course category: Major Mandatory

Course Name: Drug Supply Management (Pharm4064)

credit Hour: 2

Prerequisite: Health service management and policies (Pharm4061)

Course description (Synopsis):

The drug supply management course introduces students with the concept of essential drugs, drug policy, and rational drug use and tools to investigate use of medicines. It also gives an insight on functions of drug supply management cycle, namely, selection, quantification, procurement, distribution, and rational use. Furthermore, accounting principles, as well as marketing and sales management principles and techniques will be introduced.

Course category: Major Mandatory

Course Name: Medical supplies, equipment and reagents (Pharm4066)

credit Hour: 2

Prerequisite: Health service management and policies (Pharm4061)

Course description (Synopsis):

This introductory course is designed to prepare graduate pharmacists who can competently involve in managing the supply of medical supplies, equipment and reagents. Students will be able to differentiate between the different classes of medical supplies and equipment. This course also introduces students with the basic types of diagnostic drugs and reagents. This in turn helps the trainees for ease selection, quantification and procurement of different classes of medical supplies, equipment's and reagents which are required by the health establishment or academic institution they shall join.

Course category: Major Mandatory

Course Name: Pharmacy practice-II (Pharm5151)

credit Hour: 3

Prerequisite: Pharmacy practice-II (Pharm4156)

Course description (Synopsis):

This course provides series of practical attachments on pharmacy practice, including: community and hospital pharmacies, pharmaceutical industry, and drug regulatory body and pharmacy associations. The course enables the student to assume the duties and responsibilities of various settings of pharmacy practice. It also enables the student to develop good working relationships with other health care professionals, and participate in public health education.

Course category: Major Mandatory

Course Name: Nutrition (Pharm5051)

credit Hour: 2

Prerequisite: Biochemistry (Biol2041)

Course description (Synopsis):

This human nutrition course is designed to prepare Bachelor of pharmacy students in order to be competent in nutrition related to health and disease. The course is designed to introduce students to normal nutrition, diet therapy, infant & child and maternal nutrition. It helps the students to identify different nutrients and to be competent in assessing and managing nutrition and nutrition related problems in the community and for women, children and PLWHA in particular. It also helps students to recognize public importance of ensuring food safety and quality.

Course category: Major Mandatory

Course Name: First Aid (Pharm5053)

credit Hour: 2

Prerequisite: None

Course description (Synopsis):

This course will prepare the young pharmacy student to interact effectively with doctors, nurses, dentists, physiotherapists and other health workers. At the end of this course the student will get the soft skills set to work cohesively with the team as a team player and will add value to the pharmaceutical business.

Course category: Major Mandatory

Course Name: Team Training Program (Pharm5061)

credit Hour: 2

Prerequisite: Communication skills for pharmacists (Pharm4062)

Course description (Synopsis):

Team Training program (TTP) helps the individual students to think and act as a team to achieve a common goal. Teamwork happens when the work of the team members is synergistic. This team synergy consists of shared tasks, collective beliefs, valued behaviors, motivation, and co-ordination to achieve a common goal. When team members understand that high-performing teamwork is their responsibility, alignment, synergy, and the common goal can be achieved. This course provides a platform for the students to understand how effective teams operate and how individual team members contribute to the development of a high-performance team in pharmaceutical industries and hospitals.

Course category: Basic Mandatory

Course Name: Biostatistics & Research Methodology (Math5013)

credit Hour: 3

Prerequisite: None

Course description (Synopsis):

To understand the applications of Biostatics in Pharmacy. This subject deals with descriptive statistics, Graphics, Correlation, Regression, logistic regression Probability theory, Sampling technique, Parametric tests, non-Parametric tests, ANOVA, Introduction to Design of Experiments, Phases of Clinical trials and Observational and Experimental studies, SPSS, R and MINITAB statistical software's, analyzing the statistical data using Excel.

Course category: major elective

Course Name: Pharmaceutical Product Development (Pharm5221)

credit Hour: 3

Prerequisite: Industrial Pharmacy – I (Pharm4121) & Industrial Pharmacy – II (Pharm4122)

Course description (Synopsis):

This course deals with the various parameters used in the pharmaceutical dosage forms development.

Course category: major elective

Course Name: Pharmaceutical Engineering (Pharm5223)

credit Hour: 3

Prerequisite: Industrial Pharmacy – I (Pharm4121) & Industrial Pharmacy – II (Pharm4122)

Course description (Synopsis):

This course is designed to impart a fundamental knowledge on the art and science of various unit operations used in pharmaceutical industry.

Course category: major elective

Course Name: Social and Preventive Pharmacy (Pharm5251)

credit Hour: 3

Prerequisite: Pharmacy practice-I (Pharm4156), Pharmacy practice-II (Pharm5151)

Course description (Synopsis):

The purpose of this course is to introduce to students a number of health issues and their challenges. This course also introduced a number of national health programmes. The roles of the pharmacist in these contexts are also discussed.

Course category: major elective

Course Name: Pharmacovigilance (Pharm5253)

credit Hour: 3

Prerequisite: Pharmacy practice-I (Pharm4156), Pharmacy practice-II (Pharm5151)

Course description (Synopsis):

This paper will provide an opportunity for the student to learn about development of pharmacovigilance as a science, basic terminologies used in pharmacovigilance, global scenario of Pharmacovigilance, train students on establishing pharmacovigilance programme in an organization, various methods that can be used to generate safety data and signal detection. This paper also develops the skills of classifying drugs, diseases and adverse drug reactions.

Course category: major elective

Course Name: Pharmacoeconomics (Pharm5261)

credit Hour: 3

Prerequisite: Introduction to Economics (SOSC2002)

Course description (Synopsis):

This course is designed to prepare graduate pharmacists who can competently involve in pharmaco-economic decision making. Students will be able to describe and use different methods of pharmaco-economic evaluation and effectively analyze and evaluate different pharmaco-economic studies. This course also introduces students with the basic concepts in economics.

Course category: major elective

Course Name: Pharmaceutical Regulatory Science (Pharm5263)

credit Hour: 3

Prerequisite: Industrial Pharmacy – II (Pharm4122)

Course description (Synopsis):

This course is designed to impart the fundamental knowledge on the regulatory requirements for approval of new drugs, and drug products in regulated markets of India & other countries like US, EU, Japan, Australia, UK etc. It prepares the students to learn in detail on the regulatory requirements, documentation requirements, and registration procedures for marketing the drug products.

Course category: major mandatory

Course Name: Student Research Project (Pharm5362)

credit Hour: 4

Prerequisite: Accomplishment of all didactic courses

Course description (Synopsis):

The course is based on an individual research work under the supervision of a faculty member. The candidate is expected to select a research topic, frame appropriate research questions and hypotheses, adopt appropriate research methodology, conduct necessary detailed research, and submit the project report. The candidate will present his / her research work to the scientific committee for evaluation. The research project can be done in the university or pharmaceutical industry or in a hospital upon prior approval.

Course category: major mandatory**Course Name: Pharmaceutical industry Internship (Pharm5322)****credit Hour: 4****Prerequisite: Accomplishment of all didactic courses of previous semesters****Course description (Synopsis):**

This course aims to provide the pharmacy students hands-on experience and up-to-date information about the pharmaceutical industry, which helps the students to enter the competitive job market. Students will have the opportunity to learn about manufacturing process of various pharmaceutical dosage forms, viz., tablets, capsules, syrups, etc. Through industrial training, theoretical knowledge acquired from lectures can be applied and practiced then, there by experiences can be acquired. Enhancing skills and working experiences among undergraduates a necessity in addition to qualification background. This course also provides a platform to the students to improve their entrepreneurial and managerial skills.

Course category: major mandatory**Course Name: Pharmaceutical QC & QA Internship (Pharm5342)****credit Hour: 4**

Prerequisite: Accomplishment of all didactic courses of previous semesters

Course description (Synopsis):

This course provides the students to have exposure to quality control (QC) testing methodologies in pharmaceutical industry which ensure that the medicines meet the international quality standards, and to ensure they are being effective and safe. The students will get hands-on-training in testing of active pharmaceutical ingredients (APIs), excipients, packaging materials and/or pharmaceutical products, stability testing, testing against specifications and investigative testing. This course also provides the students to get hands-on-experience in handling sophisticated analytical instruments used in QC, interpretation of results and furnishing the reports to the concerned authorities.

Course category: major mandatory

Course Name: Pharmaceutical Regulatory Internship (Pharm5364)

credit Hour: 4

Prerequisite: Accomplishment of all didactic courses of previous semesters

Course description (Synopsis):

This course provides a practical understanding of the regulatory approval and communication processes involving pharmaceutical and biotechnology drugs as well as natural health products, medical device, food, cosmetics and nutraceuticals. The students will acquire knowledge of international health care system, health care legislation, procedures and practices for regulating the development, manufacture, quality assurance and marketing of health care products. The students also get the detailed information regarding approval process of international regulatory authorities like US Food and Drugs Administration (FDA), European Medicines Agency (EMA) and also the national authority, Ethiopian Food and Drug Authority (EFDA).

Course category: major mandatory

Course Name: Drug Information Service & Patient Counseling Internship (Pharm5352)

credit Hour: 4

Prerequisite: Accomplishment of all didactic courses of previous semesters

Course description (Synopsis):

This course provides the students an insight exposure to the drug information center (DIC) in a hospital setup. The purpose of DIC is to provide authentic individualized, accurate, relevant and unbiased drug information to the consumers and healthcare professionals regarding medication related inquiries to the nation for health care and drug safety aspects by answering their call regarding the all-critical problems on drug information, their uses and their side effects. Apart from that the center also provides in-depth, impartial source of crucial drug information to meet the needs of the practicing physicians, pharmacists and other health care professionals to safeguard the health, financial and legal interests of the patient and to broaden the pharmacist role visible in the society and community.

Course category: major mandatory

Course Name: Community Pharmacy Internship (Pharm5354)

credit Hour: 4

Prerequisite: Accomplishment of all didactic courses of previous semesters

Course description (Synopsis):

Community pharmacy Internship is a good opportunity for pharmacy students to deals directly with people in their local community. It has responsibilities including checking and dispensing of prescription drugs, over-the-counter (OTC) drugs and counseling to the patients with care, accuracy, and legality. A community pharmacy has appropriate procurement, storage, dispensing and documentation of medicines. There will be numerous opportunities to gain an appreciation

and understanding of the concept of pharmaceutical care as well as share in the ultimate responsibility for patient care outcomes. Most importantly patient counseling practice develops communication skills and competence to deliver the professional service to the community.

Course category: major mandatory

Course Name: Hospital Pharmacy Internship (Pharm5356)

credit Hour: 4

Prerequisite: Accomplishment of all didactic courses of previous semesters

Course description (Synopsis):

This Internship is one of the important skill development courses for a pharmacy student because it imparts both clinical and administrative responsibilities. The students will get clinical exposure like dispensing of medicines and medical devices, storage of medications, monitoring and reporting drug safety, advising healthcare professionals and patients on their safe, effective and efficient use of medications. Students also get experience in adverse drug reactions (ADRs) and medication error reporting. The students will get administrative skills like, planning of medication quantities for the hospitals, preparing budgets for medication and making purchasing decisions

2. School of Electrical Engineering and Computing

2.1 Computer Science and Engineering

General information

I. Duration of study

Normal modality

Regular: a 5 years program

Extension: 6 years program

Dual major/minor: 6 years

II. Course category

No	Course category		Course level	Credit requirement	Percentage from the total
1	General	Mandatory	University required	27	15.00%
2	Basic	Mandatory	School required	47	26.11%
3	Major	Mandatory	Department required	67	37.22%
		Elective		33	18.33%
		Subtotal		100	55.55%
4	Free electives			6	3.33%
Total				180	100%

Course category: General/ university required

Course Name: Entrepreneurship and Business Development (SOSC5003)

Credit Hour: 3

Prerequisite: None

Course description (Synopsis):

This interdisciplinary course in general is designed to introduce students to the concept of sustainable entrepreneurship, a manageable process that can be applied across careers and work settings. It focuses on building entrepreneurial attitudes and behaviours that will lead to creative solution within community and organizational environments. This course is designed to prepare individuals for ownership of their own innovative business, and assist start-ups to function more effectively, increase the chances of new business success, enhance profitability, and increase employment.

More specifically, the course provides students with an introduction to the concepts and skills necessary to successfully commercialize new products and services. Entrepreneurship is not just about starting a business. It is also about identifying good opportunities and then creating,

communicating, and capturing value from those opportunities; including innovation in a corporate context. It will also teach students the skills to analyse business opportunities, and articulate them as a compelling business description, and pitch to an audience of investors, customers, or business partners. It focuses on building entrepreneurial attitudes and behaviors that will lead to creative solution within community and organizational environments.

Course category: General/ university required

Course Name: Communicative English Skills (EnLa 1001)

Credit Hour: 3

Prerequisite: None

Course description (Synopsis):

Communicative English Skills is a course where students learn what they need to know for a career in science context. The course gives students the language, information, and skills they need to study science context. It also provides students the language appropriate for studying science context and real work situations as it comprises unique sections such as: ‘it’s my job’ wherein real people talk about their work in science context, ‘listening’ whereby students are exposed to situations related to science context, technical explanations, and interviews, ‘reading’ whereby students meet a variety of science context based texts, and the ‘writing section’ which is designed to let students compose short reports on different activities.

Course category: General/ university required

Course Name: Basic Writing Skills (EnLa-1002)

Credit Hour: 3

Prerequisite: Communicative English Skills (EnLa 1001)

Course description (Synopsis):

Basic Writing Skills course aims at developing students’ basic writing skills in science context. The course gives students the language writing skills they need to study science. It contains

sentence level writing: sentence structure, sentence types sentence combinations, common sentence errors (fragment, run on, comma splices, misplaced modifier, dangling modifier, faulty parallelism, faulty reference of pronoun, faulty agreement and shifts); paragraph level writing: the essence of a paragraph, components of a paragraph (topic sentence, supporting sentences, concluding sentence), characteristics of effective paragraph (unity, coherence and completeness) and the steps in writing a paragraph and types of a paragraph; essay level writing: structure of an essay, thesis statement and supporting paragraphs, types of essays and techniques of essay development.

Course category: General/ university required

Course Name: Introduction to Civics and Ethics (LART 1001)

Credit Hour: 3

Prerequisite: None

Course description (Synopsis):

It is now become clear that Ethics and Citizenship Studies has become not only a field of specialization in itself but has also been attracting leaders who envision instilling democracy on a nun shakable ground within their own society. Autoscore, Ethics is a system of moral principles which involves systematizing, defending and recommending concepts of rights and wrong behavior.It affects how people make decisions and lead their lives. Citizenship, on its part, is a legal status of individuals within a given state. It embodies the legal and political relationship between citizens and state, underlining the reciprocal relationship between the two. This course is designed with the aim of equipping learners with necessary ethical qualities and civic competences while dealing with issues that affect their society at all levels and human in general. The course starts with unfolding the notions, principles and theories of ethics which can shape human attitude, action and behaviour in making moral judgments. Next, the course introduces learners to the nature, mutual interactions and historical evolutions of society, state, government

and citizenship. It also elucidates issues pertaining to political governance such as constitution, democracy, and human rights in some details. To enable learners, grasp basic knowledge of political, economic and social dynamics of international system in today's globalized world, the course also introduces international relations and foreign policy and other major contemporary global issues. In light of this, the course does not present mere theoretical knowledge, but also practical knowledge of accentuating art of governing and protecting national interest in today's complex world.

Course category: General/ university required

Course Name: Logic and Critical thinking (LART 1002)

Credit Hour: 3

Prerequisite: None

Course description (Synopsis):

The main goal of the course is to improve critical and logical reasoning skills. Students will see how our ordinary intuitions on good or bad reasoning can be articulated explicitly in formal systems, and gain a new ability to evaluate arguments and reasoning they encounter every day with rigorous logical concepts and tools. As to the subject matter, it introduces systematic methods of reasoning, such as argument, deduction, induction, syllogistic, and propositional logic.

Course category: General/ university required

Course Name: Introduction to Economics (SOSC2002)

Credit Hour: 3

Prerequisite: None

Course description (Synopsis):

This course provides a general introduction to economics combining elements of micro and macro fundamentals. The main objective of this course is to introduce and acquaint students with the preliminary principles (theories) and knowledge of economics and the application of economic theories (principles) in the actual world; the daily activities of the households, firm business or any other form of enterprises at micro levels. Students will also be able to contextualize the key macroeconomic variables and policy instruments.

Specifically, the course introduces students with theory of consumer behaviors, production, and cost of production. In these theories how decisions are made by different economic agents will be discussed. Furthermore, the course covers different characteristics of perfect and imperfect market structure. Lastly the course tries to introduce basic macroeconomic concepts such as national income accounting, unemployment, inflation, fiscal and monetary policy instruments.

Course category: General/ university required

Course Name: General Psychology and Life Skills (LART 2002)

Credit Hour: 3

Prerequisite: None

Course description (Synopsis):

Psychology is a science of human cognitive processes and behaviors. This course is designed to give students an overview of what psychological science has discovered about human behaviors and mental processes throughout human history. Students will gain an understanding of the psychological phenomena that occur in daily life as well as the practical applications of psychological knowledge. Upon completing the course, students shall be able to demonstrate a basic knowledge of the science of psychology. Specifically, the course general psychology is concerned with discussing perspectives in psychology and basic psychological concepts such as sensation and perception, learning, personality, motivation, emotion, and basic life skills (intrapersonal, interpersonal, social and academic skills). Emphasis will be given to both theoretical and practical implications of these concepts to effectively function as individual and team in a community.

Course category: General/ university required

Course Name: Physical Fitness and Conditioning I(SpSc1011)

Credit Hour: 0 cr.hr

Prerequisite: None

Course description (Synopsis):

This course will provide the students with basic concepts of the five components of health-related physical fitness (cardiovascular, muscular strength and endurance, flexibility, and body composition), hypokinetic disease and general principles of training. It is mainly practical oriented. As a result, the students will be exposed to various exercise modalities, sport activities, minor and major games, and various training techniques as a means to enhance health related physical fitness components. In addition, they will develop the skills to assess each component of fitness and will practice designing cardiovascular, muscular strength and endurance, and flexibility programs based on the fitness assessment. The course serves as an introduction to the role of exercise in health promotion, fitness, performance including the acute and chronic responses of the body to exercise.

Course category: General/ university required

Course Name: Physical Fitness and Conditioning II (SpSc 1022)

Credit Hour: 0 cr.hr

Prerequisite: SpSc 1011

Course description (Synopsis):

This course is designed to acquaint freshman engineering and applied natural science students with the nature and scope of different ball games.

It emphasizes the value of establishing lifelong fitness using ball games as a means and focuses on the fundamental of volley ball, hand ball, basketball and football as a life time leisure activity also focuses on the development of personalized approach to healthy active living through participation in a variety of ball games that have the potential to engage students' interest throughout their lives. Again the courses enable the participants enjoying practice and acquire proper technique and strategies associated with the ball games mentioned above and learn rules governing the game.

Course category: General/ university required

Course Name: Geography of Ethiopia and the Horn (LART 1004)

Credit Hour: 3

Prerequisite: None

Course description (Synopsis):

This course covers a brief description on the location, shape and size of Ethiopia as well as basic skills of reading map, the physical background and natural resource endowment of Ethiopia and the Horn which includes its geology and mineral resources, topography, climate, drainage and water resources, soil, fauna and flora. It also deals with the demographic characteristics of the country and its implications on economic development.

Course category: General/ university required

Course Name: History of Ethiopia and the Horn (LART 1003)

Credit Hour: 3

Prerequisite: None

Course description (Synopsis):

This course describes why history is important, how history is studied and introduces the region Ethiopia and the Horn. It treats human evolution, Neolithic Revolution, settlement patterns as well as religion and religious processes in Ethiopia and the Horn. Based on these historical backgrounds, the course describes states, external contacts, economic formations and achievement in terms of architecture, writing, calendar, and others to the end of the 13th century. Historical processes including states formation and power rivalry, trade, external relation, threats and major battles, centralization and modernization attempts, Italian occupation, and socio-economic conditions from 1800 to 1941 makes central position in the modern history of the region.

Course category: Basic**Course Name: Applied Mathematics I (Math1101)****Credit Hour: 4****Prerequisite: None****Course description (Synopsis):**

This course covers vectors, matrices & determinants, limit and continuity, derivatives & their applications, integrals, integration techniques and their applications.

Course category: Basic**Course Name: Applied Mathematics II (Math 1102)**

Credit Hour: 4

Prerequisite: Applied Mathematics I (Math 1101)

Course description (Synopsis):

This course covers sequences, series, power series, Fourier series differential and integrals calculus of functions of several variables and their applications. problems. This course covers integer programming, deterministic.

Course category: Basic

Course Name: Applied Mathematics –III (Math2101)

Credit Hour: 4

Prerequisite: Applied Mathematics-II

Course description (Synopsis):

This course covers the topics in First order ordinary Differential Equation, second order ordinary Differential Equation, Laplace transforms and its application, scalar and vector fields and complex analytic function.

Course category: Basic

Course Name: General Chemistry (Chem1102)

Credit Hour: 3

Prerequisite: None

Course description (Synopsis):

General Chemistry is the science of the properties of atoms and the laws governing their combination, composition, and structure of substances, the transformations they undergo, and the energy that is released or absorbed during Chemical or physical process. The topics covered in this course includes: Introduction to the study of modern Chemistry, acids and bases, the periodic table, Chemical bond and molecular structure, rates of physical and Chemical processes,

materials, kinetic molecular description of the state of matter and equilibrium in Chemical reaction.

Course category: Basic

Course Name: General Physics (Phys1101)

Credit Hour: 4

Prerequisite: Knowledge in Higher Secondary Physics

Course description (Synopsis):

At the end of this course students are expected to be acquainted with basic concepts in different branches of physics, identify the connection between them and explain the common phenomena. They will also develop skills of solving problems.

Course category: Major Mandatory

Course Name: Computer Architecture and Organization (ECEg4201)

Credit Hour: 3

Prerequisite: ECEg3201 Digital Logic Design

Course description (Synopsis):

This course focus on: Computer Arithmetic; The Central Processing Unit: Architecture and Instruction Set; Instruction Format and Addressing Modes; Register Transfer Descriptions; Organization of the Arithmetic and Logic Unit; The Control Unit Realization: Hardwired and Micro programmable; The Memory Hierarchy and Memory Management; Input-Output Devices; Software of a Computer System; Design of a Small Computer System Testing.

Course category: Basic

Course Name: Introduction to Computing (CSEg 1101)

Credit Hour: 3

Prerequisite: None

Course description (Synopsis):

In this course the basic techniques of computational problem solving will be covered by using computational thinking while writing small and medium sized programs, mapping problems into computational frameworks emphasizing on scientific problems, understanding problems and formulation of problems based on the elective programming language (using python). The course includes the concepts and techniques of data structure, input/output, flow control and incidental program, and by using a systematic division of problem solution and concept of module, to solve problems in numerical value field and non-numerical value field with program experiment.

Course category: Basic

Course Name: Introduction to Emerging Technologies (CSEg1102)

Credit Hour: 3

Prerequisite: None

Course description (Synopsis):

This course will enable students to explore current breakthrough technologies in the areas of Artificial Intelligence, Internet of Things and Augmented Reality, Data Science and other technologies that have emerged over the past few years. Besides helping learners become literate

in emerging technologies, the course will prepare them to use technology in their respective professional preparations.

Course category: Basic

Course Name: Fundamentals of Programming (CSEg1104)

Credit Hour: 3

Prerequisite: Introduction to Computing

Course description (Synopsis):

The course is designed to introduce structured programming in C++ by providing an overview of programming concepts, on creating and working computer programs in C++. It will address fundamental concepts of program analysis, design, coding, testing and development. It includes introduction to computer programming; programming paradigms; algorithms and problem-solving; introduction to data structures and Programming constructs. The course is designed on how to solve business and scientific problems through the technique of structured programming. It will prepare students for focused studies in any programming language.

Course category: Basic mandatory

Course Name: Fundamentals of electrical engineering I (EPCE 2101)

Credit Hour: 4

Prerequisite: Maths1102 and General physics

Course description (Synopsis):

The course will deal with basic concepts of electrical engineering, basic circuit law and circuit analysis methods, fundamental circuit theorems, transient circuit analysis, steady state circuit and power analysis, introduction to polyphase circuits, electromagnetisms and frequency analysis.

Course category: Basic

Course Name: Data Structures and Algorithms (CSEg 2101)

Credit Hour: 3

Prerequisite: CSEg 1104

Course description (Synopsis):

The course covers the design, analysis, and implementation of data structures and algorithms to solve engineering problems. Topics include basic data structures such as arrays, stacks, queues, and lists and advanced data structures such as trees and graphs. The algorithms used to manipulate these structures, and their application to solving practical engineering problems.

Course category: Major mandatory

Course Name: Electronics circuits-I (ECEg-2201)

Credit Hour: 4

Prerequisite: Fundamentals of Electrical Engineering-EPCE2101

Course description (Synopsis):

Introducing semiconductor devices, basic structure, principles and operations. Analysis of BJT and FET basic operation with i-v characteristics and small signal analysis of BJT and FET. Application of semiconductor devices, BJT, FET with real time examples. Frequency Response of BJT and FET and various coupling methods. Basic construction of Amplifiers with various biasing methods and its application.

Course category: Major mandatory

Course Name: Electronics circuits-II (ECEg2202)

Credit Hour: 4

Prerequisite: Electronics circuits-I

Course description (Synopsis):

Introducing feedback amplifier and the analysis of negative feedback amplifiers with various topologies and applications, More analysis of feedback amplifier with differential mode response and some other parameters. Introducing integrated circuit with various effective parameters and illustrate with real time applications. Introducing oscillators and different types of oscillator circuit with frequency determination and describe about multivibrator circuits with applications. Power semiconductor devices like SCR, TRIAC, DIAC devices with operation and characteristics. Explain in detail about single and double tuned amplifiers, ideal band pass amplifiers and power amplifiers.

Course category: Major mandatory

Course Name: Digital Logic Design (ECEg3201)

Credit Hour: 4

Prerequisite: ECEg2201 Electronics Circuits I

Course description (Synopsis):

In this course, students will study various digital logic families such as TTL, 119 ECL, and CMOS, the logic gates under these families, and the electronic circuit techniques used to implement them. Subsequently, they will learn Boolean algebra, logic expressions, number systems and combinational logic design, including logic minimization and hazards. In addition, with the understanding of combinational logic design, students will learn how to design sequential systems, including analysis of the behavior of synchronization elements and system

timing design. Finally, in this course, students will have hands-on design experiences by carrying out experiments with component-level devices and designing digital systems.

Course category: Major mandatory

Course Name: Network Analysis and Synthesis (EPCE3201)

Credit Hour: 3

Prerequisite: ECEg2204-Signals and Systems analysis

Course description (Synopsis):

This course deals about Introduction to Network Analysis and Synthesis, network transform representations and analysis, network functions for one port and two ports, properties of driving point functions and transfer functions, calculation of network functions, poles and zeros, time domain behavior from pole-zero plot, elements of realizability theory, synthesis of one port networks using two kinds of elements, two port networks and relationship between transfer functions using two port parameters and interconnection of two-port parameter, basics of filters, filter approximation, insertion loss synthesis and synthesis of active and passive networks and filters.

Course category: Major mandatory

Course Name: Introduction to control systems (EPCE 3204)

Credit Hour: 3

Prerequisite: Network Analysis and synthesis-EPCE3201

Course description (Synopsis):

This course deals about introduction to control system, control system modelling of physical system, time domain analysis of control systems, Root locus analysis, frequency domain analysis and classical controller design techniques.

Course category: Major mandatory

Course Name: Digital Signal Processing (ECEg3205)

Credit Hour: 3

Prerequisite: ECEg2204-Signals and Systems Analysis

Course description (Synopsis):

Introducing the development of analytical representation and design of discrete time signals and systems. Discussing the Analysis of discrete time signals and systems in time domain and transform domains. ADC and DAC, Sampling theorem, Sampling Rate conversion, Aliasing, LTI signals and systems, Discrete time Fourier Transform, Fast Fourier Transform, Z-transform, and analysis and design of digital filters.

Course category: Major elective

Course Name: Real Time and Embedded Systems (CSEg4202)

Credit Hour: 3

Prerequisite: CSEg3314-Microcomputer and Interfacing

Course description (Synopsis):

This course is designed to provide students a working knowledge of Embedded Systems their design and programming at an introduction level. In this course the fundamentals of embedded systems, hardware and firmware designs will be explored. Issues such as embedded microcontrollers, embedded programs, realtime operating systems, low power computing, interfacing, optimization, as well as practical work in laboratories will be discussed.

Course category: Major elective

Course Name: Microcomputer & Interfacing (CSEg3314)

Credit Hour: 4

Prerequisite: CSEg3203 - Computer Architecture & Organization

Course description (Synopsis):

This course is designed to impart in-depth knowledge in the design, programming and organization of microcomputers and interfacing circuits. The two most common computer architectures, the Reduced Instruction Set Computing (RISC) and the Complex Instruction Set Computing (CISC) will also be explained. The course involves the study of interfacing peripheral chips (Programming and Signals). It completely covers the popular Intel 8086, which would be a steppingstone for learning the X86 families of microprocessors.

Course category: Major mandatory

Course Name: Database Systems (CSEg2208)

Credit Hour: 4

Prerequisite: None

Course description (Synopsis):

A database system is a collection of data with its managements system. So, DB systems discusses an issues related with a data such as, approaches of compiling data/information, manipulating data, keeping data safely, accessing data, concurrent process and etc.

Course category: Major mandatory

Course Name: Introduction To Artificial Intelligence (CSEg3206)

Credit Hour: 3

Prerequisite: CSEg 2206 Discrete Mathematics for Computer Science

Course description (Synopsis):

This course is an introductory course on Artificial Intelligence (AI) that presents an overview of AI principles and approaches. It will introduce the basic principles in artificial intelligence research, simple representation schemes, problem solving paradigms, constraint propagation, and search strategies. Areas of application such as knowledge representation, programming in logic, inference and reasoning mechanism, natural language processing, expert systems, vision and robotics will be explored. The PROLOG and other AI programming language will also be introduced.

Course category: Major mandatory

Course Name: Compiler Design (CSEg 4310)

Credit Hour: 3

Prerequisite: CSEg 4201

Course description (Synopsis):

This course describes the basic techniques and tool required to construct a compiler. The two parts of compilation: analysis and synthesis will be introduced and discussed. In the analysis part, will learn how to break the source program in to constitute pieces and create an intermediate representation of the source program. In the synthesis part, we will construct a target program from the intermediate representation. Moreover, widely used construction tools (Lex and Yacc) will be explained. Examine the generic issue in the design of code generator.

Course category: Major mandatory

Course Name: Computer Architecture & Organization (CSEg3203)

Credit Hour: 3

Prerequisite: ECEg3204 (Digital Logic Design)

Course description (Synopsis):

This course aims to provide a strong foundation for students to understand modern computer system architecture and to apply these insights and principles to future computer designs. The course is structured around the three primary building blocks of general-purpose computing systems: processors, memories, and networks. The first half of the course focuses on the fundamentals of each building block. Topics include instruction set architecture; single-cycle, FSM, and pipelined processor microarchitecture; direct mapped vs. set-associative cache memories; memory protection, translation, and virtualization; FSM and pipelined cache microarchitecture; cache optimizations; network topology and routing; buffer, channel, and router microarchitecture; and integrating processors, memories, and networks. The second half of the course delves into more advanced techniques and will enable students to understand how these three building blocks can be integrated to build a modern shared-memory multicore system. Topics include superscalar execution, out-of-order execution, register renaming, memory disambiguation, branch prediction, and speculative execution; multithreaded, VLIW, and SIMD processors; non-blocking cache memories; and memory synchronization, consistency, and coherence. Students will learn how to evaluate design decisions in the context of past, current, and future application requirements and technology constraints

Course category: Major (core elective)

Course Name: Computer Graphics (CSEg2310)

Credit Hour: 3

Prerequisite: C ++

Course description (Synopsis):

Computer graphics is the art and science of communicating information using images that are generated and presented through computation. This requires (a) the design and construction of models that represent information in ways that support the creation and viewing of images, (b) the design of devices and techniques through which the person may interact with the model or the view, (c) the creation of techniques for rendering the model, and (d) the design of ways the images may be preserved. The goal of computer graphics is to engage the person's visual centers alongside other cognitive centers in understanding. Generally, this course deals with fundamental techniques in graphics, graphic.

Course category: Major mandatory

Course Name: Computer Systems Security (CSEg4307)

Credit Hour: 3

Prerequisite: None

Course description (Synopsis):

This course covers fundamental issues and first principles of security and information assurance. The course will look at the security policies, models and mechanisms related to confidentiality, integrity, authentication, identification, and availability issues related to information and information systems. Other topics covered include basics of cryptography (e.g., digital signatures) and network security (e.g., intrusion detection and prevention), risk management, security assurance and secure design principles, as well as e-commerce security. Issues such as organizational security policy, legal and ethical issues in security, standards and methodologies for security evaluation and certification will also be covered.

Course category: Major mandatory

Course Name: Data Communication and Computer Networks (CSEg3222)

Credit Hour: 4

Prerequisite: None

Course description (Synopsis):

This course deals with basic concepts, principles and applications of data communication system. ISO OSI reference model for open system interconnection is used as the basis to discuss the functions and protocols of layered network structures. The course also introduces the evolution trends of networking technologies, various types of networks from LAN to WAN and internetworking architectures. Transmission Control Protocol / Internet Protocol (TCP/IP) will be discussed in detail.

Course category: Major mandatory

Course Name: Design and Analysis of Algorithms (CSEg3211)

Credit Hour: 3

Prerequisite: Data Structures and Algorithms

Course description (Synopsis):

This course provides an introduction to mathematical modelling of computational problems. It covers the common algorithms, algorithmic paradigms, and data structures used to solve these problems. The course emphasizes the relationship between algorithms and programming, and introduces basic performance measures and analysis techniques for these problems.

Course category: Major mandatory

Course Name: Probability & Random Processes (ECEg3103)

Credit Hour: 3

Prerequisite: Maths1102-Applied Mathematics II

Course description (Synopsis):

Introducing some application area of probability and random processes and revising Set theory, Function, Factorial, Permutation and Combination. Basic concept of Probability Theory: Probability models and axioms, Conditional probability, total probability, Independence and Bayes' theorem. Random Variables, Probability Distributions and Densities function, Discrete and Continuous random variables, Gaussian Random Variable and Q-Function, Conditional Distribution and Density Function. Expectations, variances, moments, Expectation of a Function of Random Variable, Characteristic Function, Central Limit Theorem and Transformation of Random Variables. Two and more random variables and their joint distributions and densities. Random processes, Auto and cross correlation Functions, covariance, Stationary Random Processes, Ergodic Random Processes and Power Spectral Density Function. Introduction to parameter estimation and prediction.

Course category: Major Restrictive Elective

Course Name: Digital Image Processing (ECEg-4314)

Credit Hour: 3

Prerequisite: ECEg 3205 Digital Signal Processing

Course description (Synopsis):

The course basically designed in the areas of Imaging optics, sensors and sampling patterns, image pre-processing, Frequency domain image processing, Color image processing, linear and nonlinear operations on images, enhancement fundamentals of semantic image processing, practical applications of imaging system, image segmentation and its application to biomedical imaging, satellite imaging etc. This course focuses the student's ability in analyzing technologies for digital image, compression, writing and developing of algorithms, implementations of various digital image applications, Image representation and conversant with the image processing techniques.

Course category: Major mandatory (dual major)

Course Name: Distributed Systems (CSEg5307)

Credit Hour: 3

Prerequisite: CSE3222 Data Communication and Computer Networks CSEg4201

Course description (Synopsis):

This course introduces students to the principles, design, and implementation of distributed systems. The Lectures focus primarily on the principles and design of distributed systems, and cover communication, Processes, naming, synchronization, Consistency and Replication, and fault tolerance. A course project exposes students to the implementation aspects of distributed systems and serves to solidify students' understanding of the course material.

Course category: Major mandatory

Course Name: Formal Language & Automata Theory (CSEg4201)

Credit Hour: 3

Prerequisite: None

Course description (Synopsis):

The course introduces some fundamental concepts in automata theory and formal languages including grammar, finite automaton, regular expression, formal language, pushdown automaton, and Turing machine. Not only do they form basic models of computation, they are also the foundation of many branches of computer science, e.g. compilers, software engineering, concurrent systems, etc. The properties of these models will be studied and various rigorous techniques for analyzing and comparing them will be discussed, by using both formalism and examples.

Course category: Major Mandatory

Course Name: Object Oriented Programming (CSEg2202)

Credit Hour: 3

Prerequisite: CSEg1102 (Fundamental of Programming)

Course description (Synopsis):

In this course, the students will learn the concepts of object-oriented programming and solving problems in object-oriented programming language. The course begins with comparison of structural programming paradigm with object-oriented paradigm, a brief review of control structures and data types with emphasis on structured data types and array processing. It then moves on to introduce the object-oriented programming paradigm, focusing on the definition and use of classes and objects, Inheritance, Package and Interface, Exception Handling, File I/O, GUI and Multithreading.

Course category: Major mandatory

Course Name: Operating Systems (CSEg4201)

Credit Hour: 3

Prerequisite: Computer Organization and Architecture

Course description (Synopsis):

This course examines the important problems in operating system design and implementation. The operating system provides an established, convenient, and efficient interface between user programs and the bare hardware of the computer on which they run. The operating system is responsible for sharing resources (e.g., disks, networks, and processors), providing common services needed by many different programs (e.g., file service, the ability to start or stop processes, 237 and access to the printer), and protecting individual programs from interfering with one another. The course will start with a brief historical perspective of the evolution of

operating systems over the last fifty years and then cover the major components of most operating systems. This discussion will cover the tradeoffs that can be made between performance and functionality during the design and implementation of an operating system. Particular emphasis will be given to three major OS subsystems: process management (processes, threads, CPU scheduling, synchronization, and deadlock), memory management (segmentation, paging, swapping), and file systems; and on operating system support for distributed systems.

Course category: Major Restricted Elective

Course Name: Embedded and real time systems (ECEg5315)

Credit Hour: 3

Prerequisite: Microprocessor & Interfacing -ECEg4202

Course description (Synopsis):

This course is designed to provide students a working knowledge of embedded systems and its application to the modern technology. In this course the fundamentals of embedded systems, hardware and firmware designs will be explored. Different types of microcontrollers commonly used in the world today will be introduced. The student can have the choice on which microcontrollers that can be used for specific design. Embedded programs using assembly language and higher programming language will be used in the program. Real-time operating systems, low power computing, interfacing as well as optimization are the core topics to be discussed in designing embedded systems.

Course category: Major Restricted Elective

Course Name: Introduction to Block chain (CSEg5304)

Credit Hour: 3

Prerequisite: Object-oriented language (CSEg2202) Distributed Systems Linux fundamentals

Course description (Synopsis):

This course is for students wishing to explore block chain technology's potential use—by entrepreneurs and incumbents—to change the world of money and finance. The course begins with a review of Bitcoin and an understanding of the commercial, technical, and public policy fundamentals of block chain technology, distributed ledgers, and smart contracts. The class then continues on to current and potential block chain applications in the financial sector.

Course category: Major Elective

Course Name: Introduction to Parallel and Distributed Processing (CSEg5303)

Credit Hour: 3

**Prerequisite: Introduction to Algorithms and Data Structures Distributed Systems
Introduction to Computer Organization**

Course description (Synopsis):

This course will cover widely used parallel and distributed computing methods, including threaded applications, GPU parallel programming, and datacenter-scale distributed methods such as MapReduce and distributed graph algorithms. We'll study the types of algorithms which work well with these techniques, and have the opportunity to implement some of these algorithms. We'll also look at the types of hardware architectures which have been developed along with these computing methods.

Course category: Major Elective

Course Name: Mobile Computing and applications (CSEg3306)

Credit Hour: 3

Prerequisite: Fundamental programming, Data Communication and Networking

Course description (Synopsis):

This course covers software mobile application development, its architecture and lifecycle, as well as its inherent design considerations. Students will learn about mobile resources, activities, views, layouts, and intents in addition to interacting with the location-based services, messaging services, multimedia interfaces, and sensors available on the mobile device. The applications developed will manage data input from and output to files, databases and content providers. After developing applications in an emulation environment, students will install them on individual mobile devices as well as prepare them for marketplace distribution.

Course category: Major Elective

Course Name: Multimedia Technologies (CSEg4305)

Credit Hour: 3

Prerequisite: None

Course description (Synopsis):

Theoretical foundations of the representation, coding and transmission of multimedia data are focus of this course. Starting from the sampling of captured data, limits of digital representations are given. Audio- and video coding are based on human perception models and motivated by their source models. The latest standards related to speech-, audio-, video- and synthetic media are discussed along with their application to different technologies. Finally, relevant transport mechanisms, data bases and protocols combining multiple data sources are explained. Simulations of fundamental processing mechanisms are exercised in Mat lab.

Course category: Major elective

Course Name: Programming languages (CSEg4306)

Credit Hour: 3

Prerequisite: CSEg2222

Course description (Synopsis):

This course provides students with the necessary underlying principles in the design and implementation of programming languages. Lectures use a variety of existing general-purpose programming languages from different programming paradigms: imperative, functional, logical, and object-oriented programming.

Course category: Major elective

Course Name: Web Programming (CSEg4204)

Credit Hour: 3

Prerequisite: None

Course description (Synopsis):

This course will cover World Wide Web as a platform for interactive applications, content publishing and social services. The development of web based applications requires knowledge about the underlying technology and the formats and standards. In this course you will learn about the HTTP communication protocol, the markup languages HTML, CSS and Server-side programming (PHP).

Course category: Major elective

Course Name: Wireless Mobile Networks (CSEg4312)

Credit Hour: 3

Prerequisite: None

Course description (Synopsis):

This course introduces Wireless and Mobile Networks technologies, Wireless Transmission, MAC Layer, Cellular networks, Satellite Networks, Wireless LAN, Broadband Wireless Access, WiMax: Architectures and topologies, Mobile Network Layer, Mobile Transport Layer, Support for Mobility, Wireless Sensor and Ad Hoc Networks, Game Theory for Wireless Networks.

Course category: Major elective

Course Name: Wireless (CSEg5309)

Credit Hour: 3

Prerequisite: CSEg 3222

Course description (Synopsis):

This course introduces Wireless and Mobile Networks technologies, Wireless Transmission, MAC Layer, Cellular networks, Satellite Networks, Wireless LAN, Broadband Wireless Access, WiMax: Architectures and topologies, Mobile Network Layer, Mobile Transport Layer, Support for Mobility, Wireless Sensor and Ad Hoc Networks, Game Theory for Wireless Networks.

Course category: Major elective

Course Name: Information Storage and Retrieval (CSEg3304)

Credit Hour: 3

Prerequisite: None

Course description (Synopsis):

This course introduces theoretical and practical issues involved in designing, implementing and evaluating modern Information Retrieval systems. The major topics covered in this course are: Overview of IR, Text operations, Index structures, IR models, Retrieval effectiveness, Query Languages, Query operations and Searching the Web.

2.2 Electronics & Communication Engineering program

General information

I. *Duration of study*

Normal modality

Regular: a 5-year program

Continuing: 5-8year program

Dual major/manor: 6 year

Fast Track modality: may finish before ten semesters and delayed students may finish after ten semesters.

II. *Course category*

NO	Course category	Course level	Credit requirement	Percentage from the total	
1	General	Mandatory	University requirement	27	15.17%
			Department requirement	2	1.12%
		Subtotal		29	16.29%
2	Basic	Mandatory	University Requirement	30	16.85%
			School requirement	13	7.31%
		Subtotal		43	24.16%
3	Major	Mandatory	Department requirement	67	37.64%
		Elective		33	18.54%
		Subtotal		100	56.18%
4	Free electives		6	3.37%	
Total			178	100%	

Course category: General/ university required

Course Name: Entrepreneurship and Business Development (SOSC5003)

Credit Hour: 3

Prerequisite: None

Course description (Synopsis):

This interdisciplinary course in general is designed to introduce students to the concept of sustainable entrepreneurship, a manageable process that can be applied across careers and work settings. It focuses on building entrepreneurial attitudes and behaviors that will lead to creative solution within community and organizational environments. This course is designed to prepare individuals for ownership of their own innovative business, and assist start-ups to function more effectively, increase the chances of new business success, enhance profitability, and increase employment. More specifically, the course provides students with an introduction to the concepts and skills necessary to successfully commercialize new products and services. Entrepreneurship is not just about starting a business. It is also about identifying good opportunities and then creating, communicating, and capturing value from those opportunities; including innovation in a corporate context. It will also teach students the skills to analyses business opportunities, and articulate them as a compelling business description, and pitch to an audience of investors, customers, or business partners. It focuses on building entrepreneurial attitudes and behaviors that will lead to creative solution within community and organizational environments.

Course category: General/ university required

Course Name: Communicative English Skills (EnLa 1001)

Credit Hour: 3

Prerequisite: None

Course description (Synopsis):

Communicative English Skills is a course where students learn what they need to know for a career in science context. The course gives students the language, information, and skills they need to study science context. It also provides students the language appropriate for studying science context and real work situations as it comprises unique sections such as: ‘it’s my job’ wherein real people talk about their work in science context , ‘listening’ whereby students are exposed to situations related to science context , technical explanations, and interviews, ‘reading’ whereby students meet a variety science context based texts, and the ‘writing section’ which is designed to let students compose short reports on different activities.

Course category: General/ university required

Course Name: Basic Writing Skills (EnLa-1002)

Credit Hour: 3

Prerequisite: Communicative English Skills (EnLa 1001)

Course description (Synopsis):

Basic Writing Skills course aims at developing students’ basic writing skills in science context. The course gives students the language writing skills they need to study science. It contains sentence level writing: sentence structure, sentence types sentence combinations, common sentence errors (fragment, run on, comma splices, misplaced modifier, dangling modifier, faulty parallelism, faulty reference of pronoun, faulty agreement and shifts); paragraph level writing: the essence of a paragraph, components of a paragraph (topic sentence, supporting sentences, concluding sentence), characteristics of effective paragraph (unity, coherence and completeness) and the steps in writing a paragraph and types of a paragraph; essay level writing: structure of an essay, thesis statement and supporting paragraphs, types of essays and techniques of essay development.

Course category: General/ university required

Course Name: Introduction to Civics and Ethics (LART 1001)

Credit Hour: 3

Prerequisite: None

Course description (Synopsis):

It is now become clear that Ethics and Citizenship Studies has become not only a field of specialization in itself but has also been attracting leaders who envision instilling democracy on a nun shakable ground within their own society. Autoscore, Ethics is a system of moral principles which involves systematizing, defending and recommending concepts of rights and wrong behavior. It affects how people make decisions and lead their lives. Citizenship, on its part, is a legal status of individuals within a given state. It embodies the legal and political relationship between citizens and state, underlining the reciprocal relationship between the two. This course is designed with the aim of equipping learners with necessary ethical qualities and civic competences while dealing with issues that affect their society at all levels and human in general. The course starts with unfolding the notions, principles and theories of ethics which can shape human attitude, action and behavior in making moral judgments. Next, the course introduces learners to the nature, mutual interactions and historical evolutions of society, state, government and citizenship. It also elucidates issues pertaining to political governance such as constitution, democracy, and human rights in some details. To enable learners, grasp basic knowledge of political, economic and social dynamics of international system in today's globalized world, the course also introduces international relations and foreign policy and other major contemporary global issues. In light of this, the course does not present mere theoretical knowledge, but also practical knowledge of accentuating art of governing and protecting national interest in today's complex world.

Course category: General/ university required

Course Name: Logic and Critical thinking (LART 1002)

Credit Hour: 3

Prerequisite: None

Course description (Synopsis):

The main goal of the course is to improve critical and logical reasoning skills. Students will see how our ordinary intuitions on good or bad reasoning can be articulated explicitly in formal systems, and gain a new ability to evaluate arguments and reasoning they encounter every day with rigorous logical concepts and tools.

As to the subject matter, it introduces systematic methods of reasoning, such as argument, deduction, induction, syllogistic, and propositional logic.

Course category: General/ university required

Course Name: Introduction to Economics(SOSC2002)

Credit Hour: 3

Prerequisite: None

Course description (Synopsis):

This course provides a general introduction to economics combining elements of micro and macro fundamentals. The main objective of this course is to introduce and acquaint students with the preliminary principles (theories) and knowledge of economics and the application of economic theories (principles) in the actual world; the daily activities of the households, firm business or any other form of enterprises at micro levels. Students will also be able to contextualize the key macroeconomic variables and policy instruments.

Specifically, the course introduces students with theory of consumer behaviours, production, and cost of production. In these theories how decisions are made by different economic agents will be discussed. Furthermore, the course covers different characteristics of perfect and imperfect market structure. Lastly the course tries to introduce basic macroeconomic concepts such as national income accounting, unemployment, inflation, fiscal and monetary policy instruments.

Course category: General/ university required

Course Name: General Psychology and Life Skills (LART 2002)

Credit Hour: 3

Prerequisite: None

Course description (Synopsis):

Psychology is a science of human cognitive processes and behaviours. This course is designed to give students an overview of what psychological science has discovered about human behaviours and mental processes throughout human history. Students will gain an understanding of the psychological phenomena that occur in daily life as well as the practical applications of psychological knowledge. Upon completing the course, students shall be able to demonstrate a basic knowledge of the science of psychology.

Specifically, the course general psychology is concerned with discussing perspectives in psychology and basic psychological concepts such as sensation and perception, learning, personality, motivation, emotion, and basic life skills (intrapersonal, interpersonal, social and academic skills). Emphasis will be given to both theoretical and practical implications of these concepts to effectively function as individual and team in a community.

Course category: General/ university required

Course Name: Physical fitness and conditioning I (SpSc1011)

Credit Hour: 0 cr.hr

Prerequisite: None

Course description (Synopsis):

This course will provide the students with basic concepts of the five components of health related physical fitness (cardiovascular, muscular strength and endurance, flexibility, and body composition), hypokinetic disease and general principles of training. It is mainly practical oriented. As a result, the students will be exposed to various exercise modalities, sport activities, minor and major games, and various training techniques as a means to enhance health related physical fitness components. In addition, they will develop the skills to assess each component of fitness and will practice designing cardiovascular, muscular strength and endurance, and flexibility programs based on the fitness assessment. The course serves as an introduction to the role of exercise in health promotion, fitness, performance including the acute and chronic responses of the body to exercise.

Course category: General/ university required

Course Name: Physical fitness and conditioning II (SpSc 1022)

Credit Hour: 0 cr.hr

Prerequisite: SpSc 1011

Course description (Synopsis):

This course is designed to acquaint freshman engineering and applied natural science students with the nature and scope of different ball games.

It emphasizes the value of establishing lifelong fitness using ball games as a means and focuses on the fundamental of volley ball, hand ball, basketball and football as a life time leisure activity also focuses on the development of personalized approach to healthy active living through participation in a variety of ball games that have the potential to engage students' interest throughout their lives. Again the courses enable the participants enjoying practice and acquire proper technique and strategies associated with the ball games mentioned above and learn rules governing the game.

Course category: General/ university required

Course Name: Geography of Ethiopia and the Horn (LART 1003)

Credit Hour: 3

Prerequisite: None

Course description (Synopsis):

This course covers a brief description on the location, shape and size of Ethiopia as well as basic skills of reading map, the physical background and natural resource endowment of Ethiopia and the Horn which includes its geology and mineral resources, topography, climate, drainage and water resources, soil, fauna and flora. It also deals with the demographic characteristics of the country and its implications on economic development.

Course category: General/ university required

Course Name: History of Ethiopia and the Horn (LART 1004)

Credit Hour: 3

Prerequisite: None

Course description (Synopsis):

This course describes why history is important, how history is studied and introduces the region Ethiopia and the Horn. It treats human evolution, Neolithic Revolution, settlement patterns as well as religion and religious processes in Ethiopia and the Horn. Based on these historical backgrounds, the course describes states, external contacts, economic formations and achievement in terms of architecture, writing, calendar, and others to the end of the 13th century. Historical processes including states formation and power rivalry, trade, external relation, threats and major battles, centralization and modernization attempts, Italian occupation, and socio-economic conditions from 1800 to 1941 makes central position in the modern history of the region.

Course category: Basic Mandatory

Course Name: Applied Mathematics I (Math1101)

Credit Hour: 4

Prerequisite: None

Course description (Synopsis):

This course covers vectors, matrices & determinants, limit and continuity, derivatives & their applications, integrals, integration techniques and their applications.

Course category: Basic Mandatory

Course Name: General Physics (Phys1101)

Credit Hour: 3

Prerequisite: Knowledge in Higher Secondary Physics

Course description (Synopsis):

At the end of this course students are expected to be acquainted with basic concepts in different branches of physics, identify the connection between them and explain the common phenomena. They will also develop skills of solving problems.

Course category: Basic Mandatory

Course Name: General Chemistry (Chem1102)

Credit Hour: 3

Prerequisite: None

Course description (Synopsis):

General Chemistry is the science of the properties of atoms and the laws governing their combination, composition, and structure of substances, the transformations they undergo, and the energy that is released or absorbed during Chemical or physical process. The topics covered in this course includes: Introduction to the study of modern Chemistry, acids and bases, the periodic table, Chemical bond and molecular structure, rates of physical and Chemical processes, materials, kinetic molecular description of the state of matter and equilibrium in Chemical reaction.

Course category: Basic Mandatory

Course Name: Introduction to Computing (CSEg 11011)

Credit Hour: 3

Prerequisite: None

Course description (Synopsis):

In this course the basic techniques of computational problem solving will be covered by using computational thinking while writing small and medium sized programs, mapping problems into computational frameworks emphasizing on scientific problems, understanding problems and formulation of problems based on the elective programming language (using python). The course includes the concepts and techniques of data structure, input/output, flow control and incidental program, and by using a systematic division of problem solution and concept of module, to solve problems in numerical value field and non-numerical value field with program experiment.

Course category: Basic Mandatory

Course Name: Applied Mathematics II (Math 1102)

Credit Hour: 4

Prerequisite: Applied Mathematics I (Math 1101)

Course description (Synopsis):

This course covers sequences, series, power series, Fourier series differential and integrals calculus of functions of several variables and their applications.

Course category: Basic Mandatory

Course Name: Introduction to Emerging Technologies (CSEg1102)

Credit Hour: 3

Prerequisite: None

Course description (Synopsis):

This course will enable students to explore current breakthrough technologies in the areas of Artificial Intelligence, Internet of Things and Augmented Reality, Data Science and other technologies that have emerged over the past few years. Besides helping learners become literate in emerging technologies, the course will prepare them to use technology in their respective professional preparations.

Course category: Basic Mandatory

Course Name: Fundamentals of Programming (CSEg1104)

Credit Hour: 3

Prerequisite: Introduction to Computing

Course description (Synopsis):

The course is designed to introduce structured programming in C++ by providing an overview of programming concepts, on creating and working computer programs in C++. It will address fundamental concepts of program analysis, design, coding, testing and development. It includes introduction to computer programming; programming paradigms; algorithms and problem-solving; introduction to data structures and Programming constructs. The course is designed on how to solve business and scientific problems through the technique of structured programming. It will prepare students for focused studies in any programming language.

Course category: Basic Mandatory

Course Name: Applied Mathematics –III (Math2101)

Credit Hour: 4

Prerequisite: Applied Mathematics-II

Course description (Synopsis):

This course covers the topics in First order ordinary Differential Equation, second order ordinary Differential Equation, Laplace transforms and its application, scalar and vector fields and complex analytic function.

Course category: Basic Mandatory

Course Name: Fundamentals of electrical engineering (EPCE 2101)

Credit Hour: 4

Prerequisite: Maths1102 and General physics

Course description (Synopsis):

The course will deal with basic concepts of electrical engineering, basic circuit law and circuit analysis methods, fundamental circuit theorems, transient circuit analysis, steady state circuit and power analysis, introduction to polyphase circuits, electromagnetisms and frequency analysis.

Course category: Basic Mandatory

Course Name: Data Structures and Algorithms (CSEg 2101)

Credit Hour: 3

Prerequisite: CSEg 1104

Course description (Synopsis):

The course covers the design, analysis, and implementation of data structures and algorithms to solve engineering problems. Topics include basic data structures such as arrays, stacks, queues, and lists and advanced data structures such as trees and graphs. The algorithms used to manipulate these structures, and their application to solving practical engineering problems.

Course category: Basic Mandatory

Course Name: Applied Modern Physics (Phys2208)

Credit Hour: 3

Prerequisite: Phys1101-General Physics

Course description (Synopsis):

The rationale of this course is to introduce students to the basic ideas of modern physics with emphasis on the Theory of Special Relativity, identification of the limitations of classical mechanics and the development of quantum mechanics, the wave particle duality and the atomic structure.

Course category: Major Mandatory

Course Name: Electronics circuits-1 (ECEg-2201)

Credit Hour: 4

Prerequisite: Fundamentals of Electrical Engineering-EPCE2101

Course description (Synopsis):

Introducing semiconductor devices, basic structure, principles and operations. Analysis of BJT and FET basic operation with i-v characteristics and small signal analysis of BJT and FET. Application of semiconductor devices, BJT, FET with real time examples. Frequency Response of BJT and FET and various coupling methods. Basic construction of Amplifiers with various biasing methods and its application.

Course category: Major Mandatory

Course Name: Electronics circuits-II (ECEg2202)

Credit Hour: 4

Prerequisite: Electronics Circuits-I

Course description (Synopsis):

Introducing feedback amplifier and the analysis of negative feedback amplifiers with various topologies and applications, More analysis of feedback amplifier with differential mode response and some other parameters. Introducing integrated circuit with various effective parameters and illustrate with real time applications. Introducing oscillators and different types of oscillator circuit with frequency determination and describe about multivibrator circuits with applications. Power semiconductor devices like SCR, TRIAC, DIAC devices with operation and characteristics. Explain in detail about single and double tuned amplifiers, ideal band pass amplifiers and power amplifiers.

Course category: Major Mandatory

Course Name: Signals and Systems Analysis (ECEg-2204)

Credit Hour: 3

Prerequisite: Applied Mathematics III- Math2101

Course description (Synopsis):

This course deals with the analysis of continuous-time and discrete-time signals and systems. Topics include: representations of linear time-invariant systems, representations of signals, Laplace transform, transfer function, impulse response, step response, the convolution integral and its interpretation, Fourier analysis for continuous time signals and systems and an introduction to sampling.

Course category: Major Mandatory

Course Name: Electromagnetics Field (EPCE2202)

Credit Hour: 3

Prerequisite: Maths2101-Applied Mathematics II

Course description (Synopsis):

Review of Vectors and vector fields, Electrostatic Fields, Magneto static Fields, Magnetic Forces & Materials, Forces due to Magnetics and Introduction to Time Varying Electromagnetic Fields.

Course category: Major Mandatory

Course Name: Engineering Application Software (ECEg2208)

Credit Hour: 3

Prerequisite: None

Course description (Synopsis):

The course gives an introduction of the various engineering application software that are in use in the field of electronics and communication engineering. The fundamentals of MATLAB programming are illustrated with emphasis on features that are applicable to communication systems problems. Introduction: Matlab desktop environment, variables assignment, operations on variables, relational and numerical expressions, operations on vectors and matrices, data types and casting. Programming with MATLAB: MATLAB scripts, decision and loop statements. Data Structures: cell arrays, structures sorting and indexing. Plotting, File input/output: using plotting functions and customizing tools. Advanced Mathematics with MATLAB: statistical functions, fitting data to a curve, system of linear equations, calculus with MATLAB. Discrete Time Signal and Systems with MATLAB: discrete time signal, operations on signals, discrete time systems (LTI).

Course category: Major Mandatory

Course Name: Computational Methods (EPCE 2208)

Credit Hour: 3

Prerequisite: Maths2101-Applied Mathematics III and Fundamentals of Programming

Course description (Synopsis):

Number system and numerical error analysis, review of matrices, solution of linear equation, solution of nonlinear equation, approximation and interpolation techniques and numerical differentiations and integrations.

Course category: Major Mandatory

Course Name: Digital Logic Design (ECEg3201)

Credit Hour: 4

Prerequisite: ECEg2201 Electronics Circuits I

Course description (Synopsis):

In this course, students will study various digital logic families such as TTL, ECL, and CMOS, the logic gates under these families, and the electronic circuit techniques used to implement them. Subsequently, they will learn Boolean algebra, logic expressions, number systems and combinational logic design, including logic minimization and hazards. In addition, with the understanding of combinational logic design, students will learn how to design sequential systems, including analysis of the behavior of synchronization elements and system timing design. Finally, in this course, students will have hands-on design experiences by carrying out experiments with component-level devices and designing digital systems.

Course category: Major Mandatory

Course Name: Network Analysis and Synthesis (EPCE3201)

Credit Hour: 3

Prerequisite: ECEg2204-Signals and Systems analysis

Course description (Synopsis):

This course deals about Introduction to Network Analysis and Synthesis, network transform representations and analysis, network functions for one port and two ports, properties of driving point functions and transfer functions, calculation of network functions, poles and zeros, time domain behavior from pole-zero plot, elements of realizability theory, synthesis of one port networks using two kinds of elements, two port networks and relationship between transfer functions using two port parameters and interconnection of two-port parameter, basics of filters, filter approximation, insertion loss synthesis and synthesis of active and passive networks and filters.

Course category: Major Mandatory

Course Name: Probability & Random Processes (ECEg3103)

Credit Hour: 3

Prerequisite: Maths1102-Applied Mathematics II

Course description (Synopsis):

Introducing some application area of probability and random processes and revising Set theory, Function, Factorial, Permutation and Combination. Basic concept of Probability Theory: Probability models and axioms, Conditional probability, total probability, Independence and Bayes' theorem. Random Variables, Probability Distributions and Densities function, Discrete and Continuous random variables, Gaussian Random Variable and Q-Function, Conditional Distribution and Density Function. Expectations, variances, moments, Expectation of a Function of Random Variable, Characteristic Function, Central Limit Theorem and Transformation of Random Variables. Two and more random variables and their joint distributions and densities. Random processes, Auto and cross correlation Functions, covariance, Stationary Random Processes, Ergodic Random Processes and Power Spectral Density Function. Introduction to parameter estimation and prediction.

Course category: Major Mandatory

Course Name: Digital Signal Processing (ECEg3205)

Credit Hour: 3

Prerequisite: ECEg2204-Signals and Systems Analysis

Course description (Synopsis):

Introducing the development of analytical representation and design of discrete time signals and systems. Discussing the Analysis of discrete time signals and systems in time domain and transform domains. ADC and DAC, Sampling theorem, Sampling Rate conversion, Aliasing, LTI signals and systems, Discrete time Fourier Transform, Fast Fourier Transform, Z-transform, and analysis and design of digital filters.

Course category: Major Mandatory

Course Name: Introduction to Communication Systems (ECEg-3202)

Credit Hour: 4

Prerequisite: ECEg2202: Electronics Circuit II

Course description (Synopsis):

This course introduces about basic of an analog communication system, analysis of AM and angle modulation signals in time and frequency domain, modulation and demodulation technique of linear AM, DSB, SSB, VSB signal and nonlinear modulation techniques such as PM and FM, various types of noises and its mathematical representation, Effect of noise on AM and FM receiver and comparative performance of between AM and FM system.

Course category: Major Mandatory

Course Name: Microelectronic devices & circuits (ECEg-3206)

Credit Hour: 3

Prerequisite: Electronic Circuit-II (ECEg2202)

Course description (Synopsis):

In this course, the topics to be covered include modeling of microelectronic devices, basic microelectronic circuit analysis and design, physical electronics of semiconductor junction and MOS devices, relation of electrical behavior to internal physical processes, development of circuit models, and understanding the uses and limitations of various models. The course uses incremental and large-signal techniques to analyze and design bipolar and field effect transistor circuits, with examples chosen from digital circuits, single-ended and differential linear amplifiers.

Course category: Major Mandatory

Course Name: Introduction to Electrical Machines (EPCE 3205)

Credit Hour: 4

Prerequisite: Electromagnetic fields [EPCE 2202]

Course description (Synopsis):

Electromagnetic principles; Transformers; 3-Phase Induction motors; D.C Machines; Synchronous Machines.

Course category: Major Mandatory

Course Name: Introduction to Power Systems (EPCE 3206)

Credit Hour: 3

Prerequisite: Electromagnetic field EPCE 2202

Course description (Synopsis):

Introduces Fundamentals of power systems, Representation of power system components, Electrical design of transmission line, Mechanical design of transmission lines, Characteristic and performance of power transmission lines, Corona, Overhead line insulators, Underground cables.

Course category: Major Mandatory

Course Name: Computer Architecture and Organization (ECEg4201)

Credit Hour: 3

Prerequisite: ECEg3201 Digital Logic Design

Course description (Synopsis):

This course focus on: Computer Arithmetic; The Central Processing Unit: Architecture and Instruction Set; Instruction Format and Addressing Modes; Register Transfer Descriptions; Organization of the Arithmetic and Logic Unit; The Control Unit Realization: Hardwired and Micro programmable; The Memory Hierarchy and Memory Management; Input-Output Devices; Software of a Computer System; Design of a Small Computer System Testing.

Course category: Major Mandatory

Course Name: Digital Communication (ECEg4203)

Credit Hour: 3

Prerequisite: Introduction to Communication systems- ECEg3202

Course description (Synopsis):

Comprehensive introduction to digital communication principles. The major part of the course is devoted to studying how to translate information into a digital signal to be transmitted, and how to retrieve the information back from the received signal in the presence of noise and intersymbol interference (ISI). Various digital modulation schemes are discussed through the concept of signal space. Analytical and simulation models for digital modulation systems are designed and implemented in the presence of noise and ISI. Optimal receiver models for digital baseband and band-pass modulation scenes are covered in detail. Baseband transmission and Optimal Reception of Digital Signal will be also covered. This course will also give knowledge on information theory and coding.

Course category: Major Mandatory

Course Name: EM Waves and Guided Structure (ECEg4205)

Credit Hour: 3

Prerequisite: EPCE2202 Electromagnetic Field

Course description (Synopsis):

Review of Vectors and Maxwell's Equations: Scalar & Vector Fields; Line, Surface, & Volume Integrals; Gradient of a Scalar field, Divergence & Curl of a Vector Field, the Divergence & Stokes's Theorems, Laplacian of a Scalar Field; Solenoid & Irrotational Vector Fields, Helmholtz's Theorem; Field Quantities; Maxwell's Equations; Boundary Conditions; Time-Harmonic Fields. Position's Equations and Laplace's Equations, Electromagnetic Wave Propagation: Waves in General; Wave Propagation in Lossy Dielectrics; Plane Waves in Free Space; Plane Waves in Lossless Dielectrics; Plane Waves in Good Conductors; Power and Poynting Vector, Poynting Theorem; perpendicular Polarization parallel polarization standing waves Reflection of Plane Wave at Normal and Oblique Incidence; Summary of TEM Waves, Transmission Lines: Electrical Dimension, Circuit and Field Analysis; Transmission Line Equations; Input Impedance, SWR, and Power; The Smith Chart; Some Application of Transmission Lines. Transients in loss less lines Waveguides: Rectangular Waveguides; TM Modes; in two-dimensional planar TE Modes; Power Transmission and wave guide, coupling matching and Attenuation; Waveguide Resonators. Powers transmitted in a lossless wave guide. Power dissipation in a lossy wave guide.

Course category: Major Mandatory

Course Name: Introduction to control systems (EPCE 3204)

Credit Hour: 3

Prerequisite: Network Analysis and synthesis-EPCE3201

Course description (Synopsis):

This course deals about introduction to control system, control system modelling of physical system, time domain analysis of control systems, Root locus analysis, frequency domain analysis and classical controller design techniques.

Course category: Major Mandatory

Course Name: Instrumentation & Measurement (EPCE 4207)

Credit Hour: 3

Prerequisite: Electronic Circuit II-ECEg2202

Course description (Synopsis):

This course deals with the basic concepts of Electrical measurement and instrumentation, instrumentation type and performance characteristics (static and dynamic), basic concepts of sensors and their application, calibration of measuring sensors and instruments, general principles of signal conditioning and conversion, signal processing elements, output presentation element and design some simple Measurement systems using different sensors, actuators and semiconductors.

Course category: Major Mandatory

Course Name: Microprocessor and Interfacing (ECEg4202)

Credit Hour: 4

Prerequisite: ECEg4201: Computer Architecture and Organization

Course description (Synopsis):

The Microprocessor and interfacing course intends in getting the concepts to the mastering of basic microprocessors and microcomputers. The discussion of the course will be based around the 8086 Intel microprocessor and selected advanced microprocessors and microcontrollers. However, this is not stiff and could be subjected to change. The fact that the 8086 is the considered basic processor architecture, make the discussion be based on the microprocessors. The discussion of the course will begin by introducing the microcontroller evolution in their historical background. The course will describe and explain the detailed architecture of the processor. Bus, memory, IO, and registers will be highly focused. The assembly language code will be studied, and different programs will be attempted. The most important discussion will be

the interfacing of different types of devices and ICs to the microprocessor. This will help students in equipping them with appropriate knowledge in helping them to develop solutions to real world problems. Interfacing of interrupts, IO modules and other important concepts will be examined.

Course category: Major Mandatory

Course Name: Antenna and Radio Wave Propagation (ECEg4204)

Credit Hour: 3

Prerequisite: ECEg4205 EM Waves and Guide Structure

Course description (Synopsis):

This course initially describes the Radiation Integrals and Auxiliary Potential Functions. This leads to the development of various types of antennas and their applications in various types of communication systems. Then a detailed characteristic aspect of antennas are described as Antenna Parameters: Radiation Resistance, Radiation Pattern, Radiation Intensity, Directive Gain and Directivity, Power Gain. Later on, this course gives a detailed classification of various types of antennas in different frequency bands as; Wire Antennas: Antenna Types; Hertzian Dipole; Half-Wave Dipole Antenna; Quarter-Wave Monopole Antenna; Small Loop Antenna. Aperture Antennas, Frequency Independent Antennas, Broadband Antennas and Planar Antennas, Antenna Arrays: Two Element Array; N- Element Linear Array; Broadside Array; Ordinary End-Fire Array; Phased (Scanning) Array; Hansen-Woodyard End-Fire Array. This course also describes about the smart antennas required for the future generation wireless mobile communication systems where the signal processing techniques are combined along with array antennas: Beam Shaping Techniques Multi-beam antennas, active antennas, efficient adaptive array control algorithms. This course finally describes about the various problems associated with signal propagating through the wireless channels (both fixed and mobile) as; Radio Wave Propagation: Ground Wave Propagation; Space Wave Propagation; Line of Sight Propagation; Ionospheric Propagation; Noise. The related research areas include Log-Periodic Antennas, Fractal Antenna, Microstrip Antennas, Rectangular Patch & Circular Patch Antenna, Antenna

Arrays, Ridge Antennas, the current and future generation wireless communication systems, and the medical industry.

Course category: Major Mandatory

Course Name: Engineering Research and Development Methodology (ECEg4206)

Credit Hour: 2

Prerequisite: Senior standing courses

Course description (Synopsis):

This course introduces different types of Research methods: necessity, types and levels of researches; problem formulation, modeling & experimentation; data collection/generation and processing; Presentation skills: research and project proposals; oral presentations formats; applications of audiovisual equipment; Management aspect of Research and Development (R&D) works and outputs: discussion forums; intellectual property rights; management of R&D works.

Course category: Major Mandatory

Course Name: Data Communication and Computer Networks (ECEg4208)

Credit Hour: 3

Prerequisite: ECEg-4203 Digital Communication.

Course description (Synopsis):

This is a senior level undergraduate course for students who wish to gain a broad understanding of data communications, communication networks and Internet protocols. Students are expected to have a basic knowledge of applied probability, signals and systems, and familiarity with software. There will be several real-life projects related to data communications and students will use software for implementation or simulation. These projects complement the theoretical aspects and have considerable pedagogic value in helping students understand concepts and

design. Note that while use of MATLAB is encouraged for carrying out the projects, students may use other general-purpose programming languages such as C, C++ or JAVA.

Course category: Major Mandatory

Course Name: Wireless and Mobile Communication (ECEg5201)

Credit Hour: 3

Prerequisite: ECEg4203-Digital Communication

Course description (Synopsis):

Introducing of wireless and mobile communication systems: history of Mobile Radio Communication, Examples of Wireless Communications (Zigbee, Bluetooth, and Internet of Things), and Trends in Cellular Radio Communication Systems (1G to 4G mobile networks). Evolution of mobile telephony system: introduction mobile telephony system, GSM mobile telephony system, UMTS/WCDMA mobile telephony system, LTE mobile network, "5G mobile network". Mobile Radio Channel Modeling & Mitigations: Wireless Channel Models and Signal Propagations, Small Scale Fading and Multipath, Mitigation Techniques for Fading Wireless Channels, Equalization Techniques, Diversity Techniques, Coding Techniques. Cellular Concept and System Design Fundamentals: Cellular Concept & Frequency Reuse, Channel Assignment Strategies, Handoff Strategies, Interference and System Capacity, Trunking and Grade of Services. Multiple Access Techniques for Wireless Systems: Frequency Division Multiple Access, Time Division Multiple Access, Code Division Multiple Access, Space Division Multiple Access, Spread Spectrum Multiple Access, OFDMA wideband systems.

Course category: Major mandatory

Course Name: Power Electronics (EPCE3202)

Credit Hour: 3

Prerequisite: Electronic circuits II-ECEg2202

Course description (Synopsis):

Introduction to power electronics, overview of different types of power semiconductor devices and their dynamic characteristics, operation and characteristics of controlled rectifiers, operation and switching techniques of DC-DC switching regulators, modulation techniques of PWM inverters, operation of AC voltage controller and cycloconverters.

Course category: Major Restrictive Elective

Course Name: Integrated Circuit Technology (ECEg-4312)

Credit Hour: 3

Prerequisite: Microelectronic devices & circuits (ECEg-3206)

Course description (Synopsis):

In this course, students will study wide range of IC technology fabrication process, IC technology industrial machines and tools. Course covers various internal elements manufacturing methods and models.

Course category: Major Restrictive Elective

Course Name: Microwave Devices and Systems (ECEg4310)

Credit Hour: 3

Prerequisite: EM Waves and Guide Structures-ECEg4205

Course description (Synopsis):

Review of Smith Chart applications: impedance, susceptance, VSWR calculations, quarter wave impedance transformer, the slotted line impedance finder. Microwave Network Analysis: impedance matrix, susceptance matrix, hybrid matrix, ABCD matrix, scattering parameters, signal flow graphs. Matching Networks and Tuning: Impedance matching RLC networks, Microstrip matching networks, Single Stub Tuning. Amplified design considerations; stability considerations, power gain considerations, amplifier tuning. Oscillator Design; oscillation conditions, oscillator configurations.

Course category: Major Restrictive Elective

Course Name: Semiconductor Devices (ECEg-4316)

Credit Hour: 3

Prerequisite: None

Course description (Synopsis):

This course explores semiconductor physics, and operation & applications of semiconductor devices such as p-n junctions, BJTs, JFETs and MOSFETs. They also include optoelectronics theory and discuss various optoelectronic semiconductor devices.

Course category: Major Restrictive Elective

Course Name: Digital Image Processing (ECEg-4314)

Credit Hour: 3

Prerequisite: ECEg 3205 Digital Signal Processing

Course description (Synopsis):

The course basically designed in the areas of Imaging optics, sensors and sampling patterns, image pre-processing, Frequency domain image processing, Colour image processing, linear and nonlinear operations on images, enhancement fundamentals of semantic image processing, practical applications of imaging system, image segmentation and its application to biomedical imaging, satellite imaging etc. This course focuses the student's ability in analysing technologies for digital image, compression, writing and developing of algorithms, implementations of various digital image applications, Image representation and conversant with the image processing techniques.

Course category: Major Restrictive Elective

Course Name: VLSI Design (ECEg5307)

Credit Hour: 3

Prerequisite: Digital Logic Design (ECEg3201)

Course description (Synopsis):

Very Large-Scale Integrated Circuits (VLSI) have become the prime medium of realization of modern Electronics Systems. The main objective of this course is the study of MOSFETs and their fabrication techniques in order to design various combinational and sequential circuits using CMOS Logic. This course also introduces the concepts and techniques of modern integrated circuit design and analysis along with optimization of combinational and sequential circuit using static and dynamic based CMOS Circuits. This course is one of the vital courses for designing the processors and verifications.

Course category: Major Restrictive Elective

Course Name: Embedded and real time systems (ECEg5315)

Credit Hour: 3

Prerequisite: Microprocessor & Interfacing -ECEg4202

Course description (Synopsis):

This course is designed to provide students a working knowledge of embedded systems and its application to the modern technology. In this course the fundamentals of embedded systems, hardware and firmware designs will be explored. Different types of microcontrollers commonly used in the world today will be introduced. The student can have the choice on which microcontrollers that can be used for specific design. Embedded programs using assembly language and higher programming language will be used in the program. Real-time operating systems, low power computing, interfacing as well as optimization are the core topics to be discussed in designing embedded systems.

Course category: Major Restrictive Elective

Course Name: Introduction to Robotics and Industrial Automation (EPCE5308)

Credit Hour: 3

Prerequisite: Introduction control systems (EPCE3204)

Course description (Synopsis):

This course deals about Review of Industrial Control Devices and Circuits; Basic Ladder Logic and Control; Programmable Logic Controllers and Applications; Robot Fundamentals; Mechanisms and Actuators, Sensors and Detectors; Modeling and Control of Manipulators; Robot Applications and Programming.

Course category: Major Restrictive Elective

Course Name: Introduction to Mechatronics (ECEg-5305)

Credit Hour: 3

Prerequisite: None

Course description (Synopsis):

Mechatronics is the combination of electronics , computer science, , and mechanics (engineering) and is applied to most industries through automation enhancements. This course will allow the student to experience realistic applications of automation control. After learning this student will be capable to design of microprocessor-controlled electromechanical systems. Interfacing sensors and actuators to a personal computer and a single-board computer. Electrical and mechanical design, prototyping, and construction. Dissection of a commercial mechatronic product. Students work in teams to produce final computer-controlled electromechanical projects of their own design.

Course category: Major Restrictive Elective

Course Name: Biomedical instrumentation and analysis (ECEg5321)

Credit Hour: 3

Prerequisite: None

Course description (Synopsis):

By giving general introduction to anatomy and Physiology of the human body, the key measurement principles of sensors found in healthcare technologies, medical devices used in hospitals, will be discussed. This course also shows how to build bio-potential amplifiers, record and interpret bioelectrical data (e.g. heart activity, muscle activity). It gives an insight into the working principles underlying the instrumentation for measuring respiratory and cardiovascular function such as blood pressure, blood flow as well as biochemical sensors. General discussions on medical imaging and prosthetics and therapeutic devices are covered.

Course category: Major Restricted Elective

Course Name: Optics and Optical Communication (ECEg-5302)

Credit Hour: 3

Prerequisite: Digital Communication-ECEg4203

Course description (Synopsis):

Introduction of optical communication: propagation of light, ray theory and model. Different types of fibers: Single and multimode fibers, step index fibers. Signal degradation due to scattering, attenuation and dispersion and its losses. Optical Sources; Light emitting diode, Laser diode, rate equation, Modulators: electro optic, electro-absorption. Optical receivers: Photodiodes: p-i-n, avalanche, responsivity, capacitance, transit time. Optical receiver performance: Q factor, bit error ratio, sensitivity degradation. Non-Linear effects: solution based communication. Optical communication system architecture: optical amplifier,

Fiber optic link design, and amplified WDM systems. Free – Space –Optics (FSO) in optical communication applications.

Course category: Major Restricted Elective

Course Name: Analysis & design of Digital integrated circuit (ECEg5304)

Credit Hour: 3

Prerequisite: ECE3206

Course description (Synopsis):

This course explores on the latest CMOS and related recent technologies. The emphasis of the course will be on designing and analysis of CMOS circuits. This course will provide an excellent introduction to digital circuit design for students.

Course category: Major Restricted Elective

Course Name: Telecommunication Networks and Switching (ECEg-5306)

Credit Hour: 3

Prerequisite: ECEg-4203 - Digital Communication

Course description (Synopsis):

Students will be able to acquire knowledge on systems view of communications, integrating perspectives from computer science, electrical engineering, operations research and economics. Students will learn to consider tele-traffic demands, quality of service, scalability, performance and cost into consideration to develop requirements and architectures. They will be able to understand recent topics like switching systems, time divisions witching systems, data communication Networks. ISDN, voice data integration and importance of telephone traffic analysis and telephone networks. The Course also provides a good understanding of the fundamentals and application of telecommunication networks i.e. PSTN, PDN and ISDN.

Course category: Major Restricted Elective

Course Name: Introduction to Computer Vision (ECEg-5308)

Credit Hour: 3

Prerequisite: Digital Image Processing-ECEg4314

Course description (Synopsis):

Introducing theory and application of computer vision. Topics includes digital image fundamentals, binary vision, gray-level vision, Imaging optics, sensors and sampling patterns, image pre-processing, Frequency domain image processing, Color image processing, linear and nonlinear operations on 2D and 3D images, enhancement, fundamentals of semantic image processing, practical applications of imaging system.

Course category: Major Restricted Elective

Course Name: Satellite Communication (ECEg-5310)

Credit Hour: 3

Prerequisite: ECEg-4204- Antenna and Radio Wave Propagation

Course description (Synopsis):

This course aims at providing thorough information of the conventional and upcoming satellite communication technology. The course covers the History of Satellite communication, Basic concepts of Satellite Communications, Communication Networks and Services, Comparison of Network Transmission technologies, Orbital and Spacecraft problems, Growth of Satellite communications, Orbital mechanics, Look angle determination, Orbital perturbations, Orbital determination, Launchers and launch vehicles, Orbital effects in communication system performance, Satellite Subsystems, Attitude and Control Systems (AOCS), Telemetry, Tracking, Command and monitoring, Power systems, Communication subsystems, Satellite antennas, Equipment reliability and space qualification, Basic transmission theory, System noise temperature and G/T Ratio, Design of downlinks, Scatter-site systems using small earth stations, Uplink design, Design of specified C/N: Combining C/N and C/I values in satellite links system design examples.

Course category: Major Restricted Elective

Course Name: FPGA Design (Eceg5312)

Credit Hour: 3

Prerequisite: ECEg4201-Computer Architecture and organization

Course description (Synopsis):

Students will be able to acquire knowledge on Hardware Description Languages, Programmable logic devices and FPGAs, design of FPGA based systems, combinational and sequential networks, FPGA architecture and Large FPGA Systems.

2.3 Electrical Power and Control Engineering program

General information

I. *Duration of study*

Normal modality

Regular: a 5-year program

Continuing: 5-8year program

Dual major/manor: 6 years

Fast Track modality: may finish before ten semesters and delayed students may finish after ten semesters.

II. *Course category*

No	Course category		Course level	Credit requirement	Percentage of the total
1	General	Mandatory	University required	27	15%
2	Basic	Mandatory	School required	44	24.44%
	Basic	Mandatory	Department required	3	1.67%
	Major	Mandatory	Department required	65	37.22%
		Elective		33	18.33%
Subtotal				172	96.67%
3	Free electives			6	3.33%
Total				178	100%

Course category: General/ university required

Course Name: Entrepreneurship and Business Development (SOSC5003)

Credit Hour: 3

Prerequisite: None

Course description (Synopsis):

This course is designed to prepare individuals for ownership of their own innovative business, and assist start-ups to function more effectively, increase the chances of new business success, enhance profitability, and increase employment. The course also provides students with an introduction to the concepts and skills necessary to successfully commercialize new products and services. Entrepreneurship is not just about starting a business. It is also about identifying good opportunities and then creating, communicating, and capturing value from those opportunities; including innovation in a corporate context. This course will teach students the skills to analyze business opportunities, and articulate them as a compelling business description, and pitch to an audience of investors, customers, or business partners. It focuses on building entrepreneurial attitudes and behaviors that will lead to creative solution within community and organizational environments.

Course category: General/ university required

Course Name: Communicative English Skills (EnLa 1001)

Credit Hour: 3

Prerequisite: None

Course description (Synopsis):

Communicative English Skills is a course where students learn what they need to know for a career in science context. The course gives students the language, information, and skills they need to study science context. It also provides students the language appropriate for studying science context and real work situations as it comprises unique sections such as: ‘it’s my job’ wherein real people talk about their work in science context , ‘listening’ whereby students are exposed to situations related to science context , technical explanations, and interviews, ‘reading’ whereby students meet a variety science context based texts, and the ‘writing section’ which is designed to let students compose short reports on different activities.

Course category: General/ university required

Course Name: Basic Writing Skills (EnLa-1002)

Credit Hour: 3

Prerequisite: Communicative English Skills (EnLa 1001)

Course description (Synopsis):

Basic Writing Skills course aims at developing students’ basic writing skills in science context. The course gives students the language writing skills they need to study science. It contains sentence level writing: sentence structure, sentence types sentence combinations, common sentence errors (fragment, run on, comma splices, misplaced modifier, dangling modifier, faulty parallelism, faulty reference of pronoun, faulty agreement and shifts); paragraph level writing: the essence of a paragraph, components of a paragraph (topic sentence, supporting sentences, concluding sentence), characteristics of effective paragraph (unity, coherence and completeness) and the steps in writing a paragraph and types of a paragraph; essay level writing: structure of an essay, thesis statement and supporting paragraphs, types of essays and techniques of essay development.

Course category: General/ university required

Course Name: Introduction to Civics and Ethics (LART 1001)

Credit Hour: 3

Prerequisite: None

Course description (Synopsis):

It is now become clear that Ethics and Citizenship Studies has become not only a field of specialization in itself but has also been attracting leaders who envision instilling democracy on a nun shakable ground within their own society. Autoscore, Ethics is a system of moral principles which involves systematizing, defending and recommending concepts of rights and wrong behavior. It affects how people make decisions and lead their lives. Citizenship, on its part, is a legal status of individuals within a given state. It embodies the legal and political relationship between citizens and state, underlining the reciprocal relationship between the two. This course is designed with the aim of equipping learners with necessary ethical qualities and civic competences while dealing with issues that affect their society at all levels and human in general. The course starts with unfolding the notions, principles and theories of ethics which can shape human attitude, action and behavior in making moral judgments. Next, the course introduces learners to the nature, mutual interactions and historical evolutions of society, state, government and citizenship. It also elucidates issues pertaining to political governance such as constitution, democracy, and human rights in some details. To enable learners, grasp basic knowledge of political, economic and social dynamics of international system in today's globalized world, the course also introduces international relations and foreign policy and other major contemporary global issues. In light of this, the course does not present mere theoretical knowledge, but also practical knowledge of accentuating art of governing and protecting national interest in today's complex world.

Course category: General/ university required

Course Name: Logic and Critical thinking (LART 1002)

Credit Hour: 3

Prerequisite: None

Course description (Synopsis):

The main goal of the course is to improve critical and logical reasoning skills. Students will see how our ordinary intuitions on good or bad reasoning can be articulated explicitly in formal systems, and gain a new ability to evaluate arguments and reasoning they encounter every day with rigorous logical concepts and tools. As to the subject matter, it introduces systematic methods of reasoning, such as argument, deduction, induction, syllogistic, and propositional logic.

Course category: General/ university required

Course Name: Introduction to Economics (SOSC2002)

Credit Hour: 3

Prerequisite: None

Course description (Synopsis):

This course provides a general introduction to economics combining elements of micro and macro fundamentals. The first part of the course focuses on partial equilibrium aspects of theories of consumer behavior, producer behavior as well as on the arrangements and implications of different market structures. It will also cover the neoclassical theory of product and/or service pricing for perfectly competitive, monopolistic, introduction to oligopoly. The second part will discuss elements of macroeconomics that revolve around issues of measurement of aggregate economic activities: National Income Accounting, Fluctuation in economic activities, unemployment, and inflation, and policy Instruments: fiscal and monetary policy.

Emphasis will also be given to sources, consequences and policy responses to economic fluctuations. In the first part the course commences by highlighting the underlying assumptions behind each theory followed by in-depth analyses of the decisions of economic units subject to resource constraints in an effort to realize their respective objectives assuming the prevalence of market clearing situation. Finally, students will be able to contextualize the key analytical instruments with stylized facts from the Ethiopian economy.

Course category: General/ university required

Course Name: General Psychology and Life Skills (Psyc1011)

Credit Hour: 3

Prerequisite: None

Course description (Synopsis):

Psychology is a science of human cognitive processes and behaviors. This course is designed to give students an overview of what psychological science has discovered about human behaviors and mental processes throughout human history. Students will gain an understanding of the psychological phenomena that occur in daily life as well as the practical applications of psychological knowledge. Upon completing the course, students shall be able to demonstrate a basic knowledge of the science of psychology. Specifically, the course general psychology is concerned with discussing perspectives in psychology and basic psychological concepts such as sensation and perception, learning, personality, motivation, emotion, and basic life skills (intrapersonal, interpersonal, social and academic skills). Emphasis will be given to both theoretical and practical implications of these concepts to effectively function as individual and team in a community.

Course category: General/ university required

Course Name: Physical fitness and conditioning I (SpSc1011)

Credit Hour: 0 cr.hr

Prerequisite: None

Course description (Synopsis):

This course is design to acquaint students with the nature and knowledge of physical fitness for better health. This course is also encompassing health related physical fitness components which are important for better life and health. This health- related physical fitness includes cardio-respiratory endurance, muscular strength, muscular endurance and flexibility. In addition to health-related fitness components, this course is also deal with the high lights of basic gymnastic activities.

Course category: General/ university required

Course Name: Physical fitness and conditioning II (SpSc 1022)

Credit Hour: 0 cr.hr

Prerequisite: SpSc 1011

Course description (Synopsis):

This course is designed to acquaint freshman engineering and applied natural science students with the nature and scope of different ball games.

It emphasizes the value of establishing lifelong fitness using ball games as a means and focuses on the fundamental of volley ball, hand ball, basketball and football as a life time leisure activity also focuses on the development of personalized approach to healthy active living through participation in a verity of ball games that have the potential to engage students' interest throughout their lives. Again, the courses enable the participants enjoying practice and acquire proper technique and strategies associated with the ball games mentioned above and learn rules governing the game.

Course category: General/ university required

Course Name: Geography of Ethiopia and the Horn (LART 1003)

Credit Hour: 3

Prerequisite: None

Course description (Synopsis):

This course covers a brief description on the location, shape and size of Ethiopia as well as basic skills of reading map, the physical background and natural resource endowment of Ethiopia and the Horn which includes its geology and mineral resources, topography, climate, drainage and water resources, soil, fauna and flora. It also deals with the demographic characteristics of the country and its implications on economic development.

Course category: General/ university required

Course Name: History of Ethiopia and the Horn (LART 1004)

Credit Hour: 3

Prerequisite: None

Course description (Synopsis):

This course describes why history is important, how history is studied and introduces the region Ethiopia and the Horn. It treats human evolution, Neolithic Revolution, settlement patterns as well as religion and religious processes in Ethiopia and the Horn. Based on these historical backgrounds, the course describes states, external contacts, economic formations and achievement in terms of architecture, writing, calendar, and others to the end of the 13th century. Historical processes including states formation and power rivalry, trade, external relation, threats and major battles, centralization and modernization attempts, Italian occupation, and socio-economic conditions from 1800 to 1941 makes central position in the modern history of the region.

Course category: Basic Mandatory

Course Name: Fundamentals of Electrical Engineering (EPCE2101)

Credit Hour: 4

Prerequisite: Maths1102 and Phys1101

Course description (Synopsis):

The course deals with basic concepts of electrical engineering, basic circuit law and circuit analysis methods, fundamental circuit theorems, transient circuit analysis, steady state circuit and power analysis, introduction to polyphase circuits, electromagnetism, and frequency analysis.

Course category: Basic

Course Name: Applied Mathematics I (Math1101)

Credit Hour:4

Prerequisite: None

Course description (Synopsis):

This course covers vectors, matrices & determinants, limit and continuity, derivatives & their applications, integrals, integration techniques and their applications.

Course category: Basic

Course Name: Applied Mathematics II (Math1102)

Credit Hour:4

Prerequisite: Math1101

Course description (Synopsis):

This course covers sequences, series, power series, Fourier series differential and integrals calculus of functions of several variables and their applications. problems. This course covers integer programming, deterministic dynamic programming, inventory models, forecasting models, decision making, Queuing Theory, and Simulation Models.

Course category: Basic

Course Name: Applied Mathematics –III (Math2101)

Credit Hour:4

Prerequisite: Math 1102

Course description (Synopsis):

This course covers the topics in First order ordinary Differential Equation, second order ordinary Differential Equation, Laplace transforms and its application, scalar and vector fields and complex analytic function.

Course category: Basic

Course Name: General Chemistry (Chem1102)

Credit Hour:3

Prerequisite: None

Course description (Synopsis):

General Chemistry is the science of the properties of atoms and the laws governing their combination, composition, and structure of substances, the transformations they undergo, and the energy that is released or absorbed during Chemical or physical process. The topics covered in this course includes: Introduction to the study of modern Chemistry, acids and bases, the periodic table, Chemical bond and molecular structure, rates of physical and Chemical processes, materials, kinetic molecular description of the state of matter and equilibrium in Chemical reaction.

Course category: Basic

Course Name: Applied Modern Physics (Phys2208)

Credit Hour:3

Prerequisite: Phys1101

Course description (Synopsis):

The rationale of this course is to introduce students to the basic ideas of modern physics with emphasis on the Theory of Special Relativity, identification of the limitations of classical mechanics and the development of quantum mechanics, the wave particle duality and the atomic structure.

Course category: Basic

Course Name: Introduction to Emerging Technologies (CSEg1102)

Credit Hour:3

Prerequisite: None

Course description (Synopsis):

This course will enable students to explore current breakthrough technologies in the areas of Artificial Intelligence, Internet of Things and Augmented Reality, Data Science and other technologies that have emerged over the past few years. Besides helping learners become literate in emerging technologies, the course will prepare them to use technology in their respective professional preparations.

Course category: Basic

Course Name: Fundamentals of Programming (CSEg1104)

Credit Hour:3

Prerequisite: CSEg 1101

Course description (Synopsis):

The course is designed to introduce structured programming in C++ by providing an overview of programming concepts, on creating and working computer programs in C++. It will address fundamental concepts of program analysis, design, coding, testing and development. It includes introduction to computer programming; programming paradigms; algorithms and problem solving; introduction to data structures and Programming constructs. The course is designed on how to solve business and scientific problems through the technique of structured programming. It will prepare students for focused studies in any programming language.

Course category: Basic

Course Name: Introduction to Computing (CSEg1101)

Credit Hour:3

Prerequisite: None

Course description (Synopsis):

In this course the basic techniques of computational problem solving will be covered by using computational thinking while writing small and medium sized programs, mapping problems into computational frameworks emphasizing on scientific problems, understanding problems and formulation of problems based on the elective programming language (using python). The course includes the concepts and techniques of data structure, input/output, flow control and incidental program, and by using a systematic division of problem solution and concept of module, to solve problems in numerical value field and non-numerical value field with program experiment.

Course category: Basic

Course Name: Data Structures and Algorithms (CSEg 2101)

Credit Hour:3

Prerequisite: CSEg 1104

Course description (Synopsis):

The course covers the design, analysis, and implementation of data structures and algorithms to solve engineering problems. Topics include basic data structures such as arrays, stacks, queues, and lists and advanced data structures such as trees and graphs. The algorithms used to manipulate these structures, and their application to solving practical engineering problems.

Course category: Basic

Course Name: Probability and Random Processes (ECEg3103)

Credit Hour:3

Prerequisite: Maths1102

Course description (Synopsis):

Introducing some application area of probability and random processes and revising Set theory, Function, Factorial, Permutation and Combination. Basic concept of Probability Theory: Probability models and axioms, Conditional probability, total probability, Independence and Bayes' theorem. Random Variables, Probability Distributions and Densities function, Discrete and Continuous random variables, Gaussian Random Variable and Q-Function, Conditional Distribution and Density Function. Expectations, variances, moments, Expectation of a Function of Random Variable, Characteristic Function, Central Limit Theorem and Transformation of Random Variables. Two and more random variables and their joint distributions and densities. Random processes, Auto and cross correlation Functions, covariance, Stationary Random Processes, Ergodic Random Processes and Power Spectral Density Function. Introduction to parameter estimation and prediction.

Course category: Basic

Course Name: Electronics Circuits-1 (ECEg2201)

Credit Hour:4

Prerequisite: EPCE2101

Course description (Synopsis):

Introducing semiconductor devices, basic structure, principles and operations. Analysis of BJT and FET basic operation with i-v characteristics and small signal analysis of BJT and FET. Application of semiconductor devices, BJT, FET with real time examples. Frequency Response of BJT and FET and various coupling methods. Basic construction of Amplifiers with various biasing methods and its application.

Course category: Major Mandatory

Course Name: Electromagnetic Field (EPCE2202)

Credit Hour: 3

Prerequisite: Math2101

Course description (Synopsis):

This course is deals with: review of Vectors and vector fields, Electrostatic Fields, Electric Fields in Material Body, Electrostatic Boundary-Value Problems, Magnetostatic Fields, Magnetic Forces & Materials, Forces due to Magnetics and Introduction to Time Varying Electromagnetic Fields.

Course category: Major Mandatory

Course Name: Computational Method (EPCE2204)

Credit Hour: 3

Prerequisite: Math2101 and Fundamentals of Programming

Course description (Synopsis):

The course deals with the following major points: - Number system and numerical error analysis, review of matrices, solution of linear equation, solution of nonlinear equation, approximation and interpolation techniques, and numerical differentiation and integrations.

Course category: Major Mandatory

Course Name: Network Analysis and Synthesis (EPCE3201)

Credit Hour: 3

Prerequisite: Signals and Systems analysis

Course description (Synopsis):

The course deals with the following major points: - Introduction to Network Analysis and Synthesis, network transform representations and analysis, network functions for one port and two ports, properties of driving point functions and transfer functions, calculation of network functions, poles and zeros, time domain behavior from pole-zero plot, elements of realizability theory, synthesis of one port networks using two kinds of elements, two-port networks and the relationship between transfer functions using two-port parameters and interconnection of two-port parameter, basics of filters, filter approximation, insertion loss synthesis and synthesis of active and passive networks and filters.

Course category: Major Mandatory

Course Name: Electrical Workshop Practices (EPCE3203)

Credit Hour: 2

Prerequisite: EPCE2101

Course description (Synopsis):

The course deals with the following major points: - Workshop safety rules and precautions, common electric shocks and shock treatments, common electrical hand tools and measuring instruments, wiring materials and accessories, splicing, soldering, joining and termination, electrical wiring and PCB design.

Course category: Major Mandatory

Course Name: Introduction to Electrical Machines (EPCE3205)

Credit Hour: 4

Prerequisite: EPCE2202

Course description (Synopsis):

The course deals with the following major points: - Electromagnetic principles; Transformers; 3-Phase Induction motors; D.C Machines; Synchronous Machines.

Course category: Major Mandatory

Course Name: Power Electronics (EPCE3202)

Credit Hour:3

Prerequisite: Electronic circuits – II

Course description (Synopsis):

The course deals with the following major points: - Introduction to power electronics, an overview of different types of power semiconductor devices and their dynamic characteristics, operation and characteristics of controlled rectifiers, operation and switching techniques of DC-DC switching regulators, modulation techniques of PWM inverters, operation of AC voltage controller and cycloconverters.

Course category: Major Mandatory

Course Name: Introduction to Control Systems (EPCE3204)

Credit Hour:4

Prerequisite: EPCE3201

Course description (Synopsis):

The course deals with the following major points: - introduction to control system, control system modelling of physical system, time domain analysis of control systems, Root locus analysis, frequency domain analysis and classical controller design techniques.

Course category: Major Mandatory

Course Name: Introduction to Power Systems (EPCE3206)

Credit Hour:4

Prerequisite: EPCE3205

Course description (Synopsis):

The course deals with the following major points: - Introduces Fundamentals of power systems, Representation of power system components, Electrical design of transmission line, Mechanical design of transmission lines, Characteristic and performance of power transmission lines, Corona, Overhead line insulators, Underground cables.

Course category: Major Mandatory

Course Name: Power System Analysis (EPCE4201)

Credit Hour:3

Prerequisite: EPCE3206

Course description (Synopsis):

The course deals with the following major points: - Load/Power Flow analysis, Power flow solutions, Fault analysis, Power system transients, Power system stability, power system control and Economic Load Dispatch.

Course category: Major Mandatory

Course Name: Electrical Design of Building (EPCE4203)

Credit Hour:2

Prerequisite: EPCE3203

Course description (Synopsis):

The course deals with the following major points: - Introduction to Illumination, Design of electrical Installation, auxiliary electrical system design, grounding system and Testing, contracting electrical constructions.

Course category: Major Mandatory

Course Name: Industrial Wiring and Design (EPCE4205)

Credit Hour:2

Prerequisite: EPCE3203

Course description (Synopsis):

The course deals with the following major points: - basic principle of Industrial Wiring, Wiring of Relay Circuits, designing and winding of induction motors and small power transformer and troubleshooting and maintenance.

Course category: Major Mandatory

Course Name: Electrical Measurement & Instrumentation (EPCE4207)

Credit Hour:3

Prerequisite: Electronic Circuit II

Course description (Synopsis):

The course deals with the following major points: - basic concepts of Electrical measurement and instrumentation, instrumentation type and performance characteristics (static and dynamic), basic concepts of sensors and their application, calibration of measuring sensors and instruments, general principles of signal conditioning and conversion, signal processing elements, output presentation element and design some simple Measurement systems using different sensors, actuators and semiconductors.

Course category: Major Mandatory

Course Name: Modern Control Systems (EPCE4202)

Credit Hour:3

Prerequisite: EPCE3204

Course description (Synopsis):

The course deals with the following major points: - State space representation of control systems, analysis of system models in state space model, design and synthesize controllers in state space & optimal control system.

Course category: Major Mandatory

Course Name: Microcomputers and Interfacing (EPCE4204)

Credit Hour:3

Prerequisite: DLD

Course description (Synopsis):

The course deals with the following major points: - History and evolution of microprocessors, architecture of 8086 microprocessor, instruction set of 8086, Assembly language programming fundamentals, interfacing of memory, keyboard, display, I/O, stepper motor, A/D and D/A converter and timer to 8086 and introduction of 8051 microcontroller.

Course category: Major Mandatory

Course Name: Process Control Fundamentals (EPCE5201)

Credit Hour:4

Prerequisite: EPCE4202

Course description (Synopsis):

The course deals with the following major points: - basic principles & importance of process control in industrial process plants, Specification of the required instrumentation and final elements to ensure that well-tuned control system to be achieved, explain the use of block diagrams & the mathematical basis for the design of process control system. Designing and tuning of process (PID) controllers, software tools used for the modelling of plant dynamics and the design of well-tuned control loops, the importance and application of good instrumentation for the efficient design of process control loops for process engineering plants and the experimental implementation of advanced process control schemes and the methods for process monitoring and diagnosis.

Course category: Major Mandatory

Course Name: Engineering Research Methodology (EPCE5203)

Credit Hour:2

Prerequisite: None

Course description (Synopsis):

The course deals with the following major points: - introduction, research problem formulations, research design and data collection, interpretation and report writing and presentation skills.

Course category: Major Mandatory

Course Name: Semester Project (EPCE5205)

Credit Hour:2

Prerequisite: All previous Major courses

Course description (Synopsis):

This course focuses on semester project that addresses specific problem areas in the field of Electrical Power and Control Engineering. The students are given guides from their project advisor(s) to analysis and solve a problem.

Course category: Major mandatory

Course Name: BSc Project (EPCE5202)

Credit Hour:6

Prerequisite: All previous major courses

Course description (Synopsis):

This course enables students to enhance their problem-solving skills, all students must carry out an independent (to the possible extent) research project. The study should be Problem oriented, Community based, Scientifically and ethically acceptable, Feasible, and Action oriented.

Course category: Major mandatory

Course Name: General Physics (Phys1101)

Credit Hour:3

Prerequisite: Knowledge in Higher Secondary Physics

Course description (Synopsis):

At the end of this course students are expected to be acquainted with basic concepts in different branches of physics, identify the connection between them and explain the common phenomena. They will also develop skills of solving problems.

Course category: Major mandatory

Course Name: Signals and Systems Analysis (ECEg-2204)

Credit Hour:3

Prerequisite: Math2101

Course description (Synopsis):

This course deals with the analysis of continuous-time and discrete-time signals and systems. Topics include: representations of linear time-invariant systems, representations of signals, Laplace transform, transfer function, impulse response, step response, the convolution integral and its interpretation, Fourier analysis for continuous time signals and systems and an introduction to sampling.

Course category: Major mandatory

Course Name: Digital Logic Design (ECEg3201)

Credit Hour:4

Prerequisite: ECEg2201

Course description (Synopsis):

In this course, students will study various digital logic families such as TTL, ECL, and CMOS, the logic gates under these families, and the electronic circuit techniques used to implement them. Subsequently, they will learn Boolean algebra, logic expressions, number systems and combinational logic design, including logic minimization and hazards. In addition, with the understanding of combinational logic design, students will learn how to design sequential systems, including analysis of the behavior of synchronization elements and system timing

design. Finally, in this course, students will have hands-on design experiences by carrying out experiments with component-level devices and designing digital systems.

Course category: Major elective

Course Name: Energy Conversion Engineering (EPCE4301)

Credit Hour:3

Prerequisite: EPCE3206

Course description (Synopsis):

The course deals with the following major points: - Overview of thermodynamics, Thermal power plants, Hydropower plants, nuclear power plants, Basics of Solar energy, Biomass energy, Geothermal energy, Ocean and Wave energy and overview of Energy Storage devices.

Course category: Major Elective

Course Name: Electrical Materials and Technology (EPCE3301)

Credit Hour:3

Prerequisite: Applied Modern Physics

Course description (Synopsis):

The course deals with the following major points: - Introduction to Electrical Engineering Materials. Review of atomic theory; Physical properties of conductors, superconductors, semiconductors, dielectrics, magnetic and optic materials and manufacturing processes and application areas of electrical and electronic engineering materials.

Course category: Major elective

Course Name: Electrical Machines II (EPCE4303)

Credit Hour:3

Prerequisite: EPCE3205

Course description (Synopsis):

The course deals with the following major points: - Working principles, performance characteristics and design aspects of various types of electrical machines.

Course category: Major elective

Course Name: Programmable Logic Controller and Robotics (EPCE4302)

Credit Hour:3

Prerequisite: EPCE4202

Course description (Synopsis):

The course deals with the following major points: - Review of Industrial Control Devices and Circuits; Basic Ladder Logic and Control; Programmable Logic Controllers and Applications; Robot Fundamentals; Mechanisms and Actuators, Sensors and Detectors; Modeling and Control of Manipulators; Robot Applications and Programming.

Course category: Major elective

Course Name: Electrical Power Transmission and Distribution Engineering (EPCE4304)

Credit Hour:3

Prerequisite: EPCE4201

Course description (Synopsis):

The course deals with the following major points: - Substation, substation layouts and design considerations, distribution system, classification of distribution system, EHV and HVDC transmission system, Flexible AC transmission systems, FACTS devices.

Course category: Major elective

Course Name: Introduction to Electrical Vehicle and Traction (EPCE4306)

Credit Hour:3

Prerequisite: EPCE3202

Course description (Synopsis):

This course deals about Introduction to Electric Vehicle, Electric Vehicle Drivetrains, Electric Vehicle Propulsion unit, Energy Storage, Electric Vehicles charging station, Sizing the drive system.

Course category: Major elective

Course Name: Advanced Instrumentation (EPCE4308)

Credit Hour:3

Prerequisite: EPCE4207

Course description (Synopsis):

The course deals with the following major points: - advanced instrumentation concepts that includes review of instrumentation and standards, detection and conversion of various industrial variables, applications of instrumentation and introduction to intelligent instruments.

Course category: Major elective

Course Name: Hydropower Engineering (EPCE4310)

Credit Hour:3

Prerequisite: EPCE3206

Course description (Synopsis):

The course deals with the following major points: - Introduction to hydroelectric generation, classification of hydropower plants and development process, hydropower plant components, Dams and spillways, hydropower plant electrical systems, hydropower turbines.

Course category: Major elective

Course Name: Power System Protection and Control (EPCE5301)

Credit Hour:3

Prerequisite: EPCE4201

Course description (Synopsis):

This course deals with the Introduction of power system protection schemes, Fuses and circuit breaker, it also tries to assess the concept of automatic generation control and voltage control, finally it will discuss how to perform power system reliability and security analysis.

Course category: Major elective

Course Name: Embedded System (EPCE5305)

Credit Hour:3

Prerequisite: EPCE4204

Course description (Synopsis):

This course deals about Introduction to embedded and real time system, architecture of different embedded microcontrollers, programming of embedded 8051 microcontrollers, design of specific application wise embedded system: I/O, memory serial communication, hardware and software interrupts, and introduction to real time operating system.

Course category: Major elective

Course Name: Introduction to Mechatronics (EPCE5307)

Credit Hour:3

Prerequisite: EPCE4204

Course description (Synopsis):

This course Introduces technologies involved in mechatronics (Intelligent Electro-Mechanical Systems) and the techniques necessary to apply this technology to mechatronic system design. The topics includes but not limited to the following; electronics A/D, D/A converters, op-amps, filters, power devices; software program design, event-driven programming; hardware and DC Stepper Motors, solenoids, and robust sensing. Lab component of structural assignments and open-ended team project.

Course category: Major elective

Course Name: Introduction to Intelligent Controllers (EPCE5309)

Credit Hour:3

Prerequisite: EPCE3204

Course description (Synopsis):

This course provides an overview and fundamentals of intelligent control systems (Neural Networks and Fuzzy logic)), which includes a wide range of real time engineering applications. Also covers intelligent auto tuning of controller with evolutionary techniques, ANFIS system.

Course category: Major elective

Course Name: Power System Planning and Operation (EPCE5302)

Credit Hour:3

Prerequisite: EPCE4201

Course description (Synopsis):

The course power system planning and operation consists the following main focus areas Load Forecasting, Power system planning and design, Power system operation, Generation system cost analysis and optimization and security.

Course category: Major elective

Course Name: Fundamental of Electric Drives (EPCE5304)

Credit Hour:3

Prerequisite: EPCE3202

Course description (Synopsis):

This course will try to discuss about Introduction to electric drives, and the Characteristics of Electric Drives, beside this it will tries to explain Dc-Drives, Ac-Drives and Closed-loop Control of Electric Drives/Power-electronic systems.

Course category: Major elective

Course Name: Digital Control Systems (EPCE53064)

Credit Hour:3

Prerequisite: EPCE4202

Course description (Synopsis):

This course deals about introduction to digital control system, stability, modeling and analysis of digital control systems, MATLAB application and computer implementation using digital control system components such as DAC, ADC, microcontrollers, sensors, etc. and design digital control system using different techniques and implementation for common servo applications and etc.

Course category: Major elective

Course Name: Introduction to Biomedical Engineering (EPCE5303)

Credit Hour:3

Prerequisite: EPCE4203

Course description (Synopsis):

Introduction to biomedical engineering subfields, Overview of organ systems, a physiological and anatomical principles, Simulation and modelling of medical instrumentation and physiological systems, Origins of bioelectric phenomena and their measurement, Biomedical sensors and instrumentation, Tissue stimulation, Biomedical signal processing and Biomechanical, biomaterials, and regulatory considerations for medical instrumentation.

Course category: Major elective

Course Name: Digital Signal Processing (ECEg3205)

Credit Hour:3

Prerequisite: ECEg2204

Course description (Synopsis):

Introducing the development of analytical representation and design of discrete time signals and systems. Discussing the Analysis of discrete time signals and systems in time domain and transform domains. ADC and DAC, Sampling theorem, Sampling Rate conversion, Aliasing, LTI signals and systems, Discrete time Fourier Transform, Fast Fourier Transform, Z-transform, and analysis and design of digital filters.

Course category: Major elective

Course Name: Introduction to Communication Systems (ECEg-3202)

Credit Hour:4

Prerequisite: ECEg2202

Course description (Synopsis):

This course introduces about basic of an analog communication system, analysis of AM and angle modulation signals in time and frequency domain, modulation and demodulation technique of linear AM, DSB, SSB, VSB signal and nonlinear modulation techniques such as PM and FM, various types of noises and its mathematical representation, Effect of noise on AM and FM receiver and comparative performance of between AM and FM system.

Course category: Major elective

Course Name: Computer Architecture and Organization (ECEg4201)

Credit Hour:3

Prerequisite: ECEg3201

Course description (Synopsis):

This course focus on: Computer Arithmetic; The Central Processing Unit: Architecture and Instruction Set; Instruction Format and Addressing Modes; Register Transfer Descriptions; Organization of the Arithmetic and Logic Unit; The Control Unit Realization: Hardwired and Micro programmable; The Memory Hierarchy and Memory Management; Input Output Devices; Software of a Computer System; Design of a Small Computer System Testing.

2.4 Software Engineering program

General information

I. Duration of study

Normal modality

Regular: a 5-year program

Continuing: 5-8year program

Dual major/manor: 6 year

Fast Track modality: may finish before ten semesters and delayed students may finish after ten semesters.

II. Course category

No	Course Category		Course level	Credit Requirement	Percentage
1	General	Mandatory	University required	27	15%
2	Basic	Mandatory	School required	47	26.1%
	Major	Mandatory	Department required	70	38.9%
		Elective		33	18.3%
3	Free Electives			3	1.7%
Total				180	100%

Course category: General/ university required

Course Name: Entrepreneurship and Business Development (SOSC5003)

Credit Hour: 3

Prerequisite: None

Course description (Synopsis):

This interdisciplinary course in general is designed to introduce students to the concept of sustainable entrepreneurship, a manageable process that can be applied across careers and work settings. It focuses on building entrepreneurial attitudes and behaviours that will lead to creative solution within community and organizational environments. This course is designed to prepare individuals for ownership of their own innovative business, and assist start-ups to function more effectively, increase the chances of new business success, enhance profitability, and increase employment.

More specifically, the course provides students with an introduction to the concepts and skills necessary to successfully commercialize new products and services. Entrepreneurship is not just about starting a business. It is also about identifying good opportunities and then creating, communicating, and capturing value from those opportunities; including innovation in a corporate context. It will also teach students the skills to analyse business opportunities, and articulate them as a compelling business description, and pitch to an audience of investors, customers, or business partners. It focuses on building entrepreneurial attitudes and behaviours that will lead to creative solution within community and organizational environments.

Course category: General/ university required

Course Name: Communicative English Skills (EnLa 1001)

Credit Hour: 3

Prerequisite: None

Course description (Synopsis):

Communicative English Skills is a course where students learn what they need to know for a career in science context. The course gives students the language, information, and skills they need to study science context. It also provides students the language appropriate for studying science context and real work situations as it comprises unique sections such as: ‘it’s my job’ wherein real people talk about their work in science context , ‘listening’ whereby students are exposed to situations related to science context , technical explanations, and interviews, ‘reading’ whereby students meet a variety science context based texts, and the ‘writing section’ which is designed to let students compose short reports on different activities.

Course category: General/ university required

Course Name: Basic Writing Skills (EnLa-1002)

Credit Hour: 3

Prerequisite: Communicative English Skills (EnLa 1001)

Course description (Synopsis):

Basic Writing Skills course aims at developing students’ basic writing skills in science context. The course gives students the language writing skills they need to study science. It contains sentence level writing: sentence structure, sentence types sentence combinations, common sentence errors (fragment, run on, comma splices, misplaced modifier, dangling modifier, faulty parallelism, faulty reference of pronoun, faulty agreement and shifts); paragraph level writing: the essence of a paragraph, components of a paragraph (topic sentence, supporting sentences, concluding sentence), characteristics of effective paragraph (unity, coherence and completeness) and the steps in writing a paragraph and types of a paragraph; essay level writing: structure of an essay, thesis statement and supporting paragraphs, types of essays and techniques of essay development.

Course category: General/ university required

Course Name: Introduction to Civics and Ethics (LART 1001)

Credit Hour: 3

Prerequisite: None

Course description (Synopsis):

This course is designed for undergraduate students with the aim of familiarizing learners to the essence of ethics and citizenship rights and responsibilities. It will help students to acquire a necessary ethical qualities and civic competences while dealing with issues that affect their society at all levels, country and human in general. The course starts with unfolding the notions, principles and theories of ethics which can shape our attitude, action and behavior in making moral judgment. Next, the course introduces learners to the nature, mutual interactions and historical evolutions of society, state, government and citizenship. It also elucidates issues pertaining to political governance such as constitution, democracy, and human rights in some details. To enable learners grasp basic knowledge of political, economic and social dynamics of international system in today's globalized world, the course also introduces international relations and foreign policy and other major contemporary global issues. In light of this, the course does not present mere theoretical knowledge, but also practical knowledge of accentuating art of governing and protecting national interest in today's complex world.

Course category: General/ university required

Course Name: Logic and Critical thinking (LART 1002)

Credit Hour: 3

Prerequisite: None

Course description (Synopsis):

The main goal of the course is to improve critical and logical reasoning skills. Students will see how our ordinary intuitions on good or bad reasoning can be articulated explicitly in formal systems, and gain a new ability to evaluate arguments and reasoning they encounter every day with rigorous logical concepts and tools. As to the subject matter, it introduces systematic methods of reasoning, such as argument, deduction, induction, syllogistic, and propositional logic.

Course category: General/ university required

Course Name: Introduction to Economics (SOSC2002)

Credit Hour: 3

Prerequisite: None

Course description (Synopsis):

This course provides a general introduction to economics combining elements of micro and macro fundamentals. The main objective of this course is to introduce and acquaint students with the preliminary principles (theories) and knowledge of economics and the application of economic theories (principles) in the actual world; the daily activities of the households, firm business or any other form of enterprises at micro levels. Students will also be able to contextualize the key macroeconomic variables and policy instruments.

Specifically, the course introduces students with theory of consumer behaviors, production, and cost of production. In these theories how decisions are made by different economic agents will be discussed. Furthermore, the course covers different characteristics of perfect and imperfect market structure. Lastly the course tries to introduce basic macroeconomic concepts such as national income accounting, unemployment, inflation, fiscal and monetary policy instruments.

Course category: General/ university required

Course Name: General Psychology and Life Skills (LART 2002)

Credit Hour: 3

Prerequisite: None

Course description (Synopsis):

Psychology is a science of human cognitive processes and behaviors. This course is designed to give students an overview of what psychological science has discovered about human behaviors and mental processes throughout human history. Students will gain an understanding of the psychological phenomena that occur in daily life as well as the practical applications of psychological knowledge. Upon completing the course, students shall be able to demonstrate a basic knowledge of the science of psychology. Specifically, the course general psychology is concerned with discussing perspectives in psychology and basic psychological concepts such as sensation and perception, learning, personality, motivation, emotion, and basic life skills (intrapersonal, interpersonal, social and academic skills). Emphasis will be given to both theoretical and practical implications of these concepts to effectively function as individual and team in a community.

Course category: General/ university required

Course Name: Physical Fitness and Conditioning I (SPSc 1011)

Credit Hour: 0 cr.hr

Prerequisite: None

Course description (Synopsis):

This course will provide the students with basic concepts of the five components of health-related physical fitness (cardiovascular, muscular strength and endurance, flexibility, and body composition), hypokinetic disease and general principles of training. It is mainly practical oriented. As a result, the students will be exposed to various exercise modalities, sport activities, minor and major games, and various training techniques as a means to enhance health related physical fitness components. In addition, they will develop the skills to assess each component of fitness and will practice designing cardiovascular, muscular strength and endurance, and flexibility programs based on the fitness assessment. The course serves as an introduction to the role of exercise in health promotion, fitness, performance including the acute and chronic responses of the body to exercise.

Course category: General/ university required

Course Name: Physical Fitness and Conditioning II(SPSc 1022)

Credit Hour: 0 cr.hr

Prerequisite: SpSc 1011

Course description (Synopsis):

This course is designed to acquaint freshman engineering and applied natural science students with the nature and scope of different ball games.

It emphasizes the value of establishing lifelong fitness using ball games as a means and focuses on the fundamental of volley ball, hand ball, basketball and football as a life time leisure activity also focuses on the development of personalized approach to healthy active living through participation in a variety of ball games that have the potential to engage students' interest throughout their lives. Again, the courses enable the participants enjoying practice and acquire proper technique and strategies associated with the ball games mentioned above and learn rules governing the game.

Course category: General/ university required

Course Name: Geography of Ethiopia and the Horn (LART 1003)

Credit Hour: 3

Prerequisite: None

Course description (Synopsis):

This course covers a brief description on the location, shape and size of Ethiopia as well as basic skills of reading map, the physical background and natural resource endowment of Ethiopia and the Horn which includes its geology and mineral resources, topography, climate, drainage and water resources, soil, fauna and flora. It also deals with the demographic characteristics of the country and its implications on economic development.

Course category: General/ university required

Course Name: History of Ethiopia and the Horn (LART 1004)

Credit Hour: 3

Prerequisite: None

Course description (Synopsis):

This course describes why history is important, how history is studied and introduces the region Ethiopia and the Horn. It treats human evolution, Neolithic Revolution, settlement patterns as well as religion and religious processes in Ethiopia and the Horn. Based on these historical backgrounds, the course describes states, external contacts, economic formations and achievement in terms of architecture, writing, calendar, and others to the end of the 13th century. Historical processes including states formation and power rivalry, trade, external relation, threats and major battles, centralization and modernization attempts, Italian occupation, and socio-economic conditions from 1800 to 1941 makes central position in the modern history of the region.

Course category: Basic

Course Name: Applied Mathematics I(Math1101)

Credit Hour: 4

Prerequisite: None

Course description (Synopsis): This course covers vectors, matrices & determinants, limit and continuity, derivatives & their applications, integrals, integration techniques and their applications.

Course category: Basic

Course Name: Applied Mathematics II (Math 1102)

Credit Hour: 4

Prerequisite: Applied Mathematics I (Math 1101)

Course description (Synopsis):

This course covers sequences, series, power series, Fourier series differential and integrals calculus of functions of several variables and their applications.

problems. This course covers integer programming, deterministic dynamic programming, inventory models, forecasting models, decision making, Queuing Theory, and Simulation Models.

Course category: Basic

Course Name: Applied Mathematics –III (Math2101)

Credit Hour: 4

Prerequisite: Applied Mathematics-II

Course description (Synopsis):

This course covers the topics in First order ordinary Differential Equation, second order ordinary Differential Equation, Laplace transforms and its application, scalar and vector fields and complex analytic function.

Course category: Basic

Course Name: General Physics (Phys1101)

Credit Hour: 4

Prerequisite: Knowledge in Higher Secondary Physics

Course description (Synopsis):

At the end of this course students are expected to be acquainted with basic concepts in different branches of physics, identify the connection between them and explain the common phenomena. They will also develop skills of solving problems.

Course category: Basic

Course Name: Probability and Statistics for Engineers (Math2105)

Credit Hour: 3

Prerequisite: None

Course description (Synopsis):

This is include: History of statistics, Meaning of statistics; Methods of data collection; Methods of data presentation; Measures of location; Measures of variation; Moments, skewness and kurtosis; terminologies in probability; Counting Techniques; definition of Probability (approaches to probability); Probability distributions; Sampling and Sampling Distribution of the mean and proportion; Elementary description of the tools of statistical inference: Basic concepts; Estimation: (Point and Interval) for the population mean and proportion; Hypothesis testing on the population mean and proportion; Simple linear regression, correlation and rank correlation.

Course category: Basic

Course Name: Introduction to Emerging Technologies (CSEg1102)

Credit Hour: 3

Prerequisite: None

Course description (Synopsis):

This course will enable students to explore current breakthrough technologies in the areas of Artificial Intelligence, Internet of Things and Augmented Reality, Data Science and other technologies that have emerged over the past few years. Besides helping learners become literate in emerging technologies, the course will prepare them to use technology in their respective professional preparations.

Course category: Basic

Course Name: Introduction to Computing (CSEg 1101)

Credit Hour: 3

Prerequisite: None

Course description (Synopsis):

In this course the basic techniques of computational problem solving will be covered by using computational thinking while writing small and medium sized programs, mapping problems into computational frameworks emphasizing on scientific problems, understanding problems and formulation of problems based on the elective programming language (using python). The course includes the concepts and techniques of data structure, input/output, flow control and incidental program, and by using a systematic division of problem solution and concept of module, to solve problems in numerical value field and non-numerical value field with program experiment.

Course category: Basic

Course Name: Fundamentals of Programming (CSEg1104)

Credit Hour: 3

Prerequisite: Introduction to Computing

Course description (Synopsis):

The course is designed to introduce structured programming in C++ by providing an overview of programming concepts, on creating and working computer programs in C++. It will address fundamental concepts of program analysis, design, coding, testing and development. It includes introduction to computer programming; programming paradigms; algorithms and problem-solving; introduction to data structures and Programming constructs. The course is designed on how to solve business and scientific problems through the technique of structured programming. It will prepare students for focused studies in any programming language.

Course category: Basic

Course Name: Data Structures and Algorithms (CSEg 2101)

Credit Hour: 3

Prerequisite: CSEg 1104

Course description (Synopsis):

The course covers the design, analysis, and implementation of data structures and algorithms to solve engineering problems. Topics include basic data structures such as arrays, stacks, queues, and lists and advanced data structures such as trees and graphs. The algorithms used to manipulate these structures, and their application to solving practical engineering problems.

Course category: Major Elective

Course Name: Software Requirement Engineering (SEng3201)

Credit Hour: 3

Prerequisite: Fundamentals of Software Engineering

Course description (Synopsis):

The course will discuss concepts for systematically establishing, defining and managing the requirements for a large, complex, changing and software-intensive systems, from technical, organizational and management perspectives. This course introduces students to the process of requirements engineering and helps them understand important issues in requirements engineering. It will also help them to learn and apply the RE concepts for elicitation, specification, modeling and analysis of software requirements.

Course category: Major Elective

Course Name: Software Architecture and Design (SEng3204)

Credit Hour: 3

Prerequisite: Software Requirements engineering (SEng3201)

Course description (Synopsis):

In this course, An in-depth look at the software design. Continuation of the study of design patterns, frameworks, and architectures. Survey of current middleware architectures and technologies. Design of a new systems using middleware. Component based design. Measurement theory and appropriate use of metrics in design. Designing for qualities such as performance, safety, security, reusability, reliability, etc. Measuring internal qualities and complexity of software.

Course category: Major Elective

Course Name: Software Testing and Quality Assurance (SEng4201)

Credit Hour: 3

Prerequisite: SEng3201 Software Requirements engineering

SEng3204 - Software Design and Architecture

Course description (Synopsis):

This course gives fundamental concepts of software testing on a new software development through software quality assurance methods and principles in order to produce reliable, cost effective and scalable software product that meet users need and organizational standards.

Course category: Major Elective

Course Name: Software Process and Project Management (SEng4204)

Credit Hour: 3

Prerequisite: SEng3201-Software Requirement Engineering

SEng3204 -Software design and architecture

Course description (Synopsis):

This course will introduce the area of software engineering processes is concerned with software process definition, software life cycles, software process assessment and improvement, software measurement, and software engineering process tools and presenting basic software project management techniques and approaches and aiming to develop a critical awareness of the challenges and shortcomings of the area. Software Process and Project Management is an important area of study since most non-trivial software development efforts will be making use of some type of project management approach in an aim to manage the development process in such a way that the Software meets its requirements and is on-time and within budget.

Course category: Major Elective

Course Name: Software Evolution and Maintenance (Seng 4203)

Credit Hour: 3

Prerequisite: Fundamentals of Software Engineering(SEng2206)

Course description (Synopsis):

This course is an introduction to the main issues related to software systems aging and evolution. It examines some of the available methods and technologies for software reverse engineering and reengineering as well as some of the managerial and planning issues specific to software reengineering projects. This course explores the foundations of software maintenance by introducing several challenges linked to software evolution along with support tools to approach them.

Course category: Major Elective

Course Name: Programming Under Unix (SEng4205)

Credit Hour: 3

Prerequisite: SEng2202

Course description (Synopsis):

The course introduces the use of the UNIX/Linux operating system and its utilities for program development, maintenance, and debugging. It utilizes advanced programming techniques utilizing procedural and object-oriented programming. Topics to be covered include basic operating system concepts, effective command line usage, shell programming, C and python language, programming development tools, system programming, network programming (client-server model and sockets). Design and implementation of a comprehensive programming project is required.

Course category: Major Elective

Course Name: Fundamental of Cloud and Edge Computing (SEng4308)

Credit Hour: 3

Prerequisite: SEng3202

Course description (Synopsis):

This course is both a practical and theoretical course. It introduces cloud computing components and architecture, service and deployment models, cloud usage scenario, virtualization, security in the cloud.

Course category: Major Elective

Course Name: Introduction to Big Data (SEng5302)

Credit Hour: 3

Prerequisite: Data Structures and Algorithms

Course description (Synopsis):

The course starts with Big Data basics and foundations, then moves to Big Data Platforms and Data Storage Solutions. It discusses different types of Big Data analytics algorithms that are commonly used to process and manipulate huge size of data (Big Data). It also includes Cloud Platforms Solutions available in the current market such as: Amazon Web Services (AWS), Google Cloud Platform, Microsoft Azure, IBM Bluemix, Pivotal Cloud Foundry, Yahoo Cloud Platform etc. In addition, it teaches fundamental techniques of streaming Big Data processing. The course also covers how to design and implement software systems that manage and organize large size data. Finally, Big data visualization techniques, and tools will be discussed.

Course category: Major Elective

Course Name: Introduction to Cyber Security (SEng5310)

Credit Hour: 3

Prerequisite: Computer Systems Security (SEng 5203)

Course description (Synopsis):

This course provides a basic understanding of full-spectrum cyberspace operations, the complexities of the cyberspace environment, as well as planning, organizing, and integrating cyberspace operations. The course will consist of presentations and exercises that will teach students how to develop a cyber-operations design and bring it to fruition. At the conclusion of the course, students will have a fundamental understanding of how to analyze, plan for, and execute cyberspace operations. This course, founded on concept operations and real cyber capabilities, provides students with the understanding, tools, and processes needed to conduct malware analysis with real-world malicious code samples to dissect. Students will be able to prepare and plan an effective offensive and defensive strategy, as well as evaluate covert protocols. Analysis of system specific, nondescript tools will be introduced to aid in attack and defense.

Course category: Major Elective

Course Name: Component based Software Development (SEng5305)

Credit Hour: 3

Prerequisite: Software Architecture and Design (SEng3204)

Course description (Synopsis):

Instead of building monolithic systems from scratch, Component-based Software Development (CBD) aims to construct systems by assembling ready-made components, and thereby reduce production cost and time-to-market, whilst increasing software reuse. The cornerstone of a CBD approach is the underlying component model, which defines what components are and how they can be composed. In this course, we will study current component models and how they measure up to the goals of CBD.

Course category: Major Elective

Course Name: Introduction to Software Integration and Engineering (SEng5204)

Credit Hour: 3

Prerequisite: Fundamentals of Software Engineering (SEng 2206)

Course description (Synopsis):

This course studies the process of integrating different systems and software applications by examining current and emerging trends, strategies, and techniques for developing systems integration solutions effectively. Example topics covered include, but are not limited to: documenting integration requirements using business process models, designing integration solutions reusing patterns, and implementing integration solutions using service-oriented architecture.

Course category: Major Elective

Course Name: Digital Forensics (SEng5306)

Credit Hour: 3

Prerequisite: Fundamentals of Software Engineering (SEng 2206)

Course description (Synopsis):

This course provides an introduction to the methodology and procedures associated with digital forensic analysis. Students will be introduced on creating and preserving digital evidence, data recovery and evidence collection algorithms, evidence construction and reconstruction, methods for certifying evidence, storing evidence, data acquisition, forensic analysis algorithms, image files, network forensics, logging methods to trace back attacks and digital trails, e-mail investigations. This course will incorporate demonstrations and laboratory exercises to reinforce practical applications of course instruction.

Course category: Major Elective

Course Name: Introduction to Cyber Security (SEng5310)

Credit Hour: 3

Prerequisite: Computer Systems Security (SEng 5203)

Course description (Synopsis):

This course provides a basic understanding of full-spectrum cyberspace operations, the complexities of the cyberspace environment, as well as planning, organizing, and integrating cyberspace operations. The course will consist of presentations and exercises that will teach students how to develop a cyber-operations design and bring it to fruition. At the conclusion of the course, students will have a fundamental understanding of how to analyze, plan for, and execute cyberspace operations. This course, founded on concept operations and real cyber capabilities, provides students with the understanding, tools, and processes needed to conduct malware analysis with real-world malicious code samples to dissect. Students will be able to prepare and plan an effective offensive and defensive strategy, as well as evaluate covert protocols. Analysis of system specific, nondescript tools will be introduced to aid in attack and defense.

Course category: Major Elective

Course Name: Component based Software Development (SEng5305)

Credit Hour: 3

Prerequisite: Software Architecture and Design (SEng3204)

Course description (Synopsis):

Instead of building monolithic systems from scratch, Component-based Software Development (CBD) aims to construct systems by assembling ready-made components, and thereby reduce production cost and time-to-market, whilst increasing software reuse. The cornerstone of a CBD approach is the underlying component model, which defines what components are and how they can be composed. In this course, we will study current component models and how they measure up to the goals of CBD.

Course category: Major Elective

Course Name: Introduction to Software Integration and Engineering (SEng5204)

Credit Hour: 3

Prerequisite: Fundamentals of Software Engineering (SEng 2206)

Course description (Synopsis):

This course studies the process of integrating different systems and software applications by examining current and emerging trends, strategies, and techniques for developing systems integration solutions effectively. Example topics covered include, but are not limited to: documenting integration requirements using business process models, designing integration solutions reusing patterns, and implementing integration solutions using service-oriented architecture.

Course category: Major Elective

Course Name: Digital Forensics (SEng5306)

Credit Hour: 3

Prerequisite: Computer Systems Security (SEng 5203)

Course description (Synopsis):

This course provides an introduction to the methodology and procedures associated with digital forensic analysis. Students will be introduced on creating and preserving digital evidence, data recovery and evidence collection algorithms, evidence construction and reconstruction, methods for certifying evidence, storing evidence, data acquisition, forensic analysis algorithms, image files, network forensics, logging methods to trace back attacks and digital trails, e-mail investigations. This course will incorporate demonstrations and laboratory exercises to reinforce practical applications of course instruction.

Course category: Major Elective

Course Name: Agile and Test-Driven Development (SEng5304)

Credit Hour: 3

Prerequisite: SEng3204

Course description (Synopsis):

This course introduces the principles and practice of agile software development methodologies for small to medium sized software projects. Through building a significant software system in a team, and reflecting critically on this experience, students will further their understanding of how the software engineering process used affects the development and delivery of software. The course will cover various agile methods which includes Scrum, extreme programming (XP), test driven development (TDD), Kanban... in this courses student also apply agile methodologies like planning and estimation techniques by implementing software project.

Course category: Major Elective

Course Name: *Software Requirement Engineering (SEng3201)*

Credit Hour: 3

Prerequisite: Fundamentals of Software Engineering

Course description (Synopsis):

The course will discuss concepts for systematically establishing, defining and managing the requirements for a large, complex, changing and software-intensive systems, from technical, organizational and management perspectives. This course introduces students to the process of requirements engineering and helps them understand important issues in requirements engineering. It will also help them to learn and apply the RE concepts for elicitation, specification, modeling and analysis of software requirements.

Course category: Core Module

Course Name: *Formal Methods in Software Engineering (SEng3203)*

Credit Hour: 3

**Prerequisite: SEng2102 Fundamentals of Software Engineering and
basic understanding of logic and discrete structures**

Course description (Synopsis):

This course introduces to Formal Methods used in software engineering. It discusses elements of discrete mathematics, formal mechanisms for specifying and verifying the correctness, reliability and efficiency of software systems. Explains how formal methods can help to eliminate errors early in the design process. The topics initially revise basic mathematical concept like proposition, predicates, sets, series or sequences and mathematical proofs. Then, it use these concepts and techniques to and demonstrate how specification can be scrutinized using the Formal Methods. It also focuses on formal specification methods and techniques of software application development that are used to confirm the correctness of the software being developed.

Course category: Major mandatory

Course Name: Object Oriented Programming (SEng2202)

Credit Hour: 3

Prerequisite: CSE1102 (Fundamental of Programming)

Course description (Synopsis): In this course, the students will learn the concepts of object-oriented programming and solving problems in object-oriented programming language. The course begins with comparison of structural programming paradigm with object-oriented paradigm, a brief review of control structures and data types with emphasis on structured data types and array processing. It then moves on to introduce the object-oriented programming paradigm, focusing on the definition and use of classes and objects, Inheritance, Package and Interface, Exception Handling, File I/O, GUI and Multithreading.

Course category: Major mandatory

Course Name: Computer Architecture & Organization (SEng2204)

Credit Hour: 3

Prerequisite: ECE3204 (Digital Logic Design)

Course description (Synopsis):

This course aims to provide a strong foundation for students to understand modern computer system architecture and to apply these insights and principles to future computer designs. The course is structured around the three primary building blocks of general-purpose computing systems: processors, memories, and networks. The first half of the course focuses on the fundamentals of each building block. Topics include instruction set architecture; single-cycle, FSM, and pipelined processor microarchitecture; direct mapped vs. set-associative cache memories; memory protection, translation, and virtualization; FSM and pipelined cache microarchitecture; cache optimizations; network topology and routing; buffer, channel, and router microarchitecture; and integrating processors, memories, and networks. The second half of the course delves into more advanced techniques and will enable students to understand how these three building blocks can be integrated to build a modern shared-memory multicore system. Topics include superscalar execution, out-of-order execution, register renaming, memory disambiguation, branch prediction, and speculative execution; multithreaded, VLIW, and SIMD processors; non-blocking cache memories; and memory synchronization, consistency, and coherence. Students will learn how to evaluate design decisions in the context of past, current, and future application requirements and technology constraints.

Course category: Major mandatory

Course Name: Engineering Research and Development Methodology (SEng4206)

Credit Hour: 2

Prerequisite: none

Course description (Synopsis):

The course deals with the following major points: - introduction, research problem formulations, research design and data collection, interpretation and report writing and presentation skills.

Course category: Major mandatory

Course Name: Fundamentals of Software Engineering (SEng2206)

Credit Hour: 3

Prerequisite: Explain well-known software development process models.

Course description (Synopsis):

This course deals with principles of software engineering: requirements, design and testing. Reviews the principles of object orientation: object-oriented analysis using UML, Frameworks and APIs. Introduction to the client-server architecture. Analysis, design and programming of simple servers and clients. Introduction to user interface technology.

Course category: Major mandatory

Course Name: Fundamentals of Software Engineering (SEng2206)

Credit Hour: 3

Prerequisite: Explain well-known software development process models.

Course description (Synopsis):

This course deals with principles of software engineering: requirements, design and testing. Reviews the principles of object orientation: object-oriented analysis using UML, Frameworks and APIs. Introduction to the client-server architecture. Analysis, design and programming of simple servers and clients. Introduction to user interface technology.

Course category: Major mandatory

Course Name: Engineering Web Based System (SEng3202)

Credit Hour: 3

Prerequisite: SEng1102

Course description (Synopsis):

This course introduces to the discipline of web Engineering including the principles, methods and techniques used in web-based system development so as to produce high-quality software applications for the distributed, client-server context of the Web. Emphasis is on architectural designs, methods, models, language and data access methods that are common in Web-based systems. In addition, the course introduces web service concepts.

Course category: Major mandatory

Course Name: Formal Methods in Software Engineering (SEng3203)

Credit Hour: 3

Prerequisite: SEng2102 Fundamentals of Software Engineering and

basic understanding of logic and discrete structures

Course description (Synopsis):

This course introduces to Formal Methods used in software engineering. It discusses elements of discrete mathematics, formal mechanisms for specifying and verifying the correctness, reliability and efficiency of software systems. Explains how formal methods can help to eliminate errors early in the design process. The topics initially revise basic mathematical concept like proposition, predicates, sets, series or sequences and mathematical proofs. Then, it use these concepts and techniques to and demonstrate how specification can be scrutinized using the Formal Methods. It also focuses on formal specification methods and techniques of software application development that are used to confirm the correctness of the software being developed.

Course category: Major mandatory

Course Name: Software Architecture and Design (SEng3204)

Credit Hour: 3

Prerequisite: Software Requirements engineering (SEng3201)

Course description (Synopsis):

In this course, An in-depth look at the software design. Continuation of the study of design patterns, frameworks, and architectures. Survey of current middleware architectures and technologies. Design of a new systems using middleware. Component based design. Measurement theory and appropriate use of metrics in design. Designing for qualities such as performance, safety, security, reusability, reliability, etc. Measuring internal qualities and complexity of software.

Course category: Major mandatory

Course Name: Operating Systems (SEng3207)

Credit Hour: 3

Prerequisite: Computer Organization and Architecture

Course description (Synopsis):

This course examines the important problems in operating system design and implementation. The operating system provides an established, convenient, and efficient interface between user programs and the bare hardware of the computer on which they run. The operating system is responsible for sharing resources (e.g., disks, networks, and processors), providing common services needed by many different programs (e.g., file service, the ability to start or stop processes, and access to the printer), and protecting individual programs from interfering with one another. The course will start with a brief historical perspective of the evolution of operating systems over the last fifty years and then cover the major components of most operating systems. This discussion will cover the tradeoffs that can be made between performance and functionality during the design and implementation of an operating system. Particular emphasis will be given to three major OS subsystems: process management (processes, threads, CPU scheduling, synchronization, and deadlock), memory management (segmentation, paging, swapping), and file systems; and on operating system support for distributed systems.

Course category: Major mandatory

Course Name: Advanced Programming (SEng3209)

Credit Hour: 3

Prerequisite: Object Oriented Programming

Course description (Synopsis):

This intensive hands-on course explores advanced Java language features and packages. Students will be able to take the content learned and immediately apply it to the problems encountered on the job. The course emphasis on Collections, Database Programming using JDBC, Object Serialization, Reflection and JAR files creation, Distributed Programming using Remote Method Invocation, and Server-side Web programming using Servlets and JSP.

Course category: Major mandatory

Course Name: Software Testing and Quality Assurance (SEng4201)

Credit Hour: 3

Prerequisite: SEng3201 Software Requirements engineering

SEng3204 - Software Design and Architecture

Course description (Synopsis):

This course gives fundamental concepts of software testing on a new software development through software quality assurance methods and principles in order to produce reliable, cost effective and scalable software product that meet users need and organizational standards.

Course category: Major mandatory

Course Name: Software Evolution and Maintenance (Seng4203)

Credit Hour: 3

Prerequisite: Fundamentals of Software Engineering (SEng2206)

Course description (Synopsis):

This course is an introduction to the main issues related to software systems aging and evolution. It examines some of the available methods and technologies for software reverse engineering and reengineering as well as some of the managerial and planning issues specific to software reengineering projects. This course explores the foundations of software maintenance by introducing several challenges linked to software evolution along with support tools to approach them.

Course category: Major mandatory

Course Name: Computer Systems Security (Seng4205)

Credit Hour: 3

Prerequisite: None

Course description (Synopsis):

This course covers fundamental issues and first principles of security and information assurance. The course will look at the security policies, models and mechanisms related to confidentiality, integrity, authentication, identification, and availability issues related to information and information systems. Other topics covered include basics of cryptography (e.g., digital signatures) and network security (e.g., intrusion detection and prevention), risk management, security assurance and secure design principles, as well as e-commerce security. Issues such as organizational security policy, legal and ethical issues in security, standards and methodologies for security evaluation and certification will also be covered.

Course category: Major mandatory

Course Name: Introduction to Artificial Intelligence (Seng4208)

Credit Hour: 3

Prerequisite: CSE 2206 Discrete Mathematics for Computer Science

Course description (Synopsis):

This course is an introductory course on Artificial Intelligence (AI) that presents an overview of AI principles and approaches. It will introduce the basic principles in artificial intelligence research, simple representation schemes, problem solving paradigms, constraint propagation, and search strategies. Areas of application such as knowledge representation, programming in logic, inference and reasoning mechanism, natural language processing, expert systems, vision and robotics will be explored. The PROLOG and others AI programming language will also be introduced.

Course category: Major mandatory

Course Name: Ethics and Professionalism in Computing (Seng5203)

Credit Hour: 2

Prerequisite: None

Course description (Synopsis):

This course explores ethical issues in the field of computing. Students will develop the skills needed to identify and analyze various ethical concerns. We will cover standard ethical concepts and theories, as well as standard methods of ethical analysis. I place a strong emphasis on practical application of the ethical process. This means that once you've learned the basics of ethical analysis, you'll apply that information to different scenarios. It's important to keep in mind that the field of ethics considers many different viewpoints. A good ethicist will fairly evaluate positions that may, on a personal level, be far outside his or her comfort zone. I expect you to become good ethicists! Your ethical analysis work will usually be in the form of an essay,

so you'll practice your writing skills at the same time that you practice your ethics skills. Initial writing assignments will work on grammar, punctuation, and sentence structure.

Course category: Major mandatory

Course Name: *Database Systems (SEng2208)*

Credit Hour: 4

Prerequisite: None

Course description (Synopsis):

A database system is a collection of data with its managements system. So, DB systems discusses an issue related with a data such as, approaches of compiling data/information, manipulating data, keeping data safely, accessing data, concurrent process and etc.

Course category: Major mandatory

Course Name: *Data Communication and Computer Networks (SEng3205)*

Credit Hour: 4

Prerequisite: None

Course description (Synopsis):

This course deals with basic concepts, principles and applications of data communication system. ISO OSI reference model for open system interconnection is used as the basis to discuss the functions and protocols of layered network structures. The course also introduces the evolution trends of networking technologies, various types of networks from LAN to WAN and internetworking architectures. Transmission Control Protocol / Internet Protocol (TCP/IP) will be discussed in detail.

Course category: Major mandatory

Course Name: *Mobile application Design and Development (SEng3206)*

Credit Hour: 3

Prerequisite: None

Course description (Synopsis):

This course introduces students to programming technologies, design and development related to mobile applications. Topics include accessing device capabilities, industry standards, operating systems, and programming for mobile applications using an OS Software Development Kit (SDK). Upon completion, students should be able to create basic applications for mobile devices.

Course category: Major mandatory

Course Name: *Programming Under Unix (SEng3208)*

Credit Hour: 3

Prerequisite: SEng2202

Course description (Synopsis):

The course introduces the use of the UNIX/Linux operating system and its utilities for program development, maintenance, and debugging. It utilizes advanced programming techniques utilizing procedural and object-oriented programming. Topics to be covered include basic operating system concepts, effective command line usage, shell programming, C and python language, programming development tools, system programming, network programming (client-server model and sockets). Design and implementation of a comprehensive programming project is required.

Course category: Major mandatory

Course Name: *Introduction to Software Integration and Engineering (SEng5204)*

Credit Hour: 3

Prerequisite: Fundamentals of Software Engineering (SEng 2206)

Course description (Synopsis):

This course studies the process of integrating different systems and software applications by examining current and emerging trends, strategies, and techniques for developing systems integration solutions effectively. Example topics covered include, but are not limited to: documenting integration requirements using business process models, designing integration solutions reusing patterns, and implementing integration solutions using service-oriented architecture.

Course category: Major mandatory

Course Name: Industry Internship I (SEng3200)

Credit Hour: 3

Prerequisite: SEng5201

Course description (Synopsis):

In industry internship students must be attached with an industry for two months in summer in order to get real world experience in their field of study, which compliments their education. Industry internship prepares graduates for careers as professional software engineers in areas such as system analysis and modeling, software system design, software systems architecture, software projects managements and control, and multidisciplinary programming solutions.

The training should be versatile and enables graduates to work in research, design, development, manufacturing, software quality control, marketing, sales and technical support, and as entrepreneurs, consultants and teachers.

Course category: Major mandatory

Course Name: Industry Internship □ II (Seng4200)

Credit Hour: 3

Prerequisite: SEng5201

Course description (Synopsis):

In industry internship students must be attached with an industry for two months in summer in order to get real world experience in their field of study, which compliments their education. Industry internship prepares graduates for careers as professional software engineers in areas such as system analysis and modeling, software system design, software systems architecture, software projects managements and control, and multidisciplinary programming solutions.

The training should be versatile and enables graduates to work in research, design, development, manufacturing, software quality control, marketing, sales and technical support, and as entrepreneurs, consultants and teachers.

The prerequisite for registration in the industry attachment program is successful completion of all semesters before the internship program.

At the end of their internship, the student and the internship coach at the industry have to submit a report on the attachment program, which is evaluated at the departmental committee with pass or fail grade. This comprehensive report duly be endorsed by the student's host company and assessed by predefined assessment criteria on the course of internship by assigned internship program evaluator (or university professors/lecturers). Students who cannot obtain a pass mark for the internship program will not be allowed to register for the next semester. Hence, they will be advised to repeat the semester with the next batch of students.

Course category: Major mandatory

Course Name: Senior Project I (SEng5201)

Credit Hour: 3

Prerequisite: al pervious course

This course focuses on development of requirement definitions, architectural design specification, detailed design specification, testing plan and documentation for the software and/or hardware components of a comprehensive software project. The students are given guides from their project advisor(s) to analysis and solve a problem.

Course category: Major mandatory

Course Name: Senior Project II (SEng5202)

Credit Hour: 3

Prerequisite: SEng5201

Course description (Synopsis):

This course is the continuation of Senior Project I where students are expected to implement software designed in the previous semester. Students are expected to convert software design specification into implementation using specified programming languages and tools, test and verify the software and prepare required documentation.

3. School of civil engineering and Architecture

3.1. Architecture program

General information

I. Duration of study

Normal modality

Regular: a 5-year program

Continuing: 6-year program

Fast Track modality:

dual major/minor there may be one year extension as stated in the university senate legislation.

II. Course category

NO	Course category	Course level	Credit requirement	Percentage from the total
1	General	Mandatory	University required	27
2	Basic	Mandatory	School required	29
3	Major	Mandatory	Department required	75
Elective	37			
Subtotal	112			
4	Free electives	6		
Total	174			

Course category: General/ university required

Course Name: Entrepreneurship and Business Development (SOSC5003)

Credit Hour: 3

Prerequisite: None

Course description (Synopsis):

This interdisciplinary course in general is designed to introduce students to the concept of sustainable entrepreneurship, a manageable process that can be applied across careers and work settings. It focuses on building entrepreneurial attitudes and behaviors that will lead to creative solution within community and organizational environments. This course is designed to prepare individuals for ownership of their own innovative business, and assist start-ups to function more effectively, increase the chances of new business success, enhance profitability, and increase employment.

More specifically, the course provides students with an introduction to the concepts and skills necessary to successfully commercialize new products and services. Entrepreneurship is not just about starting a business. It is also about identifying good opportunities and then creating, communicating, and capturing value from those opportunities; including innovation in a corporate context. It will also teach students the skills to analyze business opportunities, and articulate them as a compelling business description, and pitch to an audience of investors, customers, or business partners. It focuses on building entrepreneurial attitudes and behaviors that will lead to creative solution within community and organizational environments.

Course category: General/ university required

Course Name: Communicative English Skills (EnLa 1001)

Credit Hour: 3

Prerequisite: None

Course description (Synopsis):

Communicative English Skills is a course where students learn what they need to know for a career in science context. The course gives students the language, information, and skills they need to study science context. It also provides students the language appropriate for studying science context and real work situations as it comprises unique sections such as: ‘it’s my job’ wherein real people talk about their work in science context , ‘listening’ whereby students are exposed to situations related to science context , technical explanations, and interviews, ‘reading’ whereby students meet a variety science context based texts, and the ‘writing section’ which is designed to let students compose short reports on different activities.

Course category: General/ university required

Course Name: Basic Writing Skills (EnLa-1002)

Credit Hour: 3

Prerequisite: Communicative English Skills (EnLa 1001)

Course description (Synopsis):

Basic Writing Skills course aims at developing students’ basic writing skills in science context. The course gives students the language writing skills they need to study science. It contains sentence level writing: sentence structure, sentence types sentence combinations, common sentence errors (fragment, run on, comma splices, misplaced modifier, dangling modifier, faulty parallelism, faulty reference of pronoun, faulty agreement and shifts); paragraph level writing: the essence of a paragraph, components of a paragraph (topic sentence, supporting sentences, concluding sentence), characteristics of effective paragraph (unity, coherence and completeness) and the steps in writing a paragraph and types of a paragraph; essay level writing: structure of an essay, thesis statement and supporting paragraphs, types of essays and techniques of essay development.

Course category: General/ university required

Course Name: Introduction to Civics and Ethics (LART 1001)

Credit Hour: 3

Prerequisite: None

Course description (Synopsis):

This course is designed with the aim of equipping learners with necessary ethical qualities and civic competences while dealing with issues that affect their society at all levels and human in general. The course starts with unfolding the notions, principles and theories of ethics which can shape human attitude, action and behavior in making moral judgments. Next, the course introduces learners to the nature, mutual interactions and historical evolutions of society, state, government and citizenship. It also elucidates issues pertaining to political governance such as constitution, democracy, and human rights in some details. To enable learners grasp basic knowledge of political, economic and social dynamics of international system in today's globalized world, the course also introduces international relations and foreign policy and other major contemporary global issues.

Course category: General/ university required

Course Name: Logic and Critical thinking (LART 1002)

Credit Hour: 3

Prerequisite: None

Course description (Synopsis):

The main goal of the course is to improve critical and logical reasoning skills. Students will see how our ordinary intuitions on good or bad reasoning can be articulated explicitly in formal systems, and gain a new ability to evaluate arguments and reasoning they encounter every day with rigorous logical concepts and tools. As to the subject matter, it introduces systematic methods of reasoning, such as argument, deduction, induction, syllogistic, and propositional logic.

Course category: General/ university required

Course Name: Introduction to Economics (SOSC2002)

Credit Hour: 3

Prerequisite: None

Course description (Synopsis):

This course provides a general introduction to economics combining elements of micro and macro fundamentals. The main objective of this course is to introduce and acquaint students with the preliminary principles (theories) and knowledge of economics and the application of economic theories (principles) in the actual world; the daily activities of the households, firm business or any other form of enterprises at micro levels. Students will also be able to contextualize the key macroeconomic variables and policy instruments.

Specifically, the course introduces students with theory of consumer behaviors, production, and cost of production. In these theories how decisions are made by different economic agents will be discussed. Furthermore, the course covers different characteristics of perfect and imperfect market structure. Lastly the course tries to introduce basic macroeconomic concepts such as national income accounting, unemployment, inflation, fiscal and monetary policy instruments.

Course category: General/ university required

Course Name: General Psychology and Life Skills (LART 2002)

Credit Hour: 3

Prerequisite: None

Course description (Synopsis):

Psychology is a science of human cognitive processes and behaviors. This course is designed to give students an overview of what psychological science has discovered about human behaviors and mental processes throughout human history. Students will gain an understanding of the psychological phenomena that occur in daily life as well as the practical applications of psychological knowledge. Upon completing the course, students shall be able to demonstrate a basic knowledge of the science of psychology.

Specifically, the course general psychology is concerned with discussing perspectives in psychology and basic psychological concepts such as sensation and perception, learning, personality, motivation, emotion, and basic life skills (intrapersonal, interpersonal, social and academic skills). Emphasis will be given to both theoretical and practical implications of these concepts to effectively function as individual and team in a community.

Course category: General/ university required

Course Name: Physical fitness and conditioning I (SpSc1011)

Credit Hour: 0 cr.hr

Prerequisite: None

Course description (Synopsis):

This course will provide the students with basic concepts of the five components of health-related physical fitness (cardiovascular, muscular strength and endurance, flexibility, and body composition), hypokinetic disease and general principles of training. It is mainly practical oriented. As a result, the students will be exposed to various exercise modalities, sport activities, minor and major games, and various training techniques as a means to enhance health related physical fitness components. In addition, they will develop the skills to assess each component of fitness and will practice designing cardiovascular, muscular strength and endurance, and flexibility programs based on the fitness assessment. The course serves as an introduction to the role of exercise in health promotion, fitness, performance including the acute and chronic responses of the body to exercise.

Course category: General/ university required

Course Name: Physical fitness and conditioning II (SpSc 1022)

Credit Hour: 0 cr.hr

Prerequisite: SpSc 1011

Course description (Synopsis):

This course is designed to acquaint freshman engineering and applied natural science students with the nature and scope of different ball games.

It emphasizes the value of establishing lifelong fitness using ball games as a means and focuses on the fundamental of volley ball, hand ball, basketball and football as a life time leisure activity also focuses on the development of personalized approach to healthy active living through participation in a variety of ball games that have the potential to engage students' interest throughout their lives. Again, the courses enable the participants enjoying practice and acquire proper technique and strategies associated with the ball games mentioned above and learn rules governing the game.

Course category: General/ university required

Course Name: Geography of Ethiopia and the Horn (LART 1003)

Credit Hour: 3

Prerequisite: None

Course description (Synopsis):

This course covers a brief description on the location, shape and size of Ethiopia as well as basic skills of reading map, the physical background and natural resource endowment of Ethiopia and the Horn which includes its geology and mineral resources, topography, climate, drainage and water resources, soil, fauna and flora. It also deals with the demographic characteristics of the country and its implications on economic development.

Course category: General/ university required

Course Name: History of Ethiopia and the Horn (LART 1004)

Credit Hour: 3

Prerequisite: None

Course description (Synopsis):

This course describes why history is important, how history is studied and introduces the region Ethiopia and the Horn. It treats human evolution, Neolithic Revolution, settlement patterns as well as religion and religious processes in Ethiopia and the Horn. Based on these historical backgrounds, the course describes states, external contacts, economic formations and achievement in terms of architecture, writing, calendar, and others to the end of the 13th century. Historical processes including states formation and power rivalry, trade, external relation, threats and major battles, centralization and modernization attempts, Italian occupation, and socio-economic conditions from 1800 to 1941 makes central position in the modern history of the region.

Course category: Basic

Course Name: Applied Mathematics I (Math1101)

Credit Hour: 4

Prerequisite: None

Course description (Synopsis):

Generally, the Course Covers Basic Ideas and Principles of Vectors& Matrices of Linear Algebra and Basic ideas of Calculus. In Particular the course Contains principles of vectors, matrices & determinants, limit and continuity, derivatives & their applications, integrals, integration techniques and their applications.

Course category: Basic

Course Name: General Physics (Phys1101)

Credit Hour: 3

Prerequisite: Knowledge in Higher Secondary Physics

Course description (Synopsis):

At the end of this course students are expected to be acquainted with basic concepts in different branches of physics, identify the connection between them and explain the common phenomena. They will also develop skills of solving problems.

Course category: Basic

Course Name: General Chemistry (Chem1102)

Credit Hour: 3

Prerequisite: None

Course description (Synopsis):

General Chemistry is the science of the properties of atoms and the laws governing their combination, composition, and structure of substances, the transformations they undergo, and the energy that is released or absorbed during Chemical or physical process. The topics covered in this course includes: Introduction to the study of modern Chemistry, acids and bases, the periodic table, Chemical bond and molecular structure, rates of physical and Chemical processes, materials, kinetic molecular description of the state of matter and equilibrium in Chemical reaction.

Course category: Basic elective

Course Name: Introduction to Computing (CSEg 1101)

Credit Hour: 3

Prerequisite: None

Course description (Synopsis):

In this course the basic techniques of computational problem solving will be covered by using computational thinking while writing small and medium sized programs, mapping problems into computational frameworks emphasizing on scientific problems, understanding problems and formulation of problems based on the elective programming language (using python). The course includes the concepts and techniques of data structure, input/output, flow control and incidental program, and by using a systematic division of problem solution and concept of module, to solve problems in numerical value field and non-numerical value field with program experiment.

Course category: Basic

Course Name: Applied Mathematics II (Math 1102)

Credit Hour: 4

Prerequisite: Applied Mathematics I (Math 1101)

Course description (Synopsis):

This course covers sequences, series, power series, Fourier series. Differential and integrals calculus of functions of several variables and their applications. The course aims to develop the basic ideas and methods of multi variable calculus, including the Taylor series of function, Fourier series, extrema, the examination of constrained maxima and minima using Lagrange multipliers and the integration of elementary functions of several variables. It aims to enable students to understand the extension from single variable to several variables of basic concepts such as continuity, differentiability and integration. Moreover, the course aims to strengthen the ability to apply mathematical concepts like partial differentiation and multiple integrals in computing some important quantities which will appear in engineering, such as rates of changes of quantities with several variables, the area and volume of physical bodies, the center of mass of some rigid body, and so on.

Course category: Basic

Course Name: Introduction to Emerging Technologies (CSEg1102)

Credit Hour: 3

Prerequisite: None

Course description (Synopsis):

This course will enable students to explore current breakthrough technologies in the areas of Artificial Intelligence, Internet of Things and Augmented Reality, Data Science and other technologies that have emerged over the past few years. Besides helping learners become literate in emerging technologies, the course will prepare them to use technology in their respective professional preparations.

Course category: Basic

Course Name: Fundamentals of Programming (CSEg1104)

Credit Hour: 3

Prerequisite: Introduction to Computing

Course description (Synopsis):

The course is designed to introduce structured programming in C++ by providing an overview of programming concepts, on creating and working computer programs in C++. It will address fundamental concepts of program analysis, design, coding, testing and development. It includes introduction to computer programming; programming paradigms; algorithms and problem-solving; introduction to data structures and Programming constructs. The course is designed on how to solve business and scientific problems through the technique of structured programming. It will prepare students for focused studies in any programming language.

Course category: Basic

Course Name: Basic Architectural design I (ARCH2202)

Credit Hour: 3

Prerequisite: None

Course description (Synopsis):

The aim of this course is to familiarize students with visual grammar, elements of design and visual composition. It encompasses introduction to design as a conceptual discipline directed at the analysis, interpretation, synthesis, and transformation of the physical environment. The studio provides a conceptual framework of fundamental design elements and principles of design. Students will explore the relationship between the human body and the built environment, and develops skills that enable design creativity, thinking, representation, and development. Beginning with abstract exercises, introduces techniques for designing and developing 2-dimensional and 3- dimensional form and space in architecture.

Course category: Basic

Course Name: Graphic Communication Skill I (ARCH 2204)

Credit Hour: 3

Prerequisite: None

Course description (Synopsis):

Graphic tools, techniques and conventions to communicate architectural ideas, Presentations, demonstrations, assignments and discussions in the studio encourage students to improve and enhance their graphic skills starting from simple basics of sketching to the more formal methods of presenting architectural drawings. Through practice and informal studio interaction among students and instructor, interest in the subject is developed allowing graphics to be an enjoyable experience. It also explores the idea that a visual message accompanying text has a greater power to inform, educate, or persuade a person or audience.

Course category: Basic elective

Course Name: Strength of materials (CEng2202)

Credit Hour: 4

Prerequisite: Engineering Mechanics, CEng2201

Course description (Synopsis):

Strength of materials, also called mechanics of materials, deals with the behavior of solid objects subject to stresses and strains. The complete theory began with the consideration of the behavior of one- and two-dimensional members of structures, whose states of stress can be approximated as two dimensional, and was then generalized to three dimensions to develop a more complete theory of the elastic and plastic behavior of materials. This course is a fundamental course which makes the students acquainted with the concept of load resultant, consequences and how different kinds of loadings can be withstood by different kinds of members with some specific materials having different behaviors.

Course category: Major Mandatory

Course Name: History of Architecture-I (ARCH 2206)

Credit Hour: 3

Prerequisite: None

Course description (Synopsis):

History of architecture is the study of art and science of design and construction of various buildings/monuments of the particular period of history in the world. It tells the various periods of historic development have left certain historic buildings/monuments such as Tombs, Temples, Cathedrals, Temples, Palaces, and Cottages. These historic buildings reveal different belongings like people's life, nature of materials and nature of construction under different rulers, built form development, ornamentation, structural solutions, and organization in relation to technological, environmental factors, sociological, aesthetic, and artistic influences that determine our built environment etc. which are unknown.

Course category: Major Mandatory

Course Name: Basic Architectural design II (ARCH3201)

Credit Hour: 3

Prerequisite: Basic Architectural Design I (ARCH2202)

Course description (Synopsis):

This course is the continuation of Basic Architecture Design I, provides the foundations for architectural design covering human, social, technical, and aesthetic factors related to space and form, Architectural space qualities, and spatial assemblage. It focuses on design methodologies, formal and spatial analysis and the translation of creative conceptual strategies into architectural design propositions. The basic programming technique, analysis of space, activities through case projects and methods, will be studied. Students are introduced to urban research and further develop their skills of analytical thinking, representation, and design communication. Instruction in design skills, including digital and analogue representational techniques.

Course category: Major Elective

Course Name: Graphic Communication Skill II (ARCH 3203)

Credit Hour: 3

Prerequisite: None

Course description (Synopsis):

This course offers an advanced drawing and graphic modeling skills for architectural expressions & techniques in architectural study & presentation. It includes: Watercolor, ink and wash, rendering techniques of presentation drawings, photographic techniques printing, developing, and photomontage, advanced perspective drawings. This graphics skill is designed to extend from an intensive hand-drafting, freehand sketching and hand-rendering course to basic computer software. In this course Students will learn more importantly, how to communicate, compose and visualize various architectural spaces using a combination of sketching, handcrafting, and the various computer-aided drafting and rendering techniques. Architectural presentation drawing will be the core focus of the course.

Course category: Major Mandatory

Course Name: Architectural Working Drawing II (Arch3205)

Credit Hour: 3

Prerequisite: Architectural Working Drawing I (Arch2201)

Course description (Synopsis):

This course deals about Preparation of structural drawings and Visit to construction sites. Focused on Advanced construction systems and innovative use of materials: panels & curtain walls, wood products & boards, steel structures, reinforced concrete, prefabrication & modular co-ordination, construction of tensile structures, Preparation of working drawings & industrial construction details.

Course category: Major Mandatory

Course Name: History of Ethiopian Architecture (ARCH3203)

Credit Hour: 3

Prerequisite: None

Course description (Synopsis):

Provides an outline of the history of architecture, urbanism and settlements from ancient times to the early modern period in Ethiopia. Analyzes buildings as the products of culture and in relation to the special problems of architectural design. Stresses the geopolitical context of buildings and in the process familiarizes students with buildings, sites and cities in Ethiopia.

Course category: Major elective

Course Name: History of Architecture-II (ARC 2206)

Credit Hour: 3

Prerequisite: None

Course description (Synopsis):

The aim of this course is the students will be aware of the paradigm changes in the architecture of post-industrial era. The history of architecture-II is the study of art and architectural details from Renaissance to Modernism architectural buildings and monuments of the particular period. These buildings reveal different belongings like way of life and culture of people, materials selection, construction nature, different built forms, structural solutions, relation to technological, environmental factors, aesthetic and artistic influences which determine our built environment etc. which are unknown. At the end of this course, students will gain knowledge architectural principles and concepts from Renaissance to DE constructivism period.

Course category: Major elective

Course Name: Theory of Structure (CENG3203)

Credit Hour: 4

Prerequisite: Strength of Materials CEN2202

Course description (Synopsis):

Theory of structure is basic course which deals with the analysis of indeterminate structures of single and continuous beams, single bay frames, and trusses by different methods (force and displacement) and introduce the matrix method of analysis by flexibility and stiffness methods. It also deals with the knowledge of how-to analysis the structures for moving loads which are applied on bridges for truck movement and railways to get maximum shear forces and bending moments for determinate and indeterminate structures. In this student will familiar to analysis of indeterminate and determinate structures, Influence line to determinate and indeterminate structures and matrix method of analysis.

Course category: Major elective

Course Name: Model Making and Techniques (ARCH3305)

Credit Hour: 3

Prerequisite: None

Course description (Synopsis):

This subject extends students' basic modeling construction techniques and introduces them to different modeling techniques and media. It examines various ways of using models, across a range of scales, to highlight the model's conceptual, generative and illustrational value as evidenced through the various stages of the design process. Students explore a wide range of additive, reductive and casting modeling techniques, using diverse materials and, where appropriate, extend their existing knowledge of software to incorporate advanced digital fabrication technologies, including milling, rapid prototyping and laser cutting. The definition of model in this subject is broad and the curriculum may include the notion of the model in both its physical and digital forms, however, the emphasis is on the production of physical artifacts. As a consequence, students are expected to develop a material sensibility that demonstrates an understanding of the tactile, visual and structural potentials of any selected materials.

Course category: Major elective

Course Name: Building Bye laws and Regulations (ARCH 3307)

Credit Hour: 3

Prerequisite: None

Course description (Synopsis):

The main objective of this course is study & understanding of the basic building byelaws, regulations and code of practice to the built environment. The knowledge of this subject is very useful to get approval on building design and construction from statutory authorities with collaboration of other technical persons. At the end of this course, the students will be able to understand about significance of building byelaws and code of practice, application of appropriate regulations in different building context, applying different building codes and standards, norms of NBC and the required necessary plans and documents to get building construction approval from statutory authority.

Course category: Major mandatory

Course Name: Architectural Design Studio I (ARCH3202)

Credit Hour: 4

Prerequisite: Basic Architectural Design II (ARCH3201)

Course description (Synopsis):

Architectural studio I is a design investigation course rooted in critical issues of enclosure, structure, organization, circulation, urban site, climate, and the space created for residence. Students will engage in one main project for the semester, design of large multi-family residential building on an area located in Adama City. This design will be responses to a variety of physical and social conditions that are determined and driven by the site. The studio introduces issues of experiential, social, material, formal and conceptual concerns.

Course category: Major mandatory

Course Name: Building Information Modeling I (ARCH3204)

Credit Hour: 3

Prerequisite: None

Course description (Synopsis):

Building Information Modeling (BIM) is revolutionizing design processes through the construction industry, and professionals and students eagerly acquire the skills necessary for using BIM in practice, it is critical to understand these new tools in the context of a rapidly evolving practice. The primary goal of this course is to introduce the beginning student of architecture to basic 2-D and 3-D digital software package (i.e. AutoCAD, ArchiCAD, or their equivalents) essential to explore representation on a contemporary and critical level. The course is intended to highlight a menu of techniques that will prepare the student to use digital software as a primary communication tool throughout their architecture education. This new found knowledge can be used for highly descriptive as well transformative applications in the context of design and technical coursework. Presentations and demonstrations on various techniques and applications and reviews of student drawing projects take place in the studio setting and further develop their skills of analytical thinking, representation, and design communication. Finally, the students shall improve their experience with methodical scientific work and cope with the challenges of group work.

Course category: Major mandatory

Course Name: Architectural Science-I (ARCH3206)

Credit Hour: 3

Prerequisite: None

Course description (Synopsis):

The primary focus of this course is the study of climate and built environment. The study of this course examines the behavior of building based on the scientific principles underlying these phenomena and it introduces the students to a range of technologies and analysis techniques for designing comfortable indoor environments with respect to the climate. Students will be challenged to apply these techniques and explore the role energy can play in shaping architecture. The knowledge of this subject is very useful in design of climatically comfortably built environment for various climatic. Finally, the students will understand about the relation between the climate and the built environment to design and construct comfortable buildings to the various climatic conditions on the globe.

Course category: Major mandatory

Course Name: Introductory Graphic Design (Arch3208)

Credit Hour: 3

Prerequisite: None

Course description (Synopsis):

This course is a studio introduction to visual communication with an emphasis on principles of the visual organization of design, elements, as a means to transmit meaning and values. It seeks to expose students to the fundamental principles of graphic design: image making, typography, composition, working with color and shape, visual hierarchy, word/image relationships, typography, symbol design, and persuasion and development of a verbal and visual vocabulary to discuss and critique the designed world and contribute significant projects to it.

Course category: Major mandatory

Course Name: Building Construction (CEng3207)

Credit Hour: 3

Prerequisite: Fundamentals of Surveying, Architectural working drawing & Construction Materials

Course description (Synopsis):

The overall building construction process and understand design and performance requirements of a building shall be covered. Moreover, the student will be able to read and prepare working drawings for building construction (Floor plans, elevations, sections and detail drawings). Be able to tell the merits and demerits and select different types of material for the structural system of a building. Be able to understand the design parameters required for planning of a building and prepare bubble diagram for functional arrangement of a building. This course offers the purpose, functional requirement, types, suitability and construction details of different elements and system of a building (foundation, floor, wall, stairs, Doors & windows, roof, finishing and etc.).

Course category: Major mandatory

Course Name: Reinforced Concrete Structures I (CEng3204)

Credit Hour: 3

Prerequisite: Theory of Structures II

Course description (Synopsis):

Reinforced Concrete is a composite building material consisting of structural concrete reinforced with a reinforcing material like steel. The most common reinforcement used is steel. In this course steel is used as reinforcement. This course covers mechanical properties of concrete & reinforcing steel, concrete mix design, reinforced concrete design methods and Ethiopian building code of standards. It also covers the design of singly and doubly reinforced Rectangular & T-section beams, one-way and two-way solid slabs, ribbed slabs and stair cases. Shear in beams, Bond, anchorage & development methods, detailing of shear reinforcement, design of beams for serviceability elastic analysis of beam sections, cracking, moment-curvature relationship and deflections are also included.

Course category: Major elective

Course Name: Art History & Visual Perception (ARCH3304)

Credit Hour: 3

Prerequisite: None

Course description (Synopsis):

This course aims to introduce the students to the history and interpretation of western and Ethiopian art that explores painting, graphic arts and sculpture from the Renaissance to the present. Engages diverse methodological perspectives to examine changing conceptions of art and the artist performances, and to investigate the plural meaning of artworks within the larger contexts of culture and history. Subject includes trips to local museums and art galleries. Introduces visual perception from neurological, cultural, and artistic vantage points. Examines aspects of visual culture ranging from adornment of public spaces, and from logotypes to moving images. Topics range from ritual space to machine-aided vision (cameras, radar devices, robotic scanners). The course aims to develop skills in visual analysis and interpretation through lectures, oral presentations, field trips, research and written essays.

Course category: Major elective

Course Name: Construction Methods & Equipment (CEng5314)

Credit Hour: 3

Prerequisite: None

Course description (Synopsis):

This module introduces students to the operations and understanding of key construction equipment. At the end of this module, students will be able to have the knowledge, skills, and attitudes to enable them to select appropriate construction equipment for specific construction operations that are based on equipment output; quality and quantities of work; economic use of the equipment and the nature of work to be done Also the course will introduce students to civil construction plans, determining earthwork quantities, equipment economics and utilization, equipment production rates, fundamentals of earth moving and excavating, loading and hauling equipment.

Course category: Major elective

Course Name: Introduction to urban planning (ARCH3306)

Credit Hour: 3

Prerequisite: None

Course description (Synopsis):

This course is intended to provide an introduction to the theory and practice of urban planning that shape the development of our urban life. As the world becomes increasingly urbanized and our ecosystem become more fragile, the need for proper management of urban land through sensible land use planning has become ever more critical. In this course, we will learn about the important processes that shape our urban past, present and futures, including urbanization and the historical development of cities. These processes form an epistemic context upon which the study of urban planning will be introduced. We will discuss about the relevance of urban planning as part of urban governance, including its scope of practice, the agencies and institutions involved in the planning process in different cities, and in Ethiopia.

Course category: Major elective

Course Name: Furniture Design & Manufacturing (ARCH3308)

Credit Hour: 3

Prerequisite: None

Course description (Synopsis):

The aims of the course is to familiarize students of interior design with the design and manufacture of furniture and other furnishing objects: furniture design, in typology, ergonomics, materials, furniture construction and furniture production technology, technical drawings and also in the area of humanities, which are related to furniture design. Provides instruction in designing and building a functional piece of furniture from an original design. The final product of this design class is a finished, working, full-scale piece of furniture, related to mass production manufacturing processes. The emphasis is on common materials joined and formed using contemporary methods and processes to serve unique purposes in unusual contexts and adapted to new programs. Develops woodworking techniques from use of traditional hand tools to digital fabrication. Surveys the history of furniture making and includes site visits to local collections and artists/craftsmen.

Course category: Major Mandatory

Course Name: Architectural Design Studio II (ARCH4201)

Credit Hour:4

Prerequisite: Architectural Design Studio I (ARCH3202)

Course description (Synopsis):

This design studio, emphasize research and design of urban context, social and cultural, as determinants of architectural projects. Students will engage in design problems scaled to address issues related to commercial building as major Project and small-scale civic building project as mini (Quick) design project. Students further their understanding of building composition and architectural and urban space relationships. Students are required to work in both physical and digital models, and produce drawings, models and reports for each project. The projects will test both conceptual and analytical thinking skills and aid in the development of representational skills.

Course category: Major Mandatory

Course Name: Theory of Architecture I (ARCH 4203)

Credit Hour:3

Prerequisite: History of Architecture I (ARCH2206)

Course description (Synopsis):

Critically thinking about architecture is essential to the discipline. Since Vitruvius, many scholars have sought to describe architecture or to define a direction for architectural design. Designers need theory to carve out a position for them and to establish a foundation for design. This course covers the history of architectural theories from Vitruvius until the early 20th Century and it will examine some of the major tenets and concepts running through architectural discourse as well as challenges that architectural theory may face in the future.

Course category: Major Mandatory

Course Name: Contract, Specification and Quantity surveying (CEng4207)

Credit Hour:3

Prerequisite: CEng3207

Course description (Synopsis):

This course is designed to prepare students to handle the practical tasks the engineer is exposed to in the real life. The topics discussed in readings and course lectures are selected to give the student a comprehensive understanding of the process of generating, bidding, and performing construction contracts, components of direct and indirect construction costs, work breakdown, contingency and risk. This course teaches the methodology, procedures and organizational techniques involved in preparing a competitive bid. Detailed estimates for each major construction discipline are prepared, based upon real construction project documents. Ethical considerations in budgeting and estimating are Going to be discussed. The final project is the preparation of a formal competitive bid on a project. A study of methods and operations in managing projects from both the perspective of the constructor and designer. Topics include elements of the construction process, project delivery types and types of construction contracts.

Course category: Major Elective

Course Name: Principles of Marketing (SOSC 4307)

Credit Hour:2

Prerequisite: None

Course description (Synopsis):

Marketing plays a major role in the modern-day economy. The rise in the standard of living of people in the last four decades is attributed to the success of Marketing. Marketing Management is the business function that identifies current unfilled needs and wants, defines and measures their magnitude, determines which target markets the organization can best serve, and decides on appropriate products, services, and programs to serve these markets. Marketing serves as the link between a society's needs and its pattern of industrial response. Thus, this course provides you with an outline of core concepts and issue in Marketing.

Course category: Major Mandatory

Course Name: Architectural Science-III (Lighting in Architecture) (ARCH 4302)

Credit Hour:3

Prerequisite: None

Course description (Synopsis):

The most important communication channel of man with environment is vision. Light is the pre-request to the human eye is recognize objects by light reflected from objects. So light is a creative medium of all. Light in design brought the “Vision to Life” and it is creative guide to the process of designing and construction of built environment. Light can quickly change appearance and emotional effect of our designed space. The aim of the course is to cultivate basic knowledge on design a proper lighting of natural and artificial lighting design and its importance, influence in architectural space planning parameters in creation of three essential things such as visual function, effect and emotional feeling. At the end of the course, the students are able to apply knowledge of lighting in various design of built environment.

Course category: Major elective

Course Name: Building Information Modeling II (ARCH4303)

Credit Hour:3

Prerequisite: None

Course description (Synopsis):

Building Information Modeling (BIM) is revolutionizing design processes through the construction industry, and professionals and students eagerly acquire the skills necessary for using BIM in practice, it is critical to understand these new tools in the context of a rapidly evolving practice. This course focuses on the skills and information needed to effectively use an existing Building Information Model (BIM) in design, and plan execution for a building construction project. This is a project-based course where students gain knowledge on the implementation of BIM concepts throughout the lifecycle of a building, from planning and

design, to construction and operations. The primary goal of this course is to introduce the beginning student of architecture to advanced 2-D and 3-D digital software package (i.e. Revit Architecture , or their equivalents) essential to explore representation on a contemporary and critical level. The course is intended to highlight a menu of techniques that will prepare the student to use digital software as a primary communication tool throughout their architectural education. This new found knowledge can be used for highly descriptive as well transformative applications in the context of design and technical coursework. Presentations and demonstrations on various techniques and applications and reviews of student drawing projects take place in the studio setting and further develop their skills of analytical thinking, representation, and design communication. Finally, this course will enable students to create full 3D architectural project models and set them up in working drawings.

Course category: Major elective

Course Name: Emerging Building Materials and Technology (ARCH4305)

Credit Hour:3

Prerequisite: None

Course description (Synopsis):

The course focused on the basic theories, principles, concepts and elements of contemporary and emerging building materials, technology, details and construction methods. Also focused on Knowledge and designing and working on a project. In this course students are able to have detail understanding and experience on applying different emerging materials , sustainable building material and technologies in design and construction work Also the purpose of the course is to reduce the costs with all related issues, to use natural building materials to calculate the embodied energy in building materials and to compare this with common building materials and to calculate the costs of both possibilities as a comparison and confrontation.

Course category: Major elective

Course Name: Reinforced Concrete Structures II (CEng4203)

Credit Hour:3

Prerequisite: Reinforced Concrete Structures I

Course description (Synopsis):

This course is a continuation of Reinforced Concrete Structures I. It covers the design of column and flat slabs, inelastic moment redistribution, yield line theory for slabs, torsion in reinforced concrete members and introduction to pre-stressed concrete structures.

Course category: Major Elective

Course Name: Basic Urban Design (ARCH4307)

Credit Hour:3

Prerequisite: Introduction of Urban planning

Course description (Synopsis):

This course is an introduction to basic elements, concepts, and principles of urban design. The subject covers the relation and interpretation of human, social, technical, and aesthetic factors concerning urban space and form, various space qualities, and spatial grouping. It exposes architecture students to analyze, understand, and design urban environments in line with the context of micro and macro scales of the built environment. The insight gained has to be expressed through thinking, concept development, and design of urban spaces in the place of architectural interventions in systems of urban design. Students will also explore the relationship between the human body and the built environment. Throughout the design process, they will learn the fundamentals of design composition, research, craftsmanship & graphic representation, verbal communication, and analytical thinking on both directions of planning and design to make sustainable urban areas.

Course category: Major Elective

Course Name: ArcGIS for Architects (GE2304)

Credit Hour:3

Prerequisite: None

Course description (Synopsis):

The course introduces the basic concepts and techniques of GIS to architecture students. It is intended to provide students with a foundation for reading, understanding, and using basic GIS techniques that are relevant to architectural research. The course will be conducted in two basic segments. In the Theoretical segment, students will explore the principles of GIS. In the Application segment, students will be assigned small GIS-based research tasks that would require them to use single or multiple strategies based on the complexity of the given problems. Learning from both the theoretical and application segments will be incorporated in a final project where students will be asked to generate their architectural research questions and demonstrate GIS skills for architectural design process.

Course category: Major Mandatory

Course Name: Architectural Design Studio III (ARCH4202)

Credit Hour:4

Prerequisite: Architectural Design Studio II (ARCH4201)

Course description (Synopsis):

The third design Studio concentrates on medium-scale industrial (Major project) and farm buildings (Quick project) by focusing on integration of program, site, building services and composition in relation to structure, and methods of construction. Students further their understanding of building composition through consideration of advanced technical factors by detail study and exploration of design issues and interior spaces through large-scale models and drawings.

Course category: Major Mandatory

Course Name: Professional Practice (ARCH4204)

Credit Hour:3

Prerequisite: None

Course description (Synopsis):

This course covers aspects of the profession of architecture. Issues include a conceptual understanding of the architectural practice, its definition and historical and theoretical models, and methods of managing and delivering a complete architectural project from the pre-contract phase through cost estimating and specifications to construction. The course also clarifies the contractual and ethical responsibilities of an architect and collaborative business practices for maintaining an architectural office.

Course category: Major Mandatory

Course Name: Research Methods for Architects (ARCH4206)

Credit Hour:2

Prerequisite: None

Course description (Synopsis):

This course provides students with fundamental theories and practice skills in research methodologies. It intends to develop Architects the understanding, nature, process, and practices of research methods related to architectural projects.

Course category: Major Mandatory

Course Name: Introduction to Landscape Design (ARCH4208)

Credit Hour: 3

Prerequisite: None

Course description (Synopsis):

This course is focused on the basic theories, principles, concepts, and elements of landscape design details, a brief history of landscape architecture that focuses on answering Landscape Architecture questions through scientific-methodical well-founded ways. Design problems range from those of the immediate individual landscape spaces to large public spaces by using different graphic and design process. Students are introduced to urban landscape research and further develop their skills in analytical thinking, representation, and design communication. Planting Design in the city by Applying different design skills, including digital and analog representational techniques. Finally, the students shall improve their experience with methodical scientific work and cope with the challenges of group work.

Course category: Major Mandatory

Course Name: Architectural Science-III (Lighting in Architecture) (ARCH4302)

Credit Hour: 3

Prerequisite: None

Course description (Synopsis):

The most important communication channel of man with environment is vision. Light is the pre-request to the human eye is recognize objects by light reflected from objects. So light is a creative medium of all. Light in design brought the “Vision to Life” and it is creative guide to the process of designing and construction of built environment. Light can quickly change appearance and emotional effect of our designed space. The aim of the course is to cultivate basic knowledge on design a proper lighting of natural and artificial lighting design and its importance, influence in architectural space planning parameters in creation of three essential things such as visual

function, effect and emotional feeling. At the end of the course, the students are able to apply knowledge of lighting in various design of built environment.

Course category: Major Mandatory

Course Name: Product design) (ARC4304)

Credit Hour: 3

Prerequisite: None

Course description (Synopsis):

This class teaches modern tools and methods for product design and development. The cornerstone is a project in which teams of management, engineering, and industrial design students conceive, design, and prototype a physical product. The class is primarily intended for ASTU Engineering students. Particularly Architecture students the course is jointly taught with the school of mechanical industrial design programs.

Course category: Major Mandatory

Course Name: Introduction to Urban Sociology (ARCH4306)

Credit Hour: 3

Prerequisite: None

Course description (Synopsis):

This course is an introduction to urban sociology. The course will explore several topics related to urbanization and urbanism in this course. Topics include the history of urbanization in developed and developing countries; theories about how cities are socially and spatially organized and how these forms of organization are related; and how urban living affects social interaction. This is a writing-intensive course, and students will be required to write course papers.

Course category: Major elective

Course Name: Ecological Architecture (ARCH4308)

Credit Hour: 3

Prerequisite: None

Course description (Synopsis):

Architects build structures that serve as environments for organisms: human beings. Therefore, architects must understand how organisms interact with the environment and other organisms. This course will investigate topics in Ecology that will enable students to think more broadly about what it means to design living and working spaces.

Course category: Major elective

Course Name: Advanced Structures (ARCH4310)

Credit Hour: 3

Prerequisite: Reinforced Concrete Structures I

Course description (Synopsis):

The course focused on the basic scientific theories, principles and concepts in advanced structures design details in Architecture. The main objective of this course is study & understanding of the basic scientific principles on advanced structures like long span, shell, flat slabs, tensile and pneumatic structures structural and construction issues involved in built environment. Introduction to the basics of technical strategies and methods of installations in the context of advanced structures. The knowledge of this subject is very useful in design and application of different advanced structures with collaboration of other technical persons. At the end of this course, the students will be able to understand about scientific theories, concepts, principles and other calculations. Finally, the students will understand about design and application of advanced structure in architecture field.

Course category: Major elective

Course Name: Theory of Architecture II (ARCH 4300)

Credit Hour: 3

Prerequisite: Theory of Architecture I (ARCH 4203)

Course description (Synopsis):

The course aims to develop what studied in the course "Theory of architecture I", focusing on the trends related to the period subsequent the WWII. All the aspects of the contemporary theories will be treated in chronological order and also considering the different topics.

Course category: Major mandatory

Course Name: Integrated Design studio (ARCH5201)

Credit Hour: 4

Prerequisite: Architectural Design Studio III (ARCH4202)

Course description (Synopsis):

This course seeks to address students about the integrated design process of Complex buildings, focused on architectural design solution, building system, services and structure all together as an integral part of building system. This course assists the students to explore technological and environmental dimension of Architecture, Design buildings down to the level of building details and present a complex project with the appropriate digital media.

Course category: Major mandatory

**Course Name: Capstone Design Project- I (BaChEglor thesis research and seminar)
(ARCH5203)**

Credit Hour:2

Prerequisite: ARC4203

Course description (Synopsis):

Thesis research and seminar is a preparatory course for thesis design studio. Students are required to choose a topic and conduct research under the guidance of internal instructors. This will be a choice-based studio, with students opting for a project in an area of their interest. At the end of the course, students are required to submit a report, which follows the given format based on the university guidelines. The chairperson of undergraduate architecture program will approve the final proposal for the design project. Submission of written proposals for the degree project must be submitted and approved by the chairperson of undergraduate program and chair's office prior to the beginning of Capstone Design Project – II.

Course category: Major elective

Course Name: Contemporary Architecture (ARCH 5301)

Credit Hour:3

Prerequisite: None

Course description (Synopsis):

The course contemporary architecture pursues to expose students about the need of contemporary architecture in design of new buildings to the need of present trends as well as architectural advancement in the construction industry around the globe as a whole. This course focused on scientific theories, principles and concepts in contemporary building design and construction. It studies the basic philosophies and works, use of new technology, materials, unlimited forms, volumes and code of practice to the built environment. The knowledge of this subject is very useful to design the new style of buildings rather than the old, modernism and postmodernism with collaboration of advanced technology in built environment.

Course category: Major elective

Course Name: Urban Housing (ARC 5303)

Credit Hour:3

Prerequisite: None

Course description (Synopsis):

More than three-quarters of Ethiopian cities and urban area occupied low-rise (G+0) and mid-rise (G+4) housing. This type of housing is not enough to the urban growing population. Fast developing urban areas in Ethiopia needs advance high-raised housing to avoid the shortage of housing in mostly for Ethiopian urban areas. This can be achieved by the well-educated persons of architects and planners in the field of urban housing. Objective of this course is to provide theoretical and practical understandings and relevant techniques for formulating urban housing strategies. At end of this course, the students should apply the theoretical understandings and relevant techniques for housing challenges in urban renewal housing projects. To learn the techniques of Housing project formulation techniques and Housing Design strategies to be competent enough in the growing urban housing market.

Course category: Major elective

Course Name: Architectural Science-IV (Architectural Acoustics) (ARCH 5307)

Credit Hour:3

Prerequisite: None

Course description (Synopsis):

The main objective of this course is study & understanding of basic principles and strategies includes in architectural acoustics for design of built environment. The knowledge of this subject is very useful in design and application of different acoustical materials and design technics water for different acoustical buildings with collaboration of other technical persons. At the end of this course, the students will be able to understand the science of acoustics such as sound propagation, frequency & loudness, sound reflection & absorption, transmission & diffraction, changes in sound level and sound reduction. So that students will design different acoustical buildings with controlling noise by application of different, acoustical principles sound in room acoustics with better audible speech & music.

Course category: Major mandatory

Course Name: Introduction to Environmental Planning (ARCH5309)

Credit Hour:3

Prerequisite: None

Course description (Synopsis):

This course will provide an integrative introduction to the planning of cities and communities and the natural environments in which they are situated. Sustainability will be the primary lens through which community planning is viewed and the creation of sustainable cities. Exactly what constitutes a sustainable place will be the first question considered in the course, and students will be encouraged to think critically about what qualities or characteristics of communities are important and should be encouraged. As an initial working definition, sustainable cities and communities will be seen as places that maintain and restore the earth's natural capital, which creates a high quality of life for residents, and which are socially-equitable. The course will examine in-depth several different aspects of the built and natural environment. These include urban form and spatial patterns; transportation and mobility; housing and neighborhood design; the natural environment and the ecological characteristics of the city and its surroundings; among many others.

Course category: Major mandatory

Course Name: Capstone Design Project- II (Bachelor thesis Project) (ARCH5202)

Credit Hour:4

Prerequisite: ARC5201 and ARC5203

Course description (Synopsis):

This capstone design studio is the finale of the progress of the student's knowledge, attitudes and skills over the course of studies in architecture. Students are required to develop the design as per the design objectives and design brief submitted in the report. It is an occasion for exercising conscious choices in the field based on the student's personal abilities and inclinations, and for testing out his commitment. The thesis project requires a deep investigation into the proposal written at the Capstone research I containing identification of the problem scope of the work, data collection, case studies, analytical studies, and its application to the final design solution. The nature of the problem shall be based on the synthesis of the total experience and knowledge gained from the allied subjects. Emphasis shall be laid on the approach to the design solution rather than the end-result. The degree project should represent a synthesis of the student's understanding of architecture, in addition to research in the potential of architecture.

Course category: Major mandatory

Course Name: Environmental Impact Assessment (ARCH5204)

Credit Hour:3

Prerequisite: None

Course description (Synopsis):

This course will focus on Knowledge on the principle of environmental impact assessment (EIA), definition, history, and law related to EIA. Tools for evaluating impact. Principles of EIA on Physical, Biological, human use, and quality of life are focused. The student will also study cases.

Course category: Major Elective

Course Name: Interior Design (ARCH5301)

Credit Hour:3

Prerequisite: None

Course description (Synopsis):

The aim of this course is to explore the spatial and aesthetic concern to enhance the interior of a built environment to achieve a healthier and more aesthetically pleasing for internal space using. It includes conceptual development, space planning, site inspections, programming, and research and communicate with stakeholders of a project, construction management and execution. This course assists the students to explore their creativity in field of interior design. Identification and application of interior design principles and elements, selection of proper materials, coloring system, lighting system, furniture arrangement and landscaping arrangement are emphasized.

Course category: Major Elective

Course Name: Conservation of Urban and Architectural Heritage (ARCH5302)

Credit Hour:3

Prerequisite: None

Course description (Synopsis):

This course has the purpose to introduce the students to theoretical and practical problems related to the architectural and urban heritage conservation. Covers human, social, technical, and aesthetic factors related to space and form, both for restoration of historical building and adaptive reuse. Focuses on conservation methodologies, conceptual strategies, and practical techniques of structural repairs and architectural rehabilitation. Students are introduced to theory of conservation and further develop their skills of specific analytical design.

Course category: Major Elective

Course Name: Sustainable Architecture (ARCH5304)

Credit Hour:3

Prerequisite: None

Course description (Synopsis):

This course provides students with opportunities to develop an understanding of sustainable building design principles, regulations, building materials and technologies, environmental, low energy architecture, and low-cost building. Students will learn to investigate and evaluate current technologies for sustainable building design and to develop architectural details and drawings to resolve the integration of sustainable technologies into the building design process.

Course category: Major Elective

Course Name: Construction Management (ARCH5306)

Credit Hour:3

Prerequisite: None

Course description (Synopsis):

This course focuses on fundamental of management & project managements, Construction in national economy; parties in construction industry; construction and consulting organizations; design and construction process procedure of public projects, project management and planning techniques; linear & dynamic programming, financial project appraisal and cash-flow analysis; contract administration personnel management, site organizations.

Course category: Major Elective

Course Name: Construction Laws and Contract (CEN5312)

Credit Hour:3

Prerequisite: None

Course description (Synopsis):

The course provides an understanding of construction law which is applicable in Ethiopia as well as in other countries & a brief knowledge about the construction contracts. It examines the principles that are involved, the terms and conditions and the administration of contracts at various stages of a construction project.

3.2 Civil Engineering program

General information

I. *Duration of study*

Normal modality

Regular: a 5-year program

Continuing: 5 & ½ years including summer semesters as per the university senate legislation August 2017, Article 98.2.

Fast Track modality:

dual major/minor there may be one year extension as stated in the university senate legislation

II. *Course category*

No	Course Category		Course Level	Civil Engineering	Percentage	
1	General	Mandatory	University required	27	15.00	
2	Basic	Mandatory	School required	42	83.33	
3	Major	Mandatory	Department required	78		
		Elective		30		
		<i>Subtotal</i>		108		
4	Free Electives			3	1.67	
				Total	180	100.00

Course category: General/ university required

Course Name: Entrepreneurship and Business Development (SOSC5003)

Credit Hour: 3

Prerequisite: None

Course description (Synopsis):

This interdisciplinary course in general is designed to introduce students to the concept of sustainable entrepreneurship, a manageable process that can be applied across careers and work settings. It focuses on building entrepreneurial attitudes and behaviors that will lead to creative solution within community and organizational environments. This course is designed to prepare individuals for ownership of their own innovative business, and assist start-ups to function more effectively, increase the chances of new business success, enhance profitability, and increase employment.

More specifically, the course provides students with an introduction to the concepts and skills necessary to successfully commercialize new products and services. Entrepreneurship is not just about starting a business. It is also about identifying good opportunities and then creating, communicating, and capturing value from those opportunities; including innovation in a corporate context. It will also teach students the skills to analyze business opportunities, and articulate them as a compelling business description, and pitch to an audience of investors, customers, or business partners. It focuses on building entrepreneurial attitudes and behaviors that will lead to creative solution within community and organizational environments.

Course category: General/ university required

Course Name: Communicative English Skills (EnLa 1001)

Credit Hour: 3

Prerequisite: None

Course description (Synopsis):

Communicative English Skills is a course where students learn what they need to know for a career in science context. The course gives students the language, information, and skills they need to study science context. It also provides students the language appropriate for studying science context and real work situations as it comprises unique sections such as: ‘it’s my job’ wherein real people talk about their work in science context , ‘listening’ whereby students are exposed to situations related to science context , technical explanations, and interviews, ‘reading’ whereby students meet a variety science context based texts, and the ‘writing section’ which is designed to let students compose short reports on different activities.

Course category: General/ university required

Course Name: Basic Writing Skills (EnLa-1002)

Credit Hour: 3

Prerequisite: Communicative English Skills (EnLa 1001)

Course description (Synopsis):

Basic Writing Skills course aims at developing students’ basic writing skills in science context. The course gives students the language writing skills they need to study science. It contains sentence level writing: sentence structure, sentence types sentence combinations, common sentence errors (fragment, run on, comma splices, misplaced modifier, dangling modifier, faulty parallelism, faulty reference of pronoun, faulty agreement and shifts); paragraph level writing: the essence of a paragraph, components of a paragraph (topic sentence, supporting sentences, concluding sentence), characteristics of effective paragraph (unity, coherence and completeness) and the steps in writing a paragraph and types of a paragraph; essay level writing: structure of an essay, thesis statement and supporting paragraphs, types of essays and techniques of essay development.

Course category: General/ university required

Course Name: Introduction to Civics and Ethics (LART 1001)

Credit Hour: 3

Prerequisite: None

Course description (Synopsis):

This course is designed with the aim of equipping learners with necessary ethical qualities and civic competences while dealing with issues that affect their society at all levels and human in general. The course starts with unfolding the notions, principles and theories of ethics which can shape human attitude, action and behavior in making moral judgments. Next, the course introduces learners to the nature, mutual interactions and historical evolutions of society, state, government and citizenship. It also elucidates issues pertaining to political governance such as constitution, democracy, and human rights in some details. To enable learners grasp basic knowledge of political, economic and social dynamics of international system in today's globalized world, the course also introduces international relations and foreign policy and other major contemporary global issues.

Course category: General/ university required

Course Name: Logic and Critical thinking (LART 1002)

Credit Hour: 3

Prerequisite: None

Course description (Synopsis):

The main goal of the course is to improve critical and logical reasoning skills. Students will see how our ordinary intuitions on good or bad reasoning can be articulated explicitly in formal systems, and gain a new ability to evaluate arguments and reasoning they encounter every day with rigorous logical concepts and tools. As to the subject matter, it introduces systematic methods of reasoning, such as argument, deduction, induction, syllogistic, and propositional logic.

Course category: General/ university required

Course Name: Introduction to Economics (SOSC2002)

Credit Hour: 3

Prerequisite: None

Course description (Synopsis):

This course provides a general introduction to economics combining elements of micro and macro fundamentals. The main objective of this course is to introduce and acquaint students with the preliminary principles (theories) and knowledge of economics and the application of economic theories (principles) in the actual world; the daily activities of the households, firm business or any other form of enterprises at micro levels. Students will also be able to contextualize the key macroeconomic variables and policy instruments.

Specifically, the course introduces students with theory of consumer behaviors, production, and cost of production. In these theories how decisions are made by different economic agents will be discussed. Furthermore, the course covers different characteristics of perfect and imperfect market structure. Lastly the course tries to introduce basic macroeconomic concepts such as national income accounting, unemployment, inflation, fiscal and monetary policy instruments.

Course category: General/ university required

Course Name: General Psychology and Life Skills (LART 2002)

Credit Hour: 3

Prerequisite: None

Course description (Synopsis):

Psychology is a science of human cognitive processes and behaviors. This course is designed to give students an overview of what psychological science has discovered about human behaviors and mental processes throughout human history. Students will gain an understanding of the psychological phenomena that occur in daily life as well as the practical applications of psychological knowledge. Upon completing the course, students shall be able to demonstrate a basic knowledge of the science of psychology.

Specifically, the course general psychology is concerned with discussing perspectives in psychology and basic psychological concepts such as sensation and perception, learning, personality, motivation, emotion, and basic life skills (intrapersonal, interpersonal, social and academic skills). Emphasis will be given to both theoretical and practical implications of these concepts to effectively function as individual and team in a community.

Course category: General/ university required

Course Name: Physical fitness and conditioning I (SpSc1011)

Credit Hour: 0 cr.hr

Prerequisite: None

Course description (Synopsis):

This course will provide the students with basic concepts of the five components of health-related physical fitness (cardiovascular, muscular strength and endurance, flexibility, and body composition), hypokinetic disease and general principles of training. It is mainly practical oriented. As a result, the students will be exposed to various exercise modalities, sport activities, minor and major games, and various training techniques as a means to enhance health related physical fitness components. In addition, they will develop the skills to assess each component of fitness and will practice designing cardiovascular, muscular strength and endurance, and flexibility programs based on the fitness assessment. The course serves as an introduction to the role of exercise in health promotion, fitness, performance including the acute and chronic responses of the body to exercise.

Course category: General/ university required

Course Name: Physical fitness and conditioning II (SpSc 1022)

Credit Hour: 0 cr.hr

Prerequisite: SpSc 1011

Course description (Synopsis):

This course is designed to acquaint freshman engineering and applied natural science students with the nature and scope of different ball games.

It emphasizes the value of establishing lifelong fitness using ball games as a means and focuses on the fundamental of volley ball, hand ball, basketball and football as a life time leisure activity also focuses on the development of personalized approach to healthy active living through participation in a variety of ball games that have the potential to engage students' interest throughout their lives. Again, the courses enable the participants enjoying practice and acquire proper technique and strategies associated with the ball games mentioned above and learn rules governing the game.

Course category: General/ university required

Course Name: Geography of Ethiopia and the Horn (LART 1003)

Credit Hour: 3

Prerequisite: None

Course description (Synopsis):

This course covers a brief description on the location, shape and size of Ethiopia as well as basic skills of reading map, the physical background and natural resource endowment of Ethiopia and the Horn which includes its geology and mineral resources, topography, climate, drainage and water resources, soil, fauna and flora. It also deals with the demographic characteristics of the country and its implications on economic development.

Course category: General/ university required

Course Name: History of Ethiopia and the Horn (LART 1004)

Credit Hour: 3

Prerequisite: None

Course description (Synopsis):

This course describes why history is important, how history is studied and introduces the region Ethiopia and the Horn. It treats human evolution, Neolithic Revolution, settlement patterns as well as religion and religious processes in Ethiopia and the Horn. Based on these historical backgrounds, the course describes states, external contacts, economic formations and achievement in terms of architecture, writing, calendar, and others to the end of the 13th century. Historical processes including states formation and power rivalry, trade, external relation, threats and major battles, centralization and modernization attempts, Italian occupation, and socio-economic conditions from 1800 to 1941 makes central position in the modern history of the region.

Course category: Basic

Course Name: Applied Mathematics I (Math1101)

Credit Hour: 4

Prerequisite: None

Course description (Synopsis):

Generally, the Course Covers Basic Ideas and Principles of Vectors& Matrices of Linear Algebra and Basic ideas of Calculus. In Particular the course Contains principles of vectors, matrices & determinants, limit and continuity, derivatives & their applications, integrals, integration techniques and their applications.

Course category: Basic

Course Name: General Physics (Phys1101)

Credit Hour: 3

Prerequisite: Knowledge in Higher Secondary Physics

Course description (Synopsis):

This course provides science students with the basic concepts of physics that enable them to understand describe and explain natural phenomena. Emphasis is laid on general principles and fundamental concepts in measurements, mechanical and thermal interactions, fluid mechanics, electromagnetism, oscillations and waves with applications of physics in various fields of science. Permitting the students to voice and defend their own opinions and enhancing the students' commitment to individual study and acquiring knowledge. Active [29] involvement of learners is required at each phase. This is done through questioning and answering, reflection, reporting, solving problems associated with the respective topics.

Course category: Basic

Course Name: Introduction to Emerging Technologies (CSEg1102)

Credit Hour: 3

Prerequisite: None

Course description (Synopsis):

This course will enable students to explore current breakthrough technologies in the areas of Artificial Intelligence, Internet of Things and Augmented Reality, Data Science and other technologies that have emerged over the past few years. Besides helping learners become literate in emerging technologies, the course will prepare them to use technology in their respective professional preparations.

Course category: Basic

Course Name: General Chemistry (Chem1102)

Credit Hour: 3

Prerequisite: None

Course description (Synopsis):

General Chemistry is the science of the properties of atoms and the laws governing their combination, composition, and structure of substances, the transformations they undergo, and the energy that is released or absorbed during Chemical or physical process. The topics covered in this course includes: Introduction to the study of modern Chemistry, acids and bases, the periodic table, Chemical bond and molecular structure, rates of physical and [34] Chemical processes, materials, kinetic molecular description of the state of matter and equilibrium in Chemical reaction.

Course category: Basic elective

Course Name: Introduction to Computing (CSEg 1101)

Credit Hour: 3

Prerequisite: None

Course description (Synopsis):

In this course the basic techniques of computational problem solving will be covered by using computational thinking while writing small and medium sized programs, mapping problems into computational frameworks emphasizing on scientific problems, understanding problems and formulation of problems based on the elective programming language (using python). The course includes the concepts and techniques of data structure, input/output, flow control and incidental program, and by using a systematic division of problem solution and concept of module, to solve problems in numerical value field and non-numerical value field with program experiment.

Course category: Basic

Course Name: Introduction to Emerging Technologies (CSEg1102)

Credit Hour: 3

Prerequisite: None

Course description (Synopsis):

This course will enable students to explore current breakthrough technologies in the areas of Artificial Intelligence, Internet of Things and Augmented Reality, Data Science and other technologies that have emerged over the past few years. Besides helping learners become literate in emerging technologies, the course will prepare them to use technology in their respective professional preparations.

Course category: Basic

Course Name: Fundamentals of Programming (CSEg1104)

Credit Hour: 3

Prerequisite: Introduction to Computing

Course description (Synopsis):

The course is designed to introduce structured programming in C++ by providing an overview of programming concepts, on creating and working computer programs in C++. It will address fundamental concepts of program analysis, design, coding, testing and development. It includes introduction to computer programming; programming paradigms; algorithms and problem-solving; introduction to data structures and Programming constructs. The course is designed on how to solve business and scientific problems through the technique of structured programming. It will prepare students for focused studies in any programming language.

Course category: Basic

Course Name: Applied Mathematics II (Math 1102)

Credit Hour: 4

Prerequisite: Applied Mathematics I (Math 1101)

Course description (Synopsis):

This course covers sequences, series, power series, Fourier series. Differential and integrals calculus of functions of several variables and their applications. The course aims to develop the basic ideas and methods of multi variable calculus, including the Taylor series of function, Fourier series, extrema, the examination of constrained maxima and minima using Lagrange multipliers and the integration of elementary functions of several variables. It aims to enable students to understand the extension from single variable to several variables of basic concepts such as continuity, differentiability and integration. Moreover, the course aims to strengthen the ability to apply mathematical concepts like partial differentiation and multiple integrals in computing some important quantities which will appear in engineering, such as rates of changes of quantities with several variables, the area and volume of physical bodies, the center of mass of some rigid body, and so on.

Course category: Basic

Course Name: Applied Mathematics –III (Math2101)

Credit Hour: 4

Prerequisite: Applied Mathematics-II)

Course description (Synopsis):

This course covers the topics in First order ordinary Differential Equation, second order ordinary Differential Equation, Laplace transforms and its application, scalar and vector fields and complex analytic function. Particularly, basic definitions and properties of linear and nonlinear, homogeneous and non-homogeneous differential equations, the Laplace transform of functions and the inverse Laplace transform will be discussed. Also, different methods of solving an ordinary differential equation considered and practical problems in application of Engineering and Applied Science will be solved.

Course category: Basic

Course Name: Probability and Statistics for Engineers (Math2105)

Credit Hour: 3

Prerequisite: None

Course description (Synopsis):

Statistics looks at the data handling cycle and analysis of collected data. Up on the completion of this course, students will be able to understand the process involved in posing the question, collecting data on that question, presenting data, analyzing data using measure of spread and center, quantitative analysis of uncertainty and risk for engineering applications, estimation of distribution parameters, hypothesis testing, simple and multiple linear regressions, Poisson and Markov processes, and interpreting the results to make informed decision. There is an emphasis placed on real-world applications to engineering problems. This course include: History of statistics, Meaning of statistics; Methods of data collection and presentation; Measures of an average; Measures of variation; Moments, skewness and kurtosis; terminologies in probability; Counting Techniques; definition of Probability (approaches to probability); Probability distributions; Sampling and Sampling Distribution of the mean and proportion; Basic concepts for estimation: (Point and Interval) for the population mean and proportion; Hypothesis [93] testing on the population mean and proportion; Simple linear regression, correlation and rank correlation.

Course category: Basic

Course Name: Technical Report Writing (EnLa-2102)

Credit Hour: 3

Prerequisite: Communicative English Skill (EnLa 1001)

Course description (Synopsis):

Written communication is the foremost form of academic advancement. Thus, technical report writing, as a genre of written communication, encompasses the ability to organize and craft information for manuals, reports and other technical publications. To this effect, Technical Report Writing prepares students to design effective technical documents for written media, using various formats. The course provides students an introduction to principles of audience analysis, to conducting research and documentation, to drafting and revising processes of documents, as well as to maintaining readability and accessibility to written texts in addition to realizing the details of reports.

Course category: Major mandatory

Course Name: Architectural Working Drawing I (Arch2201)

Credit Hour: 3

Prerequisite: Engineering Drawing (DME1102)

Course description (Synopsis):

Architectural graphic standards, symbols, conventions, and terms. Architectural lettering. Preparation of architectural working drawings for architectural designs, floor plans, building sections, exterior and interior elevations, foundation plans, roof plans, reflected ceiling plans, site plan, details, and schedules, Structural drawings and Reinforcement scheduling, Sanitary drawing and Electrical installation drawing.

Course category: Major mandatory

Course Name: Engineering Mechanics (CEng2201)

Credit Hour: 3

Prerequisite: General Physics (Phy1101)

Course description (Synopsis):

Statics is the branch of mechanics that is concerned with the analysis of loads (force and torque, or "moment") acting on physical systems that do not experience an acceleration, but rather, are in static equilibrium with their environment. Engineering mechanics is the application of mechanics to solve problems involving common engineering elements. This course is an introduction to learning and applying the principles required to solve engineering mechanics problems. Concepts will be applied in this course from basic mathematics and physics. It covers about operations with vectors, coplanar and non-coplanar, concurrent and non-concurrent force systems, equilibrium and analysis of [82] structures (trusses, beams, frames and machines), internal actions in beams, centroids, area moment of inertia, and static friction.

Course category: Major mandatory

Course Name: Fundamental of Surveying (CEng2203)

Credit Hour: 3

Prerequisite: None

Course description (Synopsis):

This course treats the basics of surveying and basis for topographical problems encountered in surveying engineering. As the course deals the earth (earth and universe, earth size measurements, spheroid, spherical triangles), methods of surveying and mapping [86] (introduction, classical ground surveys, aerial surveys, and global position system), mathematical review (function, derivative, differential of a function), and theory of error (statistics and probabilities, types of error accidental errors and calculations, accidental error for indirect measurements, measurements of different reliability. Angular measurements and instruments

(definitions, instruments errors of angular measurements). Distance measurements (definitions and types, direct measurements. behavior of systematic error in direct measurements methods and equipment's for indirect measurements reduction of distances to projection plan), leveling and instruments (definitions, methods of leveling), execution of surveying works (basic network, calculation principles), areas calculations (regular and irregular figures).

Course category: Major mandatory

Course Name: Construction Materials (CEng2205)

Credit Hour: 3

Prerequisite: None

Course description (Synopsis):

The course introduces the production, nature and characteristics of different construction materials like; stone, brick, cementing materials, concrete, timber, steel and identifying them with respect to their suitability to different engineering structures.

Course category: Major mandatory

Course Name: Hydraulics (WREN2208)

Credit Hour: 3

Prerequisite: None

Course description (Synopsis):

Sound understanding of basic fluid mechanics principles such as properties of fluid, hydrostatics, and dynamics is important to compute hydrostatic forces on hydraulic structures, and selecting and sizing of water conveyance structures. This course offers fundamental concepts on Properties of fluids; Hydrostatics: Tensile stress in pipes, Pressure distributions in fluids, Manometers, Hydrostatic forces on plane and curved surfaces, Buoyancy and stability of floating bodies, relative equilibrium; Kinematics of fluid flow: Describing the pattern of flow, Types of flow, Continuity equation, Flow-net analysis; Dynamics of fluid flow: Euler's basic equation, Bernoulli's equations.

Course category: Major mandatory

Course Name: Strength of materials (CEng2202)

Credit Hour: 4

Prerequisite: Engineering Mechanics, CEng2201

Course description (Synopsis):

Strength of materials, also called mechanics of materials, deals with the behavior of solid objects subject to stresses and strains. The complete theory began with the consideration of the behavior of one- and two-dimensional members of structures, whose states of stress can be approximated as two dimensional, and was then generalized to three dimensions to develop a more complete theory of the elastic and plastic behavior of materials. This course is a fundamental course which makes the students acquainted with the [118] concept of load resultant, consequences and how different kinds of loadings can be withstood by different kinds of members with some specific materials having different behaviors.

Course category: Major mandatory

Course Name: Soil Mechanics I (CEng3201)

Credit Hour: 3

Prerequisite: None

Course description (Synopsis):

Soil Mechanics-I introduces the students to the principle of soil mechanics and provides the basics of geotechnical engineering. In this course students will learn about physical properties of soils; identification and classification of soils for engineering purposes; fundamental behavior of soils subjected to surface load; groundwater and seepage through soils; theory of compaction; consolidation of compressible soils; Upon successful completion of the course, students should be able to apply fundamentals of soil mechanics in the geotechnical engineering problems.

Course category: Major mandatory

Course Name: Theory of Structure (CEN3203)

Credit Hour: 4

Prerequisite: Strength of Materials CEN2202

Course description (Synopsis):

Theory of structure is basic course which deals with the analysis of indeterminate structures of single and continuous beams, single bay frames, and trusses by different methods (force and displacement) and introduce the matrix method of analysis by flexibility and stiffness methods. It also deals with the knowledge of how-to analysis the structures for moving loads which are applied on bridges for truck movement and railways to get maximum shear forces and bending moments for determinate and indeterminate structures. In this student will familiar to analysis of indeterminate and determinate structures, Influence line to determinate and indeterminate structures and matrix method of analysis.

Course category: Major mandatory

Course Name: Engineering Surveying (CEng3205)

Credit Hour: 3

Prerequisite: CEng2203

Course description (Synopsis):

On completion of the course, the students will be able to: set out curves, buildings, culverts and tunnels carry out a geodetic survey, taking accurate measurements using instruments and adjusting the traverse, plan a survey for applications such as road alignment and height of the building ,get introduced to different geodetic methods of survey such as triangulation, trigonometric leveling ,introduced to modern advanced surveying techniques involved such as Remote sensing, Total station, GPS, Photogrammetry etc. and invoke advanced surveying techniques over conventional methods in the field of civil engineering.

Course category: Major mandatory

Course Name: Building Construction (CEng3207)

Credit Hour: 3

Prerequisite: Fundamentals of Surveying, Architectural working drawing & Construction Materials

Course description (Synopsis):

The overall building construction process and understand design and performance requirements of a building shall be covered. Moreover, the student will be able to read and prepare working drawings for building construction (Floor plans, elevations, sections and detail drawings). Be able to tell the merits and demerits and select different types of material for the structural system of a building. Be able to understand the design parameters required for planning of a building and prepare bubble diagram for functional arrangement of a building. This course [133] offers the purpose, functional requirement, types, suitability and construction details of different elements and system of a building (foundation, floor, wall, stairs, Doors & windows, roof, finishing and etc.).

Course category: Major mandatory

Course Name: Engineering Hydrology (WREN3201)

Credit Hour: 3

Prerequisite: Probability and Statistics for Engineers (XYZW)

Course description (Synopsis):

Engineering Hydrology is one of the fundamental courses for Water Resources Engineering students that enables them to analyze and interpret the basic data for planning and designing of multi-purpose water projects like hydropower, irrigation and domestic water supply system. Specifically, it enables students understand how to predict risks and reliabilities of flood control systems. In addition, it provides students basic knowledge on the application of different rainfall runoff models, catchment characteristics, hydrology of different sizes of catchment, interpretation of data using statistics and probability. Moreover, it gives fundamental knowledge about reservoir capacity determination and urban hydrology.

Course category: Major mandatory

Course Name: Soil Mechanics-II (CEng3202)

Credit Hour: 3

Prerequisite: Soil Mechanics-I(CEng3201)

Course description (Synopsis):

Soil Mechanics is a discipline of Civil Engineering involving the study of soil, its behavior and application as an engineering material. This course introduces the students shear resistance of soils, stress at a point and Mohr stress circle, shear characteristics of soils, Mohr-Coulomb failure criteria, and shear tests, determination of bearing capacity of soils using different methods, lateral art pressure problems, earth pressure theories and Slope stability problems and slope stability analysis.

Course category: Major mandatory

Course Name: Reinforced Concrete Structures I (CEng3204)

Credit Hour: 3

Prerequisite: Theory of Structures II

Course description (Synopsis):

Reinforced Concrete is a composite building material consisting of structural concrete reinforced with a reinforcing material like steel. The most common reinforcement used is steel. In this course steel is used as reinforcement. This course covers mechanical properties of concrete & reinforcing steel, concrete mix design, reinforced concrete design methods and Ethiopian building code of standards. It also covers the design of singly and doubly reinforced Rectangular & T-section beams, one-way and two-way solid slabs, ribbed slabs and stair cases. Shear in beams, Bond, anchorage & development methods, detailing of shear reinforcement, design of beams for serviceability-elastic analysis of beam sections, cracking, moment-curvature relationship and deflections are also included.

Course category: Major mandatory

Course Name: Highway Engineering-I (CEng 3206)

Credit Hour: 3

Prerequisite: Engineering Surveying (CEng 3205)

Course description (Synopsis):

This course is one of the major courses in civil engineering department especially in transport area. It includes highway route selection, geometric design of highways: design controls and criteria, highway cross-section, sight distance, horizontal alignment, vertical alignment, intersections, interchange, drainage structures design and earthwork.

Course category: Major elective

Course Name: Transportation System and Planning (CEng3301)

Credit Hour: 3

Prerequisite: None

Course description (Synopsis):

Transportation has vital role in development of a given country by facilitating the movement of peoples and goods from one place to another place. In this course conceptual understanding and comprehend the fundamental basis of transportation planning in rural and urban area with consideration of safety and economy is incorporated.it also explain about transport polices, transport planning strategies modeling and evaluation of alternative transport.

Course category: Major elective

Course Name: Building Information Modeling I (ARCH3204)

Credit Hour: 3

Prerequisite: None

Course description (Synopsis):

Building Information Modeling (BIM) is revolutionizing design processes through the construction industry, and professionals and students eagerly acquire the skills necessary for using BIM in practice, it is critical to understand these new tools in the context of a rapidly evolving practice. Just as Computer Aided Design (CAD) represented a sea change in how drawings are produced and shared, BIM, with its 3D modeling capabilities, will deliver an equivalent or greater impact to the industry. This course presents a basic grounding in the technology and its benefits, potential applications in security, and likely implementation issues. The primary goal of this course is to introduce the beginning student of architecture to basic 2-D and 3-D digital software package (i.e. Photoshop, and AutoCAD, ArchiCAD, or their equivalents) essential to explore representation on a contemporary and critical level. The course is intended to highlight a menu of techniques that will prepare the student to use digital software

as a primary communication tool throughout their architectural education. This new found [157] knowledge can be used for highly descriptive as well transformative applications in the context of design and technical coursework. Presentations and demonstrations on various techniques and applications and reviews of student drawing projects take place in the studio setting and further develop their skills of analytical thinking, representation, and design communication. Finally, the students shall improve their experience with methodical scientific work and cope with the challenges of group work.

Course category: Major Mandatory

Course Name: Engineering Hydrology (WREN3201)

Credit Hour: 3

Prerequisite: Probability and Statistics for Engineers (XYZW)

Course description (Synopsis):

Engineering Hydrology is one of the fundamental courses for Water Resources Engineering students that enables them to analyze and interpret the basic data for planning and designing of multi-purpose water projects like hydropower, irrigation and domestic water supply system. Specifically, it enables students understand how to predict risks and reliabilities of flood control systems. In addition, it provides students basic knowledge on the application of different rainfall runoff models, catchment characteristics, hydrology of different sizes of catchment, interpretation of data using statistics and probability. Moreover, it gives fundamental knowledge about reservoir capacity determination and urban hydrology.

Course category: Major Mandatory

Course Name: Foundation Engineering-I (CEN-4201)

Credit Hour: 3

Prerequisite: Cen 3202)

Course description (Synopsis):

Foundation Engineering-I studies methods of site exploration and design of shallow foundation using principles of soil mechanics and structural design methods. In this course students will learn about site exploration methods, selection of foundation types, analysis and design of shallow foundations and retaining structures. Moreover, it will also enable students to develop appropriate skills to analysis practical field tests data.

Course category: Major Mandatory

Course Name: Reinforced Concrete Structures II (CEng4203)

Credit Hour: 3

Prerequisite: Reinforced Concrete Structures I

Course description (Synopsis):

This course is a continuation of Reinforced Concrete Structures I. It covers the design of column and flat slabs, inelastic moment redistribution, yield line theory for slabs, torsion in reinforced concrete members and introduction to pre-stressed concrete structures.

Course category: Major Mandatory

Course Name: Highway Engineering II (CEng 4205)

Credit Hour: 3

Prerequisite: Highway Engineering (CEng 3206)

Course description (Synopsis):

This course is one of the major courses in civil engineering department especially in transport area. It focuses on planning, analyzing and designing of all pavement layers and thickness. In this course students are able to have detail understanding on selecting materials used in all pavement layers and Design structurally efficient pavements according to ERA manual.

Course category: Major Mandatory

Course Name: Contract, Specification and Quantity surveying (CEng4207)

Credit Hour: 3

Prerequisite: CEng3207

Course description (Synopsis):

This course is designed to prepare students to handle the practical tasks the engineer is exposed to in the real life. The topics discussed in readings and course lectures are selected to give the student a comprehensive understanding of the process of generating, bidding, and performing construction contracts, components of direct and indirect construction costs, work breakdown, contingency and risk. This course teaches the methodology, procedures and organizational techniques involved in preparing a competitive bid. Detailed estimates for each major [175] construction discipline are prepared, based upon real construction project documents. Ethical considerations in budgeting and estimating are going to be discussed. The final project is the preparation of a formal competitive bid on a project. A study of methods and operations in managing projects from both the perspective of the constructor and designer. Topics include elements of the construction process, project delivery types and types of construction contracts.

Course category: Major elective

Course Name: Construction Health and Safety Management (CEng4301)

Credit Hour: 3

Prerequisite: Building Construction

Course description (Synopsis):

It covers psychological, physiological and technological factors in safety in construction, hazards and causes of accidents, safety measures, safety legislation and standards for construction industry, safety in construction of buildings, civil works and infrastructure development projects, management of accidents, employment and injuries and occupational hazards/diseases, safety organization, site management. Role of safety department, safety officer, safety committee. Safety training, incentives and monitoring, writing safety manuals.

Course category: Major elective

Course Name: Integrated Civil Engineering Laboratory (CEng4303)

Credit Hour: 3

Prerequisite: Soil Mechanics-II -CEng3202, Building Construction –(CEng3207)

Course description (Synopsis):

Civil Engineering Laboratory test covers laboratory testing of materials in civil Engineering disciplines. These all experiments are complementary to the basic theory that students have learned in the classroom and also to expose them to the practical work at the real-world application. In this course, students will perform a comprehensive project mainly focusing on laboratory tests on most fundamental construction materials in the construction industries such as soil, aggregate, bitumen, concrete, steel and timber.

Course category: Major Mandatory

Course Name: Open Channel Hydraulics (WREN3202)

Credit Hour: 3

Prerequisite: Hydraulics

Course description (Synopsis):

This course is introduced to emphasis on the steady and unsteady fluid flow in channels including streams and rivers. Open channel hydraulics mostly address very important concepts of energy, momentum and continuity principle to ensure flow computation for different channels and classifying flow types such as GVF and RVF. The topics covered in this course includes: Open Channel flows and its classification, basic principles in open channel flow, flow computation formulas, gradually varied flow (GVF), rapidly varied flow (RVF) and introduction to unsteady flow.

Course category: Major Mandatory

Course Name: Foundation Engineering II (CEng4202)

Credit Hour: 3

Prerequisite: Foundation Engineering I (CEng4201)

Course description (Synopsis):

This course considers design of dip foundation using principles of soil mechanics and structural design methods. Students will learn about deep foundation: Types of deep foundations, load transfer mechanism in piles, pile capacity, Pile load test, pile group capacity, settlement of pile, introduction to foundation on problematic soils.

Course category: Major Mandatory

Course Name: Structural Design (CEng4204)

Credit Hour: 3

Prerequisite: Reinforced Concrete Structures-II(CEng4203)

Course description (Synopsis):

Structural design is a course which presents the detail definition and analysis of lateral loads on the buildings based on Ethiopian building codes standards and designing of appropriate lateral loads resisting systems. Additionally, it deals with how to analyze reinforced concrete slabs by using strip method and apply plastic analysis for line members.

Course category: Major Mandatory

Course Name: Design of Steel & Timber Structures (CEng4206)

Credit Hour: 3

Prerequisite: Theory of Structures (CEng3203)

Course description (Synopsis):

Design of steel & Timber Structures course induces the structural design of steel and timber structural members which subjected to tension, compression, bending and shearing stress, bending, torsion and shearing, bending and axial compression uniaxial or biaxial stress using ES - 3, 2015 and preparing detail drawings. In this course students will adopt steel and timbers structures design code, analyze and design steel and timber structural members for tensile, compressive, bending, torsion and shearing loading. It also makes the students to select and design economical and appropriate structural connection type

Course category: Major Mandatory

Course Name: Research Methods for Engineers (CEng5203)

Credit Hour: 2

Prerequisite: None

Course description (Synopsis):

This course introduces students to research methods and contemporary issues related to research in a university setting. Students will learn about statistical data analysis, measurement techniques, research proposal development, and design of experiments, scientific literature reviews, good laboratory practice, and oral and written research communication. The course will also cover ethics and intellectual property topics related to research.

Course category: Major elective

Course Name: Soil Stabilization and Improvement (CEng4302)

Credit Hour: 3

Prerequisite: CEng3202

Course description (Synopsis):

This course introduces the various possible alternate approaches a geotechnical engineer has at his disposal when difficult soils have been encountered in the site investigation. The student would learn the topics related to field soil compaction, compaction quality control, dewatering a site, soil modification using granular and manmade admixtures. Student would also be introduced to the more contemporary concepts of soil reinforcement using both natural and synthetic geotextiles. Upon successful completion of the course, students should be able to apply fundamentals of soil mechanics in the geotechnical engineering problems.

Course category: Major elective

Course Name: Matrix Method of Analysis (CEN4303)

Credit Hour: 3

Prerequisite: Theory of structure CEN3203

Course description (Synopsis):

These days the analyses of most structures are carried out with the aid of computer programs based on the stiffness method or so-called matrix method of structural analysis. Stiffness method is a subset of the more general analysis method called the finite element method. Engineers cannot simply rely on the generated output from a computer program when designing a structure as there could be many sources of errors such as input data errors (due to misunderstanding of input parameters) and modeling errors. Classical methods of analysis provide means of checking computer generated outputs. This subject is intended to provide students with a clear and thorough understanding of how to idealize and analyses simple structures such as trusses, beams and frames. Practice in applying classical methods of structural analysis will develop in students a deeper understanding of how basic principles of statics and mechanics of materials are used in the analysis.

Course category: Major elective

Course Name: Traffic Engineering (CEng4306)

Credit Hour: 3

Prerequisite: Highway Engineering II (CEng4205)

Course description (Synopsis):

This course is one of fundamental course for characterizing flow of traffic on highways and design of highways. This course will provide students with an opportunity to develop understanding on Elements of the road traffic system, Introduction traffic studies, Introduction to traffic flow theory, principles of traffic [211] signal operation and Intelligent Transport Systems.

Course category: Major Mandatory

Course Name: Water Supply and Treatment (WREN3206)

Credit Hour: 3

Prerequisite: None

Course description (Synopsis):

Fundamental principles of Water supply and Treatment addresses sustainable provision of safe and reliable drinking water for the community. This includes broad understanding on planning, designing and construction of urban water supply system, and water treatment methods. This course offers basic knowledge on Demand for Water: Water demands, Factors affecting water consumption, variation in demand, effect of variation in demand on the design capacities of different components of a water supply schemes, Population Forecasting; Sources of Water; Collection and Distribution of Water: Intakes for collecting surface waters, service reservoir, Layout and Design of Distribution systems, Pump systems and appurtenances; Water Treatment Methods.

Course category: Major elective

Course Name: Construction Planning & Management (CEng4308)

Credit Hour: 3

Prerequisite: Contract, specification & Quantity Survey

Course description (Synopsis):

To provide students with knowledge of the various forms of project delivery methods (Design Bid-Build, Design-Build, and Construction Management) and the underlying principles for choosing the appropriate system. Students will learn to recognize the complexity of the preconstruction process including conceptual estimating and scheduling, life cycle costing, constructability reviews, value engineering, risk management and special contract requirements. To provide students with the knowledge of principles of project management and their applications in construction projects. Techniques in managing construction projects will be taught including project planning, cash flow analysis, Gantt chart, and critical path methods using network diagrams.

Course category: Major elective

Course Name: Construction Laws and Contract (CEng4310)

Credit Hour: 3

Prerequisite: None

Course description (Synopsis):

The course provides an understanding of construction law which is applicable in Ethiopia as well as in other countries & a brief knowledge about the construction contracts. It examines the principles that are involved, the terms and conditions and the administration of contracts at various stages of a construction project.

Course category: Major elective

Course Name: Contract Administration (CEN 4312)

Credit Hour: 3

Prerequisite: None

Course description (Synopsis):

To enable students, identify legal principles of elements of contract and how the selection of right contract type may affect project undertakings. And also Includes the procurement of labor contracts, as well as disputes or discrepancies that may come along with those contract procurements. In this course, students learn how to deal with unhappy customers, contracts that did not meet expectations or failure to make contract payments.

Course category: Major mandatory

Course Name: Integrated Civil Engineering Design (CEng5201)

Credit Hour: 2

Prerequisite: One of CEng4202, CEng4204, CEng4205

Course description (Synopsis):

The main objective of Integrate Civil Engineering Design course is to enable students to experience real life engineering problem solving, design, team work, project execution and management. Students should also be encouraged to use computer modelling and relevant civil engineering tools.

Course category: Major mandatory

Course Name: Hydraulic Structures (WREN4211)

Credit Hour: 3

Prerequisite: Open Channel Hydraulics

Course description (Synopsis):

This course is designed to introduce diversion head works (weir and barrage type & design) layout and functions of components. Seepage theories: critical exit gradient, Lane's theory of weighted creep length, Khosla's theory of seepage, flow – nets, causes of failure by piping and uplift, safety against uplift and piping. Causes of failure of weirs on permeable soils, Bligh's theory and Khosla's theory. Minor irrigation structures- Cross drainage works, Canal regulation structures (division box, canal drop, chute) Canal Regulation works: Falls and Regulators, Design of Hydraulic Structures: [236] Aqueduct, siphon aqueduct, Canal falls-notch type, well type, Sarda type, and Cross regulator.

Course category: Major elective

Course Name: CAD in Geotechnical Engineering (CEng5301)

Credit Hour: 2

Prerequisite: Foundation Engineering II (CEng4202)

Course description (Synopsis):

The applications of civil engineering software can be applied for many essential works like designing of huge structures and structural foundation like factories, bridges, highway systems, water treatment plants, energy efficient [240] buildings. The main purpose of software application is to minimize error, time usage and ease of documentation style. This course enables students to analysis and design of different geotechnical structures, analysis and design of earth support system as well as to Check the slope stability of soil using related software like SAFE, PLAXIS, ABACUS, SAP, STAAD and Geo studio.

Course category: Major elective

Course Name: CAD in Structural Engineering (CEng5303)

Credit Hour: 2

Prerequisite: Reinforced Concrete II (CEng4203)

Course description (Synopsis):

The applications of civil engineering software can be applied for many essential working in Civil Engineering such as designing of huge structures, factories, bridges, highway systems, water treatment plants, energy efficient buildings, Construction project management ...etc. The main purpose of application is to minimize error, time usage and ease of documentation style. This course enables students to use different structural analysis and design software related to building like ETABs, SAP, STAAD Pro, SAFE, CSi COL.... etc.

Course category: Major elective

Course Name: CAD in Transportation Engineering (CEng5305)

Credit Hour: 2

Prerequisite: Highway Engineering II(CEng4205)

Course description (Synopsis):

The applications of civil engineering software can be applied for many essential works like designing of huge structures and structural foundation like factories, bridges, highway systems, water treatment plants, energy efficient buildings. The main purpose of software application is to minimize error, time usage and ease of documentation style. The course enables the students to use different Road Design Software's like Eagle Point, In-Roads, Mx-Road and Civil 3D etc.

Course category: Major elective

Course Name: Engineering Properties of tropical Soil (CEng 5307)

Credit Hour: 3

Prerequisite: Soil Mechanics II (CEng 3202)

Course description (Synopsis):

This course introduces students to know, identify as well as characterize Engineering Properties of Tropical Soils. Students will learn about clay mineralogy, geo-technical properties and behavior of lateritic and black cotton soils, Properties of desiccated clays, relation between load and swelling, effect of climate on the behavior of clay, effect of swelling on buildings, failure of foundations, Roads, Dams, Retaining Structure and the like due to capricious nature of tropical soil (expansive soils) methods of preventing damage from swelling clays.

Course category: Major elective

Course Name: Bridge Engineering (CEng5315)

Credit Hour: 3

Prerequisite: Reinforced Concrete II (CEng4203)

Course description (Synopsis):

Bridge engineering is discipline branching from civil engineering that involves the planning, design, construction, operation, and maintenance of bridges to ensure safe and effective transportation of vehicles, people and goods. In this course students are able to have detail understanding and experience on bridge engineering in terms of analysis and design in relevance with safety and economical consideration.

Course category: Major elective

Course Name: Railway Engineering (CEng5319)

Credit Hour: 3

Prerequisite: Highway Engineering – I (CEng 3206)

Course description (Synopsis):

Railway engineering is multidisciplinary in civil engineering that involves the planning, design, construction, operation, and maintenance of railway system to ensure safe and effective transportation of vehicles, people and goods. In this course students are able to have fundamental understanding and experience on design and construction technique of railway transport with safety and economical consideration.

Course category: Major Mandatory

Course Name: Hydropower Engineering (WREN4204)

Credit Hour: 3

Prerequisite: None

Course description (Synopsis):

This course will introduce the fundamentals of design of hydropower systems and infrastructure, hydraulic power as a source of energy, and selecting appropriate site for hydropower development and design of hydropower components. Estimation of waterpower potential; flow duration curves; electrical loads on turbines, load curve; load factor; firm and secondary power; classification of hydroelectric power plants; design of Power intakes and water ways; selection and design of hydraulic turbines are covered in this course.

Course category: Major compulsory

Course Name: BSc Thesis I (CEng5203)

Credit Hour: P/F

Prerequisite: All Major Mandatory Courses before this semester & BSc. Thesis I

Course description (Synopsis):

BSc. Thesis-I deals with identifying problems existing in the society which is related to Civil Engineering discipline and develop the proposal on the selected problem by applying research conducting skills. In this thesis the students will explore literatures and develop a basic/applied scientific research proposal on the problem they identified.

Course category: Major compulsory

Course Name: BSc Thesis II (CEng5204)

Credit Hour: 4

Prerequisite: All Major Mandatory Courses before this semester & BSc. Thesis I

Course description (Synopsis):

BSc. Thesis-II deals with solving a problem existing in the society which is related to Civil Engineering discipline by applying the acquired professional knowledge and skills from previously learned courses using appropriate technologies, tools and modality. In this thesis the students will give a Civil Engineering solution for the problem they identified in the BSc Thesis-I with consideration of society and environmental context and they will develop and apply their research skill in complex Civil Engineering problem.

Course category: Major elective

Course Name: Earth Retaining Structures (CEng5302)

Credit Hour: 3

Prerequisite: Foundation II (CEng4202)

Course description (Synopsis):

Earth retaining structure studies about mass of soil and rock support structures in terms of analysis and design in relevance with safety and economical consideration. In this course students will learn about analysis and design of different types of earth retain structures including gravity, sheet pile, cantilever, and anchored earth/mechanically stabilized earth (reinforced earth) walls and slopes.

Course category: Major Mandatory

Course Name: Irrigation and Drainage Engineering (WREN3208)

Credit Hour: 3

Prerequisite: Foundation II (CEng4202)

Course description (Synopsis):

Irrigation and Drainage Engineering is one of the specialization areas of water resources engineering that deals about planning, design, construction, operation, and maintenance of irrigation and drainage projects to ensure food security. It expertise students about irrigation project feasibility studies, various types of Irrigation system design, and basic principles of irrigation methods and selection criteria. Moreover, it enables students design of surface and sub-surface drainage design.

Course category: Major elective

Course Name: Reinforced Concrete Structures III(CEng5304)

Credit Hour: 3

Prerequisite: Reinforced Concrete II (CEng4203)

Course description (Synopsis):

Reinforced concrete (RC) (also called reinforced cement concrete or RCC) is a composite material in which concrete's relatively low tensile strength and ductility are counteracted by the inclusion of reinforcement having higher tensile strength or ductility. In this course students will be able to have detail understanding and experience on reinforced concrete structures like special, curved and water retaining structures in terms of analysis and design in relevance with safety and economical consideration.

Course category: Major elective

Course Name: Pavement Evaluation and Rehabilitation (CEng 5306)

Credit Hour: 3

Prerequisite: Highway Engineering II (CEng4205)

Course description (Synopsis):

Pavement Evaluation and Rehabilitation includes identification of different types of pavement surface failure, cause of distresses and pavement management concepts. Based on the identified failures one can recommend the appropriate maintenance and rehabilitation strategies. This maintenance option may be thin surface treatments, Surface texturization, Overlay and Recycling techniques.

Course category: Major elective

Course Name: Precast Concrete Structures (CEng5308)

Credit Hour: 3

Prerequisite: Reinforced Concrete structures II (CEng4203)

Course description (Synopsis):

Precast concrete structures a course which deals with analysis and design of economical, stable and buildable precast reinforced concrete building elements such as slabs, beams, columns, walls and appropriate connections between different structural elements. In this course students will familiar to Design principals, materials used & components in precast structures and Precast concrete elements such as precast floors, precast beams, precast columns & precast walls. Additionally, students will Design of floor diaphragms, Connections: connection between vertical joints, connections between horizontal elements and connection between horizontal & vertical elements. And will have knowledge of precast elements production.

Course category: Major elective

Course Name: Engineering Economics (CEng5310)

Credit Hour: 3

Prerequisite: None

Course description (Synopsis):

To have conceptual understanding on engineering economics, time value of money, economic evaluation techniques, cost benefit analysis, effects of inflation and deflation, and depreciation & replacement of assets.

Course category: Major elective

Course Name: Construction Methods & Equipment (CEng5314)

Credit Hour: 3

Prerequisite: None

Course description (Synopsis):

This module introduces students to the operations and understanding of key construction equipment. At the end of this module, students will be able to have the knowledge, skills, and attitudes to enable them to select appropriate construction equipment for specific construction operations that are based on equipment output; quality and quantities of work; economic use of the equipment and the nature of work to be done. Also the course will introduce students to civil construction plans, determining earthwork quantities, equipment economics and utilization, equipment production rates, fundamentals of earth moving and excavating, loading and hauling equipment.

Course category: Major elective

Course Name: Sewerage System and Wastewater Treatment (WREN4308)

Credit Hour: 3

Prerequisite: None

Course description (Synopsis):

Sewerage system and wastewater treatment is designed to give broad understanding on planning, designing and construction of sewerage system and wastewater treatment plant. This course offers fundamental knowledge on Wastewater characteristics; wastewater treatment objectives and methods; Design of facilities for Physical, Chemical and Biological treatment processes; Effluent disposal and water pollution control; Sludge treatment and disposal methods; Wastewater reclamation and reuse.

3.3 Water Resources Engineering program

General information

I. Duration of study

Normal modality

Regular: a 5-year program

Continuing: 6 year program

Fast Track modality:

dual major/minor there may be one year extension as stated in the university senate legislation

II. Course category

No.	Course category		Course level	Credit requirement	Percentage from the total
1	General	Mandatory	University required	27	15%
2	Basic	Mandatory	School required	29	16%
	Major	Mandatory	Department required	86	48%
		Elective		35	19%
		Subtotal		121	67%
	Free electives			3	2%
Total				180	100%

Course category: General/ university required

Course Name: Entrepreneurship and Business Development (SOSC5003)

Credit Hour: 3

Prerequisite: None

Course description (Synopsis):

This interdisciplinary course in general is designed to introduce students to the concept of sustainable entrepreneurship, a manageable process that can be applied across careers and work settings. It focuses on building entrepreneurial attitudes and behaviors that will lead to creative solution within community and organizational environments. This course is designed to prepare individuals for ownership of their own innovative business, and assist start-ups to function more effectively, increase the chances of new business success, enhance profitability, and increase employment.

More specifically, the course provides students with an introduction to the concepts and skills necessary to successfully commercialize new products and services. Entrepreneurship is not just about starting a business. It is also about identifying good opportunities and then creating, communicating, and capturing value from those opportunities; including innovation in a corporate context. It will also teach students the skills to analyses business opportunities, and articulate them as a compelling business description, and pitch to an audience of investors, customers, or business partners. It focuses on building entrepreneurial attitudes and behaviors that will lead to creative solution within community and organizational environments.

Course category: General/ university required

Course Name: Communicative English Skills (EnLa 1001)

Credit Hour: 3

Prerequisite: None

Course description (Synopsis):

Communicative English Skills is a course where students learn what they need to know for a career in science context. The course gives students the language, information, and skills they need to study science context. It also provides students the language appropriate for studying science context and real work situations as it comprises unique sections such as: ‘it’s my job’ wherein real people talk about their work in science context , ‘listening’ whereby students are exposed to situations related to science context , technical explanations, and interviews, ‘reading’ whereby students meet a variety science context based texts, and the ‘writing section’ which is designed to let students compose short reports on different activities.

Course category: General/ university required

Course Name: Basic Writing Skills (EnLa-1002)

Credit Hour: 3

Prerequisite: Communicative English Skills (EnLa 1001)

Course description (Synopsis):

Basic Writing Skills course aims at developing students’ basic writing skills in science context. The course gives students the language writing skills they need to study science. It contains sentence level writing: sentence structure, sentence types sentence combinations, common sentence errors (fragment, run on, comma splices, misplaced modifier, dangling modifier, faulty parallelism, faulty reference of pronoun, faulty agreement and shifts); paragraph level writing: the essence of a paragraph, components of a paragraph (topic sentence, supporting sentences, concluding sentence), characteristics of effective paragraph (unity, coherence and completeness) and the steps in writing a paragraph and types of a paragraph; essay level writing: structure of an essay, thesis statement and supporting paragraphs, types of essays and techniques of essay development.

Course category: General/ university required

Course Name: Introduction to Civics and Ethics (LART 1001)

Credit Hour: 3

Prerequisite: None

Course description (Synopsis):

This course is designed with the aim of equipping learners with necessary ethical qualities and civic competences while dealing with issues that affect their society at all levels and human in general. The course starts with unfolding the notions, principles and theories of ethics which can shape human attitude, action and behavior in making moral judgments. Next, the course introduces learners to the nature, mutual interactions and historical evolutions of society, state, government and citizenship. It also elucidates issues pertaining to political governance such as constitution, democracy, and human rights in some details. To enable learners grasp basic knowledge of political, economic and social dynamics of international system in today's globalized world, the course also introduces international relations and foreign policy and other major contemporary global issues.

Course category: General/ university required

Course Name: Logic and Critical thinking (LART 1002)

Credit Hour: 3

Prerequisite: None

Course description (Synopsis):

The main goal of the course is to improve critical and logical reasoning skills. Students will see how our ordinary intuitions on good or bad reasoning can be articulated explicitly in formal systems, and gain a new ability to evaluate arguments and reasoning they encounter every day with rigorous logical concepts and tools. As to the subject matter, it introduces systematic methods of reasoning, such as argument, deduction, induction, syllogistic, and propositional logic.

Course category: General/ university required

Course Name: Introduction to Economics (SOSC2002)

Credit Hour: 3

Prerequisite: None

Course description (Synopsis):

This course provides a general introduction to economics combining elements of micro and macro fundamentals. The main objective of this course is to introduce and acquaint students with the preliminary principles (theories) and knowledge of economics and the application of economic theories (principles) in the actual world; the daily activities of the households, firm business or any other form of enterprises at micro levels. Students will also be able to contextualize the key macroeconomic variables and policy instruments.

Specifically, the course introduces students with theory of consumer behaviors, production, and cost of production. In these theories how decisions are made by different economic agents will be discussed. Furthermore, the course covers different characteristics of perfect and imperfect market structure. Lastly the course tries to introduce basic macroeconomic concepts such as national income accounting, unemployment, inflation, fiscal and monetary policy instruments.

Course category: General/ university required

Course Name: General Psychology and Life Skills (LART 2002)

Credit Hour: 3

Prerequisite: None

Course description (Synopsis):

Psychology is a science of human cognitive processes and behaviors. This course is designed to give students an overview of what psychological science has discovered about human behaviors and mental processes throughout human history. Students will gain an understanding of the psychological phenomena that occur in daily life as well as the practical applications of psychological knowledge. Upon completing the course, students shall be able to demonstrate a basic knowledge of the science of psychology. Specifically, the course general psychology is concerned with discussing perspectives in psychology and basic psychological concepts such as sensation and perception, learning, personality, motivation, emotion, and basic life skills (intrapersonal, interpersonal, social and academic skills). Emphasis will be given to both theoretical and practical implications of these concepts to effectively function as individual and team in a community.

Course category: General/ university required

Course Name: Physical fitness and conditioning I (SpSc1011)

Credit Hour: 0 cr.hr

Prerequisite: None

Course description (Synopsis):

This course will provide the students with basic concepts of the five components of health-related physical fitness (cardiovascular, muscular strength and endurance, flexibility, and body composition), hypokinetic disease and general principles of training. It is mainly practical oriented. As a result, the students will be exposed to various exercise modalities, sport activities, minor and major games, and various training techniques as a means to enhance health related physical fitness components. In addition, they will develop the skills to assess each component of fitness and will practice designing cardiovascular, muscular strength and endurance, and flexibility programs based on the fitness assessment. The course serves as an introduction to the role of exercise in health promotion, fitness, performance including the acute and chronic responses of the body to exercise.

Course category: General/ university required

Course Name: Physical fitness and conditioning II (SpSc 1022)

Credit Hour: 0 cr.hr

Prerequisite: SpSc 1011

Course description (Synopsis):

This course is designed to acquaint freshman engineering and applied natural science students with the nature and scope of different ball games.

It emphasizes the value of establishing lifelong fitness using ball games as a means and focuses on the fundamental of volley ball, hand ball, basketball and football as a life time leisure activity also focuses on the development of personalized approach to healthy active living through participation in a variety of ball games that have the potential to engage students' interest throughout their lives. Again, the courses enable the participants enjoying practice and acquire proper technique and strategies associated with the ball games mentioned above and learn rules governing the game.

Course category: General/ university required

Course Name: Geography of Ethiopia and the Horn (LART 1003)

Credit Hour: 3

Prerequisite: None

Course description (Synopsis):

This course covers a brief description on the location, shape and size of Ethiopia as well as basic skills of reading map, the physical background and natural resource endowment of Ethiopia and the Horn, which includes its geology and mineral resources, topography, climate, drainage and water resources, soil, fauna and flora. It also deals with the demographic characteristics of the country and its implications on economic development.

Course category: General/ university required

Course Name: History of Ethiopia and the Horn (LART 1004)

Credit Hour: 3

Prerequisite: None

Course description (Synopsis):

This course describes why history is important, how history is studied and introduces the region Ethiopia and the Horn. It treats human evolution, Neolithic Revolution, settlement patterns as well as religion and religious processes in Ethiopia and the Horn. Based on these historical backgrounds, the course describes states, external contacts, economic formations and achievement in terms of architecture, writing, calendar, and others to the end of the 13th century. Historical processes including states formation and power rivalry, trade, external relation, threats and major battles, centralization and modernization attempts, Italian occupation, and socio-economic conditions from 1800 to 1941 makes central position in the modern history of the region.

Course category: Basic

Course Name: Applied Mathematics I (Math1101)

Credit Hour: 4

Prerequisite: None

Course description (Synopsis):

Generally, the Course Covers Basic Ideas and Principles of Vectors & Matrices of Linear Algebra and Basic ideas of Calculus. In Particular the course Contains principles of vectors, matrices & determinants, limit and continuity, derivatives & their applications, integrals, integration techniques and their applications.

Course category: Basic

Course Name: General Physics (Phys1101)

Credit Hour: 3

Prerequisite: Knowledge in Higher Secondary Physics

Course description (Synopsis):

This course provides science students with the basic concepts of physics that enable them to understand describe and explain natural phenomena. Emphasis is laid on general principles and fundamental concepts in measurements, mechanical and thermal interactions, fluid mechanics, electromagnetism, oscillations and waves with applications of physics in various fields of science. Permitting the students to voice and defend their own opinions and enhancing the students' commitment to individual study and acquiring knowledge. Active involvement of learners is required at each phase. This is done through questioning and answering, reflection, reporting, solving problems associated with the respective topics.

Course category: Basic

Course Name: General Chemistry (Chem1102)

Credit Hour: 3

Prerequisite: None

Course description (Synopsis):

General Chemistry is the science of the properties of atoms and the laws governing their combination, composition, and structure of substances, the transformations they undergo, and the energy that is released or absorbed during Chemical or physical process. The topics covered in this course includes: Introduction to the study of modern Chemistry, acids and bases, the periodic table, Chemical bond and molecular structure, rates of physical and Chemical processes, materials, kinetic molecular description of the state of matter and equilibrium in Chemical reaction.

Course category: Basic elective

Course Name: Introduction to Computing (CSEg 1101)

Credit Hour: 3

Prerequisite: None

Course description (Synopsis):

In this course the basic techniques of computational problem solving will be covered by using computational thinking while writing small and medium sized programs, mapping problems into computational frameworks emphasizing on scientific problems, understanding problems and formulation of problems based on the elective programming language (using python). The course includes the concepts and techniques of data structure, input/output, flow control and incidental program, and by using a systematic division of problem solution and concept of module, to solve problems in numerical value field and non-numerical value field with program experiment.

Course category: Basic

Course Name: Applied Mathematics II (Math 1102)

Credit Hour: 4

Prerequisite: Applied Mathematics I (Math 1101)

Course description (Synopsis):

This course covers sequences, series, power series, Fourier series. Differential and integrals calculus of functions of several variables and their applications. The course aims to develop the basic ideas and methods of multi variable calculus, including the Taylor series of function, Fourier series, extrema, the examination of constrained maxima and minima using Lagrange multipliers and the integration of elementary functions of several variables. It aims to enable students to understand the extension from single variable to several variables of basic concepts such as continuity, differentiability and integration. Moreover, the course aims to strengthen the ability to apply mathematical concepts like partial differentiation and multiple integrals in computing some important quantities which will appear in engineering, such as rates of changes of quantities with several variables, the area and volume of physical bodies, the center of mass of some rigid body, and so on.

Course category: Basic

Course Name: Introduction to Emerging Technologies (CSEg1102)

Credit Hour: 3

Prerequisite: None

Course description (Synopsis):

This course will enable students to explore current breakthrough technologies in the areas of Artificial Intelligence, Internet of Things and Augmented Reality, Data Science and other technologies that have emerged over the past few years. Besides helping learners become literate in emerging technologies, the course will prepare them to use technology in their respective professional preparations.

Course category: Basic

Course Name: Fundamentals of Programming (CSEg1104)

Credit Hour: 3

Prerequisite: Introduction to Computing

Course description (Synopsis):

The course is designed to introduce structured programming in C++ by providing an overview of programming concepts, on creating and working computer programs in C++. It will address fundamental concepts of program analysis, design, coding, testing and development. It includes introduction to computer programming; programming paradigms; algorithms and problem-solving; introduction to data structures and Programming constructs. The course is designed on how to solve business and scientific problems through the technique of structured programming. It will prepare students for focused studies in any programming language experiment.

Course category: Basic

Course Name: Probability and Statistics for Engineers (Math2105)

Credit Hour: 3

Prerequisite: None

Course description (Synopsis):

Statistics looks at the data handling cycle and analysis of collected data. Up on the completion of this course, students will be able to understand the process involved in posing the question, collecting data on that question, presenting data, analyzing data using measure of spread and center, quantitative analysis of uncertainty and risk for engineering applications, estimation of distribution parameters, hypothesis testing, simple and multiple linear regressions, Poisson and Markov processes, and interpreting the results to make informed decision. There is an emphasis placed on real-world applications to engineering problems. This course include: History of statistics, Meaning of statistics; Methods of data collection and presentation; Measures of an average; Measures of variation; Moments, skewness and kurtosis; terminologies in probability; Counting Techniques; definition of Probability (approaches to probability); Probability distributions; Sampling and Sampling Distribution of the mean and proportion; Basic concepts for estimation: (Point and Interval) for the population mean and proportion; Hypothesis testing on the population mean and proportion; Simple linear regression, correlation and rank correlation.

Course category: Major mandatory

Course Name: Architectural Working Drawing (Arch2201)

Credit Hour: 3

Prerequisite: Engineering Drawing (DME1102)

Course description (Synopsis):

This Course seeks to expose students to the preparation of Architectural working drawings, Structural drawings, Sanitary drawing and Electrical installation drawing. Topics discussed will cover Architectural graphic standards, symbols, conventions, and terms, Architectural lettering, Preparation of Architectural working drawings such as floor plans, building sections, exterior and interior elevations, foundation plans, roof plans, reflected ceiling plans, site plan, details, and schedules.

Course category: Major mandatory

Course Name: Contract, Specification and Quantity surveying (CEng4207)

Credit Hour: 3

Prerequisite: CEng3207

Course description (Synopsis):

This course is designed to prepare students to handle the practical tasks the engineer is exposed to in the real life. The topics discussed in readings and course lectures are selected to give the student a comprehensive understanding of the process of generating, bidding, and performing construction contracts, components of direct and indirect construction costs, work breakdown, contingency and risk. This course teaches the methodology, procedures and organizational techniques involved in preparing a competitive bid. Detailed estimates for each major construction discipline are prepared, based upon real construction project documents. Ethical considerations in budgeting and estimating are Going to be discussed. The final project is the preparation of a formal competitive bid on a project. A study of methods and operations in

managing projects from both the perspective of the constructor and designer. Topics include elements of the construction process, project delivery types and types of construction contracts.

Course category: Major mandatory

Course Name: Construction Materials (CEng2205)

Credit Hour: 3

Prerequisite: None

Course description (Synopsis):

The course introduces the production, nature and characteristics of different construction materials like; stone, brick, cementing materials, concrete, and timber, steel and identifying them with respect to their suitability to different engineering structures.

Course category: Major mandatory

Course Name: Strength of materials (CEng2202)

Credit Hour: 4

Prerequisite: Engineering Mechanics, CEng2201

Course description (Synopsis):

Strength of materials, also called mechanics of materials, deals with the behavior of solid objects subject to stresses and strains. The complete theory began with the consideration of the behavior of one- and two-dimensional members of structures, whose states of stress can be approximated as two dimensional, and was then generalized to three dimensions to develop a more complete theory of the elastic and plastic behavior of materials. This course is a fundamental course which makes the students acquainted with the concept of load resultant, consequences and how different kinds of loadings can be withstood by different kinds of members with some specific materials having different behaviors.

Course category: Major mandatory

Course Name: Engineering Hydrology (WREN3201)

Credit Hour: 3

Prerequisite: Probability and Statistics for Engineers (XYZW), Introductory Hydrology & Hygrometry Practice (WREN2202)

Course description (Synopsis):

Engineering Hydrology is one of the fundamental courses for Water Resources Engineering students that enables them to analyze and interpret the basic data for planning and designing of multi-purpose water projects like hydropower, irrigation and domestic water supply system. Specifically, it enables students understand how to predict risks and reliabilities of flood control systems. In addition, it provides students basic knowledge on the application of different rainfall runoff models, catchment characteristics, hydrology of different sizes of catchment, interpretation of data using statistics and probability. Moreover, it gives fundamental knowledge about reservoir capacity determination and urban hydrology.

Course category: Major mandatory

Course Name: Hydraulics II (WREN 3203)

Credit Hour: 3

Prerequisite: Hydraulics I

Course description (Synopsis):

The overarching goal of this course is to teach the procedures and underlying theory employed by Water Resources engineers for designing and analyzing open channel flow and closed conduit systems. Hydraulics concepts are explored through the application of energy and momentum principles in open channel flow and economically based design theory. The concepts of fluid mechanics applied to pipe works, open channel flow, boundary Layer theory, closed-conduit flow, network design analysis and hydraulic machinery to develop quantitative approaches for answering questions in hydraulics.

Course category: Major mandatory

Course Name: Soil Mechanics I (CEng3201)

Credit Hour: 3

Prerequisite: None

Course description (Synopsis):

Soil Mechanics-I introduces the students to the principle of soil mechanics and provides the basics of geotechnical engineering. In this course students will learn about physical properties of soils; identification and classification of soils for engineering purposes; fundamental behaviour of soils subjected to surface load; groundwater and seepage through soils; theory of compaction; consolidation of compressible soils; Upon successful completion of the course, students should be able to apply fundamentals of soil mechanics in the geotechnical engineering problems.

Course category: Major mandatory

Course Name: Theory of Structures (CEng3203)

Credit Hour: 4

Prerequisite: Strength of Materials CEN2202

Course description (Synopsis):

Theory of structure is basic course which deals with the analysis of indeterminate structures of single and continuous beams, single bay frames, and trusses by different methods (force and displacement) and introduce the matrix method of analysis by flexibility and stiffness methods. It also deals with the knowledge of how-to analysis the structures for moving loads which are applied on bridges for truck movement and railways to get maximum shear forces and bending moments for determinate and indeterminate structures. In this student will familiar to analysis of indeterminate and determinate structures, Influence line to determinate and indeterminate structures and matrix method of analysis.

Course category: Major mandatory

Course Name: Open Channel Hydraulics (WREN3202)

Credit Hour: 3

Prerequisite: Hydraulics

Course description (Synopsis):

This course is introduced to emphasis on the steady and unsteady fluid flow in channels including streams and rivers. Open channel hydraulics mostly address very important concepts of energy, momentum and continuity principle to ensure flow computation for different channels and classifying flow types such as GVF and RVF. The topics covered in this course includes: Open Channel flows and its classification, basic principles in open channel flow, flow computation formulas, gradually varied flow (GVF), rapidly varied flow (RVF) and introduction to unsteady flow.

Course category: Major mandatory

Course Name: Soil Mechanics-II (CEng3202)

Credit Hour: 3

Prerequisite: Soil Mechanics-I(CEN3201)

Course description (Synopsis):

Soil Mechanics is a discipline of Civil Engineering involving the study of soil, its behaviour and application as an engineering material. This course introduces the students shear resistance of soils, stress at a point and Mohr stress circle, shear characteristics of soils, Mohr-Coulomb failure criteria, and shear tests, determination of bearing capacity of soils using different methods, lateral earth pressure problems, earth pressure theories and Slope stability problems and slope stability analysis.

Course category: Major mandatory

Course Name: Irrigation Engineering (WREN3204)

Credit Hour: 3

Prerequisite: Engineering Hydrology (WREN3201)

Course description (Synopsis):

Irrigation engineering is one of the specialization areas of water resources engineering profession that deals about planning, design, construction, operation, and maintenance of irrigation projects to ensure food security. It expertise students about irrigation project feasibility studies, various types of irrigation system design, and basic principles of irrigation water application methods and selection criteria.

Course category: Major mandatory

Course Name: Water Supply and Treatment (WREN3206)

Credit Hour: 3

Prerequisite: None

Course description (Synopsis):

Fundamental principles of Water supply and Treatment addresses sustainable provision of safe and reliable drinking water for the community. This includes broad understanding on planning, designing and construction of urban water supply system, and water treatment methods. This course offers basic knowledge on Demand for Water: Water demands, Factors affecting water consumption, variation in demand, effect of variation in demand on the design capacities of different components of a water supply schemes, Population Forecasting; Sources of Water; Collection and Distribution of Water: Intakes for collecting surface waters, service reservoir, Layout and Design of Distribution systems, Pump systems and appurtenances; Water “We are dedicated to innovative knowledge” 175 Treatment Methods.

Course category: Major mandatory

Course Name: Building Construction (CEng3207)

Credit Hour: 3

Prerequisite: Fundamentals of Surveying, Architectural working drawing & Construction Materials

Course description (Synopsis):

The overall building construction process and understand design and performance requirements of a building shall be covered. Moreover, the student will be able to read and prepare working drawings for building construction (Floor plans, elevations, sections and detail drawings). Be able to tell the merits and demerits and select different types of material for the structural system of a building. Be able to understand the design parameters required for planning of a building and prepare bubble diagram for functional arrangement of a building. This course offers the purpose, functional requirement, types, suitability and construction details of different elements and system of a building (foundation, floor, wall, stairs, Doors & windows, roof, finishing and etc.).

Course category: Major mandatory

Course Name: Reinforced Concrete Structures I (CEng3204)

Credit Hour: 3

Prerequisite: Theory of Structures II

Course description (Synopsis):

Reinforced Concrete is a composite building material consisting of structural concrete reinforced with a reinforcing material like steel. The most common reinforcement used is steel. In this course steel is used as reinforcement. This course covers mechanical properties of concrete & reinforcing steel, concrete mix design, reinforced concrete design methods and Ethiopian building code of standards. It also covers the design of singly and doubly reinforced Rectangular & T-section beams, one-way and two-way solid slabs, ribbed slabs and stair cases. Shear in beams, Bond, anchorage & development methods, detailing of shear reinforcement, design of beams for serviceability-elastic analysis of beam sections, cracking, moment-curvature relationship and deflections are also included.

Course category: Major mandatory

Course Name: Hydraulic Structure I (WREN4201)

Credit Hour: 4

Prerequisite: Soil Mechanics II and Open Channel Hydraulic

Course description (Synopsis):

This course emphasizes the basic principles and design of different types of Hydraulic structures and appurtenant works with stability analysis. The basic concepts of the dam loads with stability analysis is applies throughout the course. It will be given on Elements of dam engineering; classification of dams; site assessment and selection of appropriate type of dam; concrete dams: loading; analysis and design of gravity dam, arch and buttress dams, design features and construction of concrete dam; roller compacted concrete gravity dam; embankment dams: types of embankment dams. The course also introduces concepts and design principle of Dam Outlet Works, Spillway, Energy Dissipation, and Dam Safety: Instrumentation and Surveillance.

Course category: Major mandatory

Course Name: Hydropower Engineering (WREN4205)

Credit Hour: 3

Prerequisite: None

Course description (Synopsis):

This course will introduce the fundamentals of design of hydropower systems and infrastructure, hydraulic power as a source of energy, and selecting appropriate site for hydropower development and design of hydropower components. Estimation of waterpower potential; flow duration curves; electrical loads on turbines, load curve; load factor; firm and secondary power; classification of hydroelectric power plants; design of Power intakes and water ways; selection and design of hydraulic turbines are covered in this course.

Course category: Major mandatory

Course Name: Foundation Engineering (CEng4201)

Credit Hour: 3

Prerequisite: Cen 3202

Course description (Synopsis):

Foundation Engineering studies methods of site exploration and design of shallow foundation using principles of soil mechanics and structural design methods. In this course students will learn about site exploration methods, selection of foundation types, analysis and design of shallow foundations and retaining structures. Moreover, it will also enable students to develop appropriate skills to analysis practical field tests data.

Course category: Major mandatory

Course Name: Research Methods for Engineers (WREN5203)

Credit Hour: 3

Prerequisite: Probability and Statistics for Engineers

Course description (Synopsis):

When complex theoretical and technical problems are solved, new knowledge is created. In this course students learn how to apply the engineering research process and methods of inquiry to solve these problems. This involves critiquing current research in their discipline and developing competence in using instruments and software to collect data. This course introduces students to research methods, proposal development, scientific literature reviews, measurement techniques, statistical data analysis, and design of experiments. They analyze and evaluate the results and judge their quality and limitations. They also learn how to communicate, orally and in writing, findings in specific engineering formats to specialist audiences. Ethics and intellectual property topics related to research will also be covered.

Course category: Major Elective

Course Name: AutoCAD for Water Resources Engineers (WREN3305)

Credit Hour: 3

Prerequisite: None

Course description (Synopsis):

AutoCAD software is a basic requirement for Water Resources Engineers working in the real world scenario. They are confidentially expected to draw the end result of any water projects design in AutoCAD so that it will be ready and clear for contractual process, for construction purpose by the end doers (foreman) and for any modification as a result of financial limitations and/or social conditions. Specifically, it introduces in detail about the representing of drawing primitives on a computer; AutoCAD hardware and software; Basic commands of drawing and drawing settings, editing, dimensioning, text annotations of an AutoCAD software; Project work of two-dimensional Water projects drawing with AutoCAD software; Introduction to three-dimensional drawing.

Course category: Major Elective

Course Name: Fundamentals of Environmental Engineering (WREN3308)

Credit Hour: 3

Prerequisite: None

Course description (Synopsis):

The course is designed to impart students with the knowledge and practices understanding of environment and its component, practices of predicting, and responding to natural and human-induced environmental change. Understanding and addressing environmental issues such as global warming, stratospheric ozone depletion, or local and regional air, land/soil and water pollution from a diverse set of scientific disciplines including atmospheric physics and Chemistry, oceanography, glaciology, hydrology, geophysics, ecology, and biogeochemistry. This course structured around the view that the environmental system is comprised of a complex set of Chemical, physical, and biological interactions, made even more complicated by the various activities of human society.

Course category: Major Elective

Course Name: Construction Methods & Equipment (CEng5314)

Credit Hour: 3

Prerequisite: None

Course description (Synopsis):

This module introduces students to the operations and understanding of key construction equipment. At the end of this module, students will be able to have the knowledge, skills, and attitudes to enable them to select appropriate construction equipment for specific construction operations that are based on equipment output; quality and quantities of work; economic use of the equipment and the nature of work to be done Also the course will introduce students to civil construction plans, determining earthwork quantities, equipment economics and utilization, equipment production rates, fundamentals of earth moving and excavating, loading and hauling equipment.

Course category: Major Elective

Course Name: Groundwater Hydrology (WREN4205)

Credit Hour: 3

Prerequisite: None

Course description (Synopsis):

The course topics are typically interdisciplinary, drawing primarily from mathematics, physics, hydrology and geology. Groundwater resources: Scope and occurrence; ground water in hydrologic cycle; different types of aquifers and their characteristics. Ground water movement: Darcy's law, Laboratory and field determination of hydraulic conductivity, determination of ground water flow parameters. Hydraulics of wells: steady and unsteady states of flow in, phreatic, confined and unconfined aquifers. Pumping test, design of piezometer, analysis and interpretation of data. Ground Water balance and ground water management.

Course category: Major Elective

Course Name: Remote sensing and Geographical Information System (GIS) (WREN3310)

Credit Hour: 3

Prerequisite: None

Course description (Synopsis):

Remote sensing and GIS involve in planning and management of water resources using RS data sources for mapping, while GIS as a tool for management and visualization water resources. In this course the students understand the basic concepts of RS &GIS, techniques and applications of RS and GIS.

Course category: Major Elective

Course Name: Drainage Engineering (WREN4309)

Credit Hour: 3

Prerequisite: Irrigation Engineering (WREN3204)

Course description (Synopsis):

Drainage Engineering is one of the Irrigation and Drainage Engineering disciplines for water resources engineering profession that enable students to carryout feasibility study and design of drainage systems. More specifically, this course aware students about the importance of drainage for irrigated agriculture and enable them to understand soil salinity, drainage for salinity control and land reclamation. At the end of the course, students are able to know the different components of surface and sub-surface drainage systems, design surface and subsurface drainage systems for irrigated agriculture and water-logged areas.

Course category: Major Elective

Course Name: Flood and Drought Management (WREN5308)

Credit Hour: 3

Prerequisite: Engineering Hydrology (WREN3201)

Course description (Synopsis):

Floods and droughts are the most frequent natural disasters in Ethiopia. Both have caused, and continue to cause, serious economic and environmental losses. These events are the result of both natural disasters and human actions. Due to climate change and anthropogenic activities, there is an increasing need to emphasize prevention, mitigation, and risk management to respond to these events in order to protect our safety, quality of life, economy and environment. To the essence of specific description of the course, the following topics are incorporated: factors causing and aggravating river floods and droughts, flood and drought assessment and analysis tools/models, flood frequency analysis and flood routing, flood and drought management approaches, and flood forecasting and warning.

Course category: Major Elective

Course Name: Software Applications in Water Resources Engineering (WREN4307)

Credit Hour: 3

Prerequisite: None

Course description (Synopsis):

The course enables the students to know the basic knowledge of water resources engineering software applied in the different water resources engineering project. CAD software's are used to draw basic lines and shapes and pictorial drawings. Architectural drafting, symbols and conventions are covered. Presentation drawings: plans, sections, elevations and scale convections of drawings are all covered. Arc GIS and HEC-HMS are used to develop different maps and prepare watershed area for estimation of discharges.

Course category: Major Elective

Course Name: Sewerage System and Wastewater Treatment (WREN4306)

Credit Hour: 3

Prerequisite: None

Course description (Synopsis):

Sewerage system and wastewater treatment is designed to give broad understanding on planning, designing and construction of sewerage system and wastewater treatment plant. This course offers fundamental knowledge on Wastewater characteristics; wastewater treatment objectives and methods; Design of facilities for Physical, Chemical and Biological treatment processes; Effluent disposal and water pollution control; Sludge treatment and disposal methods; Wastewater reclamation and reuse.

Course category: Major Elective

Course Name: River Engineering (WREN4310)

Credit Hour: 3

Prerequisite: None

Course description (Synopsis):

In the course of River Engineering, we explore technologies for human being to coexist with the nature and implement comprehensive river training and flood control mechanisms to achieve efficient water conveying systems. The course is designed to introduce the knowledge of river characteristics, river hydraulics, morphology of river, sediment characteristics and design of stable channel and river training work to control flood.

Course category: Major Elective

Course Name: Water wells Engineering (WREN4314)

Credit Hour: 2

Prerequisite: Ground water Hydrology

Course description (Synopsis):

The course is to enable students to know groundwater exploration methods to site the location of water wells and the different types of wells. Students can design and analyze the different types of water wells, understand the construction procedures of wells and spring development. Students can also learn and know the threat of groundwater pollution, modelling and management.

Course category: Major Elective

Course Name: Reinforced Concrete Structures II (CEng4203)

Credit Hour: 3

Prerequisite: Reinforced Concrete Structures I

Course description (Synopsis):

This course is a continuation of Reinforced Concrete Structures I. It covers the design of column and flat slabs, inelastic moment redistribution, yield line theory for slabs, torsion in reinforced concrete members and introduction to pre-stressed concrete structures.

Course category: Major Elective

Course Name: Environmental Impact Assessment (WREN5201)

Credit Hour: 2

Prerequisite: None

Course description (Synopsis):

This course introduces the methodology of environmental impact assessment (EIA) as a vital tool for sound engineering project management decision making process. The course provides an overview of the concepts, methods, issues and various forms and stages of the EIA process. It examines the development of EIA overseas and in Ethiopia. It mainly draws on case studies of EIA in Ethiopia but also focuses on the EIA process in other developing countries. Different levels and systems of EIA are examined to highlight the diversity of approach and impact of the EIA process.

Course category: Major Elective

Course Name: Road Engineering (CEng4205)

Credit Hour: 3

Prerequisite: Engineering Surveying (CEng3205)

Course description (Synopsis):

This course contains multidisciplinary areas in civil engineering that involves the basics of highway engineering. It helps a student's to acquire basic knowledge on transportation system, principles of geometric design of highways, highway construction materials and the design of pavements necessary to carry the traffic load. Knowledge of overall highway design process.

Course category: Major Elective

Course Name: Hydropower Engineering II (WREN5303)

Credit Hour: 3

Prerequisite: Hydropower Engineering

Course description (Synopsis):

The course is a continuation of Hydropower Engineering and is designed to introduce the design and construction of power plant, tunnels and transmission system; and planning of hydropower projects. Students will be able to select appropriate project for hydropower development considering different constraints, design layout and elements of a hydropower plant, analyze different project alternatives based on technical, social and environmental considerations. Design of power station; tunnel design and construction; planning and design of transmission system of electric power; construction aspects of components of hydropower project; environmental and social impacts of hydropower projects; assessment of hydropower project feasibility with consideration of environmental, social and political factors will be covered in this course.

Course category: Major Elective

Course Name: Highway Engineering-I (CEng 3206)

Credit Hour: 3

Prerequisite: Engineering Surveying (CEng 3205)

Course description (Synopsis):

This course is one of the major courses in civil engineering department especially in transport area. It includes highway route selection, geometric design of highways: design controls and criteria, highway cross-section, sight distance, horizontal alignment, vertical alignment, intersections, interchange, drainage structures design and earthwork.

Course category: Major Elective

Course Name: Foundation Engineering II (CEng4202)

Credit Hour: 3

Prerequisite: Foundation Engineering I (CEng4201)

Course description (Synopsis):

Foundation Engineering-II considers design of dip foundation using principles of soil mechanics and structural design methods. Students will learn about deep foundation: Types of deep foundations, load transfer mechanism in piles, pile capacity, Pile load test, pile group capacity, settlement of pile, introduction to foundation on problematic soils.

Course category: Major Elective

Course Name: Legal & Administrative Aspects of Water Resources (WREN5313)

Credit Hour: 2

Prerequisite: None

Course description (Synopsis):

The course aims to introduce the legal frameworks, institutional and administrative arrangements and their duties and responsibilities, transboundary issues and negotiation and conflict management in relation to water resources management.

Course category: Major Elective

Course Name: Water Harvesting Technology (WREN 5311)

Credit Hour: 2

Prerequisite: None

Course description (Synopsis):

The course aims to introduce basic knowledge, skills and expertise about water harvesting technologies including rainfall-runoff analysis, design model for catchment of different systems and to utilization the water resources efficiently in terms of its usage and water conservation.

Course category: Major Elective

Course Name: Soil and Water Conservation Engineering (WREN5315)

Credit Hour: 2

Prerequisite: Engineering Hydrology (WREN3201)

Course description (Synopsis):

This course is designed to acquaint students with principles of erosion and erosion mechanisms against the valuable resource soil. Types of erosion and factors affecting erosion are dealt. Estimation of soil loss by water erosion has given more attention to aware students about the fate of soil erosion. Conservation measures to alleviate the problem of erosion are discussed viz: contouring, strip cropping, terracing, and types of terraces, planning the terrace systems, terrace outlet, location, construction and maintenance. Various conservation structures (permanent and temporary structures and their design; functional requirement and limitation of conservation structures are addressed. Wind erosion, its mechanism and causes, measures to tackle it has been introduced. Control of soil erosion by wind: agronomic and engineering measures are included. The essence of water conservation, percolation, evaporation losses of water from water bodies, reservoirs, canals and their control measures are highlighted. The concept of Water harvesting techniques and soil conservation planning are included.

The course is designed with basic knowledge of soil and water conservation engineering. It provides a clear understanding of soil erosion mechanics and the possible different soil and water conservation engineering practices to be undertaken to minimize land degradation due to soil erosion. It can also help students to understand the basic principle involve in watershed management.

Course category: Major Elective

Course Name: Irrigation Water Management (WREN4312)

Credit Hour: 2

Prerequisite: None

Course description (Synopsis):

The course is designed to impart students with the knowledge and practices of irrigation water management required to ensure productive and sustainable irrigated agricultural. Specifically, it aims to enable students: 1) understand the undesirable consequences of unwise management of irrigation water; 2) know and apply the methods and principles of schemes water demand and supply analysis 3) plan and implement water allocation to irrigation water users; 4) evaluate irrigation performances and develop improvement options.

Course category: Major Elective

Course Name: Water Resources Planning and Management (WRE5304)

Credit Hour: 3

Prerequisite: None

Course description (Synopsis):

Water Resources Planning and Management course will enable students about planning and management of water resources systems for multiple societal objectives, with emphasis on technical tools and data available to analysts. The application of statistical analysis and mathematical simulation, and optimization models will be covered. The interface between technical analysis and policymaking will also be discussed, along with several regional and international case studies.

Course category: Major Elective

Course Name: Engineering Economics (WREN4304)

Credit Hour: 3

Prerequisite: None

Course description (Synopsis):

This course emphasizes the strong correlation between engineering design and the economic issues they involve. The basic concepts of the time value of money and economic equivalence is applied throughout the course. Each engineering problem/project progressively incorporates different cash flows, the cost of funds, capital, operational and maintenance costs, salvage value, depreciation, amortization, and taxation. Students learn to apply different economic analysis methods, like present worth, annual equivalent worth, rate of return, life, cycle cost, cost/benefit in evaluating the economic viability of a project, as well as the comparison of mutually exclusive alternatives. The course also introduces concepts of replacement decisions, capital budgeting decisions, and project risk and uncertainty, and exposes students to specific issues of economic analysis of the private sector versus the public sector. Applications to a variety of engineering fields' actual cases are stresses throughout the course.

Course category: Major Elective

Course Name: Construction Planning & Management (CEng4308)

Credit Hour: 3

Prerequisite: Contract, specification & Quantity Survey

Course description (Synopsis):

To provide students with knowledge of the various forms of project delivery methods (Design Bid-Build, Design-Build, and Construction Management) and the underlying principles for choosing the appropriate system. Students will learn to recognize the complexity of the preconstruction process including conceptual estimating and scheduling, life cycle costing, constructability reviews, value engineering, risk management and special contract requirements. To provide students with the knowledge of principles of project management and their applications in construction projects. Techniques in managing construction projects will be taught including project planning, cash flow analysis, Gantt chart, and critical path methods using network diagrams.

Course category: Major Elective

Course Name: Integrated River Basin Management (WREN 5306)

Credit Hour: 3

Prerequisite: None

Course description (Synopsis):

This course intended to deal with IWRM for modelling watershed and watershed components to processes with the view of understanding the integrated watershed management. The course Integrated river basin management incorporated integrated watershed management, water resources systems and sustainability, parameters and deriving the watershed parameters, components and process of watershed ,watershed assessment methods, watershed treatment measures for non-arable land ,project cost formulation in micro watershed, watershed modelling, Land evaluation, interpretation of aerial photographs, requirements of land utilization types, survey procedures, and land evaluation, sustainability issues for land evaluation with evaluation of emphasis on irrigated agriculture.

Course category: Major Elective

Course Name: Highway Engineering II (CEng 4205)

Credit Hour: 3

Prerequisite: Highway Engineering (CEng 3206)

Course description (Synopsis):

This course is one of the major courses in civil engineering department especially in transport area. It focuses on planning, analyzing and designing of all pavement layers and thickness. In this course students are able to have detail understanding on selecting materials used in all pavement layers and Design structurally efficient pavements according to ERA manual.

4. School of Mechanical, Chemical and Materials Engineering

4.1 Chemical Engineering program

General information

I. *Duration of study*

Normal modality

Regular: a 5-year program

Continuing: 6 year program

Fast Track modality:

dual major/minor there may be one year extension as stated in the university senate legislation

II. *Course category*

S/N	Course category		Course level	Credit requirement	% from total
1	General	Mandatory	University required	27	15.00
2	Basic	Mandatory	School required	58	32.22
3	Major	Mandatory	Department required	72	40.00
		Elective		20	11.11
4	Free electives	Elective	Individual (free) required	3	1.67
Total				180	100

category: General/ university required

Course Name: Entrepreneurship and Business Development (SOSC5003)

Credit Hour: 3

Prerequisite: None

Course description (Synopsis):

This interdisciplinary course in general is designed to introduce students to the concept of sustainable entrepreneurship, a manageable process that can be applied across careers and work settings. It focuses on building entrepreneurial attitudes and behaviors that will lead to creative solution within community and organizational environments. This course is designed to prepare individuals for ownership of their own innovative business, and assist start-ups to function more effectively, increase the chances of new business success, enhance profitability, and increase employment.

More specifically, the course provides students with an introduction to the concepts and skills necessary to successfully commercialize new products and services. Entrepreneurship is not just about starting a business. It is also about identifying good opportunities and then creating, communicating, and capturing value from those opportunities; including innovation in a corporate context. It will also teach students the skills to analyses business opportunities, and articulate them as a compelling business description, and pitch to an audience of investors, customers, or business partners. It focuses on building entrepreneurial attitudes and behaviors that will lead to creative solution within community and organizational environments.

Course category: General/ university required**Course Name: Communicative English Skills (EnLa 1001)****Credit Hour: 3****Prerequisite: None****Course description (Synopsis):**

Communicative English Skills is a course where students learn what they need to know for a career in science context. The course gives students the language, information, and skills they need to study science context. It also provides students the language appropriate for studying science context and real work situations as it comprises unique sections such as: ‘it’s my job’ wherein real people talk about their work in science context , ‘listening’ whereby students are exposed to situations related to science context , technical explanations, and interviews, ‘reading’ whereby students meet a variety science context based texts, and the ‘writing section’ which is designed to let students compose short reports on different activities.

Course category: General/ university required

Course Name: Basic Writing Skills (EnLa-1002)

Credit Hour: 3

Prerequisite: Communicative English Skills (EnLa 1001)

Course description (Synopsis):

Basic Writing Skills course aims at developing students’ basic writing skills in science context. The course gives students the language writing skills they need to study science. It contains sentence level writing: sentence structure, sentence types sentence combinations, common sentence errors (fragment, run on, comma splices, misplaced modifier, dangling modifier, faulty parallelism, faulty reference of pronoun, faulty agreement and shifts); paragraph level writing: the essence of a paragraph, components of a paragraph (topic sentence, supporting sentences, concluding sentence), characteristics of effective paragraph (unity, coherence and completeness) and the steps in writing a paragraph and types of a paragraph; essay level writing: structure of an

essay, thesis statement and supporting paragraphs, types of essays and techniques of essay development.

Course category: General/ university required

Course Name: Introduction to Civics and Ethics (LART 1001)

Credit Hour: 3

Prerequisite: None

Course description (Synopsis):

This course is designed with the aim of equipping learners with necessary ethical qualities and civic competences while dealing with issues that affect their society at all levels and human in general. The course starts with unfolding the notions, principles and theories of ethics which can shape human attitude, action and behavior in making moral judgments. Next, the course introduces learners to the nature, mutual interactions and historical evolutions of society, state, government and citizenship. It also elucidates issues pertaining to political governance such as constitution, democracy, and human rights in some details. To enable learners grasp basic knowledge of political, economic and social dynamics of international system in today's globalized world, the course also introduces international relations and foreign policy and other major contemporary global issues.

Course category: General/ university required

Course Name: Logic and Critical thinking (LART 1002)

Credit Hour: 3

Prerequisite: None

Course description (Synopsis):

The main goal of the course is to improve critical and logical reasoning skills. Students will see how our ordinary intuitions on good or bad reasoning can be articulated explicitly in formal systems, and gain a new ability to evaluate arguments and reasoning they encounter every day with rigorous logical concepts and tools. As to the subject matter, it introduces systematic methods of reasoning, such as argument, deduction, induction, syllogistic, and propositional logic.

Course category: General/ university required

Course Name: Introduction to Economics (SOSC2002)

Credit Hour: 3

Prerequisite: None

Course description (Synopsis):

This course provides a general introduction to economics combining elements of micro and macro fundamentals. The main objective of this course is to introduce and acquaint students with the preliminary principles (theories) and knowledge of economics and the application of economic theories (principles) in the actual world; the daily activities of the households, firm business or any other form of enterprises at micro levels. Students will also be able to contextualize the key macroeconomic variables and policy instruments.

Specifically, the course introduces students with theory of consumer behaviors, production, and cost of production. In these theories how decisions are made by different economic agents will be discussed. Furthermore, the course covers different characteristics of perfect and imperfect market structure. Lastly the course tries to introduce basic macroeconomic concepts such as national income accounting, unemployment, inflation, fiscal and monetary policy instruments.

Course category: General/ university required

Course Name: General Psychology and Life Skills (LART 2002)

Credit Hour: 3

Prerequisite: None

Course description (Synopsis):

Psychology is a science of human cognitive processes and behaviors. This course is designed to give students an overview of what psychological science has discovered about human behaviors and mental processes throughout human history. Students will gain an understanding of the psychological phenomena that occur in daily life as well as the practical applications of psychological knowledge. Upon completing the course, students shall be able to demonstrate a basic knowledge of the science of psychology. Specifically, the course general psychology is concerned with discussing perspectives in psychology and basic psychological concepts such as sensation and perception, learning, personality, motivation, emotion, and basic life skills (intrapersonal, interpersonal, social and academic skills). Emphasis will be given to both theoretical and practical implications of these concepts to effectively function as individual and team in a community.

Course category: General/ university required

Course Name: Physical fitness and conditioning I (SpSc1011)

Credit Hour: 0 cr.hr

Prerequisite: None

Course description (Synopsis):

This course will provide the students with basic concepts of the five components of health related physical fitness (cardiovascular, muscular strength and endurance, flexibility, and body

composition), hypokinetic disease and general principles of training. It is mainly practical oriented. As a result, the students will be exposed to various exercise modalities, sport activities, minor and major games, and various training techniques as a means to enhance health related physical fitness components. In addition, they will develop the skills to assess each component of fitness and will practice designing cardiovascular, muscular strength and endurance, and flexibility programs based on the fitness assessment. The course serves as an introduction to the role of exercise in health promotion, fitness, performance including the acute and chronic responses of the body to exercise.

Course category: General/ university required

Course Name: Physical fitness and conditioning II (SpSc 1022)

Credit Hour: 0 cr.hr

Prerequisite: SpSc 1011

Course description (Synopsis):

This course is designed to acquaint freshman engineering and applied natural science students with the nature and scope of different ball games.

It emphasizes the value of establishing lifelong fitness using ball games as a means and focuses on the fundamental of volley ball, hand ball, basketball and football as a life time leisure activity also focuses on the development of personalized approach to healthy active living through participation in a verity of ball games that have the potential to engage students' interest throughout their lives. Again, the courses enable the participants enjoying practice and acquire proper technique and strategies associated with the ball games mentioned above and learn rules governing the game.

Course category: General/ university required

Course Name: Geography of Ethiopia and the Horn (LART 1003)

Credit Hour: 3

Prerequisite: None

Course description (Synopsis):

This course covers a brief description on the location, shape and size of Ethiopia as well as basic skills of reading map, the physical background and natural resource endowment of Ethiopia and the Horn which includes its geology and mineral resources, topography, climate, drainage and water resources, soil, fauna and flora. It also deals with the demographic characteristics of the country and its implications on economic development.

Course category: General/ university required

Course Name: History of Ethiopia and the Horn (LART 1004)

Credit Hour: 3

Prerequisite: None

Course description (Synopsis):

This course describes why history is important, how history is studied and introduces the region Ethiopia and the Horn. It treats human evolution, Neolithic Revolution, settlement patterns as well as religion and religious processes in Ethiopia and the Horn. Based on these historical backgrounds, the course describes states, external contacts, economic formations and achievement in terms of architecture, writing, calendar, and others to the end of the 13th century. Historical processes including states formation and power rivalry, trade, external relation, threats and major battles, centralization and modernization attempts, Italian occupation, and socio-economic conditions from 1800 to 1941 makes central position in the modern history of the region.

Course category: Basic

Course Name: Applied Chemistry (ChEg3103)

Credit Hour: 3

Prerequisite: General Chemistry

Course description (Synopsis):

The course aims to introduce students to main applied chemistry principles which helps them to practice about and perform different synthesis of organic and inorganic compounds and materials.

Course category: Basic

Course Name: Numerical Methods for Chemical Engineers (ChEg2104)

Credit Hour: 3

Prerequisite: Applied Mathematics III (Math2101) & Fundamentals of Programming (CSE1102)

Course description (Synopsis):

This course will cover the basic concepts of Mathematical modeling; Roots of equations in one variable; Linear algebraic equation; Curve fitting; Numerical integration and differentiation; Ordinary differential equations.

Course category: Basic

Course Name: Applied Mathematics I (Math1101)

Credit Hour: 4

Prerequisite: None

Course description (Synopsis):

Generally, the Course Covers Basic Ideas and Principles of Vectors& Matrices of Linear Algebra and Basic ideas of Calculus. In Particular the course Contains principles of vectors,

matrices & determinants, limit and continuity, derivatives & their applications, integrals, integration techniques and their applications.

Course category: Basic

Course Name: Applied Mathematics I (Math1101)

Credit Hour: 4

Prerequisite: None

Course description (Synopsis):

Generally, the Course Covers Basic Ideas and Principles of Vectors& Matrices of Linear Algebra and Basic ideas of Calculus. In Particular the course Contains principles of vectors, matrices & determinants, limit and continuity, derivatives & their applications, integrals, integration techniques and their applications.

Course category: Basic

Course Name: General Physics (Phys1101)

Credit Hour: 3

Prerequisite: Knowledge in Higher Secondary Physics

Course description (Synopsis):

This course provides science students with the basic concepts of physics that enable them to understand describe and explain natural phenomena. Emphasis is laid on general principles and fundamental concepts in measurements, mechanical and thermal interactions, fluid mechanics,

electromagnetism, oscillations and waves with applications of physics in various fields of science. Permitting the students to voice and defend their own opinions and enhancing the students' commitment to individual study and acquiring knowledge. Active involvement of learners is required at each phase. This is done through questioning and answering, reflection, reporting, solving problems associated with the respective topics.

Course category: Basic

Course Name: General Chemistry (Chem1102)

Credit Hour: 3

Prerequisite: None

Course description (Synopsis):

General Chemistry is the science of the properties of atoms and the laws governing their combination, composition, and structure of substances, the transformations they undergo, and the energy that is released or absorbed during Chemical or physical process. The topics covered in this course includes: Introduction to the study of modern Chemistry, acids and bases, the periodic table, Chemical bond and molecular structure, rates of physical and Chemical processes, materials, kinetic molecular description of the state of matter and equilibrium in Chemical reaction.

Course category: Basic elective

Course Name: Introduction to Computing (CSEg 1101)

Credit Hour: 3

Prerequisite: None

Course description (Synopsis):

In this course the basic techniques of computational problem solving will be covered by using computational thinking while writing small and medium sized programs, mapping problems into computational frameworks emphasizing on scientific problems, understanding problems and

formulation of problems based on the elective programming language (using python). The course includes the concepts and techniques of data structure, input/output, flow control and incidental program, and by using a systematic division of problem solution and concept of module, to solve problems in numerical value field and non-numerical value field with program experiment.

Course category: Basic

Course Name: Applied Mathematics II (Math 1102)

Credit Hour: 4

Prerequisite: Applied Mathematics I (Math 1101)

Course description (Synopsis):

This course covers sequences, series, power series, Fourier series. Differential and integrals calculus of functions of several variables and their applications. The course aims to develop the basic ideas and methods of multi variable calculus, including the Taylor series of function, Fourier series, extrema, the examination of constrained maxima and minima using Lagrange multipliers and the integration of elementary functions of several variables. It aims to enable students to understand the extension from single variable to several variables of basic concepts such as continuity, differentiability and integration. Moreover, the course aims to strengthen the ability to apply mathematical concepts like partial differentiation and multiple integrals in computing some important quantities which will appear in engineering, such as rates of changes of quantities with several variables, the area and volume of physical bodies, the center of mass of some rigid body, and so on.

Course category: Basic

Course Name: Applied Mathematics –III (Math2101)

Credit Hour: 4

Prerequisite: Applied Mathematics-II

Course description (Synopsis):

This course covers the topics in First order ordinary Differential Equation, second order ordinary Differential Equation, Laplace transforms and its application, scalar and vector fields and complex analytic function.

Course category: Basic

Course Name: Introduction to Emerging Technologies (CSEg1102)

Credit Hour: 3

Prerequisite: None

Course description (Synopsis):

This course will enable students to explore current breakthrough technologies in the areas of Artificial Intelligence, Internet of Things and Augmented Reality, Data Science and other technologies that have emerged over the past few years. Besides helping learners become literate in emerging technologies, the course will prepare them to use technology in their respective professional preparations.

Course category: Basic

Course Name Engineering Drawing (MEng1102)

Credit Hour: 3

Prerequisite: None

Course description (Synopsis):

This course introduces importance of engineering drawing, and theory of projections, theory and practices of Multi view representations, Auxiliary and revolved views, pictorial drawings and sectional drawing using drawing instrument.

Course category: Basic

Course Name: Fundamentals of Programming (CSEg1104)

Credit Hour: 3

Prerequisite: Introduction to Computing

Course description (Synopsis):

The course is designed to introduce structured programming in C++ by providing an overview of programming concepts, on creating and working computer programs in C++. It will address fundamental concepts of program analysis, design, coding, testing and development. It includes introduction to computer programming; programming paradigms; algorithms and problem-solving; introduction to data structures and Programming constructs. The course is designed on how to solve business and scientific problems through the technique of structured programming. It will prepare students for focused studies in any programming language.

experiment.

Course category: Basic

Course Name: Probability and Statistics for Engineers (Math2105)

Credit Hour: 3

Prerequisite: None

Course description (Synopsis):

Statistics looks at the data handling cycle and analysis of collected data. Up on the completion of this course, students will be able to understand the process involved in posing the question, collecting data on that question, presenting data, analyzing data using measure of spread and center, quantitative analysis of uncertainty and risk for engineering applications, estimation of distribution parameters, hypothesis testing, simple and multiple linear regressions, Poisson and Markov processes, and interpreting the results to make informed decision. There is an emphasis placed on real-world applications to engineering problems. This course include: History of statistics, Meaning of statistics; Methods of data collection and presentation; Measures of an average; Measures of variation; Moments, skewness and kurtosis; terminologies in probability; Counting Techniques; definition of Probability (approaches to probability); Probability distributions; Sampling and Sampling Distribution of the mean and proportion; Basic concepts for estimation: (Point and Interval) for the population mean and proportion; Hypothesis testing on the population mean and proportion; Simple linear regression, correlation and rank correlation.

Course category: Basic**Course Name: Basic Workshop practice (MEng2101)****Credit Hour: 3****Prerequisite: None****Course description (Synopsis):****Course category: Major Mandatory****Course Name: Fundamentals of Chemical engineering (ChEg2202)****Credit Hour: 3****Prerequisite: None****Course description (Synopsis):**

This course reintroduces the concepts of unit and dimensions and their application in solving theoretical as well as real life industrial problems. It equips students with the basic understanding mass and energy balances as preparation for subsequent courses later in the program.

Course category: Major Mandatory

Course Name: Fluid Mechanics for Chemical Engineers (ChEg2206)

Credit Hour: 3

Prerequisite: None

Course description (Synopsis):

This course will cover the basic principles and characteristics of fluid flow in different process, fluid statics and pressure, fluid kinematics, conservation principles, internal flows (pipe flow) and external (boundary-layer) flows .

Course category: Major Mandatory

Course Name: Chemical engineering thermodynamics (ChEg3201)

Credit Hour: 3

Prerequisite: None

Course description (Synopsis):

The course aims to introduce students to basic principles of heat and mass transfer and its effect on internal energy change. This course reintroduces the concepts of unit and dimensions and their application in solving theoretical as well as real life industrial problems. It equips students with the basic understanding on the transfer of work to heat and vice versa. mass and energy balances as preparation for subsequent courses later in the program.

Course category: Major Mandatory

Course Name: Heat and mass Transfer (ChEg3203)

Credit Hour: 3

Prerequisite: Fluid Mechanics for Chemical Engineers (ChEg2206)

Course description (Synopsis):

The course aims to introduce students to basic principles of heat and mass transfer in different materials and its application in different processes. It incorporates the mathematical skills and reasoning to calculate the energy needs and expenditures by and for a system to design for optimal situation.

Course category: Major Mandatory

Course Name: Chemical Reaction Kinetics (ChEg3205)

Credit Hour: 3

Prerequisite: Math2101

Course description (Synopsis):

This course will cover the basic concepts on derivation of rate formation based on general mole balance, stoichiometry relationship in reaction, and development of the kinetic (or/rate) equation for homogenous irreversible and reversible single and multiple reactions for batch and flow reactors.

Course category: Major Mandatory

Course Name: Chemical engineering thermodynamics (ChEg3202)

Credit Hour: 3

Prerequisite: Chemical engineering thermodynamics (ChEg3201)

Course description (Synopsis):

This course provides the basics of the thermodynamics involved in Chemical engineering with emphasis on thermodynamics properties of fluids, solution thermodynamics, and reaction equilibria.

Course category: Major Mandatory

Course Name: Design of Chemical reaction systems (ChEg3204)

Credit Hour: 3

Prerequisite: ChEg3205

Course description (Synopsis):

This course will cover the over view of Reactor design concept, Ideal - batch and semi – batch reactors design, Steady state ideal tubular design, Steady – State Mixed Reactors design, Heat transfer in reactors, Design for single reactions design, Catalytic Reactors design, and laboratory analysis of characteristic parameters of cascade reactors.

Course category: Major Mandatory

Course Name: Mechanical Unit Operation (ChEg3208)

Credit Hour: 3

Prerequisite: Fluid Mechanics For Chemical Engineers

Course description (Synopsis):

This course will cover concept of particle technology, the system with particle processing, transportation and storage of particle, flowing of gas through particle and the particle dynamics in liquid, the separation methods of particle and mixing methods in different process industries.

Course category: Major Mandatory

Course Name: Summer Internship I (ChEg3200)

Credit Hour: 8

Prerequisite: ChEg3201, ChEg3203, ChEg3205, ChEg3208

Course description (Synopsis):

This course will cover the basic concepts on visiting each process units in detail, draw process flow diagram of the plant with description, perform material and energy balance on each process unit, problem identification, recommended solutions for identified problems.

Course category: Major Mandatory

Course Name: Fundamentals of Biochemical Engineering (ChEg4201)

Credit Hour: 3

Prerequisite: Reaction engineering

Course description (Synopsis):

This course will cover the basic concepts on, biotechnology, fermentation, cell growth kinetics during fermentation, mass transfer during fermentation, and cell collection after fermentation (cell rapture and disruption).

Course category: Major Mandatory

Course Name: Thermal Unit Operation (ChEg3212)

Credit Hour: 3

Prerequisite: ChEg3203

Course description (Synopsis):

The course deals with Classification of heat exchanging equipment's, Basic design methods of heat Exchangers, Rating of Heat Exchangers, Fouling of Heat Exchangers, Heat Transfer in Selected Chemical Apparatus and Extended Surfaces.

Course category: Major Mandatory

Course Name: Mass Transfer Unit Operation (ChEg4205)

Credit Hour: 3

Prerequisite: Thermal Unit Operations

Course description (Synopsis):

This course will cover the basic concepts on industrial unit operations based on basic principle of mass transfer kinetics and Chemical equilibrium, performance analysis and determine the size of the separation equipment for drying, distillations, absorption, liquid-liquid extraction and solid liquid extraction.

Course category: Major Mandatory

Course Name: Selected Process Industries (ChEg4202)

Credit Hour: 3

Prerequisite: None

Course description (Synopsis):

This course will cover different production technologies in processing industries, types of processes involved in the given processing industries, production steps and processing conditions

starting from raw material up to the end product, equipment's and their working principles, parameters and measures that are used to attain the optimum processing conditions.

Course category: Major Mandatory

Course Name: Process dynamics and control (ChEg4206)

Credit Hour: 3

Prerequisite: Math2101

Course description (Synopsis):

The course deals with the basics of process dynamics and control. Fundamentals of process modeling, process dynamics, process control including: the different types of process controllers, feedback control systems and introduction to advanced control systems will be discussed.

Course category: Major Mandatory

Course Name: Basic Environmental Engineering (ChEg4303)

Credit Hour: 3

Prerequisite: None

Course description (Synopsis):

This course deals with the introduction and basic concepts of environmental Engineering. It gives an overview of water and wastewater management and engineering, solid and hazardous waste management and handling, air pollution control technologies and environmental risk assessment methods.

Course category: Major Mandatory

Course Name: Chemical Engineering Apparatus Design (ChEg4208)

Credit Hour: 3

Prerequisite: ChEg3212 ChEg4205

Course description (Synopsis):

This course is concerned with the design of equipment related to Chemical industries such as heat exchangers, reactors, distillation columns, absorbers, pressure vessels and pipe system. Criteria and procedures for equipment selection and sizing will be covered.

Course category: Major Mandatory

Course Name: Plant Design and Engineering Economics (ChEg5201)

Credit Hour: 3

Prerequisite: Chemical Engineering Apparatus Design (ChEg4208)

Course description (Synopsis):

This course will cover the basic concepts of general design considerations; Process design development; Preparing flow-sheets; Integrated Material and Energy Balances; Degrees of Freedom analysis; and Economics (definition, principles and applications).

Course category: Major Mandatory

Course Name: Summer Internship II (ChEg4200)

Credit Hour: 8

Prerequisite: ChEg3200, ChEg4208, ChEg4206 Course

Course description (Synopsis):

This course will cover the basic concepts on planning and scheduling stay in industry, management structure of the industry, draw Process flow diagram with process description and P& ID of plant, utility management of process unit, perform material and energy balance and performance study of each process unit, overall analysis of the plant efficiency, and problem identification and improvement strategies.

Course category: Major Mandatory

Course Name: Process integration and optimization (ChEg5203)

Credit Hour: 3

Prerequisite: none

Course description (Synopsis):

This course will cover concept of particle technology, the system with particle processing, transportation and storage of particle, flowing of gas through particle and the particle dynamics in liquid, the separation methods of particle and mixing methods in different process industries.

Course category: Major Mandatory

Course Name: Research Methods for Engineers (ChEg5203)

Credit Hour: 2

Prerequisite: None

Course description (Synopsis):

This course is designed to provide students with the fundamental theories and practice skill in research methodologies. It gives a basic knowledge on research proposal writing, design and analysis of experiments and technical report.

Course category: Major Mandatory

Course Name: Indigenous Technologies (ChEg 5209)

Credit Hour: 1

Prerequisite: None

Course description (Synopsis):

The course deals with survey/identify the exiting indigenous technologies, develop/select one new/exiting technology and propose mechanism/methods to improve or upgrade to industrial scale. Apply the proposed methods in the lab/workshop. Communicate/present results.

Course category: Major Mandatory

Course Name: Final year Project (ChEg5218)

Credit Hour: 6

Prerequisite: ChEg5201 ChEg3204, ChEg4206, ChEg3202

Course description (Synopsis):

Laboratory oriented research project on any Chemical engineering related area.

Course category: Major mandatory

Course Name: Chemical Engineering Drawing (ChEg4209)

Credit Hour: 1

Prerequisite: None

Course description (Synopsis):

The course contains an over view about graphics and mechanical drawings, an introduction about process equipment symbols and piping systems, instrumentation & control, and an introduction to Computer Aided Design (CAD).

Course category: Major elective

Course Name: Food Preservation and Packaging Technology (ChEg5310)

Credit Hour: 3

Prerequisite: None

Course description (Synopsis):

This course will cover the basic concepts on food preserving and packaging methods, protective functions, qualification of their properties, modified atmosphere packaging technologies, impact of packaging on environment, packaging recuse/cycling and labeling food packaging.

Course category: Major elective

Course Name: Quality and food safety management system (ChEg4309)

Credit Hour: 2

Prerequisite: None

Course description (Synopsis):

This course deals with the fundamental concept of quality, ISO 9000 families and ISO 22,000. The concepts of auditing for the certification and accreditation purposes are also included in this course.

Course category: Major elective

Course Name: Industrial Ecology and Sustainable Development (ChEg5306)

Credit Hour: 2

Prerequisite: None

Course description (Synopsis):

The course emphasizes on concepts of industrial ecology, economics of industrial ecology, application and policy issue on industrial ecology, sustainable development and associated environmental issues.

Course category: Major elective

Course Name: Computer Aided Process Design and Simulation (ChEg5313)

Credit Hour: 3

Prerequisite: Chemical Engineering Apparatus Design (ChEg4208)

Course description (Synopsis):

The course deals with Computer aided process design of fluid handling equipment (Momentum transfer operation), heat exchanging equipment (Thermal unit operation), Reactors (Unit Processes), Distillation column (Combined heat and mass transfer unit operation), Mass transfer Unit operation and the whole process plant.

Course category: Major elective

Course Name: Introduction to biotechnology (ChEg4313)

Credit Hour: 2

Prerequisite: None

Course description (Synopsis):

The subject covers basic scientific knowledge and its application in biotechnology. Basic molecular biology & practical applications, some historical examples, contemporary applications of biotechnology will be discussed to provide tools and basic knowledge in order to understand biotechnology.

Course category: Major elective

Course Name: Bio-Energy (ChEg5317)

Credit Hour: 2

Prerequisite: None

Course description (Synopsis):

This course provides an overview of key topics on sustainable bioenergy production, including the overview of bioenergy, selection of main biomass types and sources for bioenergy generation, discuss and design bioenergy conversion and utilization technology.

Course category: Major elective

Course Name: Industrial safety and Hazard Management (ChEg3318)

Credit Hour: 2

Prerequisite: None

Course description (Synopsis):

This course will cover the basic concepts of industrial safety and health management, material handling techniques and instructions, general safety consideration on process plants, source of hazard and mitigation techniques, prevention and protection of hazards, HAZOP and risk assessment, labor safety and industrial hygiene and maintenance management system.

Course category: Major elective

Course Name: Production and Project Management (ChEg5305)

Credit Hour: 2

Prerequisite: None

Course description (Synopsis):

This course examines the functional area of production and operations management in the manufacturing industry. Topics include decision-making, capacity planning, forecasting, and inventory management, distribution planning, materials requirements planning (MRP), project management and quality control.

Course category: basic

Course Name: Engineering Mechanics I (CEng2201)

Credit Hour: 3

Prerequisite: General Physics-I

Course description (Synopsis):

This course provides the fundamental physical concepts, laws and principle of statics to solve engineering problems for rigid bodies at rest. It covers about operations with vectors, coplanar and non-coplanar, concurrent and non-concurrent force systems, equilibrium and analysis of structures (trusses, beams, frames and machines), internal actions in beams, centroids, area moment of inertia, static friction and introduction to dynamics.

Course category: basic

Course Name: Engineering Mechanics II (MEng2104)

Credit Hour: 3

Prerequisite: none

Course description (Synopsis):

Introduction to basic principles of dynamics, kinematics and kinetics of 99 particles, work and energy, impulse and momentum, kinematics and kinetics of rigid bodies, which include rotation, absolute motion, relative velocity and acceleration, general equation of motion, work-energy relation and impulse momentum equation.

Course category: core module

Course Name: Machine drawing (MEng2105)

Credit Hour: 3

Prerequisite: Engineering drawing (MEng1102)

Course description (Synopsis):

Types of machine Drawings; Conventional representation of Fasteners (permanent and temporary), Bearings, Seals, Gears, Springs and Shafts, Systems of Fits and limits, Tolerance and Allowance, Surface Texture.

Course category: basic

Course Name: Introduction to Engineering Materials (MScE2101)

Credit Hour: 3

Prerequisite: General Phys Phy1101, General Chemistry Chem 1102

Course description (Synopsis):

Course category: major elective

Course Name: Applied Electrochemistry (ChEg3306)

Credit Hour: 2

Prerequisite: none

Course description (Synopsis):

This course allows students to gain introductory through knowledge in fundamental and application of electrochemistry. The course helps students to acquire knowledge in field of fuel cells, batteries, electrolytic, process and electrochemical corrosion. Further the students will gain basic abilities in calculations related to electrochemical systems.

Course category: major elective

Course Name: Sustainable Energy Technology (ChEg4304)

Credit Hour: 3

Prerequisite: none

Course description (Synopsis):

This course is essential because it provides a basic scientific knowledge and skills in technical (engineering) for the applications of sustainable energy technologies. It can also help students to analyze and developed the practical method of problem solving for energy source selection, generation/ conversion, storage and consumption.

Course category: major elective

Course Name: Solid and Hazardous Waste Management (ChEg5319)

Credit Hour: 2

Prerequisite: none

Course description (Synopsis):

This course is very important because it introduces students about solid and hazardous wastes management mechanisms and design of different treatment techniques and equipment.

Course category: major elective

Course Name: Special topics in Chemical Engineering (ChEg5316)

Credit Hour: 2

Prerequisite: none

Course description (Synopsis):

This course is important because it gives the student an overview of the current status of chemical engineering and related technology. Also, it will predict the future Concern of science & technology, and advanced applications of chemical engineering.

Course category: major elective

Course Name: Numerical Methods for Chemical Engineers (ChEg2104)

Credit Hour: 3

Prerequisite: Applied Mathematics III (Math2101) & Fundamentals of Programming (CSEg1104)

Course description (Synopsis):

This course is crucial because it teaches students the primary and basic computational or numerical methods for solving chemical engineering problems. It can also help students to develop a mathematical background and select suitable numerical method to solve different nonlinear, integral and ODE problems in chemical engineering.

4.2 Material Science and Engineering program

General information

I. Duration of study

Normal modality

Regular: a 5-year program

Continuing: program within eight years as stated in the university senate legislation August 2017, Article 98.2.

Fast Track modality:

dual major/minor there may be one year extension as stated in the university senate legislation.

II. Course categoryy

NO	Course category		Course level	credit requirement	Percentage from the total
1	General	Mandatory	University required	27	
2	Basic	Mandatory	School required	19-29	
	Major	Mandatory	Department required	55-72	
		Elective		32-42	
		Subtotal		87-114	
	Free electives			3-6	
Total				150-180	

Course category: General Mandatory

Course Name: Communicative English Skills (EnLa1001)

Credit Hour: 3

Prerequisite: None

Course description (Synopsis):

Communicative English Skills is a course where students learn what they need to know for a career in science context. The course gives students the language, information, and skills they need to study science context. It also provides students the language appropriate for studying science context and real work situations as it comprises unique sections such as: 'it's my job' wherein real people talk about their work in science context, 'listening' whereby students are exposed to situations related to science context , technical explanations, and interviews, 'reading' whereby

students meet a variety science context based texts, and the ‘writing section’ which is designed to let students compose short reports on different activities.

Course category: General Mandatory

Course Name: Basic Writing Skills (EnLa1002)

Credit Hour: 3

Prerequisite: Communicative English Skills (EnLa 1001)

Course description (Synopsis):

Basic Writing Skills course aims at developing students’ basic writing skills in science context. The course gives students the language writing skills they need to study science. It contains sentence level writing: sentence structure, sentence types sentence combinations, common sentence errors (fragment, run on, comma splices, misplaced modifier, dangling modifier, faulty parallelism, faulty reference of pronoun, faulty agreement and shifts); paragraph level writing: the essence of a paragraph, components of a paragraph (topic sentence, supporting sentences, concluding sentence), characteristics of effective paragraph (unity, coherence and completeness) and the steps in writing a paragraph and types of a paragraph; essay level writing: structure of an essay, thesis statement and supporting paragraphs, types of essays and techniques of essay development.

Course category: General Mandatory

Course Name: Introduction to Civics and Ethics (LART1001)

Credit Hour: 3

Prerequisite: None

Course description (Synopsis):

This course is designed with the aim of equipping learners with necessary ethical qualities and civic competences while dealing with issues that affect their society at all levels and human in general. The course starts with unfolding the notions, principles and theories of ethics which can shape human attitude, action and behavior in making moral judgments. Next, the course introduces learners to the nature, mutual interactions and historical evolutions of society, state, government and citizenship. It also elucidates issues pertaining to political governance such as constitution,

democracy, and human rights in some details. To enable learners grasp basic knowledge of political, economic and social dynamics of international system in today's globalized world, the course also introduces international relations and foreign policy and other major contemporary global issues.

Course category: General Mandatory

Course Name: Logic and Critical thinking (LART1002)

Credit Hour: 3

Prerequisite: None

Course description (Synopsis):

The main goal of the course is to improve critical and logical reasoning skills. Students will see how our ordinary intuitions on good or bad reasoning can be articulated explicitly in formal systems, and gain a new ability to evaluate arguments and reasoning they encounter every day with rigorous logical concepts and tools. As to the subject matter, it introduces systematic methods of reasoning, such as argument, deduction, induction, syllogistic, and propositional logic.

Course category: General Mandatory

Course Name: Introduction to Economics (SOSC2002)

Credit Hour: 3

Prerequisite: None

Course description (Synopsis):

This course provides a general introduction to economics combining elements of micro and macro fundamentals. The main objective of this course is to introduce and acquaint students with the preliminary principles (theories) and knowledge of economics and the application of economic theories (principles) in the actual world; the daily activities of the households, firm business or any other form of enterprises at micro levels. Students will also be able to contextualize the key macroeconomic variables and policy instruments.

Specifically, the course introduces students with theory of consumer behaviours, production, and cost of production. In these theories how decisions are made by different economic agents will be discussed. Furthermore, the course covers different characteristics of perfect and imperfect market structure. Lastly the course tries to introduce basic macroeconomic concepts such as national income accounting, unemployment, inflation, fiscal and monetary policy instruments.

Course category: General Mandatory

Course Name: General Psychology and Life Skills (Psyc1011)

Credit Hour: 3

Prerequisite: None

Course description (Synopsis):

Psychology is a science of human cognitive processes and behaviors. This course is designed to give students an overview of what psychological science has discovered about human behaviors and mental processes throughout human history. Students will gain an understanding of the psychological phenomena that occur in daily life as well as the practical applications of psychological knowledge. Upon completing the course, students shall be able to demonstrate a basic knowledge of the science of psychology. Specifically, the course general psychology is concerned with discussing perspectives in psychology and basic psychological concepts such as sensation and perception, learning, personality, motivation, emotion, and basic life skills (intrapersonal, interpersonal, social and academic skills). Emphasis will be given to both theoretical and practical implications of these concepts to effectively function as individual and team in a community.

Course category: General Mandatory

Course Name: Physical fitness and conditioning I (SpSc1011)

Credit Hour: 0 cr.hr

Prerequisite: None

Course description (Synopsis):

This course will provide the students with basic concepts of the five components of health-related physical fitness (cardiovascular, muscular strength and endurance, flexibility, and body composition), hypokinetic disease and general principles of training. It is mainly practical oriented. As a result, the students will be exposed to various exercise modalities, sport activities, minor and major games, and various training techniques as a means to enhance health related physical fitness components. In addition, they will develop the skills to assess each component of fitness and will practice designing cardiovascular, muscular strength and endurance, and flexibility programs based on the fitness assessment. The course serves as an introduction to the role of exercise in health promotion, fitness, performance including the acute and chronic responses of the body to exercise.

Course category: General Mandatory

Course Name: Physical fitness and conditioning II (SpSc 1022)

Credit Hour: 0 cr.hr

Prerequisite: Physical fitness and conditioning I (SpSc1011)

Course description (Synopsis):

This course is designed to acquaint freshman engineering and applied natural science students with the nature and scope of different ball games.

It emphasizes the value of establishing lifelong fitness using ball games as a means and focuses on the fundamental of volley ball, hand ball, basketball and football as a life time leisure activity also focuses on the development of personalized approach to healthy active living through participation in a variety of ball games that have the potential to engage students' interest throughout

their lives. Again, the courses enable the participants enjoying practice and acquire proper technique and strategies associated with the ball games mentioned above and learn rules governing the game.

Course category: General Mandatory

Course Name: Geography of Ethiopia and the Horn (LART1004)

Credit Hour: 3

Prerequisite: None

Course description (Synopsis):

This course covers a brief description on the location, shape and size of Ethiopia as well as basic skills of reading map, the physical background and natural resource endowment of Ethiopia and the Horn which includes its geology and mineral resources, topography, climate, drainage and water resources, soil, fauna and flora. It also deals with the demographic characteristics of the country and its implications on economic development.

Course category: General Mandatory

Course Name: History of Ethiopia and the Horn (LART1003)

Credit Hour: 3

Prerequisite: None

Course description (Synopsis):

This course describes why history is important, how history is studied and introduces the region Ethiopia and the Horn. It treats human evolution, Neolithic Revolution, settlement patterns as well as religion and religious processes in Ethiopia and the Horn. Based on these historical backgrounds, the course describes states, external contacts, economic formations and achievement in terms of architecture, writing, calendar, and others to the end of the 13th century. Historical processes including states formation and power rivalry, trade, external relation, threats and major

battles, centralization and modernization attempts, Italian occupation, and socio-economic conditions from 1800 to 1941 makes central position in the modern history of the region.

Course category: Basic Mandatory

Course Name: Technical Report Writing (EnLa2102)

Credit Hour: 2

Prerequisite: - Communicative English Skill (EnLa1001) - Basic Writing Skill (EnLa1002)

Course description (Synopsis):

Written communication is the foremost form of academic advancement. Thus, technical report writing, as a genre of written communication, encompasses the ability to organize and craft information for manuals, reports and other technical publications. To this effect, Technical Report Writing prepares students to design effective technical documents for written media, using various formats. The course provides students an introduction to principles of audience analysis, to conducting research and documentation, to drafting and revising processes of documents, as well as to maintaining readability and accessibility to written texts in addition to realizing the details of reports.

Course category: Basic Mandatory

Course Name: Basic Workshop practice (MEng2201)

Credit Hour: 2

Prerequisite: None

Course description (Synopsis):

Introduction to work shop technology, safety and care of workshop facilities, Application of measuring instruments, Bench working operations; fundamental wood working operations using hand and bench machine tools.

Course category: Basic Mandatory

Course Name: Engineering Drawing (MEng1102)

Credit Hour: 3

Prerequisite: None

Course description (Synopsis):

This course introduces importance of engineering drawing, and theory of projections, theory and practices of Multi view representations, Auxiliary and revolved views, pictorial drawings and sectional drawing using drawing instrument.

Course category: Basic Mandatory

Course Name: Applied Mathematics I (Math1101)

Credit Hour: 4

Prerequisite: None

Course description (Synopsis):

Generally, the Course Covers Basic Ideas and Principles of Vectors & Matrices of Linear Algebra and Basic ideas of Calculus. In Particular the course Contains principles of vectors, matrices & determinants, limit and continuity, derivatives & their applications, integrals, integration techniques and their applications.

Course category: Basic Mandatory

Course Name: General Physics (Phys1101)

Credit Hour: 3

Prerequisite: Knowledge in Higher Secondary Physics

Course description (Synopsis):

This course provides science students with the basic concepts of physics that enable them to understand describe and explain natural phenomena. Emphasis is laid on general principles and

fundamental concepts in measurements, mechanical and thermal interactions, fluid mechanics, electromagnetism, oscillations and waves with applications of physics in various fields of science. Permitting the students to voice and defend their own opinions and enhancing the students' commitment to individual study and acquiring knowledge. Active involvement of learners is required at each phase. This is done through questioning and answering, reflection, reporting, solving problems associated with the respective topics.

Course category: Basic Mandatory

Course Name: General Chemistry (Chem1101)

Credit Hour: 3

Prerequisite: None

Course description (Synopsis):

General chemistry is the science of the properties of atoms and the laws governing their combination, composition, and structure of substances, the transformations they undergo, and the energy that is released or absorbed during chemical or physical process. The topics covered in this course includes: Introduction to the study of modern chemistry, acids and bases, the periodic table, chemical bond and molecular structure, rates of physical and chemical processes, materials, kinetic molecular description of the state of matter and equilibrium in chemical reaction.

Course category: Basic Mandatory

Course Name: Introduction to Computing (CSEg1101)

Credit Hour: 3

Prerequisite: None

Course description (Synopsis):

In this course the basic techniques of computational problem solving will be covered by using computational thinking while writing small and medium sized programs, mapping problems into computational frameworks emphasizing on scientific problems, understanding problems and formulation of problems based on the elective programming language (using python). The course includes the concepts and techniques of data structure, input/output, flow control and incidental program, and by using a systematic division of problem solution and concept of module, to solve problems in numerical value field and non-numerical value field with program experiment.

Course category: Basic Mandatory

Course Name: Applied Mathematics II (Math1102)

Credit Hour: 4

Prerequisite: Applied Mathematics I (Math1101)

Course description (Synopsis):

This course covers sequences, series, power series, Fourier series. Differential and integrals calculus of functions of several variables and their applications. The course aims to develop the basic ideas and methods of multi variable calculus, including the Taylor series of function, Fourier series, extrema, the examination of constrained maxima and minima using Lagrange multipliers and the integration of elementary functions of several variables. It aims to enable students to understand the extension from single variable to several variables of basic concepts such as continuity, differentiability and integration. Moreover, the course aims to strengthen the ability to apply mathematical concepts like partial differentiation and multiple integrals in computing some important quantities which will appear in engineering, such as rates of changes of quantities with several variables, the area and volume of physical bodies, the center of mass of some rigid body, and so on.

Course category: Basic Mandatory

Course Name: Introduction to Emerging Technologies (CSEg1102)

Credit Hour: 3

Prerequisite: None

Course description (Synopsis):

This course will enable students to explore current breakthrough technologies in the areas of Artificial Intelligence, Internet of Things and Augmented Reality, Data Science and other technologies that have emerged over the past few years. Besides helping learners become literate in emerging technologies, the course will prepare them to use technology in their respective professional preparations.

Course category: Basic Mandatory

Course Name: Fundamentals of Programming (CSEg1104)

Credit Hour: 3

Prerequisite: Introduction to Computing

Course description (Synopsis):

The course is designed to introduce structured programming in C++ by providing an overview of programming concepts, on creating and working computer programs in C++. It will address fundamental concepts of program analysis, design, coding, testing and development. It includes introduction to computer programming; programming paradigms; algorithms and problem-solving; introduction to data structures and Programming constructs. The course is designed on how to solve business and scientific problems through the technique of structured programming. It will prepare students for focused studies in any programming language experiment.

Course category: Basic Mandatory

Course Name: Introduction to Engineering Materials (MScE2101)

Credit Hour: 3

Prerequisite: General Phys Phy1101, General Chemistry Chem1102

Course description (Synopsis):

This course is design to introduce the learner about engineering materials with their properties (mechanical, electrical, optical etc). Moreover, the learner will be familiar with materials structure, properties, process and application relationship.

Course category: Basic Mandatory**Course Name: Introduction to School Programs (MCME2101)****Credit Hour: 1****Prerequisite: None****Course description (Synopsis):**

The purpose of this course is to introduce students and create clear insight about programs encompassed in SoMCME before they elect and join the departments so as to help students choosing their program based on interest and compassion. The intended programs to be introduced are Chemical Engineering, Mechanical Engineering and Materials Science & Engineering.

Course category: Basic mandatory**Course Name: Machine drawing (MEng2105)****Credit Hour: 3****Prerequisite: Engineering Drawing (MEng1102)****Course description (Synopsis):**

Types of machine drawings; conventional representation of fasteners (permanent and temporary), bearings, seals, gears, springs and shafts, systems of fits and limits, tolerance and allowance, surface texture.

Course category: Basic Mandatory

Course Name: Engineering Mechanics (CEng2201)

Credit Hour: 3

Prerequisite: General Physics-I Course description (Synopsis):

This course provides the fundamental physical concepts, laws and principle of statics to solve engineering problems for rigid bodies at rest. It covers about operations with vectors, coplanar and non-coplanar, concurrent and non-concurrent force systems, equilibrium and analysis of structures (trusses, beams, frames and machines), internal actions in beams, centroids, area moment of inertia, static friction and introduction to dynamics.

Course category: Basic Mandatory

Course Name: Applied Mathematics III (Math2302)

Credit Hour: 4

Prerequisite: Applied Mathematics-II

Course description (Synopsis):

This course covers the topics in First order ordinary Differential Equation, second order ordinary Differential Equation, Laplace transforms and its application, scalar and vector fields and complex analytic function.

Course category: Major Mandatory

Course Name: Fundamentals of Materials Science and Engineering (MScE 2202)

Credit Hour: 3

Prerequisite: Introduction to Engineering Materials (MScE 2101)

Course description (Synopsis):

This course will introduce the fundamental concepts of materials science and engineering and utilizing of engineering materials (metals, ceramics, polymer and composite). And also this

course describes the structure, characteristics, applications, properties and processing of metals, ceramics, and polymers and composites materials.

Course category: Major Mandatory

Course Name: Thermodynamics for Materials (MScE 2204)

Credit Hour: 3

Prerequisite: None

Course description (Synopsis):

This course introduces the essential features of zeroth, first, second, and third laws of thermodynamics and their application to materials, statistical interpretation of entropy, Phase Equilibrium, Phase diagram, Electrochemistry, Defects in solid, Surface and Interfaces and Diffusion.

Course category: Major Mandatory

Course Name: Solid State Physics for Materials (MScE 2110)

Credit Hour: 3

Prerequisite: None

Course description (Synopsis):

This course help students to develop their knowledge on the principles, theories, and applications of condensed matter physics, Including the crystal structures and electronic structure, lattice dynamics, electrical properties, and optical properties of different materials (metals, semiconductors, dielectrics, and magnetic materials), based on the classical and quantum physics principles.

Course category: Major Mandatory

Course Name: Crystal Structure of Materials (MScE2206)

Credit Hour: 3

Prerequisite: Introduction to Engineering Materials (MScE2101)

Course description (Synopsis):

This course pursues the understanding of the basic concepts of crystallography, the description of crystal structure and their relevance to the crystal imperfections such as point defects, dislocations, stacking faults and interface.

Course category: Major Mandatory

Course Name: Electromagnetism for Materials (MScE2108)

Credit Hour: 3

Prerequisite: General Physics II

Course description (Synopsis):

The electromagnetism for materials introduces the concepts of magnetism for material science and Engineering theoretically. In addition to these basic vectors operations for calculating and explain the concept electromagnetism in material science and Engineering will be summarized.

Course category: Major Mandatory

Course Name: Numerical Analysis for Materials (MScE3108)

Credit Hour: 3

Prerequisite: Applied Mathematics III (Math2101) and Fundamentals of Programming (CSEg1102)

Course description (Synopsis):

This course presents an introduction to the mathematical analysis of numerical problems such as those that are encountered in many disciplines, including applied physical sciences and engineering. You will learn to select, configure and use suitable computational tools with appropriate numerical methods for integration and optimization, simulation techniques,

applications of differential equations and presentation of data. This will be a hands-on class with theory accompanied by practical implementation in MATLAB computer program. Emphasis will be placed on application to materials science and engineering related mathematical problems.

Course category: Major Mandatory

Course Name: Fundamentals of Inorganic Chemistry (MScE3203)

Credit Hour: 3

Prerequisite: General Chemistry Chem1101

Course description (Synopsis):

Group properties of transition elements: general physical and chemical properties, variable oxidation states, stoichiometric and non-stoichiometric compounds, catalytic properties etc, coordination compounds (historical development, nomenclature, isomerism, VBT, CFT, MOT), metals and metallurgical processes, descriptive chemistry of transition and inner transition elements (electronic structure, oxidation states, occurrences, isolations, reactions and uses of selected d-block and f-block elements, and chemistry of their compounds).

Course category: Major Mandatory

Course Name: Materials Laboratory I (MScE3201)

Credit Hour: 3

Prerequisite: Fundamentals of Materials Science and Engineering (MScE2202)

Course description (Synopsis):

The purpose metallic laboratory is to familiarized the students with the more basic techniques used in the metallurgical laboratory. These are hardness testing, heat treating in furnaces, temperature measurement and control, metallographic sample preparation, and quantitative metallography. The techniques developed in this experiment will be used repeatedly throughout the course.

The purpose of ceramic laboratory course is to familiarize the student with the more basic techniques used in the ceramic laboratory. These are weighing and mixing, molding with mounting press, heat treating in air, furnaces, temperature measurement and control, ceramic sample preparation, density measurement and sintered structure analysis. The techniques developed in this experiment will be used repeatedly throughout the course

Course category: Major Mandatory

Course Name: Quantum Theory of Materials (MScE3111)

Credit Hour: 3

Prerequisite: None

Course description (Synopsis):

This course is designed to the students who have little or no knowledge in the quantum aspects of materials. It provides an introductory about waves, black body radiation, photoelectric effect, wave particle duality, Schrödinger equation and uncertainty principle.

Course category: Major Mandatory

Course Name: Fundamentals of Ceramics (MScE 3207)

Credit Hour: 3

Prerequisite: Fundamentals of Materials Science and Engineering (MScE2202)

Course description (Synopsis):

Understand the structure-property-processing relationship in ceramics. The course describe structure (crystal, defects), property (electrical, mechanical), processing (diffusion, sintering) in ceramics. Moreover, the application of ceramics in various field will be discussed.

Course category: Major Mandatory

Course Name: Fundamentals of Polymers (MSCE3209)

Credit Hour: 3

Prerequisite: Fundamentals of Materials Science and Engineering (MScE2202)

Course description (Synopsis):

In this course students will develop their knowledge on basic concepts of polymers and the synthesis techniques (polymerizations) applied for different types of polymers, in addition to this student will acquire the most common characterization techniques and characterization devices to study properties of polymers.

Course category: Major Mandatory

Course Name: Fundamentals of Metallurgy (MSCE3203)

Credit Hour: 3

Prerequisite: Fundamentals of Materials Science and Engineering (MScE2202)

Course description (Synopsis):

In this course students will develop their knowledge on basic concepts of polymers and the synthesis techniques (polymerizations) applied for different types of polymers, in addition to this student will acquire the most common characterization techniques and characterization devices to study properties of polymers.

Course category: Major Mandatory

Course Name: Fundamentals of Semiconductors (MScE3206)

Credit Hour: 3

Prerequisite: Solid State Physics for Materials (MScE2110)

Course description (Synopsis):

In this course, student has opportunity to learn basic semiconductor properties, element of Quantum Mechanics, energy band theory, equilibrium carrier statistics, recombination-generation processes, and drift/diffusion carrier transport.

Course category: Major Mandatory

Course Name: Materials Laboratory II (MScE3202)

Credit Hour: 3

Prerequisite: Materials Laboratory I (MScE3201)

Course description (Synopsis):

In this course, student has opportunity to synthesize polymers and characterize them. In addition, they learn how to fabricate Polymer Semiconductor devices, investigates the Electrical properties of Polymer devices, and Electrical and Optical properties of Semiconductor based devices.

Course category: Major Mandatory

Course Name: Ceramic Processing with Lab (MScE3204)

Credit Hour: 3

Prerequisite: Fundamentals of Ceramics (MScE3207)

Course description (Synopsis):

Understand structural and functional ceramic materials, and fabricate it with fine powders by mechanical means or by way of chemical synthesis. Expose the student to handling submicron powders and approaches used to pack powders and form compacts. Discuss a variety of approaches to convert fine particulates into useful controlled density, controlled-microstructure ceramic components.

Course category: Major Mandatory

Course Name: Polymer Processing with Lab (MScE4203)

Credit Hour: 3

Prerequisite: Fundamentals of Polymers (MSE3209), Fundamental of Inorganic Chemistry (MScE3203)

Course description (Synopsis):

The course provides students with a comprehensive introduction of fluid mechanics, rheology, and balance equation, then the course emphasizes the practical aspects of transporting of polymer particulates, melting, pressurization, mixing, devolatilization.

Course category: Major Mandatory

Course Name: Principle of Extractive Metallurgy (MScE4201)

Credit Hour: 3

Prerequisite: Fundamental of Metallurgy (MScE3203)

Course description (Synopsis):

Extractive metallurgy is the practice of removing valuable metals from an ore and refining the extracted raw metals into a purer form. In order to convert a metal oxide or sulfide to a purer metal, the ore must be reduced physically, chemically, or electrolytically.

Course category: Major Mandatory

Course Name: Metal Processing with Lab (MScE4202)

Credit Hour: 3

Prerequisite: Principle of Extractive Metallurgy (MScE4201)

Course description (Synopsis):

This course describes thermodynamic analysis of Solidification and Crystallization Processes, Crystal Growth in Vapors and Liquids, Solidification Structures, and Metallic Glasses and Amorphous Alloy Melts.

Course category: Major Mandatory

Course Name: Internship I (MScE3200)

Credit Hour: 10

Prerequisite: Successful completion of 3rd year 2nd Semester

Course description (Synopsis):

At the end of this internship students are expected to be related basic concepts in different branches of materials science engineering courses learnt under the program with practical experience found on apparent ship. Demonstrate production processes, machineries, material handling equipment's, maintenance scheduling, utilization of man-power and Energy, and product/process costing.

Course category: Major Mandatory

Course Name: Internship II (MScE4200)

Credit Hour: 10

Prerequisite: Successful completion of 4th year 2nd Semester

Course description (Synopsis):

This internship introduces the essential features of technical skill, communication skill, confidence, discipline, team work, and ethics, Formulate solutions to the problem identified and Organize a comprehensive report on the finding.

Course category: Major Mandatory

Course Name: Glasses and Glass-Ceramics (MScE4204)

Credit Hour: 3

Prerequisite: Ceramic Processing with Lab (MSE3204)

Course description (Synopsis):

This course focuses on the basic principles of the glass & glass-ceramic formation, structure of glasses, and their various properties including thermal, mechanical, optical and chemical properties. It also provides comprehensive coverage of the strengthening mechanisms of oxide

glasses with regard to their properties, and applications of areas of the glasses.

Course category: Major Mandatory

Course Name: Materials Synthesis and Characterization Techniques (MScE4214)

Credit Hour: 3

Prerequisite: None

Course description (Synopsis):

The course provides a comprehensive introduction to the field of scanning electron microscopy (SEM) and X-ray microanalysis. It also emphasizes the practical aspects of the techniques described and discussed include usercontrolled functions of scanning electron microscopes and x-ray spectrometers and the use of x-rays diffractions for qualitative and quantitative analysis. This course also covers SEM sample preparation methods for hard materials, polymers, and biological specimens.

Course category: Major Mandatory

Course Name: Research Methods for Engineers (MScE5203)

Credit Hour: 3

Prerequisite: None

Course description (Synopsis):

This course introduces students to research methods and contemporary issues related to research in a university setting. Students will learn about statistical data analysis, measurement techniques, research proposal development, and design of experiments, scientific literature reviews, good laboratory practice, and oral and written research communication. The course will also cover ethics and intellectual property topics related to research.

Course category: Major Mandatory

Course Name: Construction Materials (MScE5211)

Credit Hour: 3

Prerequisite: Fundamentals of Materials Science and Engineering

Course description (Synopsis):

This course is designed to provide fundamental knowledge of the behavior, physical and mechanical and non-mechanical properties of the common construction materials, such as Natural Stones, Sands, Aggregates, Cement, Concrete, Steel and Timber. It also describes the composition and properties of the most common building materials. Selection and design of materials based on their intended use in design and construction are emphasized. The laboratory sessions are designed to provide a hand-on experience on various material testing concepts and procedures.

Course category: Major Mandatory

Course Name: Senior Project (MScE5202)

Credit Hour: 3

Prerequisite: None

Course description (Synopsis):

Laboratory oriented research project on any material science and engineering related area.

Course category: Major Elective

Course Name: Phase Transformation & Microstructure Evolution (MScE3314)

Credit Hour: 3

Prerequisite: None

Course description (Synopsis):

The course describes the background material necessary for understanding phase transformations: thermodynamics, kinetics, diffusion theory and the structure and properties of interfaces. And also deals with specific transformation: solidification, diffusional transformation

in solids and diffusionless transformations.

Course category: Major Elective

Course Name: Fundamentals of Composite and Smart Materials (MScE4212)

Credit Hour: 3

Prerequisite: Fundamentals of Materials Science and Engineering

Course description (Synopsis):

The course provides in depth knowledge on composite and smart materials of fabrication process, reinforcements, and resistance at high risk of a catastrophic failure, fiber embedded, piezo-electric, shape memory and electro active, as well as stimuli-responsive polymers used for textile communities.

Course category: Major Elective

Course Name: Introduction Modeling and Simulation for Materials (MScE5212)

Credit Hour: 3

Prerequisite: None

Course description (Synopsis):

Computational materials modeling are an increasingly important branch of materials science and engineering due to the evolution of modeling frameworks, invention of novel numerical algorithms and increased computer capability. As a consequence, modeling and simulation are emerging as powerful complementary approaches to experiment and traditional theory. Students will use Matlab and Python computer software programs to explore a range of programming and modeling concepts while acquiring those skills. They will then undertake projects that analyze one of a variety of scientific problems by designing a representative model, implementing the model, completing a verification and validation process of the model.

Course category: Major Elective

Course Name: Mechanical Behavior of Materials (MScE3310)

Credit Hour: 3

Prerequisite: Fundamentals of Materials Science and Engineering (MSE2202)

Course description (Synopsis):

This class introduces basic concepts materials by using the mechanical behavior concepts like elasticity, plastic deformation of single crystals, and dislocation theory, based on which strengthening mechanisms of materials are studied. Mechanical testing and analysis on tensile, fracture, and fatigue tests are explained by fundamental theory and experimental methods.

Course category: Major Elective

Course Name: Energy and Environment (MScE3312)

Credit Hour: 3

Prerequisite: General Physics (Phys1101), Thermodynamics of Materials (MScE2204)

Course description (Synopsis):

In this course, students will be enlightening the basic concept of energy and environment. In addition to this, student will learn how to harvest solar, wind, tidal, ocean wave, ocean thermal energy, hydroelectric powers, energy consumption, energy conversation, and energy conservations by relating with the environmentally friendly cases for sustainable development.

Course category: Major Elective

Course Name: Advanced Metals Technology (MScE4308)

Credit Hour: 3

Prerequisite: Fundamentals of Metallurgy (MScE3203)

Course description (Synopsis):

This course covers the theoretical aspects of the mechanical properties such as stress and stress properties, in addition to analysis of plasticity of metals from different mechanical properties viewpoints. Moreover, the course also provides the metals forming technologies such as Extrusion,

Drawing, and Rolling of sheet, rod and wire and will cover the theoretical aspects of the upper-bound, slip-line field, and deformation zone geometry. Furthermore, the formability of metals and interpretation of the property of metals subjected to bending will be analyzed together with the analysis of the Forming Limit Diagram (FLDs).

Course category: Major Elective

Course Name: Semiconductor Device (MScE4305)

Credit Hour: 3

Prerequisite: Fundamentals of Semiconductors (MSE3206)

Course description (Synopsis):

This course covers the fundamental theory and operating principles of various semiconductor devices such as bipolar junction transistor (BJT), metal-oxide semiconductor (MOS) capacitor, MOS field effect transistor (MOSFET), Solar cell, LED and Laser Diode.

Course category: Major Elective

Course Name: Cement Technology (MScE4309)

Credit Hour: 3

Prerequisite: Fundamentals of Materials science and Engineering Fundamentals of Ceramics

Course description (Synopsis):

Principles of cement chemistry related to the manufacturing of various cements and hydrolysis reaction during the curing process, Understand the properties of cements including chemical compositions, porosity, hardening processes and hydration chemistry. It also provides the chemical and microstructural aspects of concrete, including ones that affect its durability.

Course category: Major Elective

Course Name: Optoelectronic Materials and Devices (MScE4306)

Credit Hour: 3

Prerequisite: Semiconductor Device

Course description (Synopsis):

This course focuses on semiconductor crystal structure technology issue, electronic and optical properties of semiconductors, LED, Modulation and Amplification of devices. This course also discusses the physical characteristics of semiconductor and an overview of the various techniques used to fabricate devices.

Course category: Major Elective

Course Name: Advanced Steel Technology (MScE 4310)

Credit Hour: 3

Prerequisite: Fundamentals of Metallurgy

Course description (Synopsis):

The course covers the analysis of the fundamental thermodynamics and kinetics of metallic solutions (solid-solutions) of slags formation during steel productions. The steel making principles starting from the necessary raw materials up to the stage of the finished products will be discussed in this course.

Course category: Major Elective

Course Name: Polymer Properties (MScE 4314)

Credit Hour: 3

Prerequisite: Fundamentals of Polymers

Course description (Synopsis):

In this course students will learn and understand polymer from the physicist point of view. This course will cover polymer conformation, structure-property relationship in polymers, polymer solutions, polymer crystallinity and characterization or analysis.

Course category: Major elective

Course Name: Biomaterials (MScE 4316)

Credit Hour: 3

Prerequisite: Fundamentals of Polymer (MScE3209)

Course description (Synopsis):

This course is intended to provide an introduction to materials used in medical applications, including metals, ceramics and polymers. The nature of the subject is such that the course must integrate both materials science and biomedical engineering. It is the purpose of this course to provide the student an understanding of the fundamental principles and language associated with current biomaterials research and to understand the issues associated with medical applications of these materials.

Course category: Major Elective

Course Name: Alloy Design (MScE5303)

Credit Hour: 3

Prerequisite: Fundamentals of Metallurgy

Course description (Synopsis):

Principles of alloying mechanism into various matrices as Fe, Mg, Al and Ti. Effect of small amount of alloying elements will be explained based on the modification of crystal structures.

Course category: Major Elective

Course Name: Energy and Electronic Ceramics (MScE 5305)

Credit Hour: 3

Prerequisite: Fundamentals of Ceramics (MScE3207)

Course description (Synopsis):

Understand many aspects of ceramics and their electrical applications, specifically the fundamentals of electro-ceramics including their structure property relation. Understand the

relationship between properties of ceramic materials to the properties of green technologies to enhance the utilization of these technologies.

Course category: Major elective

Course Name: Conducting Polymers (MScE 5307)

Credit Hour: 3

Prerequisite: Fundamentals of Polymers Course description (Synopsis):

This class provides in-depth knowledge on the conducting (conjugated) polymer (CP) properties, synthesis techniques, characterization and application. Conjugated polymers are advancement compared to the normal (insulating) polymer.

Course category: Major Elective

Course Name: Special Topics in Materials Science and Engineering (MScE5311)

Credit Hour: 2

Prerequisite: None

Course description (Synopsis):

The aim of this course is to enable a student to work on a project independently indepth understanding of the subject matter, covering theory as well as concepts under the supervision of the course coordinator or an authorized person or to undertake a special course.

Course category: Major Elective

Course Name: Nanoscale Materials (MScE5302)

Credit Hour: 3

Prerequisite: Fundamentals of Materials Science and Engineering

Course description (Synopsis):

This course focuses on the basic principles of synthesis techniques, processing, micro structural

control and unique physical properties of materials in nano dimensions. It also provides balanced and comprehensive coverage of the fundamentals and processing techniques with regard to synthesis, characterization, properties, and applications of nanostructured materials. Both chemical processing and lithographic techniques are presented in a systematic and coherent manner for the synthesis and fabrication of 0-D, 1-D, and 2-D nanostructures, as well as special nanomaterials such as carbon nanotubes and ordered mesoporous oxides.

Course category: Major Elective

Course Name: Fundamentals of Electrochemistry (MScE5312)

Credit Hour: 3

Prerequisite: General Phys Phy1101, General Chemistry Chem 1102

Course description (Synopsis):

The course provides basic knowledge on electrochemical batteries, including fuel cells and their potential applications.

Course category: Major Elective

Course Name: Materials Science and Thin Film Technology (MScE5313)

Credit Hour: 3

Prerequisite: Nanoscale Materials

Course description (Synopsis):

Thin film science and technology have gone through a thorough development which results in numerous new devices (e.g., Light Emitting Diodes (LED), fuel cell and solar cell) and new materials with fundamentally new properties. Thin film research shares the knowledge from multi-disciplines (e.g., materials science, chemistry, solid state physics, mechanics and etc.)

Topics include, but are not limited to, fundamentals on crystal structures and defects in thin films, the basic nucleation and growth mechanisms of thin films (growth models, lattice matching epitaxy and domain matching epitaxy), thin film processing techniques (CVD, MOCVD, MBE, PLD, Laser-MBE, sputtering, and evaporation etc.), thin film growth instrumentation aspect (energy source, chamber configurations, vacuum systems and growth controllers), and several advanced topics related to electrical and optical devices. Lab or tour session(s) will be provided to promote teaching and learning. The following table provides a tentative guideline for course subjects.

Course category: Major Elective

Course Name: Fundamentals of Electric Circuits (MScE5314)

Credit Hour: 3

Prerequisite: Physics, applied mathematics

Course description (Synopsis):

The fundamental electric circuit as course deals with the circuit design for various applications. So that it enhances the skill of the student to deal with different circuit designing systems.

Course category: Major Elective

Course Name: Fundamentals of Energy System Integration (MScE5316)

Credit Hour: 3

Prerequisite: Energy and Environments

Course description (Synopsis):

Presents fundamental issues of successfully integrating and implementing energy systems. Exposes students to combined heat and power strategies (cogeneration system), strategies of incorporating renewable with nonrenewable energy sources, thermo-economics, and carbon

sequestrations techniques. Includes energy, energy, and thermo- economic cost factors in the presented case studies. Explores the effects of public policy, regulations, and financial operations on selecting energy technology. Students are given case studies to illustrate the complexity of implementing energy systems and are expected to complete a major project involving proposing an energy system. Emphasizes that successful implementation of energy systems requires both a technical and an economic solution. Requires calculus-based physics and chemistry.

4.3 Mechanical Engineering program

General information

I. Duration of study

Normal modality

Regular: a 5-year program

Continuing: program within eight years as stated in the university senate legislation August 2017, Article 98.2.

Fast Track modality:

dual major/minor there may be one year extension as stated in the university senate legislation.

II. Course categoryy

NO	Course Category		Course Level	Credit requirement	Percentage from the total
1	General	Mandatory	University requirement	30	
2	Basic	Mandatory	School requirement	30	
	Major	Mandatory	Department requirement	83	
		Elective		30	
		Subtotal		173	
	Free electives			3	
Total				176	

Course category: General/ university required

Course Name: Entrepreneurship and Business Development (SOSC5003)

Credit Hour: 3

Prerequisite: None

Course description (Synopsis):

This interdisciplinary course in general is designed to introduce students to the concept of sustainable entrepreneurship, a manageable process that can be applied across careers and work settings. It focuses on building entrepreneurial attitudes and behaviours that will lead to creative solution within community and organizational environments. This course is designed to prepare individuals for ownership of their own innovative business, and assist start-ups to function more effectively, increase the chances of new business success, enhance profitability, and increase employment.

More specifically, the course provides students with an introduction to the concepts and skills necessary to successfully commercialize new products and services. Entrepreneurship is not just about starting a business. It is also about identifying good opportunities and then creating,

communicating, and capturing value from those opportunities; including innovation in a corporate context. It will also teach students the skills to analyse business opportunities, and articulate them as a compelling business description, and pitch to an audience of investors, customers, or business partners. It focuses on building entrepreneurial attitudes and behaviors that will lead to creative solution within community and organizational environments.

Course category: General/ university required

Course Name: Communicative English Skills (EnLa 1001)

Credit Hour: 3

Prerequisite: None

Course description (Synopsis):

Communicative English Skills is a course where students learn what they need to know for a career in science context. The course gives students the language, information, and skills they need to study science context. It also provides students the language appropriate for studying science context and real work situations as it comprises unique sections such as: ‘it’s my job’ wherein real people talk about their work in science context, ‘listening’ whereby students are exposed to situations related to science context, technical explanations, and interviews, ‘reading’ whereby students meet a variety science context based texts, and the ‘writing section’ which is designed to let students compose short reports on different activities.

Course category: General/ university required

Course Name: Basic Writing Skills (EnLa-1002)

Credit Hour: 3

Prerequisite: Communicative English Skills (EnLa 1001)

Course description (Synopsis):

Basic Writing Skills course aims at developing students’ basic writing skills in science context. The course gives students the language writing skills they need to study science. It contains

sentence level writing: sentence structure, sentence types sentence combinations, common sentence errors (fragment, run on, comma splices, misplaced modifier, dangling modifier, faulty parallelism, faulty reference of pronoun, faulty agreement and shifts); paragraph level writing: the essence of a paragraph, components of a paragraph (topic sentence, supporting sentences, concluding sentence), characteristics of effective paragraph (unity, coherence and completeness) and the steps in writing a paragraph and types of a paragraph; essay level writing: structure of an essay, thesis statement and supporting paragraphs, types of essays and techniques of essay development.

Course category: General/ university required

Course Name: Introduction to Civics and Ethics (LART 1001)

Credit Hour: 3

Prerequisite: None

Course description (Synopsis):

It is now become clear that Ethics and Citizenship Studies has become not only a field of specialization in itself but has also been attracting leaders who envision instilling democracy on a nun shakable ground within their own society. Autoscore, Ethics is a system of moral principles which involves systematizing, defending and recommending concepts of rights and wrong behavior. It affects how people make decisions and lead their lives. Citizenship, on its part, is a legal status of individuals within a given state. It embodies the legal and political relationship between citizens and state, underlining the reciprocal relationship between the two. This course is designed with the aim of equipping learners with necessary ethical qualities and civic competences while dealing with issues that affect their society at all levels and human in general. The course starts with unfolding the notions, principles and theories of ethics which can shape human attitude, action and behavior in making moral judgments. Next, the course introduces

learners to the nature, mutual interactions and historical evolutions of society, state, government and citizenship. It also elucidates issues pertaining to “We are dedicated to innovative knowledge” 27 political governance such as constitution, democracy, and human rights in some details. To enable learners grasp basic knowledge of political, economic and social dynamics of international system in today’s globalized world, the course also introduces international relations and foreign policy and other major contemporary global issues. In light of this, the course does not present mere theoretical knowledge, but also practical knowledge of accentuating art of governing and protecting national interest in today’s complex world.

Course category: General/ university required

Course Name: Logic and Critical thinking (LART 1002)

Credit Hour: 3

Prerequisite: None

Course description (Synopsis):

The main goal of the course is to improve critical and logical reasoning skills. Students will see how our ordinary intuitions on good or bad reasoning can be articulated explicitly in formal systems, and gain a new ability to evaluate arguments and reasoning they encounter every day with rigorous logical concepts and tools. As to the subject matter, it introduces systematic methods of reasoning, such as argument, deduction, induction, syllogistic, and propositional logic.

Course category: General/ university required

Course Name: Introduction to Economics (SOSC2002)

Credit Hour: 3

Prerequisite: None

Course description (Synopsis):

This course provides a general introduction to economics combining elements of micro and macro fundamentals. The main objective of this course is to introduce and acquaint students with the preliminary principles (theories) and knowledge of economics and the application of economic theories (principles) in the actual world; the daily activities of the households, firm business or any other form of enterprises at micro levels. Students will also be able to contextualize the key macroeconomic variables and policy instruments.

Specifically, the course introduces students with theory of consumer behaviors, production, and cost of production. In these theories how decisions are made by different economic agents will be discussed. Furthermore, the course covers different characteristics of perfect and imperfect market structure. Lastly the course tries to introduce basic macroeconomic concepts such as national income accounting, unemployment, inflation, fiscal and monetary policy instruments.

Course category: General/ university required

Course Name: General Psychology and Life Skills (LART 2002)

Credit Hour: 3

Prerequisite: None

Course description (Synopsis):

Psychology is a science of human cognitive processes and behaviors. This course is designed to give students an overview of what psychological science has discovered about human behaviors and mental processes throughout human history. Students will gain an understanding of the

psychological phenomena that occur in daily life as well as the practical applications of psychological knowledge. Upon completing the course, students shall be able to demonstrate a basic knowledge of the science of psychology. Specifically, the course general psychology is concerned with discussing perspectives in psychology and basic psychological concepts such as sensation and perception, learning, personality, motivation, emotion, and basic life skills (intrapersonal, interpersonal, social and academic skills). Emphasis will be given to both theoretical and practical implications of these concepts to effectively function as individual and team in a community.

Course category: General/ university required

Course Name: Physical fitness and conditioning I (SpSc1011)

Credit Hour: 0 cr.hr

Prerequisite: None

Course description (Synopsis):

This course will provide the students with basic concepts of the five components of health related physical fitness (cardiovascular, muscular strength and endurance, flexibility, and body composition), hypokinetic disease and general principles of training. It is mainly practical oriented. As a result, the students will be exposed to various exercise modalities, sport activities, minor and major games, and various training techniques as a means to enhance health related physical fitness components. In addition, they will develop the skills to assess each component of fitness and will practice designing cardiovascular, muscular strength and endurance, and flexibility programs based on the fitness assessment. The course serves as an introduction to the role of exercise in health promotion, fitness, performance including the acute and chronic responses of the body to exercise.

Course category: General/ university required

Course Name: Physical fitness and conditioning II (SpSc 1022)

Credit Hour: 0 cr.hr

Prerequisite: SpSc 1011

Course description (Synopsis):

This course is designed to acquaint freshman engineering and applied natural science students with the nature and scope of different ball games.

It emphasizes the value of establishing lifelong fitness using ball games as a means and focuses on the fundamental of volley ball, hand ball, basketball and football as a life time leisure activity also focuses on the development of personalized approach to healthy active living through participation in a verity of ball games that have the potential to engage students' interest throughout their lives. Again, the courses enable the participants enjoying practice and acquire proper technique and strategies associated with the ball games mentioned above and learn rules governing the game.

Course category: General/ university required

Course Name: Geography of Ethiopia and the Horn (LART 1003)

Credit Hour: 3

Prerequisite: None

Course description (Synopsis):

This course covers a brief description on the location, shape and size of Ethiopia as well as basic skills of reading map, the physical background and natural resource endowment of Ethiopia and the Horn which includes its geology and mineral resources, topography, climate, drainage and

water resources, soil, fauna and flora. It also deals with the demographic characteristics of the country and its implications on economic development.

Course category: General/ university required

Course Name: History of Ethiopia and the Horn (LART 1004)

Credit Hour: 3

Prerequisite: None

Course description (Synopsis):

This course describes why history is important, how history is studied and introduces the region Ethiopia and the Horn. It treats human evolution, Neolithic Revolution, settlement patterns as well as religion and religious processes in Ethiopia and the Horn. Based on these historical backgrounds, the course describes states, external contacts, economic formations and achievement in terms of architecture, writing, calendar, and others to the end of the 13th century. Historical processes including states formation and power rivalry, trade, external relation, threats and major battles, centralization and modernization attempts, Italian occupation, and socio-economic conditions from 1800 to 1941 makes central position in the modern history of the region.

Course category: Core elective

Course Name: Technical Report Writing (EnLa-2102)

Credit Hour: 2

Prerequisite: Communicative English Skill (EnLa 1001) - Basic Writing Skill (EnLa 1002)

Course description (Synopsis):

Written communication is the foremost form of academic advancement. Thus, technical report writing, as a genre of written communication, encompasses the ability to organize and craft information for manuals, reports and other technical publications. To this effect, Technical

Report Writing prepares students to design effective technical documents for written media, using various formats. The course provides students an introduction to principles of audience analysis, to conducting research and documentation, to drafting and revising processes of documents, as well as to maintaining readability and accessibility to written texts in addition to realizing the details of reports.

Course category: Common modules

Course Name: Research Methodology (SOSC4104)

Credit Hour: 2

Prerequisite: None

Course description (Synopsis):

When complex theoretical and technical problems are solved, new knowledge is created. As a result, research methods are critical aspects of engineering professional practice and scholarship. Problem solving skills are also essential requirements for science and technology and engineering students. This course provides knowledge and understandings on the basic concepts of research, types of research, aspects of research and how to apply research process and methods of inquiry to solve engineering problems and challenge in a systematic manner. It is designed to acquaint science and technology students with the basic skills how to prepare project/research proposal, evaluate background literature, adhering to ethics, basic steps in scientific paper writings, documentation strategies, and how to communicate findings in specific scientific formats to specialist audiences and end users.

Course category: Basic

Course Name: Applied Mathematics I (Math1101)

Credit Hour: 4

Prerequisite: None

Course description (Synopsis):

Generally, the Course Covers Basic Ideas and Principles of Vectors & Matrices of Linear Algebra and Basic ideas of Calculus. In Particular the course Contains principles of vectors, matrices & determinants, limit and continuity, derivatives & their applications, integrals, integration techniques and their applications.

Course category: Basic

Course Name: General Physics (Phys1101)

Credit Hour: 4

Prerequisite: Knowledge in Higher Secondary Physics

Course description (Synopsis):

At the end of this course students are expected to be acquainted with basic concepts in different branches of physics, identify the connection between them and explain the common phenomena. They will also develop skills of solving problems.

Course category: Basic

Course Name: General Chemistry (Chem1102)

Credit Hour: 3

Prerequisite: None

Course description (Synopsis):

General Chemistry is the science of the properties of atoms and the laws governing their combination, composition, and structure of substances, the transformations they undergo, and the energy that is released or absorbed during Chemical or physical process. The topics covered in this course includes: Introduction to the study of modern Chemistry, acids and bases, the periodic table, Chemical bond and molecular structure, rates of physical and Chemical processes, materials, kinetic molecular description of the state of matter and equilibrium in Chemical reaction.

Course category: Basic elective

Course Name: Introduction to Computing (CSEg 1101)

Credit Hour: 3

Prerequisite: None

Course description (Synopsis):

In this course the basic techniques of computational problem solving will be covered by using computational thinking while writing small and medium sized programs, mapping problems into computational frameworks emphasizing on scientific problems, understanding problems and formulation of problems based on the elective programming language (using python). The course includes the concepts and techniques of data structure, input/output, flow control and incidental program, and by using a systematic division of problem solution and concept of module, to solve problems in numerical value field and non-numerical value field with program experiment.

Course category: Basic

Course Name: Applied Mathematics II (Math 1102)

Credit Hour: 4

Prerequisite: Applied Mathematics I (Math 1101)

Course description (Synopsis):

This course covers sequences, series, power series, Fourier series differential and integrals calculus of functions of several variables.

Course category: Basic

Course Name: Applied Mathematics III (Math2101)

Credit Hour: 4

Prerequisite: Applied Mathematics-II

Course description (Synopsis):

This course covers the topics in First order ordinary Differential Equation, second order ordinary Differential Equation, Laplace transforms and its application, scalar and vector fields and complex analytic function.

Course category: Basic

Course Name: Introduction to Emerging Technologies (CSEg1102)

Credit Hour: 3

Prerequisite: None

Course description (Synopsis):

This course will enable students to explore current breakthrough technologies in the areas of Artificial Intelligence, Internet of Things and Augmented Reality, Data Science and other technologies that have emerged over the past few years. Besides helping learners become literate

in emerging technologies, the course will prepare them to use technology in their respective professional preparations.

Course category: Basic

Course Name: Fundamentals of Programming (CSEg1104)

Credit Hour: 3

Prerequisite: Introduction to Computing

Course description (Synopsis):

The course is designed to introduce structured programming in C++ by providing an overview of programming concepts, on creating and working computer programs in C++. It will address fundamental concepts of program analysis, design, coding, testing and development. It includes introduction to computer programming; programming paradigms; algorithms and problem-solving; introduction to data structures and Programming constructs. The course is designed on how to solve business and scientific problems through the technique of structured programming. It will prepare students for focused studies in any programming language.

experiment.

Course category: Basic

Course Name: Probability and Statistics for Engineers (Mechanica) (Math2105)

Credit Hour: 3

Prerequisite: None

Course description (Synopsis):

Statistics looks at the data handling cycle and analysis of collected data. Up on the completion of this course, students will be able to understand the process involved in posing the question, collecting data on that question, presenting data, analyzing data using measure of spread and

center, quantitative analysis of uncertainty and risk for engineering applications, estimation of distribution parameters, hypothesis testing, simple and multiple linear regressions, Poisson and Markov processes, and interpreting the results to make informed decision. There is an emphasis placed on real-world applications to engineering problems. This course include: History of statistics, Meaning of statistics; Methods of data collection and presentation; Measures of an average; Measures of variation; Moments, skewness and kurtosis; terminologies in probability; Counting Techniques; definition of Probability (approaches to probability); Probability distributions; Sampling and Sampling Distribution of the mean and proportion; Basic concepts for estimation: (Point and Interval) for the population mean and proportion; Hypothesis testing on the population mean and proportion; Simple linear regression, correlation and rank correlation.

Course category: Basic

Course Name: Engineering Drawing (MEng 1102)

Credit Hour: 3

Prerequisite: None

Course description (Synopsis):

This course introduces importance of engineering drawing, and theory of projections, theory and practices of Multi view representations, Auxiliary and revolved views, pictorial drawings and sectional drawing using drawing instrument.

Course category: Basic

Course Name: Basic Workshop practice (MEng 2101)

Credit Hour: 2

Prerequisite: None

Course description (Synopsis):

Workshop practice is the backbone of the real industrial environment which helps to develop and enhance relevant technical hand skills required by the technician working in the various engineering industries and workshops. This course intends to impart basic know-how of various hand tools and their use in different sections of manufacturing. Irrespective of branch, the use of workshop practices in day to day industrial as well domestic life helps to dissolve the problems. The workshop experiences would help to build the understanding of the complexity of the industrial job, along with time and skills requirements of the job. The course will help the students to be conversant with the workshop hazard and to observe all safety practices and codes. Topics to be covered include introduction to basic manufacturing processes, organization of workshop, workshop hazard and safety practices and codes, properties of engineering materials, bench-work and fitting, drilling techniques and exercise, sheet metal work, welding and soldering technique with exercises etcetera.

Course category: Major mandatory

Course Name: Engineering Mechanics (CEng2201)

Credit Hour: 3

Prerequisite: General Physics-I

Course description (Synopsis):

This course provides the fundamental physical concepts, laws and principle of statics to solve engineering problems for rigid bodies at rest. It covers about operations with vectors, coplanar and non-coplanar, concurrent and non-concurrent force systems, equilibrium and analysis of structures (trusses, beams, frames and machines), internal actions in beams, centroids, area moment of inertia, static friction and introduction to dynamics.

Course category: Major mandatory

Course Name: Engineering Mechanics II (Dynamics) (MEng 2104)

Credit Hour: 3

Prerequisite: None

Course description (Synopsis):

Introduction to basic principles of dynamics, kinematics and kinetics of particles, work and energy, impulse and momentum, kinematics and kinetics of rigid bodies, which include rotation, absolute motion, relative velocity and acceleration, general equation of motion, work-energy relation and impulse momentum equation.

Course category: Major mandatory

Course Name: Machine drawing (MEng 2105)

Credit Hour: 3

Prerequisite: Engineering drawing (MEng1102)

Course description (Synopsis):

Types of machine Drawings; Conventional representation of Fasteners (permanent and temporary), Bearings, Seals, Gears, Springs and Shafts, Systems of Fits and limits, Tolerance and Allowance, Surface Texture.

Course category: Major mandatory

Course Name: Engineering Materials II (MEng2202)

Credit Hour: 3

Prerequisite: MSE 2101-Introduction to Engineering Materials

Course description (Synopsis):

Properties, Heat treatment and applications of Ferrous and Nonferrous alloys.

Course category: Major mandatory

Course Name: Machine Drawing with CAD (MEng 2208)

Credit Hour: 2

Prerequisite: Machine Drawing (MEng 2105)

Course description (Synopsis):

Sketching, part design, assembly design, drafting, border lines, title block, and bill of materials.

Course category: Major mandatory

Course Name: Strength of Materials I (MEng 2110)

Credit Hour:

Prerequisite: Introduction to Engineering Mechanics (MSE2101)

Course description (Synopsis):

Mechanics of materials I introduces concept of solid mechanics. The course also introduces the mechanical properties of solids, and fundamental mechanical tests such as tensile and impact tests. The student acquires concept of stress and strain for axial, torsion and bending loadings.

Course category: Major mandatory

Course Name: Manufacturing Engineering I (MEng3201)

Credit Hour: 3

Prerequisite: Introduction to Engineering Materials (MSE2101) and Basic Workshop practice (MEng2101)

Course description (Synopsis):

Manufacturing Engineering, I is the first course of the two course sequence of manufacturing engineering. The courses provide a treatment of manufacturing that is modern and quantitative. It is aimed to provide balanced coverage of the basic engineering materials (metals, ceramics,

polymers, and composite materials) and relevant manufacturing processes based on its emphasis on manufacturing science.

Course category: Major mandatory

Course Name: Manufacturing Engineering II (MEng3202)

Credit Hour: 3

Prerequisite: Introduction to Engineering Materials (MSE2101) and Basic Workshop practice (MEng2101) Manufacturing Engineering I(3201)

Course description (Synopsis):

Manufacturing Engineering II is the second course of the two-course sequence of manufacturing engineering. The course provides a treatment of manufacturing that is modern and quantitative. It is aimed to provide balanced coverage of the basic engineering materials (metals, ceramics, polymers, and composite materials) and relevant manufacturing processes based on its emphasis on manufacturing science.

Course category: Major mandatory

Course Name: Thermodynamics I (MEng 3203)

Credit Hour: 3

Prerequisite: Applied Mathematics I (Math 1101)

Course description (Synopsis):

Thermodynamic notions and systems; Fundamental concepts; First law of Thermodynamics: closed and open systems, enthalpy; Second law of Thermodynamics: Reversible and irreversible processes; Carnot cycle; Entropy; Availability; Irreversibility; Pure substances; Vapor pressure curves; Steam tables; Phase diagrams of steam.

Course category: Major mandatory

Course Name: Thermodynamics II (MEng 3204)

Credit Hour: 3

Prerequisite: Thermodynamics I

Course description (Synopsis):

Concepts of ideal gases and their mixtures, gas-steam mixtures, wet air, psychometric charts and air conditioning process. Discussion on various cycles including Vapor power and refrigeration cycles. Air standard cycles. Thermodynamic relations. Combustion. Phase equilibrium. Introduction to refrigeration processes.

Course category: Major mandatory

Course Name: Thermodynamics II (MEng 3204)

Credit Hour: 3

Prerequisite: Thermodynamics I

Course description (Synopsis):

Concepts of ideal gases and their mixtures, gas-steam mixtures, wet air, psychometric charts and air conditioning process. Discussion on various cycles including Vapor power and refrigeration cycles. Air standard cycles. Thermodynamic relation.

Course category: Major mandatory

Course Name: Fluid Mechanics (MEng 3205)

Credit Hour: 4

Prerequisite: Applied Mathematics III (Math2101)

Course description (Synopsis):

Introduction to Fluid Mechanics; Hydrostatics pressure in Fluids; Flow Classification; Properties of flows; Viscous fluid flows Newtonian and nonnewtonian flows; Turbulent flow in pipes. Dimensional analysis, Lift and Drag on aero foils, Two-dimensional potential flow.

Course category: Major mandatory

Course Name: Design of Machine Element I (MEng 3206)

Credit Hour:3

Prerequisite: Introduction to Engineering Mechanics (MSE2101), Strength of Materials I (ME 2110) and Strength of Materials II (ME 3109)

Course description (Synopsis):

This course aiming to develop the fundamental knowledge in calculating the stresses induced in machine parts like shafts, key, couplings, joints and mechanical springs by considering variable loading conditions. Evaluation of stresses in real time loading with respect to factor of safety is highlighted.

Course category: Major mandatory

Course Name: Heat Transfer (MEng 3208)

Credit Hour: 3

Prerequisite: Applied Mathematics III (Math2101), Thermodynamics I (MEng 2106)

Course description (Synopsis):

Heat transfer is essential across a wide range of engineering problems, and this course is sufficiently broad and self-contained to be suitable for students in all engineering curricula; it is required for mechanical engineering students. The materials are chosen to provide the student

with both a quantitative and intuitive capability for dealing with heat transfer problems. In addition to analytical solutions, the student is familiarized with the use of finite difference methods for the numerical solution of thermal problems. Lectures and discussion stress the close relationships between thermal modeling and design decisions. The students are introduced to the modes of heat transfer, analytical methods for one-dimensional steady-state, and transient problems. And, the students are also introduced to numerical methods for multi-dimensional steady-state and transient problems. The students are introduced to correlations to find heat transfer coefficients for forced and natural convection. The students are introduced to radiation heat transfer, condensation, and boiling processes.

Course category: Major mandatory

Course Name: THEORY OF MACHINES AND MECHANISMS (MEng3112)

Credit Hour: 3

Prerequisite: Engineering Mechanics II (Dynamics) MEng 2104

Course description (Synopsis):

The course focuses on the kinematics and dynamics of motion and power transmitting mechanisms used in machines. It helps students understand various linkages and mechanisms along with their position, velocity, acceleration and force analyses. Cams and followers, gears and gear trains, flywheels, speed governors, gyroscopes, and balancing of rotating and reciprocating machines are given due attention. Methods of designing mechanisms in order to fulfill motion requirements are given special emphasis.

Course category: Major mandatory

Course Name: Automotive Drive Train (MEng 5307)

Credit Hour: 3

Prerequisite: Introduction to Automobile engineering (MEng 3200)

Course description (Synopsis):

This course deals with construction, Inspection, diagnosis, disassembly and assembly of manual drive train components including clutch, manual transmission, driveshaft, universal joint, constant velocity joint, final drive, manual transaxle, transfer case and locking hub assemblies. Operation and diagnosis of automatic transmission, transaxle, transfer case, and driveline electrical components and controls including diagnosis of switches, sensors, solenoids, motors, and control devices.

Course category: Major elective

Course Name: Vehicle Maintenance (MEng 5335)

Credit Hour: 3

Prerequisite: IC Engines and Reciprocating Machines

Course description (Synopsis):

This course deals with engine diagnosis and tune up, Chassis systems inspection and maintenance as well as minor vehicle.

Course category: Major elective

Course Name: Farm Machinery and Equipment (MEng 5347)

Credit Hour: 3

Prerequisite: None

Course description (Synopsis):

This course focuses on Farm mechanization and its scope; classification, field capacity and selection of farm machinery; land reclamation, land preparation machineries, sowing and

planting equipment; fertilizer and manure application machinery; different types of sprayers and dusters; harvesting equipment: threshers, combines, and forage harvesters, mow

Course category: Major elective

Course Name: Diesel and gasoline engine overhauling (MEng 5309)

Credit Hour: 3

Prerequisite: IC Engines and Reciprocating Machines

Course description (Synopsis):

This course covers practice on trouble shooting, disassembling, cleaning, inspection, re-conditioning and adjustment on gasoline and diesel engine components and its systems.

Course category: Major elective

Course Name: Maintenance Engineering (MEng 4202)

Credit Hour: 3

Prerequisite: Probability and statistics for engineers, Mechanical Vibration (MEng 4209), Introduction to Automobile Engineering (MEng 3200).

Course description (Synopsis):

This course examines the main methods for developing a modern maintenance program for industrial plants. It provides a comprehensive understanding of theory and practice of reliability centered maintenance and total productive maintenance strategies to optimize on product quality, and address safety and environmental issues.

Course category: Major elective

Course Name: MECHANICAL VIBRATIONS (MEng4209)

Credit Hour: 3

Prerequisite: MEng 3112 (Theory of machines and Mechanisms) ECE3162,(Electrical Machines & Drives)

Course description (Synopsis):

Mechatronics is a coordinated, and concurrently developed, Integration of mechanical engineering with electronics and intelligent computer control in the design and manufacture of products and processes.

Course category: Major elective

Course Name: Introduction to Mechatronics (MEng4204)

Credit Hour: 3

Prerequisite: Engineering Mechanics II (Dynamics) MEng 2104

Course description (Synopsis):

Mechatronics is a coordinated, and concurrently developed, Integration of mechanical engineering with electronics and intelligent computer control in the design and manufacture of products and processes.

Course category: Major elective

Course Name: Numerical Methods for Engineering (MEng 4211)

Credit Hour: 3

Prerequisite: None

Course description (Synopsis):

Numerical methods provide a way to solve problems quickly and easily compared to analytic solutions. Whether the goal is integration or solution of complex differential equations, there are many tools available to reduce the solution of what can sometimes be quite tricky by analytical math to simple algebra. The students are introduced to different types of numerical methods, computations errors, and mathematical modeling concepts. They are introduced to methods to solve non-linear equations, the system of linear equations, ordinary differential and partial differential equations. They are taught how to perform regression analysis and interpolation to the given data. They are taught to derive and apply numerical formulae for differentiation and integration. They are introduced to MATLAB programming at the lab level.

Course category: Major elective

Course Name: Introduction to Finite Element Methods (MEng5309)

Credit Hour: 3

Prerequisite: Strength of materials I (MEng 2110), Strength of materials II (MEng 3109), Heat Transfer (MEng3107), Numerical methods in Engineering (MEng 3108), Fluid Mechanics (MEng 3105)

Course description (Synopsis):

This course aims to expertise in-terms of solving complex problems involved in their graduate major courses like strength of material, fluid mechanics, heat transfer and so on. All the related problems will be solved through finite element formulation through Variation Method and Weighted residual method solution process.

Course category: Major elective

Course Name: Product Design and Development (MEng 4314)

Credit Hour: 3

Prerequisite: DME 4203 Machine Design Project

Course description (Synopsis):

Product Design and Development is a project-based course that covers modern tools and methods for product design and development. The cornerstone is a project in which teams of management, engineering, and industrial design students conceive, design and prototype a Physical product. Topics include identifying customer needs, concept generation, product architecture, industrial design, and design-for-manufacturing.

Course category: Major elective

Course Name: Computer Aided Design and Manufacturing (CAD/CAM) (MEng)

Credit Hour: 3

Prerequisite: Machine Drawing with CAD (MEnG)

Course description (Synopsis):

This course aims to cover the Concept of any design task in CAD/CAM environment, It aims to impart the parametric fundamentals to create and manipulate geometric models using curves, surfaces and solids. It also aims to introduce the students to computer numerical control for manufacturing; Basic component of and classification of NC machine tools; Manual NC programming; CAD/CAM systems for programming.

Course category: Major elective

Course Name: Computer Integrated Manufacturing (MEng 4308)

Credit Hour: 3

Prerequisite: MEng 4308

Course description (Synopsis):

Uses of a common database wherever feasible and communication technologies to integrate design, manufacturing and associated business functions that combine the automated segments of a factory or a manufacturing facility.

Course category: Major elective

Course Name: Turbo machinery (MEng 4320)

Credit Hour: 3

Prerequisite: Fluid mechanics, Thermodynamics

Course description (Synopsis):

The course aims at giving an overview of different types of turbo machinery used for energy transformation, such as pumps, fans, compressors, as well as hydraulic, steam and gas-turbines. Power is one of the main needs for the development of a nation. At present all the power plants generate electricity using either hydraulic, steam or gas turbines. Therefore, it is very much essential for mechanical engineering students to study the principles of turbo machines. Students are introduced to the basic laws of thermodynamics and fluid mechanics applicable to turbo machines. They can understand the fundamental principles and fundamental needs to solve turbo machinery problems along with practical applications, design aspects and geometric configuration of the pumps, compressors, hydraulic and steam turbines.

Course category: Major elective

Course Name: Refrigeration and Air conditioning (MEng 5204)

Credit Hour: 3

Prerequisite: Basic Thermodynamics, Refrigeration and Air-co

Course description (Synopsis):

Refrigeration and Air conditioning is a core elective that will help the students in attaining understanding and application of HVAC.

Course category: Major elective

Course Name: INTRODUCTION TO COMPOSITE MATERIALS AND MECHANICS (MEng)

Credit Hour: 3

Prerequisite: None

Course description (Synopsis):

Introduction to Composite Materials course aims to enable students understand the basics of different types of composite materials analytically and experimentally. The course will enable the students to learn history of composite material, definition, grouping and its applications. Gain knowledge micromechanical properties (volume and mass fractions, density and void content) of composite lamina and also about micromechanical properties (stress/strain/elastic modulus/Hooke's-law/strain energy/stress-strain relations) of composite lamina and laminates. Design and analyze composite materials to assess failure criteria. Fabricate and test polymer matrix composite samples prepared in-house using open mold casting technique. Analysis of structure-property correlations using scanning electron microscope.

Course category: Major elective

Course Name: Thermo-fluid (MEng 5325)

Credit Hour: 3

Prerequisite: Fluid mechanics, Thermodynamics, Heat transfer and Turbomachinery

Course description (Synopsis):

Definition of Thermo-fluids; Modeling; Refrigeration cycles; Air-Conditioning Processes; Definition of Fluid Mechanic Terms; Hydrostatic Pressure Distributions; Continuity equation; Bernoulli's equation; Subsonic and supersonic; Introduction to Convection; Introduction to Radiation; Heat Exchanger Analysis; Log Mean Temperature Difference; Heat Exchanger Design and Performance Calculations; Definition of Turbo-machine Terms; Centrifugal Pumps; System and Pump Characteristic Curves; Analysis of Hydraulic Turbines; Analysis of Turbojet for Propulsion.

Course category: Major elective

Course Name: Alternative Energy Technology (MEng 5327)

Credit Hour: 3

Prerequisite: None

Course description (Synopsis):

Classification of energy resources, Environmental aspects of energy, Global energy scenario, Energy scenario in Ethiopia. Solar energy utilization, Solar photovoltaic, Wind power generation, Micro- hydro power generation, Biomass and Geothermal power generation and Design criteria for appropriate technology.

Course category: Major elective

Course Name: Production Planning and Product Costing (MEng5331)

Credit Hour: 3

Prerequisite: Introduction to Economics

Course description (Synopsis):

This course aims at developing the basic knowledge and skills of engineering students. It gives the students the capacity to analyze production process planning and different types of product cost estimation.

Course category: Major elective

Course Name: Aerodynamics (MEng 5337)

Credit Hour: 3

Prerequisite: Fluid Mechanics,

Course description (Synopsis):

Students undergoing this course are expected to understand the governing equations of fluid flow, incompressible in-viscid flow, to understand the behavior of airflow over streamlined and bluff bodies with particular emphasis on 2D circular cylinder, airfoil and wing sections in the incompressible flow regime

Course category: Major elective

Course Name: Production Planning and Product Costing (MEng5331)

Credit Hour: 3

Prerequisite: Introduction to Economics

Course description (Synopsis):

This course aims at developing the basic knowledge and skills of engineering students. It gives the students the capacity to analyze production process planning and different types of product cost estimation.

Course category: Major elective

Course Name: Introduction to Computational Fluid Dynamics (MEng 5339)

Credit Hour: 3

Prerequisite: Fluid Dynamics, Heat Transfer

Course description (Synopsis):

This course aims to introduce numerical modeling and its role in the field of heat and fluid flow; it will enable the students to understand the various discretization methods and solving methodologies and to create confidence to solve complex problems in the field of heat transfer and fluid dynamics.

Course category: Major elective

Course Name: Metal Forming Process and Analysis (MAE6110)

Credit Hour:

Prerequisite: Manufacturing Engineering I (MEng3201), Manufacturing Engineering II(MEng4211), Strength of materials I & II (MEng2110 & 3109)

Course description (Synopsis):

This course offers the higher order knowledge in predicting load requirement. Stress and strain distribution in severe plastic deformation. An analytical ability to solve all kinds of metal forming problems is a key feature.

Course category: Major elective

Course Name: Principle of Metal Cutting (DME 3203)

Credit Hour: 3

Prerequisite: DME 2204 Machining Process, M Eng. 3202- Manufacturing Engineering

Course description (Synopsis):

Cutting process, cutting tool nomenclature; mechanics of metal cutting; thermal aspects of machining; tool life and tool wear; cutting fluid.

Course category: Major elective

Course Name: Introduction to Tribology (MEng 5345)

Credit Hour: 3

Prerequisite: MEng 2202-Engineering Materials-II , MEng 3210- Theory of Machines and Mechanism

Course description (Synopsis):

Friction, wear and lubrication on metal to contact

Course category: Major elective

Course Name: Heat Exchanger Design (MEng 5351)

Credit Hour: 3

Prerequisite: Fluid Mechanics and Heat Transfer

Course description (Synopsis):

Basic Design Methods; Design Correlations; Pressure Drop in and Fouling of Heat Exchangers; Double-Pipe, Shell-and-Tube, Compact, Gasketed-Plate Heat Exchangers; Correlations for Two-phase Flow;

Course category: Major elective

Course Name: Thermal System Design (MEng5201)

Credit Hour: 3

Prerequisite: Thermodynamics, Fluid mechanics, heat transfer.

Course description (Synopsis):

Introduction to Design Process; Design and simulation; Component Design; System Design; Modeling and Simulation; Economics; Optimization; Availability/Exergy; Basic component and system design; Heat Exchangers; Fluid Flow Systems; Numerical Modeling; Term Project; Energy calculations; system selection and design, system simulation and optimization.

Course category: Major elective

Course Name: Science of welding and Casting Processes (MEng 5355)

Credit Hour: 3

Prerequisite: Physical Metallurgy (xxxx), Manufacturing Engineering, I (MEng3201), Manufacturing Engineering II (MEng4211)

Course description (Synopsis):

Science of welding and Casting Processes course aims to provide knowledge of the Physics of Welding- Energy for Welding; different “We are dedicated to innovative knowledge” 437 welding process, metallurgical aspect in the welding process. From these topics, students will elaborate their knowledge at extent of an advanced level without any defects in the joint’s configurations. In addition to these concepts, this course also educates the students by explaining an introduction and basic materials used in foundry. Different types sand molding techniques and also solidification principles for non-ferrous materials.

Course category: Major elective

Course Name: Plant layout & Material Handling (MEng 5357)

Credit Hour: 3

Prerequisite: MEng 3201-Manufacturing Technology I & MEng 3202- Manufacturing technology II

Course description (Synopsis):

Development of factory structure and effective usage material handling equipment.

Course category: Major elective

Course Name: Introduction to Robotics (MEng4318)

Credit Hour: 3

Prerequisite: MEng 4204 (Introduction to Mechatronics), MEng 3112 (Theory of machines and Mechanisms)

Course description (Synopsis):

This course gives the basic concepts of Industrial Robots and drive system. This course gives the students to analyze the design concepts and applications of end effectors, solve kinematics and trajectory related problems, improve the knowledge to identify the appropriate sensors for various robotics applications and learn different software how to use in robot applications.

Course category: Major elective

Course Name: Design of Materials Handling Equipment (MEng5302)

Credit Hour: 3

Prerequisite: Machine Element II and Strength of Materials II

Course description (Synopsis):

This course aims at developing the basic knowledge and skills of engineering students. It gives the students the capacity to design and analyze different material handling equipment.

Course category: Major elective

Course Name: Power plant Engineering (TAE5201)

Credit Hour: 3

Prerequisite: Applied thermodynamics (TAE3204)

Course description (Synopsis):

Analysis of steam cycles; Fuels and combustion; Steam generators (Boilers); Combustion mechanisms, Combustion equipment and Firing methods; Steam turbines; Steam condensers, Condensate-feed-water and circulating water systems; Internal combustion power plants; Miscellaneous topics; Engineering economy.

Course category: Major elective

Course Name: Gas Turbines and Jet Engines (MEng 5312)

Credit Hour: 3

Prerequisite: Fluid mechanics and Thermodynamic II

Course description (Synopsis):

Introduction to the principles of operation of jet propulsion engines; A brief review of: compressible flow through nozzles, compressors and gas turbines; Components of aircraft gas turbine engines; Parametric analysis of the ideal and real cycles of the engines; Analysis of overall performance of the engines.

Course category: Major elective

Course Name: Engineering Metrology G & D Tolerance (MEng4318)

Credit Hour: 3

Prerequisite: None

Course description (Synopsis):

understanding the concepts of various measurement systems & standards with regards to inspection of final product in realistic applications. The application of acceptable geometric and dimensional tolerance in the part and assembly in industrial product. To develop basic principles and devices involved in measuring surface textures.

Course category: Major elective

Course Name: Introduction to Composite Materials and Mechanics (MEng-)

Credit Hour: 3

Prerequisite: None

Course description (Synopsis):

Introduction to Composite Materials course aims to enable students understand the basics of different types of composite materials analytically and experimentally. The course will enable the students to learn history of composite material, definition, grouping and its applications. Gain knowledge micromechanical properties (volume and mass fractions, density and void content) of composite lamina and also about micromechanical properties (stress/strain/elastic-modulus/Hooke's law/strain energy/stress-strain relations) of composite lamina and laminates. Design and analyze composite materials to assess failure criteria. Fabricate and test polymer matrix composite samples prepared in-house using open mold casting technique. Analysis of structure property correlations using scanning electron microscope.

Course category: Free elective

Course Name: Introduction to Law (LART 3408)

Credit Hour: 3

Prerequisite: None

Course description (Synopsis):

The course mainly aims at introducing students to the world of law in general and Ethiopian law in particular. To this end, students be equipped with basic knowledge on the nature and functions of law, classification of law, various sources of law in general and social norms as sources of law and how law gradually evolves from social norms and distinguishes itself from these norms. In addition, students will learn about the law-making process in Ethiopia and hierarchy of laws. Likewise, students will also be introduced to the concept of legal personality and its attributes, obligations and their sources, and various conflict resolution mechanisms along with their merits and demerits.

Course category: Free elective

Course Name: Cognitive Psychology (LART 4402)

Credit Hour: 3

Prerequisite: None

Course description (Synopsis):

The course examines major issues and research findings in cognitive psychology, and the scientific study of human cognition (information processing). The course also involves developing the conceptual tools for the nature of mind and its relationship to the brain (how brains create our mind) and a computer. Furthermore, it explores how research findings in cognitive psychology are applied to human factors. Major topics include the concepts of concept

formation, cognitive development and cognition such as information processing or computation, perception, attention, consciousness, memory, language, and thinking.

Course category: supportive module

Course Name: I/O Psychology (LART 3406)

Credit Hour: 3

Prerequisite: None

Course description (Synopsis):

Industrial / Organizational (I/O) Psychology is branch of psychology that examines people in the workplace and all the factors that affect how people behave at work. This course provides an overview of the science and practices of IO psychology ranging from personnel functions to group and organizational issues. The course introduces students to the scientific basis of human behavior at work and how they relate to processes of hiring, developing, managing and supporting employees. Specifically, the course discusses the basics of the science of psychology & I/O psychology, personnel functions, employee workplace behavior, work groups and organizational issues such as leadership and organizational development.
