ADDIS ABABA
SCIENCE AND
TECHNOLOGY
UNIVERSITY
UNIVERSITY FOR INDUSTRY

AASTU

Student Handbook

2025/26

“University for Industry”

ADDIS ABABA SCIENCE AND TECHNOLOGY UNIVERSITY

OFFICE OF THE ACADEMIC PROGRAM DIRECTORATE

STUDENT HANDBOOK

October, 2025

Addis Ababa, Ethiopia

Contents

1. General Information

1.1 Introduction

Addis Ababa Science and Technology University (here after, AASTU), is one of the new public universities of the country established to play as a forefront changing actor in the technological transformation of the country by creating strong linkage with industries. As it was stated in the Five-Year Growth and Transformation Plan (2010 - 2015 G.C), the establishment of well-institutionalized and strong science and technology universities and institutes of technology will serve as a cornerstone to build an economically developed and industrialized state of Ethiopia. As a result, AASTU was founded in 2011 under the Directive of the Council of Ministers No. 216/ 2011 as well as amended by regulation numbers 314/2014 by admitting the first batch (2000 students) in November 2011.

Since 2015, Addis Ababa Science and Technology University was following nationally harmonized undergraduate programs curricula. But, by now it has developed the new undergraduate curricula to meet the requirements of accreditation, which consists of continuous quality improvements (CQIs).

In January 2016, the Ministry of Education (Education Strategy Center) developed a concept note to reform the education sector in accordance with the national vision and national development goals. Hence, one of the strategic plans proposed in the Ethiopian education road map has included common courses, which account a total of 40 credit hours as a national requirement that led to the development of fundamental changes to the Ethiopian educational system.

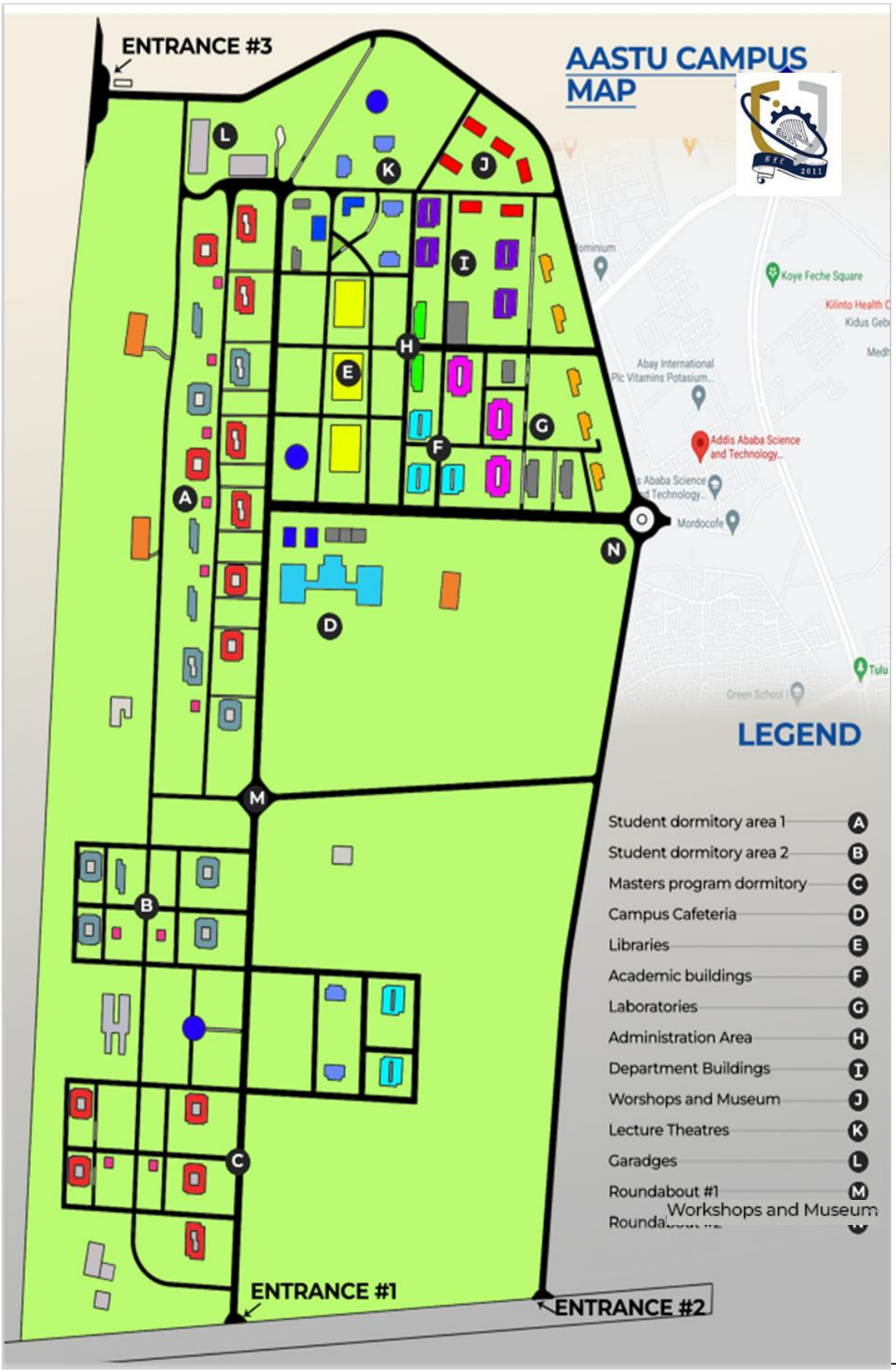
In line with the given strategic direction of Ethiopian development, Addis Ababa Science and Technology University has a mission to be a problem solver of the industry, leading in the nation research, and delivering world-class education. To meet this mission, the university has given special attention to strengthen the academic sector by working towards accreditation of all undergraduate programs.

As a result of the above reasons, the university planned to revise the entire undergraduate program curricula from the accreditation point of views. The goal of accreditation is to ensure the education

provided by higher education to an acceptable level of quality. Therefore, this curriculum framework is developed based on the requirements of the Washington accord and ABET for engineering program and applied sciences programs accreditation respectively.

1.2 Site/location

Addis Ababa Science and Technology University is established in accordance with Article 49 (3) of Higher Education Proclamation No. 650/ 2009 of the Federal Democratic Republic of Ethiopia and then transformed to be a new Science and Technology University in accordance with the Council of Ministers regulation No. 314/2014; in line with its massive program to expand higher education as a key element for technological transformation of the country. It is located, about 3.2 km North of Turinesh-Bejing Hospital, in wereda nine (Kilinto site), Akaki-kality sub-city of the Addis Ababa city administration.


ENTRANCE #3
AASTU CAMPUS MAP
Koye Feche Square
Addis Ababa Science and Technology...
Mordocofe
Tulu
LEGEND
Student dormitory area 1 A
Student dormitory area 2 B
Masters program dormitory C
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ENTRANCE #2

1.3 University Vision and Mission

1.3.1 Vision

To be an internationally recognized Ethiopian Hub of science and technology with strong national commitment and significant continental impact by 2030.

1.3.2 Mission

- Delivering world-class education and training in strategically prioritized science and technology disciplines based on national economic demand.
- Conducting problem-solving applied researches to support the productivity and competitiveness of industries.
- Serving as a center for knowledge and technological adaptation, innovation and transfer.
- Building the technical and managerial capabilities of industries.
- Building a national hub of science and technology.

1.4 AASTU Organization

1.4.1 Tuition and Other Fees

- All Ethiopian students in the Regular Undergraduate University program are not charged for admission application and regular registration. However, they are charged for tuition and boarding as well as food services under the cost sharing system, either in advance or after their graduation depending on the policy of the MoE.
- Foreign students joining the regular programs and all students joining the evening program are subject to tuition fees. Tuition and other fees shall be decided by the University and the details will be made available at the Office of the Registrar or the Office of the Continuing and Distance Education Directorate Director.

1.5 Fast-Track Program (FTP)

Starting from 2008 E.C. Addis Ababa Science and Technology University is admitting outstanding students through specially designed entrance exam from all over the country. To encourage these students, the University has implemented a Fast-Track Program (FTP) in its Legislation to enable

these gifted students complete and receive their bachelor's degrees on time while simultaneously making substantial progress in Master's level studies. This guideline will be used to screen the applicants and meet the degree requirements that will ensure the success of the students by maintaining the quality of their education. Once applicants have been screened and selected to participate in this program, they will complete a rigorous and carefully selected set of organized advanced undergraduate and graduate courses. These courses may be used to satisfy the undergraduate and graduate degree requirements. The guidelines contained in this program set an upper limit on the number of courses that a student might count toward both the bachelors and the Master's degree. In no case may the dual counted courses exceed the maximum specified below. All departments must ensure that only outstanding and academically capable students will be allowed to pursue the proposed course of study.

1.5.1 Eligibility

Students who meet the following conditions are eligible to apply for the FTP:

Undergraduate students with a CGPA of at least 3.5 for male and 3.4 for female and disabilities obtained in at least four semesters for science and in at least 6 semesters for engineering programs are eligible to apply for Master's programs fast-track system. Pass in National Graduate Admission Test (NGAT)

1.5.2 Application and Admission Procedures

Eligible students will complete FTP application form and submit to the department which is running the graduate program.

The DGC shall prepare evaluation criteria to assess the applicant's critical thinking skill (30%), analytical skill (20%), research potential (30%), and writing skill (20%). The evaluation must include standard comprehensive exam and an interview. In addition, applicants for FTP shall pass in graduate admission test as determined by MoE to be considered for admission.

The DGC will make the final decision to admit or deny the student to Fast-track Program. The evaluation result along with the application form of the selected students shall be forwarded to the College's Academic Council (CAC) and the CAC endorses the decision of the DGC.

1.5.3 General Rules of FTP

Departments are responsible to identify core courses which are mandatory to be taken by students enrolled under fast-track programs. Departments are responsible to identify courses under each undergraduate program which can potentially be substituted by advanced MSc courses. In this case, dual credit count can be considered for both programs for maximum of 9 (nine) credit hours. The Master's level courses, which are counted as dual credit, taken by the Fast-Track student will appear on both the undergraduate and graduate transcripts. These Master's level courses will count in the cumulative earned hours and CGPA for both undergraduate and graduate careers assisting the fast-track student towards degree completion at the bachelor's and Master's level. For Fast-Track students, credit can be counted by exam only (self-study) for a maximum of two undergraduate courses. The College/Departments shall plan appropriate time for fast-track students to take internship. If the student takes the internship in summer season, the minimum required time for the internship shall be three months. The Fast-Track student can take maximum of 25 credit hours per semester.

1.5.4 Requirements for Staying in FTP

A student must maintain an overall GPA of at least 3.25 in undergraduate courses. A student is expected to get grades of B or better in graduate courses. If the student earns a grade less than B in a graduate course before earning the undergraduate degree, the student will lose eligibility to remain in FTP. If, at any time, a student fails to satisfy the requirements in 2.26.3 and 2.26.4, the student will be removed from FTP. Any graduate credits earned will be applied only to the undergraduate degree, and none of the other benefits of studentship in FTP will apply.

Students dismissed from FTP will be eligible to apply to the graduate programs of the University as a regular applicant. All graduate courses taken during FTP will not be considered if the student is admitted as a regular graduate program. Request to be unrolled from the FTP program is allowed within 2 weeks period after admission. Termination in the mid-semester is not allowed. All FTP privileges will be waived for students who are unrolled from FTP.

1.6 Undergraduate Degree Programs

College of Engineering

- Bachelor of science degree in Architecture with Honors
- Bachelor of science degree in Civil Engineering with Honors
- Bachelor of science degree in Mining Engineering with Honors
- Bachelor of science degree in Chemical Engineering with Honors
- Bachelor of science degree in Environmental Engineering with Honors
- Bachelor of science degree in Electromechanical Engineering with Honors
- Bachelor of science degree in Electrical and Computer Engineering with Honors
- Bachelor of science degree in Mechanical Engineering with Honors
- Bachelor of science degree in Software Engineering with Honors

College of Natural and Applied Sciences ABET accredited programs. For complete information please use link to search for information in the ABAT Database.
(https://amspub.abet.org/aps/name-search?searchType=institution&keyword=Addis%20Ababa%20science%20and%20technology%20university)

- Bachelor of science degree in Biotechnology with Honors
- Bachelor of science degree in Geology with Honors
- Bachelor of science degree in Industrial Chemistry with Honors
- Bachelor of science degree in Food Science and Applied nutrition with Honors

1.7 Freshman and Pre-engineering program

This a program that supports commando compulsory courses and student have stay for at least for one semester to join their program of infesters. This a time of acclimatization and planning for program joining which mainly based on CGPA and choice of interest. Attending placement orientation is of paramount importance for students to follow the guideline and make a good decision.

1.7.1 Program Courses Synopsis

Course Code: Phil1012
Course Name: **Logic and Critical Thinking**
Credit Hour: 3
Prerequisite: No

Logic and Critical Thinking is an inquiry that takes arguments as its basic objects of investigation and it is an exercise, a habit, a manner of perception and reasoning that has principles of rationality as its fulcrum, and dynamically involves various reasoning skills that ought to be human approach to issues and events of life. Logic and Critical Thinking enables to construct one's own sound argument and to evaluate the arguments of other's and evaluate arguments‟ validity, strengths and weaknesses.

Course Code: Psych 1011
Course Name: General Psychology
Credit Hour: 3
Prerequisite: No

The course encompasses the fundamental concepts and principles of psychology and psychological processes which have immense applications to human life and to develop life skills based on the theories and principles of psychology.

Course Code: **FLEn 1011**
Course Name: **Communicative English Language Skills I**
Credit Hour: 3
Prerequisite: No

This course will cover specific language aspects such as developing basic functions of English language skills such as reading, listening, writing, speaking, vocabulary and grammar.

Course Code: GeES 1005
Course Name: **Geography of Ethiopia and the Horn**
Credit Hour: 3
Prerequisite: No

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 Code: Math 1001
Course Name: **Mathematics (For natural science)**
Credit Hour: 3
Prerequisite: No

This course covers the basic concepts of logic and set theory, the real and complex number systems, Mathematical induction, least upper bound and greatest lower bound, functions and types of functions, polynomial and rational functions, logarithmic and exponential functions, trigonometric functions, hyperbolic functions and their graphs and analytic geometry.

Course Code: **SpSc 1001**
Course Name: **Physical Fitness**
Credit Hour: 2
Prerequisite: No

This course covers: - Concepts of physical fitness, the health benefits of physical activity, making well-informed food choices, health related components of fitness and principles of exercise prescription and assessment of fitness components.

Course Code: Phys1011
Course Name: **General Physics**
Credit Hour: 3
Prerequisite: No

This algebra based introductory course is designed to enable students to learn the basic concepts, principles and applications of elementary physics. The topics include vectors, Kinematics & Dynamics of Particles, Fluids Mechanics, Heat and Thermodynamics, Oscillations, waves and optics, Electromagnetism & Electronics, Cross Cutting Applications of Physics.

Course Code: FLEn 1012
Course Name: **Communicative English Language Skills II**
Credit Hour: 3
Prerequisite: Communicative English Language Skills I

Communicative English Language Skills II Module is a continuation of Communicative English Language skills I Module, and it mainly aims to provide first year University students proficiency with speaking, listening, reading and writing skills.

Course Code: MCiE1012
Course Name: **Moral and Civic Education**
Credit Hour: 2
Prerequisite:

This course generally covers basic understanding of civics and ethics, approaches of ethical decision-making, moral judgment, state and government, Constitution, Democracy and Human Rights. In so doing students will have basic knowledge of their duties and rights besides the understanding of theories of state, morality and global issues.

Course Code: SNIE 1002
Course Name: **Inclusiveness**
Credit Hour: 2
Prerequisite: None

The course will provide concepts of disabilities/vulnerabilities and inclusiveness, application of assessment strategies for service provision, skills of demonstrating inclusive culture and introduce the existing national and international legal frameworks. In addition, the course will offer techniques on establishing partnership with stakeholders and apply inclusiveness for peace, democracy and development.

Course Code: Anth 1002
Course Name: **Social Anthropology**
Credit Hour: 2
Prerequisite: None

This course as a freshman course gives an understanding of different key areas of anthropological inquiry: family, means of production, political organizations, social organization, language, religion, and gender.

Course Code: Econ 1011
Course Name: Introduction to Economics
Credit Hour: 3
Prerequisite: None

This course is an introductory course covering basic principles and issues of economics. Broadly speaking, the course has two components, microeconomics and macroeconomics. In microeconomics, the focus is on the way in which individual economic agents – workers, consumers, households and firms – make decisions. This part begins with a discussions and applications of the concepts of demand & supply; theory of the consumer; theory of producer; and market structures. While in macroeconomics, the study involves the study of the economy as a whole, especially issues related to macroeconomic goals, national income account and its measurement, interest rates macroeconomic problems such as unemployment, deficit and inflation, growth and policy instruments.

Course Code: GLTr2001
Course Name: **Global Trend**
Credit Hour: 2
Prerequisite: None

The course aims to equip students with the basics of international relations, foreign policy and diplomacy, introduction to international political economy, globalization and regionalism, and major contemporary global trends.

Course Code: HiES2010

Course Name: History of Ethiopia and the Horn
Credit Hour: 3
Prerequisite: None

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 Code: EmTe-1012
Course Name: **Introduction to Emerging Technologies**
Credit Hour: 3
Prerequisite: None

This course will enable students to explore current breakthrough technologies in the areas of Artificial Intelligence, Internet of Things and Augmented Reality 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 Code: Entr.1002
Course Name: **Entrepreneurship**
Credit Hour: 2
Prerequisite: None

This course is designed to encourage students to start their own business and to acquaint them with the peculiar challenges and management decisions faced by owners of small business. It will develop such entrepreneurial skills as: identifying business opportunities; initiating, financing, and developing new venture business plans. It also addresses issues of small business, such as: legal aspects, financing, costing, locating, personnel, marketing, competition, sources of funding, and constituency services.

Course Code: Math1002
Course Name: Applied Mathematics I
Credit Hour: 4
Prerequisite: None

The course is designed to develop students' confidence with mathematical concepts, use of mathematical skills and techniques in a wide range of contexts specifically problem solving and abstract thinking. It covers basic elements of vectors, vector spaces, matrices, determinants, solving systems of linear equations, concepts and applications of differential and integral calculus of one variable.

Course Code: Econ2009
Course Name: **Economics**
Credit Hour: 3
Prerequisite: None

This course is an introductory course covering basic principles and issues of economics. Broadly speaking, the course has two components, microeconomics and macroeconomics. In microeconomics, the focus is on the way in which individual economic agents – workers, consumers, households and firms – make decisions. This part begins with a discussions and applications of the concepts of demand & supply; theory of the consumer; theory of producer; and market structures. While in macroeconomics, the study involves the study of the economy as a whole, especially issues related to macroeconomic goals, national income account and its measurement, interest rates macroeconomic problems such as unemployment, deficit and inflation, growth and policy instruments.

2. College of Engineering

- Bachelor of science Degree in Architecture
- Bachelor of science Degree in Civil engineering
- Bachelor of science Degree in Mining engineering
- Bachelor of Science Degree in Chemical Engineering
- Bachelor of Science Degree in Environmental Engineering
- Bachelor of Science Degree in Electrical and Computer Engineering
- Bachelor of Science Degree in Electromechanical Engineering
- Bachelor of Science Degree in Mechanical Engineering
- Bachelor of Science Degree in Software Engineering

2.1 Bachelor of Science Degree in Architecture

2.1.1 Introduction

Architecture is the art and science of designing and constructing buildings. A wider definition would include within its scope the design of the total built environment, from the macro-level of town planning, urban design, and landscape to the micro-level of furniture and product design. Architecture equally importantly, also refers to the product of such a design. The practice of Architecture is the act of planning and architectural designing, structural conceptualization, specifying, supervising and giving general administration and responsible direction to the erection, enlargement or alterations of buildings and built environments.

As a corollary to the first purpose mentioned, architectural education should also aspire to improve the quality of architectural output in general and architectural practice in particular. In addition to educating well-equipped graduates, this can be done by research (i.e. constantly expanding architectural knowledge), by setting good examples, by publishing and by fostering contacts with practices.

Architectural design in engineering structures or any part thereof; the scientific, aesthetic, and orderly coordination of all the processes which enter into the production of a complete building or structure, performed through the medium of unbiased preliminary studies of plans, consultations, specifications, conferences, evaluations, investigations, contract documents and oral advice and directions. Architecture is one of the key professions involved in shaping the built environment and urban space. Architectural education that prepares architects for a professional life should therefore, be seen, at least in the following contexts and the specific objectives about them:

- Social, cultural, political contexts
- Professional, technological, industrial contexts
- The World: local, global, ecological contexts
- Academic contexts: including science and knowledge in general.
- International contexts

Architecture is an interdisciplinary field that comprises several major components: humanities, social and physical sciences, technology and the creative arts. The future of architecture also

depends on an understanding and assimilation of the achievements of other disciplines and professions.

Although, like other branches of professional education, it is primarily assigned the task of educating future architects, architectural education is, generally, part of the university system and must adjust to and benefit from the traditions of the university, such as doing research and seeing the professional practice within the context of society and science.

2.1.2 Program Educational Objectives

The Department of Architecture aims to:

- Train Architects who are capable of practicing in architectural projects,
- Impart knowledge and skill in the field of architecture and produce qualified architects to satisfy the manpower needs of the country,
- Advance knowledge in the fields of architecture through research,
- Render all services, considered appropriate and best handled by the Department to the community of the region,
- Participate in the study and preservation of the architectural heritage of Ethiopia.

2.1.3 Program Education Outcome (PEO)

The Program Education Outcome (PEO) describe accomplishments that program graduates are expected to attain within five years duration after graduation. Graduates will have applied their expertise to contemporary problem solving, be engaged professionally, and have continued to learn and adapt, and have contributed to their organizations through leadership and teamwork. More specifically, the objectives of the Bachelor of Science Degree in Architecture are to engage in critical thinking, acquire the knowledge, skills, and techniques needed for the genesis, nurturing, development and feasibility of ideas and, finally, master a wide range of media necessary to express and communicate them adequately after they graduate from Addis Ababa Science and Technology University from architecture department within five years.

These criteria seek to evaluate the outcomes of architecture programs and student work within their unique institutional, regional, national, international, and professional contexts, while encouraging innovative approaches to architecture education and professional preparation.

Table Program Education Outcome (PEO)

PEO/ PC	Statement
PEO/PC -1	**Career Paths**- the program must ensures that students understand the paths to becoming licensed as an architect in the country and the range of available career opportunities that utilize the discipline's skills and knowledge.
PEO/PC -2	**Design.** Our graduates must be prepared to engage in design activity as a multi-stage process aimed at addressing increasingly complex problems, engaging a diverse consultancy, and providing value and an improved future. The architecture program is centered on creative and critical thinking. This will be accomplished by having strong learning and design studio cultures. It will reinforce through a strong connection between design studio and non-design studio courses. The program instills in **students** the role of the design process in shaping the built environment and conveys the methods by which design processes integrate multiple factors, in different settings and scales of development, from buildings to cities.
PEO/PC-3	**Ecological Knowledge and Responsibility-** the program instills in students a holistic understanding of the dynamic between built and natural environments, enabling future architects to mitigate climate change responsibly by leveraging ecological, advanced building performance, adaptation, and resilience principles in their work and advocacy activities.
PEO/PC -4	**History and Theory**-the program ensures that students understand the histories and theories of architecture and urbanism, framed by diverse social, cultural, economic, and political forces, nationally and globally.
PEO/PC -5	**Research and Innovation—**the program prepares students to engage and participate in architectural research to test and evaluate innovations in the field.
PEO/PC -6	**Leadership and Collaboration—**the program ensures that students understand approaches to leadership in multidisciplinary teams, diverse stakeholder

	constituents, and dynamic physical and social contexts, and learn how to apply effective collaboration skills to solve complex problems.
PEO/PC-7	**Learning and Teaching Culture—**the program fosters and ensures a positive and respectful environment that encourages optimism, respect, sharing, engagement, and innovation among its faculty, students, administration, and staff.
PEO/PC-8	**Social Equity and Inclusion—**the program furthers and deepens students' understanding of diverse cultural and social contexts and helps them translate that understanding into built environments that equitably support and include people of different backgrounds, resources, and abilities.

Program Courses Synopsis

Course Code: Arch2101
Course Name: Basic Design
Credit Hour: 3
Prerequisite: None

This course will introduce basic elements of design with their qualities to explore their application for spatial development. It also introduces the basic spatial qualities related to composition, transformation, arrangement and pattern

Course Code: Arch2102
Course Name: Basic Architectural Design
Credit Hour: 3
Prerequisite: Arch2101

This course will introduce a context in architecture, urban scale, urban cartography, a review on traditional city to modern city. Architectural space qualities, spatial assemblage, elements and principles of architecture. Identifying the steps of an architectural design process and exploring the basic elements and principles of architecture by integrating to create spatial qualities.

Course Code: Arch3111
Course Name: Architectural Design I
Credit Hour: 4
Prerequisite: Arch2102

This course will introduce architectural design process through the development of program for living functional space for a single family to address the material, contextual, and technological aspects of architecture.

Course Code: Arch3120
Course Name: Architectural Design II
Credit Hour: 4
Prerequisite: Arch3111

The course will introduce a basic understanding on the material, and construction aspects of architecture from previous course, this course focus on the social, cultural, economic, contextual aspects in design and development of architectural projects and developments for multi-family residential unit [apartment, community building]. In addition, student is able to develop a multi- housing unit using all the knowledge and skill they have developed from year to now. However, the overall theme of the semester focuses on cultural identity and thus, all the exercises and the final

semester major project would be in predilection for both Ethiopian and African cultural entities and taste, and contextual understanding of the life style.

Course Code: Arch4131
Course Name: Integrated Design Project I
Credit Hour: 5
Prerequisite: Arch3120

The main objective of this course is to empower students to develop a skill and knowledge of various interdependence factors of architecture, construction and structure. It uses a process of analysis, and synthesis in proposing design solutions for existing spatial and structural problems of buildings. This comprehensive course demands that students work in teams integrating constructional structural and environmental systems in the design and documentation of a large and complex building. Students research building type and systems precedents and their resulting impact on built form, analyze material properties, specify component building systems and apply codes and standards to fulfill technical, programmatic and aesthetic needs.

Course Code: Arch4138
Course Name: Integrated Design Project II
Credit Hour: 5
Prerequisite: ARCH4131 Integrated Design Project I

The course aims to focus on creating community within the city. Students investigate socio-cultural and environmental aspects of the city as they relate to architecture. The studio includes exploring history, theory and principles of architecture by integrating with urban and landscape design for the making of architecture and urban form .

Course Code: Arch5145
Course Name: Integrated Design Project III
Credit Hour: 5
Prerequisite: ARCH4138 Integrated Design Project II

Bioclimatic architecture is the design of buildings and spaces based on the local climate to provide thermal and visual comfort, using solar energy and other environmental sources. Basic natural elements of bioclimatic design are passive solar systems which are incorporated into buildings utilizing the sun and other environmental sources like air movement, vegetation, water evaporation, and shading for heating, cooling and to provide day lighting. Develop skills in architectural design through the exploration of technology, materials, structures, construction, and urban modification integral with programmatic detail within a building design initiated in response to environmental studies, building science, HVAC & other Services.

Course Code: Arch5141
Course Name: Final Year Project (Research)
Credit Hour: P/F
Prerequisite: ARCH4138 Integrated Design Project II and All Major Courses

The course of Final Year Project work is a comprehensive Architectural Design project which necessitates the coordination of other fields in the building design process. It comprises program preparation and design of buildings containing spatial, functional and social aspect.

Course Code: Arch5150
Course Name: Final Year Project (Studio)
Credit Hour: 6
Prerequisite: ARCH5141 Final Year Project (Research) and All Major Courses

The course Final Year Project is a comprehensive architectural design project that necessitates the coordination of other fields in the building design process. It comprises program preparation and design of buildings containing spatial, functional and social aspect based on the research output in the previous semester.

Course Code: Arch5149
Course Name: Interior Design
Credit Hour: 3
Prerequisite: All Architectural Design Courses

The course aims to introduce the students to the theoretical principles and practical problems related to the interior design as a form of management of the spaces inside a building (as apartments, offices, commercials, etc.) Furthermore, the course will provide the tools and techniques in creating a place that is practical, functional and fulfils the philosophical and aesthetic needs of the occupants.

Course Code: Arch3118
Course Name: Landscape Design
Credit Hour: 3
Prerequisite:

This studio introduces students to the programmatic, artistic, and technical aspects of land form and topographic adjustments to accommodate human use. Topics include pedestrian and vehicular circulation, conservation and addition of plant materials, movement of water, recreation use, and creation of views. Sculptural land forms will be emphasized through the use of topographic plans, sections, and contour models

Course Code: Arch5251
Course Name: Advanced Landscape Architecture
Credit Hour: 3
Prerequisite:

In this course, student will be offered in close consultation with urban design and planning staff of the Addis Ababa City Administration, to explore the potential improvements and impacts of increased mixed-use and housing development in central city neighborhoods.

Course Code: Arch2107
Course Name: Graphics Communication Skills I (Sketching I)
Credit Hour: 2
Prerequisite:

This course aims at developing the skills needed for documenting designs using drawings and for performing graphical analysis of two-dimensional and three-dimensional problems. The course is open to all interested students. The class designed for beginner of architecture students. Previous skill or any formal or informal class is necessary. This course introduces the student to the process of visual communication using basic drawing techniques and concepts. Students will develop sound observational skills through visualization using a variety of mark-making tools. Students will learn the fundamentals of drawing (line weight, proportion, rendering and perspective techniques) and understand how it applies to design development.

Course Code: Arch2108
Course Name: Graphics Communication Skills II (Sketching and Painting II)
Credit Hour: 3
Prerequisite: ARCH2107 Graphics Communication Skills I (Sketching I)

Ability to utilize mainly manual and instruments to explore, develop, define and communicate a design proposal. An introduction to the nature and vocabulary of graphical expression used in construction drawings, details, and sketches to include, architectural, structural, civil, mechanical, electrical, disciplines. Students develop an appreciation for the importance of effective graphical documentation and interpret drawings in terms of form, size, distance, quantity and interrelation of elements. Emphasis placed on effective sketched, verbal, and written expression of drawing interpretations to audiences not familiar with construction drawings**.** Advanced free hand drawing experiences continue the study of form and structure begun in communication skills I. In addition, students are encouraged to develop individual expression in a variety of graphic media. Drawing as a means of developing graphic ideas is stressed

Course Code: Arch2105
Course Name: Drawing (Descriptive Geometry and Drafting)
Credit Hour: 3
Prerequisite

The course deals with physical space. Descriptive geometry is essentially the technique of accurately representing objects by means of drawings and of solving graphically all problems related to their forms and position. It also provides the theoretical basis for technical drawing. Descriptive geometry deals specifically with the graphical representation on a plane (the drawing surface) of the basic geometrical elements and solution of space problems connected with their representation.

Drafting and design involves the creation of drawings and models used to build structures. Architectural drafting and design is one of several career options related to architecture and engineering.

This course aims at developing the skills needed for documenting design using drawing and for performing graphical analysis of two and three dimensional problems. Which is to provide Fundamental knowledge of drafting and engineering drawings, to train students in detail about drafting convention, equipment's and geometrical Construction, to expose students to methods and practice to use drawing scale and drafting of a house and also to train students how they use different types of projection in developing of surface.

Course Code: Arch3117
Course Name: Visual & History of Arts
Credit Hour: 2
Prerequisite

This course deals with the world history of art; it pays close attention to the social, political, and religious function of the arts created by these cultural traditions, what they might have meant to their original audiences, and the specific cultural contexts that influenced their creation. The class will specifically deal with the art of Neolithic Europe, ancient Mediterranean art, and through the development Byzantine Art, the middle Ages through the Gothic Period, and The Art of Italy (13th-16thc). Additionally it also gives high emphasis on modern art and postmodern Art and Ethiopian traditional art. In the practical part of this course, students acquire special knowledge of the human figure and anatomy. A variety of media and methods of graphic representation in watercolor might be explore. Perceptual skills, as well as cognitive aspects of drawing the human form, will be cover on the study. Live models, both clothed and nude as sources for study.

Course Code: Arch3119
Course Name: Graphics Communication Skills III (Professional CAD)
Credit Hour: 3
Prerequisite ARCH3108 Graphics Communication Skills II (Sketching II and Painting II)

This course will lead the way for students for a more complex usage of professional CAD and animation software for a more realistic presentation of their projects. The course will lead the way for students for a more complex usage of professional CAD, animation, and programming software's for a more realistic presentation of their projects. This course introduces students to the history, theory, practices, institutions, and impact of modern communications media. We will examine both print and non-print media and address the media's impact on society, how audiences respond to media, how people produce and consume media, and media industries and careers. Students will apply what they learn by composing in multiple mediums and other means of communication integral to contemporary communications.

Course Code: ARCH3122
Course Name: Professional Practice I

Credit Hour: 2
Prerequisite

Examination of organizational and management theories and practices for delivering professional design services. Includes a historic overview of the profession and a review of the architect's responsibilities from the pre-contract phase through cost estimating and specifications to construction. Application of computer technology in preparing specifications.

Course Code: ARCH4135
Course Name: Professional Practice II
Credit Hour: 2
Prerequisite : Professional Practice I

The course introduces the main issues of rule and law in the organizational structural and management of the Architects office. The contract administration and management related to professional code of ethics, legal aspects of professional liability in the law of contract offer acceptance and discharge of contracts, contract administration will be presented. Examination of organizational and management theories and practices for delivering professional design services. Includes a historic overview of the profession and a review of the architect's responsibilities from the pre-contract phase through cost estimating and specifications to construction. Application of computer technology in preparing specifications.

Course Code: ARCH3130
Course Name: Internship - I
Credit Hour: 3
Prerequisite : ARCH3120 Architectural design II

The internship program has Hands-on training in practical skills typical for the construction industry.

Course Code: ARCH4146
Course Name: Internship-II
Credit Hour: 3
Prerequisite Internship - I

The students are expected to exercise full-time position for the entire summer term as an intern in all sizes of architectural firms, design departments of public bodies or non-profit agencies in related fields. In one or several of the following fields (depending on the type of industry and company profile) Design and aiming at developing special skills related to the industrial practice. The internship programs will hands-on training in practical skills typical for the construction industry.

Course Code: ARCH2106

Course Name: History of Architecture - I
Credit Hour: 3
Prerequisite

Introducing the study of the chronological record of events (as affecting a nation or people), based on a critical examination of architectural source materials and usually presenting an explanation of their causes from ancient periods to the present day.

Analytical study of past architectural antecedents will aid in acquainting student's "with our architectural heritage and arousing interest in postulating architectural solutions that are responsive to the built environment of this civilization.

Emphasis is placed upon the understanding of the technological, sociological, aesthetic, and artistic influences which determine our built environment.

This subject provides an outline of the history of architecture and urbanism, from the first societies to the present. Students analyze buildings and the built environment as the products of culture and in relation to the special problems of architectural design and the history of architecture, with an urbanist perspective that stresses the cultural and political context from which building arises. The course develops critical tools for the analysis and appreciation of architecture, for its role in the intellectual environment in which we conduct our lives. (this one added)

Course Code: ARCH3115
Course Name: History of Architecture - II
Credit Hour: 3
Prerequisite : History of Architecture - I

Introducing the study of the chronological record of events (as affecting a nation or people), based on a critical examination of architectural source materials and usually presenting an explanation of their causes from ancient periods to the present day. Analytical study of past architectural antecedents will aid in acquainting students' "with our architectural heritage and arousing interest in postulating architectural solutions that are responsive to the built environment of this civilization. Provides an outline of the history of architecture and urbanism, from the first societies to the present. Students analyze buildings and the built environment as the products of culture and in relation to the special problems of architectural design and the history of architecture, with an urbanist perspective that stresses the cultural and political context from which building arises. The course develops critical tools for the analysis and appreciation of architecture, for its role in the intellectual environment in which we conduct our lives.(this one added)

Course Code: ARCH3128
Course Name: Ethiopian History of Architecture
Credit Hour: 3
Prerequisite : History of Architecture - II

This course introduces students to the development of vernacular, historic and modern architecture and settlements including heritage sites in Ethiopia and Horn of Africa. Introducing the study of the chronological record of events (as affecting a nation or people), based on development of vernacular, historic and modern architecture and settlements in Ethiopia. Analytical study of past architectural antecedents will aid in acquainting students "with Ethiopian architectural heritage and arousing interest in postulating architectural solutions. It introduces students to the development of vernacular, historic and modern architecture and settlements, and heritage sites in Ethiopia.

Course Code: ARCH4123
Course Name: Theory of Architecture I
Credit Hour: 3
Prerequisite

The course aims to define what constitutes "theory" in Architecture, how it relates to other types of Architectural writing such as criticism and history, and especially how it relates to the intellectual context and built works of its day, as well as to theories that came before and after it. Students are expected to influential critical and creative themes in modern Architecture and able to make Analysis of the dimensions of Art & Architecture, Determents of Architectural space & form, Typology & design; Structure, Technology & materials; Culture, Society & economy; Climate & topography. Introduces students to influential critical and creative themes in modern Architecture.
Help students understand discourses and practices, the questions and contexts that they engage, and their implications for contemporary thinking and design.

Course Code: ARCH4140
Course Name: Theory of Architecture II
Credit Hour: 3
Prerequisite Theory of Architecture I

Students are expected to influential critical and creative themes in modern Architecture with focus on 20th century Architecture: theory and practice; historiography and scientific writing; Interpretation in Architectural history and criticism; Ideology & symbolism; semantic explanations; universalism versus regionalism; modernism versus Postmodernism; de-constructivism; theories of contemporary architecture and urbanism

Course Code: ARCH3116

Course Name: General Building Heritage

Credit Hour: 2

Prerequisite

The course is designed to study different conventions and practices derived from these theories and apply Architectural heritage documentation and recording, and inventory techniques

Course Code: ARCH5253

Course Name: Architectural Heritage and Conservation

Credit Hour: 3

Prerequisite

This course has the purpose to introduce the students to practical problems by both reading various documents related to the preservation of historical cities, streets, and buildings and analyzing their real application cases.

Course Code: ARCH2103

Course Name: Building Materials and Construction I

Credit Hour: 3

Prerequisite

It introduces the basic principles and practices of building constructions.

Course Code: ARCH2104

Course Name: Building Materials and Construction II

Credit Hour: 3

Prerequisite Building Materials and Construction I

It focuses on details and systems of all main building parts as well as industrialized building components as appropriate building and give the direction of future developments in construction systems.

Course Code: ARCH3113

Course Name: Building Materials and Construction III

Credit Hour: 3

Prerequisite Building Materials and Construction II

Introducing alternative materials and alternative construction methods as well as to show advanced construction work of digital building models.

Course Code: ARCH5254

Course Name: **Advanced Building Structures – (Elective)**

Credit Hour: 3

Prerequisite

The course is designed to provide various types of loading on structures and intensify knowledge and planning skills concerning issues in building science & space.

Course Code: ARCH4129

Course Name: Building workshop I(Masonry)

Credit Hour: 1

Prerequisite

To provide a practical understanding of building materials, construction techniques and structures through practical experience.

Course Code: ARCH4134

Course Name: Building workshop II(carpentry)

Credit Hour: 1

Prerequisite

To provide a practical understanding of building materials, construction techniques and structures through practical experience.

Course Code: ARCH4142

Course Name: Appropriate Building Technology

Credit Hour: 2

Prerequisite

Introduces building processes and tools that are appropriate to the climate, socio-economic conditions and natural resources of an area, and which contribute to sustainable development.

Course Code: ARCH5147

Course Name: Construction Management

Credit Hour: 3

Prerequisite

The course provides an overview of the actual situations in a construction work and how can be handled by acquiring knowledge in the scope of construction.

Course Code: ARCH3114

Course Name: Architectural Sciences I (Water And Sewage)

Credit Hour: 2

Prerequisite

This course provides a theoretical knowledge and application of water supply and liquid waste management system of a building and its surrounding.

Course Code: ARCH4125
Course Name: Architectural Sciences II (Heating, Cooling, Ventilation)
Credit Hour: 2
Prerequisite

This course intends to discuss basic principles of heat, heat transfer, air movement and the application of this principle in developing a building system to control the indoor bioclimatic comfort.

Course Code: ARCH4144
Course Name: Architectural Sciences III (Light & Energy)
Credit Hour: 2
Prerequisite
The course discusses scientific principles of light in relation to building interiors and exterior design
Course Code: ARCH5137
Course Name: Architectural Science IV (Acoustics)
Credit Hour: 2
Prerequisite
The course intends to study Principles of sound production, propagation and transmutation of sound level to apply in creating safe and comfortable acoustical environment.
Course Code: ARCH2109
Course Name: Theory and Design of Structure – I
Credit Hour: 3
Prerequisite

This course gives an introduction to structural building systems. It provides an understanding of basic structural engineering.

Knowledge of structural systems, understanding the internal and external force systems, material properties and cross sectional properties.

Course Code: ARCH2110
Course Name: Theory and Design of Structure – II (Strength of Materials)
Credit Hour: 3
Prerequisite Theory and Design of Structure – I

This course provides an introduction to the analysis of determinate and indeterminate structure. This knowledge is very essential for an engineer to enable him in designing all types of structures.

Course Code: ARCH3121
Course Name: Theory and Design of Structure - III
Credit Hour: 3
Prerequisite Theory and Design of Structure – II (Strength of Materials)

The main objective of the course work is to make students understand core concept of design of concrete structures for a specific purpose under service loading conditions.

Course Code: ARCH3124
Course Name: Surveying
Credit Hour: 3
Prerequisite

The aim of the course is to equip the students with a theoretical and practical understanding of surveying in Architectural field. Subject areas include taping, tape corrections, leveling, angle measurements, traversing, traverse adjustments, contouring, mapping, Setting out and proper use and care of surveying instruments.

Course Code: Comp4136
Course Name: Computer Programming
Credit Hour: 3
Prerequisite

A programming language is a formal language comprising a set of instructions that produce various kinds of output. As programming involves activities such as analysis, developing understanding, generating algorithms, verification of requirements of algorithms including their correctness and resources consumption, and coding of algorithms, this course teaches students to program using a target programming language.

As an introduction, this course gives students an overview of the different concepts of programming and problem solving strategies such as Variables, Reserved words, Syntax Diagram, Constant declarations, Data types, Conditional statements, Loops, Error handling and functions. For each topic, some coding guidelines will be discussed.

Course Code: ARCH4127
Course Name: Building Information Modeling (BIM)
Credit Hour: 3
Prerequisite ARCH3118 Graphics Communication Skill III(Professional CAD)

The course is concerned specifically with the utilization of Building Information Modeling (BIM) technology. The course will be focusing on the processes involved in developing a full 3D design object model, not for the purpose of visualization alone, but more importantly as a tool for understanding and documenting how a proposed building design fits together and how it will perform during use.

Course Code: ARCH3119
Course Name: Model Making Technique
Credit Hour: 2
Prerequisite

The aim of the course is to equip the students with a theoretical and practical understanding of model making techniques, mainly the selection of materials, typology of model building, connection and masking techniques, preparation of appropriate miniature and scaled building and landscaping materials.

Course Code: ARCH3117
Course Name: Introduction to Environmental Planning
Credit Hour: 2
Prerequisite

The objective of this course is to provide an introduction to the ideas and information necessary to integrate environmental viability and sustainable development with other primary concerns namely, equity, healthy communities and economic development. The course will explore the historical roots of current trends in environmental planning; examine theories that have developed recently to encourage environmental planning, environmental regulation and systems of production; and review the status of some of the basic methods and processes of environmental planning. The focus will be on providing an overview of the major concepts, actors, methods and policies used in the decision-making context, while emphasizing practical considerations and local examples.

Course Code: ARCH4133
Course Name: Introduction to Urban Planning
Credit Hour: 3
Prerequisite

This course has relevance of the subject that deals with settlement formation and growth as a response to social, economic, political and cultural needs. It designed to give students firsthand information about urban areas (the city), its development, structure and institutions. It introduces notions of urban areas, urban planning and its relationship with other disciplines. It also discusses the role of urban planning, process of planning, functional sphere of planning, urban structure and its formation, history of urban planning and theories of urban planning.

Course Code: ARCH4135
Course Name: Ecological Architecture & Urbanism
Credit Hour: 3
Prerequisite

Through lectures, studio problems, research projects, and discussion, this course will explore the challenge and potential incorporating ecological factors in urban contexts. The course focuses on the interaction of landscape science (hydrology, geology, etc.) with the necessities and mechanisms of the human environment (urban design, transportation, economics, etc.). Lectures and research projects will particularly emphasize innovative approaches.

Course Code: ARCH4132
Course Name: Basic Urban Design
Credit Hour: 3
Prerequisite ARCH4133 Introduction to Urban Planning

The course aims to explain urban design as a tool of sustainable urban development and quality of life, fill the gap between Architecture and urban planning. This course introduces the history and theory that informs contemporary issues in urban design. It examines the evolving structure of the modern city and the ways in which theoretical ideas and design strategies impact the urban landscape. The importance of environmental and social responsibility and the role of the architect in the urban design process are stressed, while at the same time considering form and spatial qualities of buildings in the urban environment.

Course Code: ARCH5252
Course Name: Advanced Urban Design
Credit Hour: 3
Prerequisite

The aim of this course is to enable student explain contemporary and contextual urban city problems in the country in order to invent practical solutions with the available technology and advanced techniques of analysis

Course Code: ARCH5141
Course Name: Housing and Inner-City Redevelopment
Credit Hour: 3
Prerequisite ARCH4132 Basic Urban Design

The course will introduce the meaning of housing, what it is and does for the community in terms of different space philosophies in cities, towns, districts and neighborhoods. It is based on studio project, with strategies and scenarios of on-site relocation and nearby-relocation of a target population in urban upgrading. It gives the relationship between housing and inner city redevelopment on seminars presentation and practical studio work.

Course Code: ARCH5149
Course Name: Urban Sociology
Credit Hour: 2
Prerequisite ARCH4132 Basic Urban Design

This course is designed to give students a holistic understanding of the issues of social institutions, behavior of the society and to introduce students to a key concept of Urban Sociology to spaces particular to urban development in the Ethiopian context while giving the experiences of other developing countries.

Course Code: ETP4115
Course Name: Integrated Engineering Team Project
Credit Hour: 3
Prerequisite

This is a multidisciplinary team integrated engineering project in connection with a special engineering problem and under the guidance of a faculty member. The project synopsis consists of literature review, design, project management, business acumen, multidisciplinary team work, entrepreneurship

2.2 Bachelor of Science Degree in Civil Engineering

2.2.1 Program Educational Objectives

In Ethiopia, Civil Engineers are leaders in the conceptualization, design, construction, and maintenance of the infrastructures on which the society depends. Civil Engineers build and maintain bridges, highways, railways, tunnels, airports, dams, water treatment and distribution systems and large buildings, along with many other structures. Civil engineers work on environmental projects, such as ecological restoration, waste containment, and soil remediation sites or design of a safe and efficient transportation system.

As society evolves, the solutions to Civil Engineering problems are no longer exclusively technical issues. Instead, they require consideration of demographic trends, human aspirations, laws of supply and demand, and in general, social, economic and political factors. The civil engineers of the future will have to develop a better appreciation and understanding of these subjects to assume their rightful place in society.

2.2.2 Program Outcomes (POs)

The practice of Civil Engineering includes the provision of professional services in connection with identification of problems of existing infrastructure and elaboration of technically and economically feasible concepts for their solution, construction supervision, control and approval of contractors' documents and settlement of claims and disputes. The minimum standards for the BSc in Civil Engineering program at the completion of their degree program are expressed in the following minimum set of Program Learning Outcomes (PLOs). These program outcomes are statements on what students shall know, understand, and perform upon completing their course and/or program of study.

This program is aimed at creating well-qualified Civil Engineers with adequate knowledge in the area of structural, highway, geotechnical and water resources and who can be actively engaged in the planning, development and management of Civil Engineering projects.

Generally, the trainees will be equipped with the knowledge that enables them to:

- Undertake project identification, pre-feasibility and feasibility study and detail design of Civil Engineering works.

- Prepare complete contract documents and terms of references for Civil Engineering projects Plan, manage, monitor and evaluate the operation and maintenance of Civil Engineering works.
- Renovate and rehabilitate existing Civil Engineering works.

Specifically, graduates of the program will:

- Be knowledgeable of the historical context, the state-of-the-art, and emerging issues in the field of Civil Engineering and its role in contemporary society.
- Demonstrate critical reasoning and requisite quantitative skills to identify, formulate and resolve Civil Engineering problems, and to create designs that reflect economic environmental, and social sensitivities.
- Display a systems viewpoint, critical thinking, effective communication and interpersonal skills, a spirit of curiosity, and conduct reflecting a professional and ethical manner.
- Exhibit a commitment to lifelong learning and professional development, involvement in professional activity and public service, and achievement of professional licensure.
- Reflect a broad intellectual training for success in multidisciplinary professional practice, in Civil Engineering or diverse related careers, and toward achieving leadership roles in industry, government, and academia.

Table Program Outcomes/Program Learning Outcomes of Civil Engineering program

Engineering knowledge	**PLO1:** Ability to apply knowledge of mathematics, natural science, engineering fundamentals and Civil Engineering specialization to the solution of complex Civil Engineering problems.
Problem Analysis	**PO2:** Identify, formulate, research literature and analyze complex engineering problems reaching substantiated conclusions using first principles of mathematics, natural sciences and engineering sciences.
Design/development of solutions	**PO3:** Design solutions for complex Civil Engineering problems and design systems, components or processes that meet specified needs with appropriate consideration for public health, and safety, cultural, societal and environmental considerations.

Investigation	**PO4:** Conduct investigations of complex problems using research-based knowledge and research methods including design of experiments, analysis and interpretation of data, and synthesis of information to provide valid conclusions.
Modern tool usage	**PO5:** Create, select and apply appropriate techniques, resources and modern engineering and IT tools, including prediction and modelling, to complex engineering problems, with an understanding of the limitations.
The engineer and society	**PO6:** Apply reasoning informed by contextual knowledge to assess societal, health, safety, legal and cultural issues and the consequent responsibilities relevant to Civil Engineering practices and solutions to complex engineering problems.
Environment and sustainability	**PO7:** Understand and evaluate the sustainability and impact of Civil Engineering work in the solution of complex engineering problems in societal and environmental contexts.
Ethics	**PO8:** Apply ethical principles and commit to professional ethics and responsibilities and norms of Civil Engineering practice.
Individual and teamwork	**PO9:** Function effectively as an individual, and as a member or leader in diverse teams and in multi-disciplinary settings.
Communication	**PO10:** Communicate effectively on complex engineering activities with the engineering community and society at large, such as being able to comprehend and write effective reports and design documentation, make effective presentations and give and receive clear instructions.
Project management and finance	**PO11:** Demonstrate knowledge and understanding of engineering management principles and economic decision-making and apply these to one's own work as a member and leader in a team, to manage projects and in multi-disciplinary environments.
Lifelong learning	**PO12:** Recognize the need for, and have the preparation and ability to engage in, independent and life-long learning in the broadest context of technological change. (Technological Megatrends: BIM, Remote Sensing, Virtual /Augment Reality, AI, Smart Sensor, IoT)

Program Courses Synopsis

Course Name: **Engineering mechanics - I (Statics)**

Course Code: CEng2005

Credit Hour: 3

Prerequisite: Phy-1001 General Physics

Engineering mechanics (Statics) is the application of mechanics (one of the three branches of Physics) to solve problems involving common engineering elements

Course Name: **Engineering Mechanics II (Dynamics)**
Course Code: **MEng 2102**
Credit Hour: 3
Prerequisite: **CEng2015 , Engineering Mechanics I (Statics)**

This course covers the theory and applications of engineering mechanics, Select appropriate coordinate systems for physical systems and analyze motion variables such as position, velocity, and acceleration and Conduct kinematic analysis for the velocity & acceleration of moving bodies.

Course Name: **Applied Mathematics I for Engineering**
Course Code: **Math-1014**
Credit Hour: 4
Prerequisite: **No**

This course covers basic elements of vectors, vector spaces, matrices, determinants, solving systems of linear equations, concepts and applications of differential and integral calculus of one variable

Course Name: **Applied Mathematics II**
Course Code: **Mat2007**
Credit Hour: 4
Prerequisite: **Applied Mathematics I for Engineering (Math 1014)**

This course covers basic element s of sequence and series, power series, differentia l calculus of several variables and multiple integral concepts and their applications

Course Name: **Probability and Statistics**
Course Code: **Stat 3027**
Credit Hour: 3
Prerequisite: **No**

This course covers basic elements of statistics, probability, central tendencies, variation, and types of sampling, concepts and applications of estimation and hypothesis testing, regression analysis.

Course Name: **Numerical Methods**
Course Code: **CEng3112**
Credit Hour: 3

Prerequisite: Math 2051 and computer programming

The course aims at introducing students in finding numerical solutions to problems for which analytical solutions either do not exist or are not readily or cheaply obtainable. It enables students to apply linear algebra and calculus. It also aims to helps student develop programming skills.

Course Name: **Emerging Technologies for Engineers**
Course Code: EmTe1108
Credit Hour: 3
Prerequisite: No

This course will enable students to explore current breakthrough technologies in the areas of Artificial Intelligence, Internet of Things and Augmented Reality 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 Name: **Engineering Drawing**
Course Code: **MEng 2001**
Credit Hour: 3
Prerequisite: No

The course Engineering Drawing covers introduction and importance of engineering drawing, drawing instruments, drawing standards and conventions; theories of projection: types and systems of projections, projections of points and lines; multi-view drawings; pictorial drawing; auxiliary views and sectional view

Course Name: **General Workshop Practice**
Course Code: **CEng2110**
Credit Hour: 1
Prerequisite: No

This course is mainly designed to impart students to a hands-on exercises and practices
on plumbing, masonry works, concrete mixing, wood work , metal work, finishing and electrical installation and observe construction site.

Course Name: **Computer Programming**
Course Code: **Comp 2003**
Credit Hour: 3
Prerequisite: No

A programming language is a formal language comprising a set of instructions that produce various kinds of output. As programming involves activities such as analysis, developing understanding, generating algorithms, verification

of requirements of algorithms including their correctness and resources consumption, and coding of algorithms, this course teaches students to program using a target programming language.As an introduction, this course gives students an overview of the different concepts of programming and problem solving strategies such as Variables, Reserved words, Syntax Diagram, Constant declarations, Data types, Conditional statements, Loops, Error handling and functions. For each topic, some coding guidelines will be discussed.

Course Name: **Computer Aided Drafting (CAD)**

Course Code: CEng3**114**

Credit Hour: 2

Prerequisite: **MEng 2001**

Students will learn the Application Software for Civil Engineering. This course will lead the way for students for a more complex usage of professional CAD and animation software for a more realistic presentation of their projects. The course will lead the way for students for a more complex usage of professional CAD, animation, and programming software's for a more realistic presentation of their projects.

Course Name: **Fundamental of Architecture,**

Course Code: **CEng4115**

Credit Hour: 2

Prerequisite: **CEng3114**

- To understand the fundamentals of construction planning and design procedures, and site selection.
- To develop skills and knowledge in the preparation of working drawings.
- To understand the concepts of various components of a low-rise building and their construction methods.
- To acquire a thorough understanding of the basics of framed structures, shell and dome structures and prefabricated building systems.

Course Name: **Engineering Surveying I**

Course Code: **CEng3111**

Credit Hour: 3

Prerequisite: Math 2007 (Mathematics for Natural Sciences)

This course is designed to introduce Civil Engineering students to know basic principles of surveying, accurately measure distances and angles using high precision and up-to-date surveying equipment.

Course Name: **Engineering Surveying II**

Course Code: **CEng2108**

Credit Hour: 3

Prerequisite: CEng2108 (Engineering Surveying I

Triangulation; Trilateration; Resection; GPS Surveying; Topographic Surveying; Topographic Mapping; Horizontal Curve; Vertical Curve; Curve Setting Out; Introduction to Photogrammetry

Course Name: **Strength of Material**

Course Code: **CEng2104**

Credit Hour: 4

Prerequisite: **CEng2103 Engineering Mechanics I**

This course covers the Engineering mechanics (Statics) and the application of mechanics (one of the three branches of Physics) to solve problems involving common engineering elements

Course Name: **Theory of Structure I**

Course Code: **CEng3106**

Credit Hour: 3

Prerequisite: CEng2104, Strength of Material

This course covers the different types of structural systems, loads and methods of analysis for statically determinate structures

Course Name: **Theory of Structure II**

Course Code: **CEng3105**

Credit Hour: 3

Prerequisite: Theory of Structure I , CEng3105

This course introduces the analysis of indeterminate structural systems common in Civil Engineering

Course Name: **Reinforced Concrete Structure I**

Course Code: **CEng4107**

Credit Hour: 3 (5CP

Prerequisite: CEng3106 , Theory of Structure II

This course induces the structural analysis and design of reinforced concrete structural members subjected to gravity load.

Course Name: **Reinforced Concrete Structure II**

Course Code: **CEng4108**

Credit Hour: 3

Prerequisite: **Reinforced Concrete Structures I (CEng4107)**

This course induces the structural analysis and design of reinforced concrete of structural members.

Course Name: **Steel and Timber Structures**
Course Code: CEng5111
Credit Hour: 3 (5CP)
Prerequisite: CEng3106

This course induces the structural analysis with design of steel and timber members subjected to gravity and lateral loading along with the connection details

Course Name: **Fundamentals of Bridge Design**
Course Code: CEng5112
Credit Hour: 3 (5CP)
Prerequisite: CEng4110, CEng4108

To identify the different types of bridges: arch, suspension, truss, beam, cantilever and cable stayed. Learning various loads acting on bridges.

Course Name: **Structural Design**
Course Code: **CEng5109**
Credit Hour: 3
Prerequisite: CEng4108, Reinforced Concrete Structures II

This course induces the plastic analysis of frame structures, calculation lateral load on structure and design of detailing and connections.

Course Name: **Engineering Geology**
Course Code: **CEng2112**
Credit Hour: 2
Prerequisite: No

To provide an introduction to the geotechnical significance of earth materials, rock defects, structural geology, geomorphology, hydrogeology, active tectonics, earthquakes, volcanism, erosion and mass movement in the Civil Engineering practice

Course Name: **Soil Mechanics I**
Course Code: **CEng3103**
Credit Hour: 3
Prerequisite: Hydraulics (**CEng2106**) & Strength of Materials (**CEng2104**)

In this course, students will be introduced to the basic concepts of the physical properties of soils as a civil engineering material and the fundamental principles of soil mechanics.

Course Name: **Soil Mechanics II**

Course Code: **CEng3104**

Credit Hour: 3

Prerequisite: Soil Mechanics I (**CEng3103**)

To equip students with the basic inputs required for the design and construction of geotechnical structures.

Course Name: **Foundation Engineering I**

Course Code: **CEng4106**

Credit Hour: 3

Prerequisite: **Soil Mechanics II (CEng3104), Reinforced Concrete Structure I (CEng4107)**

This course covers the basic concepts of logic and set theory, the real and complex number systems, Mathematical induction, least upper bound and greatest lower bound, functions and types of functions, polynomial and rational functions, logarithmic and exponential functions, trigonometric functions, hyperbolic functions and their graphs and analytic geometry.

Course Name: **Foundation Engineering II**

Course Code: **CEng5107**

Credit Hour: 3

Prerequisite: Foundation Engineering I (**CEng4106)**

To design and construction of deep foundations, marine structures, foundations on expansive soils, and understand environmental issues related to geotechnical engineering.

Course Name: **Hydraulics**

Course Code: **CEng2106**

Credit Hour: **4 cr hr (6CP)**

Prerequisite: **Engineering Mechanics I (Statics) CEng2005**

The course provides students with basic principles of hydraulics for design of dams and its appurtenant structures

Course Name: **Open Channel Hydraulics**

Course Code: **CEng3107**

Credit Hour: 3 cr. Hr

Prerequisite: **Hydraulics (CEng2106)**

The course provides students with basic hydraulic principles that are required to solve open channel flows.

Course Name: **Hydraulic Structures I**

Course Code: **CEng4109**

Credit Hour: 3(5CP)

Prerequisite: **Engineering Hydrology (CEng3108), Open Channel Hydraulics (CEng3107)**

The course provides students with basic principles of design of dams and its appurtenant structures

Course Name: **Hydraulic Structures II**

Course Code: **CEng4110**

Credit Hour: 3

Prerequisite: **Hydraulic Structures- I (CEng4109)**

Provide students with principles of river Engineering, design of flood protection structures, and design of river bank protection structures. Design of diversion structures are taught in the course. Design of Conveyance and Cross drainage structures, drops/falls and Culvert and Bridges

Course Name: **Irrigation Engineering**

Course Code: **CEng5113**

Credit Hour: 2Cr.hr(4CP)

Prerequisite: **Hydraulic Structures II (CEng4110)**

Provide students with the basic principles of irrigation design, selection of irrigation systems, determination of the quality of water for irrigation and finally assessment of the feasibility of irrigation schemes

Course Name: **Water Supply and Urban Drainage**

Course Code: **CEng4112**

Credit Hour: 3

Prerequisite: **Engineering Hydrology (CEng3108)**

To provide students with fundamental skill on planning and design of water supply and urban drainage systems.

Course Name: **Waste Water and Solid Waste Treatment**

Course Code: CEng5114

Credit Hour: **3cr. hr (5CP)**

Prerequisite: **Water Supply and Urban Drainage,** CEng4112

Students will learn the basic methods for industrial and municipal wastewater treatment facilities and about the processes involved; they will learn the basic design of wastewater treatment facilities.

Course Name: **Transport Engineering**

Course Code: **CEng3101**

Credit Hour: **3**

Prerequisite: **No**

- ✓ Introduction to transport systems: Highways, railways, airways, and waterways.
- ✓ Transport planning: elements of transport planning, urban transport planning, and evaluating transport alternatives.
- ✓ Driver, pedestrian, vehicle, and road characteristics.
- ✓ Traffic Engineering studies: spot speed studies, volume studies, travel time and delay studies parking studies and road traffic safety.
- ✓ Fundamental principles of traffic flow: traffic flow elements, and flow-density relationships.
- ✓ Traffic-control devices and systems: traffic signs, pavement markings and islands, and traffic signals.
- ✓ Highway capacity: level of service, capacity of highways, and intersections.

Course Name: **Highway Engineering- I**

Course Code: **CEng3102**

Credit Hour: **3**

Prerequisite: **Engineering Surveying II (CEng3111) and Transport Engineering (CEng3101)**

- ✓ Introduction to Highway Engineering,
- ✓ Highway Geometric Design Factors,
- ✓ Geometric Design of Highway Alignment,
- ✓ Highway Drainage Design & drainage Structures,
- ✓ Earth work quantity & Mass Haul Diagram,
- ✓ Introduction to Intersection, Road Terminal & Interchanges
- ✓ Introduction to geometric design of Airfields

Course Name: **Railway Engineering**

Course Code: **CEng5105**

Credit Hour: **3 Cr. Hr.**

Prerequisite: **Transport Engineering (CEng3101)**

The course will be an introduction to the railway engineering and rail infrastructures and their impacts on the society and on the environment. The course will focus on alignment, track geometry, superstructure and substructure components, switches, Railway planning and capacity, railway signaling control system together with operation of railway.

Course Name: **Technical Report Writing & Research Methodology**

Course Code: **CEng4104**

Credit Hour: **1**

Prerequisite: **FLEn 1004 (Communicative English Language skills II)**

The course provides students to Prepare a standardized Proposal for their research. The topic for the thesis is assigned by the department and can be connected to any of the major subjects already taught. The subject of the assignment preferably considers the needs of the country

Course Name: **Internship Practice**

Course Code: **CEng4118**

Credit Hour: **6 cr. Hr**

Prerequisite: **CEng4103, CEng4106, CEng4108, CEng4110, CEng4111**

- The Internship Programr creates the opportunity for the students to familiarize themselves with the community/industrial practices.
- The objective of the Internship is to supplement the intern's general theoretical knowledge that has been gained through academic course work with a practical work experience
- To evaluate students by companies or any organization how much they understand the practical knowledge during the intern ship.

Course Name: **Integrated Civil Engineering Design**

Course Code: **CEng5103**

Credit Hour: **3**

Prerequisite: Internship (CEng4118)

An integrated project will assist the students in consolidating their Knowledge acquired in various previous modules. The students will apply their knowledge in solving practical and real-time projects in due time.

Students will perform a comprehensive design project using a team approach requiring interaction with practitioner's development of a team project report and a formal presentation

The main aim of this project work will let students to acquire knowledge and skills of planning and management of Civil Engineering projects. In addition to this, the objective of the course is to equip students with effective report writing skills and research methodologies. Students shall develop solid technical report and paper/thesis writing skills, analysis and data interpretation techniques, and research methodologies

Course Name: **Integrated Engineering Team Project**

Course Code: **IETP4015**

Credit Hour: **3**

Prerequisite: Comp 2003 , Entr 1006

This is a multidisciplinary team integrated engineering project in connection with a special engineering problem and under the guidance of a faculty member. The project synopsis consists of literature review, design, project management, business acumen, multidisciplinary team work, entrepreneurship

Course Name: **Construction Material**

Course Code: CEng3109

Credit Hour: **3**

Prerequisite: No

Introduces the production, nature and characteristics of different construction materials and identify them with respect to their suitability to different Engineering structures. Understand the physical and chemical property of construction materials under different conditions having basic skill how to mix and produce concrete

Course Name: **Building Construction**

Course Code: **CEng3110**

Credit Hour: **3**

Prerequisite: CEng3109

The course introduces students with the different types of buildings, their components and methods of construction. The overall building processes beginning from site works will be covered

Course Name: **Specification and Quantity Survey,**

Course Code: **CEng4111**

Credit Hour: 3cr. hr

Prerequisite: CEng3110 ,CEng3114

Students will gain knowledge in the legal aspects of contracts and bidding; types of construction documents including bonds; interpretation of technical building specifications and their application to selection and installation of materials, equipment and systems

Course Name: **Procurement and Contract Administration**

Course Code: **CEng4114**

Credit Hour: 3

Prerequisite: **Specification and Quantity Survey (CEng4111)**

Students will gain knowledge in the legal aspects of contracts and bidding; types of construction documents including bonds; interpretation of technical building specifications and their application to selection and installation of materials, equipment and systems

Course Name: **Engineering Economics ,**

Course Code: CEng4116

Credit Hour: 2cr hr

Prerequisite: Econ-2009

Expressing the basic concepts of engineering economics and identifying the time value of money, the concepts behind benefit-cost analyze. Understanding the concept of depreciation. Determining design projects on the basis of the cost implications when compared with the expected benefits.

Course Name: **Construction Equipment,**

Course Code: **CEng4102**

Credit Hour: 2cr hr

Prerequisite: CEng3109

At the end of this course, students will be able to have knowledge on equipment and properly select earthmoving, excavation, lifting and other type of equipment with safety requirements. Moreover, students will understand the economic aspects of construction equipment

Course Name: **Construction Management**

Course Code: CEng5106

Credit Hour: 3Cr.hr (5ECTS)

Prerequisite: CEng5115, CEng4102

Time Management, Cost Management, Quality Assurance and Control, Risk Management, Safety and Health in Construction

Course Name: **Final Year Project I (Proposal Preparation)**

Course Code: **CEng5101**

Credit Hour: **P/F**

Prerequisite: **CEng4114 (Internship Practice**

The course provides students to Prepare a standardized Proposal for their research. The topic for the thesis is assigned by the department and can be connected to any of the major subjects already taught. The subject of the assignment preferably considers the needs of the country.

Course Name: **Final Year Project II (Main Research)**

Course Code: **CEng5102**

Credit Hour: 6 cr. Hr

Prerequisite: CEng5101

A prospective graduate student has to prove the fact that he/she can solve a given problem independently and with little input from his mentor. The prospective graduates could apply their knowledge to solve Ethiopian-related or other problems up to the expectation of his mentor in particular and Department in general.The topic for the thesis is assigned by the department and can be connected to any of the major subjects already taught. The subject of the assignment preferably considers the needs of the country

Course Name: **Reinforced Concrete structures III**

Course Code: **CEng5210**

Credit Hour: 2 cr. Hr

Prerequisite: CEng4108

This course induces the structural design of curved beams, haunched beams, deep beams, and corbels in the ultimate limit state and verify the satisfaction of serviceability limit state requirements.

Course Name: **Highway Engineering III**

Course Code: **CEng5204**

Credit Hour: 2 cr. Hr

Prerequisite: **Highway Engineering II , (CEng4103)**

The course includes the detailed specification of roadway construction, its maintenance and rehabilitation. Introduction to road management system and the economic aspect of road construction are also a part of the course. It also deals with the method of road construction with respect to labor-based method

Course Name: **Water Resource Development**

Course Code: CEng5212

Credit Hour: **2 (4CP)**

Prerequisite: Engineering Hydrology , Hydraulic Structures II (CEng3108) , (CEng4110)

- ✓ Provide students with the principles of water resources planning and management,principles of integrated water resources development and Legal aspects

Course Name: **Tunnelling**

Course Code: **CEng5206**

Credit Hour: **3**

Prerequisite: Soil Mechanics II (CEng3104)

To know different types of underground opening; elastic and elasto- plastic stresses and displacements around underground openings; ground reaction curve; tunnel ground condition; excavation methods (drill-and-blast and machine); excavation systems for large openings and difficult ground conditions; supports and linings; determination of rock loads; exploration and instrumentation; case histories

Course Name: **Geographic Information System**

Course Code: **CEng5214**

Credit Hour: **3**

Prerequisite: Engineering Surveying II (CEng3111)

This course is designed to introduce Civil Engineering students to know basic principles of surveying, accurately measure distances and angles using high precision and up-to-date surveying equipment

Course Name: **Building Information Modeling (BIM)**

Course Code: CEng5216

Credit Hour: **3**

Prerequisite: Reinforced Concrete Structures II , Fundamental of Architecture, CEng4108, CEng4115

The course is concerned specifically with the utilization of Building Information Modeling (BIM) technology. The course will be focusing on the processes involved in developing a full 3D design object model, not for the purpose of visualization alone.

Course Name: **Building Information Modeling (BIM)**

Course Code: CEng5216

Credit Hour: **3**

Prerequisite: Reinforced Concrete Structures II , Fundamental of Architecture, CEng4108, CEng4115

2.3 Bachelor of Science Degree in Mining Engineering

2.3.1 Program Educational Objectives

Mining Engineering Graduates will have expertise to contemporary problem solving, be engaged professionally, and have continued to learn and adapt, and have contributed to their organizations through leadership, teamwork and Entrepreneur. More specifically, the PEO of Bachelor of Science in Mining Engineering is presented in Table 1.

Table: Program Education Objectives (PEO)

PEO	Statement
PEO-1	Competent mining engineers with a broad understanding of extraction, management and development of mineral resources including non-metallic, metal ores, and solid fuel and energy sources.
PEO-2	Entrepreneur mining engineers who can carry out professional work in mineral & energy industries, authority, organizations, consultancy firm and mine research institute.
PEO-3	After five years study, our mining engineering graduates will achieve professional growth in research, education, teamwork and leadership skills.

2.3.2 Program Outcome

The Program Outcome (PO)/Program Learning Outcomes (PLO) of the program are describe or state what mining engineering students shall know, understand, and perform upon completing their course and/or program of study. The Program Outcome (PO) of the mining engineering department prepared by referring (Appendix 3.2) engineering programs.

Table. Program Outcome

PO	Statement

PO-1	Apply knowledge of mathematics, natural science, engineering fundamentals, to the solution of complex mining and underground structure problems.
PO-2	Identify, formulate, research literature and analyze complex mining engineering problems reaching substantiated conclusions using first principles of mathematics, natural sciences, and engineering sciences.
PO-3	Design and planning surface and underground mines, selection of their appropriate mining method and machinery. Convert this into actions in sectors such as surface and underground working of mineral deposits, drilling and blasting technology, as well as effective safety, health and environmental management techniques in mining operations.
PO-4	Conduct investigations of complex mining engineering problems using research-based knowledge and research methods including design of experiments, analysis and interpretation of data, and synthesis of information for mineral reserve estimation, feasibility study of mineral deposits, ascertain whether the ore can be extracted economically and decide on the best way to extract it.
PO-5	Create, select and apply appropriate techniques, resources and modern engineering and IT tools, including prediction and modeling, to complex mining engineering problems, with an understanding of the limitations.
PO-6	Extract and process the mineral resources using the fundamental principles of science and engineering in conjunction with the state-of-the- art tools by consequent responsibilities considering health, safety, legal and cultural issues.
PO-7	Ability to understand the impact of professional engineering solutions in societal and environmental contexts and demonstrate knowledge of and need for sustainable development.
PO-8	Apply ethical principles and commit to professional ethics and responsibilities and norms of mining engineering practice.
PO-9	Function effectively as an individual, and as a member or leader in diverse teams and in multi-disciplinary settings.
PO-10	Communicate effectively on complex mining engineering activities with the engineering community and society at large, such as being able to comprehend and write effective reports and design documentation, make effective presentations and give and receive clear instructions..

PO-11	Demonstrate knowledge and understanding of mine management principles and mineral economic on decision-making and apply these to one's own work as a member and leader in a team, to manage projects and in multi-disciplinary environments.
PO-12	Recognize the need for, and have the preparation and ability to engage in, independent and lifelong learning in the broadest context of technological change.

2.3.3 Program Courses Synopsis

Course Code: Math-1014
Course Name: Applied Mathematics IB
Credit Hour: 4
Prerequisite: Math1007

This course covers basic elements of vectors, vector spaces, matrices, determinants, solving systems of linear equations, concepts and applications of differential and integral calculus of one variable

Course Code: CEng2005
Course Name: **Engineering Mechanics I (Statics)**
Credit Hour: 3
Prerequisite: Phys1001

Engineering mechanics (Statics) is the application of mechanics (one of the three branches of Physics) to solve problems involving common engineering elements

Course Code: Math 2007

Course Name: Applied Mathematics IIB

Credit Hour: 4

Prerequisite: Applied Mathematics IB (Math1014)

This course covers basic elements of sequence and series, power series, differential calculus of several variables and multiple integral concepts and their applications.

Course Code: MnEg2001

Course Name: Engineering Drawing

Credit Hour: 3

Prerequisite

Students will learn the Application of Engineering Drawing to sketch multi – view drawings of any given pictorial drawings.

Course Code: Comp 2003

Course Name **Introduction to Computer Programming**

Credit Hour: 3

Prerequisite: Math 2007

This course covering Fundamentals of Object-Oriented Programming: Basic concepts, Objects and classes, Data abstraction and encapsulation, Inheritance, Polymorphism and Dynamic Binding. JAVA Evolution: Java features, Java versus C and C++, Creating, compiling and running a Java program, Constants, Variables, Data types, Operators and Expressions, Decision making and branching, Decision making and looping, Classes, Objects, and methods, Sample programs.

Course Code: MnEg2102

Course Name **Geology for Mining Engineers I**

Credit Hour: 4

Prerequisite:

This course aims to introducing the students the principles of general geology , petrology, mineralogy and stratigraphy in Mining Engineering

Course Code: CEng2006

Course Name: **Strength of Materials**

Credit Hour: 3

Prerequisite: CEng2005

Exposed the students to the knowledge of analyze and design structural members subjected to tension, compression, and torsion and bending using fundamental concepts of stress, strain, elastic behavior and inelastic behavior. Conduct

themselves professionally and with regard to their responsibilities to society, especially with respect to designing structures to prevent failure.

Course Code: **Chem2004**

Course Name: **General Chemistry**

Credit Hour: 3

Prerequisite: No

The aim of engineering chemistry course is to provide students with an introduction to the basic concepts of chemistry.

Course Code: **EEEg2008**

Course Name: **Fundamentals of Electrical Engineering**

Credit Hour: 3

Prerequisite: No

Electromagnetic Phenomenon and Variables, Electric Circuit parameters, Circuit Analysis: Kirchhoff's laws (KVL & KCL), Steady State Single Phase AC Circuit Analysis, Transient Circuit Analysis, Introduction to poly - phase systems, Generation of three phase voltages; star (Y) and delta (Δ) connections; load/power flow method of three phase ac circuit analysis.

Course Code: MEng2010

Course Name: **Engineering Mechanics II (Dynamics)**

Credit Hour: 3

Prerequisite: CEng 2005

The course rationale is to develop the fundamental equation that characterizes the kinematics and Newtonian dynamics of a particle, systems of particles, and rigid bodies.

Course Code: MnEg3101

Course Name: **Introduction to Mining Engineering**

Credit Hour: 2

Prerequisite: No

To impair knowledge of historical role of mining in human civilization. To know the fundamental mining terminologies used in surface, underground mining and in mineral processing. To identify the basic stages of the life of mine, distinguish minerals, ores, and mineral deposits. Have an understanding about the economic significance and structure of the Ethiopian mining industry.

Course Code: MnEg3103
Course Name: **Mine Equipment and Machinery I**
Credit Hour: 2
Prerequisite: MnEg2112 & EEEg2008

To extract and transport the minerals to the required processing unit/ utilization point variety of machines are used in the mining industry**.** In this course the student gets acquainted with a few machineries including brief details of the machine parts, their working principles, operation and maintenance in addition to the machine installation, commissioning and safety aspects.

Course Code: MnEg3105
Course Name: Geology for Mining Engineers II
Credit Hour: 4
Prerequisite: MnEg2102

This course aims at introducing the students to the economic geology and principles and techniques of mineral exploration.

Course Code: MEng 3007
Course Name: **Fluids Mechanics**
Credit Hour: 3
Prerequisite:

The course aims to introduce Mining engineering students to thermo fluids at a more fundamental level and with a more mathematical approach.

Course Code: MnEg3109
Course Name: **Introduction to Surveying**
Credit Hour: 3
Prerequisite:

The course is intended to provide the students with the basic principles of surveying and land information system.

Course Code: MnEg3111
Course Name: Rock Mechanics
Credit Hour: 3
Prerequisite MnEg2102 and CEng 2003

The course makes students familiar with engineering properties of rocks and Soils in relation to open pit and underground mining

Course Code: Stat2091
Course Name: Probability and Statistics
Credit Hour: 3
Prerequisite

This course covers basic elements of statistics, probability, central tendencies, variation, and types of sampling, concepts and applications of estimation and hypothesis testing, regression analysis.

Course Code: MnEg3102
Course Name: **Surface Mining Methods**
Credit Hour: 3
Prerequisite MnEg2112

This course provides an overview of the basic concepts of surface mining, working principles of various excavation and transportation equipment.

Course Code: MnEg3104
Course Name: **Mine Hazards and Rescue**
Credit Hour: 3
Prerequisite MnEg3101

The course aims to introduce Mining Engineering students to the broader issues of mine hazards and the rescue and recovery work

Course Code: MnEg3106
Course Name: **Structural Geology**
Credit Hour: 3
Prerequisite MnEg 2102

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 mine geological structures in the field; to enable students how to evaluate, analyze and interpret structural data and incorporate it into synthesis of an area for mining.

Course Code: MnEg3110
Course Name: **Drilling and Blasting**
Credit Hour: 3
Prerequisite MnEg3101

To introduce various technologies of drilling and blasting techniques used in surface and underground mines, various accessories and safety measures.

Course Code: MnEg3108
Course Name: **Mine Equipment and Machinery II**
Credit Hour: 3
Prerequisite MnEg3101

The aim of the course is to introduce students to various mining equipment and their working principles

Course Code: MnEg3112
Course Name: Rock Engineering
Credit Hour: 3
Prerequisite MnEg3109

This course aims to obtain deeper knowledge on rock engineering. Rock and rock mass classification and their applications. And then characteristics of rock mass.

Course Code: MnEg4101
Course Name: Mine Ground Control and Instrumentation
Credit Hour: 3
Prerequisite MnEg3109

The course provides students with a practical understanding of the application of ground control principles in mining from the perspective of improve the design and stability of open pit and underground structures through clear understanding of factors affecting mining Geo techniques.

Course Code: MnEg5105
Course Name: Mine Systems Engineering
Credit Hour: 3
Prerequisite Stat2091

To impart knowledge on various systems and sub-systems and to introduce students to linear programming and project management techniques

Course Code: MnEg4105
Course Name: Surface Mine Planning and Design
Credit Hour: 3
Prerequisite MnEg3110

Factor affecting the selection of open pit mining; Design of Open Pit, Quarry Operations, Strip Mining of Mineral Deposits and Mechanized earth- moving, Analyze the economic indices of surface mine design and apply software packages to surface mine design

Course Code: MnEg4109
Course Name: **Mine Surveying**
Credit Hour: 2
Prerequisite MnEg3107

To introduce various technologies of surveying on the surface and underground mining situations including distance measurements, leveling, contouring, traversing etc along with descriptions of associated instruments.

Course Code: MnEg4107
Course Name: Underground Coal Mining Methods
Credit Hour: 3
Prerequisite MnEg3110

This course provides an overview of the principles and application of the major underground mining methods and equipment, and the conceptual design of the major materials handling and transport systems and support infrastructure.

Course Code: MnEg4111
Course Name: **Computer Aided Mine Planning and Design**
Credit Hour: 2
Prerequisite MnEg2009& MnEg4105 /

MnEg 4106

At the end of the course, the student will be able to plan and design practically for surface and underground mine for given the geologic data and topo files.

Course Code: MnEg4102
Course Name: Mine Safety and Health
Credit Hour: 2
Prerequisite MnEg3104

The course aims to introduce Mining Engineering students to the broader issues of global environmental challenges facing the mining projects.

Course Code: MnEg4104
Course Name: Mineral Processing Technology
Credit Hour: 3
Prerequisite MnEg 3103

This course aims to equip the student with knowledge of mineral processing unit operations normally as a member of a multi-disciplinary team in a mineral Design project or operating mine, Ore handling and classification and mineral liberation techniques.

Course Code: MnEg4106
Course Name: Underground Mine planning and Design
Credit Hour: 3
Prerequisite MnEg 4109

The course aims to provide students' knowledge of design of modes of entry to a deposit and the selection of suitable mining method. Design a ventilation system for an underground mine. Design underground support systems software package applications of mine design.

Course Code: MnEg4108
Course Name: **Underground Metal Mining**
Credit Hour: 3
Prerequisite MnEg 3110

To give the student an introduction to various metal mining techniques and support systems

Course Code: MnEg4110
Course Name: Resource Evaluation and Ore Body Modeling
Credit Hour: 3
Prerequisite Geol3103 and Stat2091

This course aims to introducing the principles of the resources estimation, ore tonnage and grade of a geological deposit from the developed block model; Geo statistical application; principal steps of computer resource estimation; principles of economic analysis of mining interventions and their role in mining decision making.

Course Code: MnEg4112
Course Name: Environmental Aspects of Mining
Credit Hour: 3
Prerequisite No

The course aims to provide students with the knowledge of the effects of mining on the environment and the remedial measures

Course Code: MnEg4114
Course Name: Internship
Credit Hour: 6
Prerequisite

The summer Internships are an exciting way for mining engineering students to gain a practical knowledge in the mining industry.

Course Code: MnEg5101
Course Name: Mine Ventilation
Credit Hour: 3
Prerequisite MnEg 3110 & MnEg4109

This course aims to provide students to detect and know the availability and determination of air quality in mines. Explain characteristics, mechanics and dynamics of fluid and airflows. Describe principles and operations of ventilation network systems, regulators in different types of mine. Define and understand the basic principles and applications of deep mining climate controlling techniques and systems

Course Code: MnEg5103
Course Name: Integrated Mining Design Project
Credit Hour: 3
Prerequisite

To gain experience in reserve estimation and building geologic models; understand ramifications of the reserve characteristics on mine design and production planning using a modern geologic-modeling design software package

Course Code: IETP4115
Course Name: Integrated Engineering Team Project
Credit Hour: 3
Prerequisite

This is a multidisciplinary team integrated engineering project in connection with a special engineering problem and under the guidance of a faculty member. The project synopsis consists of literature review, design, project management, business acumen, multidisciplinary team work, entrepreneurship

Course Code: MnEg5107
Course Name: Rock Excavation Engineering
Credit Hour: 3
Prerequisite MnEg3110

The course aims to provide the fundamentals of power systems in mining, different types of power systems and their applications used in mining works. Define nature of mechanical excavations and working principles of mechanical impact breaking in mining. Describe principles and operations of rock drilling and explosives, Mechanism of Rock breaking and blasting applications. Define and understand the basic principles and applications of underground blasting and surface mining blasting.

Course Code: MnEg5104
Course Name: Energy Resource Exploitation
Credit Hour: 3
Prerequisite

This course introduces students to the fundamental of geothermal energy from geoscience, engineering and prospective.

Course Code: MnEg5102
Course Name: Mine law and regulation
Credit Hour: 2
Prerequisite

The course aims to provide students to know current Ethiopian exploration and mining law, policy, legislation and proclamations

Course Code: MnEg5109
Course Name: Mineral Economics
Credit Hour: 3
Prerequisite Econ 1009 & MnEg3111

Familiarized with basic financial and economic analysis, funding, revenue of mineral resources and markets, financial reporting.

Course Code: MnEg5106
Course Name: Mine Project Management
Credit Hour: 3
Prerequisite MnEg4106

The main objective of this course is to explain the students about the Mine Project Management. Upon successful completion of this course program, students will be prepared to lead mine project requiring.

Course Code: MnEg5108
Course Name: Part II B.Sc. Thesis
Credit Hour: 4
Prerequisite

The course aims to give senior students the opportunity of undertaking an independent research project in Mining Engineering, in an area of interest to the students, under the supervision of a member of staff/s. Students will acquire and interpret mine datasets, using them to solve a mining engineering 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 Code: MnEg5111
Course Name: Gemstone Mining
Credit Hour: 3
Prerequisite

This course unit aims to provide students with a general introduction in the field of Gemstone Mining and understanding, investigation and exploitation of these natural resources; understanding on the occurrence of different types of gemstones; basic knowledge on the nature, composition and maturation of gemstones; and skills on the technological applications in the exploration of these resources.

Course Code: MnEg5113
Course Name: Solution mining
Credit Hour: 3
Prerequisite

The main objective of this course to introduces the students about solution mining, methods and as well as laboratory test of solution mining.

Course Code: MnEg5110
Course Name: Dimensional Stone Mining
Credit Hour: 3
Prerequisite

This course introduces students to study about historical uses of natural stones, geology, occurrences, and mining techniques, cutting tools, equipment uses and selections, environmental issues, application and processing of dimensional stones.

Course Code: MnEg5112
Course Name: Mine Automation
Credit Hour: 3
Prerequisite EEEg1202

This course introduces students to the fundamental tools and techniques of automation and robotics as applied to modern mining practice. This course provides an introduction to the basics of systems control, as well as to the fundamentals of sensing and navigation as applied to the design of robotic mobile equipment.

Course Code: MnEg5112
Course Name: Mine Automation
Credit Hour: 3
Prerequisite EEEg1202

2.4 Bachelor of Science Degree in Chemical Engineering

2.4.1 Program Education Objective (PEO)

Chemical engineering graduates will have applied their knowledge and skill to contemporary problem solving, be engaged professionally, and have continued to learn and adapt, and have contributed to their organizations through leadership and teamwork. More specifically, the objectives are expertise, engagement, learning, leadership and teamwork.

Table: Program Education Objectives (PEO)

PEOs	**PEOs Descriptions**
PEO-1	Graduates will exercise managerial positions in industries, government, and non-government organizations to achieve their career goals.

PEO-2	Graduates will become professional chemical engineers by applying their acquired skills and knowledge to design, operate, and optimize chemical processes and products that are safe, efficient, and sustainable.
PEO-3	Graduates will become successful entrepreneurs in chemical engineering.
PEO-4	Graduates will become researchers and academicians in the field of chemical engineering.

2.4.2 Program Outcomes (PO)

The programs would be measured through the attainment of the Program Outcome (PO)/Program Learning Outcomes (PLO) of the program and its courses. Hence, the PO was designed in such ways that contribute to achieve the PEO and stated as follow.

Table: Chemical Engineering Program Outcome

PO/SO	Program Outcome/ Student Outcome Statement
PO-1	Apply knowledge of mathematics, natural science, computing and engineering fundamentals, and an engineering specialization to develop solutions to complex engineering problems.
PO-2.	Identify, formulate, research literature and analyze complex engineering problems reaching substantiated conclusions using first principles of mathematics, natural sciences and engineering sciences with holistic considerations for sustainable development.
PO-3	Design creative solutions for complex engineering problems and design systems, components or processes to meet identified needs with appropriate consideration for public health and safety, whole-life cost, net zero carbon as well as resource, cultural, societal, and environmental considerations as required.

PO-4	Conduct investigations of complex engineering problems using research methods including research- based knowledge, design of experiments, analysis and interpretation of data, and synthesis of information to provide valid conclusions.
PO-5	Create, select and apply, and recognize limitations of appropriate techniques, resources, and modern engineering and IT tools, including prediction and modelling, to complex engineering problems
PO-6	Analyze and evaluate the impacts of sustainable development when solving complex engineering problems, considering society, the economy, environmental sustainability, health and safety, legal frameworks, and the environment.
PO-7	Apply ethical principles and commit to professional ethics and norms of engineering practice and adhere to relevant national and international laws. Demonstrate an understanding of the need for diversity and inclusion.
PO-8	Function effectively as an individual, and as a member or leader in diverse and inclusive teams and in multi-disciplinary, face-to-face, remote and distributed settings.
PO-9	Communicate effectively and inclusively on complex engineering activities with the engineering community and with society at large, such as being able to comprehend and write effective reports and design documentation, make effective presentations, taking into account cultural, language, and learning differences.
PO-10	Apply knowledge and understanding of engineering management principles and economic decision-making and apply these to one's own work, as a member and leader in a team, and to manage projects and in multidisciplinary environments.
PO-11	Recognize the need for, and have the preparation and ability for independent and life-long learning; adaptability to new and emerging technologies; and critical thinking in the broadest context of technological change.

2.4.3 Program Courses Synopsis

2.4.3.1 Common Course Synopsis

Course Code: Phil 1009
Course Name: Logic and Critical Thinking
Credit Hour: 3
Prerequisite: No

Logic and Critical Thinking is an inquiry that takes arguments as its basic objectives of investigation and it is an exercise, a habit, a manner of perception and reasoning that has principles of rationality as its fulcrum, and dynamically involves various reasoning skills that ought to be human approach to issues and events of life. Logic and Critical Thinking enables to construct one's own sound argument and to evaluate the arguments of other's and evaluate arguments' validity, strengths and weaknesses.

Course Code: Psyc1011
Course Name: General Psychology
Credit Hour: 3
Prerequisite: No

The course encompasses the fundamental concepts and principles of psychology and psychological processes which have immense applications to human life and to develop life skills based on the theories and principles of psychology.

Course Code: FLEn 1003
Course Name: Communicative English Language Skills I
Credit Hour: 3
Prerequisite: No

This course will cover specific language aspects such as developing basic functions of English language skills such as reading, listening, writing, speaking, vocabulary and grammar.

Course Code: GeEs1005
Course Name: Geography of Ethiopia and The Horn
Credit Hour: 3
Prerequisite: No

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 Code: SpSc 1013
Course Name: Physical Fitness
Credit Hour: 2
Prerequisite: No

This course covers:- Concepts of physical fitness, the health benefits of physical activity, making well-informed food choices, health related components of fitness and principles of exercise prescription and assessment of fitness components.

Course Code: Econ2003
Course Name: Economics
Credit Hour: 2
Prerequisite: No

This course is an introductory course covering basic principles and issues of economics. Broadly speaking, the course has two components, microeconomics and macroeconomics. In microeconomics, the focus is on the way in which individual economic agents – workers, consumers, households and firms – make decisions. This part begins with a discussions and applications of the concepts of demand & supply; theory of the consumer; theory of producer; and market structures. While in macroeconomics, the study involves the study of the economy as a whole, especially issues related to macroeconomic goals, national income account and its measurement, interest rates macroeconomic problems such as unemployment, deficit and inflation, growth and policy instruments.

Course Code: Anth1002
Course Name: Social Anthropology
Credit Hour: 2
Prerequisite: No

This course as a freshman course gives an understanding of different key areas of anthropological inquiry: family, means of production, political organizations, social organization, language, religion, and gender.

Course Code: FLEn1004
Course Name: Communicative English Language Skills II
Credit Hour: 3
Prerequisite: Communicative English Language Skills I

Communicative English Language Skills II Module is a continuation of Communicative English Language skills I Module, and it mainly aims to provide first year University students proficiency with speaking, listening, reading and writing skills.

Course Code: Incl 1010
Course Name: Inclusiveness
Credit Hour: 2
Prerequisite: No

The course will provide concepts of disabilities/vulnerabilities and inclusiveness, application of assessment strategies for service provision, skills of demonstrating inclusive culture and introduce the existing national and international legal frameworks. In addition, the course will offer techniques on establishing partnership with stakeholders and apply inclusiveness for peace, democracy and development.

Course Code: MCiE1012
Course Name: Moral and Civic Education
Credit Hour: 2
Prerequisite: No

This course generally covers basic understanding of civics and ethics, approaches of ethical decision-making, moral judgment, state and government, Constitution, Democracy and Human Rights. In so doing students will have basic knowledge of their duties and rights besides the understanding of theories of state, morality and global issues.

Course Code: GLTr2001
Course Name: Global Trend
Credit Hour: 2
Prerequisite: No

The course aims to equip students with the basics of international relations, foreign policy and diplomacy, introduction to international political economy, globalization and regionalism, and major contemporary global trends.

Course Code: Math 1107
Course Name: Mathematics for natural science
Credit Hour: 3
Prerequisite: No

This course covers the basic concepts of logic and set theory, the real and complex number systems, Mathematical induction, least upper bound and greatest lower bound, functions and types of functions, polynomial and rational functions, logarithmic and exponential functions, trigonometric functions, hyperbolic functions and their graphs and analytic geometry.

Course Code: Hist2002
Course Name: History of Ethiopia and the Horn
Credit Hour: 3
Prerequisite: None

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 Code: Ent1106
Course Name: Entrepreneurship for Engineers
Credit Hour: 3
Prerequisite: No

This course is designed to encourage students to start their own business and to acquaint them with the peculiar challenges and management decisions faced by owners of small business. It will develop such entrepreneurial skills as: identifying business opportunities; initiating, financing, and developing new venture business plans. It also addresses issues of small business, such as: legal aspects, financing, costing, locating, personnel, marketing, competition, sources of funding, and constituency services.

2.4.3.2 Core supportive and compulsory courses

Course Code: Math 1014
Course Name: Applied Mathematics IB
Credit Hour: 4
Prerequisite: No

The course is designed to develop students' confidence with mathematical concepts, use of mathematical skills and techniques in a wide range of contexts specifically problem solving and abstract thinking. It covers basic elements of vectors, vector spaces, matrices, determinants, solving systems of linear equations, concepts and applications of differential and integral calculus of one variable.

Course Code: Math2007
Course Name: Applied Mathematics IIB
Credit Hour: 4
Prerequisite: Applied Mathematics IB

The course is designed to develop students' confidence with mathematical concepts , use of mathematical skills and techniques in a wide range of contexts specifically problem solving and abstract thinking. It covers basic elements of sequence and series, power series, differential calculus of several variables and multiple integral concepts and their applications.

Course Code: Math2042
Course Name: Applied Mathematics IIIB
Credit Hour: 4
Prerequisite: Applied Mathematics IIB

This course covers basic elements of ordinary differential equations, Laplace and Fourier transforms, vector differential calculus, Line and surface integral and complex analytic functions.

Course Code: MEng2014
Course Name: Workshop Practice
Credit Hour: 1
Prerequisite: None

Measuring and layout tools; Bench work; Wood work, Metal work, cutting with the aid of conventional machine tools; Operation and maintenance of appliances and machines; Welding, brazing and soldering; Manufacture of parts.

Course Code: CEng2005
Course Name: Engineering Mechanics I Statics
Credit Hour: 3
Prerequisite: None

Engineering mechanics (Statics) is the application of mechanics (one of the three branches of Physics) to solve problems involving common engineering elements.

Course Code: CEng2002
Course Name: Engineering Mechanics II Dynamics
Credit Hour: 3
Prerequisite: Engineering Mechanics I Statics &), Applied Mathematics IB

Basic equations of motion; Kinematics of particles and rigid bodies; Kinetics of particles and rigid bodies

Course Code: Stat2004
Course Name: Probability and Statistics
Credit Hour: 3
Prerequisite: None

This course covers basic elements of statistics, probability, central tendencies, variation, and types of sampling, concepts and applications of estimation and hypothesis testing, regression analysis.

Course Code: MEng4012
Course Name: Strength of Materials
Credit Hour: 3
Prerequisite: Mathematics (natural Science) (Math1007)

Concept of stress and strain – stress and strain under axial loading – torsion of circular shafts-shear force and bending moment diagrams – bending stresses in beams – transformation of stress and strain.

Course Code: EEEg4009
Course Name: Basic Electrical Circuit and Introduction to Electrical Machine
Credit Hour: 3
Prerequisite: Applied Mathematics IIB (Math2007)

This course emphasis the basic of electrical circuit and electrical machine.

Course Code: ChEg3101
Course Name: Technical Report writing
Credit Hour: 1
Prerequisite: None

The course aims to introduce technical report writing characteristics that are in engineering disciplines like laboratory reports and field experiment data reporting skills. The students will be in a position to author professional works and handle effective communication skills with different bodies.

Course Code: MEng2001
Course Name: Engineering Drawing
Credit Hour: 3
Prerequisite: None

The course Engineering Drawing covers introduction and importance of engineering drawing, drawing instruments, drawing standards and conventions; theories of projection: types and systems of projections, projections of points and lines; multi-view drawings; pictorial drawing; auxiliary views and sectional view.

Course Code: Comp2003
Course Name: Introduction to Computer programming
Credit Hour: 3
Prerequisite: None

This course, after a brief introduction of what programming languages are and their classifications extends fundamental programming principles and concepts. It specifically deals with variables and constants; scope; operators and operator precedence; comment statements; input and output statements; control structures and arrays; functions and pointers; and structures and files.

2.4.3.3 Core courses

Course Code: InCh2108
Course Name: Applied Inorganic Chemistry
Credit Hour: 3
Prerequisite: None

This course focuses on reinforcement of theory of inorganic chemistry and synthesis of basic inorganic chemical products. The course includes overview of molecular orbital theory, chemistry of transition metals, ligands and isomerism, crystal field theory, ligand field theory and the spectrochemical series, NMR of coordination complexes, color in TM complexes, reactivity of oxides, sulphides, halogenides, hydrides etc. It also intricates about synthesis and structure of inorganic compounds, chemical reactions in solutions. It will also help to develop important problem solving and critical thinking skills.

Course Code: InCh3103
Course Name: Applied Organic Chemistry
Credit Hour: 3
Prerequisite: None

This course will make students who take the course about the basic things in organic chemistry, which are in touch with our day-to-day activities and us also. So, the course makes the students to be familiar with the various biological molecules, natural products, synthetic compounds, polymers and their roles, functions, functional groups, chemical and physical properties so that they will apply to their different fields.

Course Code: InCh3109
Course Name: Fundamentals of Analytical Chemistry
Credit Hour: 3
Prerequisite: None

The course covers ; Introduction to analytical chemistry; Acids bases, and neutralization titration; Complex formation, and complex metric titration: Gravimetric analysis; Chromatographic technique: paper, thin layer, gas chromatography and HPLC; Spectroscopic techniques; UV-Vis, AAS, IR, and Introduction to mass spectroscopy and Nuclear Magnetic Resonance spectroscopy (NMR), fluorescence, and coupled techniques such as HPLC/GC-MS, ICP-MS/OES,

Course Code: ChEg3107
Course Name: Chemical Engineering Thermodynamics I
Credit Hour: 3
Prerequisite: Applied Mathematics IIB (Math2007)

The course has the objective of fundamental principles equipping the student with the knowledge of the laws of thermodynamics and basic principle of thermodynamics in understanding heat and mass transfer and efficiency process units in process industry.

Course Code: ChEg3110
Course Name: Chemical Engineering Thermodynamics II
Credit Hour: 3
Prerequisite: Chemical Engineering Thermodynamics I

The course aims to introduce the principles of solution thermodynamics with understanding of the phase and reaction equilibrium. It focuses on determination of heat of reactions, sensible and latent heats. The course also enables to develop mathematical relationships for thermodynamic properties of ideal non-ideal solutions.

Course Code: ChEg3113
Course Name: Fluid Mechanics
Credit Hour: 3
Prerequisite: None

This course is designed to commence students to have a basic principles and characteristics of fluid flow in different processes (fluids motion and fluids at rest). It will introduce a student about fluid mechanics, the properties of fluid and types of fluids. It will also discuss on forces (pressure) applied by a fluid at rest or in rigid body motion. Using conservation principles (momentum, mass and energy) the student will examine properties of flow parameters on the fluid flow. Finally, this course will introduce dimensional analysis and the concept of similarity between a model and a prototype and also pipe flow and external flows.

Course Code: ChEg3111
Course Name: Transport Phenomena
Credit Hour: 3
Prerequisite: Applied Mathematics IIB (Math2007)/Chemical Engineering Thermodynamics I (ChEg3107) and Fluid Mechanics (ChEg3113)
This course will emphasize on the theoretical aspect of momentum, heat and energy in solving complex transport behavior. Purpose of this knowledge can analyze problems in momentum transfer, heat transfer and mass transfer.

Course Code: ChEg3081
Course Name: Fluid Machines for Chemical Engineers
Credit Hour: 3
Prerequisite: Fluid mechanics (ChEg3113)

This course is designed to commence students to have a basic principles and Characteristic Features and Definition of Fluid Machines, Energy Transfer and Specific Work of Fluid Machines, Performance Characteristics of Centrifugal Machines, Theory of Positive Displacement Pumps, Theory of Positive Displacement Compressors, Specification of Fluid, Selection and specification of Fluid Machines.

Course Code: ChEg3102
Course Name: Mechanical Unit Operations
Credit Hour: 3
Prerequisite: Fluid Mechanics (ChEg3113)

This course aims to introduce students the subject of powder technology which focuses on processing and handling of particles and powders. It gives coverage of broad areas within powder technology including characterization, particle size reduction and enlargement, fluid-particle separation based on aero- and hydro-classifications, fluid-particle separation using gravity and pressure applications, fluid flow through solid beds and fluidization, and storage and transport of mixture of particles. Application of this knowledge can solve problems relevant to the design of chemical engineering systems, particularly to the mechanical unit operation equipment in process industries. It will also help to develop important problem solving and critical thinking skills. Upon the completion of the course, students will be able to analyse laboratory data and investigate the effects of different process parameters on the performance of powder handling and processing equipment.

Course Code: ChEg3114
Course Name: Mechanical Unit Operations Laboratory
Credit Hour: 3
Prerequisite: Mechanical Unit Operations

This course will provide practical experience on the basic mechanical unit operations ensuring a thorough understanding of principles of unit operation and appropriate theory. The course includes execution of experiments,

data analysis and technical report writing and team work. Students will be able to do experiments on size reduction equipment and analysis, particle size distribution using screening, particle movement in a fluid and flow of fluid through a solid bed (Filtration, sedimentation, fluidization etc.)

Course Code: ChEg3106
Course Name: Thermal Unit Operations
Credit Hour: 3
Prerequisite: Transport Phenomena (ChEg3111)

This course will emphasize on the physical principles underlying heat flow by conduction, convection, and radiation mechanisms in heat exchangers, condensers, reboilers, boilers, evaporation processes. Application of this knowledge can solve problems relevant to the design of chemical engineering systems, especially heat exchange equipment. It will also help to develop important problem solving and critical thinking skills.

Course Code: ChEg4113
Course Name: Mass Transfer Unit Operations
Credit Hour: 3
Prerequisite: Thermal Unit Operations (ChEg3106)

Introduces the students with fundamental principles of mass transfer kinetics and chemical equilibrium. It introduces design concept of various separation processes involved in the chemical and other physical processing industries such as drying, distillations, absorption, adsorption, liquid-liquid extraction, crystallization, ion exchange and solid-liquid extraction (leaching).

Course Code: ChEg4107
Course Name: Thermal and Mass Transfer Unit Operations laboratory
Credit Hour: 2
Prerequisite: Thermal Unit Operations, Mass Transfer Unit Operations

This course will emphasize on the experimental setup of thermal and mass transfer equipment to measure effect of different parameters on heat and mass transfer, and also to evaluate performance of transfer equipment.

Course Code: ChEg3104
Course Name: Reaction Engineering I-Reaction Kinetics
Credit Hour: 3
Prerequisite: Appiled Mathematics IIB (Math2007)

This course will emphasize on the principles of chemical reaction engineering which focuses on reaction classifications; reaction kinetics (rate & mechanism of the reactions and operating conditions); reactor types; developing the performance equation for various reactors and controlling product distribution for multiple reactions.

Course Code: ChEg4101
Course Name: Reaction Engineering II-Reactor Design
Credit Hour: 3
Prerequisite: Reaction Engineering, I- Reaction Kinetics (ChEg3104)

The course emphasizes on basic concepts of chemical reactor design and evaluate operational performance of ideal, non-ideal, isothermal, non-isothermal, adiabatic, non-adiabatic of batch and flow reactors for homogeneous and heterogeneous reactions.

Course Code: ChEg4103
Course Name: Reaction Engineering Laboratory
Credit Hour: 1
Prerequisite: Reaction Engineering, I-Reaction Kinetic (ChEg3104)/ Reaction Engineering II-Reactor Design (ChEg4101)

This course will acquire the ability to carry out experiments and analyse experimental data of chemical reactors. They should also be able to obtain and interpret experimental data on batch, CSTR, PFR, Cascade CSTR reactors, Catalytic reactors.

Course Code: ChEg4106
Course Name: Fundamentals of Biochemical Engineering
Credit Hour: 3
Prerequisite: Reaction Engineering II- Reactor Design (ChEg4101)

This course covers knowledge about principles of biochemical engineering used in industries, design, operation and control of bioreactors used in bioprocess. Various unit operations employed in bioprocess industries, production of chemicals using fermentation and bioprocesses will also be introduced.

Course Code: ChEg5102
Course Name: Electro-chemical Engineering
Credit Hour: 2
Prerequisite: None

The focus of the course is to give an in-depth understanding in the application areas of electrochemistry:

- Mainly on energy storage devices (fuel cells, batteries),
- Electroplating as a means to form coatings

Electroforming to form metallic parts

Course Code: ChEg3108
Course Name: Material Science and Engineering
Credit Hour: 3
Prerequisite: None

The course discusses the physical, mechanical, electrical and chemical properties of materials, with an emphasis on the mechanical properties of metals and alloys. The course covers the fundamental understanding of:

- Types of materials (metals, ceramics, polymers, semiconductors)
- Different levels of structure in materials (atomic, microscopic, macroscopic)
- Properties of materials (mechanical, thermal, electrical, optical)

Relation among material processing, structure, properties, and performance

Course Code: ChEg3105
Course Name: Numerical Methods in chemical Engineering
Credit Hour: 3
Prerequisite: Applied Mathematics IIIB (Math2002)

This course focuses on the application of numerical technique for solving various chemical engineering problems. Further, this course elaborates about applying different computational software to solve complex equations and compare different numerical methods to obtain the solution with a minimum error. The course also deals about formulation of mathematical model for a given chemical engineering problem.

Course Code: ChEg4108
Course Name: Process Industries
Credit Hour: 4
Prerequisite: Basic principles of process calculation (**ChEg2106**)

This course will concern on different organic and inorganic chemical process technology. The application of this knowledge is to assess and evaluate chemical process industries. This leads to recommend a novel process (emerging technology) that can be effective in terms of economic, environmental, social and technical issues, if any for process industries.

Course Code: ChEg4115
Course Name: Internship
Credit Hour: 6
Prerequisite: Fundamentals of Biochemical Engineering (ChEg4106), Process Industries (ChEg4108), Chemical Engineering Apparatus Design (ChEg4110), and Process Dynamics and Control (ChEg4102), Mechanical Unit Operations (ChEg3102)

Internship is intended to give students a chance of real time industry experience and exposure, which are application of theoretical knowledge covered in class. During this period students are expected to boost practical hands-on experiences, professional/workplace behavior and knowledge, learn company culture, employer expectations. Internship also helps students to explore their career path and opportunity to professional network.

Course Code: EnEg4111
Course Name: Basic Environmental Engineering
Credit Hour: 3
Prerequisite: None

Ecosystems, environmental pollutants and ecosystem disturbances &, Basic concepts of environmental chemistry and Microbiology, Pollutant transport in environmental systems, Environmental engineering technologies and Environmental management tools

Course Code: ChEg4102
Course Name: Process Dynamics and Control
Credit Hour: 3
Prerequisite: Reaction Engineering II- Reactor Design, Fluid Mechanics

This course is designed to commence students to have a background in theory and practice of chemical process control. This course elaborates and analyzes about the characteristics of a control system and formulates the problems that must be solved during the design of a control system. Further, the aims of the course are to present a general introduction to the control aspects of a chemical process, introduce a student to modeling requirements for process control and analyze static and dynamic behavior of the process system. The course also covers the analysis and design of feedback control systems, which represent the control schemes encountered most often in a chemical plant. Finally, dynamics behavior of process control analysis using MATLAB Simulink Software is covered in this course.

Course Code: ChEg4104
Course Name: Process control Laboratory
Credit Hour: 1
Prerequisite: Process dynamics and control (ChEg4102)

Process Control laboratory is providing knowledge on practical performance of different control instruments and equipment through experimental work. The main objective of process control is to maintain a process at the desired operating conditions safely and efficiently.

Course Code: ChEg4110
Course Name: Chemical Engineering Apparatus Design
Credit Hour: 4
Prerequisite: Reaction Engineering II-Reactor Design (ChEg4101) and Mass Transfer Unit Operations (ChEg4113)

The course aims at giving basic understanding of process equipment design. Criteria and procedures for equipment selection and sizing will be discussed in detail. Equipment design techniques will be applied to the common unit operation in the chemical and process industry: internal and external pressure vessels, tall vessels, high pressure vessels, supports etc...

Course Code: ChEg5103
Course Name: Computer Aided Process Design and Simulation
Credit Hour: 3
Prerequisite: Chemical Process Apparatus Design (ChEg4110)

This course introduces the concept of new design and simulation of existing chemical processes. It deals with process simulation programs, sequential modular approach, and equation-oriented approach. Further, the course focuses on interpretation of different process technology, physical properties methods including reactor, separation, stream recycling, concept of energy integration, and environmental, health, and safety effects. This course elaborates development of process flow diagram (PFD), interpret the PFD with simulator software tools.

Course Code: ChEg5107
Course Name: Plant Design and Economics
Credit Hour: 3
Prerequisite: Chemical Engineering Apparatus Design (ChEg4110)

The course emphasizes the knowledge acquired by the student’s in previous courses and applies in the complete design of a Chemical Process Plant. The plant design includes piping and instrumentation, cost estimation, profitability analysis, plant wide control, waste management, plant safety, reliability and operability, plant layout, plant startup. It will also help for critical thinking skills and solve crucial problem.

Course Code: ChEg5117
Course Name: Integrated Plant Design Project
Credit Hour: 3
Prerequisite: Chemical Engineering Apparatus Design (ChEg4110)

This is a group plant design project intended to develop and assess the students' capability to co-ordinate the knowledge gained in previous years of chemical engineering and apply it to the comprehensive design of a process plant. It exposes students to work in teams, develop coordination and communication skills. This capstone design project that

intended to enable students to apply fundamental theoretical knowledge gained from previous courses to the conceptual design of a chemical process plant, generate cost effective process options with considerations for operability and safety of the design, screen and evaluate potential design alternatives for feasibility study. It also enables the students conduct material and energy balance, plant location, process flow sheeting and simulation. In this project the students integrate their chemical engineering skills to develop instrumentation and control strategy, look after environmental and safety aspects, perform detailed economic analysis and equipment design for the process plant.

Course Code: ChEg5113
Course Name: Process Integration and Optimization
Credit Hour: 3
Prerequisite: Internship (ChEg4115)

This course will emphasize on the physical principles underlying pinch technology, pinch point analysis and Process Optimization, the application of this knowledge can solve problems relevant to the design of chemical engineering problem and it is a powerful tool for designing and optimizing processes in terms of efficiency use of energy, typical problems in chemical engineering process design or plant operation have many solutions.

Course Code: ChEg5109
Course Name: Sustainable Resources and Energy Technology
Credit Hour: 3
Prerequisite: None

This course is designed to enable students to identify sustainable engineering systems that ensure efficient, safe and environment friendly energy utilization.

Course Code: ChEg5104
Course Name: Production and Project Management
Credit Hour: 3
Prerequisite: None

This course is an introduction to the concepts, principles, problems, and practices of production and project management. Emphasis is on managerial processes in chemical manufacturing organizations to continually improve the systems of production to ensure the most efficient and effective output in turning raw materials into a deliverable product by familiarizing the students with the major operational issues that confront managers.

Course Code: ChEg5106
Course Name: Industrial Safety and Loss Management
Credit Hour: 3
Prerequisite: None

This course is designed to provide essential information for students to acquire knowledge about safety in processing industries and to differentiate the different types of industrial hazard with their control measures.

Course Code: ChEg5111
Course Name: Research Methods and Experimental Design
Credit Hour: 2
Prerequisite: None

This course emphasizes on basic concept of research, design of experiment, collection and data analyses and research result reports. The objective of this course is to enable chemical engineering graduates understand basics of research and final years research project in particular, design of research, date collection and analysis and reporting of research outputs.

Course Code: ChEg4115
Course Name: Integrated Engineering Team Project
Credit Hour: 3
Prerequisite: None

This is a multidisciplinary team integrated engineering project in connection with a special engineering problem and under the guidance of a faculty member. The project synopsis consists of literature review, design, project management, business acumen, multidisciplinary team work, entrepreneurship

Course Code: ChEg5115
Course Name: Final Year Project Phase I
Credit Hour: P/F
Prerequisite: Internship (ChEg4115)/ ChEg5103, ChEg5105, ChEg5107, ChEg5111 and ChEg5113

This is an individual research project in connection with a special engineering problem and under the guidance of a faculty member. The project undertaken may fall under one of the following areas; mathematical analysis, experimental tests, computer simulation, hardware and/or software development, device fabrication. The project work includes literature review, research problem identification, proposal development, preliminary research work and interim report generation.

Course Code: ChEg5108
Course Name: Final Year Project Phase II
Credit Hour: 6

Prerequisite: Final Year Project Phase I

This is an individual research project in connection with a special engineering problem and under the guidance of a faculty member. The project undertaken may fall under one of the following areas; mathematical analysis, experimental tests, computer simulation, hardware and/or software development, device fabrication. The project involves complete literature survey and theoretical analysis; carry out experiments and/or design of experiments, computer modeling in pre-determined methodology; and analyze and interpret the obtained data for optimum solutions using suitable techniques/IT tools.

2.4.3.4 Elective courses

Course Code: ChEg5210
Course Name: Introduction to Food Process Technology
Credit Hour: 3
Prerequisite: None

The course describes fundamentals of techniques involved in processing, preservation, packaging, and processes that are used to transform raw materials into food. Food properties and typical characteristics with respect to extending shelf life and improving quality are described.

Course Code: ChEg5212
Course Name: Polymer Science and Engineering
Credit Hour: 3
Prerequisite: Material Science and Engineering (ChEg3108)

The course provides a broad overview of:

- Production routes of monomers and polymers
- Polymerization mechanisms the structures and properties (chemical, physical, viscoelastic, and mechanical properties) of polymers
- Polymer processing mechanisms: extrusion, injection, film blowing.

Application areas of polymeric materials.

Course Code: ChEg5214
Course Name: Petroleum Refining Engineering
Credit Hour: 3
Prerequisite: None

The course focuses on fundamentals of petroleum refining operations which include composition and properties of crude oil, conversion of crude oil to useful fractions using various technologies like distillation processes, and methods of upgrading the fractions such as catalytic cracking and reforming, and thermal processes

Course Code: ChEg5216
Course Name: Fundamentals of Bioprocess Engineering
Credit Hour: 3
Prerequisite: None

This course will focus on the fundamental concepts in Bioprocess Engineering which include enzyme kinetics, major metabolic pathways, microbial cell growth, bioreactor design and operation, sterilization techniques, recovery and purification of products. Application of enzyme and microbial cell kinetics leads to solve problems pertinent to the design of biochemical processes, particularly bioreactor design and operation. It will also help to develop important problem solving and critical thinking skills

Course Code: ChEg5218
Course Name: Fundamentals of Pharmaceutical Technology
Credit Hour: 3
Prerequisite: None

This course emphasizes on the basic principles of pharmaceutical technologies relevant to chemical engineering students which includes introduction to pharmaceutical industries, pharmacokinetics, pharmacodynamics, principles of manufacturing and drug delivery.

Course Code: ChEg5220
Course Name: Energy Management and Audit
Credit Hour: 3
Prerequisite: None

The course emphasizes on efficient energy management through effective utilization of utilities, conduct energy audit on process industries, analysis of boilers and fired systems for energy conservation options, analysis of steam and condensate systems for energy saving opportunities and waste heat recovery. The course also addresses Heating, Ventilation, and Air Conditioning (HVAC) systems as well as lighting and industrial installation for energy conservation opportunities.

Course Code: ChEg5222
Course Name: Fundamentals of textile chemical processing
Credit Hour: 3
Prerequisite: None

This course mainly deals on the overall chemical processing takes place in the textile industry starting from the fibre stage up to the garment finishes.
Therefore, students will learn the basics of textile chemical processing by incorporating fundamental chemical engineering principles such as transport phenomena, chemical process principles, and chemical engineering analysis.

Course Code: ChEg5224
Course Name: Fundamental of Nuclear Engineering
Credit Hour: 3
Prerequisite: None

This course aims to give basic knowledge about nuclear reactor engineering. It includes basic concepts of nuclear reactions and fission reaction chain, which are needed to understand the principles of nuclear reactors and some important issues in nuclear reactor engineering are also explained, including design concepts of nuclear reactors in practical use and innovative nuclear energy systems.
It will also help to develop important problem solving and critical thinking skills.

2.5 Bachelor of Science Degree in Environmental Engineering

2.5.1 Program Education Objective (PEO)

The program educational objectives describe accomplishments of environmental engineering program graduates are expected to attain within five years after graduation. Graduates are expected to apply their expertise to contemporary environmental problem solving, be engaged professionally, have continued to learn and adapt, and contributed to their organizations through leadership and teamwork. More specifically, the objectives are expertise, engagement, learning, leadership and teamwork as listed in Table 2.1.

Table 2.1: Program Education Objectives (PEO)

The Program educational objectives (PEOs) of the Environmental Engineering program are:

PEO-1: Graduates will become professional environmental engineers by applying their acquired skills and knowledge to design and implement sustainable solutions for air, water, and soil pollution using fundamental engineering principles.

PEO-2: Graduates will exercise a managerial position in industries, government, and non-government organizations to achieve their career goals.

PEO-3: Graduates will become successful entrepreneurs (develop and apply innovative technologies and best practices for resource conservation and pollution reduction) in environmental engineering.

PEO-4: Graduates will become researchers and academicians in the field of environmental engineering.

2.5.2 Program Outcomes (PO):

Engineering programs are measured through their attainment of the Program Outcome (PO)/Program Learning Outcomes (PLO) of the program and its courses. These program outcomes are statements on what students shall know, understand, and perform upon completing their course and/or program of study. State the Program Outcomes of this environmental engineering Bachelor of Science degree program are stated below (Table 2.3).

Table 2.2: Program Outcome

PO	Statement
PO-1	Apply knowledge of mathematics, natural science, computing, and engineering fundamentals, along with an environmental engineering specialization, to develop solutions to complex environmental engineering problems.
PO-2	Identify, formulate, research literature, and analyze complex environmental engineering problems, reaching substantiated conclusions using first principles of mathematics, natural sciences, and engineering sciences, with holistic considerations for sustainable development.
PO-3	Design creative solutions for complex environmental engineering problems and develop systems, components, or processes to meet identified needs, with appropriate consideration for public health and safety, whole-life cost, net-zero carbon, as well as resource, cultural, societal, and environmental considerations as required.
PO-4	Conduct investigations of complex engineering problems using research methods, including research-based knowledge, design of experiments, analysis and interpretation of data, and synthesis of information to provide valid conclusions.
PO-5	Create, select, apply, and recognize the limitations of appropriate techniques, resources, and modern engineering and IT tools, including prediction and modeling, to address complex engineering problems.
PO-6	Apply reasoning informed by contextual knowledge to assess societal, health, safety, legal, and cultural issues, and the consequent responsibilities relevant to professional environmental engineering practice and solutions to complex environmental engineering problems.

PO-7	Understand the impact of professional engineering solutions in societal and environmental contexts and demonstrate knowledge of and the need for sustainable development
PO-8	Apply ethical principles and commit to professional ethics and norms of engineering practice, adhering to relevant national and international laws. Demonstrate an understanding of the need for diversity and inclusion.
PO-9	Function effectively as an individual and as a member or leader in diverse teams and multi-disciplinary settings.
PO-10	Communicate effectively and inclusively on complex engineering activities with the engineering community and society at large, including the ability to comprehend and write effective reports and design documentation and make effective presentations, taking into account cultural, language, and learning differences.
PO-11	Demonstrate knowledge and understanding of engineering management principles and economic decision-making, and apply these to one's own work as a member and leader in a team to manage projects in multidisciplinary environments.
PO-12	Recognize the need for, and have the preparation and ability for, independent and lifelong learning; adaptability to new and emerging technologies; and critical thinking in the broadest context of technological change.

2.5.3 Program Courses Synopsis

2.5.3.1 Core supportive and compulsory courses

Course Code: Math 1014
Course Name: Applied Mathematics IB
Credit Hour: 4
Prerequisite: No

The course is designed to develop students' confidence with mathematical concepts, use of mathematical skills and techniques in a wide range of contexts specifically problem solving and abstract thinking. It covers basic elements of vectors, vector spaces, matrices, determinants, solving systems of linear equations, concepts and applications of differential and integral calculus of one variable.

Course Code: Math2007
Course Name: Applied Mathematics IIB
Credit Hour: 4
Prerequisite: Applied Mathematics IB

The course is designed to develop students' confidence with mathematical concepts , use of mathematical skills and techniques in a wide range of contexts specifically problem solving and abstract thinking. It covers basic elements of sequence and series, power series, differential calculus of several variables and multiple integral concepts and their applications.

Course Code: Math2042
Course Name: Applied Mathematics IIIB
Credit Hour: 4
Prerequisite: Applied Mathematics IIB

This course covers basic elements of ordinary differential equations, Laplace and Fourier transforms, vector differential calculus, Line and surface integral and complex analytic functions.

Course Code: CEng2005
Course Name: Engineering Mechanics I Statics
Credit Hour: 3
Prerequisite: None

Engineering mechanics (Statics) is the application of mechanics (one of the three branches of Physics) to solve problems involving common engineering elements.

Course Code: CEng2002
Course Name: Engineering Mechanics II Dynamics
Credit Hour: 3
Prerequisite: Engineering Mechanics I Statics &), Applied Mathematics IB

Basic equations of motion; Kinematics of particles and rigid bodies; Kinetics of particles and rigid bodies.

Course Code: Stat3102
Course Name: Probability and Statistics
Credit Hour: 3

Prerequisite: Math 1007

This course covers basic elements of statistics, probability, central tendencies, variation, and types of sampling, concepts and applications of estimation and hypothesis testing, regression analysis.

Course Code: MEng2001
Course Name: Engineering Drawing
Credit Hour: 3
Prerequisite: None

The course Engineering Drawing covers introduction and importance of engineering drawing, drawing instruments, drawing standards and conventions; theories of projection: types and systems of projections, projections of points and lines; multi-view drawings; pictorial drawing; auxiliary views and sectional view.

Course Code: Comp2003
Course Name: Introduction to Computer programming
Credit Hour: 3
Prerequisite: None

A programming language is a formal language comprising a set of instructions that produce various kinds of output. As programming involves activities such as analysis, developing understanding, generating algorithms, verification of requirements of algorithms including their correctness and resources consumption, and coding of algorithms, this course teaches students to program using a target programming language. As an introduction, this course gives students an overview of the different concepts of programming and problem solving strategies such as Variables, Reserved words, Syntax Diagram, Constant declarations, Data types, Conditional statements, Loops, Error handling and functions. For each topic, some coding guidelines will be discussed.

Course Code: ChEg2004
Course Name: Thermodynamics
Credit Hour: 3
Prerequisite: None

The course has the objective of fundamental principles equippingthe student with the knowledge of the laws of thermodynamics and basic principle of thermodynamics in understanding heat and mass transfer and efficiency process units in process industry.

Course Code: EnEg2102
Course Name: Environmental Microbiology
Credit Hour: 3
Prerequisite: None

The course is desired to provide students a general knowledge on microbes, their environment and the diverse roles of microorganisms in natural and artificial environments. It will cover topics including: Biology of microorganisms, microbial ecology, microbial metabolism, Factors affecting the growth of microbes, determination of microorganisms in the environment and the application of microbiology in environmental engineering.

Course Code: CEng 2002
Course Name: Strength of Materials
Credit Hour: 3
Prerequisite: CEng 2005

This course introduces the properties and strength of materials i.e. Flexure, Shear, Torsion, Compound Stress analysis and Buckling of Compression Members.

Course Code: EnEg3103
Course Name: Environmental Chemistry
Credit Hour: 3
Prerequisite: None

This course was designed to deliver a fundamental understanding of chemical and biochemical processes in aquatic, atmospheric, and soil chemistry. It also gives high emphasis on understand, analyze, and interpret toxic and hazardous chemicals in the major segments of the environment under natural and anthropogenic processes. Additionally, the course intended to provide the opportunity to develop experiences in laboratory sample analyses and instrumental operation techniques. The knowledge (skills) of physicochemical and biochemical principles are expected to be acquired which will be applied for pollution prevention, control, and remediation in the discipline of Environmental Engineering.

Course Code: ChEg3101
Course Name: Material and Energy Balances
Credit Hour: 2
Prerequisite: None

This course will emphasize on basic principles of process engineering discipline and to acquaint students with the fundamentals of process engineering calculations such as material and energy balances. It will also help to develop important problem solving and critical thinking skills.

Course Code: EnEg3105
Course Name: Environmental Engineering Hydrology
Credit Hour: 3
Prerequisite: None

This course is designed to enable students understand how observations of the hydrologic cycle are made and how they can be appropriately used, understand how to control non-point sources of pollution and comprehend how to predict risks and reliabilities of flood control systems

Course Code: EnEg3107
Course Name: Transport phenomenon for environmental engineering
Credit Hour: 3
Prerequisite: None

The course is designed to enable the students to apply the basic concepts of chemical transport phenomenon in the environmental systems. It will cover topics including: Introduction to transport phenomenon in the environment, physical mass transport of chemicals in environment and, Different models in environmental mass transportation.

Course Code: ChEg3103
Course Name: Fluid Mechanics
Credit Hour: 3
Prerequisite: None

This course is designed to commence students to have a basic principles and characteristics of fluid flow in different processes (fluids motion and fluids at rest). It will introduce a student about fluid mechanics, the properties of fluid and types of fluids. It will also discuss on forces (pressure) applied by a fluid at rest or in rigid body motion. Using conservation principles (momentum, mass and energy) the student will examine properties of flow parameters on the fluid flow. Finally, this course will introduce dimensional analysis and the concept of similarity between a model and a prototype and also pipe flow and external flows.

Course Code: CEng 3101
Course Name: Survey
Credit Hour: 3
Prerequisite: None

This course is designed to introduce Civil Engineering students to know basic principles of surveying, accurately measure distances and angles using high precision and up-to-date surveying equipment.

Course Code: EnEg3101
Course Name: Fundamental of Soils and Pollution Control
Credit Hour: 2
Prerequisite: None

This course is designed to provide essential information for students to explain the concepts of environmental soil science, definition of environmental soil science, principle and practice of environmental soil science and soil

component. In addition to this, the course is designed to classify the factors and process of soil formation, soil profiles and its horizons and to judge physical, chemical and biological properties of soil

Course Code: ChEg3104
Course Name: Reaction Engineering
Credit Hour: 3
Prerequisite: None

This course will emphasize on the principles of chemical reaction engineering which focuses on reaction classifications; reaction kinetics (rate & mechanism of the reactions and operating conditions); reactor types; developing the performance equation for various reactors and controlling product distribution for multiple reactions.

Course Code: CEng3102
Course Name: Reinforced Concrete Design
Credit Hour: 3
Prerequisite: CEng2002

This course induces the structural analysis and design of reinforced concrete structural members subjected to gravityload.

Course Code: EnEg3104
Course Name: Air pollution engineering I
Credit Hour: 3
Prerequisite: EnEg3103

This course aimed to enable the student to explain air pollution source, effect, concentration in the atmosphere and understand the basic air pollution control Technologies. The course also deigned to model the pollutant dispersion modeling in the atmosphere.

Course Code: EnEg3106
Course Name: Water Treatment Engineering
Credit Hour: 3
Prerequisite: EnEg3103 and EnEg2102

The course covers hydrological cycle, source of water quality analysis, water treatment method, convectional water treatment design (screening , aeration, coagulation, flocculation sedimentation, filtration, and disinfection) and advanced technology for water treatments (membrane filtration, reverse osmosis, ion exchange and elector dialysis).

Course Code: ChEg3102
Course Name: Unit Operation
Credit Hour: 2
Prerequisite: None

This course will provide practical experience on the basic mechanical unit operations ensuring a thorough understanding of principles of unit operation and appropriate theory. The course includes execution of experiments, data analysis and technical report writing and team work. Students will be able to do experiments on size reduction equipment and analysis, particle size distribution using screening, particle movement in a fluid and flow of fluid through a solid bed (Filtration, sedimentation, fluidization etc.)

Course Code: EnEg4103
Course Name: Numerical Analysis for environmental Engineering
Credit Hour: 3
Prerequisite: Math2002

The course aims at introducing students in finding numerical solutions to problems for which analytical solutions either do not exist or are not readily or cheaply obtainable. It enables students to apply linear algebra and calculus. It also aims to helps student develop programming skills.

2.5.3.2 Core course

Course Code: ChEg4101
Course Name: Air pollution Engineering II
Credit Hour: 3
Prerequisite: ChEg3104

Air pollution engineering focuses on mitigating or preventing air pollutant emissions. The course introduces the principles and practice of air pollution source control technology for gaseous air pollutants and particulate matter with emphasis on equipment operation and design parameters.

Course Code: EnEg 4105
Course Name: Engineering Economics
Credit Hour: 3
Prerequisite: Econ2009

This course is designed to enable students understand the basic concepts of engineering economics, the time value of money, the concepts behind benefit-cost analyses, the concept of depreciation, and Judge any designed project on the basis of the cost implications when compared with the expected benefits.

Course Code: IETP4115
Course Name: Integrated Engineering Team Project
Credit Hour: 3
Prerequisite: None

This is a multidisciplinary team integrated engineering project in connection with a special engineering problem and under the guidance of a faculty member. The project synopsis consists of literature review, design, project management, business acumen, multidisciplinary team work, entrepreneurship

Course Code: EnEg 4107
Course Name: Energy and the Environment
Credit Hour: 3
Prerequisite: None

Modern industrial societies are characterized by a significant consumption of fossil, renewable and nuclear fuels to fulfill the energy needfor the operation of the physical infrastructure (production of food and water, heating, shelter and transportation, etc.). The amount of energy used, especially in urban areas of industrialized countries, has had a significant environmental impact on both local and regional scales. The 20th century and the recent energy crisis in particular, have a remarkable interest in the topics of energy and environment. Therefore the objectives of the course

are enabling a better understanding of the complex interactions between society, energy needs and production and its effect on the environment.

Course Code: EnEg4109
Course Name: Wastewater Treatment Engineering
Credit Hour: 3
Prerequisite: EnEg2102, and EnEg 3103

This course is designed to expose the students to wastewater Engineering. Topics discussed include Collection and conveyance of sewage, Wastewater flow rates, Hydraulic design of sewers, Sewage pumping, Wastewater characteristics, Unit processes and operations for wastewater treatment, Preliminary treatment, Sedimentation and chemical clarification, Biological treatment (Sewage filtration, Activated sludge process, miscellaneous methods), Treatment and disposal of sludge, Advanced wastewater treatment and Industrial wastewater treatment. For design of wastewater treatment systems, it will cover the design of sedimentation tank, Waste Stabilization Pond, Conventional Activated Sludge, Extended Aeration, Aerated Lagoon and Trickling Filters. At the end of the course, the student should be able to apply the knowledge to design a simple unit operation of wastewater treatment systems and also to modify existing unit operation.

Course Code: EnEg 4102
Course Name: Solid waste Engineering
Credit Hour: 3
Prerequisite: ChEng3101

Solid waste engineering is a course designed to enable students to identify, and analyze the economic importance of solid waste, hierarchies of its management and design the engineered way of landfilling. The course covers the following major themes to produce this outcome. The syllabus covers Economic use of solid waste, Characterization and quantification, Engineering principles of solid waste disposal, Solid waste transformation, Energy recovery and use and, Engineering communication.

Course Code: EnEg4104
Course Name: Sewerage and drainage engineering
Credit Hour: 3
Prerequisite: EnEg 3105

The course is designed to enable the students to apply the basic knowledge and concepts of engineering hydrology, fluid mechanics and open channel hydraulics in the design of sewerage and drainage systems. It will cover topics including: Why sewerage and drainage systems are important, components of sewerage and drainage system, Basic engineering hydrology, hydraulics and open channel flows, design and construction of sewerage systems, and design and construction of storm and irrigation drainage systems.

Course Code: EnEg 4106
Course Name: GIS and Remote sensing
Credit Hour: 3
Prerequisite: None

Course Code: EnEg 4110
Course Name: Waste to Energy Technology
Credit Hour: 3
Prerequisite: EnEg 4107 and EnEg 4102

This course is designed to provide an understanding of the various aspects of Waste to Energy. The various sources of waste generation are analyzed with a focus on its potential for energy production. The need for characterization of wastes will be discussed along with the existing norms for waste utilization for alternate energy source. Various Technological options available for the production of energy form waste will delineated along with economics of using alternate sources.

Course Code: EnEg 4108
Course Name: Software applications for Environmental Engineering
Credit Hour: 3
Prerequisite: Comp 2003

The course is designed to enhance the student's skill on software applications and models; it enables the students to integrate theoretical courses with application software's. It also enables them to use application software's and models to design and predict environmental problems. It will cover topics including: Introduction to software applications and mathematical models for environmental engineering, CAD application, Water CAD, Sewer CAD and Storm CAD, SWAT and Air pollution models.

Course Code: EnEg 4112
Course Name: Environmental Impact Assessment
Credit Hour: 3
Prerequisite: None

This course is designed to enable students to assess environmental impacts of development projects and develop mitigation measures for the impacts identified.

Course Code: EnEg4114
Course Name: Environmental policy and Environmental Management Systems
Credit Hour: 2
Prerequisite: None

This course deals with the current practices and policies pertaining to the development, implementation and maintenance of environmental management systems (EMS) in an organization. ISO standards will be examined and case studies will be used to highlight the key factors involved with EMS implementation. The process of assessing environmental impacts and aspects and implementing continuous improvement measures will be addressed. This course also reviews the Procedures and Guidelines to conduct Environmental Audit.

Course Code: EnEg 4116
Course Name: Internship
Credit Hour: 6
Prerequisite: EnEg 4101; [EnEg4106]; [EnEg4109] ; [EnEg4102]; [EnEg4104]; [EnEg4110]; [EnEg4112], [EnEg4114]; [EnEg4108]

This course offers workplace training and experiences that relate to the student's general and technical course of study in preparation for work in the environmental field, including aspects of the duties, skills, and functions of the sponsoring entity. It is intended to give students a chance of real time industry experience and exposure, which are application of theoretical knowledge covered in class. During this period students are expected to boost practical hands-on experiences, professional/workplace behavior and knowledge, learn company culture, employer expectations. Internship also helps students to explore their career path and opportunity to professional network.

Course Code: EnEg 5111
Course Name: Integrated Environmental Engineering Project Design
Credit Hour: 3
Prerequisite: EnEg4114

An integrated project will assist the students in consolidating their knowledge acquired in various previous modules. The students will apply their knowledge in solving practical and real-time projects in due time. Students will perform a comprehensive design project using a team approach requiring interaction with practitioner's development of a team project report and a formal presentation. The main aim of this project work will let students to acquire knowledge and skills of planning and management of Civil Engineering projects. In addition to this, the objective of the course is to equip students with effective report writing skills and research methodologies. Students shall develop solid technical report and paper/thesis writing skills, analysis and data interpretation techniques, and research methodologies

Course Code: EnEg 5107
Course Name: Environmental Policy and Management Systems
Credit Hour: 3
Prerequisite: None

This course deals with the current practices and policies pertaining to the development, implementation and maintenance of environmental management systems (EMS) in an organization. ISO standards will be examined and case studies will be used to highlight the key factors involved with EMS implementation. The process of assessing environmental impacts and aspects and implementing continuous improvement measures will be addressed. This course also reviews the Procedures and Guidelines to conduct Environmental Audit.

Course Code: EnEg 5103
Course Name: Ecological engineering
Credit Hour: 3
Prerequisite: None

The course designed to deliver the principles of ecological engineering, components and characteristics of Freshwater Ecosystems, the energy and flow in the ecosystem for sustainable ecosystems that integrate human society with its natural environment for the benefit of both. Particular emphasis is placed on application of ecological engineering in the restoration of streams and rivers, lakes and reservoirs and wetlands, as well as treatment wetlands and mined land reclamation

Course Code: EnEg 5105
Course Name: Hazardous and E-waste Engineering
Credit Hour: 2
Prerequisite: EnEg4102

The course syllabus for hazardous and electronic waste engineering is focused on the identification, analysis and synthesis of wastes that are hazardous in nature and contain electronic components in them. It also explores the emerging technologies to treat and recycle different parts of these wastes. The courses covers Sources of waste, Classification of waste, Characterization and Emerging treatment and recycling technologies.

Course Code: EnEg 5109
Course Name: Soil pollution and Remediation technologies
Credit Hour: 3
Prerequisite: EnEg3107 and EnEg 3101

This course deals with soil pollution, technologies and approaches that are used for contaminated soil remediation and restoration. It will introduce the subject of soil pollution from a wide range of sources and human risks associated

with contaminated site remediation. Different remediation technologies and strategies to clean up contaminated soil will be covered.

Course Code: EnEg 5101
Course Name: Renewable Energy Engineering
Credit Hour: 3
Prerequisite: EnEg4107

In global wide renewable energy is one of the best solutions for current global climate deterioration and its effect on human being. Bringing this to this course, knowing renewable energy is, one step being the part of the solution for this problem. The course introduces the engineering aspect of the renewable energy, how we are going to use the energy using the tools of engineering. It introduces the growing field of renewable energy i.e. solar energy, wind energy, bio energy and other alternative energy. In this course students will be introducing on the preliminary design of different renewable energy equipments and they will participate in a combination of interactive classroom instruction and tries to construct simple renewable equipment from the resource at the disposal. As it is known all of the primary energy for electricity in Ethiopia is obtain from renewable energy therefore, this course will give also site for students to see those applications and their procedural follow up before implemented to real case scenario.

Course Code: EnEg 5107
Course Name: Final Year Project-I
Credit Hour: P/F
Prerequisite: EnEg 4114

The course provides students to Prepare a standardized Proposal for their project. The topic for the project is assigned by the department and can be connected to any of the major subjects already taught. The subject of the assignment preferably considers the needs of the country.

Course Code: EnEg 5102
Course Name: Industrial waste management technologies
Credit Hour: 3
Prerequisite: EnEg4102 and EnEg4109

The course is designed to provide students with an understanding of technical issues and the management of wastes how to treat and manage waste and control pollution in an integrated and comprehensive manner, permitting evaluation of benefits of waste minimization to industry and of pollution reduction in the environment.

Course Code: EnEg 5106
Course Name: Final Year Project-II (Main Research)
Credit Hour: 6
Prerequisite: EnEg5107

A prospective graduate student has to prove the fact that he/she can solve a given problem independently and with little input from his mentor. The prospective graduates could apply their knowledge to solve Ethiopian-related or other problems up to the expectation of his mentor in particular and department in general.

Course Code: EnEg 5108
Course Name: Climate change, adaptation and mitigation Technologies
Credit Hour: 3
Prerequisite: EnEg4114

Course Code: EnEg 5104
Course Name: Health, Safety and Environment (HSE) Engineering
Credit Hour: 3
Prerequisite: None

This course is designed to enable students describe the fundamental concepts and principles of occupational health, Safety and environment. It enables students to identify and analyses the major work place and environmental hazards and risks as well as assess risks and design mitigation measures for risks and hazards.

2.5.3.3 Elective courses

Course Code: EnEg 5201
Course Name: Environmental Biotechnology
Credit Hour: 3
Prerequisite: EnEg2102

This course is designed to enable students discusses and analyze the principles and applications of biotechnology in solving to environmental problems.

Course Code: EnEg 5203
Course Name: Cleaner Production and Life Cycle Assessment
Credit Hour: 3
Prerequisite: None

This course is designed to improve the environmental performance of industrial sectors that can enhance competitiveness and profitability. This is a win-win situation for both business and the environment while achieving sustainable development goals. Cleaner production is the technique that reduces or eliminates wastes at the source of pollution from the industry. Similarly, the life cycle assessment is also designed to give an essential overview of environmental prevention. It will help to interpret and evaluate LCA studies that can help to reduce or eliminate waste production. This analytical framework and quantitative techniques are used for systematically and holistically evaluation of environmental trade-offs presented by different alternatives to enable more informed decision-making.

Course Code: EnEg 5205
Course Name: Air quality modelling and forecasting
Credit Hour: 3
Prerequisite: EnEg3104

The course provides the fundamentals of air pollution meteorology and numerical modelling of air quality. It covers the air pollution methodology, Air Pollutants Source Distribution Models for the development, application and evaluation of air quality models. It will provide students with hands-on computer practicing. Different computer modelling techniques for solving major atmospheric processes used in current air quality models

Course Code: EnEg 5207
Course Name: Sludge treatment technologies
Credit Hour: 3
Prerequisite: EnEg2106 and EnEg4109

This course is designed to introduce the students to handling, treating, resource and energy recovery and disposing of sludge produced by wastewater treatment plants. It covers sludge pumping, thickening, conditioning, dewatering, digestion, drying storage and final disposal. Various ways of transforming sludge into useful products has also been described in detail. It also discusses loading parameters for gravity thickeners and operational parameters for air flotation thickeners. This course will provide guidelines for chemical and thermal conditioning of sludge. Finally, it illustrates the design parameters for aerobic, standard and high-rate anaerobic sludge digesters. Advanced sludge treatment (AST) options, including pyrolysis and gasification will also be briefly covered. Finally energy recovery alternatives will be analyzed.

Course Code: EnEg 5202
Course Name: Ecological Risk Assessment
Credit Hour: 3

Prerequisite: EnEg5103

This course is designed to enable students describe the fundamental concepts and principles of ecological risk assessment. The course will cover environmental exposure assessment; ecotoxicology at sub-organism, organism, population and community levels. It also includes human toxicology and risk assessment.

Course Code: EnEg 5204
Course Name: Green Building
Credit Hour: 3
Prerequisite: None

Green buildings offer widespread benefits to a number of building industry stakeholders, including building occupants and society as a whole. Knowing this course will be a solution for environmental issues related to the building. This course introduces the key principles of green building and sustainable development for buildings by examining energy usage, water consumption, options for green building materials and resources selections , selecting sustainable sites, and how site and landscape design can maximize natural benefits and indoor environmental quality. In this course students will be introducing on key trends in building design, like the application of net zero buildings and building in high risk zones then put green building in a broader sustainability context by completing small home and community design project that maximize the sustainability and green building concepts, such as green roof, green wall and Green gardening landscape, by using locally available materials.

Course Code: EnEg 5203
Course Name: Cleaner Production and Life Cycle Assessment
Credit Hour: 3
Prerequisite: None

2.6 Bachelor of Science Degree in Electrical and Computer Engineering

2.6.1 Program Education Objective (PEO)

The program education objectives shall describe accomplishments that the five years program graduates are expected to achieve in the first 3 to 5 years after graduation. The Department of Electrical and Computer Engineering has set the following program education objectives:

PEO1: The graduates will become professional engineers.

PEO2: The graduates will establish their own start-up companies.

PEO3: The graduates will be employed in high-ranking companies and universities locally and internationally.

PEO4: The graduates will be involved in research, design, and development works.

2.6.2 Program Outcome (PO)

Program outcomes are statements that express the knowledge, skills and attitudes of graduates of this program. Apparently, they are extensions and summaries of graduate profiles presented above. For this program twelve Program Outcomes are identified as presented below:

PO1: Apply fundamental knowledge of mathematics, physics and various computational methods to analyze and solve electrical and computer engineering related problems.

PO2: Identify, formulate, research literature and analyze complex electrical and computer engineering problems reaching substantiated conclusions using first principles of mathematics, applied physics and engineering sciences.

PO3: Design solutions for complex engineering problems and systems, components and processes that met specified needs, and develop new solutions with appropriate considerations for public, health, safety, cultural, societal and environmental considerations.

PO4: Conduct experiments, analyze and interpret results, and apply research outcomes to develop new technologies and improve existing ones.

PO5: Create, select and apply appropriate techniques, resources and modern engineering and ICT tools, including prediction and modeling, to complex electrical and computer engineering problems, with an understanding of the limitations.

PO6: Apply contextual knowledge to assess societal, health, safety, legal and cultural issues and the consequent responsibilities relevant to professional engineering practices and solutions to engineering problems.

PO7: Understand and evaluate the sustainability and impact of professional electrical and computer engineering works while solving complex engineering problems in societal and environmental contexts.

PO8: Ability to recognize ethical and professional responsibilities in engineering situations and make informed judgments which must consider the impact of engineering solutions in global economic, environmental, and societal contexts.

PO9: Ability to work independently and as a team, and as a leader, motivating professionalism in multidisciplinary settings.

PO10: Communicate effectively, in both written and orally, on complex electrical and computer engineering activities with a variety of audiences.

PO11: Demonstrate knowledge and understanding of engineering management principles and economic decision-making and apply these to one's own work as a member and leader in a team, to manage projects in multi-disciplinary environments.

PO12: Recognize the personal, national, and global needs for, and the preparation and ability to engage in, independent and life-long learning in the broadest context of technological dynamism.

2.6.3 Program Courses Synopsis

Course Code: Math-1051
Course Name: Applied Mathematics IB
Credit Hour: 4
Prerequisite: None

This course covers basic elements of vectors, vector spaces, matrices, determinants, solving systems of linear equations, concepts and applications of differential and integral calculus of one variable.

Course Code: MEng 2101
Course Name: Engineering Drawing
Credit Hour: 3 (1 Lecture, 1 Tutor and 5 Practical)
Prerequisite: None

The course Engineering Drawing covers introduction and importance of engineering drawing, drawing instruments, drawing standards and conventions; theories of projection: types and systems of projections, projections of points and lines; multi-view drawings; pictorial drawing; auxiliary views and sectional view.

Course Code: Comp 2003
Course Name **Introduction to Computer Programming**
Credit Hour: 3
Prerequisite: None

This course, after a brief introduction of what programming languages are and their classifications extends fundamental programming principles and concepts. It specifically deals with variables and constants; scope; operators and operator precedence; comment statements; input and output statements; control structures and arrays; functions and pointers; and structures and files.

Course Code: Meng2104
Course Name Engineering Mechanics-I (Statics)
Credit Hour: 3
Prerequisite: General Physics (Phys-1101)

Engineering mechanics (Statics) is the application of mechanics (one of the three branches of Physics) to solve problems involving common engineering elements.

Course Code: Comp 2003
Course Name Engineering Mechanics II (Dynamics)
Credit Hour: 3
Prerequisite: CEng2103: Engineering Mechanics I (Statics)

Math1051: Applied Mathematics-I

Basic equations of motion; Kinematics of particles and rigid bodies; Kinetics of particles and rigid bodies

Course Code: Math-2011
Course Name Applied Mathematics II
Credit Hour: 4
Prerequisite: Applied Mathematics I (Math 1051)

This course covers basic elements of sequence and series, power series, differential calculus of several variables and multiple integral concepts and their applications.

Course Code: Math-2022
Course Name Applied Mathematics IIIB
Credit Hour: 4
Prerequisite: Applied Mathematics II (Math-2011))

This course covers basic elements of ordinary differential equations, Laplace and Fourier transforms, vector differential calculus, Line and surface integral and complex analytic functions.

Course Code: MEng2105
Course Name **Engineering Thermodynamics**
Credit Hour: 3
Prerequisite Applied Mathematics I (Math-1051)

Fundamental concepts; Pure substances; Vapor pressure curves; Steam tables; Phase diagrams of steam; First law of Thermodynamics: closed and open systems, enthalpy; Second law of Thermodynamics: Reversible and irreversible processes; Carnot cycle; Entropy; Ideal gases and their mixtures; gas-steam mixtures; wet air; psychometric charts and air conditioning process; Vapor power and refrigeration cycles; Air standard cycles;

Course Code: Course Code: ECEg2102
Course Name **Fundamentals of Electrical Engineering**
Credit Hour: 4
Prerequisite Math-1014: Applied Mathematics I for Engineering

In this course we discuss about: Review of Electromagnetic Phenomenon and Variables, Electric Circuit parameters, Circuit Analysis, SteadyState Single Phase AC Circuit Analysis, Transient Circuit Analysis, Introduction to poly phase systems.

Course Code: ECEg2110
Course Name Probability and Random Process
Credit Hour: 3
Prerequisite

Course Code: ECEg3101
Course Name Computational Methods
Credit Hour: 4
Prerequisite Applied Engineering Mathematics III (Math-2022) and C++ Programming (ECEg2108)

The course aims at introducing students in finding numerical solutions to problems for which analytical solutions either do not exist or are not readily or cheaply obtainable. It enables students to apply linear algebra and calculus. It also aims to helps student develop programming skills.

Course Code: ECEg3103
Course Name Applied Electronics I
Credit Hour: 4(L 2,P 3,T 3)
Prerequisite Fundamentals of Electrical Engineering (ECEg2102)

The course focuses on discussing basic semiconductor theory, semiconductor diodes and their applications, BJT, FET, Amplifier frequency response, Multistage amplifiers, Power amplifier and Tuned amplifiers.

It also introduces the basic measurements on characteristics of electronic devices and circuits, semiconductor diode characteristics, rectification and filtering, bipolar junction transistor characteristics, transistor biasing and operating point stability, transistor amplifier, frequency response, multistage amplifier, power amplifier and Tuned amplifier.

Course Code: ECEg3105
Course Name **Signals and Systems Analysis**
Credit Hour: 3
Prerequisite Math-2022**:** Applied Mathematics III

The course aims and enables student to understand and apply the representation, classification, characterization and analysis of signals and systems in time and frequency domains.

Course Code: ECEg3107
Course Name **Electromagnetic Fields**
Credit Hour: 3
Prerequisite ECEg2102: Fundamentals of Electrical Engineering

This course lays the foundation for understanding basic electromagnetic concepts, fundamental governing laws and guiding principles which students can apply in subsequent courses. The course covers: Vector Algebra, Scalar and Vector Fields, Coordinate Systems and Transformation, Vector Calculus, Line, Surface and Volume Integrals, Vector Differential Operator, Electrostatic fields, Coulomb's and Gauss's Laws for static electric charge distributions in vacuum and material bodies, Electrostatic Boundary Value Problems, Poisson's and Laplace's equations, Resistance and Capacitance, Magneto static Fields, Biot-Savart's and Ampere's Laws for steady state current source in free and material space, Magnetic Forces, Materials, and Devices, Faraday's Law, Maxwell's Equations for Static and dynamic (time-varying) Electromagnetic Fields

Course Code: ECEg3109
Course Name **Object Oriented Programming**
Credit Hour: 3
Prerequisite C++ Programming (ECEg2108)

This course is designed to provide the fundamental theories and principles and techniques of object-oriented programming paradigms. Topics to be dealt with are: classes, objects, data abstraction, encapsulation and information-hiding, overloading, subclasses and inheritance, polymorphism, class hierarchies and exception handling. This course also gives chances to students to work on object-oriented programming language during practical session to implement; test and experiment an object oriented paradigm of the program design and implementation.

Course Code: ECEg4111
Course Name **Research Methods and Presentation**
Credit Hour: 2

Prerequisite None

This course deals with discussion of research and development methods. Moreover, it addresses current and emerging research topics in the area of computer engineering. Selection of topics for individual projects depends on the instructors and department. Literature review and analysis, intensive readings, discussions and reports will be the main activities and assessment methods.

Course Code: ECEg3112
Course Name **Electrical Workshop Practice I**
Credit Hour: 1
Prerequisite None

In this course we discuss about: General Safety rules, Common types of Electrical hand Tools, Wiring materials and accessories, Termination, splicing of solid and flexible wires, Soldering; Residential installation which includes Lighting, Power and Signal circuits; Fire Alarm installation, Security camera installation, testing and inspecting these electrical installations.

Course Code: ECEg3102
Course Name **Applied Electronics II**
Credit Hour: 3
Prerequisite ECEg3103-Applied Electronics I

The course focuses on discussing advanced electronics circuits and concepts of feedback system. Discusses the working principles of differential and operational amplifiers. Design and simulate the circuits of differential and operational amplifiers using Multisim. Discuss, design and simulate applications of amplifiers.

Introduces to the wave shaping circuits such as oscillators and Multi vibrators, timers and switching circuits.

Course Code: ECEg3104
Course Name **Digital Logic Design**
Credit Hour: 4
Prerequisite Applied Electronics II (ECEg3102)

Digital Logic Design is a comprehensive study of the principles and techniques of modern digital system. It provides an overview of the principles underlying number systems, arithmetic operations, decimal and alphanumerical codes, Boolean algebra, combinational and sequential circuits. Furthermore, analysis and design of combinational sequential logic system is discussed.

Course Code: ECEg3106
Course Name **Network Analysis and Synthesis**
Credit Hour: 3
Prerequisite ECEg3105: Signals and Systems Analysis

The course covers the techniques of modeling, analysis, design and synthesis of N-Port passive and active and passive electrical filters in a classical and a modern approach

Course Code: ECEg3108
Course Name **Digital Signal Processing**
Credit Hour: 4
Prerequisite ECEg3105: Signals and Systems Analysis

The course mainly deals with digital signal processing: sampling and quantization, A/D and D/A converters, Discrete-time systems convolution, Z-transforms and its Implementation, Digital filter realizations Fast Fourier transforms digital filter design, decimation and interpolation, random signals, and some applications. It also introduce FIR and IIR Filters, Filter Design Methods, Interpolation and Decimation, Adaptive Signal Processing and its application, Image and Speech Processing.

Course Code: ECEg4113
Course Name **Electrical Machines I**
Credit Hour: 4
Prerequisite ECEg3107: Electromagnetic Fields

In this course we discuss about: Principle of magnetics, Transformers, Induction Machine, DC Machine and synchronous Machine

Course Code: ECEg4107
Course Name **Electrical Workshop Practice II**
Credit Hour: 2
Co. requisite ECEg4113 Electrical Machine I

In this course we discuss about: Rewinding of transformers and Stator of three phase Squirrel cage Induction motor; starting and control of 3-phase Induction Motor, Explain and perform Computer maintenance and Repair of electrical apparatus coil (Relay coil)

Course Code: ECEg4101

Course Name **Introduction to Communication Systems**

Credit Hour: 3

Pre requisite ECEg3102: Applied Electronics II

ECEg3105: Signals and System Analysis

ECEg2110: Probability and Random Processes

This course is intended to give a strong background on Communication Systems Engineering. It starts by introducing basic concepts of communication systems, and it contains in-depth study of analog communication systems such as: AM, PM, and FM modulation/demodulation techniques. It also introduces digital modulation techniques and data communication.

Course Code: ECEg4103

Course Name **Computer Architecture and Organization**

Credit Hour: 3

Pre requisite Digital logic design (ECEg3104)

This course introduces students to the organization and architecture of computer systems, beginning with the standard von Neumann model and then moving forward to more recent architectural concepts. **General Introduction**: Organization and architecture, computer evolution, measuring performance, models of a computer system; **The Central Processing Unit**: Computer arithmetic, Instruction sets, Instruction format and addressing modes, RISC and CISC, Pipelining, The Control Unit (Hardwired and Micro-Programd Implementations); assembly/machine language programming; **Memory Systems**: Classification and hierarchy of Memory systems, Main memory, Cache Memory, Secondary Memory, Other types of memory, Memory Management I/O and interrupts; **Input Output Systems**: Input Output devices, modes of transfer, I/O interface, Techniques used for I/O Operations: Programd, Interrupt-driven, Direct Memory Access.

Course Code: ECEg4153

Course Name **Introduction to Control Systems**

Credit Hour: 3

Pre requisite Computational Method, Applied Electronics I

This course mainly provides students with the knowledge and skills required to the basic concept of control systems, mathematical modeling of physical system, characteristics of feedback and non-feedback system, time and frequency response analysis of control system. At last the students will able to design and analyze the stability of linear control systems.

Course Code: ECEg3110
Course Name **Electrical Measurement and Instrumentation**
Credit Hour: 3
Pre requisite Fundamentals of Electrical Engineering (ECEg2102)

This course mainly provides students with the basic operational principles and limitations of electrical and electronic instruments, sensors and transducers with their application, signal conditioning and conversion, output presentation, and instrument transformer.

Course Code: ECEg4109
Course Name **Power Systems I**
Credit Hour: 3
Pre requisite Electrical Machine I (ECEg4113)

This course introduces and explains fundamentals of electrical power systems design and engineering. Phasors and their application to power systems analysis are reviewed. The concept of the per-unit system is introduced and applied to circuit calculations. Transmission line parameters, their calculation, and transmission line modeling are introduced. Steady-state operation of transmission lines is modeled and investigated. Mechanical design aspect of overhead transmission line discussed. Brief introduction of underground cable construction and calculation of its insulation resistance is explained.

Course Code: ECEg4102
Course Name **Microprocessors and Interfacing**
Credit Hour: 4
Pre requisite Computer architecture and Organization (ECEg4103)

This course is designed to impart in-depth knowledge in the design, programming and organization of microcomputers and interfacing circuits. This course completely covers the popular Intel μP 8086, which would be a stepping-stone for learning the X 86 families of microprocessors. Fundamentals of Microprocessors and Microcontrollers Architecture; Register level organization; Memory organization; Bus systems; Peripheral hardware organization; Instruction Set; Assembly language programming: C programming; Microcontroller programming starting from the architecture to all its peripherals; Different applications of microcontroller in real world, lower level communication protocols for microcontrollers; Interfacing Fundamentals; Programmable Interrupt Controller (PIC); Programmable Peripheral Interface (PPI).

Course Code: ECEg4112
Course Name **Integrated Design Project**
Credit Hour: 3
Pre requisite Senior standing

This Integrated Design Project is either a group-based (up to 3) or individualized engineering design project to evaluate the overall knowledge of the student(s) before going for the BSc Thesis. If it is an individualized project the student will be evaluated on the basis of his/her understanding, application and presentation of basic computing knowledge and skills. If it is a group-based project each student will also be evaluated its role in the group work and its team work dimensions.

Course Code: ECEg4100
Course Name **Industry Internship**
Credit Hour: 6
Pre requisite Senior standing

The Students must be attached with an industry for at least five months in order to get real world experience in their field of study, which compliments their education. 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.

Course Code: ECEg5104
Course Name **Industrial Management and Engineering Economy**
Credit Hour: 3
Pre requisite Economics

Basics of management and functions of management; basics of plant layout, ergonomics and industrial safety; defining forecasting and the use of forecasting techniques; inventory management and control; basics of project management and resource allocation; project crashing and project risks; time value of money and cash flow; present and future worth of investments; basic concepts and computations of depreciation; cost comparison of alternative investments; accounting and budgeting fundamentals.

Course Code: ECEg518
Course Name **Final Year Project**
Credit Hour: 6
Pre requisite All senior standing courses

Success of the project is determined in large part by whether students have adequately solved the problem that they are working on.

2.7 Bachelor of Science Degree in Electromechanical Engineering

2.7.1 Program Educational Objectives (PEO)

Our graduates of the BSc degree in Electromechanical Engineering program are assumed to attain the following career achievements within three to five years of graduation. These objectives are based on the needs of the program's constituencies (government, employers, industries, alumni, students and research and development centers).

Table: Program Education Objectives (PEO)

PEO-1	Specify, design, deploy, implement, troubleshoot and maintain mechatronic systems.
PEO-2	Translate customer requirements and effectively integrate multiple mechanical, electronic, electrical and control systems.
PEO-3	Analyze the produced system and formulate its economic impacts on the overall organization
PEO-4	Communicate effectively in the professional environment in individual and group situations.
PEO-5	Apply appropriate strategies to maintain professional, ethical and social responsibilities in the workplace and include a respect for diversity.
PEO-6	Participate in lifelong learning to stay technically updated in the profession
PEO-7	Work effectively in individual and group-oriented settings by applying safety to all aspects of work.

2.7.2 Program Outcomes (PO)

Upon graduation, our BSc in Electromechanical Engineering program graduates will have the following attributes

PO-1 Engineering Knowledge Select and apply the knowledge, techniques, skills and modern tools in Electromechanical/Mechatronics Engineering

PO-2 Problem analysis Identify, formulate, research literature and analyze complex Electromechanical engineering problems reaching substantiated conclusions using first principles of mathematics, natural sciences and engineering sciences.

PO-3 Design /Development of Solutions Design solutions for complex Electomechanical health and safety, cultural, societal, and environmental considerations.

PO-4 Investigation conduct investigations of complex problems using research-based knowledge and research methods including design of experiments, analysis and interpretation of data, and synthesis of information to provide valid conclusions.

PO-5 Modern Tool usage Ability to create, select and apply appropriate techniques, resources and modern engineering and IT tools, including prediction and modeling, to complex engineering activities, with an understanding of the limitations.

PO-6 Environment and sustainability Ability to apply reasoning informed by contextual knowledge to assess societal, health, safety, legal and cultural issues and the consequent responsibilities relevant to professional engineering practice.

PO-7 The engineer and society Ability to understand the impact of professional engineering solutions in societal and environmental contexts and demonstrate knowledge of and need for sustainable development.

PO-8 Professional Ethics Ability to apply ethical principles and commit to professional ethics and responsibilities and norms of engineering practice.

PO-9 Individual and teamwork Function effectively as an individual and as a member or leader in diverse teams and in multidisciplinary environments engineering problems and design systems, components or processes that meet specified needs with appropriate consideration for public

PO-10 Communication Ability to communicate effectively on complex engineering activities with the engineering community and with society at large, such as being able to comprehend and write effective reports and design documentation, make effective presentations, and give and receive clear instructions.

PO-11 Life-long Learning Understand the need for an ability to engage in self-directed continuing professional development

PO-12 Project management and finance Ability to demonstrate knowledge and understanding of engineering and management principles and apply these to one's own work, as a member and leader in a team, to manage projects and in multidisciplinary environments.

2.7.3 Program Courses Synopsis

Course Code: Math-1051
Course Name: **Applied Mathematics IB**
Credit Hour: 4
Prerequisite: None ?

This course covers basic elements of vectors, vector spaces, matrices, determinants, solving systems of linear equations, concepts and applications of differential and integral calculus of one variable.

Course Code: MEng 2101
Course Name: Engineering Drawing
Credit Hour: 3 (1 Lecture, 1 Tutor and 5 Practical)
Prerequisite: None

The course Engineering Drawing covers introduction and importance of engineering drawing, drawing instruments, drawing standards and conventions; theories of projection: types and systems of projections, projections of points and lines; multi-view drawings; pictorial drawing; auxiliary views and sectional view.

Course Code: Comp 2003
Course Name **Introduction to Computer Programming**
Credit Hour: 3
Prerequisite: None

This course, after a brief introduction of what programming languages are and their classifications extends fundamental programming principles and concepts. It specifically deals with variables and constants; scope; operators and operator precedence; comment statements; input and output statements; control structures and arrays; functions and pointers; and structures and files.

Course Code: Meng2104
Course Name Engineering Mechanics-I (Statics)

Credit Hour: 3

Prerequisite: General Physics (Phys-1101)

Engineering mechanics (Statics) is the application of mechanics (one of the three branches of Physics) to solve problems involving common engineering elements.

Course Code: Comp 2003

Course Name Engineering Mechanics II (Dynamics)

Credit Hour: 3

Prerequisite: CEng2103: Engineering Mechanics I (Statics)

Math1051: Applied Mathematics-I

Basic equations of motion; Kinematics of particles and rigid bodies; Kinetics of particles and rigid bodies

Course Code: Math-2011

Course Name **Applied Mathematics II**

Credit Hour: 4

Prerequisite: Applied Mathematics I (Math 1051)

This course covers basic elements of sequence and series, power series, differential calculus of several variables and multiple integral concepts and their applications.

Course Code: EMEg3107

Course Name Fundamental of Electrical Circuits

Credit Hour: 4

Prerequisite: Applied Mathematics III

This course mainly provides students with the knowledge and skills required to identify basic electromagnetic phenomenon, circuit variables and parameters. The students will have the ability to apply the fundamental and derived circuit laws and theorems to the analysis of dc and steady state poly-phase ac circuits.

Course Code: EMEg3101

Course Name **Engineering Thermodynamics**

Credit Hour: 3

Prerequisite Applied Mathematics I

Fundamental concepts; Pure substances; Vapor pressure curves; Steam tables; Phase diagrams of steam; First law of Thermodynamics: closed and open systems, enthalpy; Second law of Thermodynamics: Reversible and irreversible processes; Carnot cycle; Entropy; Ideal gases and their mixtures; gas-steam mixtures; wet air; psychometric charts and air conditioning process; Vapor power and refrigeration cycles; Air standard cycles;

Course Code: EMEg2106

Course Name Mechanical Workshop Practice

Credit Hour: 2

Prerequisite No

Measuring and layout tools; Bench work; Wood work, Metal work, cutting with the aid of conventional machine tools; Operation and maintenance of appliances and machines; Welding, brazing and soldering; Manufacture of parts.

Course Code: EMEg2104

Course Name Object Oriented Programming in Python

Credit Hour: 3

Prerequisite Introduction to Computer Programming

This course will provide a pragmatic and hands-on introduction to the Python programming language, with a focus on practical applications and projects, rather than theoretical topics. Students will design and build software to solve problems from various disciplines. As the course progresses, students will learn to work with packages, data structures, & object-oriented programming.

Course Code: EMEg2102

Course Name Strength of Materials

Credit Hour: 3

Prerequisite Basics of Engineering Mathematics, Engineering mechanics

Concept of stress and strain – stress and strain under axial loading – torsion of circular shafts-shear force and bending moment diagrams – bending stresses in beams – transformation of stress and strain.

1. To know about how a solid (materials, structures) behaves when it is exposed to forces and deformations.
2. To apply the fundamental concepts of principle of superposition, equilibrium, compatibility, force deformation, and stress-strain relationships to the solid and structural mechanics problems.
3. To analyze determinate and indeterminate bars, beams, to determine axial forces, torques, shear forces, and bending moments.

To identify the biaxial stresses in acting in a body or an element. The course also aims to provide practical assignments and projects so as to prepare students for final year graduation project, by enhancing planning and team work skills as well as practical project work and building of prototypes

Course Code: EMEg3103
Course Name Computational Methods
Credit Hour: 3
Prerequisite Applied Mathematics III, Introduction to Computer programming

The course aims at introducing students in finding numerical solutions to problems for which analytical solutions either do not exist or are not readily or cheaply obtainable. It enables students to apply linear algebra and calculus. It also aims to helps student develop programming skills.

Course Code: MEng3151
Course Name Design of Machine Elements –I
Credit Hour: 3

Prerequisite Strength of Materials

Introduction to Machine Design, Material properties, Tolerances, Factor of Safety, Design for Static load and Design for Fatigue load, Static Theories of Failure, Fatigue Theories of Failure, Design of Welded, Bolted, Riveted Joints, Design of keys and keyways, Pin Joints, Joints, Design of Springs.

Course Code: MEng3112
Course Name Design of Machine Elements –II
Credit Hour: 3
Prerequisite Design of Machine Elements – I, Strength of Materials

Design of Shafts on the basis of strength and rigidity, Design procedures of couplings, Design of clutches using uniform pressure theory and uniform wear theory, Design of Rolling and sliding contact bearings, Design of Gears drives – Spur, Helical, Bevel and worm, Design of Flat and V belt drives, rope drives and chain drives.

Course Code: EMEg3105
Course Name: Workshop for Mechatronics
Credit Hour: 2
Prerequisite: Introduction to Computer Programming

This course mainly provides students with the knowledge and skills required to perform hand on projects. Students will have the ability to apply practical knowledge to real-world problems.

Course Code: EMEg3105

Course Name Signals & Systems

Credit Hour: 3

Prerequisite Applied mathematics III

The course will focus on how signals can be represented in time domain and how they can be transformed into other domains. The students will also learn about analytical techniques that allow modeling the behavior of the systems and gain an insight into the characteristics of signals. The course will provide skills to model, analyze and design signals and systems in general.

Course Code: MEng3110

Course Name Mechanism of Machinery

Credit Hour: 3

Prerequisite Engineering Mechanics II (Dynamics),Design of Machine Element II

Basics of Kinematic mechanisms – Velocity –Acceleration analysis for different mechanisms – law of gearing – gears- gear trains- balancing of rotating masses- force analysis – vibration analysis – control etc.,

Course Code: EMEg4108

Course Name Smart Materials & applications

Credit Hour: 3

Prerequisite No

The course aims to familiarize students with the structure and physical properties of smart materials used in Mechatronics engineering. New nanostructured active materials are being developed thanks to the advances in the fabrication technologies a n d to the understanding of frequently non-equilibrium conditions during their synthesis. In this course smart materials properties and structures will be discussed in the broader external conditions for the use with the presentation of selected application technologies and provide the students with the state-of-the-art knowledge on smart materials and smart systems, as well as the techniques used to functionalize common materials. They are now basis of numerous 21st century engineering solutions related to the control of environment, for energy management, for biotechnology, for integrated electronics, for aerospace, and for many others. Particular emphasis will be placed on the application of these materials in the industry. Examples of advanced practical applications will include smart sensors, smart actuators, energy conversion devices, advanced materials for electronics and data storage, etc.

Course Code: EMEg3108

Course Name Machine Drawing with CAD

Credit Hour: 3

Prerequisite Engineering Drawing

Introduction common engineering graphics software, representing of drawing primitives on a computer; hardware and software; Basic commands of drawing and editing, dimensioning and text annotations of a CAD software, Detail and assembly drawings of machine elements, Machine tolerance, allowances and surface texture symbols, 3D mechanical elements and their assemblies, Project works on machine elements and assemblies with CAD software.

Course Code: EMEg3106

Course Name Applied Electronics I

Credit Hour: 3

Prerequisite Fundamentals of Electrical Circuit

The course focuses on discussing basic semiconductor theory, semiconductor diodes and their applications, BJT, FET, Amplifier frequency response, Multistage amplifiers, Power amplifier and Tuned amplifiers.

It also introduces the basic measurements on characteristics of electronic devices and circuits, semiconductor diode characteristics, rectification and filtering, bipolar junction transistor characteristics, transistor biasing and operating point stability, transistor amplifier, frequency response, multistage amplifier, power amplifier and Tuned amplifier.

Course Code: EMEg4101

Course Name Applied Electronics II

Credit Hour: 3

Prerequisite Applied Electronics I

The course focuses on discussing advanced electronics circuits and concepts of feedback system. Discusses the working principles of differential and operational amplifiers. Design and simulate the circuits of differential and operational amplifiers using Multisim. Discuss, design and simulate applications of amplifiers.

Introduces to the wave shaping circuits such as oscillators and Multivibrators, timers and switching circuits.

Course Code: MEng4109

Course Name Mechanical Vibrations

Credit Hour: 3

Prerequisite Mechanisms of Machinery

Introduction to mechanical vibration; Modeling of dynamic systems; Single-degree of freedom System-Two degrees of freedom System-Damped and Undammed Longitudinal Vibrations; Transverse Vibration; Whirling of shafts; Torsional vibrations; Causes of vibrations; Introduction to vibration control and measurements.

Course Code: EMEg4103

Course Name Fluid Mechanics

Credit Hour: 3

Prerequisite Applied mathematics III

This subject aims to enable students to: understand key concepts and fundamental principles, together with the assumptions made in their development, pertaining to fluid behavior, both in static and flowing conditions; deal effectively with practical engineering situations, including the analysis and design of engineering systems and devices involving fluids and flow; appreciate possible applications and links to other disciplines; and engage in further specialized study or research. The subject also aims to enhance interests in fluid phenomena and applications. Topics include: fluid properties and statics; conservation laws of mass, momentum and energy; flow in pipes; external flow (lift and drag); boundary layers; flow measurements; and environmental fluid mechanics.

Course Code: MEng4105

Course Name Control Systems

Credit Hour: 4

Prerequisite Applied Mathematics III, Signals and Systems

This course mainly provides students with the knowledge and skills required to model physical systems in the form of differential equations. Students will have the ability to analyze systems in time and frequency domains and apply those theories to design a compensator and its realization.

Course Code: EMEg4107

Course Name Digital Signal Processing

Credit Hour: 3

Prerequisite Signal and system

This course mainly provides students with the knowledge and skill required to develop mathematical and analytical skills necessary to analyze digital signals both in time and frequency domains. From the system's perspective, the students will have the ability to incorporate extensive design skills which enables students to develop relevant prototypes with the desired level of accuracy.

Course Code: EMEg4112

Course Name Digital Logic Design

Credit Hour: 3

Prerequisite Applied Electronics II

Digital Logic Design is a comprehensive study of the principles and techniques of modern digital system. It provides an overview of the principles underlying number systems, arithmetic operations, decimal & alphanumerical codes, Boolean algebra, combinational and sequential circuits. Furthermore, analysis and design of combinational sequential logic system is discussed.

Course Code: EMEg4113

Course Name Instrumentation & Measurement Systems

Credit Hour: 3

Prerequisite Applied Electronics II

This course will introduce function, operation, and application of common mechatronics engineering instruments, measurement principles, and statistical analysis applicable for industrial instrumentation as used for troubleshooting, process measurements and process control. Specifically, the course will discuss measurement terminology, differentiating between analog and digital, describe the instrumentation used for electronic and mechanical testing and develop the principles of operation of transducers used for mechatronics system in industrial environment process parameter measurement and control.

The course will deal with the basic knowledge, techniques and components for transduction, conditioning and conversion of measurement signals. Thorough knowledge of elementary measurements principles for selected physical process variables.

The student will select and design simple measurement systems for a given application, based on different physical measurement principles, error analysis, signal conditioning, and data recording.

Course Code: EMEg4102

Course Name Modern Control Systems

Credit Hour: 4

Prerequisite DSP, Control systems

This course mainly provides students with the knowledge and skills required to analyze the mathematical models of simple and complex physical systems. Students will have the ability to find out the solutions and apply different controller design algorithms to real-world problems.

Course Code: EMEg4104

Course Name Industrial Automation and Process Control

Credit Hour: 3

Prerequisite Control systems

This course mainly provides students with the knowledge and skills required to analyze a process in the industry. The students will have the ability to apply different controller types and designing an automated system using PLC and SCADA.

Course Code: EMEg3104

Course Name Electrical Machine

Credit Hour: 3

Prerequisite Fundamentals of Electrical Circuit

In this course we discuss about: Principle of magnetics, Transformers, Induction Machine, DC Machine and synchronous Machine

Course Code: EMEg4110

Course Name Power Electronics & Drive

Credit Hour: 4

Prerequisite Applied Electronics II

This course mainly provides students with the knowledge and skills required to analyze various types of power electronics devices and their application to control circuits. The students will have the ability to apply power electronics to design motor drive circuits to implement feedback control mechanism.

Course Code: EMEg5109

Course Name Hydraulics & Pneumatics

Credit Hour: 3

Prerequisite Fluid Mechanics

Basics of fluid power systems-power generators hydraulic pumps-hydraulic actuators – control components-hydraulic circuits- working principles of pneumatic power system- trouble shooting-design of hydraulic circuits

1. Applying the working principles of fluid power systems and hydraulic pumps.
2. Applying the working principles of hydraulic actuators and control components.
3. Designing and develop hydraulic circuits and systems.
4. Applying the working principles of pneumatic power system and its components.
5 Solving problems and troubles in fluid power systems.

Course Code: EMEg4111

Course Name Industrial Internship

Credit Hour: 6

Prerequisite All Core Courses

The purpose of Industrial internship training is to expose students to real work of environment experience and at the same time, to gain the knowledge through hands on observation and job execution. From the industrial training, the students will also develop skills in work ethics, communication, management and others. Moreover, the practical training program allows students to relate theoretical knowledge with its application in manufacturing industry.

Course Code: EMEg5101

Course Name Design of Mechatronic Systems

Credit Hour: 4

Prerequisite Instrumentation measurement systems, Control systems, Modern control , Applied Electronics I , Embedded systems

The course provides the student with general overview of Mechatronic systems, their main components, actuator & transducer selection, development of control system algorithms, selection of physical controllers, and the design procedure for Mechatronic systems.

It mainly allows students to integrate their knowledge of measurement systems, control, electronics, programming and mechanics into designing comprehensive Mechatronic systems.

The students will have the ability to apply unified/integrated design approach to real-world problems of

Mechatronic system design and synthesis.

The course also aims students to provide practical assignments and the project work to prepare students for the final year graduation project, by enhancing planning and team work skills as well as practical project work and the building of prototypes

Course Code: EMEg5105

Course Name Embedded Systems

Credit Hour: 3

Prerequisite Applied Electronics II

This course mainly provides students with the knowledge and skills required to prototype any Industrial automation systems using microcontrollers. The students will master the techniques to interface different peripherals with microcontrollers and use various communication interfaces to build control automation systems from remote location.

Course Code: EMEg5103

Course Name Virtual Instrumentation

Credit Hour: 3

Prerequisite Instrumentation & Measurement

This course mainly provides students with the knowledge and programming skills required to interface instruments and acquire the data from sensors in Industrial mechatronic systems. The students will master the art of Visual and virtual instrumentation techniques.

Course Code: EMEg5107

Course Name Introduction to Robotics

Credit Hour: 3

Prerequisite control system

This course mainly provides students with the knowledge and skills required to analyze different robot functions. The students will have the ability to Use robot for industrial product effectiveness and simplification of human burden.

Course Code: EMEg4106

Course Name Manufacturing Processes and Automation

Credit Hour: 3

Prerequisite Mechanical Workshop Practice

This course provides the students an insight into different manufacturing processes used in the industry. It will provide the student with an introduction to the concepts and technologies of the principal manufacturing processes utilized by industry. Discussion subjects include the manufacturing system and its operating principles, casting, forming, material removal, welding, and advanced manufacturing processes. In addition, basic manufacturing automation concepts like, CNC Programming, Machining Codes, and Computer Assisted Programming.

Course Code: EMEg5106

Course Name Introduction to Computer Vision

Credit Hour: 3

Prerequisite DSP

This course mainly provides students with the knowledge and skills required to analyze digital images and video to extract vital information buried in them. The students will have the ability to apply theories and algorithms for real life applications such as face recognition, video surveillance and visual traffic management

Course Code: IETP4115

Course Name Integrated Engineering Team Project

Credit Hour: 3

Prerequisite

To expose the students to complex engineering problems by way of designing an engineering product/process/system/solution within such constraints as sustainability, cost-effectiveness, safety and environmental impact; to enhance students‟ skill in project management.

Course Code: EMEg5102

Course Name Industrial Management & Engineering Economy

Credit Hour: 3

Prerequisite

Basic management concepts and industrial organization; Work environment; Plant design; Materials management; Forecasting techniques; Basics of accounting principles; Project management; Financial evaluation.

Course Code: EMEG5104

Course Name Introduction to Machine Learning

Credit Hour: 3

Prerequisite Object oriented Programming in Python , Probability & Statistics

Machine learning uses interdisciplinary techniques such as statistics, linear algebra, optimization, and computer programming to create automated systems that can sift through large volumes of data at high speed to make predictions or decisions without human intervention. Machine learning as a field is now incredibly pervasive, with applications spanning from business intelligence to security, from analyzing biochemical interactions to

structural monitoring of aging bridges, and from emissions to astrophysics, etc. This class will familiarize students with a broad cross-section of models and algorithms for machine learning, and prepare students for research or industry application of machine learning techniques.

The course provides students with an in-depth introduction to two main areas of Machine Learning: supervised and unsupervised. Main models and algorithms for regression, classification & clustering and will be covered. Topics will include linear and logistic regression, probabilistic (Bayesian) inference, SVMs and kernel methods, ANNs, clustering, and dimensionality reduction. To be eligible for this course, prior knowledge of python programming, familiarity with linear algebra, probability theory has to be first fulfilled.

Course Code: EMEg5114

Course Name BSc Thesis

Credit Hour: 6

Prerequisite All courses in the curriculum

The purpose of a thesis is to enable the student to develop deeper knowledge, understanding, capabilities and attitudes in the context of the program of study.

It offers the opportunity to delve more deeply into and synthesize knowledge acquired in previous studies.

It also aims to create awareness on how to use the principles of different courses in a coordinated way and how to apply them in a product design, modification, adaptation, reengineering and development.

2.8 Bachelor of Science Degree in Mechanical Engineering

2.8.1 Program Education Objective (PEO)

The program educational objectives describe accomplishments that graduates of the program are expected to attain within five years after graduation. Graduates are expected to apply their expertise to contemporary problem solving, be engaged professionally, and develop the skill of independent and continuous learning, and will contribute to their organizations through leadership and teamwork. More specifically, the objectives are expertise, engagement, learning, leadership and teamwork.

Table: Program Education Objectives (PEO)

PEO	Statement
PEO-1	Our graduate will be able to pursue further study
PEO-2	Our graduate will be able to solve technical problems of the industry and participate in research and consultation service
PEO-3	Our graduate will be able to acquire industry and project leadership position
PEO-4	Our graduate will be engineering entrepreneur.

2.8.2 Program Outcomes (PO):

Engineering knowledge

PO1: Apply knowledge of mathematics, natural science, engineering fundamentals and an engineering specialization to the solution of complex mechanical engineering problems.

Problem analysis

PO2: Identify, formulate, research literature and analyze complex mechanical engineering problems reaching substantiated conclusions using first principles of mathematics, natural sciences and engineering sciences.

Design/ development of solutions

PO3: Design solutions for complex mechanical engineering problems and design systems, components or processes that meet specified needs with appropriate consideration for public health, and safety, cultural, societal and environmental considerations.

Investigation

PO4: Conduct investigations of complex mechanical engineering problems using research-based knowledge and research methods including design of experiments, analysis and interpretation of data, and synthesis of information to provide valid conclusions.

Modern tool usage

PO5: Create, select and apply appropriate techniques, resources and modern engineering and IT tools, including prediction and modeling, to complex mechanical engineering problems, with an understanding of the limitations.

The engineer and society

PO6: Apply reasoning informed by contextual knowledge to assess societal, health, safety, legal and cultural issues and the consequent responsibilities relevant to professional mechanical engineering practice and solutions to complex mechanical engineering problems.

Environment and sustainability

PO7: Understand and evaluate the sustainability and impact of professional engineering work in the solution of complex mechanical engineering problems in societal and environmental contexts.

Ethics

PO8: Apply ethical principles and commit to professional ethics and responsibilities and norms of engineering practice.

Individual and teamwork

PO9: Function effectively as an individual, and as a member or leader in diverse teams and in multi-disciplinary settings.

Communication

PO10: Communicate effectively on complex mechanical engineering activities with the engineering community and society at large, such as being able to comprehend and write effective reports and design documentation, make effective presentations and give and receive clear instructions.

Project management and finance

PO11: Demonstrate knowledge and understanding of engineering management principles and economic decision-making and apply these to one's own work as a member and leader in a team, to manage projects and in multi-disciplinary environments.

Lifelong learning

PO12: Recognize the need for, and have the preparation and ability to engage in, independent and life-long learning in the broadest context of technological change.

2.8.3 Program Courses Synopsis

Course Code: Math-1051
Course Name: **Applied Mathematics IB**
Credit Hour: 4
Prerequisite: None ?

This course covers basic elements of vectors, vector spaces, matrices, determinants, solving systems of linear equations, concepts and applications of differential and integral calculus of one variable.

Course Code: MEng 2101
Course Name: Engineering Drawing
Credit Hour: 3 (1 Lecture, 1 Tutor and 5 Practical)
Prerequisite: None

The course Engineering Drawing covers introduction and importance of engineering drawing, drawing instruments, drawing standards and conventions; theories of projection: types and systems of projections, projections of points and lines; multi-view drawings; pictorial drawing; auxiliary views and sectional view.

Course Code: Comp 2003
Course Name **Introduction to Computer Programming**
Credit Hour: 3
Prerequisite: None

This course, after a brief introduction of what programming languages are and their classifications extends fundamental programming principles and concepts. It specifically deals with variables and constants; scope; operators and operator precedence; comment statements; input and output statements; control structures and arrays; functions and pointers; and structures and files.

Course Code: Meng2104
Course Name Engineering Mechanics-I (Statics)
Credit Hour: 3
Prerequisite: General Physics (Phys-1101)

Engineering mechanics (Statics) is the application of mechanics (one of the three branches of Physics) to solve problems involving common engineering elements.

Course Code: Comp 2003

Course Name Engineering Mechanics II (Dynamics)

Credit Hour: 3

Prerequisite: CEng2103: Engineering Mechanics I (Statics)

Math1051: Applied Mathematics-I

Basic equations of motion; Kinematics of particles and rigid bodies; Kinetics of particles and rigid bodies

Course Code: Math-2011

Course Name **Applied Mathematics II**

Credit Hour: 4

Prerequisite: Applied Mathematics I (Math 1051)

This course covers basic elements of sequence and series, power series, differential calculus of several variables and multiple integral concepts and their applications.

Course Code: **MEng2104**

Course Name **Strength of Materials I**

Credit Hour: 3

Prerequisite: Applied Mathematics I (Math 1102)

Concept of stress and strain – stress and strain under axial loading – torsion of circular shafts-shear force and bending moment diagrams – bending stresses in beams – transformation of stress and strain.

Course Code: Math2142

Course Name **Applied Mathematics IIIB**

Credit Hour: 4

Prerequisite: **Math2101 - Applied mathematics IIB**

This course covers basic elements of ordinary differential equations, Laplace and Fourier transforms, vector differential calculus, Line and surface integral and complex analytic functions

Course Code: Math2142

Course Name **Engineering Thermodynamics I**

Credit Hour: 3

Prerequisite: Applied Mathematics I (Math 1102)

Thermodynamic notions and systems; Fundamental concepts; Pure substances; Vapor pressure curves; Steam tables; Phase diagrams of steam; Work and Heat; First law of Thermodynamics: closed and open systems, enthalpy; Second law of Thermodynamics: Reversible and irreversible processes; Carnot cycle; Entropy; Availability; Irreversibility

Course Code: MEng2108
Course Name **Basic Workshop Practice**
Credit Hour: 2
Prerequisite: Applied Mathematics I (Math 1102

Measuring and layout tools; Bench work; Wood work, Metal work, cutting with the aid of conventional machine tools; Operation and maintenance of appliances and machines; Welding, brazing and soldering; Manufacture of parts.

Course Code: MEng2110

Course Name **Machine Drawing with CAD**

Credit Hour: 4

Prerequisite: MEng2101 -Engineering Drawing

Introduction common engineering graphics software, representing of drawing primitives on a computer; hardware and software; Basic commands of drawing and editing, dimensioning and text annotations of a CAD software, Detail and assembly drawings of machine elements, Machine tolerance, allowances and surface texture symbols, 3D mechanical elements and their assemblies, Project works on machine components and assemblies with CAD software.

Course Code: MEng3101
Course Name **Engineering Thermodynamics II**
Credit Hour: 3
Prerequisite: Math1102 - Applied Mathematics I
MEng2106 - Engineering Thermodynamics

Fundamental concepts like Ideal gases and their mixtures, gas-steam mixtures, wet air, psychometric charts and air conditioning process. Vapor power and refrigeration cycles. Air standard cycles. Thermodynamic relations. Combustion. Phase equilibrium.

Course Code: MEng3103
Course Name **Strength of Materials II**
Credit Hour: 3
Prerequisite MEng2104 – Strength of Materials I

Concept of stress and strain – stress and strain under axial loading – torsion of circular shafts-shear force and bending moment diagrams – bending stresses in beams – transformation of stress and strain.

Course Code: **ECEg3101**
Course Name **Basic Electricity and Electronics**
Credit Hour: 3
Prerequisite

Course Code: **MEng3105**
Course Name **Engineering Materials**
Credit Hour: 4

Prerequisite

Fundamental concepts like Basic methods of iron and steel production, Properties and applications of steels and alloyed steels, Heat treatment process, Crystalline Structure and Defect in Crystals, Mechanical Properties, Properties and applications of different cast irons

Causes of corrosion and their protection, Properties and applications of polymer

Course Code: **MEng3107**
Course Name **Fluid Mechanics I**
Credit Hour: 3
Prerequisite Math2142 - Applied Mathematics III

Introduction to Fluid Mechanics; Hydrostatics pressure in Fluids; Flow Classification; Properties of flows; Reynolds Transport theorem, Differential Relations for fluid flow, Viscous fluid flows, Newtonian flows; Boundary Conditions, Stream functions, Vortices

Course Code: **MEng3102**
Course Name **IC Engines**
Credit Hour: 3
Prerequisite MEng3101 - Engineering Thermodynamics II

To impart the basic engine types, working principle, emission and alternative fuels skills to the learners such that there is seamless transition to advanced concepts

Course Code: **MEng4106**
Course Name **Motor Vehicle Engineering**
Credit Hour: 3
Prerequisite
Introduction; Pneumatic tires and wheel; Suspension systems;

Vehicle stability; Power train; Vehicle road performance; Braking system; Steering system; Vehicle Frame Construction; Vehicle body construction and detail; Vehicle body aerodynamics

Course Code: **MEng3104**
Course Name Introduction to Numerical Methods and FEM
Credit Hour: 3
Prerequisite Comp2103 - Introduction to computer programing,

Math2142 -Applied Mathematics III,

This course provides an introduction to Numerical Methods and Finite Element Methodsto solution of equations, interpolation and data fitting, numerical differentiation and integration, solution of ordinary differential equations, Introduction to FEM, comparison with other discretization methods, Global stiffness matrix, shape function, boundary conditions, plane truss problem, two-dimensional elements, Isoparametric elements, review of elasticity, beams and frames, dynamic problems, steady state heat transfer, potential flow problem, torsion of shafts.

Course Code: **MEng3106**
Course Name **Design of Machine Elements I**
Credit Hour: 3
Prerequisite MEng3103 - Strength of Materials

Introduction to Machine Design, Material properties, Tolerances, Factor of Safety, Design for Static load and Design for Fatigue load, Static Theories of Failure, Fatigue Theories of Failure, Design of Welded, Bolted, Riveted Joints, Design of keys and keyways, Pin Joints, Joints, Design of Springs.

Course Code: **MEng3108**
Course Name **Manufacturing Processes**
Credit Hour: 3
Prerequisite MEng2108 - Basic workshop Practice

Introduction and classification of manufacturing processes; Metal Casting Processes: Introduction to Metal Casting, Fundamentals of metal casting, Patterns: Types and various Pattern Materials, Molding processes, Casting Processes and Design, Defects in casting; Metal forming processes: Fundamentals of metal-forming process: Bulk metal forming processes, fundamentals of sheet metal processes; Metal removal Processes: Machining, Fundamentals of Metal Cutting, machining processes: Turning, Drilling, Milling and Shaping, Abrasive machining process, Machinability and Economics of metal cutting; Joining processes: Fundamentals of welding, Arc welding, Oxyacetylene welding and Solid state welding; Non-traditional machining processes

Course Code: MCng3110
Course Name **Introduction to Mechatronics**
Credit Hour: 3
Prerequisite Math2142 - Applied Mathematics III

ECEg3101 - Basic Electricity and Electronics

Introduction, Sensors and Transducers, Actuation Systems, Digital and Control systems, Recent advances

Course Code: MEng3112
Course Name **Fluid Mechanics II**
Credit Hour: 3
Prerequisite MEng3107 - Fluid Mechanics I

Dimensional analysis, Similitude, Boundary layer, shock waves, speed of sound, Normal shock, duct flow with friction, plane potential flow, aerofoil theo

Course Code: MEng4101
Course Name **Machine Elements II**
Credit Hour: 3
Prerequisite MEng3106 - Machine Elements I,

MEng3103 - Strength of Materials II

Design of Shafts on the basis of strength and rigidity, Design procedures of couplings, Design of clutches using uniform pressure theory and uniform wear theory, Design of Rolling and sliding contact bearings, Design of Gears drives – Spur, Helical, Bevel and worm, Design of Flat and V belt drives, rope drives and chain drives.

Course Code: MEng4103
Course Name **Heat Transfer**
Credit Hour: 3
Prerequisite MEng3101-Engineering Thermodynamics II

Math2142- Applied Mathematics III

Steady heat conduction: One and two dimensional applications; Analytical and numerical solutions; One dimensional transient heat conduction: Analytical, numerical and graphical solutions; Convective heat transfer: Forced and natural with laminar and turbulent flows; Boiling and condensation heat transfer coefficients; Dimensionless parameters; Radiation: Basic definitions; Black body radiation; Radiation of technical surfaces in the presence of absorbing and emitting gases; Heat exchangers: parallel, counter and cross flow.

Course Code: MEng4402
Course Name **Machining Technology**
Credit Hour: 3
Prerequisite MEng2108 – Basic Workshop Practice

MEng3108 - Manufacturing Processes

This course covers introduction to machining technology, metal cutting saws, drilling machines and operation, lathe machines and operations, shaper machines and operations, milling machines and operations, grinding machines, planning and slotting machines, boring machines and operations, broaching machines and operations & metal cutting experiments.

Course Code: MEng4105
Course Name Fluid Power Systems
Credit Hour: 3
Prerequisite MEng3112-Fluid Mechanics II &

MEng2102-Engineering Mechanics II

Introduction to Principles of Hydraulics and Pneumatics; Components and Design of Hydraulic and Pneumatic Systems; Electrical and Electronic Control Devices

Course Code: MEng4606
Course Name Turbomachinery I
Credit Hour: 3
Prerequisite MEng3112 - Fluid Mechanics II

MEng3101 - Engineering Thermodynamics II

This course will cover the basics of turbomachines for use with liquid (incompressible fluid). It will lead the student from the basic knowledge of fluid mechanics and thermodynamics to being able to perform the preliminary design of turbomachines, understand their wide applications in households, process industry and energy generation. Types and design of turbomachines, thermodynamics and fluid mechanics considerations, performance of turbomachines, velocity triangles, Euler turbomachinery equation, degree of reaction and its effect on efficiency, as well as topics on cavitation and water hammering, energy cascade will be discussed.

Course Code: ECEg4107
Course Name **Electrical Power and Machines**
Credit Hour: 3
Prerequisite ECEg3101 - Basic Electricity and Electronics

In this course we discuss about: Principle of magnetics, Transformers, Induction Machine, DC Machine and synchronous Machine

Course Code: IETP4115
Course Name Integrated Engineering Team Project
Credit Hour: 3
Prerequisite

This is a multidisciplinary team integrated engineering project in connection with a special engineering problem and under the guidance of a faculty member. The project synopsis consists of literature review, design, project management, business acumen, multidisciplinary team work, entrepreneurship

Course Code: MEng4109
Course Name **Mechanisms of Machinery**
Prerequisite MEng3101- Engineering Thermodynamics II
MEng3112 - Fluid Mechanics II
Credit Hour: 3

Prerequisite MEng2102 - Engineering Mechanics II

Basics of Kinematic mechanisms – Velocity –Acceleration analysis for different mechanisms, Cam Design –Gear Trains– gears- gear trains- balancing of rotating masses- force analysis, gyroscopes, Introduction to Computer Methods

Course Code: MEng5411
Course Name **Engineering Measurement and Metrology**
Credit Hour: 2
Prerequisite

This course includes introduction to metrology; error measurement and calibrations for various measuring instruments; limit fits and tolerances surface measurement; screw thread measurements, interferometry, Comparator, computer aided metrology and co-ordinate measuring machine.

Course Code: MEng4602
Course Name **Renewable Energy Systems**
Credit Hour: 3
Prerequisite MEng4103 - Heat Transfer

MEng3101- Engineering Thermodynamics II

MEng3112 - Fluid Mechanics II

Introduction to Renewable Energy Technology, Solar Energy, Solar Thermal Energy applications, Photovoltaic, Biomass Energy, biomass characterization Biomass Conversion, Wind Power, Hydropower Energy, Small and medium scale hydropower plants, Geothermal Energy

Course Code: MEng4102
Course Name Material Handling Equipment
Credit Hour: 3
Prerequisite MEng3101- Engineering Thermodynamics II
MEng3112 - Fluid Mechanics II

Prerequisite

Introduction; Main types and major classifications of material handling equipment; Basic principles of materials handling; Unit load concept; Basic considerations for design and selection of material handling equipment, Design of conveyers;

Course Code: MEng5601
Course Name **Energy Auditing and Management**
Credit Hour: 3
Prerequisite MEng3101 - Engineering Thermodynamics II,

MEng4103 - Heat Transfer

This course covers theoretical and empirical topics related to energy demand and consumption, energy production and supply, energy markets, public energy policies and regulation affecting (international) energy markets - with a strong emphasis on environmental effects and a focus on sustainable (alternative) energy sources. The course examines energy taxation, price regulation, energy efficiency and policies for controlling emissions. Energy efficiency and energy conservation opportunities and strategies of different sectors: energy auditing. Supply and demand side energy management. Special attention will be given to factors affecting the development of more sustainable energy sources.

Course Code: MEng4404
Prerequisite MEng3101- Engineering Thermodynamics II

MEng3112 - Fluid Mechanics II

Course Name **Computer Integrated Manufacturing**
Credit Hour: 3
Prerequisite MEng2110 - Machine Drawing with CAD

This course includes Introduction to CIM, automation and production types, Manufacturing Systems: Types of Manufacturing systems, Single and multi-station manufacturing systems, lines and assemblies; Product design and CAD/CAPP and CAM and their integrations; Group Technology and FMS: Part families, Part classification and coding systems: OPITZ, PFA, FFA, Applications of group technology, Component of FMS, Analysis of FMS, Production Planning and Control System: Production planning and schedule, Material requirements planning, Capacity planning, Shop floor control, Inventory control, manufacturing resource planning; Introduction to Robotics: Robot anatomy and related attributes, Robot control, Applications of industrial robots, Robot programming.

Course Code: MEng5311
Course Name **IC Engines and Motor Vehicles Lab**
Credit Hour: 1
Prerequisite MEng3102 - IC Engines,

MEng4106 - Motor Vehicles Engineering

Valve timing and port timing diagrams using timing diagram and dial gauge;

Determination of rotation and firing order with the help of valve overlap; Valve clearance adjustment and Influence of valve clearance to valve timing and engine performance; Study of hydraulic, electrical and eddy current dynamometers; Engine performance testing and emission analysis; Determination of fuel properties; Determination of the center of gravity location and brake force distribution; Performing vehicle inspection based on the regulation Ethiopian transport authority.

Course Code: MEng4406
Course Name Metal Casting Technology
Credit Hour: 3
Prerequisite MEng3105 - Engineering Materials

Fundamentals of casting: Pattern making, mold making, core making, solidification of metals, molding and core materials, design of castings, location of gates and risers, allowances for casting design and finishing of casting.

Course Code: MEng4108

Course Name **Turbomachinery**
Credit Hour: 4
Prerequisite MEng3112 - Fluid Mechanics II,

MEng3101 - Thermodynamics II

This course will cover the basics of turbomachines, both for use with liquid (incompressible) as well as gaseous (compressible) fluids. It will lead the student from the basic knowledge of fluid mechanics and thermodynamics to being able to perform the preliminary design of turbomachines, understand their wide applications in households, process industry, air transport and energy generation.Types and design of turbomachines, thermodynamics and fluid mechanics considerations, performance of turbomachines, velocity triangles, Euler turbomachinery equation, degree of reaction and its effect on efficiency , as well as topics on cavitation and water hammering, energy cascadewill be discussed.

Course Code: MEng5607
Course Name Turbomachinery II
Credit Hour: 2
Prerequisite **Turbomachinery 1**

This course will cover the basics of turbomachines for use with gaseous (compressible) fluids. It will lead the student from the basic knowledge of fluid mechanics and thermodynamics to being able to perform the preliminary design of turbomachines, understand their wide applications in households, process industry, air transport and energy generation. Types and design of turbomachines, thermodynamics and fluid mechanics considerations, performance of turbomachines, velocity triangles, Euler turbomachinery equation, degree of reaction and its effect on efficiency , as well as topics on surge and chocking in compressors will be discussed.

Course Code: MEng5305
Course Name **Automotive Electronic systems**
Credit Hour: 3
Prerequisite MEng4310 - Automotive Electrical Systems

Fundamentals of Automotive Electronics: Sensors Actuators and Microprocessor：Si Engine Management and digital engine control system：Ci Engine Management and Digital Engine Control System：Vehicle Management Systems：Introduction to Automotive Networking.

Course Code: MEng4310
Course Name Automotive Electrical systems
Credit Hour: 3
Prerequisite ECEg3101 - Basic Electricity and Electronics,

ECEg4107 - Electrical Power Machines,

MEng3102 - IC Engines

Batteries, starting system and Charging system, ignition, Lighting systems and accessories

Course Code: MEng4110
Course Name Refrigeration and Air Conditioning
Credit Hour: 4
Prerequisite MEng3110 - Engineering Thermodynamics II

MEng4103 - Heat Transfer

The aim of the course is to introduce and explain the basic fundamental principles of refrigeration and air conditioning systems. This course will introduce students with basic analysis, design and selection of refrigeration and air conditioning systems and equipment's applicable for different purpose. The course will provide students with a working knowledge of computer-aided calculations of thermal loads and their use in design of RAC systems

Course Code: MEng4114
Course Name Industrial Internship
Credit Hour: 6
Prerequisite MEng4101 - Machine Elements II

MEng4103 - Heat Transfer

This course focuses on providing students with an understanding of various operations and activities within the industry. Moreover, the course intended to create exposure to various engineering activities within the industry including operation and handling of different equipment, process and production methods, design and quality control & maintenance etc. The course will also equip students with hands -on-experience in handling various instruments.

Course Code: MEng4112
Course Name **Machine Design Project**
Credit Hour: 3
Prerequisite MEng4101 -Machine Elements II

Conceptual Design; Embodiment Design. Design procedures and special calculation methods related to the design projects; Practical design of typical machine assemblies; Simple machine units and elements; Design project: Unfired pressure vessels and jacks (Bottle, Scissor, Fiat Type, Service, etc.)

Course Code: MEng5101
Course Name **Power Plant Engineering**
Credit Hour: 3
Prerequisite Thermodynamics II, Fluid Mechanics or Fluid Mechanics II, Heat Transfer

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 Code: MEng5501
Course Name **Product Design and Development**
Credit Hour: 3
Prerequisite MEng4112 - Machine Design Project

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 Code: MEng5503
Course Name **Mechanical Vibration**
Credit Hour: 3
Prerequisite **MEng4109** – Mechanisms of Machinery

Introduction to mechanical vibration; Modeling of dynamic systems; Single-degree of freedom System-Two degrees of freedom system-Damped and Undamped Longitudinal Vibrations; Transverse Vibration; Whirling of shafts; Torsional vibrations; Causes of vibrations; Introduction to vibration control and measurements.

Course Code: MEng5505
Course Name **Maintenance of Machinery**
Credit Hour: 3
Prerequisite MEng4101 - Machine Elements II

MEng2108 - Basic Workshop Practice

Maintenance of machinery and installation is a comprehensive course designed to equip students with knowledge and skill of installation and commissioning of industrial machineries, damages of typical machine components and their causes; determination of the state of damage of equipment; elements of maintenance technology; how to maintain machineries and equipment; reliability, maintainability and availability; maintenance planning and organization; inventory management in maintenance.

Course Code: MEng5309
Course Name **Heavy Duty and Construction Equipment**
Credit Hour: 2
Prerequisite MEng3102 - IC Engines

MEng4106 - Motor Vehicles

Construction Equipment classification. Construction Equipment design, operation and specifications: Motor Grader, Scrapers, Dozers Excavators, Crushers, Asphalt plant, Concrete mixer.

Course Code: MEng5309
Course Name **Final Year Project Phase I**
Credit Hour:
Prerequisite MEng4112 - Machine Design Project

A project based subject in which students are required to undertake several group projects covering both the conceptual and detailed aspects of design. It involves different areas of the mechanical engineering discipline.

Course Code: MEng5309
Course Name **Final Year Project Phase I**
Credit Hour:
Prerequisite

2.9 Bachelor of Science Degree in Software Engineering

2.9.1 Program Education Objective (PEO)

The program education objective of the Software Engineering program is shown in table 2.

Table 2: Program Education Objectives (PEO)

PEO	Statement
PEO-1	To produce large scale software developers, project managers and leaderswho has an ability to address complex and large-scale problems.
PEO-2	To produce digital innovators and entrepreneurs.
PEO-3	To nurture professionally qualified software engineers with the potential to become consultant, trainer, software requirement engineer, software architect, system analyst, software quality assurance and tester.
PEO-4	To produce software engineers who incorporate standards and security in software development with appropriate consideration of socio-cultural and environmental safety.
PEO-5	To produce researchers and software engineers who will develop dynamic and smart software solutions using emerging technologies to address complex national and global challenges and demonstrate lifelong learning and continuing professional development.

2.9.2 Program Outcomes (PO):

Graduates of the Software Engineering program expected up on their graduation to demonstrate the ability to:

PO-1 Apply knowledge of mathematics, computing science, engineering fundamentals and software engineering specialization to address complex and large-scale problems.

PO-2 Identify, formulate, research literature and analyze complex problems, reaching substantiated (justifiable, validated) conclusions using software development principles, methodologies and tools.

PO-3 Design integrated and efficient software solutions, component or processes to address complex problems and implement them to meet the specified needs with appropriate consideration for public health and safety, cultural, societal (local and international) and environmental considerations.

PO-4 Conduct investigation of complex problems using research-based knowledge and research methods including design of experiments, analysis and interpretation ofdata, and synthesis of information to provide valid conclusions.

PO-5 Adopt, innovate, select and apply appropriate state of the art software design and development tools, methodologies, resources and emerging technologies including simulation, prediction and modeling for complex business process with understanding of their potential capabilities, limitations and associated risks.

PO-6 Apply logical reasoning and informed decision to assess societal, health, safety, privacy, security, legal and cultural issues and the consequent responsibilities relevant to software engineering application.

PO-7 Understand the impact of software applications in societal and environmental context and apply the principle of green computing for sustainable development.

PO-8 Apply ethical principles and commit to professional ethics and responsibilities and norms of software engineering practice.

PO-9 Function effectively as an independent software engineer, as a member or as a leader in a diverse team and multidisciplinary settings.

PO-10 Communicate effectively on complex business and system activities with the software engineering community and with a society at large; such as being able to comprehend and write effective reports, articles and design documentations using various tools, make effective presentations and give and receive clear instructions.

PO-11 Demonstrate knowledge and skill on software project management principles and apply these to manage software development processes and its resource requirements, costs in multidisciplinary projects.

PO-12 Recognize the need for and have the preparation as well as ability to engage in an independent and lifelong learning in the information and knowledge economy

2.9.3 Program Courses Synopsis

Course Code: Math-1051
Course Name: **Applied Mathematics IB**
Credit Hour: 4
Prerequisite: None ?

This course covers basic elements of vectors, vector spaces, matrices, determinants, solving systems of linear equations, concepts and applications of differential and integral calculus of one variable.

Course Code: MEng 2101
Course Name: Engineering Drawing
Credit Hour: 3 (1 Lecture, 1 Tutor and 5 Practical)
Prerequisite: None

The course Engineering Drawing covers introduction and importance of engineering drawing, drawing instruments, drawing standards and conventions; theories of projection: types and systems of projections, projections of points and lines; multi-view drawings; pictorial drawing; auxiliary views and sectional view.

Course Code: Comp 2003
Course Name **Introduction to Computer Programming**
Credit Hour: 3
Prerequisite: None

This course, after a brief introduction of what programming languages are and their classifications extends fundamental programming principles and concepts. It specifically deals with variables and constants; scope; operators and operator precedence; comment statements; input and output statements; control structures and arrays; functions and pointers; and structures and files.

Course Code: Meng2104
Course Name Engineering Mechanics-I (Statics)
Credit Hour: 3
Prerequisite: General Physics (Phys-1101)

Engineering mechanics (Statics) is the application of mechanics (one of the three branches of Physics) to solve problems involving common engineering elements.

Course Code: Comp 2003
Course Name Engineering Mechanics II (Dynamics)
Credit Hour: 3
Prerequisite: CEng2103: Engineering Mechanics I (Statics)

Math1051: Applied Mathematics-I

Basic equations of motion; Kinematics of particles and rigid bodies; Kinetics of particles and rigid bodies

Course Code: Math-2011
Course Name **Applied Mathematics II**
Credit Hour: 4
Prerequisite: Applied Mathematics I (Math 1051)

This course covers basic elements of sequence and series, power series, differential calculus of several variables and multiple integral concepts and their applications.

Course Code: **MEng2104**
Course Name **Strength of Materials I**
Credit Hour: 3
Prerequisite: Applied Mathematics I (Math 1102)

Concept of stress and strain – stress and strain under axial loading – torsion of circular shafts-shear force and bending moment diagrams – bending stresses in beams – transformation of stress and strain.

Course Code: Math2142
Course Name **Applied Mathematics IIIB**
Credit Hour: 4
Prerequisite: **Math2101 - Applied mathematics IIB**

This course covers basic elements of ordinary differential equations, Laplace and Fourier transforms, vector differential calculus, Line and surface integral and complex analytic functions

Course Code: Math2142
Course Name **Engineering Thermodynamics I**
Credit Hour: 3
Prerequisite: Applied Mathematics I (Math 1102)
Thermodynamic notions and systems; Fundamental concepts; Pure substances; Vapor pressure curves; Steam tables; Phase diagrams of steam; Work and Heat; First law of Thermodynamics: closed and open systems, enthalpy; Second law of Thermodynamics: Reversible and irreversible processes; Carnot cycle; Entropy; Availability; Irreversibility

Course Code: MEng2108
Course Name **Basic Workshop Practice**
Credit Hour: 2
Prerequisite: Applied Mathematics I (Math 1102

Measuring and layout tools; Bench work; Wood work, Metal work, cutting with the aid of conventional machine tools; Operation and maintenance of appliances and machines; Welding, brazing and soldering; Manufacture of parts.

Course Code: MEng2110
Course Name **Machine Drawing with CAD**
Credit Hour: 4
Prerequisite: MEng2101 -Engineering Drawing

Introduction common engineering graphics software, representing of drawing primitives on a computer; hardware and software; Basic commands of drawing and editing, dimensioning and text annotations of a CAD software, Detail and assembly drawings of machine elements, Machine tolerance, allowances and surface texture symbols, 3D mechanical elements and their assemblies, Project works on machine components and assemblies with CAD software.

Course Code: MEng3101
Course Name **Engineering Thermodynamics II**
Credit Hour: 3
Prerequisite: Math1102 - Applied Mathematics I , MEng2106 - Engineering Thermodynamics I

Fundamental concepts like Ideal gases and their mixtures, gas-steam mixtures, wet air, psychometric charts and air conditioning process. Vapor power and refrigeration cycles. Air standard cycles. Thermodynamic relations. Combustion. Phase equilibrium.

Course Code: MEng3103
Course Name **Strength of Materials II**
Credit Hour: 3
Prerequisite MEng2104 – Strength of Materials I

Concept of stress and strain – stress and strain under axial loading – torsion of circular shafts-shear force and bending moment diagrams – bending stresses in beams – transformation of stress and strain.

Course Code: **ECEg3101**

Course Name **Basic Electricity and Electronics**

Credit Hour: 3

Prerequisite

Course Code: **MEng3105**
Course Name **Engineering Materials**
Credit Hour: 4
Prerequisite

Fundamental concepts like Basic methods of iron and steel production, Properties and applications of steels and alloyed steels, Heat treatment process, Crystalline Structure and Defect in Crystals, Mechanical Properties, Properties and applications of different cast irons

Causes of corrosion and their protection, Properties and applications of polymer

Course Code: **MEng3107**
Course Name **Fluid Mechanics I**
Credit Hour: 3
Prerequisite Math2142 - Applied Mathematics III

Introduction to Fluid Mechanics; Hydrostatics pressure in Fluids; Flow Classification; Properties of flows; Reynolds Transport theorem, Differential Relations for fluid flow, Viscous fluid flows, Newtonian flows; Boundary Conditions, Stream functions, Vortices

Course Code: **MEng3102**
Course Name **IC Engines**
Credit Hour: 3
Prerequisite MEng3101 - Engineering Thermodynamics II

To impart the basic engine types, working principle, emission and alternative fuels skills to the learners such that there is seamless transition to advanced concepts

Course Code: **MEng4106**
Course Name **Motor Vehicle Engineering**
Credit Hour: 3
Prerequisite

Introduction; Pneumatic tires and wheel; Suspension systems;

Vehicle stability; Power train; Vehicle road performance; Braking system; Steering system; Vehicle Frame Construction; Vehicle body construction and detail; Vehicle body aerodynamics

Course Code: **MEng3104**
Course Name Introduction to Numerical Methods and FEM
Credit Hour: 3
Prerequisite Comp2103 - Introduction to computer programing,

Math2142 -Applied Mathematics III,

This course provides an introduction to Numerical Methods and Finite Element Methodsto solution of equations, interpolation and data fitting, numerical differentiation and integration, solution of ordinary differential equations, Introduction to FEM, comparison with other discretization methods, Global stiffness matrix, shape function, boundary conditions, plane truss problem, two-dimensional elements, Isoparametric elements, review of elasticity, beams and frames, dynamic problems, steady state heat transfer, potential flow problem, torsion of shafts.

Course Code: **MEng3106**
Course Name **Design of Machine Elements I**
Credit Hour: 3
Prerequisite MEng3103 - Strength of Materials

Introduction to Machine Design, Material properties, Tolerances, Factor of Safety, Design for Static load and Design for Fatigue load, Static Theories of Failure, Fatigue Theories of Failure, Design of Welded, Bolted, Riveted Joints, Design of keys and keyways, Pin Joints, Joints, Design of Springs.

Course Code: **MEng3108**
Course Name **Manufacturing Processes**
Credit Hour: 3
Prerequisite MEng2108 - Basic workshop Practice

Introduction and classification of manufacturing processes; Metal Casting Processes: Introduction to Metal Casting, Fundamentals of metal casting, Patterns: Types and various Pattern Materials, Molding processes, Casting Processes and Design, Defects in casting; Metal forming processes: Fundamentals of metal-forming process: Bulk metal forming processes, fundamentals of sheet metal processes; Metal removal Processes: Machining, Fundamentals of Metal

Cutting, machining processes: Turning, Drilling, Milling and Shaping, Abrasive machining process, Machinability and Economics of metal cutting; Joining processes: Fundamentals of welding, Arc welding, Oxyacetylene welding and Solid state welding; Non-traditional machining processes

Course Code: MCng3110
Course Name **Introduction to Mechatronics**
Credit Hour: 3
Prerequisite Math2142 - Applied Mathematics III

ECEg3101 - Basic Electricity and Electronics

Introduction, Sensors and Transducers, Actuation Systems, Digital and Control systems, Recent advances

Course Code: MEng3112
Course Name **Fluid Mechanics II**
Credit Hour: 3
Prerequisite MEng3107 - Fluid Mechanics I

Dimensional analysis, Similitude, Boundary layer, shock waves, speed of sound, Normal shock, duct flow with friction, plane potential flow, aerofoil theo

Course Code: MEng4101
Course Name **Machine Elements II**
Credit Hour: 3
Prerequisite MEng3106 - Machine Elements I,

MEng3103 - Strength of Materials II

Design of Shafts on the basis of strength and rigidity, Design procedures of couplings, Design of clutches using uniform pressure theory and uniform wear theory, Design of Rolling and sliding contact bearings, Design of Gears drives – Spur, Helical, Bevel and worm, Design of Flat and V belt drives, rope drives and chain drives.

Course Code: MEng4103
Course Name **Heat Transfer**
Credit Hour: 3
Prerequisite MEng3101-Engineering Thermodynamics II

Math2142- Applied Mathematics III

Steady heat conduction: One and two dimensional applications; Analytical and numerical solutions; One dimensional transient heat conduction: Analytical, numerical and graphical solutions; Convective heat transfer: Forced and natural

with laminar and turbulent flows; Boiling and condensation heat transfer coefficients; Dimensionless parameters; Radiation: Basic definitions; Black body radiation; Radiation of technical surfaces in the presence of absorbing and emitting gases; Heat exchangers: parallel, counter and cross flow.

Course Code: MEng4402
Course Name **Machining Technology**
Credit Hour: 3
Prerequisite MEng2108 – Basic Workshop Practice

MEng3108 - Manufacturing Processes

This course covers introduction to machining technology, metal cutting saws, drilling machines and operation, lathe machines and operations, shaper machines and operations, milling machines and operations, grinding machines, planning and slotting machines, boring machines and operations, broaching machines and operations & metal cutting experiments.

Course Code: MEng4105
Course Name Fluid Power Systems
Credit Hour: 3
Prerequisite MEng3112-Fluid Mechanics II &

MEng2102-Engineering Mechanics II

Introduction to Principles of Hydraulics and Pneumatics; Components and Design of Hydraulic and Pneumatic Systems; Electrical and Electronic Control Devices

Course Code: MEng4606
Course Name Turbomachinery I
Credit Hour: 3
Prerequisite MEng3112 - Fluid Mechanics II

MEng3101 - Engineering Thermodynamics II

This course will cover the basics of turbomachines for use with liquid (incompressible fluid). It will lead the student from the basic knowledge of fluid mechanics and thermodynamics to being able to perform the preliminary design of turbomachines, understand their wide applications in households, process industry and energy generation. Types and design of turbomachines, thermodynamics and fluid mechanics considerations, performance of turbomachines, velocity triangles, Euler turbomachinery equation, degree of reaction and its effect on efficiency, as well as topics on cavitation and water hammering, energy cascade will be discussed.

Course Code: ECEg4107
Course Name **Electrical Power and Machines**
Credit Hour: 3
Prerequisite ECEg3101 - Basic Electricity and Electronics

In this course we discuss about: Principle of magnetics, Transformers, Induction Machine, DC Machine and synchronous Machine

Course Code: IETP4115
Course Name Integrated Engineering Team Project
Credit Hour: 3
Prerequisite

This is a multidisciplinary team integrated engineering project in connection with a special engineering problem and under the guidance of a faculty member. The project synopsis consists of literature review, design, project management, business acumen, multidisciplinary team work, entrepreneurship

Course Code: MEng4109
Course Name **Mechanisms of Machinery**
Prerequisite MEng3101- Engineering Thermodynamics II
MEng3112 - Fluid Mechanics II
Credit Hour: 3
Prerequisite MEng2102 - Engineering Mechanics II

Basics of Kinematic mechanisms – Velocity –Acceleration analysis for different mechanisms, Cam Design –Gear Trains– gears- gear trains- balancing of rotating masses- force analysis, gyroscopes, Introduction to Computer Methods

Course Code: MEng5411
Course Name **Engineering Measurement and Metrology**
Credit Hour: 2
Prerequisite

This course includes introduction to metrology; error measurement and calibrations for various measuring instruments; limit fits and tolerances surface measurement; screw thread measurements, interferometry, Comparator, computer aided metrology and co-ordinate measuring machine.

Course Code: MEng4602
Course Name **Renewable Energy Systems**
Credit Hour: 3
Prerequisite MEng4103 - Heat Transfer

MEng3101- Engineering Thermodynamics II

MEng3112 - Fluid Mechanics II

Introduction to Renewable Energy Technology, Solar Energy, Solar Thermal Energy applications, Photovoltaic, Biomass Energy, biomass characterization Biomass Conversion, Wind Power, Hydropower Energy, Small and medium scale hydropower plants, Geothermal Energy

Course Code: MEng4102
Course Name Material Handling Equipment
Credit Hour: 3
Prerequisite MEng3101- Engineering Thermodynamics II
MEng3112 - Fluid Mechanics II
Prerequisite

Introduction; Main types and major classifications of material handling equipment; Basic principles of materials handling; Unit load concept; Basic considerations for design and selection of material handling equipment, Design of conveyers;

Course Code: MEng5601
Course Name **Energy Auditing and Management**
Credit Hour: 3
Prerequisite MEng3101 - Engineering Thermodynamics II,

MEng4103 - Heat Transfer

This course covers theoretical and empirical topics related to energy demand and consumption, energy production and supply, energy markets, public energy policies and regulation affecting (international) energy markets - with a strong emphasis on environmental effects and a focus on sustainable (alternative) energy sources. The course examines energy taxation, price regulation, energy efficiency and policies for controlling emissions. Energy efficiency and energy conservation opportunities and strategies of different sectors: energy auditing. Supply and demand side energy management. Special attention will be given to factors affecting the development of more sustainable energy sources.

Course Code: MEng4404
Prerequisite MEng3101- Engineering Thermodynamics II
MEng3112 - Fluid Mechanics II
Course Name **Computer Integrated Manufacturing**
Credit Hour: 3
Prerequisite MEng2110 - Machine Drawing with CAD

This course includes Introduction to CIM, automation and production types, Manufacturing Systems: Types of Manufacturing systems, Single and multi-station manufacturing systems, lines and assemblies; Product design and CAD/CAPP and CAM and their integrations; Group Technology and FMS: Part families, Part classification and coding systems: OPITZ, PFA, FFA, Applications of group technology, Component of FMS, Analysis of FMS, Production Planning and Control System: Production planning and schedule, Material requirements planning, Capacity planning, Shop floor control, Inventory control, manufacturing resource planning; Introduction to Robotics: Robot anatomy and related attributes, Robot control, Applications of industrial robots, Robot programming.

Course Code: MEng5311
Course Name **IC Engines and Motor Vehicles Lab**
Credit Hour: 1
Prerequisite MEng3102 - IC Engines,
MEng4106 - Motor Vehicles Engineering

Valve timing and port timing diagrams using timing diagram and dial gauge;

Determination of rotation and firing order with the help of valve overlap; Valve clearance adjustment and Influence of valve clearance to valve timing and engine performance; Study of hydraulic, electrical and eddy current dynamometers; Engine performance testing and emission analysis; Determination of fuel properties; Determination of the center of gravity location and brake force distribution; Performing vehicle inspection based on the regulation Ethiopian transport authority.

Course Code: MEng4406
Course Name Metal Casting Technology
Credit Hour: 3
Prerequisite MEng3105 - Engineering Materials

Fundamentals of casting: Pattern making, mold making, core making, solidification of metals, molding and core materials, design of castings, location of gates and risers, allowances for casting design and finishing of casting.

Course Code: MEng4108
Course Name **Turbomachinery**
Credit Hour: 4
Prerequisite MEng3112 - Fluid Mechanics II,

MEng3101 - Thermodynamics II

This course will cover the basics of turbomachines, both for use with liquid (incompressible) as well as gaseous (compressible) fluids. It will lead the student from the basic knowledge of fluid mechanics and thermodynamics to being able to perform the preliminary design of turbomachines, understand their wide applications in households, process industry, air transport and energy generation.Types and design of turbomachines, thermodynamics and fluid mechanics considerations, performance of turbomachines, velocity triangles, Euler turbomachinery equation, degree of reaction and its effect on efficiency , as well as topics on cavitation and water hammering, energy cascadewill be discussed.

Course Code: MEng5607
Course Name Turbomachinery II
Credit Hour: 2
Prerequisite **Turbomachinery 1**

This course will cover the basics of turbomachines for use with gaseous (compressible) fluids. It will lead the student from the basic knowledge of fluid mechanics and thermodynamics to being able to perform the preliminary design of turbomachines, understand their wide applications in households, process industry, air transport and energy generation. Types and design of turbomachines, thermodynamics and fluid mechanics considerations, performance of turbomachines, velocity triangles, Euler turbomachinery equation, degree of reaction and its effect on efficiency , as well as topics on surge and chocking in compressors will be discussed.

Course Code: MEng5305
Course Name **Automotive Electronic systems**
Credit Hour: 3
Prerequisite MEng4310 - Automotive Electrical Systems

Fundamentals of Automotive Electronics: Sensors Actuators and Microprocessor：Si Engine Management and digital engine control system：Ci Engine Management and Digital Engine Control System：Vehicle Management Systems：Introduction to Automotive Networking.

Course Code: MEng4310
Course Name Automotive Electrical systems
Credit Hour: 3
Prerequisite ECEg3101 - Basic Electricity and Electronics,

ECEg4107 - Electrical Power Machines,

MEng3102 - IC Engines

Batteries, starting system and Charging system, ignition, Lighting systems and accessories

Course Code: MEng4110
Course Name Refrigeration and Air Conditioning
Credit Hour: 4
Prerequisite MEng3110 - Engineering Thermodynamics II

MEng4103 - Heat Transfer

The aim of the course is to introduce and explain the basic fundamental principles of refrigeration and air conditioning systems. This course will introduce students with basic analysis, design and selection of refrigeration and air conditioning systems and equipment's applicable for different purpose. The course will provide students with a working knowledge of computer-aided calculations of thermal loads and their use in design of RAC systems

Course Code: MEng4114
Course Name Industrial Internship
Credit Hour: 6
Prerequisite MEng4101 - Machine Elements II

MEng4103 - Heat Transfer

This course focuses on providing students with an understanding of various operations and activities within the industry. Moreover, the course intended to create exposure to various engineering activities within the industry including operation and handling of different equipment, process and production methods, design and quality control & maintenance etc. The course will also equip students with hands -on-experience in handling various instruments.

Course Code: MEng4112
Course Name **Machine Design Project**
Credit Hour: 3
Prerequisite MEng4101 -Machine Elements II

Conceptual Design; Embodiment Design. Design procedures and special calculation methods related to the design projects; Practical design of typical machine assemblies; Simple machine units and elements; Design project: Unfired pressure vessels and jacks (Bottle, Scissor, Fiat Type, Service, etc.)

Course Code: MEng5101
Course Name **Power Plant Engineering**
Credit Hour: 3
Prerequisite Thermodynamics II, Fluid Mechanics or Fluid Mechanics II, Heat Transfer

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 Code: MEng5501
Course Name **Product Design and Development**
Credit Hour: 3
Prerequisite MEng4112 - Machine Design Project

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 Code: MEng5503
Course Name **Mechanical Vibration**
Credit Hour: 3
Prerequisite **MEng4109** – Mechanisms of Machinery

Introduction to mechanical vibration; Modeling of dynamic systems; Single-degree of freedom System-Two degrees of freedom system-Damped and Undamped Longitudinal Vibrations; Transverse Vibration; Whirling of shafts; Torsional vibrations; Causes of vibrations; Introduction to vibration control and measurements.

Course Code: MEng5505
Course Name **Maintenance of Machinery**
Credit Hour: 3
Prerequisite MEng4101 - Machine Elements II

MEng2108 - Basic Workshop Practice

Maintenance of machinery and installation is a comprehensive course designed to equip students with knowledge and skill of installation and commissioning of industrial machineries, damages of typical machine components and their causes; determination of the state of damage of equipment; elements of maintenance technology; how to maintain machineries and equipment; reliability, maintainability and availability; maintenance planning and organization; inventory management in maintenance.

Course Code: MEng5309
Course Name **Heavy Duty and Construction Equipment**
Credit Hour: 2
Prerequisite MEng3102 - IC Engines
MEng4106 - Motor Vehicles
Construction Equipment classification. Construction Equipment design, operation and specifications: Motor Grader, Scrapers, Dozers Excavators, Crushers, Asphalt plant, Concrete mixer.

Course Code: MEng5309
Course Name **Final Year Project Phase I**
Credit Hour:
Prerequisite MEng4112 - Machine Design Project

A project based subject in which students are required to undertake several group projects covering both the conceptual and detailed aspects of design. It involves different areas of the mechanical engineering discipline.

Course Code: MEng5309
Course Name **Final Year Project Phase I**
Credit Hour:
Prerequisite

3. College of Natural and Applied Sciences

- Bachelor of Science degree in Food Science and applied nutrition
- Bachelor of Science degree in Geology
- Bachelor of Science degree in Biotechnology
- Bachelor of Science degree in Industrial Chemistry

3.1 Bachelor of Science Degree in Food Sciences and Applied Nutrition

3.1.1 Program Education Objective (PEO)

The program educational objectives describe accomplishments that a four years program graduates are expected to attain within four years after graduation. Graduates will have applied their expertise to contemporary problem solving, be engaged professionally, and have continued to learn and adapt, and have contributed to their organizations through leadership and teamwork. More specifically, the objectives are expertise, engagement, learning, leadership and teamwork.

Table 3. Program Education Objectives (PEO)

PEO-1	Engage and succeed in their professional careers through teamwork, ethical behavior, proactive involvement, and effective communication
PEO-2	Develop an understanding of the importance of life-long learning through professional development, practical training, and specialized certifications; in addition, pursue postgraduate studies and succeed in academic and research careers.
PEO-3	Build progressively managerial, leading, and influential roles in their organizations and communities.

3.1.2 Program Outcomes (PO)

Applied science programs are measured through their attainment of the Program Outcome (PO)/ Program Learning Outcomes (PLO) of the program and its courses. These program outcomes are statements on what students shall know, understand, and perform upon completing their course and/or program of study.

Table : Program Outcome

PLO-1	An ability to identify, formulate, and solve broadly defined technical or scientific problems by applying knowledge of Food Science and Nutrition and/or technical topics to areas relevant to the discipline.
PLO-2	An ability to formulate or design a product, system, process, procedure or program to meet desired needs in Food Science and Nutrition.
PLO-3	An ability to develop and conduct experiments or test hypotheses, analyze and interpret data and use scientific judgment to draw conclusions in the area of Food Science and Nutrition.
PLO-4	An ability to communicate effectively with a range of audiences to provide Food Science and Nutrition Knowledge.
PLO-5	An ability to understand ethical and professional responsibilities in food regulation and the impact of technical and/or scientific solutions in global, economic, environmental, and societal contexts in the area of Food Science and Nutrition
PLO-6	An ability to function effectively on teams that establish goals, plan tasks, meet deadlines, and analyze risk and uncertainty in the sector of Food Science and Nutrition.
PLO-7	An ability to contribute in building Ethiopia, for the peaceful coexistence of peoples, healthy and productive citizen.

3.1.3 Program Courses Synopsis

Course Code: Math 1007

Course Name: Mathematics for natural science

Credit Hour: 3

Prerequisite: No

This course covers the basic concepts of logic and set theory, the real and complex number systems, Mathematical induction, least upper bound and greatest lower bound, functions and types of functions, polynomial and rational functions, logarithmic and exponential functions, trigonometric functions, hyperbolic functions and their graphs and analytic geometry.

3.1.3.1 Supportive courses

Course Code: InCh 2205

Course Name: Fundamentals of Analytical Chemistry

Credit Hour: 3

Prerequisite: None

The course covers ; Introduction to analytical chemistry; Acids and bases, neutralization titration; Complex formation, and complexometric titration: Gravimetric analysis; Chromatographic technique: paper, thin layer, gas chromatography and HPLC; Spectroscopic techniques; UV-Vis, AAS, IR, and introduction to mass spectroscopy and Nuclear Magnetic Resonance spectroscopy (NMR), fluorescence, and coupled techniques such as HPLC/GC-MS, ICP-MS/OES,

Course Code: Math1002

Course Name: Applied Mathematics IA

Credit Hour: 4

Prerequisite: None

This course is designed to develop students' confidence with mathematical concepts and relationships and use of mathematical skills and techniques in a range of contexts specifically problem solving and abstract thinking. Topics covered are basic elements of vectors, vector spaces, matrices, determinants, solving systems of linear equations, concepts and applications of differential and integral calculus of one variable.

3.1.3.2 Core course Synopsis

Course Code: Ent1108

Course Name: Entrepreneurship for Science

Credit Hour: 2

Prerequisite: No

This course is designed to encourage students to start their own business and to acquaint them with the peculiar challenges and management decisions faced by owners of small business. It will develop such entrepreneurial skills as: identifying business opportunities; initiating, financing, and developing new venture business plans. It also addresses issues of small business, such as: legal aspects, financing, costing, locating, personnel, marketing, competition, sources of funding, and constituency services.

Course Code: EmTe 2011

Course Name: Introduction to Emerging technologies

Credit Hour: 3

Prerequisite: No

This course will enable students to explore current breakthrough technologies in the areas of Artificial Intelligence, Internet of Things and Augmented Reality 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 Code: InCh1011

Course Name: General Chemistry

Credit Hour: 3

Prerequisite: No

The course General chemistry is designed to make students more prepared to the all chemistry courses by refreshing and summarizing the previous preparatory chemistry concepts before tackling the advanced chemistry courses. The course covers units and measurement, the composition of matter, chemical reactions, reactions stoichiometry, atomic structure and the periodic table, the chemical bond, structure of molecules, the properties of solutions, chemical equilibrium, introduction to functional groups and their typical reactions.

Course Code: InCh2508

Course Name: Biochemistry

Credit Hour: 3

Prerequisite: No

The course, Biochemistry is designed to make our students familiar with the different types of biological molecules, their structure and its application in industries. So that they will understand the applications of biochemistry in life and in industry. Moreover, the students will understand the different metabolic reactions and pathways in different kinds of living things.

Course Code: FSAN2101

Course Name: Introduction to food science and nutrition

Credit Hour: 3

Prerequisite: None

Introduction to food science and nutrition course covers the major food components (water, fats, carbohydrates and protein) in terms of their nature and role in foods. It also covers the nutritional principles of fat carbohydrate and protein and how dietary macronutrient requirement values are derived.

Course Code: FSAN2103

Course Name: Human Anatomy and Physiology

Credit Hour: 3

Prerequisite: None

Human anatomy and physiology course covers the structure and function of the tissues, the skeletal system, the nervous system, the endocrine system, and muscle function from the level of the cell to the level of the organism.

Course Code: FSAN2105

Course Name: Food Chemistry

Credit Hour: 3

Prerequisite: None

Food chemistry deals with the chemical, physical and functional properties of food constituents and the chemical changes these constituents undergo during handling, processing and storage including those that limit food shelf life. Food chemistry is a major aspect of Food science, that is an interdisciplinary subject in which the engineering, biological, and physical sciences are used to study the nature of foods, the causes of deterioration, the principles underlying food processing, and the improvement of foods from a consumer and sustainability perspective. The aim of the course is to provide the students with a deep understanding of how food components contributes to overall quality of foods; and to enable students to evaluate and explain how the highly complex nature of food may result in a multitude of desired and undesired reactions which are controlled by a variety of parameters.

Course Code: FSAN2107

Course Name: Principle of Food Processing and Preservation

Credit Hour: 3

Prerequisite: None

Food processing and preservation focus on the importance of food processing and preservation. Classification of foods on the basis of shelf life, pH, origin; Different types of food spoilage viz. microbiological, bio-chemical, chemical, physical and their effects on food quality

Course Code: FSAN2102

Course Name: Food microbiology

Credit Hour: 3

Prerequisite: None

Food microbiology focuses on the general biology of the microorganisms that are found in foods including: their growth characteristics, identification, and pathogenesis. Specifically, areas of interest which concern food microbiology are food poisoning, food spoilage, food preservation, and food legislation

Course Code: FSAN2104

Course Name: Food toxicology

Credit Hour: 3

Prerequisite: None

Food Toxicology covers various aspects of food safety and toxicology, including the study of the nature, properties, effects, and detection of toxic substances in food and their disease manifestations in humans. It will also include other aspects of consumer product safety.

Course Code: FSAN2106

Course Name: Food Analysis and Instrumentation

Credit Hour: 3

Prerequisite: None

Food analysis and instrumentation course focused on the application of qualitative and quantitative techniques used in the physical, chemical, sensory and instrumental examination of food products.

Course Code: FSAN2108

Course Name: Unit operation in food processing

Credit Hour: 3

Prerequisite: None

Unit operation in food processing focuses on different unit operations like mixing, pumping, heating, cooling, concentration, drying, filtration, evaporation, distillation, extraction, and many others.

Course Code: FSAN3109

Course Name: Biostatistics

Credit Hour: 3

Prerequisite: None

The field of Biostatistics allows students to use statistical principles to find patterns in public health, maintain consistent clinical trials, or conduct research in other areas of human health where pattern finding can lead to breakthroughs. Data is so crucial in the research field and processing that data spurs innovations in new treatments and medicines. It also helps us better predict the outcomes of public health issues and could even teach us how to see the beginnings of problems before they become a public health crisis. Biostatisticians are at the forefront of using big data to the advantage of human health.

Course Code: FSAN3111

Course Name: Community Nutrition

Credit Hour: 3

Prerequisite: None

This course will examine the role of nutrition in promoting, maintain and improving health in the community. It investigates traditional aspects of the emerging health delivery system, as well as entrepreneurial ventures. Students will study the financial, legislative, political, sociological, and scientific aspects of public and community health nutrition

Course Code: FSAN3113

Course Name: Fruit and vegetable science and technology

Credit Hour: 3

Prerequisite: None

The goal of this course is to introduce the students to the sciences of fruit and vegetable with the overall objective of introducing to the student to the theories, principles and practices utilized in production. It is the objective of this course to increase the capacity of the student for intelligent decision-making and problem solving based upon scientific knowledge and resources of fruits and vegetables.

Course Code: FSAN3115

Course Name: Dairy science and technology

Credit Hour: 3

Prerequisite: Successful completion of Food Processing and Preservation FSAN2041

Dairy science and technology is a field that encompasses the production and manufacturing of all dairy products as well as the machinery and methods used in the dairy industry. The largest part of the food supply chain is, by far, the dairy industry. This industry is an integral part of our food economy that not only supplies consumers with many ready-to-eat products such as milk, butter, and cheese but also produces many of the ingredients like milk powder and condensed milk that are found in processed foods. Milk itself has also become a key ingredient for the deployment of probiotics and the development of functional food products designed to improve consumer health. As such, dairy products have become an area of accelerated research and innovation, particularly in the areas of processing, sustainability, and health, and marketing strategy.

Course Code: FSAN3124

Course Name: Meat, Poultry and Fish Science and Technology

Credit Hour: 3

Prerequisite: Successful completion of Food Processing and Preservation

This course is included in the curriculum to make students familiar with the basic knowledge and skills of various technologies and equipment used for production of raw as well as processed meat, fish and poultry products. It will also familiarize students with chemical composition and microscopic structure of meat. It will make an in depth examination of the effect of feed, breed and management on meat production and quality; slaughtering of animals and poultry, inspection and grading of meat. Moreover, it will discuss the structure, composition, nutritive value and functional properties of eggs and its preservation by different methods; factors affecting egg quality and measures of egg quality. Types of fish, composition, structure, post-mortem changes in fish; handling of fresh water fish; canning, smoking, freezing and dehydration of fish; fish sausage and home making will also be dealt with.

Course Code: FSAN3119

Course Name: Coffee, Tea, Spice, and herbs Science and Technology

Credit Hour: 3

Prerequisite: Principles of Food Processing and Preservation

The course aims to introduce students to the traditional as well as state of the art industrial processing and marketing of coffee, tea and spices. It deals with the importance of coffee in the Ethiopian economy and the potential of tea and spices as a foreign currency earning commodity. It enables students to develop the skills in wet and dry processing of coffee and tea

Course Code: FSAN4016

Course Name: Integrated Science Team Project

Credit Hour: 3

Prerequisite: None

This is a multidisciplinary integrated science team project for special science computational problems under the guidance of a faculty member and a computer Programr. The course introduces the student with computer programing basics using python language to help students deal with scientific problems by drawing methods and concepts from biology, chemistry, physics and mathematics. The course deals with binary computation, problem-solving methods and algorithm development. The course also covers data types, control structures, functions, parameter passing, library functions, arrays, inheritance and graph plotting using python Matplotlib. It is aimed to aid multidisciplinary team based science problem solving and product development.

Course Code: FSAN3112

Course Name: Sport and Exercise Nutrition

Credit Hour: 2

Prerequisite: None

This class will focus on the nutritional needs and requirement of different exercises. First, the student will recognize and establish sound nutrition principles and the nutrients that play a role in determining these principles. Nutrients and other food constituents are integrated into the human body. Nutrition plays an integral part of our daily lives. It becomes even more important for athletes, who push the physical limits of their body. Providing adequate fuel is

essential and can make a difference between success and failure. Yet most athletes and coaches lack basic nutrition knowledge important for enhancing strength, speed and endurance.

Course Code: FSAN3122

Course Name: Nutritional Assessment

Credit Hour: 2

Prerequisite: None

The goal of the course is to introduce the concepts of nutritional assessment and the practical application of these concepts in the nutritional care of clients in clinical, community, and research settings. It focuses on methods of human nutritional assessment, including anthropometric (A), biochemical (B), clinical (C), and dietary (D) approaches (the A, B, C, Ds). Students will learn how to apply nutrition assessment methods across various settings ranging from the individual level (e.g., clinic) to the population level (e.g., community). Students will also develop knowledge and skills in the Nutrition Care Process, which includes nutrition screening, assessment, diagnosis, and preparing and writing nutrition assessments.

Course Code: FSAN3114

Course Name: Beverage Science and Technology

Credit Hour: 3

Prerequisite: Successful completion of Food Processing and Preservation

Being graduates of food science and applied nutrition, students are required to have a basic skill and theoretical knowledge of beverage processing and technology. With the increasing consumption of beverages all over the world, the production needs to be managed and supervised by those who are capable of producing safe and quality products.

Course Code: FSAN3118

Course Name: Food Fortification and functional food

Credit Hour: 3

Prerequisite: None

Food fortification is the enrichment of food by adding micronutrients. The course is designed to cover food fortification, types of fortification, physical characteristics, selection and use with specific food vehicle: minerals and vitamins, diets in specific disease, formulation of diets for target groups along the lifecycle, functional food, antioxidant, and different foods as functional food, anti-nutritional factors.

Course Code: FSAN3120

Course Name: Research Method in Food Science and Nutrition

Credit Hour: 3

Prerequisite: None

Research Method in Food Science and Nutrition offers an overview of research methodology and the basic concepts employed in quantitative and qualitative research methods. The course covers a brief description on the types of research, research and experiment, fundamentals of sampling and data collection, analysis of experiments, fundamentals of designs of experiments, basic principles of design of experiments, summarizing data sets using statistics, measures of data variability, analysis of variance (ANOVA), completely randomized design (CRD), randomized complete block designs (RCBD) Latin square designs (LSD), designs and analysis of multiple factors

experiments, two, three and fractional factorial experiments, regression and correlation analysis, nonlinear regression analysis, selection of research topics, research proposal writing, scientific report writing in relation to food science and nutrition.

Course Code: FSAN3117

Course Name: Cereal and pulse Science and Technology

Credit Hour: 3

Prerequisite: None

To acquaint with production trends, structure, composition, quality evaluation and processing technologies for product development and value addition of various cereals and pulses.

Course Code: FSAN4125

Course Name: Food economics, marketing and distribution

Credit Hour: 2

Prerequisite: None

This course is based on a systems approach to the study of food production, processing, marketing, and consumption. The importance of technology and economic relationships is emphasized. Students will learn a variety of concepts, including analytical models and how to use them in assessment of the real-world marketing strategies, consumer behavior, and market performance.

Course Code: FSAN4127

Course Name: Honey, Sugar and Confectionery Science and Technology

Credit Hour: 3

Prerequisite: Principle of Food Processing and Preservation

The course is designed to provide students with sugar, honey confectionery sciences and technological applications. Sugar, Honey and Confectionery Science and Technology covers sugar technology, analysis of quality of raw materials, extraction and refining of sugar, honey production in Ethiopia, the process of honey synthesis and ripening, botanical origin, physicochemical and biofunctional property of honey, honey processing and quality attributes, sugar and chocolate confectioneries.

Course Code: FSAN4132

Course Name: Food safety, quality assurance and legislation

Credit Hour:

Prerequisite: None

In this course, students will acquire the knowledge necessary for the assurance of food quality and safety. After passing through this course, they will be able to orient themselves in legislation relevant for the performance of official controls. Basing on practical skills and knowledge acquired when elaborating HACCP plans they will be able to prevent risks jeopardizing people either directly or indirectly (environmentally) and to eliminate them or, at least, to reduce them to an acceptable level.

Course Code: FSAN4133

Course Name: Food and Nutrition Security

Credit Hour: 2

Prerequisite: None

Human Nutrition provides an integrated overview of the physiological requirements and functions of different macro and micronutrients, which are determinants of health and diseases in human populations. The course cover food security and its dimensions, levels of analysis of food security, the conceptual framework of malnutrition, instruments for assessment and analysis of food and nutrition security (FNS) situation at macro level, indicators & instruments for assessment & analysis of FNS situation at micro & meso level, designing a plan for assessing and analysing the FNS situation, interventions to improve FNS at macro level, interventions to improve FNS at micro and meso level, developing appropriate strategies for FNS.

Course Code: FSAN4135

Course Name: Nutrition Throughout the Life Cycle

Credit Hour: 3

Prerequisite: None

Nutrition needs throughout the stages of the life cycle, which include pregnancy and lactation, infancy, adolescence and aging. Nutrition throughout the Life Cycle encompasses the socioeconomic, cultural and psychological influences on food and nutrition behavior. The course covers macronutrients and micro nutrients, the lifespan approach to nutrition, malnutrition and associated diseases, assessment of nutritional status of individuals and populations, preconception nutrition, nutrition during pregnancy, nutritional requirements during lactation, infant and child nutrition, school age nutrition, adolescent nutrition, adult nutrition and nutrition and aging.

Course Code: FSAN4137

Course Name: Senior Seminar

Credit Hour: 1

Prerequisite: Successful completion of practical attachment

Senior Seminar is a course prepared by the student for public lecture in support of their instructor, which concentrates on delivering information on the pertinent area of Food Science and Nutrition. The students are engaged to prepare a written document using a scientific way of writing, which consequently presented for students, staffs and interested groups.

Course Code: FSAN4139

Course Name: Final Year Project I

Credit Hour: P/F

Prerequisite: Research methods in Food Science and Nutrition (FSAN3118)

This is an individual research project in connection with Food Science and applied Nutrition cases and under the guidance of a faculty member. The project undertaken may fall under one of the following areas; nutritional composition analysis, sensory analysis, nutritional assessment, product development. The project work includes literature review, research problem identification, proposal development, preliminary research work and interim report generation.

Course Code: FSAN4124

Course Name: Food and Nutrition Policy and program

Credit Hour: 3

Prerequisite: None

The purpose of this course is to familiarize and engage the student in the steps and dynamics of policy making processes that address nutrition problems and issues. Where ever nutrition problems exist, policy and program options address the problems. Food and Nutrition Policy and program course covers the definitions of policies, strategies, and related terms, the concept nutrition policy and food strategy, the process of policy and strategy development, dietary standards, food guides and dietary goals, national nutrition policies, strategies of nutrition improvement, approaches/ strategies for improving nutrition and health status of the community, selecting policy options and developing policy strategy, drafting public health legislation, reviewing proposed public health legislation, legislative oversight, developing policies, strategies and public health programs.

Course Code: FSAN4126

Course Name: Nutrition Education and Counselling

Credit Hour: 2

Prerequisite: None

This course aims to provide students with the theories and skills necessary to design and implement nutrition education programs. It shows how nutrition education can facilitate dietary changes in a group of people. Specific educational counselling of customers with specific health conditions is also emphasized. The course cover the concept of nutrition education and counselling, dietary counselling and communication for behavior change,

development of a plan for nutrition education Programrs in community, designing a plan for assessing and analysing the FNS situation, selecting the right counselling method, nutrition education in emergencies.

Course Code: FSAN4128

Course Name: Nutrition Epidemiology

Credit Hour: 3

Prerequisite: Biostatistics

The course directed students to key concepts and methods in Nutrition Epidemiology in order to equip them with the tools needed to design, analyze, and critically evaluate population-based nutrition research. Nutrition Epidemiology covers evolution of epidemiology, important terminologies and their definitions, types and purpose of epidemiology, basic epidemiologic assumptions, natural history of disease, epidemiological approach in disease causation, frequency measures used in epidemiology, epidemiological designs, nutritional assessment methods, surveillance and outbreak investigation, introduction to nutrition screening and surveillance, outbreak investigations.

Course Code: FSAN4130

Course Name: Diet Therapy

Credit Hour: 2

Prerequisite: Human Physiology and Anatomy

This *course* explores the various nutrients, their sources, digestion, absorption, metabolism, interaction, storage, and excretion with relating to human health. The course Diet Therapy cover diet and therapeutic nutrition, food service in health care institutions, principles and objective of diet therapy: screening, assessment, monitoring, and counseling and diet manuals, methods of nutrient delivery: oral delivery, enteral tube feeding and parenteral feeding, interactions: food and nutrients versus medications and supplements, diet in renal disease, diet in diabetes mellitus and hypoglycemia, other health disorders.

Course Code: FSAN4131

Course Name: Food Product Development and Sensory Evaluation

Credit Hour: 3

Prerequisite: None

This course is designed to provide students with a basic ability of product development and sensory evaluation. Food product development and sensory evaluation is designed to successfully produce food prototypes or food concepts,

formulate products by preparing laboratory samples and sourcing raw materials, develop formulations to meet cost targets, design effective food safety plans (HACCP), run different sensory test methods and statistically analyze all data from sensory tests. The course include product development processes, developing strategies, stages of product development, the consumers in product development, shelf life and safety issues, sensory physiology, sensory attributes and ways of perception, consumer- and product- oriented testing, factors influencing sensory judgment, basic description and application of sensory test methods, sensory data analysis and interpretation, computer laboratory and desk discussion.

Course Code: FSAN4136

Course Name: Final Year Project II

Credit Hour: 4

Prerequisite: Final Year Project I

Final year project is a BSc Thesis work in the area of Food Science and Applied Nutrition, which is prepared by graduating students with the support of their assigned advisors. The course is the continuation of final project one. The proposal developed in the previous semester will be used for the project. Designed to develop a BSc Thesis based on the scientific methods of writing. The thesis will be defended and finally submitted to the Department of Food Science and Applied Nutrition.

3.2 Bachelor of Science Degree in Geology

3.2.1 Program Education Objective (PEO)

The program educational objectives describe accomplishments that,a four years geology program graduates are expected to attain within four years after graduation. Graduates will have applied their expertise to contemporary problem solving, be engaged professionally, and have continued to learn and adapt, and have contributed to their organizations through leadership and teamwork. More specifically, the objectives are expertise, engagement, learning, leadership and teamwork.

Table: Program Education Objectives (PEO)

PEO	Statement
PEO-1	Apply and evaluate data, models, hypotheses, and conclusions published in scientific literatures.
PEO-2	Identify problems, design projects and conduct an independent geoscience investigation
PEO-3	Communicate the findings of the geoscientific investigations in the form of presentations, reports and publications.
PEO-4	Investigate geoscientific issues that affect the society and to find scientifically viable solutions
PEO-5	Collaborate with others, including multidisciplinary groups to solve scientific problems in accordance with professional and ethical standards
PEO-6	Develop the abilities to engage in lifelong learning

3.2.2 Program Outcomes (PO):

Applied science programs are measured through their attainment of the Program Outcome (PO)/Program Learning Outcomes (PLO) of the program and its courses. These program outcomes are statements on what students shall know, understand, and perform upon completing their course and/or program of study. State the Program Out comes of the department by referring (Appendix 3.2).

Table: Program Outcome

PO	Statement
PO-1	Ability to integrate the concept of natural and numerical sciences in solving complex geological problems
PO-2	Ability to identify, describe, measure and record geological data using conventional and modern technologies in order to produce geoscience maps with accompanying report
PO-3	Ability to analyze, synthesize and apply fundamental geoscience knowledge into actionable practices in sustainable earth resources evaluation and development.

PO-4	Ability to conduct basic and applied geoscience researches and be able to communicate with stakeholders (public, scientific community and industries)

3.2.3 Program Courses Synopsis

3.2.3.1 Core course Synopsis

Course Code: Math 1007

Course Name: Mathematics for natural science

Credit Hour: 3

Prerequisite: No

This course covers the basic concepts of logic and set theory, the real and complex number systems, Mathematical induction, least upper bound and greatest lower bound, functions and types of functions, polynomial and rational functions, logarithmic and exponential functions, trigonometric functions, hyperbolic functions and their graphs and analytic geometry.

Course Code: EmTe 2011

Course Name: Introduction to Emerging technologies

Credit Hour: 3

Prerequisite: No

This course will enable students to explore current breakthrough technologies in the areas of Artificial Intelligence, Internet of Things and Augmented Reality 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 Code: InCh1101

Course Name: General Chemistry

Credit Hour: 3

Prerequisite: No

The course General chemistry is designed to make students more prepared to the all-chemistry courses by refreshing and summarizing the previous preparatory chemistry concepts before tackling the advanced chemistry courses. The

course covers units and measurement, the composition of matter, chemical reactions, reactions stoichiometry, atomic structure and the periodic table, the chemical bond, structure of molecules, the properties of solutions, chemical equilibrium, introduction to functional groups and their typical reactions.

Course Code: Math 1114

Course Name: Applied Mathematics I A

Credit Hour: 4

Prerequisite: No

This course is designed to develop students' confidence with mathematical concepts and relationships and use of mathematical skills and techniques in a range of contexts specifically problem solving and abstract thinking. Topics covered are basic elements of vectors, vector spaces, matrices, determinants, solving systems of linear equations, concepts and applications of differential and integral calculus of one variable.

Course Code: Geol2101 General Geology

Course Name: General Geology

Credit Hour: 4

Prerequisite: No

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 Code: Geol2103

Course Name: Palaeontology

Credit Hour: 3

Prerequisite: None

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 palaeo 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 Code: Geol2105 Crystallography and Mineral Optics

Course Name: Crystallography and Mineral Optics

Credit Hour: 3

Prerequisite: Geol1011

The course covers the following topics: Historical background of Crystallography. Introduction to morphological relations of crystals: Molecular, structure, crystal structure and amorphous structure. Introduction to mineralogy: definition, history of mineralogy and its early use, mineral deposits, ore, rocks, genesis of minerals, mineral nomenclature, mineral classification. Crystal Symmetry: Symmetry elements, symmetry operations, crystal classes (point groups), crystal systems, Steno's and Haüy's laws, crystal forms, Miller indices, Stereographic projections.

Real crystals: crystal growth, crystal aggregates. Internal structure of crystals: crystal lattice and its properties, lattice types, Bravais lattices, Space groups. Introduction to X-ray diffraction (XRD) in crystals

Course Code: Geol2108

Course Name: Mineralogy

Credit Hour: 3

Prerequisite: Geol2105

The course covers the following topics: Introduction to mineralogy: definition, history of mineralogy and its early use, mineral deposits, ore, rocks, genesis of minerals, mineral nomenclature, mineral classification; Crystal property: definition, chemistry, structure types, polymorphism, psuedomorphism, isomorphism and mineraloids; Introduction to X-ray diffraction (XRD); Physical properties related to symmetry: cleavage, piezoelectricity, pyroelectricity; Crystal optics: light and its properties; Examination of crystals in plane-polarized light: opacity, color, refractive index, pleochroism; Examination of crystals under crossed polars: isotropic and anisotropic crystals, interference colors, birefringence; Examination of crystals in convergent light: uniaxial and biaxial crystals, extinction, cleavage, twining, interference figures, optic angle, optic sign; Miscellaneous optical properties; Mineral identification: Physical characteristics of minerals: Polarizing microscope (use of transmitted and polarized light, reflected light); Systematic mineralogy: native elements, oxides, silicates, sulfides and sulfates, phosphates, chromates, tungstates, molybedates, arsenates, vanadite. Carbonates, halides: Sampling methods of mineralogical materials: Fractionation of mineral particles.

Course Code: Entr1108

Course Name: Entrepreneurship for sicence

Credit Hour: 2

Prerequisite: None

This course is designed to encourage students to start their own business and to acquaint them with the peculiar challenges and management decisions faced by owners of small business. It will develop such entrepreneurial skills as: identifying business opportunities; initiating, financing, and developing new venture business plans. It also addresses issues of small business, such as: legal aspects, financing, costing, locating, personnel, marketing, competition, sources of funding, and constituency services.

Course Code: InCh2010

Course Name: Fundamentals of Physical Chemistry

Credit Hour: 3

Prerequisite: None

The Fundamentals of Physical Chemistry course has been designed to provide for the basics of Physical Chemistry to non-chemistry students. It helps the learners to acquire a deep understanding on their area of specialization.

Course Code: Geol2102

Course Name: Stratigraphy and Earth History

Credit Hour: 3

Prerequisite: Geol 1111, Geol 2121

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.

Course Code: Geol2104

Course Name: Plate Tectonics

Credit Hour: 2

Prerequisite: None

The course is to help students understand the present configuration of lithospheric plates and the characteristic features and processes at their boundaries, know the dynamics of mantle plume and plate motion; introduce students to the basic methods of plate reconstruction of the past.

Course Code: Geol2106

Course Name: Sedimentary Petrology

Credit Hour: 3

Prerequisite: Stratigraphy and Earth History (Geol 2102)

The course covers the following topics: Sedimentary grain textures and rock fabrics; Sedimentary structures; Siliciclastic sedimentary grain compositions; Weathering; Sedimentary environments – rivers, lakes, deserts, deltas, shallow-marine siliciclastic and carbonate settings; facies concepts and Stratigraphy; Turbidity currents on continental margins; Glaciations; The Earth's climate system - present day and a geological perspective.

Course Code: Phys2003

Course Name: General Physics

Credit Hour: 3

Prerequisite: None

This algebra based introductory course is designed to enable students to learn the basic concepts, principles, and applications of elementary physics. The topics include vectors, Kinematics & Dynamics of Particles, Fluids Mechanics, Heat and Thermodynamics, Oscillations, Waves and optics, Electromagnetism & Electronics, Cross-Cutting Applications of Physics.

Course Code: Geol2110

Course Name: Igneous Petrology

Credit Hour: 3

Prerequisite: None

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 Code: Stat2006

Course Name: Introduction to statistics

Credit Hour: 3

Prerequisite: None

This course covers basic elements of statistics, probability, central tendencies, variation, and types of sampling

Course Code: Geol3101

Course Name: Structural Geology

Credit Hour: 4

Prerequisite: None

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 Code: Geol3103

Course Name: Geological mapping and Report Writing

Credit Hour: 3

Prerequisite: None

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, field data collection, report writing and presentation techniques. The course introduces students with the aerial photography and its interpretation, and basics of drawing. The course introduce students with the basic skills of fieldwork planning, surveying and sampling techniques, field data recording, communication through field report writing and presentation.

Course Code: Geol3105

Course Name: Remote Sensing and GIS

Credit Hour: 3

Prerequisite: None

Course Code: Geol3107

Course Name: Mapping Sedimentary Terrain

Credit Hour: 3

Prerequisite: Geol2106

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 Code: Geol3102

Course Name: Mapping Igneous Terrain

Credit Hour: 3

Prerequisite: Geol2108, Geol3103 and Geol3101

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 crosssections, reconstruction of geologic history as well as production of a geological report.

Course Code: Geol4105

Course Name: Economic Geology

Credit Hour: 3

Prerequisite: None

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 Code: Geol3106

Course Name: Fundamentals of Soil and Rock Mechanics

Credit Hour: 3

Prerequisite: Geol3101

Course Code: Geol3108

Course Name: Principles of hydrogeology

Credit Hour: 3

Prerequisite: None

Course Code: Geol3103

Course Name: Geological mapping and Report Writing

Credit Hour: 3

Prerequisite: None

The course is designed to address basic principles and concepts of hydrogeology. What the students must learn from this course has outlined in six learning outcomes (CLO) outlined here under. The course adequately addresses the principles and basic concepts regarding the hydrologic cycle, Surface water hydrology & water balance, groundwater

recharge and discharge, groundwater flow, Aquifer characterization, Pumping tests, fundamentals of groundwater flow modeling and basics of groundwater geochemistry and water quality.

Course Code: Geol3110

Course Name: Metamorphic Petrology

Credit Hour: 3

Prerequisite: None

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.

Course Code: Geol3112

Course Name: Geochemistry

Credit Hour: 3

Prerequisite: Igneous Petrology (Geol2110)

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.

Course Code: Geol4101

Course Name: Groundwater Exploration and Development

Credit Hour: 3

Prerequisite: None

Groundwater occurrences in different rocks, Groundwater exploration techniques, Application of hydrological, geological, hydrogeological, geophysical, remote sensing and GIS in groundwater exploration. Drilling methods, Drilling fluids, well design and well constructions, Pumping test, Groundwater resource evaluation & assessment, Sustainable yield of groundwater aquifers, Groundwaters of Ethiopia.

Course Code: Geol4103

Course Name: Mapping Metamorphic Terrain

Credit Hour: 3

Prerequisite: Geol3110,3103

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 Code: Geol3104

Course Name: Geophysics

Credit Hour: 4

Prerequisite: None

Course Code: Geol4107

Course Name: Engineering Geology

Credit Hour: 3

Prerequisite: Geol3106

Course Code: Geol4109

Course Name: Mineral Exploration and Resource Evaluation

Credit Hour: 2

Prerequisite: None

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 Code: Geol4102

Course Name: Energy Resource of the Earth

Credit Hour: 3

Prerequisite: Geol2106,

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 resource

Course Code: Geol4104

Course Name: Geology and Geologic Resources of Ethiopia

Credit Hour: 3

Prerequisite: None

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 Code: Geol4106

Course Name: Environmental Geology

Credit Hour: 2

Prerequisite: None

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 Code: Geol4111

Course Name: Research Methods in Geosciences

Credit Hour: 2

Prerequisite: None

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

Course Code: Geol4108

Course Name: Senior Project

Credit Hour: 3

Prerequisite: Geol4111,

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 Code: Geol4110

Course Name: Mining Geology

Credit Hour: 2

Prerequisite: None

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 Code: Geol4016

Course Name: Integrated Geological Team Project

Credit Hour: 2

Prerequisite: None

This is a multidisciplinary team integrated geological project in connection with a special geological problem and under the guidance of a faculty member. The project synopsis consists of literature review, design, project management, business acumen, multidisciplinary team work, entrepreneurship

3.2.3.2 Elective courses

Course Code: Geol4201

Course Name: Industrial Minerals, Rocks and Gems

Credit Hour: 3

Prerequisite: Economic Geology (Geol 4105)

The course covers the following topics: Industrial minerals and rocks composition, structure, physical properties, and origins, will be covered along with topics of particular interest in gemology, such as mechanisms of color, history and lore of gems, and uses of gems. Occurrence, processing, economics and applications of commodities (nonmetallic minerals and rocks) will be focused such as: rock aggregates, bentonites, datomites, salt, soda ash &chllor-alkali; magnestie, brucite & magnesia; glass; bauxite & alumina; pigments & fillers; high-tech ceramics; limestone & dolomite; dimension stone; cement; gypsum; wollastonite; rare earths; phosphates; borates and gemstone: opal, sapphires,
rubies, olivine, garnet.

Course Code: Geol 4202

Course Name: Groundwater Resource Management

Credit Hour: 3

Prerequisite: Geol 3108, Geol 4101

The volume of groundwater stored in an aquifer at any instant of time depends on the dynamic relationship between recharge inputs, and outflow by natural discharge and abstraction. Aquifer storage provides a buffer between highly variable, climatically driven recharge processes and the variable outflow that supports surface water ecology. Un controlled abstraction of groundwater both for drinking and irrigation, alters the dynamic balance between “natural”

recharge and the state of surface waters. Both quantity and quality of groundwater can be altered by over-pumping of aquifers. Thus, the groundwater resource management objective is to determine the regime of abstraction without causing un acceptable environmental effects. This course aims at enhancing student's skills and knowledge to use tools, methods and approaches used in groundwater resources management to ensure the development of groundwater in a way that ensures long-term sustainable use for future generations.

Course Code: Geol4205

Course Name: Quaternary Geology

Credit Hour: 3

Prerequisite: None

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 paleoenvironment and paleoclimate.

Course Code: Geol4206

Course Name: Environmental Impact Assessment (EIA)

Credit Hour: 3

Prerequisite: None

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.

Course Code: Geol4203

Course Name: Fundamentals of Gemology

Credit Hour: 3

Prerequisite: None

This course deals with basic gemological knowledge that are important in jewellery design, metalsmithing, gem-setting along with instrumentation basic for gem identification in the industrial practice. Gemologists are expected to be able to identify gemstones and detect a number of gems in the market including treatments, synthetics and imitations. The fundamental course is not an end by itself but requires a series of other courses like Advanced Gemology and Gem Identification practical lab exercises to be qualified being competent in the industry.

Course Code: Geol42045

Course Name: Introduction to Geohazard Assessment

Credit Hour: 3

Prerequisite: Geol4107

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.

3.3 Bachelor of Science Degree in Biotechnology

3.3.1 Program Education Objectives (PEO)

The Biotechnology program at Addis Ababa Science and Technology University produces graduates with a strong foundation of scientific and technical knowledge and who are equipped with problem solving, team work, and communication skills that will serve them throughout their careers consistent with the following program educational objective. The program prepares students for career in Biotechnology and its related fields. It also prepares students to further their education in graduate schools.

Table: Program Education Objectives (PEO)

PEO	Statement
PEO-1	To prepare graduates who demonstrate knowledge and technical competency and leadership commitments for careers of productive services.
PEO-2	To produce biotechnologists who can sustain the development of the bio-economy for the betterment of the society and the nation.
PEO-3	To prepare graduates for advanced studies in various disciplines of biotechnology and related fields.

3.3.2 Program Learning Outcomes (PO):

The biotechnology program is measured through its attainment of the Program Outcome (PO) of the program and its courses.

Table: Program Learning Outcome

PO	Statement
PO-1	Each graduate will have an ability to identify, formulate, and solve broadly defined technical or scientific problems by applying principles and practices of biotechnology, sciences, and mathematics.

PO-2	Each graduate will have an ability to formulate or design a system, process, procedure or program to meet desired needs of biotechnological applications in agriculture, industry, environment and health development.
PO-3	Each graduate will have an ability to develop and conduct appropriate experimentation, analyze and interpret data and use scientific judgment to draw conclusions.
PO-4	Each graduate will have an ability to communicate effectively with a range of audiences.
PO-5	Each graduate will have an ability to understand ethical and professional responsibilities and make informed judgment, which must consider the impact of biotechnological solutions in global, economic, environmental, and societal contexts.
PO-6	Each graduate will have an ability to function effectively on a team whose members together provide leadership, create a collaborative and inclusive environment, establish goals, plan tasks, meet objectives and deadlines, and analyze risk and uncertainty.
PO-7	Each graduate will have an ability to develop an entrepreneurial mindset and understand the dynamics of bioscience industry to translate scientific innovations into bio-based products, processes, services and viable business opportunities
PO-8	Each graduate will have an ability to acquire and apply new knowledge and technologies in the bioeconomy development.

3.3.3 Graduation Requirements

- The graduation requirement for all undergraduate programs should satisfy the following minimum requirements as stated in article 109, July 2017 university's senate legislation. All the required courses/modules and the minimum credit hours set in the program curriculum by the respective academic unit should be satisfied, except phase-in and phase-out programs. For a student to graduate, total credit hours of 151 shall be taken, with a cumulative grade point average (CGPA) of 2.00 in all and major area courses; with No "F" grade in any course taken and shall score pass mark for all courses which have Pass/Fail grade an pass the exit exam

3.3.5 Program Courses Synopsis

3.3.5.1 Core course Synopsis

Course Code: Math 1107

Course Name: Mathematics for natural science

Credit Hour: 3

Prerequisite: No

This course covers the basic concepts of logic and set theory, the real and complex number systems, Mathematical induction, least upper bound and greatest lower bound, functions and types of functions, polynomial and rational functions, logarithmic and exponential functions, trigonometric functions, hyperbolic functions and their graphs and analytic geometry.

Course Code: Ent1108

Course Name: Entrepreneurship for Science

Credit Hour: 2

Prerequisite: No

This course is designed to encourage students to start their own business and to acquaint them with the peculiar challenges and management decisions faced by owners of small business. It will develop such entrepreneurial skills as: identifying business opportunities; initiating, financing, and developing new venture business plans. It also addresses issues of small business, such as: legal aspects, financing, costing, locating, personnel, marketing, competition, sources of funding, and constituency services.

Course Code: InCh1101

Course Name: General Chemistry

Credit Hour: 3

Prerequisite: No

The course General chemistry is designed to make students more prepared to the all-chemistry courses by refreshing and summarizing the previous preparatory chemistry concepts before tackling the advanced chemistry courses. The course covers units and measurement, the composition of matter, chemical reactions, reactions stoichiometry, atomic structure and the periodic table, the chemical bond, structure of molecules, the properties of solutions, chemical equilibrium, introduction to functional groups and their typical reactions.

Course Code: Math 1114

Course Name: Applied Mathematics I A

Credit Hour: 4

Prerequisite: No

This course is designed to develop students' confidence with mathematical concepts and relationships and use of mathematical skills and techniques in a range of contexts specifically problem solving and abstract thinking. Topics covered are basic elements of vectors, vector spaces, matrices, determinants, solving systems of linear equations, concepts and applications of differential and integral calculus of one variable.

Course Code: SWENG2109

Course Name: Introduction to computer science

Credit Hour: 2

Prerequisite: No

This course introduces the student with the use of a PC in an MS Windows environment. It introduces the two main application packages in that context – MS Excel and MS Word. In addition, it introduces the students with the world wide web for e-mail and information gathering.

Course Code: EmTe1106
Course Name: Emerging technologies for Science
Credit Hour: 3
Prerequisite: None

Course Code: InCh2103
Course Name: Organic Chemistry
Credit Hour: 3
Prerequisite: None

This course will make students who take the course about the basic things in organic chemistry, which are in touch with our day-to-day activities and us also. So the course makes the students to be familiar with the various biological molecules, natural products, synthetic compounds, polymers and their roles, functions, functional groups, chemical and physical properties so that they will apply to their different fields of Biotechnology. This course will complement molecules and molecule-interaction about as theoretical Background and will create basic knowledge for next fundamental biotechnology courses.

Course Code: Biot2005
Course Name: Cell Biology
Credit Hour: 3
Prerequisite: None

This course deals with level of organization of cells; Cell structure of Prokaryotes, Eukaryotic cell, Viruses, virioids; function and structure of Cellular organelles which is a basic knowledge for biotechnological and genetic studies. The course also introduces cell membrane and different transports systems across cell membrane; Cell division; Regulation of cellular activity with enzymes.

Course Code: Biot2007
Course Name: Principles of Genetics
Credit Hour: 3
Prerequisite: None

The course introduces the students about pre-Mendelian views of heredity; Mendel's works, results and deductions; cytological basis of heredity; chromosome banding, crosses involving different levels of hybrids and the concomitant genotypic and phenotypic ratios; probability and chi-square testing in genetics; allelic (dominance) and non-allelic gene interactions and modifications of phenotypic ratios; effect of external and internal environments on gene expression; multiple allelic inheritance; linkage, crossover and gene mapping; extra-nuclear (cytoplasmic) inheritance; mechanisms of sex determination and inheritances related to sex; experiments that led to the identification of DNA as the genetic material; structure of the DNA. Information flow from DNA (replication, transcription, translation); how genes determine phenotypes through the intermediary of proteins; mutations and how they change codons and protein structure and function; brief introduction to genotypic and phenotypic frequencies in populations.

Course Code: Biot2102
Course Name: Molecular Biology
Credit Hour: 2
Prerequisite: Principles of Genetics

The course deals with basic molecular biology concepts such as constituents, structures & functions of DNAs, polymerization and base pairing; denaturation & renaturation of DNA, various forms of DNA, structure of RNA, DNA replication, replication of linear and circular DNA molecules, proofreading activity during DNA replication, structure of genes; transcription and translation process in prokaryotes and eukaryotes; regulation of gene expression in prokaryotes and eukaryotes; protein targeting, mutation and repair mechanism.

Course Code: Biot2104
Course Name: Techniques in Molecular Biology
Credit Hour: 1
Prerequisite: Principles of Genetics

The course deals with basic techniques in molecular biology such as clean handling, solution preparations, sterility (laboratory safety), DNA isolation (Bacterial genomic and plasmid DNA, Eukaryotic DNA); Agarose Gel electrophoresis, Elution of the DNA fragment from the gel, Restriction digestion, PCR amplification of DNA, cloning techniques, Competent cell formation, transformation, protein isolation, RNA isolation, UV spectroscopy techniques for DNA and protein estimation; SDS-PAGE separation of proteins: blotting techniques (Southern, Northern and Western blotting)

Course Code: Biot2110
Course Name: Microbial Genetics
Credit Hour: 2
Prerequisite: None

The course focuses primarily on gene structure and function of prokaryotic systems as a paradigm for processes in eukaryotes. The course also delves extensively into the intricacies of bacterial virus (bacteriophage) molecular genetics. Bacterial genome and its elements, extra-chromosomal elements, plasmids and their properties, DNA replication, recombination in bacteria, gene structure of prokaryotes, operons , control of gene expression, transformation, conjugation, transduction, transposition, genetic fine structure and co-linearity, mapping methods, transposable elements, virulent and avirulent phages, mutation, DNA repair.

Course Code: Biot2112
Course Name: Fundamentals of Biochemistry
Credit Hour: 4
Prerequisite: Cell biology

The students will learn about theory and practically Structure, classification and function of Carbohydrates, Lipids, Amino acids, Proteins, Nucleic acids, Vitamins and Enzymes. And to develop understanding and provide scientific basics of the life processes at the molecular level and explain the structure, function and inter-relationships of biomolecules and their deviation from normal and their consequences for interpreting and solving Industrial problems.

Course Code: InCh2114
Course Name: Analytical Chemistry and instrumentation
Credit Hour: 3
Prerequisite: None

The course deals with Introduction to analytical chemistry; Acids bases, neutralization, titration, Complex formation, and complex metric titration, measurement of BOD and COD, gravimetric analysis, Chromatographic and spectroscopic techniques. The students will learn about through analytical chemistry and instrumentation subject to

knowing the appropriate applications of various analytical techniques used in biotechnology, make the experiment easier and let the researcher obtain a better result which also reduces the time period of experiment by eliminating the trial-and-error methods. Analytical equipment's find its application not only in the research works but also at the industry level for the quality analysis and quantities analysis of the final products.

Course Code: Biot2108
Course Name: Animal Anatomy and Physiology
Credit Hour: 2
Prerequisite: Cell Biology

Anatomy and Physiology is a basic and mandatory course for biologists, medical professionals and Biotechnologies as it gives a clear understanding to make use of biological products and organisms for human use. Through the course students will be exposed to general introduction of animal anatomy and reference terminologies to study anatomy and physiology, ; Cell, Basic structural levels (Cell, Tissue, Organ, Organ system, Different); Homeostasis (Mechanisms of Homeostasis, Transport of material across membrane); Joints (Types of Joints, Classification of joint, Different joints of the body); Muscular system (Types of muscle, Composition of muscle fiber, Muscles found on different body parts); Nervous system (Central Nervous system (CNS), Peripheral Nervous system (PNS), Neuron, Nerve message, Synapses, Neurotransmitter), Cardiovascular system (Heart, Blood vessel, Blood); Respiratory system (Parts of the respiratory system, Mechanism of pulmonary ventilation (Breathing), Muscles of breathing, Pulmonary volumes and capacities, Respiratory pigment, Exchange of air between alveoli and capillaries, Regulation of breathing); Lymphatic system; Digestive system; Urinary system; Reproductive system (Male reproductive organs, Spermatogenesis, Female reproductive organs, Oogenesis, Mammary gland); Endocrine system. After the completion of the course, students interested in the animal biotechnology stream will benefit a lot for their advanced animal biotechnology courses and applications in their careers.

Course Code: Biot2006
Course Name: Plant Anatomy and Physiology
Credit Hour: 2
Prerequisite: None

This course integrates the plant structures with cell biology and allows the student conceptually integrate the ultra-cell structure with its physiological functions and developmental structures and reproductive biology. The course impart a comprehensive knowledge and exposure related to plant anatomy and physiology with the focused topics include the ultra-cell structure, root and stem anatomy and modifications, transport of water and solute translocation, inorganic nutrition, plant metabolisms, regulation of growth and development, plant hormones, control of flowering and stress physiology.

Course Code: Biot3111
Course Name: Principles of Plant Breeding
Credit Hour: 2
Prerequisite: None

The course concedes the aims and objectives of Plant Breeding; Modes of reproduction, sexual, asexual, apomixis and their classification, significance in plant breeding. Modes of pollination, genetic consequences, differences between self and cross-pollinated crops. The course addresses types of breeding: introduction and acclimatization, selection, and hybridization. Methods of handling of segregating generations – pedigree method, bulk method, back cross method and various modified methods considered. Heterosis, inbreeding depression, various theories of heterosis, exploitation of hybrid vigour-development of inbred lines, single cross and double cross hybrids will be covered. During the course, population improvement Programs, recurrent selection, synthetics and composites, methods of breeding for vegetative propagated crops will be focused. The significance of different breeding techniques like clonal selection, mutation breeding, Ploidy breeding, Wide hybridization will be also covered in the course.

Course Code: Biot3103
Course Name: Principles of Animal Breeding
Credit Hour: 2
Prerequisite: Animal Anatomy and Physiology

Through the course students will be exposed to the different techniques of improving the genetic potentials of farm animals with great emphasis on selection and the different mating systems. Students will be familiar with:the core concept and principles of animal genetics that helps students to identify types of farm animal traits and their mode of inheritance, and other related laws governing principles of genetics in a given farm animal population with emphasis on quantitative traits inheritance, populations genetics, genetic parameters and possible genetic improvement strategies (breeding programs) of selection and cross breeding with possible response to animal breeding programs. The genetic parameters including heritability, genetic correlation and repeatability of farm animals: selection and mating systems (Cross breeding and Inbreeding); hybrid vigour and inbreeding depression; relationship characterization of indigenous livestock and principles and methods of conservation of animal genetic resources; breeding schemes, application and use of biotechnology in animal breeding.

Course Code: Biot3101
Course Name: Immunology and immunotechnology
Credit Hour: 3
Prerequisite: Cell Biology

Immunology is the study of an organism immune system. It deals with the defense mechanism including all physical chemical and biological properties of the organisms that help it to combat its susceptibility to foreign organism. It can be defined as the branch of biology that is concerned with the structure and function of the immune system, the bodily distinction of self from non self, and the use of antibody based laboratory techniques or immunoassays. Immunology deals with a range of immune cells, tissues and chemicals that interact to overcome infection, repair tissue damage

and maintain the integrity of the body. It also studies the, environmental, genetic, neurological and psychological factors that affect the immune response of the organism. Immunotechnology is an important arm of biotechnology, constituting industrial scale application of immunological procurers to produce vaccine, monoclonal antibody and other cells and molecules important for treatment, diagnosis and immunization of the organism.

Course Code: Biot3105
Course Name: Microbial Biotechnology
Credit Hour: 3
Prerequisite: General Microbiology

This course entails ecosystem services provided by microorganisms in biogeochemical cycle and their roles in industrial, agricultural and environmental microbial biotechnology applications. It deals with the significance of microbes in wide production of biotechnologically important industrial products that include primary and secondary metabolites such as enzymes, organic acids alcohols, antibiotics biochemical, biopolymers, food ingredients, and pharmaceuticals etc. It also portray the impacts of microorganisms in using biofertilizers, biocontrols, biocides, and the production of foods and animal feeds to develop agricultural yields and productivity . The course also encompasses the application of microbial cells and products for environmental safety and health. The practical aspects of this course inculcate students with biotechnological applications of microbial screening, isolation, characterization, and preservation as well as manipulation (using relevant molecular biology and gene expression technologies) for the development of potential isolates/strains/ for various products and applications in industries, agriculture, environmental protection and medicine.

Course Code: Biot3107
Course Name: Fundamentals of BioProcessing Engineering
Credit Hour: 2
Prerequisite: None

The students will learn about through bioprocessing engineering subject to operation modes based upon the nature of bioproducts and cell lines and other process criteria. Make to apply modeling and simulation of bioprocesses, so as to reduce costs and to enhance the quality of products and systems. To understand the requirements for successful operations of downstream processing. Future Plan a research career or to work in the biotechnology industry with strong foundation about bioreactor design and scale-up. Integrate research lab and Industry; identify problems and seek practical solutions for large scale implementation of Biotechnology. Industrial visit is needed for 2 times to different industries to learn the production process and safety regulations followed in Food/ Beverage industries as part of the course

Course Code: Biot3109
Course Name: Biophysics
Credit Hour: 2
Prerequisite: None

Biophysics deals with the application of physics to biological systems. The concepts and techniques of biophysics find applications in bio-electronics, medicine/health, and population dynamics and are closely related to statistical mechanics and transport processes. Specifically, this course provides an introduction to the physics of many-body systems, diffusion models, polymeric materials, transport phenomena of neutral and electrically charged particles, thermodynamics, medical applications of electricity, and most biological systems.

Course Code: Biot3115
Course Name: Genetic Engineering
Credit Hour: 3
Prerequisite: Molecular Biology

The course deals with basic molecular biology processes involving gene manipulation, cloning strategies such as cDNA and genomic libraries cloning host such as eukaryotic and prokaryotic hosts. In addition, the course also deals with screening strategies to identify desirable clones from DNA libraries, mutagenesis, gene mapping and applications of recombinant DNA technology in medicine, agriculture, industries and environment.

Course Code: Biot3113
Course Name: Biostatistics and Experimental design
Credit Hour: 3
Prerequisite: None

This course covers and focus on methods od data collection and presentations, basic principles of experimental design, error estimation and control in experimentation, complete randomization, randomized complete block, Latin square, factorial and confounded factorial, incomplete block (lattice square) designs, transformation of abnormal data, Covariance analysis and regression analysis

Course Code: Biot3104
Course Name: Molecular Diagnostic
Credit Hour: 1
Prerequisite: Techniques in molecular biology

Molecular Diagnostics is the process of identifying a disease by understanding the molecules, such as proteins, DNA, and RNA, in a tissue or fluid, which forms the markers of the diseases directly or indirectly. Molecular diagnostics is not confined to human diseases but can be used in animals and plants also. Molecular diagnostics can also be used to identify foodstuffs, vegetables, meet types and food processing methods etc., and can be also used in environmental monitoring, detect the presence of specific microorganisms in various samples including food materials. The course will provides the theory and use of molecular techniques in the diagnostic techniques, with more importance on nucleic

acids based techniques. Common analytical techniques and molecular techniques related to the development and use of diagnostics such as variants of polymerase chain reaction (PCR), quantitative real time PCR (qRT-PCR), immunohisto-compatibility test(IHC) and ELISA tests, chromosomal techniques such as hybridization techniques(FISH), SNP marker analysis and DNA sequencing will be emphasized in this course.

Course Code: Biot3102
Course Name: Plant Biotechnology
Credit Hour: 2
Prerequisite: None

This course to explore the techniques of plant Biotechnology to create genetic variation in plants and to recognize how genes contribute at the molecular level for the phenotypic expression of genotypes that leads to morphological variation. This knowledge is the key aspect to improve the ability to modify the plant responses towards global food security and commercial exploitation of biotechnology in agricultural, industrial and environmental sectors. The course outlines the techniques used in plant biotechnology and the application of these techniques in science and society. The molecular marker techniques for detecting the genetic variation and other applications will be dealt. The key concepts of the course will be integrated in a cohesive mode through a series of case studies of plant biotechnology.

Course Code: Biot3108
Course Name: Medical Biotechnology
Credit Hour: 3
Prerequisite: Immunology and Immunotechnology

The course integrates genetics, genomics, and molecular biology approaches to elucidate the pathogenesis of human diseases, and is intended to encourage students to unravel novel disease mechanism for improving management of human diseases. It deals with omics and structural biology for diseases identification as well as dragable target identification, the mucosal and immune system and the related diseases, neurological diseases, infectious diseases and viral replication in human cell and animal model for human disease study. Finally, new approaches in diseases treatment will be disscussed.

Course Code: Biot3110
Course Name: Fungal Biotechnology
Credit Hour: 2
Prerequisite: None

The course is designed to provide basic concepts about kingdom fungi (general characteristics of fungi, fungal evolution and classification) and primarily focus on the role of fungi in agricultural Biotechnology, industrial Biotechnology, medical biotechnology, food Biotechnology and environmental Biotechnology. It extensively discusses about fungal originated biotechnological products (enzymes, vitamins, polysaccharides, alcoholic beverages, organic acids, pigments, lipids, glycolipids, antibiotics, etc.,) and the role of fungi in solving the major problems the world faced to day (shortage of food, diminishing quality of health and environmental pollution).

Course Code: Biot3112
Course Name: Animal Biotechnology
Credit Hour: 3
Prerequisite: None

Introduction to animal biotechnology, historical perspectives and scope of animal biotechnology, fertilization, embryogenesis, animal cell culture and its manipulation, in vitro fertilization, embryo transfer, genetic engineering in animals, transgenic animals, hybridoma technology, molecular markers for the animal diseases, stem cells and its applications, laboratory practices of animal cell culture and its genetic engineering (experiments details are included in the course content).

Course Code: Biot3118
Course Name: aquatic biotechnology
Credit Hour: 2
Prerequisite: None

The course deals with Introduction to Aquatic biotechnology; Molecular Genetics of Aquatic organisms: Discovery & cloning of novel genes, Genetic manipulations of finfish & shellfish; Medical Applications of aquatic biotechnology: Drugs & medicines from the sea, Environmental applications of Aquatic biotechnology: Antifouling Agents, Biosensors, aquatic environmental remediation; Marine biotechnology: Fish & marine invertebrate, transgenic fish technology & its application in fish production; The uses of macro & micro algae, fish feed technology.

Course Code: Biot3114
Course Name: Introduction to Bioinformatics
Credit Hour: 3
Prerequisite: Molecular Biology

Bioinformatics is an emerging discipline that covers a wide range of topics including but not limited to the storage and retrieval of biological data such as sequence data of DNA, RNA and protein molecules, mathematical modeling of biological sequences, analysis of possible mechanisms behind complex biological processes, understanding and modeling of the evolutionary history of life. The course provides a theoretical and practical introduction to bioinformatics methods with topics that deal with biological databases, sequence similarity analysis, DNA sequencing, phylogenetic analysis, protein structure prediction and homology modeling, restriction mapping and PCR primer designing with sufficient description and coverage on each and every topic.

Course Code: Biot3106
Course Name: Plant cell and Tissue culture
Credit Hour: 2
Prerequisite: None

The course deals with a review of the historical importance of plant tissue culture. This is followed by studying the different media compositions for in vitro techniques to amplify the expertise of in vitro procedures for micro propagation, haploid production through anther and ovule culture, cryopreservation and developing disease free planting materials through meristem tip culture. The course brings out the growth hormone regulation of in vitro techniques and the acclimatization process to harden the tissue cultured plants.

Course Code: Biot3116
Course Name: Research Methodology and Academic writing
Credit Hour: 2
Prerequisite: None

The course deals with basic of researching such as sources of knowledge, types of research, research problem identification, research topic selection, developing a hypothesis, proposal writing; power point preparation and oral presentation; the principles of scientific writing and the use of bibliographic index; preparation of a review paper, correct use and preparation of tables and figures and research ethics.

Course Code: Biot4101
Course Name: Enzyme Technology
Credit Hour: 3
Prerequisite: None

This course elaborates historical background of enzymes/biocatalysts and their advantage over non-biological catalysts, nontraditional enzymes, and enzymes from extremophiles, properties of enzymes, classification of enzymes, enzyme production sources and method, immobilization of enzymes, enzyme engineering, and application of enzymes, current use and potential of enzyme technology for the production of goods to meet various human needs.

Course Code: Biot4103
Course Name: Industrial Biotechnology
Credit Hour: 3
Prerequisite: General Microbiology

Industrial biotechnology is the application of biotechnology for industrial purposes, including the practice of using cell (biology) or components of cells like enzymes to generate industry useful products. The course deals with basic principles of fermentation technology, industrially important microorganisms, handling and development of inocula for various fermentation processes; types of fermentation, process development, production of microbial products, etc. The focus of the techniques taught in this program is the use of biological resources as input to biobased processes

which are economically and environmentally sustainable, to equip students with skills on recent methodologies and practice in industrial biotechnology and to expose students to relevant and recent advances in industrial biotechnology.

Course Code: Biot4105
Course Name: Environmental Biotechnology
Credit Hour: 3
Prerequisite: None

The course deals with the environmental problems, its legislation and biotechnological methods for wastewater treatment and its advancements, solid waste management, sewage sludge disposal and utilization (Composting), bioremediation and its types and strategy, biodegradation of xenobiotic compounds, recalcitrant, hazardous wastes, genetic engineering approach for biodegradation, vermitechnology, sustainable technology (biofertilizers, biopesticides, biosensors, bioleaching, biofuels) and environmental monitoring, removal of heavy metal pollutants and treatment of various industrial waste water.

Course Code: Biot4107
Course Name: Introduction to Omics science
Credit Hour: 2
Prerequisite: Genetic Engineering

This course deals with physical aspects of the genome; construction and study of various types of genome maps, tanscript mapping and large scale sequencing. The human genome project and the plant genome program, structural and functional genomics to address gene discovery, isolation, localization and characterization, protein structure and function, discovery and finding genetic markers for plant breeding purposes will also be dealt out. Moreover, strategy for developing diagnostic tests for plant, animal and human diseases and therapeutics techniques will be covered in addition to gene and protein expression and the external and cellular factors that influence their expression. It gives sufficient description and coverage on each and every topic with learning objectives stated under the section, Course Learning Outcome.

Course Code: Biot4109
Course Name: Biotechnology internship
Credit Hour: 3
Prerequisite: None

This course encompasses a pre-arranged 3 credit hour work focusing on practical job/research experience. Attachment of the students to a host organization (private, public, non-profit organizations or/and research centers), engaged in fundamental and/or applied biotechnology related endeavors will be arranged for two months during the summer break, post completion of the third year- second semester. During the practical attachment, the students will remain under the guidance of an identified Industry/research lab-based supervisor. Besides providing an avenue to have hands-on-experience in an industry/research setting, the major assignments of this course are to write, submit and present the expectations, various experiences the student gains during his/her respective internship, information on the

background and focus of the institution, methods or protocols used/learned, instruments handled or product produced, new skills acquired, the plausible challenges or limitations encountering the institution and the attached student and finally recommendations/scope for improvement. Mentored by a departmental advisor, each student will submit a report on his/her attachment, and will make a report presentation at the end of the attachment.

Course Code: Biot4111
Course Name: Final Year Project I
Credit Hour: 3
Prerequisite: Research methods and Academic writing

The course deals with introducing the students to seminar presentation, proposal writing and research problems identification connected to department research divisions (Microbial biotechnology, Agricultural biotechnology, Plant breeding, Industrial biotechnology, Environmental biotechnology and Medical biotechnology). It is emphasized that the student shall learn to identify research problems, present research plans and initiate his/her work individually within the chosen topic, and also learn how to obtain detailed knowledge through literature studies and practical work. The student will have mandatory seminar presentation and progress report submission for their initiated research project at the end of the semester. The laboratory project work is carried under the supervision of an adviser.

Course Code: Biot4113
Course Name: Nanobiotechnology
Credit Hour: 2
Prerequisite: None

This course gears off with a general introduction to nanotechnology, the basic principles of nanoscience and the scope of applications in the domain of biotechnology. The various preparative strategies, tools and techniques for characterization and biophysicochemical attributes of various nanobiomaterials are embraced. With inclusion of topics like nanobiosensing, nanobiomaterials for tissue engineering, micro/nanofluidics, artificial cells, nanodiagnostics and nanotherpeutics, as well as biomacromolecular (DNA, RNA, protein, lipid and carbohydrate based) nanotechnology, the course is streamlined to highlight the various advanced and feasible applications in diverse realms of health care, environment, agriculture, food industry, forensic science etc. Post perusal of various plausible nano-bio interfacial actions and reactions *vis-à-vis* nanotoxicology, the course concludes with analysis of plausible future trend in the realm.

Course Code: Biot4112
Course Name: Final Year Project II
Credit Hour: 3
Prerequisite: Final Year Project I

The course deals with introducing the students to research problems connected to Department research divisions (Microbial biotechnology, Agricultural biotechnology, Plant breeding, Industrial biotechnology, Environmental biotechnology and Medical biotechnology). It is emphasized that the student shall learn to individually within the chosen topic, and also learn how to obtain detailed knowledge through literature studies and practical work. The students will have mandatory report submission and oral presentation of the project at the end of the semester. The laboratory project work is carried out individually under the supervision of an adviser.

Course Code: Biot4106
Course Name: Cancer Biology
Credit Hour: 2
Prerequisite: Molecular biology

The course aims to introduce students with a basic understanding of the molecular and cellular mechanisms that lead to cancer. It primarily focuses on the role of growth factors, oncogenes, tumor suppressor genes, angiogenesis, and signal transduction mechanisms in tumor formation. In addition, students gain knowledge of cancer-related mutagens and pathways, and cancer therapy.

Course Code: Biot4104
Course Name: Food Biotechnology
Credit Hour: 2
Prerequisite: Microbial biotechnology

The food Biotechnology course deals with the application of biotechnology in food science to the selection, preservation, processing, packaging, distribution, and use of safe, nutritious, and wholesome food. Food biotechnology covers some of the main areas of application of biotechnology such as: the production of new kinds of foods and drinks, both by modern developments of conventional techniques and by genetically modifying the products themselves, or producing them using genetically modified organisms or their products. This course makes students learn about current trends in food biotechnology concerning modern biotechnological and biochemical interventions aiming towards food safety and food security with safety guidelines.

Course Code: Biot4106

Course Name: Pharmaceutical Biotechnology

Credit Hour: 2

Prerequisite: None

The course aims to give strong foundation and advanced information on biopharmaceuticals manufacturing techniques, drug discovery & development strategies including different phases of clinical trials. This course also provides core responsibilities for the development and monitoring of the drug and the preparation of medicines according to the standard operating procedures / GMP norms. To gain knowledge in physicochemical properties, pharmacokinetics and pharmacodynamics, and the formulation of commonly used biopharmaceuticals, packaging materials and recent techniques used, etc.

Course Code: Biot4108

Course Name: Biosafety and Intellectual property rights in biotechnology

Credit Hour: 2

Prerequisite: None

The course gives a brief outlook about the social and environmental impacts of the new developments in biotechnology in the areas of agriculture, medicine, and human reproduction. Students will gain a basic scientific/technical literacy pertaining to the biological concepts associated with bioethics, biosafety and intellectual property rights in the field of biotechnology. In addition, principles used to deal with concerns of biotechnology applications, regulatory frameworks in biosafety and IPR will also be dealt in details. There will be discussions and critical analyses of the contributions of science to public policy and the role of values in science.

Course Code: Biot4110

Course Name: Introduction to Systems and Synthetic Biology

Credit Hour: 1

Prerequisite: Introduction to omics Science

Biological systems are complex. System level analysis of interaction of components helps in solving many biological problems and for the reconstruction of artificial gene circuits. This course tries to introduce concepts in systems and synthetic biology. It deals with biological networks, mathematical models for networks, gene circuits and synthesis and assembly approaches for artificial gene circuits. And finally, application of synthetic biology and its safety considerations will be dealt in details.

Course Code: ISTP3116

Course Name: Integrated Science Team Project

Credit Hour: 3

Prerequisite: None

This is a multidisciplinary integrated science team project for special science computational problems under the guidance of a faculty member and a computer Programmer. The course introduces the student with computer programming basics using python language to help students deal with scientific problems by drawing methods and concepts from biology, chemistry, physics and mathematics. The course deals with binary computation, problem-solving methods and algorithm development. The course also covers data types, control structures, functions, parameter passing, library functions, arrays, inheritance and graph plotting using python Matplotlib. It is aimed to aid multidisciplinary team based science problem solving and product development.

Supportive Module

Course Code: BMgt4116

Course Name: Project Planning and Management

Credit Hour: 2

Prerequisite: None

The course deals with the different stages of project management. Topics covered include: project planning and national planning, project preparation, the project cycle, identification and quantification of costs and benefits, investment criteria, important financial ratios, risk and sensitivity analysis and applications on project planning and management.

3.3.5.2 Elective

Course Code: Biot4218

Course Name: Biodiversity and Conservation of Genetic Resources

Credit Hour: 2

Prerequisite: None

The course of biodiversity is designed to introduce the students to get knowledge about the meaning of biodiversity and its sub components of biosystematics, species diversity, species loss, habitats and ecosystems. Biodiversity is teaching the students the uses and values of biodiversity, as well as conservation and management of biodiversity at national, regional and international levels. The diversity of living organisms like animals, plants and microorganisms. The concept of extinction, threatened organisms is also demonstrated. This course will provide an introduction to the basic principles of conservation and biodiversity. The field of conservation biology is interdisciplinary. Protecting our remaining biological diversity will involve all fields of science, from the humanities to natural sciences.

Course Code: Biot4220

Course Name: Animal Cell and tissue culture

Credit Hour: 2

Prerequisite: Animal Biotechnology

Introduction to cell culture, design of the cell culture laboratory, the culture environment: media preparation and formulations, primary cell culture, maintaining cells: contamination and storage, and laboratory practices of animal cell culture.

Course Code: Biot4222

Course Name: Forensic Biotechnology

Credit Hour: 2

Prerequisite: Molecular biology

This course is designed to introduce the student to the hands-on techniques and opportunities in the field of biotechnology for the forensic field. The course will cover topics including introduction to forensic science, DNA applications in forensic investigation such as DNA fingerprinting. The course will cover various techniques used in biotechnology (very significant for forensics) such as PCR, and DNA diagnostics. There will be field visits, case studies, and group discussions about the latest events in the field of forensic biotechnology.

3.4 Bachelor of Science Degree in Industrial Chemistry

3.4.1 Program Education Objectives (PEO)

In general, the graduates of B. Sc. in Industrial Chemistry in the next 4-5 years of their graduation are expected to have applied their expertise in problem solving, be engaged professionally, and have continued to learn and adapt, and have contributed to their organizations through leadership and teamwork. Specifically, in 4-5 years of their graduation, the graduates will meet the following objectives as shown in Table below.

Table : Program Education Objectives (PEO)

PEO	Statement
PEO-1	Become experts in manufacturing industries (R&D group leader, QC manager).
PEO-2	Develop their career (pursuing postgraduate studies, adapting to new and state-of-the-art technology)
PEO-3	Become entrepreneurs (startups, consultancy)

3.4.2 Program outcome (PO)

Upon successful completion of the four-year program, the B. Sc. Industrial Chemistry graduates will develop the following skills, knowledge, and attributes.

Table : Program Objectives (PO)

PO	Statement
PO-1	An ability to identify, formulate, and solve broadly defined technical and scientific problems by applying knowledge of mathematics and science and/or technical topics to Industrial Chemistry.
PO-2	Ability to formulate or design a system, process, procedure or program in chemical industries to meet desired needs.

PO-3	An ability to develop and conduct experiments, or test hypotheses, analyze and interpret data and use scientific judgment to draw conclusions.
PO-4	An ability to operate advanced scientific equipment properly.
PO-5	An ability to communicate effectively with a range of audiences.
PO-6	An ability to understand ethical and professional responsibilities and the impacts of technical and scientific solutions in global, economic, environmental, and societal contexts.
PO-7	An ability to fulfill a multiplicity of roles as research scientists, development chemists, and technical representatives and as lab/unit/plant/company managers.
PO-8	An ability to function effectively in teams together with other professionals that establish goals, plan tasks, meet deadlines, and analyze the risks and uncertainty.

3.4.3 Program Courses Synopsis

3.4.3.1 Supportive courses

Course Code: Stat2103

Course Name: Statistics for Industrial Chemists

Credit Hour: 3

Prerequisite: No

This course covers basic elements of statistics, probability, central tendencies, variation, and types of sampling

3.4.3.2 Core course Synopsis

Course Code: Chem1106

Course Name: General Chemistry

Credit Hour: 3

Prerequisite: No

The course General chemistry is designed to make students more prepared to the all-chemistry courses by refreshing and summarizing the previous preparatory chemistry concepts before tackling the advanced chemistry courses. The course covers units and measurement, the composition of matter, chemical reactions, reactions stoichiometry, atomic structure and the periodic table, the chemical bond, structure of molecules, the properties of solutions, chemical equilibrium, introduction to functional groups and their typical reactions.

Course Code: Phys2114

Course Name: Physics for Industrial Chemists

Credit Hour: 3

Prerequisite: None

This course introduces Coulomb's Law, Electric Field, Gauss' Law, Electric Potential, Electric Potential Energy, Capacitors and Dielectric, Electric Circuits, Magnetic Field, Biot-Savart's Law, Ampere's Law, Electromagnetic Induction, Inductance, Circuits with time dependent currents, and Maxwell's equations

Course Code: ChEg3106

Course Name: Unit operation

Credit Hour: 3

Prerequisite: No

This course will give basic introduction on unit operations that are available in chemical process industries. Mainly focuses on mechanical unit operations like particle technology including size reduction and enlargement, mechanical hydromechanical aero mechanical separations, and mixing. students will have ability to analyze heat transfer operations like heat exchange, condensation and evaporation in detail.

Course Code: Biot3108

Course Name: Industrial Microbiology

Credit Hour: 3

Prerequisite: Organic Chemistry, Basic Biochemistry and Basic knowledge in microbiology

Industrial Microbiology is the application of Microbial biotechnology for industrial purposes, including the practice of using cell (biology) or components of cells like enzymes to generate industry useful products. The course deals with basic principles of Microbiology, fermentation technology, industrially important microorganisms, handling and development of inocula for various fermentation processes; types of fermentation, Process development, production of microbial products, etc. The focus of the techniques taught in this program is the use of biological resources as input to bio-based processes which are economically and environmentally sustainable, to equip students with skills on recent methodologies and practice in industrial biotechnology and to expose students to relevant and recent advances in industrial Microbiology. Industrial visit is needed for 2 times to different industries to learn the fermenter types, operational conditions and production process of fermented products in Beverage or Food industries as part of the course.

Course Code: InCh2101

Course Name: Analytical Chemistry

Credit Hour: 3

Prerequisite: High school chemistry

The course is designed to introduce students to the fundamentals of chemical analysis, and enable them develop competencies on chemical metrology; measurement in chemistry; traceability in chemical analysis; method validation, inter-laboratory test reference materials; calibration and standardization, Presenting analytical data; Evaluation and statistical data treatment; Errors in chemical analysis; estimation of uncertainty; combined standard uncertainty, the ISO GUM and the Nordtest approach; Ionic equilibrium; Titrimetric methods of analysis; as well as Gravimetric analysis.

Course Code: InCh2105

Course Name: Practical Analytical Chemistry

Credit Hour: 3

Prerequisite: No

The course is designed to enable students acquire the basic skills in calibration and standardization. Moreover, the course enables students to develop skills on different types of titrations and determination of end points. The course familiarizes the students with the skills in gravimetric analysis. As a result the students, after completion of the course, will develop the practical competency to carry out chemical analysis in various fields such as chemical industry, agriculture, environmental chemistry, clinical chemistry, medicine, pharmaceutical industries and others. The experiments to be conducted include: Calibration of burettes, pipettes, determination of standard and expanded uncertainty, neutralization, precipitation, complex formation, redox titrations and gravimetric analysis.

Course Code: Inch2102

Course Name: Instrumental Analysis I

Credit Hour: 3

Prerequisite: InCh2201

This course is designed for undergraduate students to develop basic theoretical competency in separation sciences and electro analytical techniques. The course helps students to familiarize students with analytical separation techniques and electroanalytical techniques methods. The first segment of this course covers principles, instrumentations and application of modern chromatographic techniques like Gas chromatography (GC), high performance liquid chromatography (HPLC), hyphenated techniques; GC-MS and LC-MS, supercritical fluid chromatography, size exclusion chromatography, ion exchange chromatography and electrophoresis. The second segment of this course encompasses the basics of electroanalytical techniques such as conductometry, potentiometry, coulometry, electro-gravimetry and voltammetry and their application areas such as toxicology, environmental science, pharmaceuticals, quality controlling, chemical industry, clinical chemistry, medicine etc. is included.

Course Code: InCh2104

Course Name: Practical Instrumental Analysis I

Credit Hour: 1

Prerequisite: InCh2203

The course is designed to provide practical skills and develop competency in carrying out chemical analysis using modern chromatographic techniques and electroanalytical techniques. The course includes practical experiments of chromatography (TLC, CC, GC, HPLC), and Electroanalytical methods (potentiometry, voltammetry, Conductometry, coulometry, electrogravimetry).

Course Code: InCh3101

Course Name: Instrumental Analysis II

Credit Hour: 3

Prerequisite: InCh2102

The course is designed to make the students develop the theoretical competency in using spectroscopic techniques for analytical purposes. The course familiarizes the students with the theoretical background of the principles of spectroscopic instruments like atomic absorption, atomic emission, ultraviolet-visible and infrared spectroscopy; nuclear magnetic resonance and mass spectrometers, as well as hyphenated techniques. The course also addresses the instrumentations of the various techniques and their application in various fields like, toxicology, environmental science, pharmaceuticals, quality controlling, chemical industry, clinical chemistry, medicine and the like.

Course Code: InCh3103

Course Name: Practical Instrumental Analysis II

Credit Hour: 1

Prerequisite: InCh2204

The course is designed to make the students develop the practical competency in using spectroscopic techniques for analytical purposes. The course familiarizes the students with the practical skills of operating spectroscopic instruments for qualitative and quantitative analysis. Practical experiments include atomic spectroscopy (AAS, AES), UV-Vis molecular absorption spectroscopy, IR spectroscopy and refractive index.

Course Code: InCh4102

Course Name: Real sample analysis

Credit Hour: 1

Prerequisite: InCh3103

Systematic analysis of real samples: sampling, preservation and preparation of samples for the determination of the major and/or trace elements, inorganic compounds (speciation) and organic compounds from real samples: biological samples; food and beverages; water and waste water samples; soils and related samples.

Course Code: InCh3111

Course Name: Inorganic Chemistry II

Credit Hour: 4

Prerequisite: InCh2101

This course is designed for undergraduate Industrial chemistry students to introduce the concept of Symmetry and point groups. Most Importantly it introduces Coordination chemistry, where formation, stability, reactions, catalytic activity and the electronic spectra of coordination compounds are widely discussed; Industrial applications of selected coordination compounds are also explained. Furthermore, chemistry of Main General Chemistry group and Transition Metal Organometallics: Nomenclature, bonding, and stability, reactivity as well as their reaction mechanisms are discussed. Finally, this course introduces Bioinorganic chemistry that motivates the students to study further on the function of metal ions in biological system.

Course Code: InCh2108

Course Name: Practical Inorganic Qualitative Analysis

Credit Hour: 1

Prerequisite: InCh2101

The course is designed to give student's competency in chemistry of transition elements mainly titanium, vanadium, chromium, manganese, cobalt, nickel, Platinum, copper, silver, cadmium, zinc, and mercury. The course familiarizes the students with the different oxidation states and reactions of transition elements and their compounds. The students will be able to prepare compounds of transition metals and study their behaviors in different media (acidic, basic, and neutral). The course equips the students with the required competency to work in areas that require the competency such as the chemical industry, agriculture, environmental chemistry, Geology, Biology and others.

Course Code: InCh3113

Course Name: Practical Inorganic Synthesis

Credit Hour: 1

Prerequisite: InCh3111

Practical Inorganic Synthesis is designed to give the students competency in analyzing inorganic compounds/species both in laboratory and in real samples. At the end of this course the students have expected to equip with the practical knowledge of synthesis, isolation and characterization of coordination compounds.

Course Code: InCh2109

Course Name: Organic Chemistry I

Credit Hour: 3

Prerequisite: None

This course is primarily designed to offer basic understanding of structures, reactivities and synthesis of simple organic compounds and the relationships between structure and properties. Although the course follows mechanistic approach to reactions of organic compounds (substitution, elimination, addition, rearrangement reactions), a chapter is devoted to brief discussion of functional groups, their typical reactions and synthesis. This will enable the students to understand the twin strategies of studying chemistry of the millions of organic compounds by either classifying them according to the reaction types they undergo (mechanistic approach) or according to their functional groups (functional group approach). The course also introduces the concept of stereochemistry and stereoisomerism (configurational and conformational isomerism) and its importance in organic reactions. This enables the students to appreciate the more subtle types of isomerism than the obvious structural (constitutional) isomerism. This course will complement practical organic chemistry-I course as theoretical background and will create basic knowledge for next organic chemistry courses.

Course Code: InCh2111

Course Name: Practical Organic Chemistry I

Credit Hour: 1

Prerequisite: InCh2401

This course designed to make the students aware of basic organic laboratory activities such as simple recrystallization, melting point determination, simple, steam and fractional distillation, and chromatography techniques. In addition to this student will prepare simple organic compounds like soap, aspirn in laboratory scale. Student will learn the

laboratory safely and regulation rules of organic laboratory. The course will give basic knowledge and skill on experimental organic chemistry because organic chemistry is everywhere, from the delicate smell of violets to the paper these words printed on. It is in the laboratory where the advances of science made. Without laboratory work, science would be just a poetic fabrication.

Course Code: InCh2110

Course Name: Organic Chemistry II

Credit Hour: 3

Prerequisite: InCh2109

This course designed to make students aware of organic reactions in detail and depth. It will elaborate chemistry of aromatic, amine, carbonyl compounds, carboxylic acid, and oxidation– reduction reactions. In addition, biological molecules such as carbohydrates, amino acids, peptides, lipid, and nucleic acids are introduced to address basic concepts about natural product chemistry.

Course Code: InCh2112

Course Name: Practical Organic Chemistry II

Credit Hour: 1

Prerequisite: InCh2111

This course designed to integrate the theoretical organic reaction with small-scale laboratory practice. The course enable students to understand organic reactions such as Esterification reactions; dehydration, acetylation, oxidation, aldol condensation, Friedel-Crafts reaction; and the Diels-Alder reaction. Extraction technique is very helpful in organic research. Thus, under this course extraction of limonene from citrus fruit and isolation of caffeine from tea are included to introduce basic extraction skills. In addition to this, students will understand dying process.

Course Code: InCh2110

Course Name: Systematic Identification of Organic Compounds

Credit Hour: 2

Prerequisite: InCh2112

This course designed to apply different physio-chemical and spectroscopic techniques. The course enables students to identify different functional groups of organic compounds by applying chemical tests. It also enables students to design

and synthesize derivatives for functional groups in organic compounds. The course will help students to apply and exercise the practical as well as theoretical knowledge for the identification of unknown organic compounds.

Course Code: InCh2106

Course Name: Physical Chemistry I

Credit Hour: 3

Prerequisite: None

This course is designed for students of Industrial chemistry as it makes them to have good understanding of bulk properties of system (thermodynamics) and enable them describe and predict chemical and physical changes mathematically by computing the change in properties of the system during the change and Predict criteria for any change to take place..

Course Code: InCh3107

Course Name: Practical Physical Chemistry I

Credit Hour: 1

Prerequisite: Physical Chemistry I, Physical Chemistry II

The Practical Physical Chemistry I course is delivered to the students of Chemistry in order to supplement the compulsory Theoretical Physical Chemistry courses which the students attend in the classroom. The laboratory course enables the students to develop skills of experimental data generation, interpretation and analysis of the data. Students are also motivated to do independent work through exploration on various physical properties of substances.

Course Code: InCh3107

Course Name: Physical Chemistry II

Credit Hour: 3

Prerequisite: Physical Chemistry I (InCh2302)

This course is designed to enhance and extend students' ability to understand rate of chemical reactions, electrochemistry and surface chemistry through leaning theoretical laws and principles. Additionally, they will be ready to conduct laboratory experiments, making observations and analyzing results, designing and analyzing products, and formulating and testing hypotheses based on evidence so that they are ready for making environmental and chemical analysis.

Course Code: InCh3104

Course Name: Practical Physical Chemistry II

Credit Hour: 1

Prerequisite: Physical Chemistry II, Physical Chemistry III

This practical course is designed to familiarize students with mechanisms of by which rate of reaction is determined. It also enable students develop skill of analysis of compounds using electrochemical and optical techniques. This practical course familiarizes students with the research tool and computational software used by chemists.

Course Code: InCh3102

Course Name: Physical Chemistry III

Credit Hour: 3

Prerequisite: Physical Chemistry II (InCh3301)

The Physical Chemistry III (Quantum Chemistry) course has been designed for the students to develop the knowledge of matter at the submicroscopic level. It also enriches students with the knowledge of computing properties of atomic and molecular species, which can be compared with the experimental results, so that the learners develop full confidence on the applications of quantum chemistry.

Course Code: InCh3112

Course Name: Industrial Inorganic Products

Credit Hour: 3

Prerequisite: None

This course is designed to introduce concepts of industrial processes and process variables, sources of water and its treatment for chemical industries, metallurgical processes and other chemical industries. It is designed to give deep understanding of manufacture of nitrogen containing compounds, synthesis and transportation means of some selected gases. It also emphasizes on a basic foundation of the manufacturing process of mineral acids and other concept that turns out to be a fundamental basis for many chemical processes.

Course Code: InCh3115

Course Name: Industrial Organic chemicals and Consumer products

Credit Hour: 3

Prerequisite: None

This course is designed to introduces undergraduate Industrial chemistry students about - the coal and petroleum, their value added products, Lubricants, their Classification mechanism of lubricants and their industrial application, synthesis and composition of soaps, detergents, shampoo , their biodegradation and environmental effects, formulation and composition of cosmetics products, chemistry of oil and fat, their function and their industrial applications, formulation and evaluation of Perfume, Industrial organic synthesis and their application

Course Code: InCh4112

Course Name: Chemistry of Cement, Glass and Ceramics

Credit Hour: 3

Prerequisite: None

This course is designed to introduces undergraduate Industrial chemistry students about Introduction to Cements; cements production, types of cements, binders (organic and inorganic), clinker production process and hardening of cements; Glass and its properties, type of glasses, constituents of glasses, Production processes of glasses, fuels needed for glass production, furnaces to be used for glass manufacture; Ceramics classification, properties and manufacturing process.

Course Code: InCh4103

Course Name: Leather Processing and Production

Credit Hour: 3

Prerequisite: None

course is designed to make students familiar with the process and production of leather from skin histology to last product through different processes so that they will understand the application of chemistry in leather industry. Moreover, the students will understand the different methods of increasing the quality and quantity of skin and leather. The course covers Skin histology and structure: microorganisms: curing: beam house: tanning: combination tanning: dyeing and fat liquoring.

Course Code: InCh4107

Course Name: Chemistry of Materials

Credit Hour: 3

Prerequisite: None

The course, Chemistry of Materials is designed to make students familiar with the different types of solids (crystalline and amorphous solid), solid state reactions and special applications of solid state materials (magnetic materials, liquid crystals, ionic conductors and special materials) so that they will understand the applications of chemistry in real life. Moreover, the students will learn about polymer synthesis and characterization; polymer structure and properties, and their industrial fabrication.

Course Code: InCh4105

Course Name: Industrial pharmacy

Credit Hour: 3

Prerequisite: None

This course is designed to introduce undergraduate Industrial Chemistry students about the concept of formulation, manufacturing, packaging, storage and quality control of pharmaceutical dosage forms (oral liquids, capsules, conventional tablets, coated tablets, and sterile products (parenteral, ophthalmic, irrigating solutions)). In addition students will be familiar with the equipment and machinery used for granulation, production and quality control of pharmaceutical dosage forms. The course will also give overall concepts about quality assurance and good manufacturing practices aspects of these dosage forms.

Course Code: InCh4108

Course Name: Chemistry of paper, pigments and natural products

Credit Hour: 3

Prerequisite: None

This course is designed to make students familiar with production, analysis and utilization of dyes and pigments, and pulp and paper. The students also understand the importance and industrial applications of natural products. The course covers pigments and paints, types of pigments, formulation, composition and related properties of dyes, paper industry, manufacture of paper, and manufacture of pulp by different processes, classes of natural product, effect of chemical structures on physiological activities of natural products and importance of natural products in health care and commerce.

Course Code: InCh4104

Course Name: Pharmaceutical Analysis

Credit Hour: 2

Prerequisite: Industrial Pharmacy

This course designed to make students familiar with the basic concepts of Pharmaceutical Analysis. The main points to be covered include; concepts in Pharmaceutical analysis, Pharmaceutical quality control and quality assurance: Pharmaceutical sample preparation for analysis: Limit tests: Pharmaceutical applications: Biological methods of analysis: Quality control: Current good laboratory practices (GLP). They will also able to propose suitable analytical technique for a sample, carry out analysis for different pharmaceuticals as well as handle, interpret and report data obtained from the analysis. The course also deals with the applications of important instrumental analytical techniques and gives biological assay methods.

Course Code: InCh4111

Course Name: Biochemistry

Credit Hour: 3

Prerequisite: None

The course, Biochemistry is designed to make our students familiar with the different types of biological molecules, their structure and its application in industries. So that they will understand the applications of biochemistry chemistry in life and in industry. Moreover, the students will understand the different metabolic reactions and pathways in different kinds of living things.

Course Code: InCh4109

Course Name: Environmental Chemistry and Waste management

Credit Hour: 3

Prerequisite: General Chemistry

This is an undergraduate level course designed to introduce students with contemporary concepts in environmental chemistry and Waste management. The course covers the chemical composition of different segment of the environment, relationship between different segment of the environment, environmental pollution, sources, transport and fate of pollutants atmospheric chemistry and air pollutants; aquatic chemistry; water quality assessment, toxicology, industrial waste classification, soil chemistry and pollution, waste management; waste treatment, cycling, resource recovery; Green chemistry and sustainability.

Course Code: InCh4106

Course Name: Quality Assurance and Management systems

Credit Hour: 2

Prerequisite: None

This course is designed to introduce students about the concept of quality and contemporary quality management concepts, tools and models specifically in a manufacturing industry set up and prepare them for job market. The concepts, aspects and development of quality; Laboratory quality assurance and control; models and standards for quality management systems etc. will be covered in detail in this course.

Course Code: InCh4110

Course Name: Industrial Safety and Loss prevention

Credit Hour: 2

Prerequisite: None

This course is designed to introduce concepts of industrial safety system and loss prevention. It describes the general safety requirements for the workplace as well as the general safety equipment, facilities and controls. The course presents the basic principles of workplace safety and health protection, as well as the constituents of Safety management program that establish control of the hazards and risks of work. Determination and evaluation of hazardous properties of substances. Materials handling, fire control, Loss prevention working with machinery and apparatus, It explains the possible workplace industrial accidents and loss statistics, nature of the accidents/hazardous processes as well as controlling strategies from its possible dangerous effect. It also deals with personal safety devices and ways of mitigating health and physical hazards. .

Course Code: InCh3117

Course Name: Industrial attachment

Credit Hour: 3

Prerequisite: None

At the end of their third year, during summer vacations (for 2 months) the students are assigned to the various industries to get practical skills and exposure to the real industry working conditions. During this time students will get mentoring and supervision both from the industry and a faculty member from the department. After completion of their practice, students are expected to submit a report and present it to the evaluators in an arranged session.

Course Code: InCh4114

Course Name: Student Project

Credit Hour: 4

Prerequisite: Research Methods and Scientific Writing (InCh 3601)

During their final year, students will be allowed to solve a particular industrial chemistry problem following appropriate research methodology and write a scientific report which will be defended orally. The department assign suitable supervisor based on the scientific problem chosen. The course will help students develop, scientific process and writing skills as well as hands on experience.

Course Code: InCh3114

Course Name: Introduction to Research Methods and Scientific writing

Credit Hour: 2

Prerequisite: None

This course will introduce the meaning of research and its objectives, types of research and research process, proposal writing, writing research reports, and poster and oral presentations. It also introduces to literature review including the source of literature and the information that could be get from them. They will be acquainted with literature reviewing, proposal writing, seminar and poster presentations through projects.

Course Code: InCh3115

Course Name: Computer Application for Industrial Chemists

Credit Hour: 2

Prerequisite: None

The course covers the applications of computers in chemistry including computer fundamentals, data collection, data analysis and presentation. Construction, visualization and geometry optimization of simple molecules would encourage the student to shape his/her career as a good chemist in the future.

Course Code: InCh4101

Course Name: Sugar Processing and Production

Credit Hour: 3

Prerequisite: None

History of Sugar Industry, Cane Sugar Processing, Cane preparation, Sugar Beets; Cultivation, Harvesting, Preparation; Production of Juice; Juice Clarifications and Methods; Production of Sugar from Thick Juice; Separation of Sugar from Massecuite; Preparation of Refined and White Sugar.

Course Code: InCh3116

Course Name: Integrated Science Team Project

Credit Hour: 3

Prerequisite: None

This is a multidisciplinary integrated science team project for special science computational problems under the guidance of a faculty member and a computer Programmer. The course introduces the student with computer programming basics using python language to help students deal with scientific problems by drawing methods and concepts from biology, chemistry, physics and mathematics. The course deals with binary computation, problem-solving methods and algorithm development. The course also covers data types, control structures, functions, parameter passing, library functions, arrays, inheritance and graph plotting using python Matplotlib. It is aimed to aid multidisciplinary team-based science problem solving and product development.

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