Course Descriptions

MTH121 – Engineering Mathematics I (3, 3-0-2)

Limits of functions, theorems about limits, evaluation of limit at a point and infinity, continuity. Derivatives of algebraic and trigonometric functions, maxima and minima, engineering applications of derivatives. The definite and indefinite integrals and their applications. Integration by parts, Integration using powers of trigonometric functions, Integration using trigonometric substitution, Integration by partial fractions. Integration of improper integrals. Transcendental functions.

Pre-requisite: ---.

MTH122 – Engineering Mathematics II (3, 3-0-2)

Matrix addition, subtraction, multiplication and transposition. Complex numbers, algebraic properties of complex numbers, absolute values, complex conjugate, polar representation, powers and roots. Functions of several variables. Double and triple integrals in rectangular and polar coordinates. Applications of multiple integrals in engineering. Infinite sequences, tests for convergence, power series expansion of functions, Taylor series, Laurent series, Fourier series and their applications in engineering.

Pre-requisite: MTH121.

MTH221 – Engineering Mathematics III (3, 3-0-2)

Vector Calculus and its engineering applications. First order differential equations. Homogeneous linear second-order differential equations with constant and variable coefficients, nonhomogeneous linear second-order differential equations with constant coefficients, higher-order linear differential equations with constant coefficients. Power series solution of differential equations. Laplace Transform, Inverse Laplace Transform. Application of Laplace Transform to solve ordinary differential equations. Introduction to partial differential equations (PDEs), first order PDEs, second order PDEs, boundary value problems, engineering applications.

Pre-requisite: MTH122.

MTH222 – Engineering Mathematics IV (3, 3-0-2)

Linear Algebra: Matrices and determinants, solution of systems of linear equations, eigenvalues and eigenvectors, engineering applications, computer exercises. Complex Analysis: Complex functions, derivative of complex functions, analytic functions, Cauchy-Riemann equations, harmonic functions. Fourier analysis: Fourier Series, Fourier Integrals, Fourier series of even and odd functions with applications. Discrete Mathematics and its engineering applications.

Pre-requisite: MTH221.

MTH321 – Engineering Mathematics V (3, 3-0-2)

To introduce the students, the fundamentals of probability, random variables, and random processes so that they can deal with randomness and uncertainty involved processes and systems.

Prerequisites: MTH122.

PHY121 – Engineering Physics I (4, 3-2-2)

Vectors, motion, and Newton's laws. Work, energy, momentum and conservation of momentum. Rotation of rigid bodies, dynamics of rotational motion. Equilibrium and elasticity. Stress and strain. Periodic motion. Engineering applications.

Pre-requisite: ---.

PHY122 – Engineering Physics II (4, 3-2-2)

Electric charge and electric field. Coulomb's law and Gauss's law with applications. Capacitance and dielectrics. DC circuits. Magnetic fields. Ampere's law and its applications. Electromagnetic induction, Faraday's law, Lenz's law, induced electric fields. Self- and mutual-inductance. Electromagnetic waves and Maxwell's equations. Optics and its engineering applications.

Pre-requisite: PHY121.

CHE101 – Chemistry for Engineers (3, 2-2-0)

Atoms, molecules, ions and formulas of ionic compounds. Electronic structure and the periodic table. Quantum numbers, energy levels and orbital. Orbital diagrams of atoms. Various types of bonds. Chemistry of the metals and semiconductors. Introduction to organic chemistry, bonding and types of hybridization in carbon atom, alkanes and cyclo alkanes, alkyl and halogen substituents. Alkenes and alkynes, Diels-Alder reaction. Types, properties, and use of polymers.

Pre-requisite: ---.

MEC101 – Introduction to Engineering (1, 1-0-1)

Career in engineering, various specializations in engineering, mechanical engineering degree requirements, application areas in mechanical engineering, career opportunities in mechanical engineering. Discussions of design problems, challenges and future directions in engineering, impact of engineering on society and environment, professional practice and ethical considerations, codes of ethics.

Pre-requisite: ---.

MEC102 – Computer Programming (3, 3-0-2)

The course introduces the basic concepts of computer programing with C++ and involves practice at basic to intermediate level utilizing fundamentals and main features and procedures such as problem solving and flow charts, data types, input, output and control statements. Use of functions, arrays and strings is also practiced with engineering problem solving assignments.

Pre-requisite: COM111.

MEC103 – Engineering Drawing and Mechanical Workshop (3, 1-(2+2)-0)

Engineering drawing techniques; orthographic and pictorial projections; dimensioning and tolerance; limits and fits; screw fasteners; cam; gears; computer aided drafting and modeling; product design.

The students will also be introduced to basic workshop skills such as safety, hand tools applications and basic machine tool operations, (hand drills, grinding, welding, etc.).

Pre-requisite: ---.

MEC201 – Fundamentals of Electrical Engineering (4, 3-2-1)

Basic principles of circuit; steady-state A.C. circuit theory; magnetic circuits; transformers; direct-current motors; three-phase power system; induction motors; step motors. Introduction to Electronics. Introduction to microprocessors and microcontrollers.

Pre-requisite: PHY122.

MEC202 – Engineering Mechanics – Statics (3, 3-0-1)

Fundamental concepts and principles of mechanics, vectors and force systems, concept of free-body-diagram, principle of equilibrium, analysis of structures, trusses, frames and machines, shear and bending moment in beams, center of gravity, centroids, moment of inertia, and friction.

Pre-requisite: PHY121.

MEC203 – Engineering Materials (3, 2-2-1)

Introduction to fundamental concepts related to structure and properties of materials, metals and alloys, non-metals, polymers, ceramics and composites with applications.

Pre-requisite: CHE101.

MEC204 – Thermodynamics (3, 3-0-1)

Basic concepts of thermodynamics, properties of matter, processes and cycles, energy transfer, first law of thermodynamics for closed systems and control volumes, second law of thermodynamics, entropy, applications on engineering devices, basics of vapor power and gas power cycles. Introduction to internal combustion engines.

Pre-requisite: PHY121.

MEC205 – Engineering Mechanics – Dynamics (3, 3-0-1)

Fundamental concepts of kinematics and kinetics with application to motion of particles and plane motion of rigid bodies, rectilinear and curvilinear motion, Newton's second law, impulse and momentum methods, impact, dynamics of systems of particles, kinematics of rigid bodies; plane motion of rigid bodies, forces and accelerations, energy and momentum methods.

Pre-requisite: MEC202.

MEC206 – Mechanics of Solids (4, 3-2-1)

Stress and strain; mechanical properties of materials; axial load, torsion, bending and transverse shear; combined loadings; stress transformation; deflection of beams and shafts; and buckling of columns; thin-walled pressure vessels.

Pre-requisite: MEC202.

MEC207 – Fluid Mechanics (4, 3-2-1)

Fundamental concepts and properties of fluids; fluid statics, units and measurement of pressure; forces on planar and curved surfaces, and buoyancy; kinematics of fluid motion; conservation equations with applications; continuity, momentum and energy equations, Bernoulli's equation; velocity and flow rate measurements; dimensional analysis and modeling; frictional losses in pipes and introduction to fluid dynamic forces on immersed bodies.

Pre-requisite: PHY121.

MEC208 – Report Writing and Presentation (3, 3-0-1)

To develop engineering students' skills in technical report writing, business correspondence, and effective oral presentation.

Pre-requisite: MEC101.

MEC301 – Heat Transfer (4, 3-2-1)

Mechanisms of heat transfer, steady-state conduction solution in various geometries, electric network analogy, fins, numerical methods in heat transfer, transient conduction, internal and external forced and natural convection with applications to heat exchangers, and fundamentals of thermal radiation.

Pre-requisite: MEC204.

MEC302 – Computational Methods in Engineering (3, 3-0-2)

An introductory course on computational methods for solving problems in engineering using faster and more efficient approximate numerical solution techniques with the help of computers. Examples of applications from mechanical engineering will be used.

Prerequisite: MTH221, MEC102.

MEC303 – Design of Machine Elements (3, 3-0-1)

Mechanical systems and elements, overall design considerations, safety, economy and societal considerations in design. Design codes and standards. Load, stress and critical sections in machine parts. Theories of Failure. Torque Transmission Systems: Design of shaft, axle, keys. Selection of bearings; other machine elements: Selection of springs, Design of power screws;

Pre-requisites: MEC103, MEC206.

MEC304 – Control Systems (4, 3-2-2)

To develop students' concepts of control systems, familiarize them with different analysis techniques, and to enable them to design and analyze the performance of feedback control systems.

Prerequisite: MTH321.

MEC305 – Engineering Management (3, 3-0-1)

This course presents an overview of the functions of engineering management and business fundamentals for engineering managers. The course aims at teaching the students how to contribute and manage the organization's people, technology, facilities and other recourses effectively to achieve its business objectives. Introduction to engineering economy.

Pre-requisite: MEC208.

MEC306 – Machine Design (4, 3-2-1)

Power Transmission System - Design of gear system; Design of brakes & clutches. Selection of flexible drives, Design of mechanical systems.

Pre-requisite: MEC303.

MEC307 – Manufacturing Technology (4, 3-2-1)

Fundamentals of manufacturing processes, including casting, forming, welding and machining operations, powder metallurgy. Surface treatment. Basics of economics of metal cutting, statistical quality control, non-metals manufacturing and other contemporary topics in manufacturing.

Pre-requisite: MEC206.

MEC401 – Directed Studies in Mechanical Engineering (3, 3-0-0)

The course permits students to investigate possible research fields or pursue topics of interest through reading, presentation and seminars under the supervision and guidance of a faculty member. At the beginning of the semester, the course instructor gives students a list of the course topics with brief introductions. Students are required to investigate and

research each topic and prepare a reports and a presentation. Topics will be in areas that are not covered in other courses or topic that deal with broad knowledge and professional practice.

Pre-requisite: MEC305.

MEC402 – Turbo Machines (3, 3-0-0)

Fundamental concepts of compressible and incompressible flow turbomachines dimensional analysis and similitude, basic governing equations for turbomachines, cascades, Euler equation and head losses, centrifugal pumps and piping systems, net positive displacement machines, hydraulic turbines, compressible flow turbomachines (compressors, fans and turbines), safety, specifications and standards.

Prerequisite: MEC207, MEC301.

MEC403 – Refrigeration and Air Conditioning (4, 3-2-0)

Introduction to refrigeration and air conditioning. Heating, ventilating, and air conditioning (HVAC) systems including psychometrics, ventilation requirements, load estimates, and building energy system design, simulation, and control.

Pre-requisite: MEC301.

MEC491 – Graduation Design Project I (3, 1-4-0)

The course is aimed at the development of conceptual and applied design skills through discussions, meetings and laboratory work involving the completion of a mechanical engineering design project. The project experience is intended to develop students' skill in problem solving, team work, design, innovation, use information technology, engineering, ethics, and social responsibility.

Pre-requisites: MEC306, MEC307.

MEC492 – Graduation Design Project II (3, 1-4-0)

The course is aimed at the development of conceptual and applied design skills through discussions, meetings and laboratory work involving the completion of a mechanical engineering design project. The project experience is intended to develop students skill in problem solving, team work, design, innovation, information technology, engineering, medical ethics, and social responsibility. Students are expected to complete a design project that demonstrates the skills and knowledge gained through applying engineering principles to solve a design problem.

Pre-requisite: MEC491.

Program Electives:

MEC451 – Industrial Automation and Mechatronics (3, 3-0-0)

The course introduces the current practices and trends in manufacturing industry in terms of automation and use of mechatronics. Fundamentals of electronics, microprocessors and controllers. Use of sensors, transducers, devices for data acquisition and data processing.

Engineering applications. System components and system integration. CNC machines and part programing.

Pre-requisites: MEC201, MEC302, MEC304.

MEC452 – Computer Aided Design and Manufacturing (3, 3-0-0)
Introduction to the use of computers in product design and manufacturing. An overview of CAD. Product design. Modern prototyping and machining methods. NC programing. Design for manufacturing and assembly.

Pre-requisites: MEC103, MEC302.

MEC453 – Renewable Energy Systems (3, 3-0-0)
Introduction to renewable and non-renewable energy resources. Environmental and social impact of renewable energy and its uses. Renewable energy technologies such as solar, wind, geothermal, ocean. Operation, maintenance, efficiency and related issues. Future technologies.

Pre-requisite: MEC301.

MEC454 – Finite Element Methods with Applications (3, 3-0-0)
Basics of finite element methods (FEM) as an introductory course. FEM as a tool for solving differential equations with a variety of applications such as in structural frameworks, stress analysis, heat flow, and fluid flow.
Pre-requisite: MEC302.

MEC455 – Advanced Fluid Mechanics (3, 3-0-0)
Introduction to fluid dynamics. Viscous flow in pipes. Flow over immersed bodies. Introduction to compressible flow. Numerical methods in fluid flow. Introduction to computational fluid dynamics.

Pre-requisites: MEC207, MEC302.

MEC456 – Water Desalination (3, 3-0-0)
The course introduces the need for water desalination, basic science and technology related to water desalination, water properties, basics of water desalination, desalination processes and technologies problems in water desalination.

Pre-requisites: MEC207, MEC301.

Program Free Electives:

BME308 – Biomechanics (3, 3-0-0)
Basics of Anatomy and Mechanics, Applications involving forces and moments, Statics: Analysis of systems in equilibrium: Applications to human joints: Properties of deformable bodies: Basics of Dynamics, Impulse and momentum, Applications from real-life problems: Applications to various sports, Contemporary issues: Motion / gait analysis.

Pre-requisites: MEC206.

BME304 – Biomaterials Basics and Applications (3, 3-0-0)

Introduction to biomaterials, structure and properties of materials, crystalline and non-crystalline materials, properties of biological materials, tissue response to implants (biocompatibility). Metallic implant materials – properties and applications. Ceramic implant materials – properties and applications. Polymeric implant materials – properties and applications, polymerization. Composite implant materials. Applications and major considerations of materials in various areas, such as cardio-vascular, ophthalmologic, orthopedic, dental implants.

Pre-requisites: MEC203.

MGT211 – Production and Operations Management (3, 3-0-0)

Operations Management is concerned with efficient and effective transformation of inputs – raw materials, personnel, machines, technology, capital, information, and other resources – into marketable and competitive outputs. The course will introduce students to the main principles, standards and methodologies of Production and Operations Management (POM). It will explore past and present topics in production and operations management that have had a significant impact in the management of Manufacturing and Service operations.

Pre-requisites: MEC305, STA112.

MGT212 – Management of Small Business (3, 3-0-0)

The course is designed to answer the fundamental question that most students and aspiring entrepreneurs often ask: How to start and manage my own business? With this objective the course discusses different types of businesses, legal organizations, accounting and financial requirements. Other specific topics covered in the course include: obtaining capital, controlling inventory, selling prices, staffing, marketing strategies, growth and expansion decisions and strategies.

Pre-requisites: MEC305.

ELE480 – Fuzzy Logic and Neural Networks (3, 3-0-0)

To introduce students to the theory of fuzzy logic and artificial neural networks and develop their understanding of neural/fuzzy technology applications and implementations.

Pre-requisites: MEC302.