Course Code	Course Title	Unit	Semester Offered	Course Description	Learning Outcomes	Pre-requisites	Co-requisites	Preclusions	Syllabus	Assessment	Illustrative Reading List
ME1103	Principles of Mechanics and Materials	4	1 & 2	This course comprises two parts, namely: Part I on mechanics, and Part II on materials. Part I provides basic mechanical engineering knowledge and theory of mechanics of materials, and how they are used to solve practical engineering problems. It includes statics analysis of rigid body and assemblies, such as truss, frame and machines. It also covers the basic concept internal force and moment, which in turn translate to the stress in structures, such as axially loaded truss and laterally loaded beam. Part II introduces engineering materials and their properties, including the tests used to establish these properties. The structures of the various classes of materials will be discussed in relation to their different properties and deformation behaviour. The basics of materials selection will also be covered.	1. Apply the concepts of static equilibrium of a rigid body to solve for the unknown forces under different supporting conditions and external loads. 2. Apply the concepts of static equilibrium to analyse internal forces in assembly of rigid bodies, specifically to truss, frames and machines. 3. Describe the relationships between internal force/moment induced within slender structure and the corresponding stress states, which in turn define their structural integrity. 4. Describe the mechanical properties of engineering materials and how they are tested. 5. Correlate the structures of materials to their mechanical properties. 6. Perform simple materials selection.	Nil	Nil	ME1102 and ME2112	- Review of Force and Moments – A brief revision on force and moment. (3 hrs) - Statics – Static equilibrium of a rigid body and assembly of rigid bodies, specifically truss, frames and machines, under different supporting conditions and external loads. (8 hrs) - Internal force and stress – Calculations of internal force and moment, and hence the stresses, induced within different structures under external loads. (2 hrs) - Mechanical properties and testing – stiffness, strength, hardness; tensile test and indentation hardness test (4 hrs) - Material structures and deformation behaviour in metals, ceramics and polymers – atomic bonding; crystal structures; imperfections; deformation and strengthening mechanisms (7 hrs) - Materials selection (2 hrs)	Project/Group Project Quizzes/Tests Laboratory Tests Final Examination	**Supplementary reading:** Vector Mechanics for Engineers Fundamentals of Materials Science and Engineering
ME2105	Principles of Mechatronics and Automation	4	1 & 2	This course is designed to equip Mechanical Engineering students with fundamental knowledge and skills in Mechatronics and Automation. The curriculum covers key topics such as circuit analysis, basic electronics, sequential circuits, sensors, signal conditioning, AC circuits, AC power, and the conversion of electrical energy to mechanical energy. By the end of the course, students will be able to design and construct basic mechatronic systems. To reinforce theoretical concepts, the course includes three laboratory sessions. These hands-on sessions provide students with the opportunity to work with mechatronic instruments and sensors, construct electrical circuits, and operate both DC and AC motors, offering practical insights into the operation and integration of mechatronic components.	1. Analyse basic electrical circuits. 2. Understand the basic principles and application of various sensors. 3. Understand the basic principles and characteristics of DC and AC motors. 4. Understand and utilise mechatronics components and system integration. 5. Develop teamwork during lab class and able to write clear and precise reports.	Nil	Nil	ME2104, ME2143, TME2143	1. Circuit Analysis (4 hours) Circuits, Currents, and Voltages; Power and Energy; Kirchhoff's Current Law (KCL); Kirchhoff's Voltage Law (KVL); Voltage- and Current-Divider; Node-Voltage Analysis; Thévenin and Norton Equivalence 2. Capacitor and Inductor (2 hours) Working principles of capacitors and inductors; Energy stored in capacitors and inductors.Capacitors/Inductors in Series and Parallel; Charging and discharging of capacitors/inductors. 3. Operational Amplifier (3 hours) Model of op-amp; Analysis, Ideal and practical op-amp; Op-amp circuits – inverting/non-inverting/summing/difference amplifier; Applications 4. Sensors and Signal Conditioning (4 hours) Accuracy and precision; Characteristics of sensors; Types of sensors – thermal, force and displacement; Sensing principles; Wheatstone bridge 5. Semi-conductors (1 hour) Basic semiconductor physics; Junction diodes; Zener diodes; Bipolar junction transistors 6. DC Motors (3 hours) Review of electromagnetism; Principles of DC machines; PMDC, shunt and series motors; Motors' characteristics; Governing equations 7. Steady-state Sinusoidal Analysis (5 hours) Review of complex numbers; Sinusoidal current and voltage; RMS value; Phasors; Complex impedance; Complex impedance of capacitor and inductor; Circuit analysis of steady state AC circuit, AC power, 3 phase, Y connection 8. AC Motors (4 hours)	Laboratory Tests Final Examination	**Compulsory reading:** Electrical Engineering:Principles and Applications, International Edition by Allan R Hambley Introduction to Mechatronics and Measurement Systems, David G. Alciatore; Michael B. Histand
ME2102	Engineering Innovation and Modelling	4	1 & 2	This course introduces the students to the various standards and techniques of sketching, prepare engineering drawings and specifications, and interpreting drawings. Students also get to use advanced commercial CAD software to do 3D solid modeling. Above all, this course expands the students' creative talent and enhances their ability to communicate their ideas in a meaningful manner. Major topics include: Principles of projections; Isometric; Orthographic and Isometric sketching; 3D solid modeling; Sectioning and Dimensioning; Welding representations, Drawing standards; Limits, Fits and Geometrical Tolerances. This course also provides the student with the fundamental knowledge to do calculations on design components like bolts, screws, fasteners, weld joints, springs, gears, material selection, fatigue, bearings and shafts. This is a 100% CA core course for all Mechanical Engineering students.	On successful completion of this course, the student will: 1. Demonstrate the basic knowledge in engineering drawing principles, tolerance, engineering conventions and representations. 2. Use advanced 3D modeling software in solid modeling. 3. Perform calculations on design components	Nil	Nil	Nil	Introduction to engineering drawing, scale, title-block Principles of projection; 1st and 3rd angles. Isometric views Sectioning and Dimensioning of parts Isometric & orthographic sketching Limits, Fits and Geometrical Tolerances Symbols for machine elements, Conventions, Keys, coupling & Locking Devices Welding symbols & representation Screws, bolts and fasteners, Weld joints, Springs, Gears Selection of materials, Design against fatigue Selection of rolling bearings Design of shafts	100% CA Quiz Lab	N.A
ME2112 (cohort AY2425 & before)	Strength of Materials	4	1 & 2	This course provides basic mechanical engineering knowledge and theory of mechanics of materials, and how they are used to solve practical engineering problems. The course includes introduction to statics, concept of stress and strain, analysis of stresses and deflections in a loaded beam, torsion of a circular bar as well as analysis of frames and machines.	Students will be able to 1. Understand the concepts of statics, equilibrium of a rigid body, forces and moments 2. Understand frames and machines in a structural component 3. Understand and analyse simple slender structures. 4. Understand stress-strain relations and frame transformation.	Cohort AY18/19 & before = EG1111 Cohort AY19/20 - AY23/24 =ME1102	Nil	ME2113	• Introduction to Statics, Equilibrium of Rigid Bodies, Frames and machines. • Deformable Bodies; Stress and Strain and Sign Convention; Linear Elastic Stress-Strain Relationships. • Rods under axial loading • Cylindrical rods under torsion • Bending of beams • Stress and strain transformation	Lab Quiz Assignment Final Examination	N.A
ME2116 (Offered from AY26/27 for cohort AY25/26)	Mechanics of Materials	4	1 & 2	This course on mechanics of materials teaches how materials deform when mechanically loaded and consequently how engineering structures respond under external loads. The concept of stress and strain is introduced and then applied to the analysis of rods under axial loads and torsion, bending of beams and buckling of slender structures. Common criteria for determining failure of brittle and ductile materials will be introduced and used in the failure analysis of structures.	1. Understand the concept of stress and strain and their relationship 2. Analyse/determine stresses and deformation of rods under uniaxial loads and torsion. 3. Analyse/determine stresses and deformation of beams. 4. Analyse/determine instability in columns. 5. Apply failure criteria in stress analysis	ME1102 or ME1103	Nil	ME2112/ ME2114/ TME2114	• Concept of Stresses and Strains • Rods under Axial Loads Relationships. • Shafts under Torsion • Bending of Beams • Transformation of Stresses and Strains • Failure Analysis • Instability	Lab Quiz Final Examination	N.A
ME3115 (previously known as ME2115)	Mechanics of Machines	4	1 & 2	This course covers the fundamental engineering principles on kinematics and kinetics. The topics of rigid body dynamics and vibration will be covered, including the theoretical development and practical application to mechanisms and machinery. The salient features of dynamics to be applied for each instance will be clearly explained and the interpretation of the results obtained will be highlighted.	1. Understand the principles of kinematics of rigid body motion and apply them to the analysis of simple mechanisms 2. Understand the principles of kinetics of rigid body motion and apply them to the analysis of simple mechanisms. 3. Apply the knowledge of dynamics to solve mechanical vibration problems.	Cohort AY18/19 & before = PC1431 Cohort AY19/20 & after =ME1102 or ME1103	Nil	ME2115	1. Revision for kinematics and dynamics of particles 2. Kinematics for rigid bodies 3. Kinetics for rigid bodies 4. Work and energy principle for rigid bodies 5. Vibration of single degree of freedom system 6. Analysis of mechanisms and linkages.	Project Lab Onlne Quizzes Final Examination	**Supplementary reading:** **Vector Mechanics for Engineers: Dynamics** Ferdinand Beer; Phillip Cornwell; Brian Self; Jr. Johnston, E. Russell

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ME2121	Engineering Thermodynamics and Heat Transfer	4	1 & 2	This course introduces fundamental concepts of thermodynamics and heat transfer. It covers thermodynamic properties of pure substances, state diagrams, reversible and irreversible processes, and the first and second laws of thermodynamics, including non-flow and flow processes. The second half explores the three modes of heat transfer—conduction, convection, and radiation—emphasising their applications in engineering. Students will develop essential skills to analyse and solve problems in heat transfer systems.	On successful completion of this course, the student will be able to: 1. Apply the fundamental concepts of thermodynamics, including thermodynamic properties, state diagrams, and the first and second laws, to analyse energy systems. 2. Apply entropy principles to determine the feasibility of processes. 3. Apply the three modes of heat transfer—conduction, convection, and radiation—in engineering contexts. 4. Evaluate simple thermal systems and design basic heat transfer solutions by integrating concepts from conduction, convection, and radiation.	Cohort AY18/19 & before = PC1431 Cohort AY19/20 & after =ME1102 Cohort AY25/26= ME1103	Nil	TME2121	Properties of Pure Substances, Steam Tables **First Law of Thermodynamics:** First Law applied to non-flow, flow processes and cycles. Ideal gas and condensable substances. **Second Law of Thermodynamics:** Direct and reversed heat engines. Reversibility, processes and cycles. Carnot cycle. Clausius inequality. Entropy of substances. **Conduction Heat Transfer** Steady heat conduction with and without energy generation; Unsteady heat conduction Conduction heat transfer through extended surfaces **Convection Heat Transfer** Hydrodynamic and thermal boundary layers; Laminar and turbulent forced convection heat transfer for external and internal flows;Free convection;Overall heat transfer coefficient **Radiation Heat Transfer** Black and gray body radiation; Radiation between diffuse surfaces	Lab, Quiz, Test, Final Examination	**Compulsory reading:** Thermodynamics: An Engineering Approach by Michael Boles; Yunus Cengel **Heat and Mass Transfer** Yunus A. Cengel; Afshin Jahanshahi Ghajar **Supplementary reading:** Fundamentals of Thermodynamics by Claus Borgnakke by Richard E. Sonntag Engineering Thermodynamics by Gordon Frederick Crichton Rogers by Yon Richard Mayhew Fundamentals of Engineering Thermodynamics by Michael J. Moran; Howard N. Shapiro; Daisie D. Boettner; Margaret B. Bailey Fundamentals of Heat and Mass Transfer by Frank P. Incropera Heat Transfer by Jack Philip Holman
ME2134	Fluid Mechanics I	4	1 & 2	This is an introductory course to fluid mechanics as applied to engineering. After introducing the basic terminology and a classification of fluid and flow, students are taught fluid statics, which cover hydrostatic forces on submerged bodies, surface tension forces, buoyancy, metacentric height and stability of floating bodies. Numerous examples of engineering applications pertaining to each aspect of fluid statics are presented. In the section on fluid dynamics, basic principles of fluid motion are introduced. This covers the continuity equation, Bernoulli and energy equations. The momentum equation and its engineering application using the control volume approach are included. In the analysis of fluid-mechanics problems, dimensional analysis and similitude are taught with practical engineering examples. On viscous flow in pipes, laminar and turbulent pipe flows, Hagen-Poiseuille law, friction factor, losses in pipe fittings and use of Moody's Chart will be covered.	On successful completion of this course, the student will be able to: 1. Classify different types of fluid flows, identify different flow regimes, relate stress and rate of strain in a fluid, and solve problems involving surface tension. 2. Evaluate hydrostatic forces on submerged plane or curved surfaces, identify the states of equilibrium of floating bodies and analyse their stability. 3. Analyse equilibrium of fluids undergoing rigid-body translation and rotation, and perform control volume analysis using the continuity, linear and angular momentum equations. 4. Apply the Continuity and Bernoulli equations, and appreciate the limitations of the Bernoulli equation. 5. Formulate dimensionless groups using Rayleigh's Method and Buckingham's Pi Theorem, and apply concepts of modeling and similitude. 6. Analyse energy losses and velocity distributions for laminar and turbulent flows in smooth and rough pipes, apply Moody's chart and compute minor losses in pipe systems.	Cohort AY18/19 & before = PC1431 Cohort AY19/20 & after =ME1102 Cohort AY25/26= ME1103	Nil	TME2134	1. **Introduction to Fluid Mechanics.** 2. **Classification of Fluid and Flow:** Real and ideal; Newtonian and non-Newtonian; Uniform and non-uniform; Steady and unsteady; Laminar and turbulent; Incompressible and compressible. 3. **Fluid Statics**: Hydrostatic forces on submerged body, buoyancy, metacentric height, stability of floating bodies. 4. **Principles of Fluid Motion**: Definition of streamline. Continuity equation, Bernoulli equation and Energy equations. Equilibrium of moving fluid (in translation and rotation). Momentum equation and its applications. 5. **Dimensional Analysis and Similitude**: Rayleigh's method, Buckingham's Π theorem, Dimensionless numbers. Type of physical similarities: geometric, kinematic and dynamic. Reynolds number, Froude number, etc and their simple applications. 6. **Laminar and Turbulent Pipe Flows**: Hagen-Poiseuille equation, Darcy friction factor, Darcy-Weisbach equation, turbulent flow in smooth and rough pipes, application of Moody's chart and minor losses in pipe system.	Lab reports Assignment Final Examination	N.A
ME3142 (previously known as ME2142)	Feedback Control Systems	4	1 & 2	This course introduces students to fundamental concepts in control system analysis and design. Topics include mathematical modeling of dynamical systems, time responses of first and second-order systems, steady-state error analysis, frequency response analysis of systems and design methodologies in both the time and the frequency domains.	On successful completion of this course, the student will be able to: 1. Obtain the dynamic models of simple physical systems, particularly mechanical and electrical systems and obtain the transfer functions of these systems. 2. Determine the transient response of first and second order systems. 3. Determine the stability characteristics of a system using Routh's stability criterion and the root locus method. 4. Determine the steady state error characteristics of systems. 5. Determine the steady state frequency response of physical systems and represent the frequency response graphically in terms of Bode and Nyquist plots. 6. Determine the stability of physical systems through the frequency response using the Nyquist stability criterion. 7. Determine the relative stability measures such as gain and phase margins and to translate these values in terms of transient response. 8. Conduct simple experiments determining performance of control systems	MA1512+ MA1513 or MA1508E	Nil	ME2142, TME2142 and EE3331C	**1. General Introduction to Automatic Control:** Definitions. Closed-loop and Open-loop Control. Examples **2. Review of Mathematical Background:** Review of Laplace Transformation. Inverse Laplace Transformation. Solution of Differential Equations. **3. Mathematical Model of Physical Systems:** Transfer functions. Block diagrams. Modeling of mechanical systems, electrical systems, motors. **4. Transient Response Analysis:** Standard time response test functions. Time responses of first-order, second-order and higher-order systems. **5. System Stability and Steady State Characteristics:** Routh's stability criterion. Root locus Method. System Types. Steady state error analysis **6. Frequency Response Analysis:** Forced sinusoidal response. Graphical frequency response methods – Bode and Nyquist plots. Nyquist stability criterion. Gain and phase margins. Closed-loop frequency response.	Lab, Final Examination	**Supplementary reading:** **Modern Control Engineering** Katsuhiko Ogata; Mathematical modeling of control systems. Mathematical modeling of mechanical systems and electrical... **Modern Control Systems** Richard C. Dorf; Robert H. Bishop **Automatic Control** Benjamin C. Kuo
ME2162	Manufacturing Processes	4	1 & 2	Manufacturing processes and technologies have evolved and diversified to fulfil society's ever-increasing demands for better products. In this course, students will learn how to convert raw materials into useful products through conventional and advanced manufacturing processes. They will learn to appreciate and determine the appropriate manufacturing pathways for producing specific products. The major topics that are covered include an introduction to manufacturing, metal casting, powder metallurgy and processing, bulk deformation processing, sheet metalworking, machining, cutting tool technology, welding, and additive manufacturing.	On successful completion of this course, the student will be able to: 1. Understand and illustrate the fundamental principles and characteristics of both conventional and advanced manufacturing processes. 2. Evaluate and compare the different manufacturing processes. 3. Determine the appropriate manufacturing methods for specific products. 4. Understand the operations and the execution of the manufacturing processes.	Nil	Nil	Nil	General introduction to the manufacturing processes Solidification processes, including the casting of metals, etc. Particulate processing, including powder metallurgy, ceramic processing, etc. Bulk deformation processing, including rolling, forging, extrusion, drawing, etc. Sheet metalworking, including shearing, bending, deep drawing, etc. Machining processes, including turning milling, drilling Welding processes, including arc and gas welding, pressure welding, MIG, TIG, submerged-arc, friction, resistance, laser and electron-beam welding. Additive manufacturing, including binder jetting, directed energy deposition, material extrusion, material jetting, powder bed fusion, sheet lamination, vat photopolymerization	Lab Mid term CA test Final Examination	NA

Course Code	Course Title	Unit	Semester Offered	Course Description	Learning Outcomes	Pre-requisites	Co-requisites	Preclusions	Syllabus	Assessment	Illustrative Reading List
ME3123	Applied Thermofluids (offered from AY26/27 for cohort AY25/26 & before)	4	1 & 2	This course covers advanced topics in thermodynamics and fluid mechanics. The thermodynamics component includes power and refrigeration cycles (Rankine, vapor compression), air standard cycles (Otto, Diesel, gas turbine), and principles of heat exchangers, with a focus on applications in practical energy systems. The fluid mechanics component of the course introduces students to the operating principles of hydraulic pumps and turbines, their applications, methods of selecting pumps to match system requirements, and how to avoid cavitation damage. Fundamentals of viscous fluid flow, the Navier-Stokes equations and some of their exact solutions will also be covered.	On successful completion of this course, the student will be able to: 1. Analyse, model and design power plants utilising water or air as working fluids. 2. Analyse, model and design vapour compression refrigeration systems. 3. Analyse heat exchanger performance and determine the overall heat transfer coefficient. 4. Apply angular momentum principle and dimensional analysis to analyse the performance of pumps, perform pump-system matching and assess the likelihood of cavitation occurrence. 5. Apply the Navier-Stokes equations to obtain exact and approximate solutions for elementary viscous flow problems.	ME2121 & ME2134	Nil	ME2135	**Power and Refrigeration Cycles (6 hours):** - Water as working fluid for power cycles - Rankine cycle, superheating and reheating - Vapour compression cycle **Air Standard Cycles (6 hours):** - Analysis of Otto, Diesel and Mixed cycles. - Gas turbine cycle **Heat Exchangers (6 hours):** - Introduction to parallel flow, counter flow and cross flow heat exchangers, UA-LMTD and ε-NTU methods, and unmixed /finned compact heat exchangers **Turbomachines (9 hours):** - Introduction, Classification and Terminology - Basic Energy Considerations - Angular Momentum Considerations - Pump Performance Characteristics - Pump Dimensionless Parameters and Similarity Rules - Matching of Pump and System Requirements - Cavitation **Turbomachines (9 hours):** - Introduction, Classification and Terminology - Basic Energy Considerations - Angular Momentum Considerations - Pump Performance Characteristics - Pump Dimensionless Parameters and Similarity Rules - Matching of Pump and System Requirements - Cavitation	Lab Tests Mid Term Assignment Final Exam	**Compulsory reading:** 1. Yunus A. Çengel; Michael A. Boles; Mehmet Kanoglu, "THERMODYNAMICS: AN ENGINEERING APPROACH, SI" 2. Frank M. White, "Fluid Mechanics" **Supplementary reading:** 1. Claus Borgnakke; Richard Edwin Sonntag, "Fundamentals of Thermodynamics" 2. Gordon Frederick Crichton Rogers; Yon Richard Mayhew," Engineering Thermodynamics: Work and Heat Transfer" 3. Michael J. Moran; Howard N. Shapiro; Daisie D. Boettner; Margaret B. Bailey," Fundamentals of Engineering Thermodynamics" 4. Philip M. Gerhart; Andrew L. Gerhart; John I. Hochstein," Munson, Young and Okiishi's Fundamentals of Fluid Mechanics" 5. Robert W. Fox; Alan T. McDonald; Philip J. Pritchard," Introduction to Fluid Mechanics" 6. Yunus A. Çengel; John M. Cimbala," Fluid Mechanics"
ME4101A	B.Eng. Dissertation	8	1 & 2 (across 2 semesters)	This core requirement course is a research- or design-based project to be conducted by a final year undergraduate student, as a demonstration of their level of mastery of Mechanical Engineering. Projects may be experimental, theoretical or numerical in nature; and may be multi-disciplinary. Through the project, students are introduced to the basic methodology of research in the context of a problem of interest, including surveying of available literature, design and execution of relevant experiments and analysis of results. Students will practise soft skills such as project planning and management, technical report writing and giving technical oral presentations.	On successful completion of this course, the student will be able to: (1) Undertake research projects in a methodological manner including literature search, formulation of problems, conduct experiments, and results analysis. (2) Think critically and learnt independently (3) Communicate effectively through technical report writing (4) Communicate effectively through technical oral presentations.	Stage 4 standing (112Units)	Nil	ME4101/ EG4301/ ME4101B	NA	100% CA	NA