



Mechanical Engineering Program: Undergraduate 5 years with 2 semesters Plan [Required Credit hours 156] [Applicable 2025 (1447)] Total courses = 63

Math & Basic Science
36 credit hours

Engineering Topics
70 credit hours

General Education
14 credit hours

Broad Education
26 credit hours

Major Design Experience
6 credit hours

FIRST YEAR		SECOND YEAR		THIRD YEAR		FOURTH YEAR		FIFTH YEAR	
FALL (1)	SPRING (2)	FALL (3)	SPRING (4)	FALL (5)	SPRING (6)	FALL (7)	SPRING (8)	FALL (9)	SPRING (10)
QUR 1001 [2] Quran Kareem UNI 1001 [2] University Elective 2 from Package 1 GE 1103 [3] Engineering Graphics and Design PHY 1117 [3] Physics I PHY 1119 [1] Physics I Lab CO: PHY1117 ENGL1120 [3] Technical Writing in English MAT 1122 [3] Pre-Calculus	UNI 1002 [2] University Elective 3 from Package 2 UNI 1003 [2] University Elective 4 from Package 2 UNI 1004 [2] University Elective 5 from Package 3 GE 1101 [0] Engineering Reports CHM 1104 [3] General Chemistry CHM 1105 [1] General Chemistry Lab CO: CHM1104 MAT 1115 [3] Calculus I PRE: MAT1122 PHY 1118 [3] Physics II PRE: PHY 1117, PHY 1119 PHY 1120 [1] Physics Lab II PRE: PHY1117, PHY1119 CO: PHY1118	FRC 1101 [2] Free Elective 1 FRC 1102 [2] Free Elective 2 GE 1108 [3] Programming for Engineers PRE: MAT 1115 MAT 1116 [3] Calculus II PRE: MAT 1115 STA 1215 [3] Probability and Statistics for Engineers PRE: MAT 1115 ME 1101 [0] Introduction to Mechanical Engineering ME 1111 [3] Materials Science and Engineering PRE: MAT1115 CHM1104	UNI 1105 [2] University Elective 6 from Package 3 MAT 1207 [3] Calculus III PRE: MAT1116 MAT 1228 [3] Linear Algebra & ODE PRE: MAT1116 GE 1201 [3] Statics PRE: MAT1116, PHY1117 GE 1305 [3] Fundamentals of Electrical Engineering PRE: MAT1116, PHY1118, PHY1120 ME 1221 [3] Thermodynamics I PRE: MAT1116 CHM1104	MAT 1236 [3] Mathematical Methods for Engineers PRE: MAT1207, MAT1228 GE 1202 [3] Dynamics PRE: GE1201 ME 1216 [3] Mechanics of Materials PRE: GE 1103, ME 1111, GE 1201 ME 1213 [1] Mechanics of Materials Lab CO: ME1216 ME 1222 [3] Fluid Mechanics PRE: ME1221, GE1201 ME 1223 [1] Thermo-Fluids Lab PRE: ME1222 ME 1224 [3] Thermodynamics II PRE: ME1221	NAH 1001 [2] Linguistic Skills ME 1202 [3] Introduction to Finite Element Analysis PRE: MAT1236, GE 1108 ME 1324 [3] Heat Transfer PRE: ME1222 ME 1231 [3] Mechanics of Machines PRE: MAT1236, GE1202 ME 1233 [3] Mechanical Vibrations PRE: MAT1236, GE1202 ME 1365 [3] Machine Design I PRE: ME1216	UNI 1107 [2] University Elective 8 from Package 4 FRC 1103 [2] Free Elective 3 GE 1403 [3] Engineering Economy PRE: MAT1236 ME 1325 [1] Heat Transfer Lab PRE: ME1222, GE 1101 CO: ME1324 ME 1334 [2] Automatic Control PRE: ME1233 ME 1363 [3] Manufacturing Technology ME 1364 [1] Manufacturing Technology Lab PRE: ME1216, GE 1101 CO: ME1363 ME 1465 [3] Machine Design II PRE: ME1231, ME1365	UNI 1108 [2] University Elective 9 from Package 5 GE 1401 [3] Project Management PRE: STA1215 ME 1436 [3] System Dynamics and Modeling PRE: ME1233 ME 1451 [3] HVAC Systems PRE: ME1324 ME 1491 [3] Graduation Project 1 PRE: Completion of 116 CHrs., ME1365 ME 14** [3] Technical Elective 1	UNI 1109 [2] University Elective 10 from Package 5 GE 1402 [2] Professional Ethics for Engineers ME 1441 [3] Internal Combustion Engines PRE: ME1224 ME 1466 [1] Industrial and Environment Safety ME 1492 [3] Graduation Project 2 PRE: ME1491 ME 14** [3] Technical Elective 2 ME 14** [3] Technical Elective 3	Cooperative Training GE 1599 [4] PRE: Completion of 152 credit hours
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Bachelor's of Mechanical Engineering Degree will be awarded on the successful completion of GE 1599



Mechanical Engineering Program - Elective Courses (156 credit hours 2 semesters course plan)

THIRD YEAR		FINAL YEAR	
Fall	Spring	Fall	Spring

Material Engineering and Processing

ME 1411
ME 1216

ME 1412
ME 1216,
ME 1363

ME 1413
ME 1211

ME 1414
ME 1216,
ME 1363

ME 1415
ME 1324,
ME 1365

ME 1416
ME 1363

ME 1417
ME 1216

ME 1419

ME 1411: Mechanical Behavior of Materials
 ME 1412: Nano Materials
 ME 1413: Corrosion Engineering
 ME 1414: Processing of Polymer materials
 ME 1415: Tribology
 ME 1416: Introduction to Failure Analysis of Mechanical Parts
 ME 1417: Destructive and Nondestructive Materials Testing
 ME 419: Special Topics

Thermal Sciences, Power Generation and Energy Conversion

ME 1421
ME 1224

ME 1440
ME 1224,
ME 1324

ME 1442
ME 1224

ME 1443
ME 1224

ME 1444
ME 1224

ME 1445
ME 1224,
ME 1324

ME 1446
ME 1222,
ME 1224

ME 1447
ME 1224,
ME 1324

ME 1448
ME 1224,
ME 1324

ME 1449

ME 1421: Design and Analysis of Thermal systems
 ME 1440: Renewable and Sustainable Energy Systems
 ME 1442: Power and Desalination Plants
 ME 1443: Turbomachinery
 ME 1444: Gas Turbine Engines
 ME 1445: Introduction to Nuclear Energy
 ME 1446: Gas Dynamics
 ME 1447: Energy Efficiency and Conservation
 ME 1448: Green Hydrogen Plants
 ME 1449: Special Topics

Computational Methods in Mechanical Engineering

ME 1471
MAT 1236,
ME 1202 or
GE 1301

ME 1472
ME 1202

ME 1473
ME 1202,
ME 1324

ME 1474
ME 1224,
ME 1324

ME 1476
ME 1224,
ME 1324

ME 1479

ME 1471: Introduction to Finite Element Methods
 ME 1472: Engineering Optimization
 ME 1473: Computational Fluid Dynamics (CFD)
 ME 1474: Pumps & Compressors Technologies and Design
 ME 1476: Introduction to Aerospace Engineering
 ME 1479: Special Topics

THIRD YEAR		FINAL YEAR	
Fall	Spring	Fall	Spring

Control Theory and System Dynamics

ME 1433
GE 1108,
GE 1202,
GE 1305

ME 1434
ME 1334,
ME 1436

ME 1435
ME 1334

ME 1439

ME 1433: Mechatronics
 ME 1434: Introduction to Robotics
 ME 1435: Automotive control
 ME 1439: Special Topics

Heating, Ventilation, & Air Conditioning

ME 1452
ME 1224,
ME 1324

ME 1453
ME 1224,
ME 1324

ME 1452: Design of Cold Storage
 ME 1453: Refrigeration Systems and Equipment

Manufacturing Engineering and Safety

ME 1461
ME 1363

ME 1462
ME 1363

ME 1463
ME 1216,
ME 1365,
ME 1466,
GE 1403

ME 1469

ME 1467
ME 1365,
ME 1363

ME 1468
ME 1365,
ME 1363

ME 1461: Computer Aided Design and Computer Aided Manufacturing
 ME 1462: Advanced Manufacturing Technology
 ME 1463: Metal Forming
 ME 1467: Additive manufacturing technologies and Reverse Engineering
 ME 1468: Mould and Die Design
 ME 1469: Special Topics

Reliability, Safety, and Emerging Technologies

ME 1481
ME 1466,
GE 1403

ME 1482
ME 1224,
ME 1324,
ME 1363

ME 1483
ME 1365,
ME 1363

ME 1484
ME 1466,
ME 1363,
GE 1403

ME 1481: Risk Assessment and Safety Management
 ME 1482: Artificial Intelligence in Engineering
 ME 1483: Maintenance and Reliability
 ME 1464: Lean Manufacturing and Quality Control

Compulsory Courses

Elective Courses

Special topics

Course Description

1. GENERAL EDUCATION

GE 1108	Programming for Engineers	3 Credit Hours
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The course introduces students to structured programming techniques. Topics include different control statements (sequence, selection, and repetition), functions, fundamental data types, and data structures (arrays and pointers). Upon successful completion of the course, students will solve computer problems by using structured programming techniques and adequate tools (text editor, compiler, and debugger).

GE 1403	Engineering Economy	3 Credit Hours
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This course investigates methods of economic analysis for decision making among alternative courses of action in engineering, business and government applications. Topics include: Time value of money, Money management, and Equivalence calculations under inflation, Present worth analysis, Annual Equivalence Analysis, Rate of return analysis. Benefit-Cost ratio & profitability index analyses.

GE 1599	Engineering Training	4 Credit Hours
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Eight weeks training in a relevant industry under the supervision of an external supervisor from industry. Each student must submit a technical report about his learning experience during training in addition to fulfilling any other requirements as determined by the department.

GE 1401	Project Management	3 Credit Hours
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General methodology of managing a technical project from concept to operational use with emphasis on functions, roles, and responsibilities of the project manager. Topics include: Career aspects of project management; Business factors affecting the project, the manager, and the organization; Planning and scheduling using arrow networks, execution, and communications; Project life cycle, risk analysis, reporting, and reaction to critical problems; Labor, materials, and equipment utilization; Cost estimation; Pricing; Contracting; Planning; Cost control, monitoring, and accounting; Project management systems.

GE 1402	Professional Ethics for Engineers	2 Credit Hours
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Introduction to engineering ethics; definition of a profession, personal and professional ethics, explore many of the ethical issues, discussion of ethical theories, code of ethics, problem solving techniques. Introduce engineer's rights and responsibilities. Assess Safety, risk and accidents. Explain the Rights and Responsibilities of Engineers.

2.CORE COURSES AND TECHNICAL ELECTIVES

This section contains all the course descriptions for 200, 300, 400 level courses to be taught in Mechanical Engineering Program.

GE 1103 Engineering Graphics and Design 3 Credit Hours

Use of computer drafting software (AutoCAD) to model parts and assemblies; Use of parametric and non-parametric solids; Surface and wireframe models; Part editing; Two-dimensional documentation of models; Planar projection theory; Sketching of perspective, isometric, multi-view, auxiliary, and section views; Spatial visualization exercises; Dimensioning guidelines; Tolerance techniques; Team or individual design project.

GE 1201 Statics 3 Credit Hours

Vector analysis, Forces, Moments, and Couples, Resultants of Force Systems. Equilibrium Analysis and Free-Body Diagrams. Analysis of forces acting on members of Trusses and Frames. Shear-Force and Bending-Moment Distributions. Centroids, Centre of mass, hydraulic pressure. Moment of Inertia, Parallel axis theorem, Polar Moment of Inertia and Product of Inertia.

GE 1202 Dynamics 3 Credit Hours

Kinematics and kinetics of particles including Newton's second law, energy-work principles, and impulse-momentum methods. Planar kinematics and planar kinetics of rigid bodies: translation, rotation about a fixed axis, and general plane motion. Introduction to three-dimensional dynamics of rigid bodies.

GE 1305 Fundamentals of Electrical Engineering 3 Credit Hours

Basic laws: Ohm's, KVL, KCL. Resistive networks. Circuit analysis techniques: nodal and mesh analysis. Network theorems: Thevenin's, Norton's, source transformations, superposition, maximum power transfer. Energy storage elements. phasor technique for steady-state sinusoidal response. Transient analysis of first-order circuits.

ME 1111 Materials Science and Engineering 3 Credit Hours

Introduction to Materials Science, Atomic Structure and Interatomic Bonding, Structures of Metals and Ceramics, Polymer Structures, Polymers' properties & processing, Mechanical Properties and Testing, Solidification of Metals and Alloys, Imperfections in Metals and Alloys, Phase Diagrams, Materials Strengthening Mechanisms, Classification of Metal Alloys, Basics of Corrosion and corrosion prevention.

ME 1213 Mechanics of Materials Lab 1 Credit Hour

Material testing against tension, compression and impact testing, investigations of Hooke's law, strain gages measurements of deflection, phenomena of bending, phenomena of hardness via its

different tests and theory of torsion and deflection. Phenomena of creep and its effect on temperature. Dynamic testing of materials like fatigue.

ME 1216	Mechanics of Materials	3 Credit Hours
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Normal and shear stress, normal and shear strain, stress-strain relations for ductile and brittle materials, yield and ultimate stress, elasticity and plasticity, Hooke's law, Poisson's ratio. Axial loading, stress on inclined planes. Torque and torsion, deformation of circular bars under torsion, polar moment of inertia. Pure shear and pure bending, Euler's beam theory, curvature and bending moment, second moment of inertia, normal and shear stress in beams of various cross-sections. Plain stress and strain, Principal and maximum shear stress and strain, Mohr's circle, general 3-d stress-strain relationship in elasticity, buckling of columns.

ME 1221	Thermodynamics I	3 Credit Hours
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Thermodynamic properties, system, process, cycle and equilibrium. Control mass and control volume analysis. Properties and behaviour of pure substances. First law of Thermodynamics. Steady state and transient processes and their application to thermodynamic systems and devices. Entropy and the Second law of thermodynamics. Ideal gas equation of state and compressibility factor. Simple steam power and vapor compression refrigeration cycles.

ME 1222	Fluid Mechanics	3 Credit Hours
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Introduction to fluid mechanics, Fluid Properties, Fluid Statics, Flowing Fluids and Pressure Variation, Control Volume Approach and Continuity Equation, Momentum Equation, Surface Resistance with Uniform Laminar Flow, and Flow in Conduits.

ME 1223	Thermo Fluid Lab	1 Credit Hour
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Introduction to basic fluid mechanics instrumentation, experimental verification and reinforcement of the analytical concepts introduced in ME 221 and ME 222. Pressure drop in pipes, fittings and centrifugal pump performance.

ME 1224	Thermodynamics II	3 Credit Hours
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Analysis of gas power, vapor power and advanced refrigeration cycles. Availability (exergy), irreversibility and second law efficiency. Moist air properties and psychometric analysis. Combustion analysis. Introduction to compressible fluid flow.

ME 1324	Heat Transfer	3 Credit Hours
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One-dimensional axial and radial heat conduction. Steady state and transient heat conduction. Analogy of thermal systems with electrical systems (thermal network modelling). Numerical method in heat conduction. Dimensionless numbers. Convection heat transfer in internal and external flows. Conduction-convection systems (lumped capacitance method). Heat exchanger design (the LMTD

and NTU methods), Surface radiation properties. Radiation heat transfer from black and grey surfaces. Net radiation exchange in enclosures.

ME 1325 Heat Transfer Lab 1 Credit Hour

Practices and measurement techniques for heat transfer and thermal systems. Experimental-problem solving applied to heat transfer.

ME 1231 Mechanics of Machines 3 Credit Hours

Introduction to mechanisms, kinematics of mechanisms, position, velocity and acceleration analysis of linkages using graphical and analytical methods, dynamic force analysis of mechanisms.

ME 1233 Mechanical Vibrations 3 Credit Hours

This course envelops harmonic and periodic motion including both damped and undamped free and forced vibration, single-and multi-degree-of-freedom systems and matrix techniques suitable for computer simulations.

ME 1334 Automatic Control 2 Credit Hours

Theory and analysis of linear closed-loop control systems containing electronic, hydraulic, and mechanical components. Differential equations. Laplace transforms. Stability, Nyquist and Bode diagrams.

ME 1363 Manufacturing Technology 3 Credit Hours

Relationship between product engineering and manufacturing engineering. Fundamentals of metal casting, shaping process of plastics, powder metallurgy. fundamentals of metal forming and bulk deformation, metalworking processes and sheet metal working. Theory of machining operations, machine tools, cutting-tool technology. Grinding and other abrasive processes, fundamentals of welding, concepts of advanced manufacturing processes.

ME 1364 Manufacturing Technology Lab 1 Credit Hour

Practical demonstration and learning of various manufacturing processes such as metal machining, welding, sheet rolling, shearing, etc. Study and familiarisation with various measuring instruments. Measuring specified dimensions such as lengths, internal and external diameters radii, angles and taper dimensions. Estimating measurement variations. Identifying typical errors. Familiar with various safety measures.

ME 1365 Machine Design I 3 Credit Hours

General principles of machine design, reliability and statistical considerations, engineering materials and their mechanical properties, factor of safety, fits & tolerances, deflections and stress analysis for different types of elements, buckling, static strength and failure theories, fatigue strength and failure

theories. Basic design principles of some machine elements and their selection (power screws, fasteners, and welded joints). Ethical and social impacts of mechanical design.

ME 1436	System Dynamics and Modelling	3 Credit Hours
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This course introduces the mathematical modelling and simulation of systems including mechanical, electrical, electro-mechanical, fluid and thermal systems. Topics include frequency response analysis, stability, and feedback control design.

ME 1441	Internal Combustion Engines	3 Credit Hours
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Engine types and basic operation, cycles and combustion thermodynamics, two-stroke and four-stroke cycles, engine testing and control, friction and wear of engine parts. Air, fuel, cooling and lubrication systems, engine emissions, fuels and lubricants, engine performance.

ME 1451	HVAC Systems	3 Credit Hours
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Qualitative and quantitative study in concepts of basic air-conditioning with focus on buildings including building envelope, moist air thermodynamics, human comfort. Thermal load calculations, thermal behaviour of buildings, HVAC systems/equipment, and design of space air-conditioning and its relationship to architectural design.

ME 1465	Machine Design II	3 Credit Hours
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This course introduces the fundamentals of machine design, including analysis and design of mechanical components. Covers shafts, fasteners, belt and chain drives, brakes, gears, springs and bearings. Includes predicting static and fatigue failures for various loadings and materials. Design techniques and the design of a simple machine.

ME 1466	Industrial and Environmental Safety	1 Credit Hours
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Accident: accident causes and costs. Appraising safety performance and risk assessment. Analysis of accident causes. Accident reports and records. Job safety analysis. Plant inspection. Accident investigation. Plant layout and arrangement. Plant housekeeping. Maintenance and safety. Material handling and safety. Machine guarding. Explosion and fire prevention. Noise and environmental safety, Personal protection. Planning for emergencies.

ME 1491	Graduation Project I	3 Credit Hours
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The Graduation Project integrates the various components of the curriculum into a comprehensive design exercise. This course covers the preliminary phase of the Project. In this phase, the students choose a topic and a faculty advisor; define the project scope, which may include theoretical design, experimentation, fabrication or computer simulation and modelling. By the end of the semester, they should complete the Project Goals/Objectives, Project Execution Plan, a thorough literature review and some initial work as defined in the Execution Plan. They must submit a preliminary report of the work done at the end of the semester.

ME 1492	Graduation Project II	3 Credit Hours
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The type of graduation project has to be a capstone design. A capstone design project should be planned to provide a unified effort in developing teamwork skills, multidisciplinary interaction, communication skills, fundamentals of engineering design processes, and application of engineering design principles to a real engineering project.

ME 1411	Mechanical Behaviour of Materials	3 Credit Hours
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Studies of stresses and strains in two- and three-dimensional elastic problems. Failure theories and yield criteria. Analysis and design of load-carrying members. Energy methods and stress concentrations. Elastic and plastic behaviour. Fatigue and fracture, and composite materials.

ME 1412	Nanomaterials	3 Credit Hours
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This course provides a comprehensive introduction to nanomaterials, synthesis/processing techniques used for nanomaterials and also the properties of nanomaterials.

ME 1413	Corrosion Engineering	3 Credit Hours
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This course is designed to introduce basic and modern concepts of corrosion engineering, including mixed potential theory, types of corrosion, cell potentials, factors influencing the corrosion rate of metals, and prevention techniques. The corrosion properties of materials and their applications are also discussed.

ME 1414	Processing of Polymer Materials	3 Credit Hours
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Chemistry and classification of polymers, crystal structure and morphology of polymers, physical and chemical characterization of polymers, manufacturing processes of plastics/composites, and properties of polymer composites.

ME 1415	Tribology	3 Credit Hours
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Nature of solid surfaces. Interaction of solid surfaces. Friction of metals and non-metals (mechanisms, theories, applications). Wear of metals and non-metals (types, mechanisms, theories, applications). Lubrication (methods, types, theories, applications). Lubricants (types, utilization). Selection of materials for tribology applications. Surface Engineering.

ME 1419	Special Topics in Materials Engineering and Processing	3 Credit Hours
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Topics relevant to specialization of Materials Engineering and Processing to strengthen student's knowledge in this field. This course covers many topics such as Types and Applications of Materials; Synthesis, Fabrication, and Processing of Materials; Composites; Thermal and Magnetic Properties of Materials; Corrosion and Degradation of Materials; Biomaterials; Nanomaterials and Nanotechnology; and Economic, Environmental, and Societal Issues in Materials Engineering.

ME 1433	Mechatronics	3 Credit Hours
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Focus on the fundamentals of design-oriented mechanical, electrical and computer systems integration. Specifically, analogue and digital electronic design, data acquisition, transducers, actuator technologies and control, design with microprocessors and embedded electronics, and application of control theory.

ME 1434	Introduction to Robotics	3 Credit Hours
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Forward and inverse kinematics of robot manipulators, path planning, motion planning for mobile robots. Dynamics of robot manipulators, control algorithms, computed torque algorithm, adaptive control algorithms and current topics in mobile robots. Cooperative motion planning of mobile robots and formation control.

ME 1435	Automotive Control	3 Credit Hours
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Basic engine operation; lambda control, speed control, knock control, fuel injection timing control, ignition control of SI engines; driveline modeling, automatic transmission control, clutch phasing control; wheel model, complete vehicle model; observers, friction coefficient estimators, tire contact patch force estimators; anti-lock brake control, traction control, yaw stability control; drive-by-wire systems.

ME 1439	Special Topics in Control Theory and System Dynamics	3 Credit Hours
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Topics relevant to specialization in Control Theory and System Dynamics to strengthen student's knowledge in these fields. Any course from other engineering departments or University must be approved by the ME Department Council.

ME 1421	Design and Analysis of Thermal Systems	3 Credit Hours
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Application of energy and exergy concepts to thermal fluid systems. Modeling and development of thermal systems with particular focus on heat-pumping cycles, such as vapor compression, absorption, and some advanced refrigeration cycles. Students combine the principles of thermodynamics, heat transfer and fluid mechanics to study and develop sustainable environment friendly systems with emphasis on refrigeration systems.

ME 1442	Power and Desalination Plants	3 Credit Hours
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First law, second law and exergy analysis of steam turbine cycles. Steam generating systems: boiler types, components and auxiliaries, steam turbines, condensers and feed water heaters. Single and multi-effect desalting vapor compression systems. Multistage flash desalination. Reverse osmosis. Scale formation and fouling on heat transfer surfaces and their prevention.

ME 1443	Turbomachinery	3 Credit Hours
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Applying energy, momentum, and continuity equations of thermo-fluids to turbomachinery. Blade geometry and aerodynamics. Performance and design parameters. Turbomachine design.

ME 1444	Gas Turbine Engines	3 Credit Hours
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Basic operating principles and analysis of performance characteristics of gas turbine engines for aircraft & vehicular propulsion and stationary power. Turbojet, turbofan and turboprop cycle analysis. Analysis of flow through compressors, turbines, combustors, inlets, nozzles, and regenerators. Component matching and off-design performance.

ME 1445	Introduction to Nuclear Energy	3 Credit Hours
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Introduction to the fundamentals of nuclear engineering, including power plant design fuel cycle and fuel design. Reactor physics, reactor theory and design and reactor thermo-hydraulics. Radiation protection and safety. Fuel reprocessing and recycling.

ME 1446	Gas Dynamics	3 Credit Hours
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Sonic wave propagation and Mach number, flow in converging and converging-diverging nozzles, normal and oblique shocks, Prandtl-Meyer, Fano and Rayleigh flows, semi-perfect and real gas behaviour, air-breathing and rocket propulsion systems, supersonic diffusers.

ME 1449	Special Topics in Thermal Sciences and Energy	3 Credit Hours
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Rankine cycle analysis, fossil-fuel steam generators, energy balances, fans, pumps, cooling towers, steam turbines, availability (second law) analysis of power systems, energy management systems, and rate analysis.

ME 1461	Computer Aided Design and Computer Aided Manufacturing (CAD/CAM)	3 Credit Hours
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Introduction to Computer Aided Engineering. Solid modeling. Introduction to Finite Element Method. CAD packages. Static linear analysis in one, two, and three dimensions. Steady state thermal analysis. Introduction to non-linear analysis. Optimum design. Computer applications in mechanical design. Automation strategies. Production economics. High volume production systems. Automated flow lines. Assembly and line balancing. Numerical control. NC part programming. DNC, CNC, and adaptive control. Industrial robots. Material handling and storage. Group technology and flexible manufacturing. Quality control and automated inspection. Control systems. Programmable controllers. Computer networks.

ME 1462	Advanced Manufacturing Technology	3 Credit Hours
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Introduction to advanced manufacturing technologies. Principles, process mechanisms and typical applications of non-traditional machining like Abrasive Jet, Water-Jet, Ultrasonic, Chemical, Electrochemical, Electric-Discharge, Plasma-Arc, Laser-Beam, Electron-Beam. Advanced welding processes. Rapid prototyping/3D printing technologies. Numerical control of machine tools:

Automation of manufacturing processes, coordinate systems, types and components of CNC systems, programming for CNC, adaptive control. Computer Integrated Manufacturing CIM. Future of manufacturing.

ME 1463	Metal Forming	3 Credit Hours
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Yielding criteria, Plastic stress-strain relation, Plane stress and plane strain problems, Determination of flow equation. Applications: instability in thin vessels, thick vessels subjected to internal pressure, and beam under pure bending. Classification of metal forming processes and Technique of analysis: slab method, upper bound method, slip line field, application to indentation problem. Bulk deformation processes, equipment and die: forging, rolling, extrusion, and rod and wire drawing.

ME 1464	Risk Assessment and Safety Management	3 Credit Hours
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Basic concepts of risk, reliability and hazard. Potential elements of risk assessment, statistical methods, control charts, appraisal of advanced techniques, fault tree analysis, failure mode and effect analysis. Quantitative structure to activity relationship, analysis of fuzzy model for risk assessment. Analysis of safety program organization through current industry leadership, supervision and management.

ME 1469	Special Topics in Manufacturing Engineering and Safety	3 Credit Hours
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Introduction to structure-based deformation behaviour of materials, mechanical testing to obtain properties, stress and strain relationships in two and three-dimensional elastic problems, introduction to fracture mechanics, mechanical and manufacturing aspects of extrusion and sheet metal forming, material selection criteria in design, and factor of safety.

ME 1471	Finite Element Methods in Analysis and Design	3 Credit Hours
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Virtual formulation. Finite element analysis: shape formation, equilibrium conditions, element classification, and assembly of elements, modelling methodology. Structures and elements: trusses, beams, 2-D solids, 3-D solids, axisymmetric solids, thin-walled structures. Dynamic analysis. Heat transfer and thermal analysis.

ME 1472	Engineering Optimization	3 Credit Hours
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Application of optimization techniques in solving engineering problems. Linear programming, non-linear programming, dynamic programming, integer programming, stochastic programming, genetic algorithms, heuristic methods, queuing theory, and new optimization methods.

ME 1473	Computational Fluid Dynamics	3 Credit Hours
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Physical and mathematical foundations of computational fluid mechanics with emphasis on applications. Solution methods for model equations and the Euler and the Navier-Stokes equations.

The finite volume formulation of the equations. Classification of partial differential equations and solution techniques. Truncation errors, stability, conservation, and monotonicity. Computer projects.

ME 1479

**Special Topics in Computational Methods in
Mechanical Engineering**

3 Credit Hours

Topics relevant to specialization in Computational Methods to strengthen students' knowledge in this field. Any course from other engineering departments or University must be approved by the ME Department Council.