Course Descriptions

GEU 2010 Statics (Core) 3(3,1,0)
Force systems: vector analysis of forces, moments and couples in 2 and 3 dimensions. Equilibrium of force systems. Analysis of structures: plane trusses and frames. Distributed forces system: centroids of composite bodies and figures. Area and mass moments of inertia. Friction

Prerequisites: MATH 1060, MATH 1070, PHYS 1040

GEU 2410 Mechanical Engineering Drawing (1) (Core) 3(2,1,1)
Introduction to engineering drawings and technical communications: introduction to cad tools, standard sheets, standard layout elements: Orthographic projection, Isometric sketching, Dimensioning, Sectional and auxiliary views, Intersections, and Developed views using CAD tools.

CAD sketching Lab: geometric entities, drawing tangents to two Circles, drawing an arc tangent to a line or Arc and through a point, bisecting an angle, drawing a line through a point and Parallel to a line, drawing a triangle with sides given, drawing a right triangle with hypotenuse and one side given, laying out an angle, drawing an equilateral triangle, polygons, drawing a regular pentagon, drawing a hexagon, ellipse shapes, spline curves, solid primitives, recognizing symmetry, extruded forms, revolved forms, irregular surfaces, sketch constraints, orthographic projection and 2D drawing representation, section views and auxiliary views.

Prerequisites: None

ME 2520 Materials Science and Enginering (Core) 4(3,1,1)
Introduction to materials science and engineering. Types and properties of materials (metallic, polymeric, ceramic and composites), Crystal Structure of materials. Solidification of metals and crystalline imperfections, Diffusion in solids, Mechanical properties of materials, Equilibrium-phase diagrams. Heat treatment of plain-carbon steels, and precipitation hardening of non-ferrous metals. Corrosion of metals and protection.
Lab: Metallographic preparation of samples and optical microscopy investigation, Tensile and Compression tests, Hardness test, Bending test, Torsion test, and Fatigue test., heat treatment of materials.

Prerequisites: PHYS 1040, Chem 1010

GEU 2020 Dynamics (Core) 3(3,1,0)
Kinematics of a particle: linear and curvilinear motion and, relative motion .Kinematics of a rigid body in plane motion: relative velocity and acceleration, and rotating axes.Kinetics of particles: Newton's law, work and energy, impulse and momentum, and impact .Kinetics of a rigid body in

plane motion: translation, fixed axis rotation, general motion, work and energy, and impulse and momentum.

Prerequisites: GEU 2010

ME 2420 Mechanical Engineering Drawing (2) (Core) 2(1,1,1)

(Drawing scale and dimensioning: symbols, curves, threads, tapers, chamfers; Surface roughness; Sheet metal bends; Tolerancing: specification, limit, stacking, tolerancing for machining process, tolerances of angles; Threads: external symbols, internal symbols; Thread in assembly; Bolts, studs, and screws; Standard bolts and nuts; Specifications for bolts and nuts; Locknuts; Standard cap screws; Standard machine screws; Standard set screws; Keys and Keyways; Pins; Rivets; Springs; Working drawings: identify the elements of a detail drawing, list the parts of an assembly drawing, describe the process for revising drawings, Welding representation , gears and Cams.
Lab: CAD tool for drawing mechanical assembly using threads, Bolts, Gears and cams and other mechanical elements; Generate different views from the assembly and include dimensioning and tolerancing.

Prerequisites: ME 2410

ME 3510 Mechanics of Materials (Core) 3(3,1,0)

Stress: Equilibrium of a Deformable Body Stress, Average Normal Stress in an Axially Loaded Bar, Average Shear Stress,
Strain: Deformation and Strain,
Axial Load: Saint-Venant's Principle, Elastic Deformation of an Axially Loaded Member, Principle of Superposition, Statically Indeterminate Axially Loaded Members, The Force Method of Analysis for Axially Loaded Members, Thermal Stress,
Torsion: Torsional Deformation of a Circular Shaft, The Torsion Formula, Angle of Twist, Torsion of solid noncircular shafts,
Bending: Shear and Moment Diagrams, Graphical Method for Constructing Shear and Moment Diagrams, Bending Deformation of a Straight Member, The Flexure Formula, Unsymmetric Bending,
Combined Loadings: Thin-Walled Pressure Vessels, State of Stress Caused by Combined Loadings,
Stress Transformation: Plane-Stress Transformation, General Equations of Plane-Stress Transformation, Principal Stresses and Maximum In-Plane Shear Stress, Mohr's Circle—Plane Stress, Absolute Maximum Shear Stress,
Strain Transformation: Plane Strain, Mohr's Circle—Plane Strain, Absolute Maximum Shear Strain,
Deflection of Beams and Shafts: The Elastic Curve, Slope and Displacement by Integration.

Prerequisites: GEU 2010, ME 2520

ME 3710 Thermodynamics (1) (Core) 3(3,1,0)

Basic concepts and definitions of thermodynamics – System and control volume – Property and state – Processes and cycles – Work and heat transfer –Ideal gases – State equation – Tables of thermodynamics – Pure substances – Properties of pure substances –First law of thermodynamics for closed and open systems – Application of first law on processes – Internal energy – Enthalpy – Conservation of mass – Steady state, steady flow processes – Second law of thermodynamics - Entropy: Reversible path, Clausius theorem Carnot cycle and inverse Carnot cycle –The inequality of Clausius – Exergy.

Prerequisites: PHYS 1040

EE 3090 Circuits and Electrical Machines (Core) 2(2,1,0)

Electrical quantities & units. Circuit elements and laws. Network theorem. Nonlinear networks. AC Circuits (Phasors, circuit analysis, frequency response, resonance). Transformers (construction, types, operation, equivalent circuit). Synchronous machines (construction, generator performance, motor characteristics, starting). Induction machines (construction, three phase motor: types, operation, equivalent circuit, starting speed control). Introduction to DC machines. Electric application.

Prerequisites: PHYS 1040, MATH 1060

ME 4620 System dynamics (Core) 3(3,1,0)

Laplace transform. Modeling of mechanical, electrical, electromechanical, liquid-level, pneumatic, hydraulic and thermal systems. Transfer functions, Analogies. State-space approach. Linearization of nonlinear systems. Response of first order systems, response of second order systems. Solution of the State Equation. Frequency domain analysis of dynamic systems.

Prerequisites: MATH 2040, GEU 1090

ME 3310 Manufacturing Processes 1 (Core) 3(2,1,1)

Introduction and overview of manufacturing .Plant and shop layout. Basic bench work operations. Metal casting fundamentals & processes. Fundamentals of metal forming. Bulk Deformation Processes (Rolling, Forming, Extrusion and Wire and Bar Drawing). Sheet-Metal Forming Processes (sheet-metal characteristics ,shearing, bending and deep drawing). Welding processes (Fusion-Welding, Solid-State Welding, Brazing and Soldering).

Lab covers Industrial safety. Workshop metrology. Basic bench work operations. Casting processes: Sand casting, Die casting. Metal forming processes: Rolling, Forging, Bending, and shearing. Welding processes: Gas welding, Arc welding, Brazing and Soldering.

Prerequisites: ME 3510

ME 3410 Mechanics of Machinery (Core) 3(2,1,1)

Studying degree-of-freedom. The motion elements such as position, velocity, and acceleration analysis of linkages: graphical and analytical methods. Rolling and sliding contacts, gears kinematics, cam mechanisms design, Flywheels and static and dynamic balancing.

Lab: 2D- mechanisms, Flywheels. Cam mechanisms, Mass moment of inertia, Simple and epicyclical gear trains. Rolling and sliding contacts, static and dynamic balancing

Prerequisites: GEU 2020

ME 3730 Thermodynamics (2) (Core) 4(3,1,1)

Derivation of the cycle efficiency and applications for the following cycles: Rankine cycle, regeneration and Reheat, vapor compression cycle, Otto cycle, diesel cycle, dual cycle, Brayton cycle, Compound cycle , Air standard refrigeration cycle, Vapor refrigeration cycle – Second law analysis .Thermodynamic relations. Ideal gas mixtures .Gas-vapor mixtures and air conditioning. Chemical reactions, combustion. Introduction to internal combustion engines.

Lab : Multistage reciprocating air compressor performance test. Measuring the performance and emissions of an internal combustion engine. Measuring performance of the refrigeration cycle. Gas turbine performance measurement. Simulation of thermodynamic cycles.

Prerequisites: ME 3710

ME 3810 Fluid Mechanics (Core) 4(4,1,0)

Dimensions and units. Fundamental concepts in fluids. Fluid statics. Control volume. Conservation of mass and momentum equations. Energy equation. Differential analysis of fluid motion. Euler's equations. Bernoulli's equation. Internal incompressible viscous

Prerequisites: ME 3710, GEU 2020

ME 3750 Heat Transfer (Core) 4(3,1,1)

Steady and unsteady heat conduction. Free and forced convection. Heat exchangers. Introduction to radiation exchange between surfaces.

Lab: Visualization of real flow around streamlined and bluff bodies. Pipe flow. Velocity distribution. Pressure drop and friction factor. Flow measurements: Orifice, venturi and nozzle calibrations .Pumps performance. Heat conduction in solid, thermal conductivities of metals. Free and forced convection, thermal performance of fins.

Prerequisites: ME 3810

ME 3420 Mechanical Design (1) (Core) 3(3,1,0)
Stress Analysis: Allowable Stress Design, Limit State Design, Stress Concentration,
Material Selection principles
Bending: Beam Design, Deflection of Beams, Statically Indeterminate Beams and Shafts, Curved Beams, Deflection and Stiffness: Spring Rates review,
Transverse Shear: Shear in Straight Members, The Shear Formula, Shear Flow in Built-Up Members,
Buckling: Buckling and Design of Columns for Concentric Loading, Buckling and design of Columns for Eccentric Loading,
Failures Resulting from Static Loading: Failure Theory (Maximum Normal stress theory), Maximum Shear stress Theory, Von Mises Theory,
Failures Resulting from Variable Loading: Introduction to Fatigue in Metal, S-N diagram, Endurance limit, Fluctuating Stress,
Screws, Fasteners, and the Design of Nonpermanent Joints: Thread standard and Definition, Tension Loaded Bolted Joints, Bolt joint stiffness, Member stiffness, Bolted and Riveted Joints Loaded in Shear,
Welding, Bonding, and the Design of Permanent Joints: Welding Symbols, Butt and Fillet Welds, Stresses in Welded Joints in Bending, The Strength of Welded Joints,

Prerequisites: ME 2420, ME3410, ME3510

ME 4310 Manufacturing Processes 2 (Core) 3(2,1,1)
Fundamentals of Machining (Mechanics of Cutting, Cutting Forces and Power, Temperatures in Cutting, Tool Life, Surface Finish and Integrity, Machinability). Cutting-Tool Materials and Cutting Fluids. Machining Processes: Turning and Hole Making. Machining Processes: Milling, Broaching, Sawing, Filing, and Gear Manufacturing. Manufacturing process planning. Machining Economics. Introduction to Advanced Machining Processes.
Lab covers Machining processes (turning, boring, drilling, tapping, milling, and gear manufacturing) and Machine tools (lathe, drilling, and milling). Cutting tool geometry. Experimental study in metal cutting: chip formation, tool wear and cutting force measurements. Developing process planning, Non-Traditional machining processes.

Prerequisites: ME 3310

ME 4610 Measuring and Instrumentation (Core) 3(2,1,1)
Units and standards. Measurement and errors. Basics of mechanical metrology. Advanced technologies in the inspection. Surface Roughness measurement .Tolerances, Limits, and Fits. Classification of measurement instruments. Electronics instruments characteristics and principles. Digital and Analog signal meters. Sensors characteristics (Static- Dynamic). Sensors for measurements of (thermal, strain, acceleration, force, pressure, flow, level, proximity, &, etc…). Signal processing and signal conditioning elements. Data acquisition and data presentation. I/O devices. Basics Actuators (Mechanical, Hydraulic, Pneumatic & Electrical).

Lab covers errors and statistical measurement. Voltmeter –Ammeter method of DC resistance Measurement .Using of Oscilloscope, power supply, and wave generator Strain gauge .Infrared sensors & switche. Ultrasonic sensors. Potentiometer. Pressure sensors. Load cell. speeds sensors. Mechanical measurements .Surface roughness measurement

Prerequisites: EE3090

ME 4710 Refrigeration and Air Conditioning (Core) 2(2,1,0)
Gas refrigeration systems: standard cycle and its modification. Vapor - compression refrigeration systems: standard cycle and its modification, compressors, condensers, evaporators, expansion devices, system analysis, multi-pressure systems .Other refrigeration systems. Psychrometric processes, air conditioning systems, load calculations, air duct design.

Prerequisites: ME 3750

ME 4630 Mechatronics (Core) 3(2،1،1)
introduction to mechanical system interfacing and actuation. Theory and application of electronic and electromechanical devices. Concepts in electrical power transmission. Operational and power amplifiers. Electrical actuation systems: DC and stepper motors. Analog to Digital and digital to analog converters. Industrial Control System. Micro-Controllers. Real-Time Software. MEMS sensors. Data acquisition boards. PC-based controllers. Programmable Logic Controllers.
Lab work:
Experiments related to the various topics in mechatronics applications, computer-aided instrumentation and data acquisition. Laboratory study in design, prototyping, and testing with electrical and electronics components and electromechanical devices.

Prerequisites: ME 4610

ME 4720 Power Plants (Core) 2(2,1,0)
Steam power plants :superheat, reheat and regeneration, description, thermal analysis and performance of the plant systems and components. Gas Power Plants: Thermal analysis of the simple cycle, intercooling, reheat and regeneration, plant components, combined gas and steam cycle plants. Power generation analysis: Load curve and plant factors.

Prerequisites: ME 3750

ME 3430 Mechanical Design (2) (Core) 3 (2,1,1)
Mechanical engineering design Process: The design process, The life of a product, The Product Design Specification (PDS), Concept design - idea generation, Concept selection, Shafts: Shaft

Materials, Shaft Layout, Shaft Design for Stress, Deflection Considerations, Critical Speeds for Shafts, Miscellaneous Shaft Components, Limits and Fits, Mechanical Spring: Static Loading, Stresses in Helical Springs, The Curvature Effect, Compression Springs, Stability, Spring Materials, Extension Springs.
Rolling-Contact Bearings, Bearing Types, Bearing Life, Bearing Load Life at Rated Reliability, Bearing Survival: Reliability versus Life, Relating Load, Life, and Reliability, Combined Radial and Thrust Loading, Variable Loading, Selection of Ball and Cylindrical Roller Bearings, Selection of Tapered Roller Bearings, Design Assessment for Selected Rolling-Contact Bearings, Lubrication, Mounting and Enclosure,
Lubrication and Journal Bearings: Types of Lubrication, Viscosity, Design Considerations, The Relations of the Variables, Steady-State Conditions in Self-Contained Bearings, Clearance, Pressure-Fed Bearings, Loads and Materials, Bearing Types, Thrust Bearings, Boundary-Lubricated Bearings,
Clutches, Brakes, Couplings, Flywheels: Static Analysis of Clutches and Brakes, Internal Expanding Rim Clutches and Brakes, External Contracting Rim Clutches and Brakes, Band-Type Clutches and Brakes, Frictional-Contact Axial Clutches, Disk Brakes, Cone Clutches and Brakes, Energy Considerations, Temperature Rise, Friction Materials, Miscellaneous Clutches and Couplings, Flywheels,
Gears: Power Transmission, Types of Gear, Nomenclature, Conjugate Action, Involute Properties Fundamentals, Contact Ratio Interference, The Forming of Gear Teeth, Straight Bevel Gears, Parallel Helical Gears, Worm Gears Tooth Systems, Gear Trains,
Flexible Mechanical Elements: Belts, Flat- and Round-Belt Drives, V Belts, Timing Belts, Roller Chain, Wire Rope, Flexible Shafts

Lab: The lab is organized as a project-like activity where the student have to work on a mechanical design that includes different mechanical elements like gears, brakes, bearings, etc, and using a CAD software.

Prerequisites: ME 3420

ME 4640 Automatic Control (Core) 3(2,1,1)
Introduction to feedback control systems. Representation of control system components. Block diagrams. Time response of feedback control systems. Root locus technique. Frequency response methods. Compensation. PID controller design. Introduction to digital control systems. Design projects.
Experiments in support of control theory including: hydro-mechanical liquid level control, pressure control, pneumatic. Digital simulation of linear systems using a software package) MATLAB

Prerequisites: ME 4620

ME 4730 Desalination (Core) 2(2,1,0)
Fundamentals of water desalination. Thermal methods of desalination: MSF & MED, vapour compression, humidification-dehumidification - solar still. membrane evaporation desalination. Reverse Osmosis Method. Electro Dialysis. Economic analysis of desalination processes.

Prerequisites: ME 3750

ME 4410 Finite Element in Mechanical Design (Core) 2 (1,1,1)
General Introduction, Introduction to the Stiffness (Displacement) Method, Development of Truss Equations, Development of Beam Equations, Frame and Grid Equations, Development of the Plane Stress and Plane Strain Stiffness Equations, Practical Considerations, Three-Dimensional Stress Analysis.
Lab: Use FE software to solve various 1-D, 2-D and 3-D design problems.

Prerequisites: GEU 3010, ME 3510, ME 3430

ME 4930 Seminars in Mechanical Engineering (Core) 1(0,0,1)
This seminar course focus on Mechanical Engineering topics they don't typically have a chance to teach, including an emerging research area or an outside interest. Experts from the fields of mechanical design and emergent technologies, including speculative futures and speculative design, contribute to the program as guest lecturers. The course may include field trips, and career development workshops. Each seminar section will include an active learning element such as group projects, class discussions, writing reports, and presentation. The specific course topic associated with academic study, chosen by the course instructor, will vary by section and semester and will be indicated at the beginning of the course.

Prerequisites: None

ME 4980 Senior Design Project I (Core) 3(1,0,2)
Students learn how to choose a topic, establish a project, focus and conduct a literature review of the engineering design problem including the problem definition and the existing challenges, and then propose a solution, utilizing recent scientific research papers and well-established books. They prepare for/or preliminary conducting the experiments. Students collect the field data and develop the mathematical/computer model if applicable. They write the first two chapters along with any preliminary findings.

Prerequisites: None

ME 4990 Senior Design Project II (Core) 3(1,0,2)

Senior Design Project II is the continuation of the Senior Design Project I. Students work on the solution of the design problem, experiment data, and survey outcomes including running and finalizing the experimental program or the mathematical/computer model, analyzing the results and findings, and drawing the conclusion. Students are encouraged to perform a workable prototype and a code using simulation software and/or mathematical modeling of the engineering design problem. The output and the results obtained are then documented and submitted in the form of a scientific project report and a poster. Finally, students present and defend their project.

Prerequisites: ME 4980