UNDERGRADUATE COURSE DESCRIPTIONS

15102 Statics 3 Cr. Basic concepts. Forces, moments, and couples. Equilibrium of particles and rigid bodies. First and second moments. Structures (trusses, frames, machines). Distributed-force systems. Friction. Virtual work.

Prerequisite: Calculus I 19101, Physics of Mechanics 20101.

15103 Statics (Non-ME students) 2 Cr. Fundamentals. Forces, moments of forces, and couples. Equilibrium of particles and rigid bodies. Mass center. First moments. Second moments. Structures. Friction.

Prerequisite: Calculus I 19101, Physics of Mechanics 20101.

15104 Strength of Materials (Non-ME students) 2 Cr. Stress. Stress tensor. Equilibrium equation. Strain. Stress-strain relation. Hook's law. Torsion problem. Bending of beams. Transformation of stress. Deflection of beams.

15105 Dynamics (Non-ME students) 2 Cr. Kinematics and kinetics of particles. Force and acceleration. Work and energy. Impulse and momentum. Plane kinematics of rigid bodies. Rotation. Absolute and relative motion. Motion relative to rotating axes.

15106 General Fluid Mechanics (Non-ME students) 3 Cr. Definitions and general concepts. Fluid statics. Fluid kinematics. Conservation laws of mass, energy, and momentum and their applications. Incompressible flow in closed conduits.

15107 Industrial Thermodynamics (Non-ME students) 2 Cr. Pure substances. Work and heat. First and second laws of thermodynamics. Entropy. Irreversibility and availability.

15108 Statics and Strength of Materials (Non-ME students) 3Cr. Force systems. Equilibrium. Plane trusses (Methods of joints and sections). Center of mass and centroids of areas. Area moment of inertia. Shear force and bending moment in beams. Stress and strain. Axial loading. Torsion of circular sections. Pure bending.

15111 Thermodynamics I 3 Cr. Properties of pure substances. Work and heat. First and second laws of thermodynamics. Entropy. Irreversibility and availability.

Prerequisite: Calculus II 19102, Physics of Heat 20103.

15112 Fluid Mechanics I 3 Cr. Fundamental concepts. Fluid statics. Basic equations in integral and differential forms. Incompressible invicid flow. Dimensional analysis and similitude.

Prerequisites: Statics 15102, Differential Equations 19201.

15122 Thermodynamics II 3 Cr. Power and refrigeration cycles. Thermo- dynamic relations. Mixtures and solutions. Chemical reactions. Chemical equilibrium. Flow through nozzles.

Prerequisites: Thermodynamics I 15111, Fluid Mechanics I 15112.

15134 Dynamics of Machinery 3 Cr. Linkages and mechanisms. Cams. Spur gears. Gear trains. Velocity and acceleration analysis of machinery. Balance of machinery.

Prerequisite: Dynamics 15139.

15139 Dynamics I 4 Cr. Kinematics of particles. Force and acceleration. Work and energy. Impulse and momentum. Plane kinematics and kinetics of rigid bodies. Motion of rigid bodies in three dimensions. Vibrations.

Prerequisites: Thermodynamics I 15111, Fluid Mechanics I 15112.

15200 Production Methods & Workshop 3 Cr. Casting. Powder metallurgy. Hot and cold forming processes. General hand-workings of metals in cold state.

Prerequisite: Materials Science 11201.

15202 Strength of Materials I 3 Cr. General concepts. Stress. Strain. Safety concepts. Axial loading. Generalized Hooke's law. Torsion of circular & non-circular members. Pure bending. Bending with axial forces. Shear stress in beams.

Prerequisite: Statics 15102.

15213 Fluid Mechanics II 3 Cr. Internal incompressible viscous flow. Laminar and turbulent flows. Pipe friction. External flow. Flow in open channels. Flow measurement. Potential flow.

Prerequisite: Fluid Mechanics I 15112.

15214 Fluid Mechanics Lab 1 Cr. Selected experiments covering the main subjects of fluid mechanics.

Prerequisite: Fluid Mechanics II 15213.

15222 Fuel & Combustion 2 Cr. Properties of gaseous and liquid fuels. Stoichiometric analysis. Chemical equilibrium. Theory of chemical kinetics. Combustion. Flames. Burners.

Prerequisite: Thermodynamics II 15122.

15224 Strength of Materials Lab. 1 Cr. Selected experiments covering the main subjects of strength of materials.

Prerequisite: Strength of Materials II 15225.

15225 Strength of Materials II 3 Cr. Transformation of stress and strain and yield criteria. Deflection of beams. Stability of equilibrium. Design of columns. Energy and virtual work methods. Statically indeterminate problems. Plastic limit analysis.

Prerequisite: Strength of Materials I 15202.

15231 Design of Machine Elements I 3 Cr. Design considerations. Stress - strain analysis. Design for static strength. Stress concentration. Failure theories. Fatigue. Shafts and couplings. Power screws. Threaded fasteners, riveted, welded, and bonded joints. Springs.

Prerequisites: Dynamics 15139; Strength of Materials II 15225; Engineering Drawing I 28110.

15232 Design of Machine Elements II 3 Cr. Journal and rolling element bearings. Gears (spur, helical, bevel, worm). Flexible mechanical elements (belt drives, roller chains, wive ropes). Brakes and clutches.

Prerequisite: 15231 Design of Machine Elements I.

15244 Strength of Materials III 3 Cr. Equation of elasticity. Stress function. Torsion. Analogies to torsion problem. Torsion of thin-walled section. Energy method. Beam on elastic foundation. Deformation beyond elastic limit.

Prerequisite: Strength of Materials II 15225.

15309 Heat Transfer I 3 Cr. Steady-state conduction. Unsteady-state conduction. Principles of convection. Empirical and practical relations for forced-convection heat transfer. Radiation heat transfer.

Prerequisites: Thermodynamic I 15111; Fluid Mechanics II 15213; Engineering Mathematics 19202

15311 Turbomachinery 3 Cr. Definitions and classifications. Theory of turbomachineries. Dimensional analysis. Design and applications of turbo- machineries.

Prerequisites: Thermodynamics II 15122; Fluid Mechanics II 15213 .

15316 Solar Energy 3 Cr. Solar radiation. Flat-plate collectors. Concentrating collectors and reflectors. Transfer of collected heat. Thermal energy storage.

Prerequisite: Heat Transfer I 15309.

15318 Gas Dynamics 3 Cr. One-dimensional isentropic flow of a perfect gas in nozzles. Normal shock wave. Flow with friction or heat transfer in constant-area ducts. One-dimensional unsteady flow.

Prerequisites: Thermodynamics II 15122; Fluid Mechanics II 15213.

15320 Heat Transfer II 3 Cr. Forced convection heat transfer. Natural convection. Condensation and boiling heat transfer. Heat exchangers.

Prerequisite: Heat Transfer I 15309.

15334 Design of Mechanisms 3 Cr. Geometry of constrained plane motion with applications to linkage design. Path curvature. Inflection circle. Cubic of stationary curvature. Finite displacements. 3 and 4 separated positions. Graphical and analytical techniques.

Prerequisite: Dynamics of Machinery 15134.

15338 Vibrations 3 Cr. Kinematics of vibration. Undamped and damped free vibration. Vibration under harmonic and general forcing conditions. Two and multidegree of freedom systems. Modal analysis. Continuous systems.

Prerequisites: Engineering Mathematics 19202; Dynamics 15139; Strength of Materials II 15225.

15340 Thermodynamics and Heat Transfer Lab. 1 Cr. Selected experiments covering the main subjects of thermodynamics and heat transfer.

Prerequisites: Thermodynamics II 15122; Heat Transfer I 15309.

15341 Dynamics of Machinery and Vibrations Lab. 1 Cr. Selected experi- ments covering the main subjects of dynamic machines and vibrations.

Prerequisites: Dynamics of Machinery 15134; Vibrations 15338.

15342 Bearings & Lubrication 2 Cr. Basic concepts. Hydrodynamic action. Lubricant properties. Surface roughness. Bearing materials. Thrust and hydrostatic bearings. Elastohydrodynamic lubrication. Mapping of lubrication regimes.

Prerequisites: Design of Machine Elements I 15231; Fluid Mechanics I 15112.

15350 Robotics 3 Cr. An overview. Forward (configuration) kinematics. Inverse (configuration) kinematics. Force/torque relations. Trajectory planning. Dynamics (kinetics). Positional control.

Prerequisite: Dynamics of Machinery 15134.

15370 Engineering Design Methods 3 Cr. Inventiveness. Scope of design. Design process. Mathematical methods of optimization. Human aspects of design.

Prerequisite: Design of Machine Elements II 15232.

15411 Water Distribution Systems 3 Cr. Water cycle. Urban and industrial water resources. Water distribution through pipes and channels and their design issues. Industrial water distribution systems. Design examples.

Prerequisite: Fluid Mechanics II 15213.

15413 Heat Exchanger Design 3 Cr. Types of heat exchangers. Methods of thermal analysis. Overall heat transfer coefficient. Fouling factor. □□-NTU, F-LMTD, □□-P methods. Thermal-hydraulic design. Shell & tube and compact heat exchangers. Air coolers, radiators, cooling towers, furnaces, and condensers.

Prerequisite: Heat Transfer I 15309.

15421 Thermal Power Plants I 3 Cr. Rankine cycle. Steam generators. Heat balance in steam generators. Impulse and reaction turbines. Condensate-feedwater systems. Circulating-water systems. Gas turbines and combined cycles.

Prerequisite: Thermodynamics II 15122; Heat Transfer I 15309.

15426 Air Conditioning System Design 3 Cr. Load estimating. Apparatus and duct design for air distribution. Water and steam piping design. Auxiliary equipments (pumps, motors, boilers). Water and dam systems. Fan-coil unit systems.

Prerequisite: Thermodynamics II 15122; Heat Transfer I 15309.

15427 Freezing & Cooling Systems Design 3 Cr. Theory of refrigeration methods. Refrigeration equipments (compressors, condensers, evaporators, expansion devices). Load estimating for cold stores. Cold store design.

Prerequisite: Heat Transfer I 15309.

15428 Hydro- & Aero-Dynamics 3 Cr. Introduction to potential flow theory. Basic solutions. Flow about a body. Aerodynamic characteristics of airfoils. Finite wing theory. Panel methods. Compressibility effects.

Prerequisite: Fluid Mechanics II 15213.

15429 Computational Fluid Dynamics 3 Cr. Fundamentals of finite-difference methods. Applications of selected model equations. Applications to simple fluid mechanics and heat transfer problems.

Prerequisite: Fluid Mechanics II 15213, 19301.

15431 Gas Turbines & Jet Engines 3 Cr. Thermodynamics of simple gas turbines and various propulsion engines (turbojets, turbofans, turboprops) at design point. Some aspects of compressor and turbine aerodynamic design.

Prerequisite: Thermodynamics II 15122; Fluid Mechanics II 15213.

15432 Applied Plasticity 3 Cr. Properties of metals and atomic structure of metals. Dislocations. Deformation under complex stress systems. Deformation loads and their energy. Survey of mechanical working process (forging, extrusion, etc.).

Prerequisite: Strength of Materials II 15225.

15433 Industrial Hydraulics 3 Cr. Hydraulic pumps. Pressure, flow, and directional-control valves. Cartridge valves. Actuators. Fluid for hydraulic systems. Hydraulic system design and maintenance.

Prerequisite: Fluid Mechanics II 15213.

15434 Machine Tools Design 3 Cr. Types of machines. Design of machine frames, components, beds, and foundations. Spindles, bearings, and guiding systems. Main drives. Drive mechanisms and clutches. Control systems.

Prerequisites: Design of Machine Elements II 15232; Design of Mechanisms 15334.

15435 Instrumentation 2 Cr. Generalized configurations and functions. Static and dynamic performance characteristics. Dimensional, motion, force, torque, power, pressure, flow, and temperature measuring devices.

Prerequisites: Fundamentals of Electrical Eng. I 17218; Automatic Control 15437.

15437 Automatic Control 3 Cr. Introduction to control systems. Modelling of dynamic systems. Time-response analysis. Root locus analysis. Frequency-response analysis. Design and compensation techniques.

Prerequisites: Vibrations 15338; Fundamentals of Electrical Eng. I 17218.

15440 Installation & Maintenance Engineering 3 Cr. Tolerances, fits , and technical rules for mounting of mechanical machine components. Foundation. Handling equipments. Installation of machines. Alignment, maintenance, and inspection of machine elements.

Prerequisite: Design of Machine Element II 15232.

15447 Hydraulic Power Stations 3 Cr. Hydrological and hydraulic calculations. Hydraulic turbines. Turbine selection. Cavitation in hydraulic turbines. Gate valves and ducts in hydraulic power stations.

Prerequisites: Fluid Mechanics II 15213.

15448 Environmental Pollution 2 Cr. General concepts. Major pollutants and their effects on human and environment. Pollution from different industries and vehicles. Air pollution control methods and equipments.

Prerequisites: Thermodynamics II 15122; General Chemistry 21107.

15449 Die Design 3 Cr. Theory of cutting. Types of cutting dies. Theory of bending. Types of bending dies. Theory of deep drawing. Types of deep drawing dies. Principles of die casting. Principles of Injection dies.

Prerequisite: Design of Machine Element II 15232.

15452 Chassis Design 3 Cr. Chassis and general vehicles. General design considerations. Wheel suspensions. Performance and handling characteristics of road vehicles. Vehicle ride characteristics. Mechanics of pneumatic tires.

Prerequisite: Design of Machine Element II 15232.

15461 Computer-Aided Design 3 Cr. Computer-aided drafting (AUTOCAD). Drawing, editing, and dimensioning. Finite element analysis. Galerkin formulation. Applications of NISA II software in heat transfer. Structural and solid mechanics (truss, beam, frame and two-dimensional elements).

Prerequisites: Design of Machine Element II 15232; Numerical Methods 19301.

15462 Composite Materials 3 Cr. Introduction, definition, and classifications of composite materials. Introduction to processing methods, physical properties, and mechanical behavior of composite materials.

Prerequisites: Strength of Materials I 15202; Materials Science 11201.

15470 Automatic Assembly 3 Cr. Assembly methods. Transfer systems. Vibratory bowl feeders. Non-vibratory feeders. Orientation of parts. Feed tracks, escapements, and part-placing mechanisms. Design, performance and economics of assembly systems.

Prerequisite: Vibrations 15338, Dynamics of Machinery 15134.

28110 Engineering Drawing I 2 Cr. Projection concepts. Drawing standards .Volume and surface analysis for drawing the third multiview projection. Isometric and demetric (oblique & nonoblique) projections. Types of sectional views .Industrial (Assembly and workshop) drawings. Dimensioning.

28120 Engineering Drawing II 2 Cr. Descriptive geometry (orthogonal projection, point, line, plane). Determination of length, distance, angle, and area .Method of rotation and replacing planes of projection. Intersections of lines, planes ،and volumes. Perspectives. Various types of industrial drawings. Introduction to AUTOCAD software.

Prerequisite: Engineering Drawing I 28110.