Mechanics 1

Analysis and problem solving in statics. Vector and matrix analysis. Force-moment balance equations. Analysis of stress and strain. Behavior of isotropic materials. Area moments of inertia. Behavior of members subjected to axial, torsional, and flexural loadings, combined stress, compression members and columns. Recommendations: Sophomore standing Pre-requisites: PHY-0011 and MATH-0034

Mechanics 2

Equilibrium of particles and rigid bodies in two and three dimensions. Kinematics and kinetics of particles and of rigid bodies in plane motion. Mass moments of inertia of solid bodies. Momentum and impulse methods. Energy methods. Single degree of freedom vibrations. Derivation and solution of differential equations of motion. Recommendations: MATH-0051 Pre-requisites: ME-0020

Shorter of Mechanics 1&2:

(Statics, vector & matrix analysis, force-moment balance equations, stress & strain, combined loadings, equilibrium, kinematics & kinetics of particles & rigid bodies, inertia, momentum, impulse & energy methods)

Materials & Manufacturing 1

Product teardown, component and sub-assembly identification, CAD modeling of parts and assembly. Materials identification and selection for engineering applications, Ashby charts. Basic principles and advantages/disadvantages of manufacturing processes, hands on component manufacturing. Recommendations: Sophomore standing

Materials & Manufacturing 2

Phase diagrams, microstructures of materials, methods of structural material modification. Material classification and basic structures, material properties, property characterization and testing methods. Dislocations, twinning, diffusion and strengthening mechanisms. Recommendations: ME-0020 Pre-requisites: ME-0010, CHEM-0001

Shorter of Materials & Manufacturing 1&2:

(Materials & Manufacturing I,II (Product teardown, CAD modelling parts and assembly, materials structures, properties, classification & testing, Ashby charts, manufacturing principles & processes, phase diagrams, strengthening methods)

Engineering Design 1

User-centric design process, project planning, framing the design challenge. Intellectual property, market research. Task analysis, identification of user needs and engineering requirements, user profiles and persona, need ranking. Ideation techniques, decision making based on design criteria, detailed design. Working with vendors and communicating designs, usability testing, design iteration, engineering drawings in CAD, prototype fabrication. Pre-requisites: Sophomore standing

Engineering Design 2

Machine applications, component analysis, load analysis, free body diagrams. Analytical modeling, finite element analysis, failure modes, stress concentrations, failure theories. Machine design component selection, applications, materials, loading conditions. Recommendations: ME-0020 Pre-requisites: ME-0040

Shorter of Engineering Design 1&2:

(Design criteria & ideation process, iteration, drawings, project planning, intellectual property, prototyping, testing, analytical modelling, FEA, stress concentrations, failure modes & theories, component selection)

Thermal Fluid Systems 1

Classical thermodynamics and energy balances. Thermophysical properties of matter, first and second law of thermodynamics in closed and open systems, entropy, and thermodynamic cycles. Dimensional analysis. One-dimensional steady state and transient conduction, and radiative heat transfer. Emphasis on application of thermodynamic reasoning to system design. Recommendations: Sophomore standing, CHEM-0001 Pre-requisites: PHY-0011 Pre-requisites or Co-requisites: MATH-0042 or MATH-0044

Thermal Fluid Systems 2

Fluid mechanics and convective heat transfer for internal and external flows. Properties of fluids, pressure, hydrostatic forces. Control volume and differential analysis. Conservation of mass, momentum, and energy. Bernoulli and Navier-Stokes equations. Introduction to turbulent flows. Momentum and thermal boundary layers. Forced and free heat convection, and heat exchangers. Emphasis on combined heat transfer and fluid flow in thermodynamic systems. Pre-requisites: ME-0050 and MATH-0051