

LOWER-DIVISION COURSES

10. Graphical Communication in Design

Introduction to the design process and graphical communications tools used by engineers. Documentation of design through freehand sketching and engineering drawings. Basic descriptive geometry. Computer-aided design as a design tool. Conceptual design projects presented in poster format. Computer Laboratory. (5 units)

11. Materials and Manufacturing Processes

Manufacturing processes and their use in the production of mechanical components from metals and plastics. *Prerequisites: MECH 10 and 15.* (4 units)

15. Introduction to Materials Science

Physical basis of the electrical, mechanical, optical, and thermal behavior of solids. Relations between atomic structure and physical properties. Laboratory. *Prerequisite: CHEM 11.* (5 units)

UPPER-DIVISION COURSES

102. Introduction to Mathematical Methods in Mechanical Engineering

The application of mathematical methods to the solution of practical engineering problems. A review of fundamental mathematical methods and calculus of a single variable, multivariable calculus, ordinary differential equations, numerical methods, and basics of linear algebra. (4 units)

114. Machine Design I

Analysis and design of mechanical systems for safe operation. Stress and deflection analysis. Failure theories for static loading and fatigue failure criteria. Team design projects begun. Formal conceptual design reports required. *Prerequisites: MECH 15, CENG 41, and CENG 43.* (4 units)

114L. Machining Lab

Practical experience with manual machine tools such as mills, lathes, drill press, sheet metal tools, etc. Basic training in safe and proper use of the equipment associated with simple mechanical projects. Laboratory. *Must be taken in conjunction with MECH 114.* P/NP (1 unit)

115. Machine Design II

Continuation of MECH 114. Treatment of basic machine elements (e.g., bolts, springs, gears, bearings). Design and analysis of machine elements for static and fatigue loading. Team design projects completed. Design prototypes and formal final report required. *Prerequisite: MECH 114.* (4 units)

121. Thermodynamics I

Definitions of work, heat, and energy. First and second laws of thermodynamics. Properties of pure substances. Application to fixed mass systems and control volumes. Irreversibility and availability. *Prerequisite: PHYS 33.* (4 units)

122. Fluid Mechanics I

Fluid properties and definitions. Fluid statics, forces on submerged surfaces, manometry. Streamlines and the description of flow fields. Euler's and Bernoulli's equations. Mass, momentum, and energy analysis with a control volume. Laminar and turbulent flows. Losses in pipes and ducts. Dimensional analysis and similitude. Laboratory. *Prerequisite: CENG 42 or MECH 140 (can be taken concurrently).* (5 units)

123. Heat Transfer

Introduction to the concepts of conduction, convection, and radiation heat transfer. Application of these concepts to engineering problems. Laboratory. *Prerequisites: MECH 121 and 122.* (5 units)

125. Thermal Systems Design

Analysis, design, and simulation of fluids and thermal engineering systems. Application of optimization techniques, life cycle and sustainability concepts in these systems. *Prerequisite: MECH 123.* (4 units)

132. Fluid Mechanics II

Introduction to gas dynamics. Concepts of lift and drag. Mechanics of laminar and turbulent flow. Introduction to boundary-layer theory. Application to selected topics in lubrication theory, aerodynamics, turbo-machinery, and pipe networks. Offered every other year. *Prerequisites: MECH 121 and 122.* (4 units)

140. Dynamics

Kinematics of particles in rectilinear and curvilinear motion. Kinetics of particles, Newton's second law, energy and momentum methods. Systems of particles. Kinematics and plane motion of rigid bodies, forces and accelerations, energy and momentum methods. Introduction to three-dimensional dynamics of rigid bodies. *Prerequisites: PHYS 31, CENG 41, AMTH 106, and MECH 10.* (4 units)

141. Mechanical Vibrations

Fundamentals of vibration, free and force vibration of (undamped / damped) single degree of freedom systems. Vibration under general forcing conditions. Free and force vibration of (undamped / damped) two degree of freedom systems. Free and force vibration of (undamped / damped) multidegree of freedom systems. Determination of natural frequencies and mode shapes. Laboratory. *Prerequisite: MECH 140.* (5 units)

142. Control Systems, Analysis and Design

Introduction to system theory, transfer functions, and state space modeling of physical systems. Course topics include stability, analysis and design of PID, Lead/Lag, other

forms of controllers in time and frequency domains, root locus Bode diagrams, gain and phase margins. Laboratory. *Prerequisite: MECH 141.* (5 units)

143. Mechatronics

Introduction to the behavior, design, and integration of electromechanical components and systems. Review of appropriate electronic components/circuitry, mechanism configurations, and programming constructs. Use and integration of transducers, microcontrollers, and actuators. Also listed as ELEN 123. *Prerequisite: ELEN 50.* (5 units)

144. Smart Product Design

Design of innovative smart electro-mechanical devices and products. Topics include a review of the basics of mechanical, electrical and software design and prototyping, and will emphasize the synthesis of functional systems that solve a customer need, that are developed in a team-based environment, and which are informed by the use of methodologies from the fields of systems engineering, concurrent design and project/business management. Designs will be developed in the context of a cost-constrained business environment, and principles of accounting, marketing, and supply chain are addressed. Societal impacts of technical products and services are reviewed. Enrollment is controlled in order to have a class with students from diverse majors. Offered every other year. *Prerequisites: Core Foundation-level natural science and mathematics, or equivalent; instructor permission required.* (5 units)

145. Introduction to Aerospace Engineering

Basic design and analysis of atmospheric flight vehicles. Principles of aerodynamics, propulsion, structures and materials, flight dynamics, stability and control, mission analysis, and performance estimation. Introduction to orbital dynamics. Offered every other year. *Prerequisites: MECH 122 and 140. Co-requisite: MECH 121.* (4 units)

146. Mechanism Design

Kinematic analysis and synthesis of planar mechanisms. Graphical synthesis of linkages and cams. Graphical and analytical techniques for the displacement, velocity, and acceleration analysis of mechanisms. Computer-aided design of mechanisms. Three or four individual mechanism design projects. Offered every other year. *Prerequisite: Junior standing in mechanical engineering.* (4 units)

151. Finite Element Theory and Applications

Basic introduction to finite elements; direct and variational basis for the governing equations; elements and interpolating functions. Applications to general field problems—elasticity, fluid mechanics, and heat transfer. Extensive use of software packages. Offered every other year. *Prerequisites: COEN 44 or equivalent and AMTH 106.* (4 units)

152. Composite Materials

Composite Materials. Analysis of composite materials and structures. Calculation of properties and failure of composite laminates. Manufacturing considerations and design of simple composite structures. Knowledge of MATLAB or equivalent programming

environment is required. Prerequisites: MECH 15, CENG 43, and COEN 44 or COEN 45.

156. Introduction to Nanotechnology

Introduction to the field of nanoscience and nanotechnology. Properties of nanomaterials and devices. Nanoelectronics: from silicon and beyond. Measurements of nanosystems. Application and implications. Laboratory experience is an integral part of the course. This course is part of the Mechanical Engineering Program and should be suitable for juniors and seniors in engineering and first-year graduate students. Also listed as ELEN 156. *Prerequisite: PHYS 33 (5 units).*

160. Modern Instrumentation for Engineers

Introduction to engineering instrumentation, computer data acquisition hardware and software, sampling theory, statistics, and error analysis. Laboratory work spans the disciplines of mechanical engineering: dynamics, fluids, heat transfer, controls, with an emphasis on report writing and experimental design. *Prerequisite: MECH 123. (5 units)*

188. Co-op Education

Practical experience in a planned program designed to give students work experience related to their academic field of study and career objectives. Satisfactory completion of the assignment includes preparation of a summary report on co-op activities. P/NP grading. *May be taken for graduate credit. (2 units)*

189. Co-op Technical Report

Credit given for a technical report on a specific activity such as a design or research project, etc., after completing the co-op assignment. Approval of department co-op advisor required. Letter grades based on content and presentation quality of report. May be taken twice. *May be taken for graduate credit. (2 units)*

192. Technical Writing

Organization of engineering proposals and reports. General aspects of technical communications. Development of oral presentation skills and strategies. *Prerequisite: ENGL 2. (2 units)*

194. Advanced Design I: Tools

Design tools basic to all aspects of mechanical engineering, including design methodology, computer-design tools, CAD, finite element method, simulation, engineering economics, and decision making. Senior design projects begun. *Prerequisite: MECH 115. (3 units)*

195. Advanced Design II: Implementation

Implementation of design strategy. Detail design and fabrication of senior design projects. Quality control, testing and evaluation, standards and specifications, and human factors. *Prerequisite: MECH 194.* (4 units)

196. Advanced Design III: Completion and Evaluation

Design projects completed, assembled, tested, evaluated, and judged with opportunities for detailed re-evaluation by the designers. Formal public presentation of results. Final written report required. *Prerequisite: MECH 195.* (3 units)

199. Directed Research/Reading

Investigation of an engineering problem and writing an acceptable thesis. Conferences as required. *Prerequisite: Senior standing.* (2–4 units)