

**REQUIREMENTS FOR THE BACHELOR OF SCIENCE IN  
MECHANICAL ENGINEERING  
2005  
COLLEGE OF ENGINEERING  
UNIVERSITY OF TEXAS AT ARLINGTON**

**General Requirements  
Total Credit Hours = 131**

<b>FRESHMAN</b>							
<b>FIRST SEMESTER</b>			<b>Hours</b>	<b>SECOND SEMESTER</b>			<b>Hours</b>
ENGL	1301	Critical Thinking, Reading and Writing I	3	ENGL	1302	Critical Thinking, Reading and Writing II	3
MATH	1426	Calculus I	4	MATH	2425	Calculus II	4
CHEM	1441	General Chemistry	4	PHYS	1444	Tech. Physics II (w/ Lab)	4
PHYS	1443	Technical Physics I (w/ Lab)	4	MAE	1312	Engineering Statics	3
MAE	1104	Intro to Engineering	1	DG	1350	Graphics for Engineers	3
MAE	1105	Intro to MAE	1				
<b>TOTAL CREDIT HOURS</b>			<b>17</b>	<b>TOTAL CREDIT HOURS</b>			<b>17</b>
<b>SOPHOMORE</b>							
<b>FIRST SEMESTER</b>			<b>Hours</b>	<b>SECOND SEMESTER</b>			<b>Hours</b>
MATH	2326	Calculus III	3	EE	2320	Circuits Analysis	3
MAE	2312	Solid Mechanics	3	MAE	2381	Exp. Methods & Meas	3
MAE	2321	Materials Science	3	MAE	3310	Thermodynamics I	3
MAE	2323	Dynamics	3	MAE	3344	Intro to Mfg Engineering	3
MAE	2360	Numerical Analysis & Programming	3	MAE	3360	Engineering Analysis	3
HIST	1311	History of U.S	3	HIST	1312	History of U.S	3
<b>TOTAL CREDIT HOURS</b>			<b>18</b>	<b>TOTAL CREDIT HOURS</b>			<b>18</b>
<b>JUNIOR</b>							
<b>FIRST SEMESTER</b>			<b>Hours</b>	<b>SECOND SEMESTER</b>			<b>Hours</b>
MAE	2314	Fluid Mechanics I	3	MAE	3314	Heat Transfer	3
MAE	3121	Material Science Lab	1	MAE	3318	Kin & Dyn of Machines	3
MAE	3242	Mechanical Design I	2	MAE	3319	Dyn System Modeling & Simulation	3
MAE	3311	Thermodynamics II	3	POLS	2312	State & Local Government	3
MAE	3321	Mech. Behavior of Materials	3	ENGL	23XX	English Literature	3
POLS	2311	US Government	3				
<b>TOTAL CREDIT HOURS</b>			<b>15</b>	<b>TOTAL CREDIT HOURS</b>			<b>15</b>
<b>SENIOR</b>							
<b>FIRST SEMESTER</b>			<b>Hours</b>	<b>SECOND SEMESTER</b>			<b>Hours</b>
MAE	3183	Measurements Lab II	1	MAE	4188	Design Project II	1
MAE	4287	Design Project I	2	MAE	4310	Intro to Automatic Control	3
MAE	4342	Mechanical Design II	3	ECON	2305	Principles of Macroeconomics	3
MAE	4344	Computer Aided Engr	3				
SPCH	3302	Prof & Tech Comm	3				
§ Approved Technical Elective			3	■ Fine Arts Elective			3
				§ Approved Technical Elective			3
				§ Approved Technical Elective			3
<b>TOTAL CREDIT HOURS</b>			<b>15</b>	<b>TOTAL CREDIT HOURS</b>			<b>16</b>

§ To be chosen from the approved list of technical electives available in the MAE office, 204 WH.

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(\*\*) Students who do not have two units of a single foreign language in high school will be required to take two courses of a single foreign language in addition to the previously listed curriculum requirements.

## COURSES IN CHEMISTRY & BIOCHEMISTRY (CHEM)

**CHEM 1441. GENERAL CHEMISTRY (3-4) 4 hours credit. (CHEM 1412).** The lecture covers the fundamentals of atomic structure, chemical bonding, the periodic table, nomenclature, kinetic theory, gas laws, chemical equations, and solutions. The laboratory introduces the scientific method, experiment design, data collection and analysis, as well as illustrates fundamental principles presented in the lecture. Students who have not had high school chemistry are advised to take CHEM 1300 first. Semesters offered: Fa Prerequisite: MATH 1302 or equivalent

## COURSES IN CIVIL ENGINEERING (CE)

**CE 2312. STATICS AND DYNAMICS (2-2) 3 hours credit.** The lecture covers principles of forces and force systems, resultants and components of force systems, forces due to friction, condition of equilibrium, forces acting on members of trusses and frame structures, centroids and moments of inertia, review of kinematics and kinetics of particle motion, and two-dimensional motion of rigid bodies. The lab period is used for reinforcement of the course principles through problem solving as well as computer simulation demonstrations. Prerequisite: PHYS 1443; and MATH 2425 or concurrent registration therein.

## COURSES IN COMPUTER SCIENCE ENGINEERING (CSE)

**CSE 1320. INTERMEDIATE PROGRAMMING (3-2) 3 hours credit.** Programming concepts beyond standard control structures in C/C++. Emphasis is given to data structures and modular design consistent with software engineering principles. Windows and UNIX operating systems are used. Prerequisite: CSE 1105 (or concurrently) and CSE 1310, or EE 1347; and MATH 1323

## COURSES IN ELECTRICAL ENGINEERING (EE)

**EE 2320. CIRCUIT ANALYSIS (3-0) 3 hours credit.** For non-electrical engineering majors. Basic principles of R, L, and C components. Kirchhoff's laws, network analysis, loop and node equations, basic network theorems. Steady-state AC phasor analysis, operational amplifiers, filtering, and digital circuits. Prerequisite: Math 2425, PHYS 1444.

## COURSES IN MATHEMATICS (MATH)

**MATH 1426. CALCULUS I (3-2) 4 hours credit. (MATH 2413).** Concepts of limit, continuity, differentiation and integration; applications of these concepts. Prerequisite: MATH 1323 or MATH 1325.

**MATH 2326. CALCULUS III (3-0) 3 hours credit. (MATH 2315).** Partial differentiation, multiple integrals (with applications), line integrals, Green's Theorem, surface integrals, Stokes' Theorem, divergence theorem. Prerequisite: MATH 2425.

**MATH 2425. CALCULUS II (3-2) 4 hours credit. (MATH 2314).** Applications of integration, techniques of integration, parametric equations, polar coordinates, sequences and series. Prerequisite: MATH 1426.

## COURSES IN MECHANICAL ENGINEERING (MAE)

**MAE 1104. INTRODUCTION TO ENGINEERING (1-0) 1 hours credit.** Introduction to basic engineering concepts. Students will become familiar with engineering and its many sub-fields, ethical responsibilities, creativity and design. Semesters offered: Fa Prerequisite: Co-requisite: MAE 1105.

**MAE 1105. INTRODUCTION TO MECHANICAL AND AEROSPACE ENGINEERING (1-0) 1 hours credit.** Introduction to basic engineering concepts. Opportunities are provided to develop skills in oral and written communication, and department-specific material. Case studies are presented and analyzed. Semesters offered: Fa Prerequisite: Co-requisite: MAE 1104.

**MAE 1312. ENGINEERING STATICS (3-0) 3 hours credit.** A study of forces and force systems, resultants and components of force systems, forces due to friction, conditions of equilibrium, forces acting on members of trusses and frame structures, centroids and moments of inertia. Vector and index notation introduced. Semesters offered: Fa Prerequisite: Pass PHYS 1443 and MATH 1426 with C or better before enrolling in MAE 1312.

**MAE 2201. INTRODUCTION TO AERONAUTICS AND ASTRONAUTICS (2-0) 2 hours credit.** The historical development of aerodynamic theory before and after the first successful powered flight and fundamental principles of astronautics and aeronautics. Basic concepts of fluid mechanics, statics, and similarity. Semesters offered: Fa Prerequisite: MATH 2425 and MAE 1312 or concurrent enrollment.

**MAE 2312. SOLID MECHANICS (3-0) 3 hours credit.** The relationship between stresses and strains in elastic bodies and the tension, compression, shear, bending, torsion, and combined loadings which produce them. Deflections and elastic curves, shear and bending moment diagrams for beams, and column theory. Also taught as CE 3311. Semesters offered: Fa Prerequisite: MAE 1312 or CE 2312.

**MAE 2314. FLUID MECHANICS I (3-0) 3 hours credit.** Fundamental concepts of fluid mechanics leading to the development of both the integral and differential forms of the basic conservation equations. Application of the integral conservation equations to engineering problems in fluid dynamics including buoyancy and other hydrostatics problems. Dimensional analysis and similitude are also discussed. Semesters offered: Fa Prerequisite: MAE 2323, MATH 2326 or concurrent enrollment, and MAE 3310 or concurrent enrollment.

**MAE 2321. MATERIALS SCIENCE (3-0) 3 hours credit.** Physical, mechanical, electrical, chemical properties of metals, semiconductors, ceramics, polymers, composites, and aggregates and the relationships between these properties and the electronic, crystal, micro and macrostructures of the materials. Semesters offered: Fa Prerequisite: CHEM 1441 and PHYS 1444.

**MAE 2323. DYNAMICS (3-0) 3 hours credit.** The relation between forces acting on particles, systems of particles and rigid bodies and the changes in motion produced. Review of kinematics and vector analysis, Newton's Laws, energy methods, methods of momentum, inertia tensor and Euler's equations of motion. Semesters offered: Fa Prerequisite: MAE 1312 or CE 2312 and MATH 2425.

**MAE 2360. ENGINEERING ANALYSIS I (2-3) 3 hours credit.** Utilization of digital computers in mechanical and aerospace engineering. Computational algorithms and their representation in FORTRAN and C. Introduction to Linear Algebra and Numerical Methods. Semesters offered: Fa Prerequisite: MATH 2425 or concurrent enrollment.

**MAE 2381. EXPERIMENTAL METHODS AND MEASUREMENTS (2-3) 3 hours credit.** Introduction to data analysis, incorporating statistics and probability, design and planning of engineering experiments for error prediction and control. Measurement and instrumentation, basic instruments, their calibration and use. Semesters offered: Fa Prerequisite: MATH 2425

**MAE 3121. MATERIALS SCIENCE LAB (0-3) 1 hours credit.** Experimental studies of the basic mechanical, chemical, and physical properties of materials. Emphasis on the relationships between macroscopic properties and the corresponding influence of the atomic and microstructural nature of the materials. Semesters offered: Fa Prerequisite: MAE 3321 or concurrent enrollment.

**MAE 3181. MATERIALS AND STRUCTURES LAB (0-3) 1 hours credit.** Experiments to study materials behavior and deformation of structural elements common to aerospace vehicles. Prerequisite: MAE 3315 or concurrent enrollment.

**MAE 3242. MECHANICAL DESIGN I (2-0) 2 hours credit.** The overall nature of design as a process is presented along with various models of the process. Emphasis is placed on the need to identify and correct problems early in the process. Methods, techniques and tools, including concurrent engineering for capturing problems early, for the various phases of the process provide the student with an excellent understanding of how to design. The idea of design patterns (problems, contexts and standard solutions) is introduced. Semesters offered: Sp Prerequisite: MAE 2312 (or CE 3312), MAE 2321, and MAE 2323.

**MAE 3310. THERMODYNAMICS I (3-0) 3 hours credit.** Basic concepts and definitions, properties of pure substance, work and heat, first law of thermodynamics, second law of thermodynamics, entropy, thermodynamics of gases, vapors, and liquids in various nonflow and flow processes, and irreversibility and availability. Semesters offered: Fa Prerequisite: MATH 2425 or 2525; PHYS 1444; MAE 2360; and CE 2312, or MAE 2322, or MAE 1312.

**MAE 3311. THERMODYNAMICS II (3-0) 3 hours credit.** Power and heat pump cycles, property relations and equations of state, ideal gas mixtures, mixtures of gases and vapors, combustion stoichiometry,

thermodynamics of combustion, and compressible flow. Emphasis is on applying these topics to thermal systems design. Semesters offered: Fa Prerequisite: CHEM 1441; MAE 3310, 3360, 2314 or concurrent enrollment.

**MAE 3314. HEAT TRANSFER (3-0) 3 hours credit.** The fundamental laws of heat and mass transfer, including steady and unsteady conduction, convection, and radiation. Applications of heat transfer to thermal systems design are included. Semesters offered: Fa Prerequisite: MAE 3360, 2314, 3311.

**MAE 3318. KINEMATICS AND DYNAMICS OF MACHINES (3-0) 3 hours credit.** The motion and interaction of machine elements. Fundamental concepts of kinematics, statics, and dynamics applied to the determination of forces acting on the parts of machines. Specific mechanisms and applications such as cams, gears, flywheels, and balancing. Semesters offered: Sp Prerequisite: MAE 2323.

**MAE 3319. DYNAMIC SYSTEMS MODELING AND SIMULATION (3-0) 3 hours credit.** Introduction to modeling and prediction of behavior of engineering systems. Analytic and numerical simulation, state-space differential equations, and Laplace transform methods. Effects of physical characteristics of system elements on system design and dynamic performance. Semesters offered: Fa Prerequisite: MAE 2360, 2323, 3310, 3360. Concurrent enrollment: MAE 2314 and 3314; EE 2320.

**MAE 3321. MECHANICAL BEHAVIOR OF MATERIALS (3-0) 3 hours credit.** The interrelationships between processing, structure, and properties of engineering materials with emphasis on the mechanical behavior of metals, polymers, and composite materials. Semesters offered: Fa Prerequisite: MAE 2321.

**MAE 3360. ENGINEERING ANALYSIS II (3-0) 3 hours credit.** Methods for solving, by means of mathematical analysis, problems which occur in engineering. Basic mathematical analysis tools will be selected from numerical and closed form solutions of differential equations, numerical integration and differentiation, vector spaces, linear transformations, matrix/vector algebra, solutions of linear systems, eigenvectors, Laplace transform, infinite series, complex variables; Fourier analysis; special functions, and systems of equations. Semesters offered: Sp Prerequisite: MATH 2326 and MAE 2360.

**MAE 4188. DESIGN PROJECT LABORATORY II (0-3) 14 hours credit.** The design project from MAE 4287 continued. The design is finalized, a physical model (prototype) is manufactured and tested. Redesign and retest is accomplished as desired. The final design is documented by written report and oral presentation. Graduating senior's portfolios, exit survey forms, and exit essays must be submitted to complete the requirements of this course. Semesters offered: LS Prerequisite: MAE 4287.

**MAE 4191, 4291, 4391. SPECIAL PROBLEMS IN MECHANICAL AND AEROSPACE ENGINEERING (Variable credit, individual instruction).** Special problems in mechanical and aerospace engineering for students of senior standing.

**MAE 4287. DESIGN PROJECT I (2-0) 2 hours credit.** Team engineering approach to a design project that integrates engineering knowledge from several courses. Problem definition and creative synthesis of prospective design solutions. Engineering proposals, feasibility studies, trade-off studies, systems models and analysis, decision making, and engineering reports and presentations. Professionalism, ethics, and societal impact issues. Semesters offered: Fa Prerequisite: must be within two calendar semesters of graduation (possibly including an 11-week summer session).

**MAE 4310. INTRODUCTION TO AUTOMATIC CONTROL (3-0) 3 hours credit.** Block diagram algebra, transfer functions, and stability criteria. The use of transient response, frequency response, and root locus techniques in the performance analysis, evaluation, and design of dynamic systems. Semesters offered: Sp Prerequisite: MAE 3319. Also offered as EE 4314.

**MAE 4314. MECHANICAL VIBRATIONS (3-0) 3 hours credit.** Harmonic and periodic motion including both damped and undamped free and forced vibration. Single- and multidegree-of-freedom systems. Matrix techniques suitable for digital computer solution. Prerequisite: MAE 3360, 2323.

**MAE 4315. INTRODUCTION TO COMPOSITES (3-0) 3 hours credit.** Composite classification, laminate coding, fabrication, processing and properties of composite laminates, point stress analysis and failure prediction of composite laminates, material allowables, issues in composite structural design. Semesters offered: Fa Prerequisite: MAE 1312, 2312, 2322 or CE 3311.

**MAE 4332. OPTIMUM MECHANICAL DESIGN (3-0) 3 hours credit.** Mathematical approximations, manufacturing errors, and factor of safety. A method of optimum design is formulated and applied to a number of mechanical elements. Prerequisite: MAE 3242.

**MAE 4336. ADVANCED MECHANICAL BEHAVIOR OF MATERIALS (3-0) 3 hours credit.** Concept of stress and strain, theory of plasticity; elementary dislocation theory. Deformation of single crystals; strengthening mechanisms like solid solution strengthening, and precipitation hardening. Fracture mechanics; microscopic aspects of fracture, fatigue, and creep of materials; design and processing of materials for improved mechanical properties. Prerequisite: MAE 2312, 3321.

**MAE 4342. MECHANICAL DESIGN II (3-0) 3 hours credit.** A brief review of the design process and process models refreshes the students knowledge and prepares them for the rest of the course. The course has as its premise that there are standard solutions to design Mechanical Engineering Design problems in specific contexts. This concept has been called Design Patterns. Examples of specific design patterns (e.g., providing forces, oscillations, transmitting torque, braking or connecting rotating members, supporting rotating members, etc.) are presented in the form of a statement of the problem, the specific context, the solution to that problem in that context and analytical techniques drawing on solid mechanics, fatigue, fracture mechanics and heat transfer. Semesters offered: Sp Prerequisite: MAE 3242, 3318 and 3321.

**MAE 4344. COMPUTER-AIDED DESIGN (3-0) 3 hours credit.** A study of the principles of computer-aided design in mechanical engineering. Applications in machine, structural, control, thermal, and fluid systems. Semesters offered: Fa Prerequisite: MAE 2360, 3319 and 3242

**MAE 4390. SPECIAL TOPICS IN MECHANICAL ENGINEERING (3-0) 3 hours credit.** Special topics pertinent to the field of mechanical engineering will vary from semester to semester depending on the availability of faculty. May be repeated, provided that topics are different. Prerequisite: prior approval by the student's advisor.

## COURSES IN PHYSICS (PHYS)

**PHYS 1443. GENERAL TECHNICAL PHYSICS I (3-3) 4 hours credit. (PHYS 2425).** The first half of a one-year technical course. Required for many science and engineering majors, exceeds premedical requirement. The study of physical phenomena in the fields of mechanics, heat, and waves. Prerequisite: MATH 1426 or concurrent enrollment.

**PHYS 1444. GENERAL TECHNICAL PHYSICS II (3-3) 4 hours credit. (PHYS 2426).** The second half of a one-year technical course. The study of physical phenomena including electricity, magnetism, circuit theory, light, and optics. Prerequisite: PHYS 1443 and MATH 2325 or concurrent enrollment.