

**REQUIREMENTS FOR THE BACHELOR OF SCIENCE IN
AEROSPACE ENGINEERING
2005
COLLEGE OF ENGINEERING
UNIVERSITY OF TEXAS AT ARLINGTON
General Requirements
Total Credit Hours = 131**

FRESHMAN							
FIRST SEMESTER			Hours	SECOND SEMESTER			Hours
ENGL	1301	Critical Thinking, Reading and Writing I	3	ENGL	1302	Critical Thinking, Reading and Writing II	3
CHEM	1441	Gen Chemistry I (w/ Lab)*	4	MATH	2425	Calculus II*	4
MATH	1426	Calculus I*	4	PHYS	1444	Tech Physics II (w/ Lab)*	4
PHYS	1443	Tech Physics I (w/ Lab)*	4	DG	1350	Graphics for Engineers*	3
MAE	1104	Intro to Engineering*	1	MAE	1312	Engineering Statics*	3
MAE	1105	Intro to MAE*	1				
TOTAL CREDIT HOURS			17	TOTAL CREDIT HOURS			17
SOPHOMORE							
FIRST SEMESTER			Hours	SECOND SEMESTER			Hours
EE	2320	Circuits Analysis*	3	MAE	2312	Solid Mechanics*	3
MATH	2326	Calculus III*	3	MAE	2314	Fluid Mechanics I*	3
MAE	2201	Intro to Aeronautics & Astronautics*	2	MAE	2321	Material Science*	3
				MAE	2381	Experimental Methods & Measurements*	3
MAE	2323	Dynamics*	3				
MAE	2360	Numerical Analysis	3	MAE	3310	Thermodynamics I*	3
HIST	1311	U.S. History to 1865	3	MAE	3360	Engineering Analysis	3
TOTAL CREDIT HOURS			17	TOTAL CREDIT HOURS			18
JUNIOR							
FIRST SEMESTER			Hours	SECOND SEMESTER			Hours
MAE	3302	Aerodyn of Incomp Flows**	3	MAE	3303	Aerodynamics of Compressible Flows**	3
MAE	3314	Heat Transfer	3				
MAE	3315	Aerospace Structural Stat **	3	MAE	3305	Flight Dynamics**	3
ENGL	23XX	English Literature	3	MAE	3316	Aerospace Structural Dynamics**	3
POLS	2311	US Government	3				
MAE	3181	Structures Lab**	1	MAE	3319	Dyn Sys Model & Sim	3
				POLS	2312	State & Local Government	3
				MAE	3182	Aero Lab**	1
TOTAL CREDIT HOURS			16	TOTAL CREDIT HOURS			16
SENIOR							
FIRST SEMESTER			Hours	SECOND SEMESTER			Hours
MAE	3304	Astronautics I**	3	MAE	4351	Aero Vehicle Design II**	3
MAE	4310	Intro to Auto Control	3	ECON	2305	Economics	3
MAE	4321	Air Breathing Engine Propulsion**	3	HIST	1312	U.S. History since 1865	3
MAE	4350	Aero Vehicle Design I**	3				
SPCH	3302	Prof & Tech Comm.	3				
						§ Approved Technical Elective	3
						■ Fine Arts Elective	3
TOTAL CREDIT HOURS			15	TOTAL CREDIT HOURS			15

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.

(*) Must earn a grade of C or better in these courses before taking further 3000-4000 level courses

(**) Courses offered only during the semester shown

§ Must be approved 3000-4000 level course in math, science, or engineering

■ Approved fine arts electives are: ARCH 1301, 2300, 2302, 2305, 2308-2310; ART 1301, 1309, 1310, 3302, 3305-3308, 3310-3315, 3331, 4302-4304, 4306, 4317, 4330; MUSI 1300, 1302, 3300, 3301; THEA 1343, 3307, 4303, 4304, 4330; CLAS 2310, 2320; PHIL 2312.

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COURSES IN AEROSPACE ENGINEERING (AE)

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 hydrostatic 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 2322. STATICS AND SOLID MECHANICS (3-0) 3 hours credit. Force systems, free body diagrams, equilibrium of particles, rigid bodies and structures; centroids and moments of inertia; stress and strain in elastic solids, and applications to simple engineering problems. **Prerequisite:** PHYS 1443, MATH 2425.

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. Numerical ANALYSIS (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 hour 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 hour credit. Experiments to study materials behavior and deformation of structural elements common to aerospace vehicles. **Prerequisite:** MAE 3315 or concurrent enrollment.

MAE 3182. AERODYNAMICS AND FLUIDS LAB (0-3) 1 hour credit. Wind tunnel experiments to study flow phenomena of aerodynamics interest, including scale testing of airfoils, wings, and aircraft. **Prerequisite:** MAE 3303 or concurrent enrollment.

MAE 3302. AERODYNAMICS OF INCOMPRESSIBLE FLOWS (3-0) 3 hours credit. Fundamental theory of incompressible flows with applications to the prediction of aerodynamic characteristics of wings and bodies. Viscosity effects on aerodynamics. **Prerequisite:** MAE 2314, MAE 3360

MAE 3303. AERODYNAMICS OF COMPRESSIBLE FLOWS (3-0) 3 hours credit. Fundamentals of physical and mathematical gas dynamics; isentropic, adiabatic, barotropic and Prandtl-Meyer flows; normal, oblique shocks; the shock-expansion theory; thin-airfoil and small-perturbation theory; design principles for supersonic vehicles and wind tunnels. **Semesters offered:** Sp **Prerequisite:** MAE 3402

MAE 3304. ASTRONAUTICS I (3-0) 3 hours credit. Introduction to astronautics, the solar system, and the two-body problem. Engineering approximation for orbital transfers and vehicle staging of powered trajectories. The single vehicle to orbit problem. Design considerations for earth satellites. **Semesters offered:** Fa **Prerequisite:** MAE 2323 and MATH 2326.

MAE 3305. FLIGHT DYNAMICS (3-0) 3 hours credit. General equations of motion of a flight vehicle. Determination of aircraft performance, static stability and control. Stability derivatives, stability of uncontrolled motion, and open loop and closed loop control. **Semesters offered:** Sp **Prerequisite:** MAE 3302, MATH 2326.

MAE 3309. THERMAL ENGINEERING (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, and introduction to conductive, convective, and radiative transfer. **Semesters offered:** Fa **Prerequisite:** MATH 2425, PHYS 1444.

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 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 3315. AEROSPACE STRUCTURAL STATICS (3-0) 3 hours credit. Concepts of stress/strain tensor and traction vector, differential equations of equilibrium, constitutive relations, anisotropic solids, bending and extension of advanced beams, torsion in thin-walled closed sections. Shear in advanced beams. **Prerequisite:** MAE 2312

MAE 3316. AEROSPACE STRUCTURAL DYNAMICS (3-0) 3 hours credit. Work and energy principles, general procedure of finite element method, static analysis; truss, frame and plate elements, dynamic analysis; vibration and transient dynamic response. **Semesters offered:** Sp **Prerequisite:** MAE 3415.

MAE 3317. LINEAR SYSTEMS (3-0) 3 hours credit. Time-domain transient analysis, convolution, Fourier Series and transforms, Laplace transforms and applications, transfer functions, signal flow diagrams, Bode plots, stability criteria, sampling, and Z-transforms. **Prerequisite:** MAE 3360. Also taught as EE 3317.

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 3360. ENGINEERING ANALYSIS (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 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 4294. HONORS MECHANICAL ENGINEERING PROBLEMS (Variable credit, individual instruction). A problem course designed to meet the needs of mechanical engineering undergraduate students in the honors program. This course may be repeated for credit as approved by the ME undergraduate advisor. **Prerequisite:** Admission to Honors ME.

MAE 4304. ASTRONAUTICS II (3-0) 3 hours credit. The restricted three-body problem, the n-body problem and approximations. Interplanetary transfers. Design considerations for both manned and unmanned interplanetary vehicles. **Prerequisite:** MAE 3304.

MAE 4307. FINITE ELEMENT METHODS (3-0) 3 hours credit. Static response of complex structures and continua; application to field problems; mesh generation; error estimation and adaptive refinement. **Prerequisite:** MAE 3242 or 2312.

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 4320. HYDRAULIC AND PNEUMATIC SYSTEMS (3-0) 3 hours credit. The fundamentals of fluid mechanics as applied to hydraulic and pneumatic hardware. Mathematical models of pumps, motors, pistons, accumulators, valves, and transmission lines. Design and analysis procedures for implementing total fluid power systems with high operating efficiencies and adequate dynamic response characteristics. Theory is supported by laboratory demonstrations. **Prerequisite:** MAE 2314 or 2412, and 4310 or permission of instructor.

MAE 4321. AIR-BREATHING ENGINE PROPULSION (3-0) 3 hours credit. First course of a two-semester sequence for students interested in aerospace propulsion. Development of thrust and efficiency relations, cycle analysis for ramjet, turbojet, and turbofan engines, component design and performance analysis, off-design performance analysis. **Semesters offered:** Fa **Prerequisite:** MAE 3303, MAE 3311 or 2411.

MAE 4348. COOLING OF ELECTRONIC PACKAGES (3-0) 3 hours credit. The calculation of heat loads and temperature fields using different cooling techniques. Includes parameter evaluation and design studies. **Prerequisite:** MAE 3309 or 3314

MAE 4350. AEROSPACE VEHICLE DESIGN I (3-0) 3 hours credit. Methodology and decision making involved in the preliminary design of aerospace vehicles. Applications to meet vehicle requirements and mission specifications, including conceptual design, preliminary sizing, trade-off studies, weight, and cost estimates. Also included will be economic, environmental, sustainability, manufacturability, safety, social and political considerations. **Semesters offered:** Fa **Prerequisite:** MAE 3303, MAE 3305.

MAE 4351. AEROSPACE VEHICLE DESIGN II (3-0) 3 hours credit. Student multidisciplinary design teams will be formed to apply design methods to aircraft, spacecraft, vehicle propulsion systems, vehicle structural systems, or other systems. Applicable iterative methods and trade-off studies will be applied to optimize the design. Also included will be economic, environmental, sustainability, manufacturability, safety, social and political considerations. Formal written and oral reports will be required. Graduating senior's portfolio, exit survey forms and exit essays must be submitted to complete the requirements of this course. **Semesters offered:** Sp **Prerequisite:** MAE 4350 or MAE 4287 and MAE 4188

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 DESIGN GRAPHICS (DG)

DG 1350. GRAPHICS FOR ENGINEERS (2-3) 3 hours credit. Freehand, instrumental, and computer graphics, including CAD systems (including Autocad and Pro-E software packages) and graphical representation of data using microcomputer software. Emphasis on the use of computer software in the graphical process to originate ideas and to solve engineering problems and generate graphical representations to solutions. **Prerequisite:** Prerequisite or co-requisite: MATH 1426.

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.

MATH 3319. DIFFERENTIAL EQUATIONS AND LINEAR ALGEBRA (3-0) 3 hours credit. Introductory course with emphasis on solution techniques. Ordinary differential equations, vector spaces, linear transformations, matrix/vector algebra, eigenvectors, Laplace Transform, and systems of equations. **Prerequisite:** MATH 2326 or concurrent registration.

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.