

# COURSE DESCRIPTIONS

All courses offered at the University are described on the following pages and are listed by disciplines, arranged alphabetically.

The course numbering scheme is as follows: 100 to 199, courses primarily open to freshmen; 200 to 299, courses primarily open to sophomores; 300 to 399, courses primarily open to juniors; 400 to 499, courses primarily open to seniors; and 600 to 699, courses limited to graduate students or undergraduate students with special approval.

Figures in parentheses following the number of the courses indicate the clock hours per week devoted to theory and practice, respectively. Theory includes recitations and lectures; practice includes work done in the laboratory, shop, drawing room, or field. The unit of credit is the semester hour, which involves one hour of theory, or from two to four hours of practice per week for one semester of 15 weeks.

When courses are cross-listed (e.g., offered as MARA 212 at TAMUG and MGMT 212 at TAMU), credit cannot be received for both courses.

Any course may be withdrawn from the semester or summer schedule if the number of registrants is too small to justify its being offered.

## **Accounting (ACCT)**

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229. INTRODUCTORY ACCOUNTING. (3-0). Credit 3. (TCCNS ACCT 2301). Analysis, recording and reporting of business transactions; partnership and corporation accounting; analysis and use of financial statements.

230. INTRODUCTORY ACCOUNTING. (3-0). Credit 3. (TCCNS ACCT 2302). Continuation of ACCT 229. Use of budgets; introduction to cost accounting; cost control techniques and methods of measuring performance. Prerequisites: ACCT 229.

315. INTERMEDIATE ACCOUNTING FOR NON-ACCOUNTING MAJORS I. (3-0). Credit 3. Revenue recognition principles of asset valuation, and disclosure requirements for corporations; interpretation of financial statements, rather than their preparation. Prerequisites: ACCT 230. Junior or senior classification.

316. INTERMEDIATE ACCOUNTING FOR NON-ACCOUNTING MAJORS II. (3-0). Credit 3. Includes the measurement and disclosure requirements for liabilities and stockholders' equity, SEC registration statements, and cash flow reporting; focus on the analysis and interpretation of financial statements rather than their preparation. Does not qualify as a directed or free elective for accounting majors and does not count towards the accounting requirement for the CPA exam. Prerequisite: ACCT 315 or 327.

## **Agricultural Economics (AGEC)**

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350. ENVIRONMENTAL AND NATURAL RESOURCE ECONOMICS. (3-0). Credit 3. Inspection of issues such as environmental degradation, population growth, recycling, water use and depletion, natural habitat protection, water and air pollution, acid deposition, fishery management, and global warming using economically derived principles and tools. Prerequisite: Junior or senior classification or approval of instructor.

## **Anthropology (ANTH)**

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202. INTRODUCTION TO ARCHAEOLOGY. (3-0). Credit 3. (TCCNS ANTH 2302). An introduction to the study of the human past through the retrieval, analysis, and interpretation of material remains.

210. SOCIAL AND CULTURAL ANTHROPOLOGY. (3-0). Credit 3. (TCCNS ANTH 2351). Evolution of cultures; differences, similarities and effects of material and non-material culture on economic, social and political organization.

225. BIOLOGICAL ANTHROPOLOGY. (3-3). Credit 4. Human biology to include examination of evolutionary processes acting on human populations; human genetics; non-human primate anatomy, classification and ecology of primates; the primate paleontological record, and human variation and adaptation. Prerequisite: BIOL 111.

316. NAUTICAL ARCHAEOLOGY. (3-0). Credit 3. Underwater shipwrecks, sunken harbors, and other submerged evidence of human activities; relationship to cultural geography in general; problems of diving technology, surveying and preservation; relevance to modern problems. Prerequisite: Junior or senior classification.

318. NAUTICAL ARCHAEOLOGY OF THE AMERICAS. (3-0). Credit 3. Seafaring in the Americas from the 16th to the 20th centuries based on shipwreck archaeology; ship construction, exploration, commerce, naval warfare and related activity; influence of seafaring on the cultures, economics and history of the Western Hemisphere. Prerequisite: Junior or senior classification or approval of instructor.

350. ARCHAEOLOGY OF THE OLD WORLD. (3-0). Credit 3. Overview of archaeology and prehistory of Europe, Africa and Asia from the evolution of the hominids to the development of agriculture and the rise of civilization. Prerequisite: Junior or senior classification or approval of instructor.

351. CLASSICAL ARCHAEOLOGY. (3-0). Credit 3. Origins and spread of Western civilization through the material remains of Minoan, Mycenaean, Etruscan, and early Greek and Roman cultures. Prerequisite: Junior or senior classification or approval of instructor.

423. BIOARCHAEOLOGY. (3-0). Credit 3. Role of human skeletal studies in reconstructing the biological and cultural past of humans; evidence gleaned from human skeletal remains recovered from archaeological sites such as data regarding diet, health, genetics and migration. Prerequisites: ANTH 225 or BIOL 225; junior or senior classification.

485. DIRECTED STUDIES. Credit 1-9. Individual research in anthropology on subjects not included in established courses. Prerequisites: Approval of department head. Junior or senior classification or approval of instructor.

## **Biology (BIOL)**

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111. INTRODUCTORY BIOLOGY I. (3-3). Credit 4. (TCCNS BIOL 1306 and TCCNS 1106). First half of an introductory two-semester survey of contemporary biology that covers the chemical basis of life, structure and biology of the cell, molecular biology and genetics.

112. INTRODUCTORY BIOLOGY II. (3-3). Credit 4. (TCCNS BIOL 1307 and TCCNS 1107). The second half of an introductory two-semester survey of contemporary biology that covers evolution, history of life, diversity and form and function of organisms. Prerequisite: BIOL 111, except MARS, MARS-LO and OCRE majors.

351. FUNDAMENTALS OF MICROBIOLOGY. (3-4). Credit 4. Basic microbiology; comparative morphology, taxonomy, pathogenesis, ecology, variation and physiology of microorganisms. Prerequisites: CHEM 227, 237; BIOL 111, 112; or approval of instructor. Junior or senior classification.

### **Center for Academic Enhancement (CAEN)**

101. APPLICATION OF LEARNING THEORY. (2-0). Credit 2. A seminar course designed to introduce students to the resources, skills, and strategies needed to succeed in college.

102. CAREER AWARENESS. (2-0). Credit 2. Introduction to the concepts of career planning, employment trends, and methods of researching and preparing for the job market.

### **Chemistry (CHEM)**

101. FUNDAMENTALS OF CHEMISTRY I. (3-0). Credit 3. (TCCNS CHEM 1311, 1411). Introduction to modern theories of atomic structure and chemical bonding; chemical reactions; stoichiometry; states of matter; solutions; equilibrium; acids and bases; coordination chemistry. Prerequisite: Concurrent registration in CHEM 111 is suggested.

102. FUNDAMENTALS OF CHEMISTRY II. (3-0). Credit 3. (TCCNS CHEM 1312, 1412). Theory and applications of oxidation-reduction systems; thermodynamics and kinetics; complex equilibria and solubility product; nuclear chemistry; descriptive inorganic and organic chemistry. Prerequisites: CHEM 101, CHEM 111 or their equivalent.

107. GENERAL CHEMISTRY FOR ENGINEERING STUDENTS. (3-0). Credit 3. I, II Introduction to important concepts and principles of chemistry; emphasis on areas considered most relevant in an engineering context; practical applications of chemical principles in engineering and technology. Students completing CHEM 107 and changing majors to curricula requiring CHEM 101 and CHEM 102 may substitute CHEM 107 for CHEM 101. Students may not receive credit for both CHEM 107 and CHEM 101.

111. FUNDAMENTALS OF CHEMISTRY LABORATORY I. (0-3). Credit 1. (TCCNS CHEM 1111). Introduction to methods and techniques of chemical experimentation; qualitative and semiquantitative procedures applied to investigative situations. Prerequisite: CHEM 101 or registration therein.

112. FUNDAMENTALS OF CHEMISTRY LABORATORY II. (0-3). Credit 1. (TCCNS CHEM 1112). Introduction to analytical and synthetic methods and to quantitative techniques to both inorganic and organic compounds. Prerequisites: CHEM 101, 111; CHEM 102 or registration therein.

117. GENERAL CHEMISTRY FOR ENGINEERING STUDENTS LABORATORY. (0-3). Credit 1. Introduction to important concepts and principles of chemistry in the laboratory; emphasis on areas considered most relevant in an engineering context; practical applications of chemical principles in engineering and technology. Students completing CHEM 117 and changing majors to curricula requiring CHEM 111 and CHEM 112 may substitute CHEM 117 for CHEM 111. Students may not receive credit for both CHEM 117 and CHEM 111. Prerequisites: CHEM 107 or registration therein.

227. ORGANIC CHEMISTRY I. (3-0). Credit 3. (TCCNS CHEM 2323). Introduction to chemistry of compounds of carbon. General principles and their application to industrial and biological processes. Concurrent registration in CHEM 237 is suggested. Prerequisite: CHEM 102/112 or 104.

228. ORGANIC CHEMISTRY II. (3-0). Credit 3. (TCCNS CHEM 2325). Continuation of CHEM 227. Concurrent registration in CHEM 238 is suggested. Prerequisite: CHEM 227.

237. ORGANIC CHEMISTRY LABORATORY. (0-3). Credit 1. (TCCNS CHEM 2123). Operations and techniques of elementary organic chemistry laboratory. Preparation, reactions and properties of representative organic compounds. Prerequisites: CHEM 112 or 114; CHEM 227 or concurrent registration.

238. ORGANIC CHEMISTRY LABORATORY. (0-3). Credit 1. (TCCNS CHEM 2125). Continuation of CHEM 237. Prerequisites: CHEM 237; CHEM 228 or registration therein.

285. DIRECTED STUDIES. Credit 1-4. Introduction to research, library, and laboratory work. Prerequisite: Approval of MARS department head.

316. QUANTITATIVE ANALYSIS. (2-0). Credit 2. Introduction to methods of chemical analysis. Chemical equilibrium. Prerequisites: CHEM 102/112 or 104. Junior or senior classification or approval of instructor.

318. QUANTITATIVE ANALYSIS LABORATORY. (0-3). Credit 1. Laboratory work consists of selected experiments in quantitative analysis designed to typify operations of general application; work is primarily volumetric with limited gravimetric experiments. Prerequisites: CHEM 102/112 or 114; CHEM 315 or 316 or concurrent registration. Junior or senior classification or approval of instructor.

383. CHEMISTRY OF ENVIRONMENTAL POLLUTION. (3-0). Credit 3. Chemical pollutants in the air, in water, and on land. Their generation, chemical reactivity, action on environment and disappearance through chemical mechanisms. Chemistry of existing pollution abatement. Prerequisites: CHEM 228 or equivalent. Junior or senior classification or approval of instructor.

483. GREEN CHEMISTRY. (3-0). Credit 3. Environmentally benign chemistry; the design of chemical products and processes that reduce or eliminate the use and generation of hazardous substances; twelve principles of Green Chemistry; atom economy; use of renewable resources; catalysis for Green Chemistry; alternative solvents and reaction media; energy and the environment. Prerequisites: CHEM 228, CHEM 362 is recommended. Junior or senior classification or approval of instructor.

485. DIRECTED STUDIES. Credit 1-4. Introduction to research, library, and laboratory work. Prerequisites: Senior classification; approval of MARS department head.

### **Civil Engineering (CVEN)**

221. ENGINEERING MECHANICS: STATICS. (2-2). Credit 3. I, II General principles of mechanics; concurrent force systems; statics of particles; equivalent force/moment systems; centroids and center of gravity; equilibrium of rigid bodies; trusses, frames, and machines; internal forces in structural members; friction; second moments of areas. Prerequisites: MATH 251 or 253 or registration therein; PHYS 218.

311. FLUID DYNAMICS. (3-0). Credit 3. Fluid properties; statics; kinematics; basic conservation principles of continuity, energy and momentum; similitude and hydraulic models; incompressible flow in pipes; fluid dynamic drag. Prerequisites: ENGR 211 or 221. Enrollment in MASE major degree sequence. Junior or senior classification or approval of instructor.

336. FLUID DYNAMICS LABORATORY. (0-2) Credit 1. Introduction to laboratory techniques; calibration principles, reports and fluid measurements; determination of fluid properties; visualization of types of flow; experiments in closed conduit flow of air, water and oil; fluid drag and turbomachinery tests; open channel and gravity wave demonstrations. Prerequisites: CVEN 311 or registration therein. Enrollment in MASE major degree sequence. Junior or senior classification or approval of instructor.

345. THEORY OF STRUCTURES. (3-0). Credit 3. Structural engineering-functions of structure, design loads, reactions and force systems. Analysis of statically determinate structures; including beams, trusses, and arches. Methods of determining deflections of structures. Influence lines and criteria for moving loads. Analysis of indeterminate structures; including continuous beams and frames. Prerequisites: ENGR 211 or 221, MASE 214. Enrollment in MASE major degree sequence. Junior or senior classification or approval of instructor.

365. INTRODUCTION TO GEOTECHNICAL ENGINEERING. (2-2). Credit 3. Physical properties of soils, classification systems, soil exploration, permeability, consolidation, compaction, and shear strength. Laboratory tests conducted to determine the physical and engineering soil properties needed for application in geotechnical engineering design. Prerequisites: ENGR 211 or 221. Enrollment in MASE major degree sequence. Junior or senior classification or approval of instructor.

446. STRUCTURAL STEEL DESIGN. (3-0). Credit 3. Design of structural steel elements found in bridges and building structures, including plate girders, other build-up members, composite beams and slender columns; frame stability, tubular members and connections. Prerequisites: CVEN 345. Enrollment in MASE major degree sequence. Junior or senior classification or approval of instructor.

483. ANALYSIS AND DESIGN OF STRUCTURES. (2-3). Credit 3. Overall procedure of analysis and design; including functions, loads, layouts of force systems; analysis, design drafting, specifications, cost comparisons, and maintenance as applied to typical simple bridge and building structures. Prerequisites: CVEN 344, 346, 365. Enrollment in MASE major degree sequence. Junior or senior classification or approval of instructor.

### **Classics (CLAS)**

371. IN SEARCH OF HOMER AND THE TROJAN WAR. (3-0). Credit 3. The nature, background, authorship, and historically of the Iliad and the Odyssey, Aegean culture in the Stone, Bronze, and early Iron ages; the value of Greek epics as historical documents; oral poetry; the Trojan War in Greek literature, readings in English. Prerequisites: Junior or senior classification or approval of instructor.

### **Communications (COMM)**

203. PUBLIC SPEAKING. (3-0). Credit 3. (TCCNS SPCH 1321). Training in speeches of social and technical interest designed to teach students to develop and illustrate ideas and information and to inform, stimulate, and persuade their audiences.

### **Computer Science (CSCE)**

203. INTRODUCTION TO COMPUTING. (3-0). Credit 3. (TCCNS COSC 1317, 1417) Algorithms, programs and computers; basic programming and program structure; data representation; computer solution of numerical and non-numerical problems using FORTRAN.

285. DIRECTED STUDIES. Credit 1-6. Permits work on special projects in computing science. Project must be approved by MARS department head.

485. DIRECTED STUDIES. Credit 1-6. Permits work on special projects in computing science. Project must be approved by MARS department head. Prerequisite: Senior classification.

### **Developmental Studies (CAEX)**

001. BASIC MATHEMATICAL SKILLS. Credit 0. Developmental instruction in mathematics; includes the integers and rational numbers and applications, exponents, polynomials, solution of equations, graphing, elementary geometry, and reasoning skills. May not be used for credit toward a degree.

002. BASIC WRITING SKILLS. Credit 0. Individualized instruction in English composition based on an analysis of the student's proof-reading, revision, and editing skills; a programmed sequence of study and practice designed for improvement of writing performance through mastery of basic skills at word, sentence, paragraph, and multiparagraph levels. May not be used for credit toward a degree.

003. BASIC READING SKILLS. Credit 0. Individualized instruction in reading based on an analysis of the student's reading comprehension skills; study and practice of reading strategies designed to increase reading comprehension skills. May not be used for credit toward a degree.

### **Economics (ECON)**

202. PRINCIPLES OF ECONOMICS. (3-0). Credit 3. (TCCNS ECON 2302). Elementary principles of economics; the economic problem and the price system; theory of demand, theory of production and the firm, theory of supply; the interaction of demand and supply.

203. PRINCIPLES OF ECONOMICS. (3-0). Credit 3. (TCCNS ECON 2301). Measurement and determination of national income, employment, and price; introduction to monetary and fiscal policy analysis; the effects of government deficits and debt, exchange rates and trade balances. Prerequisite: ECON 202.

311. MONEY AND BANKING. (3-0). Credit 3. Fundamental principles of money, credit, and banking; arbitrage conditions in domestic and international capital markets; theoretical and institutional analysis of money markets. Prerequisite: ECON 203.

322. APPLIED MICROECONOMIC THEORY. (3-0). Credit 3. Use of microeconomic theory in the analysis of problems that would face decision makers, not only in business but also in government, non-profit firms and other institutions. Prerequisite: ECON 202.

323. MICROECONOMIC THEORY. (3-0). Credit 3. Determination of prices and their role in directing consumption, production, and distribution under both competitive and non-competitive market situations. Prerequisites: ECON 202 and MATH 142.

412. PUBLIC FINANCE. (3-0). Credit 3. Economic role of governments; the choice of public sector output in a democracy and the effects of various taxes on resource allocation and income distribution. Prerequisite: ECON 322.

452. INTERNATIONAL TRADE THEORY AND POLICY. (3-0). Credit 3. Basis for trade; theory of comparative advantage; determination of product and factor prices; gains from international trade; commercial policy and its implications for income distribution; concept of effective protection; market distortions, policy generated distortions and the arguments for tariffs. Prerequisite: ECON 322.

485. DIRECTED STUDIES. Credit 1-3. Research and design of specific problem areas approved on an individual basis with the intention of promoting independent study and to supplement existing course offerings. Results of study presented in writing. Prerequisite: Cumulative GPA of 2.5 or higher or approval of MARS department head.

### **Engineering Design Graphics (ENDG)**

105. ENGINEERING GRAPHICS. (0-6). Credit 2. (TCCNS ENGR 1204). Graphical approach to the engineering design process as applied to products; methods of graphical communications, three-dimensional geometry, working drawings, data analysis, computer graphics, introduction to team dynamics, and creative problem solving.

106. ENGINEERING DESIGN GRAPHICS. (0-6). Credit 2. Introduction to engineering design; product development and team dynamics using graphical methods and descriptive geometry. Spatial analysis of geometric elements, vectors, data analysis, and graphical applications to a variety of engineering areas. Prerequisite: ENDG 105.

### **Engineering (ENGR)**

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109. ENGINEERING PROBLEM SOLVING AND COMPUTING. (2-3). Credit 3. Professional ethics, registration, and disciplines in engineering; engineering problem-solving environments (economic, political, technical, social), requirements, and methodologies; FORTRAN programming on PCs, minis and mainframes. Prerequisites: Admission to engineering curriculum and background in trigonometry.

111. FOUNDATIONS OF ENGINEERING I. (1-3). Credit 2. Introduction to the engineering profession, ethics, and disciplines; development of skills in teamwork, problem solving and design. Other topics included, depending on the major, are: emphasis on computer applications and programming, visualization and CAD tools, introduction to electrical circuits, semiconductor devices, digital logic, communications and their applications in systems; Newton's laws, unit conversions, statistics, computers, Excel; basic graphics skills; visualization and orthographic drawings. Co-requisite: MATH 151.

112. FOUNDATIONS OF ENGINEERING II. (1-3). Credit 2. Continuation of ENGR 111. Topics include, depending on the major: emphasis on computer applications and programming and solids modeling using CAD tools or other software; fundamentals of engineering science. advanced graphic skills. Prerequisite: ENGR 111, MATH 151.

211. CONSERVATION PRINCIPLES IN ENGINEERING MECHANICS. (2-2) Credit 3. Conservation principles in engineering and their application to the modeling of mechanical systems and structures; equations of motion for particles and rigid bodies; fundamentals of engineering mechanics. Prerequisites: ENGR 112, MATH 251 or 253 or concurrent registration, PHYS 218.

212. CONSERVATION PRINCIPLES IN THERMAL SCIENCES. (2-2) Credit 3. Theory and application of energy methods in engineering; conservation principles to investigate "traditional" thermodynamics and internal flow fluids. Prerequisites: Upper division status in major; MATH 251 or MATH 253 or concurrent registration; ENGR 211 or concurrent registration.

221. STATICS AND PARTICLE DYNAMICS. (2-2). Credit 3. Application of the fundamental principles of Newtonian mechanics to the statics and dynamics of particles and the equilibrium of trusses, frames, beams and other rigid bodies. Prerequisites: Admission to a major sequence in engineering; ENGR 112 or instructor approval; MATH 251 or 253 or concurrent registration; PHYS 218.

### **English (ENGL)**

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104. COMPOSITION AND RHETORIC. (3-0). Credit 3. (TCCNS ENGL 1301). Focus on referential and persuasive researched essays through the development of analytical reading ability, critical thinking and library research skills.

203. INTRODUCTION TO LITERATURE. (3-0). Credit 3. (TCCNS ENGL 1302). Exploration of literature by genre and/or theme; literary analysis and interpretation; intensive writing about literature. Prerequisite: ENGL 104.

212. SHAKESPEARE. (3-0). Credit 3. Exploration of selected works of Shakespeare. Prerequisite: ENGL 104.

222. WORLD LITERATURE. (3-0). Credit 3. (TCCNS ENGL 2333). Representative works in translation of major authors from A.D. 1500 to present from various cultures, including such authors as Cervantes, Molière, Goethe, Tolstoy, Mahfouz, Munif, Achebe, Tolstaya, Vargas Llosa, and Duras. Prerequisite: ENGL 104.

228. AMERICAN LITERATURE: CIVIL WAR TO PRESENT. (3-0). Credit 3. (TCCNS ENGL 2328). Expressions of the American experience in realism, regionalism and naturalism; varieties of modernist and contemporary writing; the rise of ethnic literature and experimental literary forms; includes such writers as Dickinson, Twain, James, Crane, Frost, Eliot, Fitzgerald, Hemingway, Faulkner, O'Neill, Baldwin, and Rich. Prerequisite: ENGL 104.

236. INTRODUCTION TO CREATIVE WRITING: POETRY. (3-0). Credit 3. (TCCNS ENGL 2308). Initiation into the craft of poetry writing; extensive reading in the genre; peer workshops. Prerequisite: ENGL 104.

251. THE LANGUAGE OF FILM. (2-2). Credit 3. Development of the language of film: major movements, representative works, theory and techniques; lecture/discussion following film screenings. Prerequisite: ENGL 104.

253. INTRODUCTION TO CULTURAL STUDIES AND POPULAR CULTURE. (3-0). Credit 3. An introduction to the history, theories and methods of contemporary cultural studies. The course will explore key concepts in cultural theory to examine specific aspects of popular culture as well as cultural sites and practices so as to expand upon the analytical and critical thinking skills learned in ENGL 104 and 203. Prerequisite: ENGL 104.

285. DIRECTED STUDIES. Credit 1-3. Readings selected for specific need of major or minor in English.

301. TECHNICAL WRITING. (3-0). Credit 3. Advanced writing in technical, scientific, and business fields; reports, proposals, and other papers; correspondence. Prerequisites: ENGL 104. Junior or senior classification or approval of instructor.

330. ARTHURIAN LITERATURE. (3-0) Credit 3. Legend of King Arthur in English and American literature from its Medieval origins to the present. Prerequisites: ENGL 104. Junior or senior classification or approval of instructor.

334. SCIENCE FICTION PAST AND PRESENT. (3-0). Credit 3. Origins and development of the science fiction genre, including such authors as Wells, Lewis, Clarke, Miller, and Le Guin. Prerequisites: ENGL 104. Junior or senior classification or approval of instructor.

335. LITERATURE OF THE SEA. (3-0). Credit 3. Significance of the sea in fictional and factual accounts, such as novels, short stories, poems, and narratives of sailors and seafaring life. Prerequisites: Three credits of literature at 200 level or above. Junior or senior classification or approval of instructor.

338. AMERICAN ETHNIC LITERATURE. (3-0). Credit 3. Multi-ethnic study of American Literature, the writings of Black Americans, American Indians, Mexican-Americans, Jewish Americans, as well as Euro-American ethnic groups. Prerequisite: ENGL 104.

339. AFRICAN-AMERICAN LITERATURE POST 1930. (3-0). Credit 3. Major works of the African-American literary tradition studied in their cultural and historical context, including such authors as Douglass, Du Bois, Hurston, Wright and Morrison. Prerequisite: Three credits of literature at 200-level or above.

374. WOMEN WRITERS. (3-0). Credit 3. History of literature by women in English primarily from the 16th century to the present; emphasis on continuity of ideas and on literary contributions; study of poetry, essays, novels, short stories, with particular attention to characteristic themes and to racial, social, cultural diversity of women writing in English. Prerequisites: ENGL 104. Junior or senior classification or approval of instructor.

415. STUDIES IN A MAJOR AUTHOR. (3-0). Credit 3. Exploration of a major author as a vehicle for emphasizing intensive analysis, scholarship and literary criticism. Prerequisite: Three credits of literature at 300-level or above.

485. DIRECTED STUDIES. Credit 1-3. Readings selected for specific need of major or minor in English. Prerequisite: Junior or senior classification or approval of instructor.

### **Finance (FINC)**

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341. BUSINESS FINANCE. (3-0). Credit 3. Financial practices and financial management of modern business corporations; cash flow, planning, procurement of funds, management of long-term funds and working capital. Prerequisites: ACCT 229. Junior or senior classification.

### **Galveston Study Abroad (GALV)**

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301. TAMUG STUDY ABROAD. (1-18). For students in approved study abroad programs, may be repeated for credit.

### **Geography (GEOG)**

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201. INTRODUCTION TO HUMAN GEOGRAPHY. (3-0). Credit 3. (TCCNS GEOG 1302). A survey of the major systems of man-land relations of the world and their dissimilar developments. The processes of innovation, diffusion, and adaptation stressed with regard to changing relationships between people and their environment.

202. GEOGRAPHY OF THE GLOBAL VILLAGE. (3-0). Credit 3. (TCCNS GEOG 1303). Uses of resources; identification of problems pertaining to poverty, hunger, overpopulation; relations between nations and races, environmental destruction and violence within the major geographic regions of the world.

301. GEOGRAPHY OF THE UNITED STATES. (3-0). Credit 3. Geographic personality (physical and cultural) of the United States. Note: To be used as a humanities elective for any degree program. Prerequisite: Junior or senior classification or approval of instructor.

### **Geology (GEOL)**

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104. PHYSICAL GEOLOGY. (3-3). Credit 4. Earth materials, structures, external and internal characteristics; physical processes at work upon or within the planet. A working knowledge of high school chemistry and mathematics is required.

285. DIRECTED STUDIES. Credit (1-4) each semester. Individually supervised research or advanced study on restricted area not covered in regular courses.

301. MINERAL RESOURCES. (2-3) Credit 3. Origin, geologic relations, geographic distribution, reserves and uses of exhaustible mineral and energy resources. Not available to geology majors. Prerequisite: Junior or senior classification or approval of instructor.

485. DIRECTED STUDIES. Credit (1-4) each semester. Individually supervised research or advanced study on restricted area not covered in regular courses. Prerequisite: Junior or senior classification or approval of instructor.

### **History (HIST)**

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105. HISTORY OF THE UNITED STATES. (3-0). Credit 3. (TCCNS HIST 1301 ). Colonial Heritage; revolution; adoption of Constitution; growth of nationalism and sectionalism; Civil War; reconstruction.

106. HISTORY OF THE UNITED STATES. (3-0). Credit 3. (TCCNS HIST 1302). Since reconstruction; new social and industrial problems; rise of progressivism; U.S. emergence as a world power; World War I; reaction and New Deal; World War II; contemporary America.

226. HISTORY OF TEXAS. (3-0). Credit 3. (TCCNS HIST 2301). History of Texas from Spanish period to present day. Stress placed upon period of Anglo-American settlement, revolution, republic, and development of modern state.

232. HISTORY OF AMERICAN SEA POWER. (3-0). Credit 3. Development of American sea power from the 18th century to the present.

370. CIVIL WAR AND RECONSTRUCTION. (3-0). Credit 3. Survey of background and causes of the war; military, political, economic, and diplomatic aspects of the war; life behind the lines; reconstruction and post-war adjustments, 1861-1877. Prerequisite: Junior or senior classification or approval of instructor.

373. THE GREAT DEPRESSION AND WORLD WAR II. (3-0). Credit 3. The United States, 1929-1945; cultural, social, economic, and political developments in the nation; global diplomacy and military strategy. Prerequisite: Junior or senior classification or approval of instructor.

374. THE UNITED STATES AFTER WORLD WAR II. (3-0). Credit 3. The United States since World War II; political, economic, cultural, and social changes and role as a world leader. Prerequisite: Junior or senior classification or approval of instructor.

405. HISTORY OF THE HOLOCAUST. (3-0). Credit 3. History of the Nazi Holocaust; Third Reich; Jewish ghetto life and concentration camps; role of the military, S.S. and German business; lessons and legacies. Prerequisite: Junior or senior classification or approval of instructor.

485. DIRECTED STUDIES. Credit 1-3. Selected fields of history not covered in depth by other courses. Reports and extensive reading required. Prerequisites: Approval of department head. Junior or senior classification or approval of instructor.

### **Information and Operations Management (INFO)**

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303. STATISTICAL METHODS. (3-0). Credit 3. Collection, tabulation, and presentation of numerical data; sampling, estimation of averages and variation, probability and error, hypothesis testing, and correlation. Prerequisites: MATH 142. Junior or senior classification.

336. DECISION SUPPORT SYSTEMS. (3-0). Credit 3. Application of quantitative decision-making techniques to management decision problems. Planning, analysis, and control of operating systems in organizational settings. Prerequisite: INFO 364 or concurrent registration.

364. OPERATIONS MANAGEMENT. (3-0). Credit 3. Concepts, issues and techniques used to plan, analyze, and control systems of production; operational problems in producing goods and services. Prerequisite: INFO 303 or concurrent registration.

485. DIRECTED STUDIES. Credit 1-4 each semester. Directed study of selected problems in an area of business analysis not covered in other courses. Prerequisites: Cumulative GPA of 2.5 or higher. Approval of instructor and MARA department head.

### **Kinesiology (KINE)**

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198. HEALTH AND FITNESS ACTIVITY. (0-2). Credit 1. Half lecture; half activity; student choice of designated fitness or strength related activities; lecture portion covers current health topics.

199. REQUIRED PHYSICAL ACTIVITY. (0-2). Credit 1. (TCCNS PHED 1151, 1152, 1164, 1251, 1252, 1253, 2155, 2255). Selection from a wide variety of activities designed to increase fitness and/or encourage the pursuit of lifetime activity.

## **Land Development (LDEV)**

671. SUSTAINABLE DEVELOPMENT. (3-0). Credit 3. Sustainability perspectives about values, rights, property and what constitutes an optimum human environment; sustainability principles and case studies emphasizing on-the-ground, incentive-based land development that balances economic growth with environmental quality. Prerequisite: Graduate classification.

## **Management (MGMT)**

105. INTRODUCTION TO BUSINESS. (3-0). Credit 3. (TCCNS BUSI 1301). Survey of economic systems, forms of business ownership and running the small business; organizing and managing businesses; managing human resources; managing production and information; managing marketing; introducing financial issues including accounting, money, and banking, securities markets; business issues and challenges including legal and regulatory environment, business ethics, and international business.

211. LEGAL AND SOCIAL ENVIRONMENT OF BUSINESS. (3-0) Credit 3. (TCCNS BUSI 2302). Role of government in business and society; analysis of social policy and legal institutions; ethical problems in management decisions; administrative law; antitrust law; employment and discrimination law; regulation of business transactions; protection of property rights; regulation of information in markets including securities and product safety; international business law. Prerequisite: Sophomore classification.

481. SEMINAR IN MANAGEMENT. (1-0). Credit 1. Discussions and observation of current management practice in the public and private sectors of the nation. Reading and discussion of current events and changes taking place in management theory and/or its application and practice in actual business and government situations. May be repeated for credit. Prerequisite: MARA 466 or concurrent registration. Senior classification.

## **Marine Biology (MARB)**

101. SUCCEEDING IN SCIENCE. (1-0). Credit 1. An orientation of the biological sciences including the nature of science, functions of scientists, and a better understanding of the fundamentals of science. Students receive hands-on experiences that provide opportunities to work with faculty, graduate and other undergraduate students.

200. INTRODUCTION TO MARINE BIOLOGY: THE SEA WORLD EXPERIENCE. (3-3). Credit 4. Exploration of marine organisms, survey topics in vertebrate marine biology, and introduction to the role that aquatic oriented parks play in education, research and conservation. Students will have hands-on experiences by participating in aspects of maintaining aquatic organisms in captivity including animal care and nutrition, physiology, behavior, animal training and water quality. Exposure to marine organismal taxonomy, natural history, anatomy and ecology. Prerequisites: BIOL 111 with a >C average; GPA >2.0; freshman or sophomore status or instructor permission.

285. DIRECTED STUDIES. Credit 1-6 per semester. Special topics and problems in field and/or laboratory work suited to analysis by individuals or small groups concerning aspects of marine biology. Usually requires a report describing techniques and results. Only 3 credit hours may be used in the degree plan curriculum. Prerequisites: 2.25 GPR, Approval of instructor.

289. SPECIAL TOPICS IN MARINE BIOLOGY. Credit 1-4. Study of selected topics in an identified area of marine biology. Prerequisite: Approval of instructor.

300. SCIENTIFIC METHODS IN MARINE BIOLOGY. (1-3). Credit 2. An introduction to field, laboratory and analytical methods, equipment and instruments. The field portion will include making proper observations, sampling techniques, and data recording. The laboratory portion will include sample analysis methods, use of instruments, introduction to data analysis including elementary statistics, introduction to scientific literature and report writing style. Prerequisites: BIOL 112. Curriculum sophomore, junior or senior classification or approval of instructor.

301. GENETICS. (3-3). Credit 4. Fundamental principles of genetics; physical basis of Mendelian inheritance; expression and interaction of genes, linkage, sex linkage, biochemical nature of genetic material, and mutation. Prerequisites: CHEM 227, 228, 237 and 238. Curriculum junior or senior classification or approval of instructor.

303. BIostatISTICS. (2-2). Credit 3. Introduction to sampling, experimental design, analysis of data, and testing of hypotheses, with emphasis on methods applied to biological investigations. Parametric and non-parametric techniques. Descriptive statistics, analysis of variance, correlation and regression. Prerequisites: MATH 151. Curriculum sophomore, junior or senior classification or approval of instructor.

310. INTRODUCTION TO CELL BIOLOGY. (3-3). Credit 4. Cellular structure/function; procaryotic vs. eucaryotic cells. Examination of cellular membranes and membrane transport. Analysis of DNA replication, transcription, and protein translation (an extension of their treatment in MARB 301). Introduction to the components and genetics of immunology. Cell Biology should precede or be concurrent with enrollment in MARB 450. Prerequisites: BIOL 112, CHEM 228, MARB 301. Junior or senior classification or approval of instructor. MARS 360 is recommended but not required.

311. ICHTHYOLOGY. (3-3). Credit 4. Freshwater and marine fishes. Subject will be mainly systematic, but evolution, ecology, life history, and economics of more important species will be treated. Prerequisites: BIOL 112 and MARB 315. Curriculum sophomore, junior or senior classification or approval of instructor.

312. FIELD ICHTHYOLOGY. (3-3). Credit 4. Field and laboratory studies on identification and ecology of freshwater and marine fishes of Texas. Field trips required. Prerequisites: MARB 311. Curriculum sophomore, junior or senior classification or approval of instructor.

315. NATURAL HISTORY OF VERTEBRATES. (3-3). Credit 4. Natural history of fishes, amphibians, reptiles, birds, and mammals, with emphasis on coastal Texas vertebrates. Prerequisites: BIOL 112. Curriculum sophomore, junior or senior classification or approval of instructor.

320. FISHERIES TECHNIQUES. (3-3). Credit 4. An introduction to theory and techniques in fisheries biology and ecology. Experience with fisheries equipment and techniques will be provided in both field and laboratory. Practical sampling design, collection, and interpretation of data from estuarine, coastal and offshore environments will be addressed. Prerequisites: BIOL 112, MARB 311. Junior or senior classification or approval of instructor.

325. BIOSPELEOLOGY. (3-3). Credit 4. A field-oriented introduction to the biology of aquatic and terrestrial cave organisms with discussions on the origin of caves, cave environment, cave fauna, and evolution. Field trips required. Prerequisites: BIOL 112, CHEM 101. Junior or senior classification or approval of instructor.

330. PHYSIOLOGICAL ECOLOGY. (3-0). Credit 3. Examination of how ecological pressures dictate individual and interorganismal physiological processes that lead to individual and community adaptation. Discussion of the physiological interrelationships between members of an ecological community. Attention will be directed toward physiological systems of plants and animals. Prerequisites: BIOL 112. Junior or senior classification or approval of instructor.

334. **BIOLOGY OF SEA TURTLES.** (3-3). Credit 4. Living sea turtles of the world, with emphasis on species in the Atlantic, Gulf and Caribbean basins. Emphasis includes phylogeny, population biology, ecology, life history, behavior, social and economic aspects and their impact on sea turtle conservation and recovery. Prerequisites: BIOL 112, MARB 315 or instructor approval.

335. **FISH PHYSIOLOGY.** (3-0). Credit 3. Study of the basic physiology of fishes. Examination of fish cardiovascular, renal, digestive, locomotor, reproductive, and central/peripheral nervous systems. Discussion of physiological adaptations enhancing survival in a water medium. Prerequisites: BIOL 112. Junior or senior classification or approval of instructor.

340. **TROPICAL MARINE ECOLOGY.** (1-9). Credit 4. This course provides for field-oriented experience in coral reef, mangrove, sea grass and other tropical marine ecosystems. Special emphasis will be placed on biodiversity, ecology and conservation issues specific to Yucatan Peninsula of Mexico. Prerequisites: BIOL 112. All students who dive must either be a current AAUS scientific diver or present a current medical examination (which will be provided by the Diving Safety Officer or instructor) completed within the past 12 months and signed by a doctor, to the instructor before class participation in the pool will be allowed. Prior to using scuba equipment, all students must provide proof of open water certification or equivalent diving experience (advanced certification recommended). Permission of the instructor and the Diving Safety Officer is required before any pool activity takes place. Divers Alert Network insurance, or equivalent, is required.

345. **INTRODUCTION TO SCIENTIFIC DIVING.** (3-3). Credit 4. Prepare and qualify divers for entry into the TAMUG Scientific Diving Program. Students must pass medical, swimming, skin diving and scuba diving tests. Lectures include diving equipment, physics, physiology, medicine, regulations, environment, emergency and decompression procedures. Prerequisites: BIOL 111, PHYS 201, advanced scuba certification. Junior or senior classification or approval of instructor. All students must present a current medical examination (which will be provided by the Diving Safety Officer or instructor) completed within the past 12 months, to the instructor before class participation in the pool will be allowed. Prior to using scuba equipment, all students must provide proof of basic certification. Permission of the instructor and the Diving Safety Officer is required before any pool activity takes place. Divers Alert Network insurance, or equivalent, is required.

350. **METHODS IN RESEARCH DIVING.** (2-6). Credit 4. Survey of research methods and techniques using diving. Lecture and lab designed to train students in safe, efficient use of diving to collect and record data underwater for studies primarily in biology, geology, and archaeology. Prerequisites: MARB 345. Junior or senior classification or approval of instructor. All students must present a completed medical examination (Appendices 1-4 in the TAMUG diving manual) signed by a doctor, to the instructor before class participation in the pool will be allowed. Prior to using scuba equipment, all students must provide proof of advanced open water certification or equivalent diving experience. Permission of the instructor and the Diving Safety Officer is required before any pool activity takes place. Divers Alert Network insurance, or equivalent, is required.

360. **MARINE CONSERVATION BIOLOGY.** (3-3). Credit 4. Lectures and laboratories cover the major principles of conservation biology; a new synthetic field that applies concepts of ecology, systematics and evolution, biogeology, genetics, behavioral sciences, and social sciences to the conservation of marine fisheries resources. Lab exercises include morphometric and genetic variation, GIS, molecular systematics and phylogenetic inference. Prerequisite: Junior or senior classification or approval of instructor.

400. **BIOLOGY OF MARINE MAMMALS.** (3-3). Credit 4. A broad-spectrum course on the taxonomy, evolution, morphology behavior, and ecology of marine mammals, including sirenians, carnivores, baleen and toothed whales and dolphins. Prerequisite: BIOL 112, MARB 315. Junior or senior classification or approval of instructor.

401. **PHYSIOLOGICAL ECOLOGY OF MARINE MAMMALS.** (3-0). Credit 3. Anatomy, taxonomy, phylogeny and physiological adaptations of marine mammals. Prerequisites: BIOL 112, and MARB 315. Junior or senior classification or approval of instructor.

402. **GENERAL MAMMALOGY.** (2-3) Credit 3. Mammalian biology; evolution, classification, biogeography, reproduction, physiology, ecology, and behavior; focuses on basic concepts necessary for a foundation in both wildlife science and biology. Prerequisites: MARB 315. Junior or senior classification or approval of instructor.

403. **CETACEAN BEHAVIOR AND BEHAVIORAL ECOLOGY.** (3-3). Credit 4. This course consists of lecture of up to date descriptions of Cetacean behavior and ecology; and of labs that evaluate the literature of topics of present relevance. Prerequisite: MARB 315. Junior or senior classification or approval of instructor.

405. **MARINE PARASITOLOGY.** (3-3). Credit 4. Fundamentals of parasitology, with emphasis on marine applications. Survey of major parasites of marine animals and the diseases they cause, especially in ecologically and commercially-important host species. Prerequisites: BIOL 112. Junior or senior classification or approval of instructor.

408. **MARINE BOTANY.** (3-3). Credit 4. Morphology, systematics, ecology, and biochemistry of representative algae, fungi, and submarine grasses. Prerequisites: BIOL 112. Curriculum sophomore, junior or senior classification or approval of instructor.

410. **ANIMAL BEHAVIOR.** (2-3). Credit 3. Examination of ethological concepts. Discussion of the development, genetics, physiology, and evolution of animal behavior patterns involved in reproduction, territoriality, aggression, communication, population dispersion, sociality, and sociobiology of invertebrates and vertebrates. Prerequisites: BIOL 112. Curriculum sophomore, junior or senior classification or approval of instructor.

412. **SOCIOBIOLOGY OF REPRODUCTION.** (3-0). Credit 3. Application of sociobiological concepts to examine the evolution and adaptive significance of reproductive strategies utilized by marine and terrestrial animals. Strategy-influencing factors to be discussed include: mate selection and competition, sex roles, bonding, parental investment in offspring, and socialization. Prerequisites: BIOL 112, MARB 301 or equivalent, or concurrent registration. Curriculum sophomore, junior or senior classification or approval of instructor.

414. **TOXICOLOGY** (3-0). Credit 3. This course presents the history and scope of toxicology as it applies to mammals. Where possible, marine species will be used for examples and assigned papers. Prerequisites: BIOL 112, CHEM 227, CHEM 228.

415. **COASTAL MARINE BIOLOGY AND GEOLOGY OF ALASKA.** (3-0). Credit 3. This field course will be conducted in south-central Alaska for two weeks. Students will work at the remote Alice Cove Research Station, located in Prince William Sound. They will conduct research on marine mammals behavior and ecology, and time will be spent exploring the geology and glaciology. Prerequisites: BIOL 112.

420. **COMPARATIVE ANIMAL PHYSIOLOGY.** (3-3). Credit 4. Principles of animal physiology are examined using invertebrate and vertebrate model systems. Topics include osmoregulation in marine vs. freshwater vs. terrestrial organisms, excretion, fluid circulation, nervous system structure and function, muscle activity, sensory neurobiology, and endocrine mediation. Prerequisites: BIOL 112, CHEM 228, MARB 310. Junior or senior classification or approval of instructor. MARS 360 is recommended but not required.

423. **MARICULTURE.** (3-3). Credit 4. Study of factors determining the success of efforts to cultivate estuarine and marine species of economic importance. Mariculture practices used worldwide in the production of algae, mollusks, crustaceans, and fishes will be discussed. Prerequisite: Junior or senior classification or approval of instructor.

425. MARINE ECOLOGY. (3-3). Credit 4. Relationship between various marine environments and their inhabitants; intra- and interspecific relationships between organisms; structure and function among marine communities. Laboratory emphasis is placed on study of living material and natural habitats in the Gulf of Mexico. Prerequisites: MARB 315, 408, 435; curriculum senior or approval of instructor.
426. AQUATIC ANIMAL NUTRITION. (3-0). Credit 3. Chemistry, digestion, absorption and intermediary metabolism of nutrient classes with special emphasis on their relationship to warmwater fish nutrition. Determination of nutrient requirements, feed evaluation, feed processing, ration formulation and feeding practices. Prerequisites: CHEM 227. Junior or senior classification or approval of instructor.
430. COASTAL PLANT ECOLOGY. (3-3). Credit 4. Study of the identification, distribution, production, and ecological importance of estuarine, coastal marsh, and dune vascular plants; the interaction of plants with their abiotic and biotic environments; and techniques of vegetation management and evaluation. Prerequisites: BIOL 112. Junior or senior classification or approval of instructor.
431. WETLANDS ECOLOGY, MONITORING, AND DELINEATION. (2-6). Credit 4. Study of the characteristics and importance of wetlands and methods for delineating, monitoring, and evaluating wetlands. Students will become knowledgeable in wetland soils, plants, ecological interactions of wetlands and other habitats and animals, and the laws pertaining to obtaining permits and managing wetlands of the U.S. Prerequisites: BIOL 111 and 112. Junior or senior classification or approval of instructor.
432. GIS USE IN COASTAL RESOURCES. (2-3). Credit 3. Basic concepts of design, planning, and integration of Geographical Information Systems in management of biological systems in coastal environments. Students are taught to input data into GIS, organize the data, and analyze, query, and manage data sets. Prerequisite: Junior or senior classification or approval of instructor.
435. MARINE INVERTEBRATE ZOOLOGY. (3-3). Credit 4. General biology of marine invertebrate animals; morphology, evolution, and systematics. Laboratory will stress studies of local fauna. Prerequisites: BIOL 112. Junior or senior classification or approval of instructor.
436. NON-VERTEBRATE FISHERIES. (3-3). Credit 4. A survey of the history and importance of harvesting commercially important algae and invertebrates, with an assessment of the current status, problems and prospects for each fishery. Identification, distribution and biology of commercially important species will also be addressed. Prerequisites: BIOL 112. Junior or senior classification or approval of instructor.
437. PATHOLOGY OF MARINE ANIMALS. (3-3). Credit 4. An introduction to the structural and functional changes in cells, tissues and organ systems of marine invertebrates and vertebrates as they relate to disease and/or injury. Mechanisms of disease and identification of lesions in common diseases and human-induced injuries will be included. Laboratory will consist of gross and microscopic aspects of pathology in both invertebrate and vertebrate animals. Prerequisites: MARB 315, 435, MICR 351. Junior or senior classification or approval of instructor.
438. COASTAL ORNITHOLOGY. (2-3). Credit 3. Field and laboratory studies on the identification, classification, distribution and ecology of birds with special emphasis on birds of the Texas Gulf Coast. Classroom lectures to include anatomy, physiology, behavior and migration. Field trips required. Prerequisites: MARB 315. Junior or senior classification or approval of instructor.
445. MARINE FISHERIES MANAGEMENT. (3-3). Credit 4. Basic knowledge from marine ichthyology, biology of fishes and biological oceanography related to applied aspects of marine fisheries sciences. Emphasis placed on management techniques applicable to tidal-influenced inland water, estuaries, and oceans. Prerequisite: Junior or senior classification or approval of instructor.
454. ORNAMENTAL FISH HEALTH MANAGEMENT. (3-0). Credit 3. Maintenance and health care of ornamental fish in closed recirculating systems; aquariology, anatomy and physiology, nutrition, immunology, infectious and noninfectious diseases, checklists, quarantine procedures and health maintenance of ornamental fish. Prerequisites: MICR 351 and MARS 360. Junior or senior classification or approval of instructor.
460. FISHERIES POPULATION DYNAMICS. (3-3). Credit 4. An introduction to the behavior of populations. Classical and recent population theories will be discussed in lecture. In lab, extant and programs written by students will be used to explore population behavior and interactions. Prerequisites: MATH 151. Senior classification or approval of instructor.
466. EVOLUTIONARY BIOLOGY. (3-0). Credit 3. A conceptual examination of evolutionary theory, not a survey of specific organismal evolutions. Evidence for the abiotic origin of life is presented, followed by a discussion of micro-evolutionary (including drift and natural selection) and macro-evolutionary (including evolutionary trends) mechanisms. The course concludes with application of these concepts to human evolution. Prerequisites: BIOL 112. Junior or senior classification or approval of instructor. MARB 301 is recommended but not required.
482. SEMINAR IN MARINE BIOLOGY. (1-0). Credit 1. Compilation of literature pertaining to topics in marine biology. Emphasis placed on preparation of a written report and presentation of a synopsis of that report. Prerequisite: Junior or senior classification or approval of instructor.
484. UNDERGRADUATE INTERNSHIP. Credit 1-9. Supervised study in a research or teaching laboratory remote from TAMUG. Student involvement is to consist of real-life learning or marine biological research, teaching, management, or a combination of these. Prerequisite: Junior or senior classification or approval of instructor.
485. DIRECTED STUDIES. Credit 1-6 per semester. Special topics and problems in field and/or laboratory work suited to analysis by individuals or small groups concerning aspects of marine biology. Usually requires a report describing techniques and results. Only 3 credit hours may be used in the degree plan curriculum. Prerequisites: 2.25 GPR. Curriculum sophomore, junior or senior classification or approval of instructor.
489. SPECIAL TOPICS IN MARINE BIOLOGY. Credit 1-4. Study of selected topics in an identified area of marine biology. Prerequisite: Junior or senior classification or approval of instructor.
491. RESEARCH IN MARINE BIOLOGY. Credit 1 to 4. Research conducted under the direction of faculty member in Marine Biology. May be repeated 2 times for credit. Please see academic advisor in department. Registration in multiple sections of this course is possible within a given semester provided that the per semester credit hour limit is not exceeded. Prerequisites: Junior or senior classification and approval of instructor.
603. CETACEAN BEHAVIOR AND BEHAVIORAL ECOLOGY. (3-3). Credit 4. Consists of lectures, readings and discussion sessions on the social, calf rearing, foraging and migrating strategies of whales, dolphins and porpoises. Emphasis is on the recent literature of animals in nature, although results from aquaria are also presented with comparisons to social strategies in the wild. Prerequisite: Undergraduate or graduate level vertebrate biology course.
606. ADVANCED CONCEPTS IN MARINE POPULATION BIOLOGY. (3-0). Credit 3. Novel Approaches and concepts employed studying factors affecting recruitment, determining trophic relationships (e.g., stable isotopes), and the consequences, at various levels, of changes in abundance of marine populations, including ecological (community), population (Allee effects) and genetic (effective population size). Inference of population connectivity determined through the use of electronic tags and molecular techniques is also examined. Prerequisite: B.S. Marine Biology or Marine Science or approval of instructor



616. INTRODUCTION TO METHODS IN SCIENTIFIC DIVING. (2-3). Credit 3. This course prepares students to use SCUBA as a research tool for the marine sciences in compliance with University, American Academy of Underwater Sciences and Federal OSHA standards. Practical work in pool and open waters will complement academic experience and provide training towards scientific diver status. Prerequisite: Advanced scuba certification.

617. RESEARCH DIVING METHODS. (0-6). Credit 2. Field experience in a wide range of research diving environments stressing dive planning and safety, buoyancy control, equipment configuration and scientific methodology in biological, physical, chemical, archaeological and geological sciences. Students will design, supervise and conduct independently developed scientific diving projects. Prerequisite: MARB 616 or equivalent.

620. MARINE BIOLOGICAL RESOURCES. (3-0). Credit 3. An introduction to biological resources which can be recovered from the marine environment to provide food, biomass and materials, recreation, and employment to the coastal United States and other regions. With emphasis on fisheries and hatcheries, in: oceanic resources, coastal and estuarine resources, and mariculture. Natural and societal limitations to resource recovery are investigated, and environmental impacts are analyzed. Prerequisites: (at least 3 of these) CHEM 102, BIOL 112, GEOL 104 and/or OCNG 251; graduate status or special approval.

651. SHORE AND ESTUARINE FISHES OF THE GULF OF MEXICO. (2-6) Credit 4. Taxonomy, ecology and zoogeography of fishes inhabiting estuarine and marine ecosystems of the northwestern Gulf of Mexico. Particular emphasis on community structure and factors affecting spatial and temporal abundance of fishes found along the Texas coast. Prerequisites: MARB 311 or equivalent; approval of instructor.

654. COASTAL PLANT ECOLOGY. (3-3). Credit 4. Study of estuarine, coastal and dune plant communities and associated environmental factors affecting plants including the identification, distribution, ecological importance and management techniques of vascular plants in these communities. Prerequisites: Graduate standing; permission of instructor.

655. WETLANDS ECOLOGY, MONITORING AND DELINEATION. (2-3). Credit 4. Study of the characteristics and importance of wetlands, and methods of delineating, monitoring and evaluating wetlands. Students will learn wetland plants, soils, hydrology, ecology, inhabiting animals, delineation techniques, laws, permits required for impacts, mitigation and management techniques. Prerequisite: Graduate standing.

656. TROPICAL MARINE ECOLOGY. (1-6). Credit 3. Field oriented experience in coral reef, mangrove, sea grass, cave and other tropical marine ecosystems. Special emphasis will be placed on biodiversity, ecology and conservation issues specific to the Yucatan Peninsula of Mexico. This course will involve one week of course work in Galveston and a two-week field trip to Akumal on the Caribbean coast of Yucatan. Students will design, supervise and conduct an independently developed research project. Prerequisite: Scuba Certification.

662. BIOLOGY OF THE MOLLUSCA. (3-3). Credit 3. Survey of mollusks including their morphology, ecology, physiology and reproduction. Emphasis on marine species of ecological and commercial importance. Prerequisite: MARB 435 or MARB 665 or equivalent.

665. BIOLOGY OF INVERTEBRATES. (3-3). Credit 4. Morphology, biology and phylogeny of invertebrates. Topics may be either detailed discussions/dissections of specific organisms or comparative information on a process. Prerequisites: MARM 435 or ZOOL 335 or equivalent; approval of instructor.

667. BIOLOGY OF MARINE ANNELIDA. (3-3). Credit 4. Survey of Marine Annelids including their behavior, organ systems physiology and reproduction. Emphasis on morphology and taxonomy of polychaetous annelids to enable students to move more rapidly and accurately analyze benthic assemblage data. Prerequisites: MARM 435 or ZOOL 335 or equivalent; approval of instructor.

668. MARINE EVOLUTIONARY BIOLOGY. (3-0). Credit 3. Lecture, readings and discussions on advanced evolutionary topics including: history of evolutionary thought, organic evolution, evolutionary methods and modern applications to organismal evolutionary questions. Students will lead and participate in journal club style discussion of selected recent literature. Prerequisite: Graduate standing.

681. SEMINAR IN MARINE BIOLOGY. (1-0). Credit 1. Detailed reports on specific topics within the field of marine biology. Students may register in no more than two sections of this course in a given semester. Prerequisite: Graduate Standing.

684. PROFESSIONAL INTERNSHIP. Credit 1-9. On the job training in the field of marine biology. Prerequisites: Graduate standing; approval of instructor.

685. DIRECTED STUDIES. Credit 1-6. Limited investigations in fields other than those chosen for the thesis or dissertation topic. May be repeated for credit. Prerequisites: Graduate standing; approval of instructor.

689 SPECIAL TOPICS IN. Credit 1-3. Selected topics in an identified area of marine biology. Prerequisites: Graduate standing; approval of instructor.

691 RESEARCH FOR THESIS OR DISSERTATION. Credit 1-9. MARB 691 is the designated field and/or laboratory research leading to the M.S. or Ph.D. degree. MARB 691 may be offered by any faculty member in MARB and may be offered as many times as necessary in a given semester. MARB 691 may be repeated for credit by a student. Prerequisites: Graduate standing; approval of instructor.

### **Marine Engineering Technology (MARE)**

100. MARINE ENGINEERING FUNDAMENTALS. (2-3). Credit 3. A study of basic marine engineering systems, with emphasis on propulsion plants. Introduction to propulsion plant machinery, watchstanding organization and duties, shipboard safety practices and equipment.

102. INTRODUCTION TO MECHATRONICS. (0-6). Credit 2. Use of word processing, spreadsheet, CAD, and data acquisition. Engineering ethics. Presentation of engineering data. The design process; generation of ideas, analysis of alternatives, prototype construction, testing and presentation. Writing proposals and progress report. VI construction applied to marine engineering field. Voltage, current, power. Prerequisites: ENDG 105, MARE 100.

180. BASIC MACHINE SHOP TECHNIQUES. (0-3). Credit 1. Safety, care of machines and hand-tools, cutting speeds and feeds, measuring instruments, gauging, standard machine tool work in metals, layouts, drilling, tapping, threading, vertical and horizontal milling and shaving.

200. BASIC OPERATIONS. Credit 4. Practical application of student's classroom studies while at sea on training ship during sea-training period. Student required to complete several projects relating to engineering plant of ship. Prerequisite: NAUT 104.

203. DIESEL ENGINE TECHNOLOGY. (2-3). Credit 3. Basic principles of two- and four-stroke diesel engines; intake, scavenging and exhaust systems, injection systems; starting and reversing methods; cooling and lubricating systems; engine room layout in modern motor vessels.

205. ENGINEERING MECHANICS I. (3-0). Credit 3. Statics, basic vector operations, mechanics of particles and rigid bodies. Center of gravity, analysis of structures, friction, moments of inertia. Prerequisites: MATH 151, PHYS 218.

206. ENGINEERING MECHANICS II. (3-0). Credit 3. Dynamics; scalar and vector solutions of relative linear velocities and acceleration; kinetics; dynamics of translation and rotation; work; energy; impact; momentum. Prerequisite: MARE 205.
207. ELECTRICAL POWER I. (2-3). Credit 3. Application of circuit analysis principles to DC and AC circuits having sources and passive inductors, resistors and capacitors; electrical instrumentation; power and voltage/current phase relationships in AC circuits; balanced three-phase AC power circuits; cable sizing. Prerequisites: MATH 151 and PHYS 208.
209. MECHANICS OF MATERIALS. (2-3). Credit 3. Introduction to the study of stresses, strains, and deformation of a solid body which results when static forces are applied. Transformation of stresses and strains, torsion, beam deflection, and combined loadings are discussed. Prerequisite: MARE 205.
242. MANUFACTURING METHODS I. (0-3). Credit 1. Introduction to manufacturing methods used in marine industries emphasizing fabrication techniques including oxy-acetylene cutting and welding, brazing, arc welding, pipe welding and sheet metal fabrication. Laboratory exercises will develop the knowledge and skills needed to perform fabrication operations, routine maintenance and emergency repairs of marine engineering structures and systems.
243. MANUFACTURING METHODS II. (1-3). Credit 2. Continued introduction to manufacturing methods used in marine industries including machine, foundry and forge work and other manufacturing technologies. Laboratory emphasizes machine shop practices including safety, use and care of machine and hand tools; measuring instruments, layout, gauging, cutting speeds and feeds, drilling, tapping, threading, turning and milling. Prerequisite: Approval of Instructor.
261. ENGINEERING ANALYSIS. (3-0). Credit 3. Review of mathematical concepts previously studied (e.g., complex quantities, vectors and calculus), coupled with study of advanced concepts (e.g., differential equations, Laplace Transforms, statistics and numerical methods) with a view to emphasize applications in nuclear engineering, electrical engineering, thermodynamics, heat transfer and turbine theory. Prerequisite: MATH 152 or 161.
280. WELDING TECHNIQUES. (0-3). Credit 1. To introduce students to the materials, equipment and techniques of welding and brazing and to develop skills required by the marine engineer for this work in the engine room of commercial ships.
285. DIRECTED STUDIES. Credit 1-3 each semester. Special problems in marine engineering technology not covered by any other course in the curriculum. Work may be in either theory or laboratory. Prerequisite: Approval of department head.
289. SPECIAL TOPICS. Credit 1-4 each semester. Selected topics in an identified area of marine engineering technology. May be repeated for credit. Prerequisite: Approval of instructor.
295. ELECTROMECHANICAL SYSTEMS FOR MARINE TECHNOLOGISTS. (3-0). Credit 3. Practical solutions of physical models of electromechanical systems; steady state and transient response of linear electrical and mechanical systems; elements of periodic and random excitations and techniques for practical solutions; computer modeling of elementary continuous systems. Prerequisites: MATH 152 and PHYS 218; PHYS 208 or concurrent registration.
300. INTERMEDIATE OPERATIONS. Credit 4. Training program for second sea-training period. Sea project required of each student under supervision of officer-instructors. Lifeboat and safety training. Prerequisite: Junior or senior classification or approval of instructor.
303. MARINE THERMODYNAMICS. (3-0). Credit 3. Energy concepts. First and second law of thermodynamics. Carnot and Rankine principles and reversible heat cycles. Properties and processes of vapors, vapor-power cycles, and vapor refrigeration cycles. Prerequisites: MATH 161. Junior or senior classification or approval of instructor.
304. MARINE THERMODYNAMICS AND HEAT TRANSFER. (3-2). Credit 4. Advanced topics in gas dynamics: flow through nozzles and through compressor and turbine blades, compressible duct flow with friction. Study of gas mixtures and chemical combustion. Thermodynamics of propulsion systems, elements of heat transfer and heat exchanger analysis. Prerequisites: MASE 303. Junior or senior classification or approval of instructor.
305. FLUID MECHANICS THEORY. (3-3). Credit 4. Theory of incompressible and compressible fluid flow, introduction to fluid power systems and controls, and dynamics of turbomachinery. Mathematical analysis of piping systems to determine pump head, system resistance, and pipe sizing optimization. Topics include physical properties of fluids, continuity equation, Bernoulli's Equation, Darcy's Equation, series and parallel flow, relative roughness, friction factors, dimensional analysis, and laws of similitude. Prerequisite: Junior or senior classification or approval of instructor.
306. ELECTRICAL POWER II. (2-3). Credit 3. Electrical power generation and distribution; AC and DC rotating machinery; transformers; controllers and safety devices; operation, maintenance and repair procedures and practices; static converters AC/DC and DC/AC that are used in modern electric propulsion systems. Prerequisite: MARE 207.
307. MARINE ELECTRONICS. (2-3). Credit 3. Introduction to the theory of electronic circuits. Fundamentals and basic concepts of semi-conductors; solid-state components; power supplies; amplifiers; inverters; rectifiers; oscillators; digital and analog integrated circuits. Application in automation, motor controllers, battery-charging systems, communications; and propulsion plant monitoring systems. Prerequisite: MARE 207.
309. MARINE CONSTRUCTION MATERIALS. (2-3). Credit 3. Introduction to materials science and engineering, structural, property relationships; advanced manufacturing techniques from the point of view of marine applications such as subsea pipelines, ship hulls, etc.; corrosion and biofouling. Laboratory includes experimental testing of materials properties, materials syntheses and heat treatment techniques. Prerequisite: MARE 209.
311. STEAM PROPULSION PLANTS. (2-3). Credit 3. Comprehensive study of fossil fuel steam generators, propulsion turbines and condensers, reduction gears, line shafting. Studies include internal fittings and fluid flow paths, automatic controls; regulatory requirements for safety device settings, and system tests and inspections. Additional topics include boiler water-feed water test and treatment, and turbine/reduction gear lubrication. Laboratory includes computer-aided heat balance and parametric analysis of plant performance. Prerequisites: MARE 303. Sophomore, junior or senior classification or approval of instructor.
312. DIESEL PROPULSION PLANTS. (2-3). Credit 3. Comprehensive study of diesel propulsion plants, including direct-drive low speed diesels, geared medium speed diesels, waste heat recovery systems, engine reversing methods, and heavy fuel processing. Laboratory includes computer-aided parametric analysis of engine performance and use of a low-speed diesel propulsion plant simulator. Prerequisites: MARE 305, 313. Junior or senior classification or approval of instructor.
313. HEAT TRANSFER. (2-3). Credit 3. Introduction to heat transfer; basic heat transfer modes and different solution techniques; introduction to 1-D and 2-D heat conduction in transient and steady state conditions; fundamentals of convection heat transfer under different flow

conditions; forced convection in internal and external flows; analysis and selection of heat exchangers; introduction to thermal radiation heat transfer. Prerequisites: MARE 261 and MARE 305 or concurrent enrollment.

395. ELECTROMECHANICAL SYSTEMS FOR TECHNOLOGISTS. (3-0). Credit 3. Practical solutions of physical models of electro-mechanical systems; steady state and transient response of linear electrical and mechanical systems; elements of periodic and random excitations and techniques for practical solutions; computer modeling of elementary continuous systems. Prerequisites: MATH 152, PHYS 218, 219 or 208. Junior or senior classification or approval of instructor.

400. ADVANCED OPERATIONS. Credit 4. Training program for third sea-training period. At the end of this period each student will have achieved the knowledge and will have demonstrated the ability to take complete charge of a modern marine power plant while underway at sea. Prerequisite: Junior or senior classification or approval of instructor.

401. MARINE AUXILIARY SYSTEMS. (2-3). Credit 3. Study of the principal shipboard auxiliary systems, including: auxiliary fired-boilers, sea water service, ballast, freshwater service, lubricating oil, fuel oil storage and transfer, distilling, and steering systems. Major components, operation and maintenance, and interrelationship with other auxiliary systems are covered. Additional topics include steam turbine, gas turbine, and diesel-driven electric power generators and support systems, as well as propulsion train power take-off type electric power generation systems. Prerequisites: MARE 305, 313. Junior or senior classification or approval of instructor.

402. SHIPBOARD AUTOMATION AND CONTROL. (3-0). Credit 3. Study of automation in marine power plants; including electronic and pneumatic proportional, integral and derivative control elements; applications in boiler combustion and water level control; engine speed control; remote sensing and performance monitoring systems. Prerequisites: MARE 307, 311, 312. Junior or senior classification or approval of instructor.

403. MARINE TECHNOLOGY AND THE ENVIRONMENT. (3-0). Credit 3. Study of environmental protection requirements such as the Oil Pollution Act of 1990, Code of Federal Regulations, and international agreements and conventions addressing prevention of pollution of the seas by oil and sewage. In addition, atmospheric pollution from propulsion plant exhaust gas is addressed. Ships' structure and systems, operational requirements, and licensed-officer liabilities are discussed. Prerequisite: Junior or senior classification or approval of instructor.

404. MARINE AIR CONDITIONING & REFRIGERATION. (3-0). Credit 3. Study of refrigeration processes, refrigerants, psychometrics, air conditioning and refrigeration systems, and operation and maintenance of AC&R systems. Prerequisites: MARE 313. Junior or senior classification or approval of instructor.

405. FUNDAMENTALS OF NAVAL ARCHITECTURE. (2-3). Credit 3. Ship geometry and arrangement; ship-form calculations; intact and damaged stability; ships' structure; fundamentals of resistance and propulsion; ship motion, maneuverability, and control; introduction to ship design, construction, and overhaul. Prerequisites: Junior or senior classification or approval of instructor.

406. MARINE ENGINEERING TECHNOLOGY PROJECTS. (3-0). Credit 3. Team approach to analysis and design of basic marine industry-level projects, in particular marine propulsion plants including efficiency enhancement for conventional steam and diesel plants, regenerative and steam injected gas turbine propulsion plants, and combined cycle plants. Additional topics include transmission and drive systems, and propulsors; integration of concepts learned in previous required courses; capstone learning experience. Prerequisites: MARE 311, 312, and MARE 401. Junior or senior classification or approval of instructor.

441. ENGINEERING ECONOMICS AND PROJECT MANAGEMENT. (3-0). Credit 3. Analysis of engineering economics and management, using costs and benefits of various engineering options. Topics include time value of money, cash flows, analysis techniques, interest rates, inflation, depreciation, optimization, statistics, network analysis and critical path programming. Prerequisite: Junior or senior classification or advisor approval.

451. SENIOR DESIGN PROJECT I. (1-3). Credit 2. Introduction to design, modeling, testing and validation processes. Design of equipment, components or systems for marine and related power generation applications. Complete design process including: definition of the problem, research for existing designs and related technologies, conceptualization and evaluation of alternatives, development of preliminary design, refining and generation of final design and documents. Prerequisites: Senior classification and approval of instructor.

452. SENIOR DESIGN PROJECT II. (1-3). Credit 2. This course is a continuation of MARE 451. Development of theoretical, computational or experimental models using the design developed in MARE 451. Formulation, construction and/or fabrication work. Refining, experimenting and testing of models considering alternatives. Analyzing results and preparing and submitting design documents including a project report. Prerequisite: MARE 451.

484. UNDERGRADUATE INTERNSHIP. Credit 1-6. Supervised study with an approved power generator, either electrical, mechanical, or thermal power. Alternatively, studies can be with a research, manufacturing or repair facility whose primary mission is to support power generation. Prerequisites: 2.5 GPR and completion of 300 level courses.

485. DIRECTED STUDIES. Credit 1-3 each semester. Special problems in marine engineering technology not covered by any other course in the curriculum. Work may be in either theory or laboratory. Prerequisites: Approval of department head. Junior or senior classification or approval of instructor.

489. SPECIAL TOPICS. Credit 1-4 each semester. Selected topics in an identified area of marine engineering technology. May be repeated for credit. Prerequisites: Junior or senior classification or approval of instructor.

491. RESEARCH IN MARINE ENGINEERING TECHNOLOGY. Credit 1 to 4. Research conducted under the direction of faculty member in Marine Engineering Technology. May be repeated 2 times for credit. Please see academic advisor in department. Registration in multiple sections of this course is possible within a given semester provided that the per semester credit hour limit is not exceeded. Prerequisites: Junior or senior classification and approval of instructor.

### **Marine Engineering (MARR)**

200. BASIC OPERATIONS. (6-0). Credit 6. Practical application of student's classroom studies while at sea on training ship during sea-training period. Student required to complete several projects relating to engineering plant of ship. Prerequisite: MART 103.

300. INTERMEDIATE OPERATIONS. (6-0). Credit 6. Training program for second sea-training period. Sea project required of each student under supervision of officer-instructors. Lifeboat and safety training. Prerequisite: Junior or senior classification or approval of instructor.

400. ADVANCED OPERATIONS. (6-0). Credit 6. Training program for third sea-training period. At the end of this period each student will have achieved the knowledge and will have demonstrated the ability to take complete charge of a modern marine power plant while underway at sea. Prerequisite: Junior or senior classification or approval of instructor.

## **Marine Sciences (MARS)**

101. INTRODUCTION TO MARINE SCIENCES. (1-0). Credit 1. A non-technical introduction to the field of marine sciences, including biology, ocean activities, and marine industries. Course includes lectures, seminars, outside speakers, and industrial contacts.
210. MARINE GEOGRAPHY. (3-0). Credit 3. Introduction to the physical and cultural patterns of the coastal zones of the world. Interrelationships between the physical forms and processes and the cultural patterns are used to analyze human use and abuse of the sea.
250. COMPUTER APPLICATIONS. (2-2). Credit 3. Introduction to microcomputer business and data applications. Fundamental concepts of information technology and algorithm development. Use of integrated word processing, spreadsheet and database applications software to solve science and/or business problems.
280. COASTAL AND OCEAN RESOURCES. (3-0). Credit 3. Resources from the ocean including food, minerals, transportation and recreation. Methods of recovery and utilization of resources from the ocean, efficiency and cost effectiveness. Provides a foundation for understanding the wealth of resources available from the ocean and its margins, to include the impact of human activity on these resources.
281. SOPHOMORE SEMINAR IN MARINE SCIENCES. (1-0). Credit 1. Compilation and discussions of literature pertaining to topics in marine sciences. Emphasis placed upon preparation and presentation of a written report. Prerequisite: Sophomore standing or approval of instructor.
285. DIRECTED STUDIES. Credit 1-6 each semester. Special topics and problems suited to analysis by individuals or small groups concerning special aspects of marine sciences. Prerequisite: Approval of department head.
289. SPECIAL TOPICS IN MARINE SCIENCES. Credit 1-4. Study of selected topics in an identified area of marine sciences. Prerequisite: Approval of instructor.
303. INTRODUCTION TO COMPUTING AND DATA DISPLAY. (2-2). Credit 3. The purpose of this course is to introduce the student to the elements of computer programming and data display primarily through the MATLAB computing environment. Students will also be exposed to the FORTRAN programming language and the UNIX operating system. Prerequisite: Junior or senior classification or approval of instructor.
305. PALEONTOLOGY. (2-3). Credit 3. Analysis of history of life and processes controlling it; study of groups of organisms important in the marine fossil record; application of paleontology to geologic problems. Field trips required. Prerequisites: GEOL 104. Junior or senior classification or approval of instructor.
306. COASTAL SEDIMENTARY GEOLOGY. (3-3). Credit 4. A survey of modern coastal sedimentary systems, including principles of sedimentology and sediment analysis. The laboratory includes a large group field projects. Local field trips required. Prerequisites: GEOL 104. Junior or senior classification or approval of instructor.
310. FIELD METHODS IN MARINE SCIENCES. (1-6). Credit 3. Techniques of documenting collected materials, the methods of reconnaissance and the mapping of traverses in the major coastal environments. Sampling and recording techniques, interview procedures, and the use of maps and remotely sensed imagery will be introduced. Prerequisites: CHEM 102, PHYS 202 or PHYS 208, GEOL 104. Junior or senior classification or approval of instructor.
325. INTRODUCTION TO GIS FOR MARINE SCIENCES. (2-2). Credit 3. Geographic Information Systems (GIS) are introduced for marine sciences and management. Basic use of software including creation of GIS models is covered. Creating, editing and querying GIS shape files is treated utilizing one of the standard GIS software packages such as ArcGis. Prerequisite: Junior or senior classification or approval of instructor.
330. PETROLEUM GEOLOGY. (3-0). Credit 3. Origin, migration and accumulation of petroleum. Reservoir rock, traps, accumulation and conditions, and subsurface methods. Prerequisites: GEOL 104. Junior or senior classification or approval of instructor.
340. GEOCHEMISTRY. (3-0). Credit 3. Chemical principles and processes that govern the behavior of geologic materials. Silica and carbonate low temperature equilibrium and kinetics. Prerequisites: CHEM 102, GEOL 104. Junior or senior classification or approval of instructor.
350. ADVANCED COMPUTER APPLICATIONS. (1-2). Credit 2. Data manipulation, merging, selection, filtering and querying in Microsoft Office primarily using large real data sets. Introduction to GIS, MatLab and other software relevant to science and/or business applications. Discussion of algorithm development in structured and object oriented programming languages.
360. BIOCHEMISTRY. (3-0). Credit 3. General introductory biochemistry; structures of lipids, saccharides and nucleotides; amino acids and protein structure; relationship of protein structure to biochemical reactivity; kinetics (and inhibition) of enzyme-catalyzed reactions; membrane phospholipids and glycoproteins and the structure and function of membranes; catabolic reaction pathways of monosaccharides and fatty acids; oxidative phosphorylation. Prerequisites: BIOL 112, CHEM 228. Junior or senior classification or approval of instructor.
361. MARINE BIOCHEMISTRY LABORATORY. (0-3). Credit 1. Selected methods used to characterize, purify, identify and isolate biomolecules. The laboratory is designed to complement the MARS 360 lecture. Prerequisite: MARS 360 or concurrent enrollment.
362. BIOCHEMICAL ADAPTATIONS. (1-0). Credit 1. A seminar on biochemical adaptations and contemporary biochemical methodology emphasizing marine life; an examination of how marine organisms, based on a common set of biochemical structures and processes and subject to a common set of physical-chemical laws, adapt to marine environmental conditions. Prerequisite: MARS 360 or concurrent enrollment.
370. COASTAL PROCESSES. (3-0). Credit 3. Introduction to the coastal system, waves and wave dominated coasts, shoreline morphodynamics, tidal and lake coasts, long term coastal development, sea level changes, subtidal and beach ecosystems, coastal dunes and wetlands, structures and organizations, coastal management and coastal hazards. Cross-listed with GEOG 370.
375. SCIENCE OF FLUIDS. (3-0). Credit 3. Classical fluid mechanics; fundamental physical principles. Fluid statics, principles of fluid motion, frictionless flow, surface waves, viscous flows, turbulence, molecular basis of fluid mechanics. Prerequisites: MATH 251, PHYS 218. Junior or senior classification or approval of instructor.
376. INTRODUCTION TO UNIX AND C. (3-0). Credit 3. Introduction to the Unix operating system and C-Language programming in a multi-user networked environment. Prerequisite: Junior or senior classification or approval of instructor.
380. INTRODUCTION TO PHYSICAL CHEMISTRY. (3-0). Credit 3. Classical thermodynamics with applications to gases, liquids, solutions, and phase equilibria. Kinetics and transport properties of gases. Statistical mechanics, spectroscopy, instrumentation, and quantum theory at the survey level. Prerequisites: CHEM 102, MATH 151. Junior or senior classification or approval of instructor.
405. WATERBORNE TRANSPORTATION OF HAZARDOUS CHEMICALS. (3-0). Credit 3. Basic concepts associated with the transportation of hazardous chemicals in congested port areas, along the nation's inland waterways, and at sea. Special emphasis on the hazards of fire, health, air and water pollution and chemical reactivity. Promulgation of safe operating practices by industry, the USCG and IMO. Prerequisites: CHEM 101. Junior or senior classification or approval of instructor.

410. INTRODUCTION TO PHYSICAL OCEANOGRAPHY. (3-0). Credit 3. Introduction to elements of the physics of the ocean; descriptive aspects and theoretical explanations of circulation, characteristic structure, and waves. Prerequisites: MATH 251, PHYS 208. Junior or senior classification or approval of instructor.
412. REMOTE FIELD INVESTIGATIONS IN MARINE SCIENCES. (6-0). Credit 6. An overview of marine sciences in remote locations varying by instructor and selected topics; lectures on recent scientific papers, methods and concepts related to field area; individual projects; data collection; data analysis and presentation. Prerequisite: Junior or senior classification or approval of instructor.
415. REMOTE SENSING TECHNOLOGY. (3-0). Credit 3. An introduction to the uses of remote sensing technology in the marine sciences, including electromagnetic, acoustic, and seismic methods. Generation, transmission, and reception methods. Active and passive systems, multispectral techniques, and signal analysis systems. Prerequisites: PHYS 202 or 208, BIOL 112. Junior or senior classification or approval of instructor.
423. ECOLOGICAL ECONOMICS. (3-0). Credit 3. An integrated study of management of ecology and economics; conceptual and professional economic and environmental policies; ethical concerns and economic benefits of nature to humans, human and nature's economies, and the complex connections between humans and nature with the valuing of ecosystem integrity. Prerequisite: Junior or senior classification.
425. COASTAL WETLANDS MANAGEMENT. ((3-0). Credit 3. Wetlands management laws, regulations, wetland delineation and applications of Geographic Information System (GIS) to wetlands management. Biological species in wetlands delineation. Basic biogeochemical cycles and interactions in wetlands. Prerequisites: BIOL 112, GEOL 104 and concurrent enrollment in MARS 426 or approval of instructor.
426. COASTAL WETLANDS DELINEATION LABORATORY. (0-3). Credit 1. Coastal wetlands delineation, including mapping techniques, Geographic Information System (GIS) and theodolite. Biological species and biogeochemical factors in wetlands delineation. Prerequisites: BIOL 112, GEOL 104 and concurrent registration in MARS 425 or approval of instructor.
430. GEOLOGICAL OCEANOGRAPHY - PLATE TECTONICS. (3-0). Credit 3. Understanding the complex interactions of the earth system and the critical role that geological oceanography plays in these interactions, specifically the plate tectonic aspects of geological oceanography. Prerequisites: GEOL 104. Junior or senior classification or approval of instructor.
431. GEOLOGICAL OCEANOGRAPHY - EARTH'S CLIMATE. (3-0). Credit 3. Understanding the complex interactions of the earth system and the critical role that geological oceanography plays in these interactions, specifically the paleoceanographic/climate change aspects of geological oceanography. Prerequisites: GEOL 104. Junior or senior classification or approval of instructor.
432. PEAK OIL, GLOBAL WARMING AND RESOURCE SCARCITY. (3-0). Credit 3. The concept of peak oil, resource depletion, and human-induced climate change and the broad consequences for food and water supplies, mortality rates, conflict, migration, and political stability; scientific/social/political debates surrounding these issues, and the individual/local/national/global options for living in a globally-warmed world with declining natural resources. Prerequisites: Any two from GEOL 104, OCNG 251, MARS 280 or approval of instructor. Junior or senior classification.
435. EXPLORATION GEOPHYSICS. (3-0). Credit 3. Physiomechanical properties of rocks and sediments. Seismic reflection and refraction principles applicable to offshore, coastal and onshore exploration. Determination of media velocity and stratigraphy from reflection and refraction studies in both marine and non-marine systems. Prerequisites: PHYS 202 or PHYS 208, GEOL 104, MATH 151. Junior or senior classification or approval of instructor.
440. INTRODUCTION TO CHEMICAL OCEANOGRAPHY. (3-0). Credit 3. Introduction to chemical processes in the marine environment. Composition of sea salt, chemical specification of dissolved material in the ocean. Biogeochemistry of oxygen, major elements, nutrient elements, and some trace metals in the surface and deep ocean. Formation, chemical composition, and alterations of detrital material and marine sediments. Simple models which relate ocean chemistry to the circulation of identifiable masses of water. Radioisotopes and stable isotopes in chemical oceanography. Prerequisites: CHEM 102. Junior or senior classification or approval of instructor.
450. PRINCIPLES OF MARINE INSTRUMENTAL ANALYSIS. (2-3). Credit 3. Fundamental principles and practical applications for state-of-the-art analytical instrumentation applied to marine and environmental science. Topics include atomic and molecular spectroscopy, gas and liquid chromatography, radiochemistry, x-ray spectroscopy, mass spectrometry and field instrumentation. Students work with instruments and make presentation on them to the class. Prerequisites: CHEM 102 and 228, PHYS 202, MATH 131 or 151. Junior or senior classification or approval of instructor.
460. MODERN OCEANOGRAPHIC METHODS. (3-6). Credit 5. This course will provide students with hands-on experience with modern oceanographic observational tools and data analysis techniques. Focus is on the four major oceanographic disciplines, i.e. geology, chemistry, physics and biology. Students will receive the necessary theoretical background, collect and analyze their own data and learn how to prepare scientific reports summarizing their work. Prerequisite: Junior or senior classification or approval of instructor.
470. ECO-ENVIRONMENTAL MODELING. (3-0). Credit 3. Biological components are in chemical and physical environments which are influenced by the bio-system and flows of energy, water and chemical species. Coupling to the complex atmospheric, aquatic and terrestrial systems is important. Modeling entails mathematical tools and the underlying science, focusing on scientific models, from the simplest to the elaborate. Prerequisites: CHEM 102, BIOL 112 and MATH 151 or approval of instructor.
481. SEMINAR. (1-0). Credit 1. Problem-oriented discussion session. Topics and reports selected for current relevance. May be repeated once only for credit. Prerequisite: Junior or senior classification or approval of instructor.
484. UNDERGRADUATE INTERNSHIP. Credit 1-6. Supervised study in a research or teaching laboratory within or outside of the Texas A&M University System. Student involvement is to consist of real-life learning or marine sciences research, teaching, management or a combination of these. Prerequisites: Junior or senior classification or approval of instructor. Approval of the department head.
485. DIRECTED STUDIES. Credit 1-6 each semester. Special topics and problems suited to analysis by individuals or small groups concerning special aspects of marine sciences. Prerequisites: Junior or senior classification or approval of instructor. Approval of department head.
488. WRITING INTENSIVE DIRECTED STUDIES IN MARINE SCIENCES. Credit 1 to 6. A writing-intensive course leading to the equivalent of a mini thesis in an area of interest to the faculty and student; introduces students to the rigors of writing for publication in professional journals in their major. Prerequisite: Junior or senior classification.
489. SPECIAL TOPICS IN MARINE SCIENCES. Credit 1-4. Study of selected topics in an identified area of marine sciences. Prerequisite: Junior or senior classification or approval of instructor.
491. RESEARCH IN MARINE SCIENCES. Credit 1 to 4. Research conducted under the direction of faculty member in Marine Sciences. May be repeated 2 times for credit. Please see academic advisor in department. Registration in multiple sections of this course is possible within a

given semester provided that the per semester credit hour limit is not exceeded. Prerequisites: Junior or senior classification and approval of instructor.

601. TEACHING ENVIRONMENTAL SCIENCES. (2-4). Credit 3. This course will concentrate on the basic principles of environmental education using a hands-on approach to learn environmental principles and how to teach them. This course will have a special emphasis on coastal issues. Prerequisite: Graduate status or approval of instructor.

602. ENVIRONMENTAL ECONOMICS AND OCEANOGRAPHY. (3-0). Credit 3. An introductory fundamentals course for Marine Resources Management students; primary concepts of economics and oceanography with emphasis on their applications to physical and living resources. Writing assignments and case studies. Prerequisite: Graduate status or approval of instructor.

610. ENVIRONMENTAL LAW. (3-0) Credit 3. This course is designed to provide a broad overview of basic environmental laws including statutes, regulations, and cases. It also focuses on the both economic and ethical issues within the context of environmental law and policy. Prerequisite: Approval of instructor; graduate status or special approval.

615. PHYSICAL AND GEOCHEMICAL MARINE RESOURCES. (3-0). Credit 3. Location, identification, extraction and exploitation of non-fisheries marine resources, including: water, salt, hydrocarbons, minerals, energy from the thermal, wave, tidal, current and wind fields, chemical compounds, pharmaceuticals, and construction materials in estuarine, coastal and open ocean areas. Prerequisites: CHEM 102, GEOL 104, OCNG 251 or equivalent. Graduate status or approval of instructor.

620. INTERNATIONAL ENVIRONMENTAL BUSINESS TRANSACTIONS. (3-0) Credit 3. This course is designed to provide an overview of those laws, regulations, and regimes involved in international environmental business transactions; and to identify those environmental regimes which are triggered when business is conducted internationally. The course includes topics in international law, regional law, and U.S. federal law. Prerequisite: Approval of instructor; graduate status or special approval.

625. GIS USE IN COASTAL RESOURCES. (1-3). Credit 2. Basic concepts of design, planning, and implementation of Geographical Information Systems; computer hardware and software evaluation; practical experience in data entry, analysis and update of spatial and characteristic data; use of maps and remotely sensed data as data. Prerequisite: Any computer science course or equivalent; graduate status or special approval.

635. ENVIRONMENTAL IMPACT STATEMENTS AND NATURAL RESOURCE DAMAGE ASSESSMENT. (3-0). Credit 3. The course presents an overview of: a) environmental impact statements (EIS) under the National Environmental Policy Act (NEPA); and b) natural resource damage assessment (NRDA) under the Oil Pollution Act of 1990 (OPA 90) and the Comprehensive Environmental Response, Compensation and Liability Act (CERCLA). It is designed to cover requirements for a wide variety of EISs. NRDA hypothetical cases will be presented in which students are asked to calculate assessments. Prerequisite: Approval of instructor; graduate status or special approval.

638. AVIAN DIVERSITY AND HABITATS AS COASTAL RESOURCES. (2-3). Credit 3. The lecture and readings will emphasize field identification, habitat requirements for native and migrant species and birds as bioindicators of habitat health and environmental stress. We will apply the study of bird diversity to environmental monitoring of coastal ecosystems and migrant stopover habitats. Labs will be conducted primarily in the field. Prerequisites: BIOL 112, MARM 315 or WFSC 302 or ZOOL 318 or approval of instructor; graduate status.

640. ENVIRONMENTAL ADMINISTRATIVE LAW. (3-0) Credit 3. Environmental law is governed, in large part, by administrative law. This course covers the processes involved in administrative environmental law. The primary focus of this course will be on: the Environmental Protection Agency, the U.S. Coast Guard, the Corps of Engineer; and NOAA. A review of international administrative bodies will also be included. Prerequisites: Approval of instructor; graduate status or special approval.

645. WILDLIFE LAW AND ETHICS. (3-0) Credit 3. This course provides an overview of the basic wildlife laws including international regimes, bilateral and multilateral treaties, conventions, and cases dealing with conservation, preservation, and management of non-Homo sapiens species; federal law, regulations, and cases; and a sampling of state law. It also focuses on the ethical issues of species management. Prerequisites: Approval of instructor; graduate status or special approval.

648. INVASIVE SPECIES. (3-0). Credit 3. The science and management of biological invasions, history and success rates including vectors and theories with positive and negative biological, ecological, economical and societal impacts. Invasive species as threats to natural areas and communities. Management theories and regulatory strategies and their effectiveness. Emphasis on marine invasive species. Prerequisite: Graduate status.

650. GEOCHEMICAL MARINE RESOURCES MANAGEMENT. (3-0) Credit 3. The purpose of this course is to provide an overview of the issues involved in geochemical marine resources management. This course explores the management of exploration, production, and protection of the geochemical marine resources of the earth and the interface of the many players. Prerequisites: Approval of instructor; graduate status or special approval.

652. SUSTAINABLE MANAGEMENT OF COASTAL MARGINS. (3-0). Credit 3. The class will study federal, state, and local laws, regulations, ordinances and programs pertaining to management of coastal margins, visit the Texas General Land Office, attend meetings of the Coastal Coordinating Council, the Texas Legislature when a coastal-related bill is being debated, or attend the Galveston County Commissioner's Court or Galveston City Council when a coastal ordinance is being considered. Prerequisite: Approval of Instructor.

655. WETLANDS MANAGEMENT. (3-3). Credit 4. This course surveys the interrelationship of chemistry, physics, geology and biology of coastal wetland systems and explores and defines the context of wetlands sustainability and management. Field exercises are an integral component providing students "hands on" experiences. Guest lectures, seminars and field trips lead by agency personnel who are experts in these fields of research are included. Prerequisite: Background in chemistry, physics, geology and biology.

660. ENVIRONMENTAL ALTERNATIVE DISPUTE RESOLUTION. (3-0) Credit 3. Because environmental issues and law were born and raised in the arena of adversarial combat, the traditional adversarial litigative process is far from ideal. This course first explores the traditional method of settling disputes: the court system. It then reviews the increasingly visible dispute resolution alternatives. Finally, it provides certification in mediation. Prerequisites: Approval of instructor; graduate status or special approval.

670. ECO-ENVIRONMENTAL MODELING. (3-0). Credit 3. Biological organisms are surrounded by chemical and physical environments which are influenced by the bio-system and flows of energy, water, and chemical species. Coupling to atmospheric, aquatic, and terrestrial systems is important. Modeling entails both mathematical tools and the underlying science. This course focuses on scientific models, from the simplest to more elaborate. Prerequisites: BIOL 111, 112; CHEM. 101, 102; MATH 151, and 161 or 166; graduate status or special approval.

675. ENVIRONMENTAL MANAGEMENT STRATEGIES FOR SCIENTISTS. (2-0). Credit 2. The course is designed to provide a scientist with EMS strategies' skills. This includes knowing: what environmental laws may be triggered by activities; the fundamental structure of an

EMS; EMS alternatives; concepts in an audit; Alternative Dispute Resolution; and how an effective EMS can reduce costs and increase profits. Prerequisite: Approval of instructor; graduate status or special approval.

676. ENVIRONMENTAL POLICY. (3-0). Credit 3. This course will provide a general introduction to the basic concepts and mechanisms of international and U.S. federal environmental law and policy. It will survey the field and its development as well as focus on case studies that illustrate the basic types of environmental problems. Prerequisites: Approval of instructor; graduate status or special approval.

680. INTEGRATIVE ANALYSES IN MARINE RESOURCES. (2-0). Credit 2. Review of public policy change mechanisms in marine resources management, including Congressional testimony, agency recommendations and structure, and NGO reports. Students propose and defend a public policy change with detailed documentation and an oral presentation demonstrating a professional understanding of marine resources issues within the context of current law. Prerequisites: 24 hours of MARM course credits completed, or in concurrent enrollment, approval of instructor.

681. SEMINAR. (1-0). Credit 1. Presentation of recent research by students, faculty and visiting faculty. Prerequisite: None.

683. Field Practicum in Marine Sciences (4-4) Credit 1-4. An overview of marine sciences in remote locations varying by instructor and selected topics. Lectures on recent scientific papers, methods, and concepts related to field area. Individual projects and data collection including data analysis and presentation of results in a formal seminar and paper based on the research and findings. Prerequisite: Enrollment in graduate program.

684. INTERNSHIP IN MARINE RESOURCES MANAGEMENT. Credit 1-9. This is a faculty supervised study with an agency or other position within or outside the Texas A&M University System. Student involvement consists of real-life learning of marine resources management issues. It is a full-immersion course that provides students with hands-on experience in marine resources management. Prerequisites: Approval of faculty sponsor; graduate status or special approval.

685. DIRECTED STUDIES. Credit 1-6. Selected Topics in an identified area of science, law policy or management of marine natural resources not covered in any other courses in the curriculum. Prerequisite: Approval of instructor.

689. SPECIAL TOPICS IN MARINE RESOURCES MANAGEMENT. Credit 1-4. Selected topics in an identified area of marine resources management. May be repeated for credit. Prerequisites: Approval of instructor; graduate status or special approval.

691. Research in Marine Sciences. Credit 1 or more each semester. For thesis or dissertation.

### **Marine Transportation (MART)**

103. BASIC SAFETY AND LIFEBOATMAN TRAINING. (2-3). Credit 3. Introduction to the maritime industry, ship types, nomenclature, cargoes and recent trends in the maritime industry. Practical lifeboat and lifesaving training for certification as Lifeboatman by the U.S. Coast Guard.

200. BASIC COMMUNICATIONS, NAVIGATION AND SEAMANSHIP. Credit 4. Practical application of student's classroom studies aboard training ship during first training cruise. Student completes basic projects in communications, navigation, seamanship and rules of the road. Prerequisites: MART 103, 203, 204, or permission of MART department head.

201. NAVAL ARCHITECTURE I. (3-2). Credit 4. Description of ship as self-sustaining unit. Shipbuilding nomenclature and dimensions, types of construction, and classification of merchant ships. Classification societies, shipbuilding materials and methods, and structural components of ships. Prerequisite: MART 103.

202. NAVAL ARCHITECTURE II. (3-0). Credit 3. Ship's lines drawing and form calculations; principles of flotation and buoyancy; inclining experiments, free liquids, transverse stability; motion of ships in waves, seaway and dynamic loads, ship structure tests. Prerequisite: MART 201.

203. SEAMANSHIP I. (2-3). Credit 3. Intermediate lifeboat, lifesaving and firefighting procedures. Practical use in lab of manila lines, wire, splicing, knots, block and tackle, cargo gear, anchoring, mooring, and steering gear operations. Introduction to the international rules of the road. Projects aboard merchant, research and offshore oil vessels in the ports of Galveston and Texas City. Prerequisite: MART 103 or concurrent registration.

204. TERRESTRIAL NAVIGATION. (2-2). Credit 3. Fundamentals of piloting, chart construction and development, aids to navigation, useful publications, principles of magnetism and the magnetic compass, great circle, Mercator and middle latitude sailing. Prerequisites: Algebra and trigonometry recommended.

285. DIRECTED STUDIES. Credit 1-4. Directed study in problems in marine transportation not covered by other courses in the department. Prerequisite: Approval of department head.

289. SPECIAL TOPICS IN MARINE TRANSPORTATION. Credit 1-3. Study of selected topics in an identified area of marine transportation or nautical science. Prerequisite: Approval of department head.

300. INTERMEDIATE COMMUNICATIONS, NAVIGATION AND SEAMANSHIP. Credit 4. Practical application of student's classroom studies aboard training ship during second training cruise. Student completes intermediate projects in communications, navigation, seamanship, and rules of the road. Thorough study made of U.S. Public Health requirements in first aid. Prerequisites: MART 200, 301, 303, METR 302, or permission of MART department head. Junior or senior classification or approval of instructor.

301. SEAMANSHIP II. (2-3). Credit 3. Mechanical appliances aboard ship, accident prevention, vessel sanitation, marine inspection laws and regulations, search and rescue procedures, communications. Prerequisites: MART 203 or concurrent registration or approval of instructor.

303. CELESTIAL NAVIGATION. (2-3). Credit 3. Full range of celestial navigation. Survey of nautical astronomy, sight reduction, sextants, compass error determination, and solutions of the navigational triangle by various methods. Prerequisites: Junior or Senior classification. MART 200, 204 or permission of MART department head.

304. ELECTRONIC NAVIGATION. (1-3). Credit 2. Theory, operation and application of marine electronic navigation aids and systems; marine gyro compass, radio direction finder, Loran, Omega, Decca, satellite, echo sounder, Doppler and integrated navigation systems. Marine radar theory, operation and interpretation. Prerequisites: MART 303 or approval of instructor.

305. SHIP CONSTRUCTION AND STABILITY. (2-3). Credit 3. Shipbuilding nomenclature, dimensions, construction and classification. Classification societies, shipbuilding materials and methods, structural components. Ship's line drawing and form calculations; principles of flotation and buoyancy; inclining experiments; free surface; transverse stability; trim and longitudinal stability; motion of ship in waves, seaways and dynamic loads; ship's structure tests and propulsion. Labs focus on manual and computer-based stability and trim calculations using standard industry-based software. Prerequisites: Junior or Senior classification. MART 103, PHYS 201 or 218 or approval of instructor.

306. RADAR/ARPA/ECDIS. (3-3). Credit 4. Introduction to the theory, operation and interpretation of marine radar and automatic radar plotting aids (ARPA) and Electronic Chart Display Systems (ECDIS). Student examined for U.S. Coast Guard Certification as "RADAR Observer" and for Standards of Training, Certification and Watchkeeping (STCW) Radar and ARPA endorsements. Minimum grade of 70% required for USCG and STCW endorsements. Prerequisites: Junior or Senior classification. MART 200, PHYS 202 or 208 or approval of instructor.

307. GLOBAL MARITIME DISTRESS SAFETY SYSTEM. (2-3). Credit 3. Requirements, regulations, equipment, principles and hands-on operating procedures of each Global Maritime Distress Safety System subsystem, including: SARTS, EPIRBs NAVTEX, INMARSAT, SAFETYNET, VHF Survival Craft Transceivers, DSC, and HF Radiotelephone. USCG and FCC certification as GMDSS Operator and Maintainer. Minimum passing grade 75%. Prerequisites: Junior or Senior classification. MART 300, PHYS 202 or 208 or approval of instructor.

309. ADVANCED TOPICS IN SHIPBOARD OPERATIONS. (2-0). Credit 2. Advanced concepts and techniques related to navigation and cargo watch responsibilities on container, dry and liquid bulk and gas tank vessels, focusing on professional licensing. Prerequisites: Junior or Senior classification. MART 300.

312. MARINE CARGO OPERATIONS I. (3-0). Credit 3. Objectives and problems with break-bulk cargo handling during loading, discharging, and in-transit carriage. Requirements of special refrigerated and dangerous cargoes. Heavy lift operations. Cargo loss prevention, safety and related documentation, log book entries, modern cargo concepts-containerization, roll-on roll-off, and others. Maximum cargo efficiency with relation to space, cargo gear, crew and labor costs. Prerequisites: Junior or Senior classification. MART 200, 301 or concurrent registration or approval of instructor.

321. MARITIME LAW I. (2-0). Credit 2. Basic laws governing vessel navigation; International and U.S. Inland Rules for the prevention of collision at sea, and the safety of life at sea convention. Prerequisites: MART 200. Junior or senior classification.

400. ADVANCED COMMUNICATIONS, NAVIGATION AND SEAMANSHIP. Credit 4. Practical application of student's classroom studies aboard training ship during third training cruise. Student completes advanced projects in communications, navigation, seamanship and rules of the road. Prerequisites: Junior or Senior classification. MART 300, 321, 406 or permission of MART department head.

404. THE NAVIGATOR. (1-3). Credit 2. Intensive, in-depth review of the principles of electronic, celestial, and terrestrial navigation in preparation for the U.S. Coast Guard examination for Third Mate. Prerequisites: Junior or Senior classification. MART 400, or approval of instructor.

406. MARINE CARGO OPERATIONS II. (3-2). Credit 4. Principles and practice of bulk liquid, gas handling, and carriage by water craft. Theoretical and practical problems involved in loading, stowing and discharging of petroleum, chemical, elevated temperature and cryogenic cargoes. Marine pollution abatement, personnel safety, and firefighting techniques and systems. Prerequisites: Junior or Senior classification. MART 312, 400 or approval of instructor.

407. LIQUEFIED GAS TANKERS. (2-3). Credit 3. Preparation as cargo officer for loading, discharging and transit of liquefied gas cargoes. Emphasis on physical and chemical properties, operations, safety, firefighting and pollution prevention. Prerequisites: Junior or Senior classification. MART 300, 406, PHYS 201.

410. BRIDGE WATCHSTANDING. (1-3). Credit 2. Bridge Watchstanding. Integration of navigation, communications and seamanship in Bridge Resource Management (BRM) training required under the International Convention on the Standards for Training and Certification of Watchkeepers, using simulator-based teaching techniques. Prerequisites: MART 304, 306, 321, 400. Junior or senior classification or approval of instructor.

422. SEAMANSHIP III. (1-3). Credit 2. Principles and methods of propulsion and steering of ships. Ship handling in narrow channels and heavy seas, docking, undocking, mooring and towing. Prerequisites: Junior or Senior classification. MART 301 or concurrent registration or approval of instructor.

485. DIRECTED STUDIES. Credit 1-4. Directed study in problems in marine transportation not covered by other courses in the department. Prerequisite: Senior classification or approval of department head.

489. SPECIAL TOPICS IN MARINE TRANSPORTATION. Credit 1-4. Study of selected topics in an identified area of marine transportation or nautical science. Prerequisites: Approval of MART department head. Junior or senior classification or approval of instructor.

491. RESEARCH IN MARINE TRANSPORTATION. Credit 1 to 4. Research conducted under the direction of faculty member in Marine Transportation. May be repeated 2 times for credit. Please see academic advisor in department. Registration in multiple sections of this course is possible within a given semester provided that the per semester credit hour limit is not exceeded. Prerequisites: Junior or senior classification and approval of instructor.

### **Maritime Administration (MARA)**

205. INTRODUCTION TO SHIPS AND SHIPPING. (3-2). Credit 4. Introduction to the maritime industry and ships used in transportation of goods and services. Shipboard nomenclature, types and missions of merchant ships, shipbuilding nomenclature and dimensions, shipbuilding materials and methods, modes of cargo handling and their impact on ship design.

212. BUSINESS LAW. (3-0). Credit 3. Legal principles of business, legal reasoning, dispute resolution and procedure, contract law, bankruptcy law, property law, Uniform Commercial Code sections concerning contracts, security interests, negotiable instruments and sales. Prerequisite: Sophomore classification.

250. MANAGEMENT INFORMATION SYSTEMS. (2-0). Credit 2. Introduction to the concepts and applications of management information systems, including information technology concepts, computer hardware, common business software, software selection and development, management information systems (MIS), decision support systems (DSS), and working in a digital world.

281. SEMINAR IN UNDERGRADUATE RESEARCH METHODS. (1-0). Credit 1. An introduction to necessary undergraduate research methods in economics and business, to prepare students for investigative writing requirements in upper division courses in maritime business administration. Prerequisite: Sophomore standing.

285. DIRECTED STUDIES. Credit 1-4. Directed study on selected problems in the area of maritime administration not covered in other courses. Prerequisite: Approval of MARA department head.

289. SPECIAL TOPICS. Credit 1-3. Study of selected topics in an identified area of maritime administration. Prerequisite: Approval of MARA department head.

301. OCEAN TRANSPORTATION I. (3-0). Credit 3. Examination of theory and practice in the management of transportation logistics, labor, rate-making, role of government, international conventions and treaties. Exposure to current trends and developments in shipping. Prerequisites: MART Students - NAUT 103, ECON 202 or ECON 203. MARA students - MARA 205, ECON 202 or ECON 203.



304. OCEAN TRANSPORTATION II. (3-0). Credit 3. Marine insurance problems and cases and how they relate directly to a ship's officer. Hull, cargo, and personal injury cases are examined from the officers' and insurers' points of view. Introduction to Admiralty Law and the court process for seamen's rights and ship owners' privileges. Actual hearings and trials are observed to complete the background. Prerequisite for MART and MARA students: MARA 301.
342. MANAGERIAL MARITIME FINANCE. (3-0). Credit 3. Continuation of topics introduced in Business Finance (FINC 341) including risk and return, investment valuation, the selection of risky investment projects, capital structure, dividend policy, and methods of raising long-term capital; applications to the maritime industry are made where appropriate. Prerequisite: FINC 341.
363. THE MANAGEMENT PROCESS. (3-0). Credit 3. Management as an academic discipline; goal setting; planning, controlling and decision-making; models for thinking about organizations; organization design; organization change; models for understanding individual behavior; job performance and job satisfaction; interpersonal behavior, motivation and leadership, behavior in work groups; careers in management, ethics and international management. Prerequisite: Junior or senior classification.
373. HUMAN RESOURCE MANAGEMENT. (3-0). Credit 3. Strategic issues in managing human resources; shared responsibilities of line managers and human resource staff for developing and implementing human resource policies and procedures; human resource planning; job design, analysis and evaluation; staffing; compensation; performance appraisal; training and development career management; labor relations; legal, ethical and international issues. Prerequisite: MARA 363.
401. BROKERAGE AND CHARTERING. (3-0). Credit 3. Operational and legal environment of ship brokerage and chartering; responsibilities of owner and charterer under various charter forms; American, British and Canadian acts governing charters and bills of lading; rules and regulations concerning loading and discharging. Prerequisites: MARA 205, MARA 301. Senior classification.
402. INLAND WATERWAYS. (3-0). Credit 3. Development of inland waterways of the U.S. and federal policies relating to them. Port and terminal development, competition with other transportation forms, manpower, rates, environmental concerns and the impact of waterway systems on regional economies. Prerequisites: ECON 203. Senior classification.
416. PORT OPERATIONS, ADMINISTRATION AND ECONOMICS. (3-0). Credit 3. Concepts of the port and methods of intermodal transfer. Port functions divided and analyzed along business lines: economics, management, finance, accounting, and marketing. Cost studies. Prerequisites: MARA 301. Junior or senior classification.
421. ADMIRALTY LAW. (3-0). Credit 3. Essential principles of admiralty, general maritime, and international law as applicable to the marine industry and ocean shipping. Evolution and state of the law concerning maritime liens, ship mortgages, rights of seamen and harbor workers, limitation of liability, bills of lading and cargo carriage, collision liability, general average, marine salvage, charter parties, and international rights and responsibilities of ships and shipping. Prerequisites: MARA 301, MARA 304.
424. ECONOMICS OF TRANSPORTATION. (3-0). Credit 3. Historical development, structure, function, and regulation of highway, rail, water, pipeline, and air transportation systems. Application of economic concepts and principles to transportation development and operations. Prerequisites: ECON 203 and senior classification.
435. LABOR LAW AND POLICY. (3-0). Credit 3. Federal and state public policy and laws regulating human resource management including National Labor Relations Act, Railway Labor Act, Fair Labor Standards Act, employment discrimination statutes, statutes regarding public sector unionization, and other relevant legal authorities; various forms of dispute settlement including litigation, mediation, fact finding and arbitration; legal ramification of strategic human resource management decision making. Prerequisites: MARA 363. Senior classification.
440. GLOBAL ECONOMY AND ENTERPRISE MANAGEMENT. (3-0). Credit 3. Introduction to the economic, political, social and ethical environments of international business including the determinants of trade and investment patterns and the logic of government interventions in both trade and capital markets; also discussed are the structure, strategy and operations of the international firm. Prerequisites: ECON 203. Junior or senior classification.
450. MARITIME SUPPLY CHAIN MANAGEMENT. (3-0). Credit 3. Introduction to the concepts involved in supply chain management (SCM); SCM encompasses the functional areas of procurement, operations management, inbound/outbound transportation, customer service, and information technologies; emphasizes how these functional areas are integrated to achieve the firm's overall objectives. Prerequisites: INFO 303 and INFO 364.
460. MANAGEMENT SYSTEMS AND CONTROL. (3-0). Credit 3 Application of management processes to complex interdisciplinary organizational environments through the study of program and project management. Adoptions of traditional management theories to the project environment. Student will be expected to master typical project management microcomputer software for project planning; resource allocation; project budgeting; and control of project cost, schedule and performance. Prerequisites: INFO 364, MARA 363. Junior classification.
466. STRATEGIC MANAGEMENT. (3-0). Credit 3. Strategic issues facing organizations, including top management decision making and social responsibility; environmental and industry analysis; establishing organizational mission and objectives; corporate, business and functional level strategy formulation; global and multidomestic strategies; strategic implementation and control; integrating operations, finance, marketing and human resource strategies; case analysis. Prerequisites: MARA 363, MKTG 321, INFO 364, FINC 341, and senior classification.
470. ENVIRONMENTAL LAW. (3-0). Credit 3. Designed to provide a broad background of basic statutes, regulations, and cases dealing with the major issues in international and federal environmental law. Specifically, the course will focus on pragmatic training in statutory, regulatory, and treaty reading and interpretation; analysis of administrative and legislative intent for law. Prerequisites: MARA 212, MARA 421. Senior classification.
484. MANAGEMENT INTERNSHIP. Credit 3-4. Internship in management; staffing, planning, organizing, leading and controlling. Enrollment is limited to those who have managerial responsibilities for the resources used by a business, non-profit, or other organization. Prerequisites: ACCT 229, ACCT 230, FINC 341, MKTG 321, MARA 363. Approval of department head.
485. DIRECTED STUDIES. Credit 1-4. Directed study on selected problems in the area of maritime administration not covered in other courses. Prerequisites: Cumulative GPA of 2.5 or higher. Approval of instructor and MARA department head.
489. SPECIAL TOPICS. Credit 1-3. Study of selected topics in an identified area of maritime administration. Prerequisite: Approval of instructor.
491. RESEARCH IN MARITIME ADMINISTRATION. Credit 1 to 4. Research conducted under the direction of faculty member in Maritime Administration. May be repeated 2 times for credit. Please see academic advisor in department. Registration in multiple sections of this course is possible within a given semester provided that the per semester credit hour limit is not exceeded. Prerequisites: Junior or senior classification and approval of instructor.

604. MARINE NATURAL RESOURCE ECONOMICS. (3-0) Credit 3. Critical evaluation of policies and procedures in the development and use of natural resources relevant to marine and maritime markets; identification of problems in resource exploration, development, and transportation; the political /economic decision-making processes; analytical tools used to make economic decisions in resource markets. Prerequisite: Graduate status or special approval.

610. INTERNATIONAL STRATEGIC PLANNING AND IMPLEMENTATION (3-0) Credit 3. An introduction to the strategic management process, with an emphasis on the maritime industry in the domestic and international context. The formulation of strategy in the context of environmental opportunities and threats, how to analyze industry competition, and how to implement strategies and build competitive advantage. Students will select a company engaged in domestic or international waterborne commerce and analyze the strategic planning processes of the firm using the standard techniques such as SWOT analysis, the Five Forces model and the Value Chain analysis. Prerequisite: Approval of instructor, graduate status or special approval.

616. MANAGEMENT OF PORT FACILITIES AND INFRASTRUCTURE (3-0) CREDIT 3. Problems associated with the management of buildings, piers, bulkheads and associated structures and connecting waterways focusing on corrosion, adverse affects of climate, tide and current affects, dredging cycles and related facilities access issues associated with structures in the coastal zone. Particular attention is paid to the requirements of state and federal agencies regarding equipment and facilities used in the safe loading, discharge, and storage of cargoes, including hazardous materials. Prerequisite: Approval of instructor, graduate status or special approval.

623. ECONOMIC ISSUES IN SHIPPING (3-0) Credit 3. The role of domestic and international shipping in the American economy; discussion of the economic characteristics of waterborne transportation, including the nature of transport demand and cost functions; economic dimension of transport service; transport market structures; and transport pricing theory and practice. Emphasis on managerial implications of transport economic principles for domestic and international shipping. Prerequisite: Approval of instructor, graduate status or special approval.

624. INTERMODAL TRANSPORTATION OPERATIONS (3-0) Credit 3. Survey of economic and operational characteristics of intermodal transportation. rail, trucking, air, shipping, and pipelines. Emphasis on the interface of surface transportation with the maritime industry; pricing strategies, cost structures, and regulatory issues. Prerequisite: Approval of instructor, graduate status or special approval.

627. MARKETING OF TRANSPORTATION SERVICES (3-0) Credit 3. Marketing planning and analysis applicable to the service firm; assessment of customer needs; quality control; competitive strategies; applications of marketing principles and practices to the maritime industry. Prerequisite: Approval of instructor, graduate status or special approval.

636. MANAGERIAL DECISION MAKING (3-0) Credit 3. Construction of mathematical models of business environments; linear programming techniques; planning, analysis and control of operations in complex organizations through mathematical techniques. Prerequisite: Approval of instructor, graduate status or special approval.

640. GLOBAL LOGISTICS (3-0) Credit 3. Transportation and logistic activities of multinational firms with an emphasis on transportation, customer service, inventory control facility location, global sourcing, customs documentation, and the role of government in importing and exporting. Attention is given to current events and their effects on the marketing and logistics activities of U.S. based organizations. Prerequisite: Approval of instructor, graduate status or special approval.

641. FINANCIAL MANAGEMENT IN MARINE TRANSPORTATION (3-0) Credit 3. Management of the corporation's sources and uses of funds with emphasis on risk and return, investment valuation, the selection of risky investment projects, capital structure, dividend policy, and methods of raising long-term capital; applications to the maritime industry are made where appropriate. Prerequisite: Approval of instructor, graduate status or special approval.

650. DISTRIBUTION LOGISTICS (3-0) Credit 3. Distribution logistics and the basic management of businesses; systems engineering techniques used to optimize profit and quality customer service; transportation modes, intermodal connections, inventory policies, warehousing, order processing, network design and facility management. Prerequisite: Approval of instructor, graduate status or special approval.

652. MARINE TRANSPORTATION SYSTEM DESIGN AND POLICY (3-0) Credit 3. Course Description: Interaction between shipping policy and design of marine transportation and port systems; effects of market structure on economics and finance; port performance and performance Measures. Prerequisite: Approval of instructor, graduate status or special approval.

658. PORT DESIGN, PLANNING AND SECURITY (3-0) Credit 3. Ground-level issues, tasks, and responsibilities that must be managed by the security manager in concert with the port director and federal and local law enforcement agencies; multiuse port facilities for recreation, hospitality, and external business and commercial interests; design of marine structures for the berthing, mooring, and repair of vessels. Prerequisite: Approval of instructor, graduate status or special approval.

660. RISK ASSESSMENT AND MARINE INSURANCE (3-0) Credit 3. Theory, techniques, participants and background of risk assessment and management with emphasis given to contemporary issues in marine insurance law; marine liability coverage, cause of loss, additional perils, exclusions, warranties, duration of risk, adjustment clauses, operating clauses, civil commotions, war insurance, and project risk management techniques. Prerequisite: Approval of instructor, graduate status or special approval.

664. PRODUCTION, OPERATIONS AND LOGISTICS MANAGEMENT (3-0) Credit 3. Types of decisions to be made at varying levels and where appropriate; quantitative models and techniques that can be used in decision making areas of the firm; analysis of how the operations function fits in with other functional areas of the firm; interrelationships with firms' strategies. Prerequisite: Approval of instructor, graduate status or special approval.

670. COASTAL AND INLAND WATERWAYS TRANSPORTATION (3-0) Credit 3. Policy, strategy and management, port and terminal development, competition with other modes of transportation, manpower, rates, environmental concerns, the impact of waterway systems on regional economies and national economic development; commercial aspects of the inland waterways with emphasis on operations, freight rate structures and applied cash flow methods. Prerequisite: Approval of instructor, graduate status or special approval.

672. THE MARITIME GLOBAL TRADING SYSTEM (3-0) Credit 3. Introduction to the theory of international waterborne trade; provides a basis for examining American foreign trade policy, and regional and world trade institutions such as the WTO, ASEAN, the EU, GATT, and NAFTA. Topics include: International trade theory and policy, open-economy macroeconomic policy, tariffs, non-tariff barriers and enhancements, multinational enterprises and foreign direct investment, global competition and integration. Prerequisite: Approval of instructor, graduate status or special approval.

689. SPECIAL TOPICS IN MARITIME ADMINISTRATION. (4-0). Credit 4. Selected topics in identified area of Maritime Administration. Prerequisites: Graduate classification and instructor permission.

691. RESEARCH IN MARITIME ADMINISTRATION (3-0) Credit 3. For thesis or dissertation. Prerequisite: Approval of instructor, graduate status or special approval.

## **Maritime Systems Engineering (MASE)**

100. INTRODUCTION TO OFFSHORE AND COASTAL ENGINEERING. (2-0). Credit 2. Introduction to offshore and coastal engineering principles with emphasis on offshore structures, underwater pipelines, floating production systems, current advances in offshore technologies; coastal structures, coastal processes, port and harbor design, and advances in ocean/wind energy technologies. Prerequisite: MATH 151 or registration therein.

210. PROPERTIES OF ENGINEERING MATERIALS. (0-3). Credit 1. Atomic and crystalline structures of materials; mechanical properties, failure, corrosion and thermal processes of metallic materials; tensile, hardness, impact and torsion testing of metal alloys. Prerequisites: ENGR 212, 221 and PHYS 208.

212. ENGINEERING SCIENCE IN THERMODYNAMICS. (2-3). Credit 3. Theory and application of thermodynamics as an engineering science; applications of the laws of thermodynamics and energy equations to heat transfer and flow. Prerequisites: ENGR 221 and MATH 251 or concurrent enrollment.

213. PRINCIPLES OF MATERIALS ENGINEERING. (2-2) Credit 3. Description of properties of materials using a unified approach; discussion of the chemical structure, crystalline structure, microstructure, interface structure, and phase diagrams for materials; develop bulk properties and characteristics of metals, polymers, and ceramics; mechanical, electrical, magnetic, thermal, and optical properties for these materials. Prerequisites: ENGR 212, 221; PHYS 208; MATH 308 or concurrent registration.

214. MECHANICS OF DEFORMABLE BODIES. (3-0). Credit 3. Concepts of stress, strain and deformation. Factor of safety. Stress-strain relationships and material properties. Stress concentrations. Area moments of inertia. Axially loaded members, torsionally loaded members, bending of beams. Shear and moment diagrams. Stresses due to combined loading. Thin-walled pressure vessels. Transformation of stress including Mohr's circle. Beam deflections and buckling stability. Prerequisites: ENGR 221; MATH 308 or concurrent registration.

215. PRINCIPLES OF ELECTRICAL ENGINEERING (2-2). Credit 3. Fundamentals of electric circuit analysis, AC power, and electronics; intended as a terminal course in these areas for most engineering disciplines. Prerequisites: ENGR 212, 221; PHYS 208, MATH 308 or concurrent registration.

216. PRINCIPLES OF THERMODYNAMICS. (2-0). Credit 2. Theory and application of thermodynamics as an engineering science; study of work, heat and energy as applied to open and closed systems; introduction to entropy, reversible and irreversible processes; intended as a terminal course in these areas for MASE students. Prerequisites: ENGR 221 and MATH 251 or registration therein.

217. ELECTRICAL ENGINEERING: CIRCUITS. (2-0). Credit 2. Fundamental principles of electric circuit analysis, DC and AC electricity, electric power; designed to prepare students for topical questions from the P.E. exam; intended as a terminal course in these areas for MASE students. Prerequisite: PHYS 208.

285. DIRECTED STUDIES. Credit 1-8. Directed study on selected current problems in the ocean and/or maritime industry. Offered to enable individuals or groups to undertake and complete with credit some specialized investigation not covered by other courses. Prerequisite: Approval of department head.

301. HYDRODYNAMICS OF OFFSHORE STRUCTURES. (3-0). Credit 3. Introduction to offshore structures, wave force formulation; wave forces on small structures, floating structure dynamics, modeling dynamics systems of rigid body motion, structure response statistics. Prerequisites: Junior or senior classification or approval of instructor, OCEN 300 or concurrent registration, MEEN 363, CVEN 345, MASE 310. Enrollment in MASE major degree sequence.

310. ENGINEERING ANALYSIS. (3-0). Credit 3. Application of numerical methods to ocean-related engineering problems; development, evaluation, and comparison of various techniques for root finding, curve fitting, numerical integration, simultaneous linear algebraic equations, matrix methods, probability and statistics, and ordinary differential equations in ocean-related engineering applications. Prerequisites: Junior or senior classification or approval of instructor, MATH 308 or concurrent registration, ENGR 111, ENGR 112.

319. NAVAL ARCHITECTURE DESIGN I. (2-3). Credit 3. Introduction to Naval Architecture. Terminology. Hydrostatics and hydrostatic stability. Processes of the design of ships, semi-submersibles and underwater vehicles including layout, arrangements, construction and construction techniques. Hull design of ships, underwater vehicles and mobile offshore drilling units (MODUs). Prerequisites: CVEN 311, 345; ENGR 221, MASE 214. Junior or senior classification or approval of instructor. Enrollment in MASE major degree sequence.

336. FLOW MEASUREMENT FUNDAMENTALS. (2-2). Credit 3. Introduction to fundamental principles of measuring fluctuating fluid velocities in open channels, simple pipe flow systems and surface waves. Laboratory includes experimental investigation of classic fluid dynamics and introduction to PIV systems. Prerequisites: PHYS 208, CVEN 311 or concurrent registration. Junior or senior classification or approval of instructor. Enrollment in MASE major degree sequence.

344. REINFORCED CONCRETE STRUCTURES. (2-3). Credit 3. Analysis and design of reinforced concrete beams, columns, slabs and footings using ultimate strength methods. Prerequisite: CVEN 345. Enrollment in MASE major degree sequence.

400. INTRODUCTION TO COASTAL ENGINEERING. (3-0). Credit 3. Mechanics of shallow water wave motion; wave diffraction, refraction and reflection; wave forecasting; water level fluctuations; coastal processes and geomorphology; erosion control and shoreline stabilization; coastal structures; beach nourishment; dredging; introduction to physical and computer models and modeling techniques; design in coastal engineering. Prerequisites: OCEN 300; senior classification or approval of instructor. Enrollment in MASE major degree sequence.

401. UNDERWATER ACOUSTICS. (3-0). Credit 3. Fundamentals of underwater acoustics, SONAR equations, propagation of underwater sound, acoustic transducers and arrays, noise in the ocean environment, design and prediction of SONAR systems, ocean engineering applications of underwater sound. Prerequisites: CVEN 311, MASE 336. Junior or senior classification or approval of instructor. Enrollment in MASE major degree sequence.

402. APPLIED UNDERWATER ACOUSTICS. (1-0). Credit 1. Theory and applications of underwater sound generation and propagation, SONAR equations, and acoustics transducers and arrays; application including design and prediction of SONAR systems, acoustical oceanography measurements, positioning of offshore marine equipment and environmental impact issues. Prerequisites: CVEN 311, OCEN 300 or instructor approval. Enrollment in MASE major degree sequence.

405. FINITE ELEMENT ANALYSIS IN ENGINEERING DESIGN. (3-0). Credit 3. Introduction to the fundamental theory and techniques; direct approach and energy formulation; element equations, assembly and solution schemes; computer implementation, design considerations; applications to field problems; original computer project required. Prerequisites: CVEN 345, MASE 214, 310. Junior or senior classification or approval of instructor. Enrollment in MASE major degree sequence.

406. CAPSTONE DESIGN I. (1-0). Credit 1. Part one of a two-course sequence; development and presentation of detailed proposals for offshore or coastal engineering projects, which will form the basis for MASE 407 design projects; includes formulation of project objectives, de-

sign constraints, delineation of alternatives, scheduling and analysis of economic and environmental impact. Prerequisites: ENGL 301 or concurrent enrollment. Students must have successfully completed all required junior-level MASE courses and be in their final academic year prior to graduation. Enrollment in MASE major degree sequence.

407. CAPSTONE DESIGN II. (0-6). Credit 3. Design of a major engineered system based on a proposal developed in MASE 406 completed as a group project; realistic application of engineering skills and tools, experience managing a significant engineering-design effort. This is a writing-intensive course including a major report and weekly one-page written reports. Prerequisites: ENGL 301, MASE 406. Enrollment in MASE major degree sequence.

410. MEASUREMENTS IN THE OCEAN LABORATORY. (0-3). Credit 1. Fundamental techniques and instrumentation for field and laboratory measurements pertaining to coastal and ocean engineering (e.g., currents, wave height, wave/sediment interaction, mass transport, surveying, etc.); experiment planning; data analysis and presentation; written reports on methodology, analysis, and results of experiments. Prerequisites: OCEN 300, MASE 400. Junior or senior classification or approval of instructor. Enrollment in MASE major degree sequence.

411. ENVIRONMENTAL NEARSHORE HYDRODYNAMICS. (3-0). Credit 3. Fundamentals of current and shallow water wave motions. Beach response to nearshore processes. Coastal sediment and pollutant transport including nearshore currents, longshore onshore-offshore transport and shoreline configuration; facilities for shoreline stabilization, backshore protection and inlet stabilization. Environmentally conscious coastal engineering design is emphasized. Prerequisites: OCEN 300. Junior or senior classification or approval of instructor. Enrollment in MASE major degree sequence.

415. OFFSHORE STRUCTURE DESIGN. (3-0). Credit 3. Design of large structures using diffraction analysis. Design project: Design of a fixed offshore structure including dynamics effects. Prerequisites: MASE 301. Junior or senior classification or approval of instructor. Enrollment in MASE major degree sequence.

421. NAVAL ARCHITECTURE DESIGN II. (2-3). Credit 3. Ship motion and mooring. Theory and practice of naval architecture, basic principles and design calculations. Hull structural design considerations, ship resistance and propulsion power prediction, propeller selection concepts, dynamic positioning systems, mobile offshore drilling unit (MODU) design considerations, practical design work on a vessel or MODU of the student's choosing under the guidance of the instructor. Prerequisites: MASE 319, CVEN 346, OCEN 462. Junior or senior classification or approval of instructor. Enrollment in MASE major degree sequence.

459. MECHANICAL VIBRATIONS. (3-0). Credit 3. Basic theory of vibrating systems with single and multiple degrees of freedom and principles of transmission and isolation of vibrations. Prerequisites: MASE 214, 221, 310. Junior or senior classification or approval of instructor. Enrollment in MASE major degree sequence.

461. OCEAN INSTRUMENTATION AND CONTROL THEORY. (3-0). Credit 3. Electrical systems components; analog and digital filters-amplifiers; network analysis; instrument behavior and displacement, velocity, acceleration, force, and flow measurements; simple feedback and control theory for linear electromechanical systems; digital data acquisition. Prerequisites: PHYS 208 and ENGR 215. Junior or senior classification or approval of instructor. Enrollment in MASE major degree sequence.

467. OFFSHORE RANDOM PROCESSES. (3-0). Credit 3. Basic probability theory and engineering statistics; irregular structural excitation and response; random vibration theory with application to offshore processes and structures; development of extreme values used in design of ocean structures. Prerequisites: MASE 301, 310 and 459; or approval of instructor. Enrollment in MASE major degree sequence.

482. SEMINAR. (1-0). Credit 1. State of technology topics in ocean engineering; professional ethics, membership in professional societies and professional registrations; case studies and lectures presented by staff and practicing engineers. Prerequisite: Junior or senior classification or approval of instructor. Enrollment in MASE major degree sequence.

483. MARINE FOUNDATION ANALYSIS AND DESIGN. (2-3). Credit 3. Design of foundations for onshore, alongshore, and offshore structures, including prediction of settlement and the bearing capacity of shallow and deep foundations; determination of earth pressure acting on retaining structures and design of steel and concrete bulkheads; design of pile foundations; and design of cofferdams and caissons. Laboratory tests conducted to determine the physical and engineering properties needed for application in geotechnical engineering design. Prerequisites: CVEN 345, 346, 365. Junior or senior classification or approval of instructor. Enrollment in MASE major degree sequence.

485. DIRECTED STUDIES. Credit 1-8. Directed study on selected current problems in the ocean and/or maritime industry. Offered to enable individuals or groups to undertake and complete with credit some specialized investigation not covered by other courses. Prerequisites: Approval of department head. Junior or senior classification or approval of instructor. Enrollment in MASE major degree sequence.

489. SPECIAL TOPICS. Credit (1-4). Selected topics in a identified area of maritime systems engineering. May be repeated for credit. Prerequisite: Junior or senior classification or approval of instructor. Enrollment in MASE major degree sequence.

491. RESEARCH IN MARITIME SYSTEMS ENGINEERING. Credit 1 to 4. Research conducted under the direction of faculty member in Maritime Systems Engineering. May be repeated 2 times for credit. Please see academic advisor in department. Registration in multiple sections of this course is possible within a given semester provided that the per semester credit hour limit is not exceeded. Prerequisites: Junior or senior classification and approval of instructor. Enrollment in MASE major degree sequence.

### **Maritime Studies (MAST)**

110. SCUBA I LECTURE. (2-0). Credit 2. Scuba I is entry level SCUBA training course. Upon successful completion of this course and the corresponding laboratory class, the student will have the basic academic knowledge and skills development needed to safely conduct Scuba dives. The student will also have acquired the First Aid/CPR skills necessary to provide basic life support in the event of an emergency. Prerequisite: Must complete a medical statement showing no contraindications to diving, or have a recreational Scuba diver's physical examination.

120. SCUBA II LECTURE. (2-0). Credit 2. Scuba II is the second course in the hierarchy of scuba training. The lecture and laboratory course objectives are to promote safe, self-reliant diving and to improve the diver's comfort, coordination, and strength in the water; to increase the diver proficiency and confidence through introductory training in a variety of practical topics; to build competency in dive planning and organization; to understand basic diver stress management and recognition; to be trained in basic surface and underwater dive rescue and life-saving skills. Prerequisite: Must complete a medical statement showing no contraindications to diving, or have a recreational SCUBA diver's physical examination; co-enrollment in KINE 199 (Scuba II Lab) and MAST 120 (Scuba II Lecture), NAUI Scuba Diver certification or equivalent.

265. ELISSA SAIL TRAINING I. (1-7). Credit 3. Fundamentals of seamanship on a late 19th century square-rigged sailing vessel. Students will learn to both sail and care for the 1877 barque ELISSA, operated by the Texas Seaport Museum. Lectures on maritime life supplement physical activity. Prerequisite: Department approval.

266. ELISSA SAIL TRAINING II. (1-7). Credit 3. Sailing and crewmanship on the 1877 barque ELISSA, operated by the Texas Seaport Museum. Includes sail training at sea. Prerequisite: MAST 265.

285. DIRECTED STUDIES. Credit (1-6). Individually supervised research or advanced study on restricted area not covered in regular courses.

289. SPECIAL TOPICS. Credit (1-4). Selected topics in a identified area of maritime studies. May be repeated for credit.

320. INTRODUCTION TO MUSEUMS AND CONSERVATION. (2-3). Credit 3. Introduction to basic issues related to the conservation, curation, management and presentation of museum collections. Emphasis placed on archaeology and historical collections, or other collections with cultural significance. Basic conservation techniques for materials as well as proper care and store of collections. Museum planning and exhibit design will be discussed. Prerequisite: Junior or senior classification or approval of instructor.

345. TEXAS MARITIME CULTURE AND HISTORY. (3-0). Credit 3. The coastal peoples, maritime history and culture of the Texas Gulf Coast ranging from pre-historic times to the present day; geography's influence on exploration, resources utilization, development and inland access; Texas ports historic and modern; shipwreck sites and historical texts; La Salle's La Belle, Texas Navy, Mexican War logistics; Civil War Naval actions, Texas Fisheries, tourism and recreation. Prerequisite: Junior or senior classification.

350. A HISTORY OF WOODEN SHIP CONSTRUCTION. (3-0). Credit 3. This course is designed to give undergraduate students an overview of ship construction and possible cultural factors that may influence how a shipwright builds a vessel. Prerequisites: Junior or senior classification and ANTH 316 or ANTH 318.

371. ARCHAEOLOGY OF THE PACIFIC. (3-0). Credit 3. Overview of the archaeology, history and cultures of the Pacific Rim; emphasizing the cultures of Polynesia, Melanesia, and Micronesia. Prerequisite: Junior or senior classification or approval of instructor.

411. INTERNATIONAL MARITIME CULTURE. (3-0) Credit 3. Strategies used in the exploitation of marine, coastal, and island habitats throughout human evolutionary history and the variety and complexity of adaptations in such environments. Classes will be devoted to lectures and group discussions with occasional slide or movie presentations. Prerequisites: ANTH 210 or GEOG 201. Senior classification or approval of instructor.

425. THESIS AND TECHNICAL WRITING. (3-0). Credit 3. Rhetorical techniques for professional expository prose; intertextual argumentation and analysis. Prerequisite: Junior classification.

481. SEMINAR IN MARITIME STUDIES. (1-0). Credit 1. This course is intended to provide students with the opportunity to conduct in-depth research on a particular issue, event, period, or people in maritime studies. Prerequisite: This one-credit hour course is open to senior maritime studies majors or approval of instructor.

484. UNDERGRADUATE INTERNSHIP. Credit 1-6. Supervised study in a research or teaching laboratory remote from TAMUG. Student involvement is to consist of real-life learning or research, teaching, management, or a combination of these. Prerequisite: Junior or senior classification or approval of instructor.

485. DIRECTED STUDIES. Credit (1-6). Individually supervised research or advanced study on restricted area not covered in regular courses. Prerequisite: Junior or senior classification or approval of instructor.

489. SPECIAL TOPICS. Credit (1-4). Selected topics in a identified area of maritime studies. May be repeated for credit. Prerequisite: Junior or senior classification or approval of instructor.

491. RESEARCH IN MARITIME STUDIES. Credit 1 to 4. Research conducted under the direction of faculty member in Maritime Studies. May be repeated 2 times for credit. Please see academic advisor in department. Registration in multiple sections of this course is possible within a given semester provided that the per semester credit hour limit is not exceeded. Prerequisites: Junior or senior classification and approval of instructor.

### **Marketing (MKTG)**

321. MARKETING. (3-0). Credit 3. Institutions, processes, and problems involved in transferring goods from producers to consumers; economic and social aspects. Prerequisite: Junior or senior classification.

### **Mathematics (MATH)**

102. ALGEBRA. (3-0). Credit 3. (TCCNS MATH 1314). Sets, structure of number system. Absolute values, solution sets of equations of second and higher degree, systems of equations, and inequalities. Relations and functions, graphical representations, variation, progressions, mathematical induction, determinants.

106. PLANE AND SPHERICAL TRIGONOMETRY. (4-0). Credit 4. Definitions of trigonometric functions; evaluation of functions of special angles, fundamental relations; solution of triangles; trigonometric reductions; angular measure; functions of composite angles; logarithms, inverse trigonometric functions; trigonometric equations; basic ideas and formulas of spherical trigonometry; solution of spherical trigonometry; solution of spherical triangles, application to terrestrial and astronomical triangles.

141. BUSINESS MATHEMATICS I. (3-0). Credit 3. (TCCNS MATH 1324). Linear equations and applications, systems of linear equations, matrix algebra and applications, linear programming (graphical and simplex methods), probability and applications, statistics. Prerequisites: High school algebra I and II and geometry. Credit will not be given for more than one of MATH 141 and 166.

142. BUSINESS MATHEMATICS II. (3-0). Credit 3. (TCCNS MATH 1325). Derivatives, curve sketching and optimization, techniques of derivatives, logarithms and exponential functions with applications, integrals, techniques and applications of integrals, multivariate calculus. Prerequisites: High school algebra I and II and geometry or satisfactory performance on a qualifying examination. Credit will not be given for more than one of MATH 131, 142, 151 and 171.

150. FUNCTIONS, TRIGONOMETRY, AND LINEAR SYSTEMS. (3-2). Credit 4. (TCCNS MATH 2412) I, II, S Graphs, functions, college algebra and trigonometry, linear systems and vectors.

151. ENGINEERING MATHEMATICS I. (3-2). Credit 4. (TCCNS MATH 2413) I, II, S Rectangular coordinates, vectors, analytic geometry, functions, limits, derivatives of functions, applications, integration, computer algebra (Maple). Prerequisite: MATH 150 or equivalent. Credit will not be given for more than one of MATH 131, 142, 147, 151 and 171.

152. ENGINEERING MATHEMATICS II. (3-2). Credit 4. (TCCNS MATH 2414). Differentiation and integration techniques and their applications (area, volumes, work), improper integrals, approximate integration, analytic geometry, vectors, infinite series, power series, Taylor series, computer algebra (Maple). Prerequisite: MATH 151 or equivalent. Credit will not be given for more than one of MATH 152, 161 and 172.

161. ENGINEERING MATHEMATICS II. (3-0). Credit 3. Differentiation and integration techniques and their applications (area, volumes, work), improper integrals, approximate integration, analytic geometry, vectors, infinite series, power series, Taylor series. Prerequisite: MATH 151 or equivalent. Credit will not be given for more than one of MATH 152, 161 and 172.

166. TOPICS IN CONTEMPORARY MATHEMATICS II. (3-0). Credit 3. Finite mathematics, matrix theory, probability theory, game theory. Prerequisites: High school algebra I, algebra II and geometry. Credit will not be given for more than one of MATH 141 and 166.

251. ENGINEERING MATHEMATICS III. (3-0). Credit 3. Vector calculus, calculus of functions of several variables, partial derivatives, directional derivatives, gradient, multiple integration, line integrals, Stoke's theorems. Prerequisite: MATH 152 or 161 or equivalent.

285. DIRECTED STUDIES. Credit 1 or more. Special problems in mathematics not covered by any other course in the curriculum. Work may be in either theory or laboratory. Prerequisite: Approval of department head.

308. DIFFERENTIAL EQUATIONS. (3-0). Credit 3. Linear ordinary differential equations, solutions in series, solutions using Laplace transforms, systems of differential equations. Prerequisite: MATH 251 or equivalent. Junior or senior classification or approval of instructor.

485. DIRECTED STUDIES. Credit 1 or more. Special problems in mathematics not covered by any other course in the curriculum. Work may be in either theory or laboratory. Prerequisites: Approval of department head. Junior or senior classification or approval of instructor.

489. SPECIAL TOPICS. Credit (1-4). Selected topics in a identified area of mathematics. May be repeated for credit. Prerequisite: Junior or senior classification or approval of instructor.

### **Mechanical Engineering (MEEN)**

363. DYNAMICS AND VIBRATION. (2-2). Credit 3. Application of Newtonian and energy methods to model dynamic systems (particles and rigid bodies) with ordinary differential equations; solutions of models using analytical and numerical approaches; interpreting solutions; linear vibrations. Prerequisites: ENGR 211, MATH 308, MASE 301. Enrollment in MASE major degree sequence. Junior or senior classification or approval of instructor.

### **Meteorology (METR)**

302. WEATHER REPORTS AND FORECASTING. (3-0). Credit 3. Basic description of atmospheric characteristics and processes relevant to the understanding of weather patterns and atmospheric principles. Prerequisite: Junior or senior classification or approval of instructor.

### **Naval Science (NVSC)**

101. INTRODUCTION TO NAVAL SCIENCE. (2-1). Credit 2. Seapower and the naval service; mission, organization, regulations, and broad warfare components of the Navy; overview of officer and enlisted rank and rating structures, procurement and recruitment, training and education, promotion and advancement, and retirement policies. Basic tenets of naval courtesy and customs, discipline, naval leadership, and ship's nomenclature. Major challenges facing naval officers; areas of equal opportunity and drug/alcohol abuse. Prerequisite: Approval of department head.

102. LEADERSHIP AND MANAGEMENT I. (3-1). Credit 3. Principles of leadership and management and their application to the duties and responsibilities of a junior naval officer; management theory, professional responsibility and human resource system programs; skills in leadership, goal setting and communication developed through guided participation in case studies and situational problems. Prerequisite: NVSC 101 or approval of department head.

200. NAVAL SCIENCE FOR THE MERCHANT MARINE OFFICER. (3-0). Credit 3. Organization of the U.S. Navy (including the U.S. Navy Control of Shipping Organization) with discussion of the Merchant Marine Naval Reserve commission in order to provide a sound basis for liaison between the U.S. Navy and the Merchant Marine. Seapower will be analyzed and naval damage control procedures and underway replenishment procedures will be introduced.

203. NAVAL SHIP SYSTEMS I: ENGINEERING. (3-1). Credit 3. Study of engineering concepts and their application in U.S. Naval vessels: basic ship design, hydrodynamic forces, fluid dynamics, stability, propulsion, closed thermodynamic systems, electrical systems, shipboard power generation and distribution, shipboard safety, organization and firefighting. Prerequisite: NVSC 101 or approval of department head.

285. DIRECTED STUDIES. Credit 1-3. Directed study in problems in the field of naval science not covered by other courses in department. Prerequisites: Senior classification and approval of department head.

302. NAVIGATION AND NAVAL OPERATIONS II. (2-2). Credit 3. Relative motion, formation tactics, ship maneuvering behavior and characteristics, applied aspects of ship handling, afloat communications and ship employment; naval warfare, operations concepts, command and control, and joint warfare; review and analysis of case studies involving moral, ethical and leadership issues. Prerequisites: NVSC 301. Junior or senior classification or approval of instructor.

401. NAVAL SHIP SYSTEMS II. (3-0). Credit 3. Types and purpose of major weapons systems and platforms of the U.S. Naval forces; theory and operational principles of radar, sonar and communication circuits; fire control problem geometry, principles of ballistics, propulsion, launching and guidance of weapons; principles of electronic warfare and nuclear weapons. Prerequisites: NVSC 102 or approval of department head. Junior or senior classification or approval of instructor.

402. LEADERSHIP AND ETHICS. (3-1). Credit 3. Theoretical concepts of Western moral traditions and ethical philosophy; topics include leadership, values, military ethics, Just War Theory, Uniform Code of Military Justice and Naval regulations; examination of the ethical foundation for the development of leadership and communications skills; should be taken the semester of graduation. Prerequisites: NVSC 102 or approval of department head. Junior or senior classification or approval of instructor.

485. DIRECTED STUDIES. Credit 1-3. Directed study in problems in the field of naval science not covered by other courses in department. Prerequisites: Senior classification and approval of department head.

### **Ocean Engineering (OCEN)**

300. OCEAN ENGINEERING WAVE MECHANICS. (3-0). Credit 3. Physical and mathematical fundamentals of ocean wave behavior. Mechanics of wave motion. Use of statistics and probability to develop design wave criteria. Prerequisite: CVEN 311. Enrollment in MASE major degree sequence. Junior or senior classification or approval of instructor.

400. BASIC COASTAL ENGINEERING. (3-0). Credit 3. Mechanics of wave motion. Wave refraction, diffraction, and reflection. Wave forecasting. Shore processes. Planning of coastal engineering projects. Design of seawalls, breakwaters, and fixed offshore installations. Off-shore pipelines. dredging. control of oil spills in estuaries and at sea. Prerequisites: CVEN 311; OCEN 300. Junior or senior classification or approval of instructor.

462. HYDROMECHANICS. (3-0). Credit 3. Kinematics of fluids, incompressible, irrotational and turbulent flow. Navier-Stokes equations, flow of viscous fluids. Prerequisites: CVEN 311; MATH 308. Junior or senior classification or approval of instructor.

## **Oceanography (OCNG)**

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251. OCEANOGRAPHY. (3-0). Credit 3. Overview of the ocean environment; interrelation of the subdisciplines of ocean sciences; importance of the oceans to human beings; human impact on the oceans. Prerequisite: Concurrent registration in ONCG 252 if necessary for meeting the 8 credit hour science core curriculum requirement.

252. OCEANOGRAPHY LABORATORY. (0-3). Credit 1. Practical laboratory experiments and exercises demonstrating principles of ocean sciences. May include weekend field trips. Prerequisite: OCNG 251 or concurrent registration.

285. DIRECTED STUDIES. Credit 1-4. Individually supervised research or advanced study on restricted area not covered in regular courses.

401. INTRODUCTION TO OCEANOGRAPHY. (3-0). Credit 3. Quantitative survey of interdisciplinary relationship between biological, chemical, geological, geophysical, and physical aspects of the ocean. Prerequisites: MATH 131 or equivalent and CHEM 101. Junior or senior classification or approval of instructor.

420. INTRODUCTION TO BIOLOGICAL OCEANOGRAPHY. (3-0). Credit 3. Biological aspects of the marine environment. Use of the sea and problems of productivity, pollution, fouling and boring organisms. Prerequisites: BIOL 112. Junior or senior classification or approval of instructor.

485. DIRECTED STUDIES. Credit 1-4. Individually supervised research or advanced study on restricted area not covered in regular courses. Prerequisite: Junior or senior classification or approval of instructor.

## **Ocean and Coastal Resources (OCRE)**

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491. RESEARCH IN OCEAN AND COASTAL RESOURCES. Credit 1 to 4. Research conducted under the direction of faculty member in Ocean and Coastal Resources. May be repeated 2 times for credit. Please see academic advisor in department. Registration in multiple sections of this course is possible within a given semester provided that the per semester credit hour limit is not exceeded. Prerequisites: Junior or senior classification and approval of instructor.

## **Philosophy (PHIL)**

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240. INTRODUCTION TO LOGIC. (3-0). Credit 3. (TCCNS PHIL 2303). Methods and principles used to distinguish between correct and incorrect reasoning; uses of language, informal and formal fallacies, Venn diagrams, truth-tables, symbolic notation, formal deductive proof, induction.

314. ENVIRONMENTAL ETHICS. (3-0). Credit 3. Moral basis of duties to preserve or protect plants, animals and environmental systems; foundations of environmental law and policy; the idea of nature in philosophy; critique of social and economic analyses of environmental values. Prerequisite: Sophomore classification or approval of instructor.

381. ETHICAL THEORY. (3-0). Credit 3. Values and conduct such as moral relativism, self-interest, utilitarianism, rules, nature of valuation, ethical language and argumentation. Prerequisite: 3 hours of Philosophy other than PHIL 240.

## **Physics (PHYS)**

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201. COLLEGE PHYSICS. (3-3). Credit 4. (TCCNS PHYS 1401). Fundamentals of classical mechanics, heat, and sound. Prerequisite: MATH 103 or equivalent.

202. COLLEGE PHYSICS. (3-3). Credit 4. (TCCNS PHYS 1402). Continuation of PHYS 201. Fundamentals of classical electricity and light; introduction to contemporary physics. Prerequisite: PHYS 201.

208. ELECTRICITY AND OPTICS. (3-3). Credit 4. Continuation of PHYS 218. Electricity, magnetism and introduction to optics. Primarily for engineering students. Prerequisites: PHYS 218; MATH 152 or 172 or registration therein.

218. MECHANICS. (3-3). Credit 4. (TCCNS PHYS 2545). Mechanics for students in science and engineering. Prerequisite: MATH 151 or concurrent registration.

219. ELECTRICITY. (3-3). Credit 4. Continuation of PHYS 218. (TCCNS PHYS 2426). Electricity, magnetism and introduction to optics. Prerequisites: MATH 161 or equivalent; PHYS 218.

285. DIRECTED STUDIES. Credit 1-4. Special work in laboratory or theory to meet individual requirements in cases not covered by regular curriculum. Prerequisite: Approval of department head.

485. DIRECTED STUDIES. Credit 1-4. Special work in laboratory or theory to meet individual requirements in cases not covered by regular curriculum. Prerequisites: Approval of department head. Junior or senior classification or approval of instructor.

## **Political Science (POLS)**

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206. AMERICAN NATIONAL GOVERNMENT. (3-0). Credit 3. (TCCNS GOVT 2305). Survey of American national government, politics, and constitutional development.

207. STATE AND LOCAL GOVERNMENT. (3-0). Credit 3. (TCCNS GOVT 2306). Survey of state and local government and politics with special reference to the constitution and politics of Texas.

331. INTRODUCTION TO WORLD POLITICS. (3-0). Credit 3. Analysis of contemporary world from point of view of nation-state; political problems, factors involved in foreign policies and relations of nations. Prerequisites: POLS 206 or approval of department head. Junior or senior classification or approval of instructor.

340. INTRODUCTION TO PUBLIC ADMINISTRATION. (3-0). Credit 3. American public administration; development of public service; theories of organization and management, executive leadership and policy formation, bureaucratic politics, administrative accountability, and personnel practices. Prerequisites: POLS 206 or approval of department head. Junior or senior classification or approval of instructor.

347. POLITICS OF ENERGY AND THE ENVIRONMENT. (3-0). Credit 3. U.S. energy and environmental problems and politics and the political, legal, and institutional factors influencing their development and implementation. Prerequisites: POLS 206 or approval of department head. Junior or senior classification or approval of instructor.

366. POLITICAL CONFLICTS OF THE MIDDLE EAST. (3-0). Credit 3. This course seeks to provide students with an understanding of the internal, regional and international politics of the Middle East; with a focus on selected political conflicts and the influence of the region's cultures, religions and natural resources, as well as outside political forces. Prerequisites: POLS 206. Junior or senior classification or approval of instructor.

### **Psychology (PSYC)**

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107. INTRODUCTION TO PSYCHOLOGY. (3-0). Credit 3. (TCCNS PSYC 2301). Introductory course dealing with elementary principles of human behavior.

306. ABNORMAL PSYCHOLOGY. (3-0) Credit 3. Survey of behavior pathology; functional and organic psychoses, psychoneurosis, character disorders, psychophysiological disorders, alcohol and drug addiction and mental retardation; therapeutic and diagnostic methods. Prerequisites: PSYC 203 and 204. Junior or senior classification or approval of instructor.

### **Recreation, Park and Tourism Sciences (RPTS)**

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301. LEISURE AND OUTDOOR RECREATION. (3-0) Credit 3. Introduction to the fundamental concepts of leisure and outdoor recreation and how they influence us as individuals, groups and society; critical factors such as self, family, lifespan, ecology, health, work patterns, communications, diversity, popular culture, and consumption are studied in relationship to past, present and future leisure patterns. Prerequisite: Junior or senior classification or approval of instructor.

340. RECREATION, PARKS AND DIVERSE POPULATIONS. (3-0). Credit 3. Review of major judicial decisions and civil rights laws on provision and distribution of recreation and park services in society; the influence of age, disability, ethnicity, national origin, race, religion and gender on individual's preferences for particular recreation opportunities and experiences; implications of individual differences for the provision of recreation services. Prerequisite: Junior or senior classification or approval of instructor.

### **Spanish (SPAN)**

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101. BEGINNING SPANISH I. (3-2). Credit 4. (TCCNS SPAN 1411). Elementary language study with oral, written and reading practice. Preparation for conversation. Part of class preparation will be done in language laboratory. Students with prior instruction are required to take the Spanish Placement Test before enrolling for the first time in college Spanish course.

102. BEGINNING SPANISH II. (3-2). Credit 4. (TCCNS SPAN 1412). Continuation of SPAN 101. Part of class preparation will be done in language laboratory. Prerequisite: SPAN 101. Students with prior instruction in Spanish are required to take the Spanish Placement Test before enrolling the first time in a college Spanish course.

201. INTERMEDIATE SPANISH I. (3-0). Credit 3. (TCCNS SPAN 2311). Readings of average difficulty. Review of grammar; practice in conversation and composition. Prerequisite: SPAN 102. Students with prior instruction in Spanish are required to take the Spanish Placement Test before enrolling for the first time in a college Spanish course.

202. INTERMEDIATE SPANISH II. (3-0). Credit 3. (TCCNS SPAN 2312). Continuation of SPAN 201 with more advanced material. Prerequisite: SPAN 201. Students with prior instruction in Spanish are required to take the Spanish Placement Test before enrolling for the first time in a college Spanish course.

### **Statistics (STAT)**

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201. ELEMENTARY STATISTICAL INFERENCE. (3-0). (TCCNS STAT 1342). Credit 3. Data collection, tabulation and presentation. Elementary description of the tools of statistical inference; probability, sampling and hypothesis testing. Applications of statistical techniques to practical problems. May not be taken for credit after any other course in statistics or BANA 303 has been taken.

303. STATISTICAL METHODS. (3-0). Credit 3. Intended for undergraduate students in the social sciences. Introduction to concepts of random sampling and statistical inference, estimation and testing hypotheses of means and variances, analysis of variance, regression analysis, chi-square tests. Credit will not be allowed for more than one of STAT 301, 302 or 303. Prerequisite: MATH 141 or 166 or equivalent.

### **Urban Planning (PLAN)**

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641. PROBLEMS OF ENVIRONMENTAL PLANNING ADMINISTRATION. (3-0). Credit 3. State and federal legislation pertaining to environmental consumer protective aspects of urban planning; review of administrative procedures; major judicial decisions.

### **Veterinary Pathobiology (VTPB)**

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409. INTRODUCTION TO IMMUNOLOGY. (3-0) Credit 3. Diverse concepts relative to immunologic mechanisms inherent to domestic and laboratory animals. Prerequisites: VTPB 405 or junior or senior classification or approval of instructor.

### **Wildlife and Fisheries Science (WFSC)**

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420. ECOLOGY FOR TEACHERS. (3-0). Credit 3. Lectures, discussions, and readings in principles of ecology and their application in today's problems in environmental conservation. Prerequisites: Junior or senior classification or approval of instructor.