CME 314 Chemical Engineering Thermodynamics II
Equilibrium and the Phase Rule; VLE model and K-value correlations; chemical potential and phase equilibria for ideal and non-ideal solutions; heat effects and property changes on mixing; application of equilibria to chemical reactions; Gibbs-Duhem and chemical potential for reacting systems; liquid/liquid, liquid/solid, solid/vapor, and liquid/vapor equilibria; adsorption and osmotic equilibria; steady state flow and irreversible processes. Steam power plants, internal combustion and jet engines, refrigeration cycle and vapor compression, liquefaction processes.
Prerequisite: CME 304
3 credits

CME 318 Chemical Engineering Fluid Mechanics
Introduces fluid mechanics. Dynamics of fluids in motion; laminar and turbulent flow, Bernoulli’s equation, friction in conduits; flow through fixed and fluidized beds. Study of pump and compressor performance and fluid metering devices. Includes introduction to microfluidics.
Prerequisites: AMS 261 (or MAT 203 or 205); PHY 131 (or 125 or 141)
3 credits

CME 320 Chemical Engineering Laboratory II: Chemical and Molecular Engineering
Introduction and operation of a continuous unit handling of air-sensitive/water-sensitive materials, sonolysis and thermal techniques for materials synthesis, preparation of polymer nano-composites and nano-sized materials.
Prerequisite: CME 310
2 credits

CME 322 Chemical Engineering Heat and Mass Transfer
Heat transfer by conduction, principles of heat flow in fluids with and without phase change, heat transfer by radiation, heat-exchange equipment. Principles and theory of diffusion, mass transfer between phases, distillation, leaching and extraction, fixed-bed membrane separation, crystallization.
Prerequisite: CME 318
3 credits

CME 323 Reaction Engineering and Chemical Kinetics
Prerequisites: CME major, U3 standing; CME 312 and 314
3 credits

CME 327 Molecular Modeling for Chemical Engineers
Molecular modeling techniques and simulation of complex chemical processes. Use of Monte Carlo methods and Molecular Dynamics methods. Emphasis on the simulation and modeling of biopolymeric systems.
Prerequisites: PHY 132; ESG 111 or MEC 111; AMS 261 or MAT 203; AMS 361 or MAT 303
2 credits

CME 401 Separation Technologies I
Fundamentals of separations. Introduction to standard classical and advanced separation methods and their relative merits and limitations. Distillation, crystallization, filtration, centrifugation, absorption, and stripping methods. Includes fundamentals of chromatography.
Prerequisites: CME major, U3 or U4 standing; CME 325
3 credits

CME 402 Separation Technologies II
Prerequisite: CME 401
3 credits

CME 410 Chemical Engineering Laboratory III: Instrumentation, Material Design, and Characterization
Synthesis of unsupported nanosized metal and nano-sized metal in a polymer. Characterization of synthesized nano materials by modern spectroscopic techniques (TEM, XRD, FTIR, and XPS). Data analysis and interpretation.
Prerequisite: CME 320
2 credits

CME 420 Chemical Engineering Laboratory IV: Directed Research
Directed laboratory research or internship in industry. Includes original research project selection and a formal report preparation.
Prerequisite: CME 410
3 credits

CME 440 Process Engineering Design I
Classical methods of chemical process engineering, advanced mathematical techniques, and computer software for efficient and accurate process design and development. Mini-project design.
Prerequisites: CME major; U3 or U4 standing; CME 320 and 327
3 credits

CME 441 Process Engineering Design II
Major design project: a review of engineering design principles; engineering economics, economic evaluation, capital cost estimation; process optimization; profitability analysis for efficient and accurate process design.
Prerequisites: CME 401 and 440
3 credits

CSE 101 Introduction to Computers and Information Technologies
An introduction to the basics of personal computing and information technologies intended primarily for students majoring in humanities, social and behavioral sciences, or business management. Topics include principles of personal (single-user) computer systems; office automation; and information in a modern, networked (multi-user) computing environment. Emphasis is on conceptual understanding of personal computing rather than use of specific hardware or software. Required participation in computer laboratories. May not be taken for credit in addition to EST 100 or any CSE or ISE course.
Prerequisite: Satisfaction of entry skill in mathematics requirement (Skill 1) or satisfactory completion of D.E.C. C
3 credits

CSE 102 Introduction to Web Design and Programming
An introduction to the design of Web pages, specifically the development of browser and device independent HTML, with an emphasis on the XHTML standard. Includes the use of style sheets (CSS) and tools for page layout and verification. HTML is presented as a mark-up language, exploring the rules of HTML elements and attributes. Students learn the separation of page viewing information from the HTML through CSS style sheets as well as the use of block layout without using HTML tables. Addresses how to display properties including text, color, image, and graphic elements as well as approaches to HTML validation and techniques.
Advisory Prerequisite: CSE 101 or basic computer skills
2 credits

CSE 110 Introduction to Computer Science
An introduction to fundamentals of computer science. Topics covered include algorithmic design; problem-solving techniques for computer programming; fundamentals of digital logic and computer organization; the role of the operating system; introductory programming methodology including variables, assignment statements, control statements, and subroutines (methods); programming paradigms; the compilation process; theoretical limits of computation; and social and ethical issues. Intended for students who have not taken any college-level computer science course containing programming assignments in a high-level programming language.
Prerequisite: Level 3 or higher on the mathematics placement examination
3 credits

CSE 113-C Foundations of Computer Science I
A rigorous introduction to the conceptual and mathematical foundations of computer science with special emphasis on recursion and its applications in functional programming as well as reasoning techniques based on propositional logic and mathematical induction.
Prerequisite: One MAT course that satisfies D.E.C. category C or score of level 4 on the mathematics placement examination
3 credits

CSE 114 Computer Science I
An introduction to procedural and object-oriented programming methodology. Topics include program structure, conditional and iterative programming, procedures, arrays and records, object classes, encapsulation, information hiding, inheritance, polymorphism, file I/O, and exceptions. Software debugging and testing techniques are emphasized including an introduction to formal verification methods. Includes required laboratory.
Prerequisite: one of the following: CSE 110 or CSE 130 or ESE 124 or ESG 111 or MEC 111 or MEC 112
3 credits

CSE 125 Computer Science and Sculpture
A multidisciplinary class that surveys how computer science and computer technology are used in sculpture. Case studies with slides, videos, and software demonstrations illustrate a range of approaches of sculptors incorporating computers in their creative process. Various state-of-the-art fabrication technologies are studied (including campus specialists). Mathematical foundations are emphasized so that students can recognize them when analyzing sculpture and choose the correct tool when designing. These ideas are reinforced with projects using a range of available software and inexpensive construction materials such as paper, cardboard, and foamcore.
Prerequisite: Level 3 on Math Placement Exam or MAP 103
3 credits

CSE 130 Introduction to Programming in C
Introduces programming concepts using the C language. Variables, data types, and expressions, Conditional and iterative statements, functions, and structures. Pointers, arrays, and strings. Scope of variables and program organization. Includes program-

http://www.stonybrook.edu/ugbulletin 351

As printed January 2005

COURSE DESCRIPTIONS
COURSE DESCRIPTIONS

CSE 150 Foundations of Computer Science: Honors
Introduction to the logical and mathematical foundations of computer science for computer science honors students. Topics include functions, relations, and sets; recursion and functional programming; basic logic; and mathematical induction and other proof techniques. Prerequisites: One MAT course that satisfies DEC category 1 or score of level 4 on the math placement exam; admission to the Computer Science Honors Program. 4 credits

CSE 160 Computer Science A: Honors
First part of a two-semester sequence, CSE 160 and CSE 260. Emphasizes a high-level, object-oriented approach to the construction of software. Focus on software engineering issues such as programming style, modularity, and code reusability. Includes the way in which software tools can be used to aid the program development process. First considers the construction of small programs, continues by treating the design and implementation of program modules, and culminates in an introduction to object-oriented design techniques suitable for larger programs. Prerequisites: CSE 110 or 114 or MEC 112 or ESG 111. 3 credits

CSE 213 Foundations of Computer Science II
A continuation of CSE 113 focusing on the descriptive formalisms relevant to computing, including set theory and its application to quantifiers, relations and graphs, combinatorics, and finite state machines. Prerequisite: CSE 113. 3 credits

CSE 214 Computer Science II
An extension of programming methodology to data storage and manipulation on complex data sets. Topics include: programming and applications of data structures; stacks, queues, lists, binary trees, heaps, priority queues, balanced trees, and graphs. Recursive programming is heavily utilized. Fundamental sorting and searching algorithms are examined along with informal efficiency comparisons. Prerequisite: C or higher in CSE 114. 3 credits

CSE 219 Computer Science III
Development of the basic concepts and techniques learned in CSE 114 Computer Science I and CSE 214 Computer Science II into practical programming skills that include a systematic approach to program design, coding, testing, and debugging. Application of these skills to the construction of robust programs of 1,000 to 2,000 lines of source code. Use of programming environments and tools to aid in the software development process. Prerequisite: C or higher in CSE 214. 3 credits

CSE 220 Computer Organization
Explores the physical structure of a computer; internal representation of information; processor organization, instruction cycle, and memory hierarchy. Introduces assembly/machine language programming and its relation to execution of high-level language programs. Elementary digital logic design and its application to design of arithmetic and logic unit, and simple data paths. Input and output devices and their interface with processor and memory. Prerequisite: C or higher in CSE 214. 3 credits

CSE 230 Intermediate Programming in C and C++
Intermediate programming concepts using the C language in a UNIX environment. Files, systems calls, stream I/O, the C preprocessor, bitwise operations, the use of makefiles, advanced formatting of input and output, conversions. Introduction to object-oriented programming using C++; classes, objects, inheritance, aggregation, and overloading. Suitable for all majors. Prerequisite: CSE 130 or ESE 124 or ESG 111 or MEC 112. 3 credits

CSE 260 Computer Science B: Honors
Second part of a two-semester sequence, CSE 160 and CSE 260. Further development of the object-oriented design strategies presented in CSE 160. Continues with introductions to event-driven programming, graphical user interfaces, and design patterns. Includes an extended design and programming project. Prerequisite: CSE 160. 4 credits

CSE 300 Writing in Computer Science
See requirements for the major in Computer Science, upper-division writing course. Prerequisites: WRT 102; CSE major; U3 or U4 standing. 1 credit, S/U grading

CSE 301-H History of Computing
A study of the history of computational devices from the early ages through the end of the 20th century. Topics include needs for computation in ancient times, development of computational models and devices through the 1800’s and early 1900’s, World War II and the development of the first modern computer, and early uses in business. Creation of programming languages and the microchip. Societal changes in computer usage due to the microcomputer, emergence of the Internet, the World Wide Web, and mobile computing. Legal and social impacts of modern computing. Cannot be used as a technical elective for the CSE or ISE major, or the CSE minor. Prerequisite: U2 standing or higher. Advisory Prerequisite: one course in computing. 3 credits

CSE 303 Introduction to the Theory of Computation
An introduction to the abstract notions encountered in machine computation. Topics include finite automata, regular expressions, and formal languages, with emphasis on regular and context-free grammars. Questions relating to what can and cannot be done by machines are covered by considering various models of computation, including Turing machines, recursive functions, and universal machines. Prerequisites: CSE 213 and 214. 3 credits

CSE 304 Compiler Design
Topics studied include formal description of programming languages, lexical analysis, syntax analysis, symbol tables and memory allocation, code generation, and interpreters. Students undertake a semester project that includes the design and implementation of a compiler for a language chosen by the instructor. Prerequisites: CSE 219, 220, and 303. 3 credits

CSE 305 Principles of Database Systems
The design of database management systems to obtain consistency, integrity, and availability of data. Conceptual models and schemas of data: relational, hierarchical, and network. Students undertake a seminar project that includes the design and implementation of a database system. This course is offered as both CSE 305 and ISE 305. Prerequisites: CSE 219 and 220. 3 credits

CSE 306 Operating Systems
Students are introduced to the structure of modern operating systems. Topics include virtual memory, resource allocation strategies, concurrency, and protection. The design and implementation of a simple operating system are performed. Prerequisites: CSE 219; CSE 220 or ESE 380. 3 credits

CSE 307 Principles of Programming Languages
Prerequisites: One MAT course that satisfies DEC category 1 or score of level 4 on the math placement exam; admission to the Computer Science Honors Program. 4 credits

CSE 214 Software Engineering
Introduces the basic concepts and modern tools and techniques of software engineering. Emphasizes the development of reliable and maintainable software via system requirements and specifications, software design methodologies including object-oriented design, implementation, integration, and testing; software project management; life-cycle documentation; software maintenance; and consideration of human factor issues. This course is offered as both CSE 308 and ISE 308. Prerequisite: CSE 219. 3 credits

CSE 310 Data Communication and Networks
Study of communication networks. Local area networks (LAN), integrated voice and data systems (IVDS), and wide area networks (WAN). Their topologies: bus, token passing, tree, point to point. Protocols, speed, and distance limitations: RS232, TCP/IP, MAP/TOP, ONS, OSI. Network design and management will be studied in various environments. May not be taken by students with credit for CSE/ESE 346. This course is offered as both CSE 310 and ISE 310. Prerequisites: CSE 219 and 220. 3 credits

CSE 315 Database Transaction Processing Systems
Theory and practice of design for applications involving transactional access to a database. Transaction design, schema design, restart and recovery, journaling, concurrency control, distributed databases. Student groups perform design and implementation of significant database application. This course is offered as both CSE 315 and ISE 315. Prerequisite: CSE/ISE 305. 3 credits

CSE 320 Computer Architecture
Covers the detailed physical implementation techniques for floating-point data path, advanced pipeline control, multi-level memory hierarchy, I/O and disk subsystems, architectural support for operating systems and programming languages, and multiprocessor/multicomputer architectures. Prerequisite: CSE 220. 3 credits

CSE 326 Digital Image Processing
Covers digital fundamentals, image transforms, image enhancement, image restoration, image compression, segmentation, representation and description.
COURSE DESCRIPTIONS

CSE 327 Computer Vision
Introduces fundamental concepts, algorithms, and computational techniques in visual information processing. Covers image formation, image sensing, binary image analysis, image segmentation, Fourier image analysis, edge detection, reflectance map, photometric stereo, basic photogrammetry, stereo, pattern classification, extended Gaussian images, and the study of human visual system from an information processing point of view. This course is offered as both CSE 327 and ESE 358.
Prerequisite for CSE majors: CSE 114
Prerequisites for ESE and ECE majors: ESE 212 and ESE 271
3 credits

CSE 328 Fundamentals of Computer Graphics
An introduction to computer graphics including graphics application programming; data structures for graphics; representing and specifying color; fundamental mathematical and software concepts for calligraphic and raster displays; two-dimensional, geometric transformations; introduction to three-dimensions, graphics standards; and input devices, interaction handling, and user-computer interface.
Prerequisites: CSE 219 and 220; permission of instructor
3 credits

CSE 332 Introduction to Scientific Visualization
Visualization of scientific, engineering, medical, and business data sets. Mechanisms to acquire sampled, computed, or synthetic data and methods to transform symbolic into the visual. Topics include classic visualization process; visual perception; volume and surface visualization; methods for visualizing sampled, simulated, and geometric objects; and visualization systems. Emphasis on applications and case studies. This course is offered as both CSE 332 and ISE 332.
Prerequisites: CSE 219; MAT 211 or AMS 210
3 credits

CSE 333 User Interface Development
Survey of user interface systems, including topics such as command language, windowing, multiple input/output devices, architecture of user interface management systems, and tool kits for designing user interfaces. Applications may include human factors, standards, or visual languages. Students participate in a project involving the design and implementation of a user interface system. This course is offered as both CSE 333 and ISE 333.
Prerequisite: CSE 219
Advisory prerequisite: PST 103
3 credits

CSE 334 Introduction to Multimedia Systems
Survey of technologies available for user interfaces. Discussion of hypertext; voice, music, and video together with tools and models for capturing, editing, presenting, and combining them. Capabilities and characteristics of a range of peripheral devices including devices based on posture, gesture, head movement, and touch. Case studies of academic and commercial multimedia systems including virtual reality systems. Students participate in laboratory exercises and build a multimedia project. This course is offered as both CSE 334 and ISE 334.
Prerequisites: CSE or ISE major; U3 or U4 standing
3 credits

CSE 336 Internet Programming
Introduces the design and development of software for Internet commerce. Topics include extended markup language, servlets, cookies, sessions, computer media types, Web protocols, digital signatures, certificates, encryption, and the wireless Internet. This course is offered as both CSE 336 and ESE 336.
Prerequisite: CSE 219
3 credits

CSE 346 Computer Communications
Basic principles of computer communications. Introduction to performance evaluation of protocols. Protocols covered include those for local, metropolitan, and wide area networks. Introduction to routing, high-speed packet switching, circuit switching, and optical data transport. Other topics include TCP/IP, Internet, Web server design, network security, and grid computing. Not for credit in addition to CSE/ISE 310. This course is offered as both CSE 346 and ESE 346.
Prerequisites for CSE majors: AMS 310 or 311
Pre-or corequisite for CSE majors: AMS 310 or AMS 311
Pre-requisites for CSE or ECE majors: ESE 306
Pre-or corequisite for CSE majors: AMS 310 or 311
3 credits

CSE 352 Artificial Intelligence
Topics covered include critique of artificial intelligence research; state-space problem representations and search algorithms; game-playing programs; theorem-proving programs; programs for the study and simulation of cognitive processes and pattern recognition. Further topics in current research as time permits.
Prerequisites: CSE 219 and 303
3 credits

CSE 355 Computational Geometry
The design and analysis of efficient algorithms to solve geometric problems that arise in computer graphics, robotics, geographical information systems, manufacturing, and optimization. Topics include convex hulls, triangulation, Voronoi diagrams, visibility, intersection, robot motion planning, and arrangements. This course is offered as both AMS 345 and CSE 355.
Prerequisite for AMS majors: AMS 301; programming knowledge of C or C++ or Java
3 credits

CSE 364 Advanced Multimedia Techniques
Digital media production techniques for high-bandwidth applications such as electronic magazine illustration, broadcast television, and motion picture special effects. Students explore techniques such as 3D modeling and character animation, video composting, and high-resolution image processing in a state-of-the-art multimedia computing laboratory. High-capacity multimedia storage, high-speed networks, and new technologies such as DVD, HDTV, and broadband will be reviewed. This course is offered as both CSE 364 and ISE 364.
Prerequisites: CSE/ISE 334 and permission of the instructor
3 credits

CSE 366 Introduction to Virtual Reality
An introduction to the practical issues in the design and implementation of virtual environments. Topics covered include the fundamentals of systems requirements, transformations, user-interaction models, human vision models, tracking systems, input/output devices and techniques, and augmented reality. The topics covered are explained through the use of real-life applications of virtual-reality systems in engineering, science, and medicine.
Prerequisites: CSE 328, CSE/ISE 332, 333
3 credits

CSE 370 Wireless and Mobile Networking
Prerequisites: CSE 310 and 346
3 credits

CSE 371 Logic
A survey of the logical foundations of mathematics: development of propositional calculus and quantification theory, the notions of a proof and of a model, the completeness theorem, Gödel’s incompleteness theorem. This course is offered as both CSE 371 and MAT 371.
Pre-or Corequisite: MAT 200 or CSE 213
3 credits

CSE 373 Analysis of Algorithms
Mathematical analysis of a variety of computer algorithms including searching, sorting, matrix multiplication, fast Fourier transform, and graph algorithms. Time and space complexity. Upper-bound, lower-bound, and average-case analysis. Introduction to NP completeness. Some machine computation is required for the implementation and comparison of algorithms. This course is offered as AMS 375, CSE 375, and MAT 375.
Prerequisites: MAT 211 or AMS 210; CSE 214
5 credits

CSE 375 Concurrency
The concurrent execution of asynchronous processes in the abstract using state diagrams and a related language. The concurrent aspects of Java are discussed as a practical implementation of these issues and program logic is introduced to describe them formally. Examples are drawn from operating systems, database systems, and communication systems.
Prerequisites: CSE 305 or 306 or ESE 333
5 credits

CSE 376 Advanced Systems Programming in UNIX/C
Focuses on several aspects of producing commercial-grade system software: reliability, portability, security, and survivability. Uses Unix and C, heavily used in industry when developing systems and embedded systems code. Emphasizes techniques and tools to produce reliable, secure, and highly portable code. Requires substantial programming as well as a course project.
Prerequisite: CSE 214 or 230
3 credits

CSE 390, 391, 392, 393, 394 Special Topics in Computer Science
A lecture or seminar course on a current topic in computer science. Supplement to this Bulletin contains specific description when course is offered. May be repeated for credit as the topic changes, but cannot be used more than twice to satisfy CSE major requirements.
Prerequisites: CSE or ISE major; U3 or U4 standing
3 credits per course

CSE 408 Network Security
Principles and practices of computer network security. Cryptography, authentication protocols, digital signatures, IP/E-commerce security, VPNs, firewalls, and network intrusion detection.
Prerequisites: CSE/ISE 310 or CSE/ISE 346
3 credits

CSE 409 Computer System Security
Principles and practices of computer system security. Operating system security, authentication and access control, capabilities, information flow, program security, database security, cryptographic key management, auditing, assurance, vulnerability analysis and intrusion detection.
Prerequisites: CSE 306 or 376 or ESE 333
3 credits

http://www.stonybrook.edu/ugbulletin 353

As printed January 2005
CSE 495-496 Senior Honors Research Program
Project I, II
A two-semester research project carried out under the supervision of a computer science faculty member. Students must submit a written project report and make a presentation to the department at the year-end Honors Project Colloquium. Students who enroll in CSE 495 must complete CSE 496 in the subsequent semester and receive only one grade upon completion of the sequence.
Prerequisite to CSE 495: Admission to the Computer Science Honors Program
Prerequisite to CSE 496: CSE 495
3 credits per course

ECO Economics

ECO 100-F Economics for Social Studies Teachers
An introduction to the principles of micro- and macroeconomics for students planning to become social studies teachers. The course will focus on economic concepts and reasoning with the goal of teaching prospective teachers how to apply these ideas to important public policy issues. Not for economics major credit.
Prerequisite: Admission to the secondary teacher education program in social studies
3 credits

ECO 108-F Introduction to Economics
An introduction to economic analysis. Microeconomics (the study of individual, firm, industry, and market behavior) and macroeconomics (the study of the determination of national income, employment, and inflation).
Prerequisite: C or higher in MAT 122 or MAT 123 or AMS 151 or level 4 on the mathematics placement examination
4 credits

ECO 303-F Intermediate Microeconomic Theory
Analytical study of the behavior of fundamental economic units (consumer and the firm) and their implications for the production and distribution of goods and services. Emphasis on the use of economic theory to provide explanations of observed phenomena, including the analytical derivation of empirically verifiable propositions.
Prerequisites: C or higher in ECO 108; C or higher in MAT 122 or MAT 123 or AMS 151 or placement level 4 on the mathematics placement examination
4 credits

ECO 305-F Intermediate Macroeconomic Theory
The theory of national income determination, employment, distribution, price levels, inflation, and growth. Keynesian and classical models of the different implications of monetary and fiscal policy.
Prerequisites: C or higher in ECO 108; C or higher in MAT 122 or MAT 123 or AMS 151 or placement level 4 on the mathematics placement examination
4 credits

ECO 310 Basic Computational Methods in Economics
A first course in the computational and graphical techniques for finding numerical solutions to the economic models presented in undergraduate courses. Includes the foundations of programming (using BASIC), data management, Newton’s method for solving nonlinear equations, exploring and fitting functional graphs, and finding maxima of functions.
Prerequisite: C or higher in ECO 303
4 credits

ECO 316-K U.S. Class Structure and Its Implications
Investigation of the economic foundations of social class in the U.S. and connections among class, race, and gender. Consideration of both theoretical and empirical strategies to understand the working class, the middle class, and the capitalist class in contemporary U.S. society, including the implications of class analysis for social issues such as government economic policy formation, the “underclass” and welfare reform, globalization, living standards, the distribution of income and wealth, and economic ethics.
Prerequisite: C or higher in ECO 108
3 credits

ECO 317 Marxist Political Economy
An analysis of capitalism as a social system of production and exchange, based on the economic writings of Karl Marx and others working in that broad tradition. The course begins with study of Marx’s philosophical method, dialectical materialism, and applies this method to the historical development of capitalism and the operation of the modern capitalist economy. The course explores connections between economic power and political, cultural, and ethical issues.
Prerequisite: C or higher in ECO 108
3 credits

ECO 320 Mathematical Statistics
An introduction to statistical methods and their properties that are useful in analysis of economic data. Topics include elements of probability theory and its empirical application, univariate and multivariate distributions, sampling distributions, limiting distributions, and point and interval estimation. Regular problem sets and computer projects are required. Not for credit in addition to AMS 310.
Prerequisites: C or higher in ECO 108; C or higher in MAT 122 or MAT 123 or AMS 151 or placement level 4 on the mathematics placement examination
4 credits

ECO 321 Econometrics
The application of mathematical and statistical methods to economic theory. Topics include the concept of an explanatory economic model, multiple regression, hypothesis testing, simultaneous equation models, and estimating techniques. Emphasis is placed on the application of econometric studies.
Prerequisites: C or higher in ECO 320 or AMS 310; C or higher in ECO 108
4 credits

ECO 325 International Economics
Economic theory of international trade, protection, commercial policy, customs unions, capital movements, and international finance.
Prerequisite: C or higher in ECO 303
3 credits

ECO 326 Industrial Organization
A study of the structure of firms and markets and interactions between them. Price theory, strategic theory, and transaction costs analysis are used to illuminate the sources of and limitations on market power of firms. Some empirical evidence, drawn primarily from the U.S. economy, is explored. A brief introduction to antitrust policy and regulatory policy is included. 
Prerequisite: C or higher in ECO 303
3 credits

ECO 327-F Health Economics
An application of microeconomics to the health sector of the economy. Topics include the demand for health care; the roles of hospitals, physicians, and HMOs in the supply of health care; the role of the government in the provision of health care; and the determinants of health care costs.
Prerequisite: C or higher in ECO 303
3 credits

ECO 328-F Regional Economics
An examination of the major theories of economic structure within a spatial context. Special attention is paid to economic growth within a spatial world, migration of firms and resources across space, the empirical modeling of these processes, and regional economic modeling. Topics include export base theory, input-output modeling, social accounting matrices (SAMs), computable general equilibrium models (CGEs), and regional econometric and conjoined models.
Prerequisite: C or higher in ECO 303
3 credits

ECO 329 Urban Economics
Construction of models to explain aspects of cities, including existence, dynamics, and land use patterns. Concepts include Lorenz Curve, externalities, tipping points, bid-rent curves, and separation of economic activities. Uses algebra, pre-calculus, graphing, and calculus. Computer spreadsheets and scientific hand calculators used.
Prerequisite: C or higher in ECO 303
Advisory Prerequisite: MAT 131
3 credits

ECO 334-J Demographic Economics of Developing Countries
Problems related to both economics and demography. In scope, the material deals with both contemporary and historical situations in developing countries. Microeconomic aspects of the course concern fertility, marriage, divorce, and migration; macroeconomic aspects concern the implications for growth and development of various patterns of population increase.
Prerequisites: C or higher in ECO 320 or AMS 310; C or higher in ECO 303 and 305
3 credits

ECO 335 Economic Development
An examination of problems and aspects facing developing countries in the transition from traditional, predominantly rural economies to modern, largely urban-oriented economies. Theories of economic growth and development are presented in the light of the actual experience of developing countries.
Prerequisites: C or higher in ECO 308; MAT 120 or 131 or 141 or AMS 151
3 credits