437 Advanced Geological & Geotechnical Design For Hazardous Waste Mgt (LEC 3.0) Geological and geotechnical design factors for hazardous waste management facilities and remedial actions (cleanup) of uncontrolled hazardous waste sites. Prerequisite: Ge Eng 337 or consent of instructor.

441 Geotechnical Construction Practice (LEC 3.0) Advanced level lecture topics on procedures used for site characterization, standards for earthquake grading and construction, including embankments, building pads, retention structures, roads, levees, and earthen dams. Specific emphasis on preparation of documents involved in such work and engineer's responsibilities. Prerequisite: Geo Eng 341.

446 Advanced Remote Sensing And Image Processing (LEC 2.0 and LAB 1.0) Quantitative methods of utilizing remote sensing technology for terrain analysis. Digital image processing of landsat and/or aircraft scanner data for mineral resource studies and geological engineering applications. Prerequisite: Geo Eng 346. (Co-listed with Geology 446)


482 Surface Waves (MASW) and Ground Penetrating Radar (GPR) (LEC 2.0 and LAB 1.0) Geological engineering applications of surface wave and ground penetrating radar methods are emphasized. Field data will be acquired, processed and interpreted. Prerequisites: Geo Eng 50 or Civ Eng 215 or equivalent, and graduate standing.

484 Advanced Engineering And Environmental Geophysics (LEC 3.0) An introduction to the theory and application of the gravity, magnetic, resistivity, self-potential induced polarization, seismic, electromagnetic and GPR methods as applied to the solution of engineering and environmental problems. Prerequisite: Admittance into USAES-S&T Cooperative Degree Program. (Co-listed with Geophysics 484)

490 Research (IND 0.0-15.0) Investigations of an advanced nature leading to the preparation of a thesis or dissertation. Consent of instructor required.

491 Internship (IND 0.0-15.0) Students working toward a doctor of engineering degree will select, with the advice of their committees, appropriate programs for preparation of a dissertation. The problem selected and internship plan must conform to the purpose of providing a high level engineering experience consistent with the intent of the doctor of engineering degree.

493 Oral Examination (IND 0.0) After completion of all other program requirements, oral examinations for on-campus M.S./Ph.D. students may be processed during intersession. Off-campus M.S. students must be enrolled in oral examination and must have paid an oral examination fee at the time of the defense/comprehensive examination (oral/ written). All other students must enroll for credit commensurate with uses made of facilities and/or faculties. In no case shall this be for less than three (3) semester hours for resident students.

495 Continuous Registration (IND 1.0) Doctoral candidates who have completed all requirements for the degree except the dissertation, and are away from the campus must continue to enroll for at least one hour of credit each registration period until the degree is completed. Failure to do so may invalidate the candidacy. Billing will be automatic as will registration upon payment.

Geology Courses

300 Special Problems (IND 0.0-6.0) Problems or readings on specific subjects or projects in the department. Consent of instructor required.

301 Special Topics (Variable 0.0-6.0) This course is designed to give the department an opportunity to test a new course. Variable title.

305 Hydrogeology (LEC 3.0) This course discusses geologic aspects of major surface and subsurface hydrologic systems of North America. Chemical and physical relationships between groundwater and fractures, faults, karst, subsurface pressures, mineral deposits plus both contaminant and hydrocarbon migration are discussed. Prerequisites: Ge Eng 50 or Geo 51, Geo 223 recommended.

307 Physical Oceanography (LEC 3.0) An introduction to the study of the physical and geological processes in the world's oceans including the importance of the oceans to the environment and to life on Earth. Prerequisite: Geology 325 or equivalent.

308 Astronomy and Planetary Science (LEC 3.0) Basic principles of astronomy, the origin and evolution of the universe, stellar evolution, and the origin, composition, and processes operating on the planetary bodies in the solar system (besides the Earth). Prerequisite: Entrance requirements for the MST program in Earth Science.

309 Meteorology and Climatology (LEC 3.0) An introduction to the atmospheric and climatic systems of the Earth including weather, paleoclimatology, and global climate change. Prerequisite: Geology 325 or equivalent.

310 Seminar (RSD 0.0-6.0) Discussion of current topics. Required for two semesters during senior year. (Course cannot be used for graduate credit). Prerequisite: Senior standing. (Co-listed with Geo Eng 310, Pet Eng 310)

312 Ore Microscopy (LEC 1.0 and LAB 2.0) A study of polished sections of minerals and ores under reflected light. Includes the preparation of polished sections, the identification of ore minerals, and the study of the textures, associations, and alterations of ore minerals. Prerequisite: Geo 113.
320 Advanced Structural Geology (LEC 2.0 and LAB 1.0) The course provides theoretical background, analytical techniques, and hands-on experience for analyzing geologic structures at a variety of scales hand sample to global. Prerequisites: Geology 220, Geophysics 381.

324 Advanced Stratigraphy And Basin Evolution (LEC 3.0) Advanced topics in sedimentary geology including: tectonic controls on sedimentary basin development, global sequence stratigraphy, regional facies and diagenetic patterns, basin hydrogeology, thermal evolution of basins and distribution of economic resources. Prerequisites: Geo 223, 220, preceded or accompanied by Geo 275 recommended.

326 Advanced Historical Geology (LEC 2.0 and LAB 1.0) Study of the physical and biological history of the Earth beginning with the origin of the solar system up to the present. Emphasis will be placed on processes that shaped the Earth and its ecosystems. Prerequisite: Entrance requirements for the MST program in Earth Science.

329 Micropaleontology (LEC 2.0 and LAB 1.0) Introduction to the preparation and study of microscopic fossils. Prerequisite: Geo 227.

330 Granites And Rhyolites (LEC 3.0 and LAB 1.0) Processes governing the generation and crystallization of felsic magma will be covered, with specific reference to: 1) crust vs mantle sources, 2) melt migration and emplacement, 3) magma chamber dynamics, 4) the volcanic-plutonic connection, and 5) the relationship to tectonic setting. A field trip at the student's expense is required. Prerequisite: Geo 130.

332 Depositional Systems (LEC 3.0) Development of three dimensional depositional models using Walther's Law, Walther's Warning and seismic stratigraphy. Emphasis on overall geometries and internal porosity and permeability characteristics of aquifers and hydrocarbon reservoirs. Includes 3-D models for clastic, carbonate and evaporate sequences. Prerequisite: Geology 51 or Geo Eng 50.

334 Advanced Igneous and Metamorphic Petrology (LEC 3.0 and LAB 1.0) Processes governing the formation of igneous and metamorphic rocks as constrained by geochemical, isotopic, and thermodynamic data, with particular reference to the relationship between rock suites and tectonic setting. The laboratory will emphasize the description of rock suites in hand sample and thin section. A field trip at the student's expense is required. Prerequisite: Geology 130.

338 Computer Mapping In Geology (LEC 2.0 and LAB 1.0) This course introduces the basics of both surface and subsurface geologic mapping. It introduces procedures and problems associated with digitizing, gridding, contouring, volumetrics and generation of three dimensional diagrams on the PC. Integration of field gathered data with USGS and GSI databases for the purpose of making surface geologic maps is also included. Prerequisite: Geo 51.

340 Petroleum Geology (LEC 2.0 and LAB 1.0) Principles of origin, migration, and accumulation of oil and gas. The laboratory introduces the procedures used for exploration, and development of hydrocarbon resources. Prerequisite: Geology 51 or Geo Eng 50 (Introductory Geology course)

341 Applied Petroleum Geology (LEC 1.0 and LAB 2.0) The principles of petroleum geology are applied in solving hydrocarbon exploration and developmental problems. Geological and economical techniques for evaluating hydrocarbonbearng reservoirs are presented, with methods for decision making under conditions of extreme uncertainty. Prerequisite: Geo 340.

344 Remote Sensing Technology (LEC 2.0 and LAB 1.0) Principles of digital image processing including image enhancement and multispectral classification. Emphasis upon design and implementation of remote sensing systems and analysis of remotely sensed data for geotechnical and environmental investigations. Prerequisite: Ge Eng 248. (Co-listed with Geo Eng 344)

345 Radioactive Waste Management And Remediation (LEC 3.0) Sources and classes of radioactive waste, long-term decay, spent fuel storage, transport, disposal options, regulatory control, materials issues, site selection and geologic characterization, containment, design and monitoring requirements, domestic and foreign waste disposal programs, economic and environmental issues; history of disposal actions, and conduct of remedial actions and cleanup. Prerequisite: Math 204. (Co-listed with Nu Eng 345)

346 Applications Of Geographic Information Systems (LEC 2.0 and LAB 1.0) Applications of Geographical Information Systems and remote sensing to environmental monitoring, mineral resource exploration, and geotechnical site evaluation. Prerequisite: Geo Eng 275 or consent of instructor. (Co-listed with Geo Eng 346)

350 Paleoclimatology and Paleoeocology (LEC 3.0) This course will introduce students to the elements of climate, evidence of climate changes, proxy measurements and paleoclimate models. There is a review of Holocene climates and Archean to Pleistocene paleoclimates. Prerequisite: Geology 52.

360 Methods Of Karst Hydrogeology (LEC 3.0) Familiarize geoscientists with the origin and identification of karst features, discuss groundwater movement, engineering problems, water quality and supply in karst areas, and teach investigative techniques including fluorescent dye tracing. Several field trips at student expense will be required. Prerequisite: Geology 51 or Geo Eng 50; Geology 223.

372 Geological Field Studies (LEC 3.0) Intensive review of the scientific literature corresponding to a selected geographical region of geologic interest; followed by a 7 to 10 day long field trip to be held over spring break or after the end of the semester. Students will be expected to bear a portion of the field trip expenses. Repeatable for credit. Prerequisites: Geology 51 or Geo Eng 50.
373 Field Geology (LAB 3.0) Field practice in geologic mapping and interpretation in the Western United States using topographic base maps and aerial photos. Emphasizes the description and interpretation of stratigraphic sections, sedimentary and tectonic structures. Prerequisite: Two Geology courses.

374 Advanced Field Geology (LAB 3.0) Detailed field work in areas related to the projects of Geology 373. Courses to be taken the same summer. A written report on the full summer's projects is required. Prerequisite: Geo 373.

375 Applied Geochemistry (LEC 2.0 and LAB 1.0) Application of the principles of geochemistry and techniques of geochemical analysis in a student research project investigating geochemical processes (mineral deposits, environmental geochemistry, trace element migration, or water-rock interaction). Field trip fee required. Prerequisites: Geo 113 and Geo 275.

376 Aqueous Geochemistry (LEC 3.0) Studies of the interaction of water with minerals and organic materials at low temperatures; including processes affecting the migration of elements (alteration, precipitation, and adsorption), the influence of geochemical processes on water composition, weathering, soil formation, and pollution. Field trip fee required. Prerequisite: Geo 275.

378 Isotope Geochemistry (LEC 2.0 and LAB 1.0) Introduction to the fundamentals of radiogenic and stable isotopes as used to understand geologic processes. The use of selected isotopic systems in petrology, ore petrogenesis, paleontology, and the global climate systems will be discussed. Prerequisites: Geology 130, 223, 275.

383 Electrical Methods in Geophysics (LEC 3.0) The theory and instrumentation for measurements of the electrical properties of the earth. Includes passive and active techniques, the advantages and disadvantages of the various techniques, and geologic interpretations of electrical soundings. Several weekends are spent making a variety of electrical surveys of local features. Prerequisites: Math 325 and Geop 321.

390 Undergraduate Research (IND 0.0-6.0) Designed for the undergraduate student who wishes to engage in research. Not for graduate credit. Not more than six (6) credit hours allowed for graduation credit. Subject and credit to be arranged with the instructor.

394 Coal Petrology (LEC 3.0) Formation, composition, and properties of coals. Discussion of the geology of selected coal deposits, the analysis of coal, and the optical identification of coal minerals. Prerequisite: Permission of instructor.

400 Special Problems (IND 0.0-6.0) Problems or readings on specific subjects or projects in the department. Consent of instructor required.

401 Special Topics (Variable 0.0-6.0) This course is designed to give the department an opportunity to test a new course. Variable title.

405 Geology of Natural Resources (LEC 3.0) The origin and distribution of economically important natural resources including soils, water resources, metals, non-metals, building materials, petroleum, and other energy resources. Prerequisites: Geology 325 and 326 or equivalents.

407 Environmental Geology (LEC 3.0) Overview of environmental problems facing humans. Emphasis will be placed on surface and groundwater pollution, geological hazards, and pressures on Earth's ecosystems and natural resources by urbanization and population growth. Prerequisites: Geology 325 and 326 or equivalents.

410 Seminar (RSD 0.0-6.0) Discussion of current topics.

412 Advanced Ore Microscopy (LEC 1.0 and LAB 2.0) A study of ore suites utilizing various advanced, quantitative ore microscopy techniques including hardness, spectral reflectance, indentation, color, rotation property measurements, fluid inclusion geothermometry, and salinity measurements. Laboratory study includes demonstration and operation of the luminoscope and other microbeam techniques. Prerequisite: Geo 312.

413 Clay Mineralogy (LEC 2.0 and LAB 1.0) Mineral structure, geochemical properties, occurrence, environment, and uses of clays. Determination of physical properties, optics, x-ray diffraction, and thermal features of clays. Field trip fee required. Prerequisites: Geo 113 and 275, or Chem 237, or Cv Eng 315, or Ge Eng 372.

420 Analytical Structural Geology (LEC 2.0 and LAB 1.0) The course provides theoretical background, analytical techniques, and hands-on experience, for quantifying processes that lead to the formation and evolution of rocks and structures produced as a result of deformation at a variety of scales - hand sample to global. Poster - and oral - presentations, and a research paper required. Prerequisites: Geology 220, Geophysics 381.

423 Sedimentary Basin Analysis (LEC 3.0) An advanced study of stratigraphic, diagenetic and tectonic processes in sedimentary basins. Prerequisites: Geo 220, 223, 275 or 375 or 376.

425 Advanced Physical Geology (LEC 3.0) Examination of topics concerned with the physical properties of earth materials, processes affecting changes of the surface and interior of the earth, and the driving forces causing such changes. Weekly critical assessment of literature, and an oral presentation and term paper required. Prerequisite: Consent of instructor.

431 Clastic Sedimentary Petrology (LEC 2.0 and LAB 1.0) Petrology and petrography of clastic sedimentary rocks. Emphasis on origin, diagenesis and description of clastic, sedimentary rocks. Prerequisite: Geo 223.

432 Carbonate Petrology (LEC 2.0 and LAB 1.0) Petrology, chemistry and sedimentology of carbonates and other associated chemical sedimentary rocks. Prerequisites: Geo 130, 114, 223 and Chem 3 or equivalent Geo 275 recommended.
433 Advanced Igneous Petrology (LEC 2.0 and LAB 1.0) The genesis of eruptive rocks as evidenced by the physical-chemical conditions of formation of their constituent minerals. A critical examination of various magmatic processes. Use of advanced petrographic techniques. Prerequisite: Geo 234.

434 Granite and Rhyolite Petrogenesis (LEC 3.0 and LAB 1.0) The origin of granites and rhyolites with respect to extreme fractionation, crustal anatexis, magma mixing, and tectonic setting will be explored through critical reading of the literature and examination of hand samples and thin sections from classic geologic terranes. A research paper is required as well as a field trip at the student's expense. Prerequisite: Geology 130.

435 Applied Ore Microscopy (LEC 1.0 and LAB 2.0) Application of ore microscopic and petrographic techniques to problems in ore beneficiation, pelleting, sintering, smelting, refining, refractories, cement, mining, and exploration. Discussions and laboratories are based upon industrial case histories. Prerequisite: Geo 312.

437 Advanced Palynology (LEC 1.0 and LAB 2.0) Study of the processes of sporopollenin preservation, sedimentation and palynofacies. Major emphasis on independent palynostratigraphic research. Chronicle of Phanerozoic palynology in lectures. Prerequisite: Geology 227 or 329.

440 Advanced Geochemistry (LEC 3.0) A study of the absolute and relative abundance of elements and isotopes in the Earth, principles of element transport, formation of the Earth's crust, mineral deposits, and soils. Field trip fee required. Prerequisite: Geo 275.

443 Advanced Petroleum Geology (LEC 1.0 and LAB 2.0) Examples of various types of oil and gas accumulation are reviewed in detail. Study of criteria useful in evaluating the petroleum potential of undrilled areas. Special investigation assignment is required. Prerequisite: Geo 340.

446 Advanced Remote Sensing And Image Processing (LEC 2.0 and LAB 1.0) Quantitative methods of utilizing remote sensing technology for terrain analysis. Digital image processing of landsat and/or aircraft scanner data for mineral resource studies and geological engineering applications. Prerequisite: Geo Eng 346. (Co-listed with Geo Eng 446)

450 Advanced Paleoclimatology and Paleoecology (LEC 3.0) Advanced study of paleoclimatic and paleoecologic processes since the Archean, and the interpretation of Holocene climate changes, including human impacts. Extensive presentations and discussions of current ideas and techniques in paleoclimatic studies. Prerequisites: Geology 223 and 227.

470 Field and Laboratory Studies in Earth Science (LAB 3.0) Hands-on laboratory and field experiences in the Earth Sciences. This course is designed to be taught in an intensive three week session during the summer on the S&T campus. Prerequisites: Geology 325 and 326 or equivalents, and at least one additional course in the MST Earth Science program.

478 Advanced Isotope Geochemistry (LEC 2.0 and LAB 1.0) The use of radiogenic and stable isotopes in geology in the study of the evolution of Earth, crust, mantle, and the Solar System as well as applications to geothermometry, ore petrogenesis, paleontology, and the global climate system. Prerequisites: Geology 130, 223, 275.

480 Geotectonics (LEC 3.0) A critical study of the origin, and differentiation of the earth, evolution of the crust, and plate tectonics. Geology of the continents and ocean basins. Regional tectonic analysis of Precambrian shields, platforms, orogenic belts, and a review of internal energy sources. Emphasis is on North America. Prerequisite: Geo 220.

481 Geodynamics (LEC 3.0) The applications of continuum physics to geological and petroleum engineering problems. Topics include plate tectonics, stress and strain in solids, elasticity and flexure, heat transfer, gravity, fluid mechanics, rock rheology, faulting, and flow in porous media. Prerequisites: Math 22 and Geology 220. (Co-listed with Pet Eng 481)

489 Ore Deposition (LEC 2.0 and LAB 1.0) An advanced study of mineral deposits, time and space in deposition, theories of deposition and their effect on exploration. Discussions based on maps, logs, and samples from the world's typical mineral deposits. Two all day field trips at student expense required. Prerequisite: Geo 294.

490 Research (IND 0.0-15.0) Investigations of an advanced nature leading to the preparation of a thesis or dissertation.

493 Oral Examination (IND 0.0) After completion of all other program requirements, oral examinations for on-campus M.S./Ph.D. students may be processed during intersession. Off-campus M.S. students must be enrolled in oral examination and must have paid an oral examination fee at the time of the defense/comprehensive examination (oral/ written). All other students must enroll for credit commensurate with uses made of facilities and/or facilities. In no case shall this be for less than three (3) semester hours for resident students.

495 Continuous Registration (IND 1.0) Doctoral candidates who have completed all requirements for the degree except the dissertation, and are away from the campus must continue to enroll for at least one hour of credit each registration period until the degree is completed. Failure to do so may invalidate the candidacy. Billing will be automatic as will registration upon payment.
Geophysics Courses

300 Special Problems (IND 0.0-6.0) Problems or readings on specific subjects or projects in the department. Consent of instructor required.

301 Special Topics (Variable 0.0-6.0) This course is designed to give the department an opportunity to test a new course. Variable title.

320 Computational Geophysics (LEC 1.0 and LAB 2.0) Scientific programming in a UNIX/Linux environment, with emphasis on solving geophysical problems such as linear and nonlinear inversion, spectral analysis, seismicity, seismic wave attenuation, shear-wave splitting, and seismic tomography. Prerequisite: Geophys 270.

321 Potential Field Theory (LEC 3.0) The mathematics and physics of gravitational, magnetic, and electrical fields of the earth as derived from potential functions, with applications to practical problems. The theorems of Laplace, Poisson, Gauss, and Green and their applications to geophysics are presented. Prerequisite: Accompanied or preceded by Math 325.

336 Geophysical Field Methods (LEC 2.0 and LAB 1.0) Imaging of selected subsurface features and engineering structures using various geophysical tools. Special emphasis is placed on ground penetrating radar and surface wave techniques. One field trip at student expense required. Prerequisite: Junior level standing or higher. (Co-listed with Geo Eng 336)

361 Transportation Applications of Geophysics (LEC 2.0 and LAB 1.0) Overview of geophysical and non-destructive test methods that are commonly used to investigate transportation structures and their foundations. Emphasis is placed on bridge system substructure, bridge system superstructure, pavement, roadway subsidence, subsurface characterization and vibration measurements. Prerequisite: Junior level standing or higher. (Co-listed with Geo Eng 361 and Civ Eng 351)

377 Seismic Interpretation (LEC 1.0 and LAB 2.0) An introduction to 2-D/3-D seismic structural interpretation, stratigraphic interpretation, reservoir identification and evaluation, and horizon and formation attributes. The students are expected to master interactive 2-D/3-D seismic interpretation software packages that are routinely used in the petroleum industry. Prerequisite: Geophys 270 or 385.

380 Seismic Stratigraphy (LEC 2.0 and LAB 1.0) A study of the seismic expression of depositional models. Reflection patterns and reflection amplitudes are interpreted to determine bed thicknesses, fluid content, depositional environment, and lithology. Special data acquisition and processing techniques are examined. Prerequisites: Geop 385, Geo 220, 223.

381 Global Tectonics (LEC 3.0) An integrated view of the Earth’s structure and dynamics with an emphasis on information gained through geophysical methods. Topics include seismology, heat flow, gravity, rheological and compositional structure, plate motions and intermotions, and mantle driving mechanisms for plate tectonics. Prerequisite: Geo 220.

382 Environmental And Engineering Geophysics (LEC 2.0 and LAB 1.0) An introduction to the theory and application of the gravity, magnetic, resistivity, self-potential, induced polarization and electromagnetic methods as applied to the solution of engineering and environmental problems. Prerequisite: Math 22. (Co-listed with Geo Eng 382)

383 Electrical Methods In Geophysics (LEC 2.0 and LAB 1.0) The theory and instrumentation for measurements of the electrical properties of the earth. Includes passive and active techniques, the advantages and disadvantages of the various techniques, and geologic interpretations of electrical soundings. Several weekends are spent making a variety of electrical surveys of local features. Prerequisites: Math 325 and Geop 285 or Geop 382.

385 Exploration And Development Seismology (LEC 2.0 and LAB 1.0) Principles of reflection seismology as applied to the delineation of geologic structures and the determination of stratigraphy and lithology. Emphasis on both the capabilities and limitations of the seismic method. The laboratory utilizes both modeled and actual seismic data. Prerequisite: Math 22.

386 Wave Propagation (LEC 3.0) A study of Hamilton’s principle and energy theorems, fundamentals of plane wave theory, waves in stratified fluids, elastic waves in solids, electromagnetic and hydromagnetic radiation, and Allen’s functions and point sources. Prerequisites: Geop 281, 321.

388 Geophysical Instrumentation (LAB 1.0) Field and laboratory practice in the use of geophysical instrumentation. Techniques of geophysical data reduction and interpretation are also covered. May be taken more than once for credit with Geop 383 and Geop 384. Prerequisite: Concurrent registration in Geop 382, 283 or 384.

389 Seismic Data Processing (LEC 2.0 and LAB 1.0) Introduction to seismic data processing. Topics to be covered include statics corrections, filtering, velocity analysis, deconvolution, stacking and migration. Prerequisites: Math 22, and Geop 283 or Geop 384. Prerequisite: Concurrent registration in Geop 382, 283 or 384.

390 Undergraduate Research (IND 0.0-6.0) Designed for the undergraduate student who wishes to engage in research. Not for graduate credit. Not more than six credit hours allowed for graduation credit. Subject and credit to be arranged with the instructor.

400 Special Problems (IND 0.0-6.0) Problems or readings on specific subjects or projects in the department. Consent of instructor required.

401 Special Topics (Variable 0.0-6.0) This course is designed to give the department an opportunity to test a new course. Variable title.

410 Seminar (RSD 0.0-6.0) Discussion of current topics.

483 Advanced Electrical And Electromagnetic Methods In Geophysical Exp (LEC 2.0 and LAB 1.0) Theory of the electrical geophysical methods as applied to subsurface investigations addressing geologic, engineering, groundwater and contaminant transport problems. Course content includes both passive and active methods and recent advances in
the application of these methods. Course will include a field component illustrating application of techniques to local problems. Prerequisites: Geop 382, Math 22.

485 **Advanced Seismic Data Processing** (LEC 2.0 and LAB 1.0) Theory and application of seismic data processing. Topics to be covered include convolution, correlation, deconvolution, 2-D filtering, migration and inversion. Prerequisites: Geop 385, 389, Stat 215.

486 **The Theory Of Elastic Waves** (LEC 2.0 and LAB 1.0) A mathematical study of elastic waves in the layered earth. Prerequisite: Geop 386.

487 **Geophysical Inverse Theory** (LEC 3.0) A study of inverse theory applied to geophysical data, focusing on the relationship between data and model spaces and ways to estimate model parameters via global and local optimization techniques. Prerequisites: Geop 286 or 384, Math 325, Stat 215.

488 **Advanced Seismic Interpretation** (LEC 1.0 and LAB 2.0) The integration of geologic information, well log data and seismic information for interpreting the earth’s subsurface. The role of data acquisition and processing is emphasized. Laboratory exercises provide experience with both real and modeled data. Prerequisite: Geop 380, 385.

490 **Research** (IND 0.0-15.0) Investigations of an advanced nature leading to the preparation of a thesis or dissertation. Consent of instructor required.

493 **Oral Examination** (IND 0.0) After completion of all other program requirements, oral examinations for on-campus M.S./Ph.D. students may be processed during intersession. Off-campus M.S. students must be enrolled in oral examination and must have paid an oral examination fee at the time of the defense/comprehensive examination (oral/written). All other students must enroll for credit commensurate with uses made of facilities and/or faculties. In no case shall this be for less than three (3) semester hours for resident students.

495 **Continuous Registration** (IND 1.0) Doctoral candidates who have completed all requirements for the degree except the dissertation and are away from the campus must continue to enroll for at least one hour of credit each registration period until the degree is completed. Failure to do so may invalidate the candidacy. Billing will be automatic as will registration upon payment.

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### Information Systems and Technology Courses

300 **Special Problems** (IND 0.0-6.0) Problems or readings on specific subjects or projects in the department. Consent of instructor required.

301 **Special Topics** (Variable 0.0-6.0) This course is designed to give the department an opportunity to test a new course. Variable title.

321 **Network Performance Design And Management** (LEC 3.0) This course provides analytical capabilities needed to effectively design, deploy, and manage computer networks and protocols. Prerequisites: IST 223, IST 233.

342 **E-Commerce Architecture** (LEC 3.0) Course will cover the issues associated with computer architecture, as it relates specifically to e-commerce applications. Topics will include e-commerce systems and processes, specialized software, and databases. Prerequisite: IST 233 or IST 336.

343 **Database Applications in Business** (LEC 3.0) Design, development and implementation of application software typical to the modern business environment utilizing popular commercial database management systems such as Oracle and Access. Focus given to business case modeling, requirement analysis, database design, and implementation challenges. Project oriented. Prerequisite: IST 243.

351 **Leadership In Technology-Based Organizations** (LEC 3.0) The course focuses on the knowledge and skills necessary for the development and implementation of effective strategies for the management of technology-based organizations. This involves: developing a general management perspective on technology and innovation, examining the problems of new product development, identifying distinctive technological competencies, licensing and marketing technologies, assessing the organizational and industrial context of technology. Prerequisite: Senior or Graduate Standing.

352 **Advanced Web Development** (LEC 3.0) Advanced Web development techniques to provide dynamic interaction; methods for extracting and delivering dynamic information to/from Web servers -- a hands-on approach. Interaction with other Web servers, especially database servers, to obtain and deliver information. Project work is required. Prerequisite: IST 286.

353 **Modular Software Systems in Java** (LEC 3.0) Introduction to Software Life Cycle and characteristics of large modular software systems. Exploration of software support for such systems, using Java, including use of GUI interfaces, advanced I/O and String handling, Interfaces, Threads, and other modularity features. Program project included. Prerequisites: IST 151 and IST 231.

354 **Multi-Media Development And Design** (LEC 3.0) Students will learn current practices for development and design of interactive multimedia. The course covers tools for development of 2-D and 3-D graphics, video, audio, animation, and integrated multimedia environments. Prerequisites: IST 51 or Comp Sci 53 or Comp Sci 73 or Comp Sci 74.