COLLEGE OF ENGINEERING AND COMPUTER SCIENCES

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Programs

- Accessibility Awareness, Graduate Certificate (http://catalog.marshall.edu/graduate/programs-az/engineering-computer-sciences/interdisciplinary-accessibility-awareness-certificate/)
- Bioinformatics, Graduate Certificate (http://catalog.marshall.edu/graduate/programs-az/engineering-computer-sciences/bioinformatics-graduate-certificate/)
- Civil and Environmental Engineering, M.S.E. (http://catalog.marshall.edu/graduate/programs-az/engineering-computer-sciences/civil-environmental-engineering-mse/)
- Computer Science, M.S. (http://catalog.marshall.edu/graduate/programs-az/engineering-computer-sciences/computer-science-ms/)
- Cybersecurity, M.S. (http://catalog.marshall.edu/graduate/programs-az/engineering-computer-sciences/cybersecurity-ms/)
- Data Science, M.S. (http://catalog.marshall.edu/graduate/programs-az/engineering-computer-sciences/data-science-ms/)
- Electrical and Computer Engineering M.S.E.E. (http://catalog.marshall.edu/graduate/programs-az/engineering-computer-sciences/electrical-computer-engineering-msee/)
- Engineering Management, M.S.E. (http://catalog.marshall.edu/graduate/programs-az/engineering-computer-sciences/engineering-management-mse/)
- Environmental Science, Graduate Minor (http://catalog.marshall.edu/graduate/programs-az/engineering-computer-sciences/environmental-science-graduate-minor/)
- Environmental Science, M.S. (http://catalog.marshall.edu/graduate/programs-az/engineering-computer-sciences/environmental-science-ms/)
- Information Security, Graduate Certificate (http://catalog.marshall.edu/graduate/programs-az/engineering-computer-sciences/information-security-graduate-certificate/)
- Information Systems, M.S. (http://catalog.marshall.edu/graduate/programs-az/engineering-computer-sciences/information-systems-ms/)
- Mechanical Engineering, M.S.M.E. (http://catalog.marshall.edu/graduate/programs-az/engineering-computer-sciences/mechanical-engineering-msme/)
- Safety, M.S. (http://catalog.marshall.edu/graduate/programs-az/engineering-computer-sciences/safety-ms/)
- Safety, Minor (http://catalog.marshall.edu/graduate/programs-az/engineering-computer-sciences/safety-minor/)
- Technology Management, Graduate Certificate (http://catalog.marshall.edu/graduate/programs-az/engineering-computer-sciences/technology-management-graduate-certificate/)
- Technology Management, M.S. (http://catalog.marshall.edu/graduate/programs-az/engineering-computer-sciences/technology-management-ms/)
- Transportation and Infrastructure Engineering, M.S.E. (http://catalog.marshall.edu/graduate/programs-az/engineering-computer-sciences/transportation-infrastructure-engineering-mse/)

Courses

Civil Engineering

CE 534 Geometric Highway Design **3 Credit hours**
Highway planning and design, including the capacity, horizontal alignment, vertical alignment, roadside design, traffic control, and other related aspects. Types of facilities discussed will include roadways, sidewalks, intersections, and interchanges.
Grade Mode: Normal Grading Mode

CE 538 Pavement Design **3 Credit hours**
Design of highway pavement systems, subgrades, subbases and bases, soil stabilization, flexible and rigid pavements; cost analysis and pavement selection; traffic data collection; drainage; earthwork; pavement evaluation and maintenance.
Grade Mode: Normal Grading Mode

CE 602 Structural Mechanics **3 Credit hours**
Grade Mode: Normal Grading Mode

CE 604 Buckling of Struct Mem & **3 Credit hours**
Grade Mode: Normal Grading Mode

CE 605 Structural Vibrations **3 Credit hours**
Grade Mode: Normal Grading Mode

CE 611 Plastic Design **3 Credit hours**
Grade Mode: Normal Grading Mode

CE 612 Advanced Steel Design **3 Credit hours**
Background of AISC 360, emphasizing building applications. Analysis method for second-order effects. Composite member design. Plate girders. Splices adn bracing connections. Eccentric connections. Wind and seismic applications.
Grade Mode: Normal Grading Mode

CE 614 Advanced Concrete Design **3 Credit hours**
Background of ACI 318, emphasizing building applications. Precast elements. Moment frames and shear walls. Continuous construction. Foundations and earth-retaining structures. Two-way slab design methods. Strut-and-tie analogies. Column supported slabs. Modern reinforced concrete design procedures; comparison of standard design codes; review of research on behavior of reinforced concrete structures; projection to future changes in design and construction practices.
Grade Mode: Normal Grading Mode

CE 616 Prestressed Concrete Design **3 Credit hours**
Behavior and design of prestressed concrete beams, columns, and beam-columns, emphasizing highway bridge applications. Methods of prestressing and loss estimation for precast and cast-in-place elements. Design of prestressed concrete structures; design for flexure, shear, and torsion; camber and deflections; contunuity; connections;fire rating; and review of research and projection to changes in practices.
Grade Mode: Normal Grading Mode

CE 618 Bridge Engineering **3 Credit hours**
Analysis, design, and rating of bridges according to AASHTO specifications, emphasizing steel superstructures. Detailing of elements and systems based on strength, serviceability, constructability, and fatigue requirements. An overview of design of highway bridges and an introduction to maintenance of highway bridges; history of bridge engineering, types, design rules, loads, inspection, rating and preventive maintenance, asthetics.
Pre-req: CE 616.
Grade Mode: Normal Grading Mode

CE 621 Advanced Soil Mechanics **3 Credit hours**
Grade Mode: Normal Grading Mode

CE 622 Foundation Engineering 2 **3 Credit hours**
Grade Mode: Normal Grading Mode

CE 623 Advanced Soil Testing Theory **3 Credit hours**
Grade Mode: Normal Grading Mode

CE 624 Design of Earth Structures **3 Credit hours**
Grade Mode: Normal Grading Mode

CE 626 Groundwater Investigation **3 Credit hours**
Grade Mode: Normal Grading Mode

CE 631 Geometric Design of Highways **3 Credit hours**
Grade Mode: Normal Grading Mode

CE 632 Highway Materials 1 **3 Credit hours**
Grade Mode: Normal Grading Mode

CE 633 Highway Materials 2 **3 Credit hours**
Grade Mode: Normal Grading Mode

CE 634 Traffic Engineering **3 Credit hours**
Design and application of signs, markings, and signals; timing of isolated and interconnected signals; speed regulationl one-way streets; capacity and analysis of highway facilities.
Grade Mode: Normal Grading Mode

CE 635 Eval of Transportation Systems **3 Credit hours**
Concepts of transportation economic analysis, transportation costs and benefits, needs studies, finance and taxation, methods of evaluation of plans and projects, environmental impact assessment.
Grade Mode: Normal Grading Mode

CE 636 Transportation Planning **3 Credit hours**
Techniques used to plan urban transportation systems; data collection, trip generation, trip distribution, mode choice, traffic assignment, modeling and evaluation techniques; travel demand modeling.
Grade Mode: Normal Grading Mode

CE 637 Highway Safety Engineering **3 Credit hours**
Traffic safety studies including: crash analysis, control and geometry improvements, hazard and countermeasures identification, before-and-after studies; data collection and computer tools for highway traffic and safety evaluation.
Grade Mode: Normal Grading Mode

CE 639 Infrastructure Management **3 Credit hours**
Application of decision analysis, mathematical programming, performance modeling and various heuristics to develop management plans for transportation infrastructure assets, primarily focusing on highway pavements and bridges.
Grade Mode: Normal Grading Mode

CE 650 Special Topics Civil Engr **3 Credit hours**
Selected topics of special and current interest to civil engineers.
Grade Mode: Normal Grading Mode

CE 651 Spec Topics Civil Engr **3 Credit hours**
Selected topics of special and current interest to civil engineers.
Grade Mode: Normal Grading Mode

CE 652 Spec Topics Civil Engr **3 Credit hours**
Selected topics of special and current interest to civil engineers.
Grade Mode: Normal Grading Mode

CE 680 Special Topics **3 Credit hours**
Grade Mode: Normal Grading Mode

CE 681 Water & Wastewater Engr Dsgn 1 **3 Credit hours**
Grade Mode: Normal Grading Mode

CE 682 Water & Wastewater Engr Dsgn 2 **3 Credit hours**
Grade Mode: Normal Grading Mode

CE 684 Biol & Physiochem Process **3 Credit hours**

CE 685 Hydrology **3 Credit hours**
Grade Mode: Normal Grading Mode

CE 686 Hyd/Sedi of Surface Mined Land **3 Credit hours**
Grade Mode: Normal Grading Mode

CE 687 Engineering Geology **3 Credit hours**
Grade Mode: Normal Grading Mode

CE 690 Special Topics in Civil Engr **1-6 Credit hours**
Grade Mode: Normal Grading Mode

CE 715 Adv Matrix Meth of Struct Anal **3 Credit hours**
Grade Mode: Normal Grading Mode

CE 790 Advanced Independent Study **1-6 Credit hours**
Grade Mode: Normal Grading Mode

CE 799 Research **1-12 Credit hours**
Grade Mode: Normal Grading Mode

Computer & Info Security

CYBR 500 Computer Security Design **3 Credit hours**
The course covers technical and analytical skills to implement comprehensive computer security that encompass designing secure systems, information security, protecting information assets, managing computer security, risk mitigation strategies, and incident response.
Grade Mode: Normal Grading Mode

CYBR 510 Intro to Cybersecurity **3 Credit hours**
This course provides an overview of the cybersecurity field, the basic foundations of the current technology and its impacts along with the predominant threat components and remediation.
Grade Mode: Normal Grading Mode

CYBR 530 Cybersec Policies & Mgmt **3 Credit hours**
The course covers risk management, integrating continuous monitoring and real-time security solutions with information systems to improve situational awareness and deployment of countermeasures.
Grade Mode: Normal Grading Mode

CYBR 535 Cyber Risk **3 Credit hours**
The functions and purposes of the latest developments in cybersecurity are covered. Topics include design, implementation, testing industrial networks and applications to ensure their security and reliability.
Pre-req: CYBR 510 with a minimum grade of D.
Grade Mode: Normal Grading Mode

CYBR 542 Cyber Operations **3 Credit hours**
Study of various concepts and aspects in choosing, deploying, supporting, troubleshooting, and securing various local and distributed components of cyber operation.
Pre-req: CYBR 530 with a minimum grade of D.
Grade Mode: Normal Grading Mode

CYBR 615 Cyber Vulnerability Assess **3 Credit hours**
This course focuses on the complete cycle of enterprise security from identifying vulnerabilities, detecting application exploitation and post exploitation mitigations and analysis for an enterprise level cyber infrastructure.
Grade Mode: Normal Grading Mode

CYBR 620 Cyberwarfare **3 Credit hours**
The course covers both offensive and defensive techniques pertaining to cybersecurity from techniques to find vulnerabilities and analyze the likelihood of an attack to developing solutions to secure cyber infrastructure.
Grade Mode: Normal Grading Mode

CYBR 625 Applied Cryptography **3 Credit hours**
This course introduces fundamentals of cryptography, including classical ciphers, Shannon's perfect secrecy, DES, AES, public-key crypto (RSA), as well as advanced cryptographic schemes.
Grade Mode: Normal Grading Mode

CYBR 680 Research in Cybersecurity **3 Credit hours**
This course covers various research methods and current significant findings in the field of cybersecurity.
Pre-req: CYBR 510 with a minimum grade of D.
Grade Mode: Credit/No Credit Grade Only

CYBR 681 Thesis **3 Credit hours**
Investigate a research problem of theoretical interest and practical value under mentorship of a cybersecurity faculty.
Pre-req: CYBR 680 with a minimum grade of D.
Grade Mode: Credit/No Credit Grade Only

CYBR 685 Independent Study **1-4 Credit hours**
Faculty supervised, individualized course of study.
Grade Mode: Normal Grading Mode

CYBR 698 Internship **1-6 Credit hours**
Supervised work experience in Cybersecurity.
Grade Mode: Credit/No Credit Grade Only

Computer Science

CS 502 Computer Architecture **3 Credit hours**
Design and analyze structure of major hardware components of computers including: ALU, instruction sets, memory hierarchy and caching, parallelism through multicore and many core, GPGPUs, storage systems and interfaces.
Grade Mode: Normal Grading Mode

CS 504 High Performance Computing **3 Credit hours**
Learn how to develop highly optimized applications for multi-core processors and clusters using software tools, parallel algorithms, performance profilers, and programming constructs in MPI, OpenMP, MapReduce, CUDA, and OpenCL.
Grade Mode: Normal Grading Mode

CS 505 Computing for Bioinformatics **3 Credit hours**
Study of computational algorithms and programming techniques for various bioinformatics tasks including parsing DNA files, sequence alignments, tree construction, clustering, species identification, principal component analysis, correlations, and gene expression arrays.
Grade Mode: Normal Grading Mode

CS 510 Advanced Database Systems **3 Credit hours**
This course introduces advanced topics in database systems including distributed systems, distributed databases, Big Data, cloud service, semantic web, web services, information security & privacy, and electronic commerce.
Grade Mode: Normal Grading Mode

CS 511 Advanced Programming **3 Credit hours**
The course covers advanced topics in Python programming including the use of parallel computation and GPU acceleration and investigate how to exploit frameworks such as Hadoop and Spark.
Grade Mode: Normal Grading Mode

CS 512 Embedded Systems **3 Credit hours**
The design of systems containing embedded computers. Micro-controller technology, assembly language and C programming, input/output interfacing, data acquisition hardware, interrupts, and timing. Real-time operating systems and application programming. Application examples.
Grade Mode: Normal Grading Mode

CS 515 Data Mining **3 Credit hours**
Covers (1) the process of knowledge discovery, (2) algorithms (association rules, classification, and clustering), and (3) real-world applications. Focuses on efficient data mining algorithms and scaling up data mining methods.
Grade Mode: Normal Grading Mode

CS 540 Digital Image Processing **3 Credit hours**
Study of mathematical techniques and algorithms for image sampling, quantization, intensity transformations, spatial filtering, Fourier transforms, frequency domain filtering, restoration and reconstruction, color imaging, wavelets, morphological image processing, and segmentation.
Grade Mode: Normal Grading Mode

CS 550 Information Retrieval **3 Credit hours**
Study of theory and algorithms for modeling and retrieving text. Text representation, IR models, query operations, retrieval evaluation, information extraction, text classification and clustering, enterprise and Web search, recommender systems.
Grade Mode: Normal Grading Mode

CS 552 Natural Lang Processing **3 Credit hours**
Fundamental algorithms and computational models for core tasks in natural language processing: word and sentence tokenization, parsing, information and meaning extraction, spelling correction, text summarization, question answering, and sentiment analysis.
Grade Mode: Normal Grading Mode

CS 580 Special Topics **1-4 Credit hours**
Study of emerging and advanced topics in Computer Science. Topics vary with instructor and change from one semester to another.
Grade Mode: Normal Grading Mode

CS 581 Special Topics **1-4 Credit hours**
Study of emerging and advanced topics in Computer Science. Topics vary with instructor and change from one semester to another.
Grade Mode: Normal Grading Mode

CS 582 Special Topics **1-4 Credit hours**
Study of emerging and advanced topics in Computer Science. Topics vary with instructor and change from one semester to another.
Grade Mode: Normal Grading Mode

CS 583 Special Topics **1-4 Credit hours**
Study of emerging and advanced topics in Computer Science. Topics vary with instructor and change from one semester to another.
Grade Mode: Normal Grading Mode

CS 600 Advanced Web Technology **3 Credit hours**
This course introduces modern web technologies and covers the concepts, practices, and technologies to design, develop, and manage scalable, reliable and secure web applications using client side and server side programming, mobile technology, web services, rest services, and cloud services that are accessible to a large number of users.
Grade Mode: Normal Grading Mode

CS 601 The Internet of Things **3 Credit hours**
This course covers the Internet of Things (IoT) Technologies. The course includes advanced topics in wireless networking technologies, mobile networks, software and hardware design for IoT applications and systems. In addition, this course offers advanced topics in cybersecurity.
Grade Mode: Normal Grading Mode

CS 602 Cloud Computing **3 Credit hours**
Study of emerging and advanced topics in Cloud Computing including theory and application development in cloud and understand the ways of increasing quality of services for hosted applications.
Grade Mode: Normal Grading Mode

CS 605 Software Specifications **3 Credit hours**
Study of software specification and verification technologies that facilitate: semantic reasoning; and verification of development artifacts including functional models, architecture, and source-code implementations.
Grade Mode: Normal Grading Mode

CS 610 Software Design **3 Credit hours**
Study of approaches to software design that meet availability, manageability, maintainability, performance, reliability, scalability, and securability goals. Emphasis is on object-oriented analysis and design, design patterns and metrics.
Grade Mode: Normal Grading Mode

CS 615 Software Testing **3 Credit hours**
Study of methods and tools to design high quality tests during all phases of software development. Topics include test design, test automation, test coverage criteria, and how to test software.
Grade Mode: Normal Grading Mode

CS 620 Applied Algorithms **3 Credit hours**
Study of clustering, graph-theoretic, genetic, probabilistic and randomized algorithms and their application to machine learning, data streams, data mining, computer vision, natural language processing, information retrieval, and bioinformatics.
Grade Mode: Normal Grading Mode

CS 625 AI Principles and Methods **3 Credit hours**
Study of machine learning and statistical pattern recognition algorithms and their application to data mining, bioinformatics, speech recognition, natural language processing, robotic control, autonomous navigation, text and web data processing.
Grade Mode: Normal Grading Mode

CS 630 Machine Learning **3 Credit hours**
Study of machine learning and statistical pattern recognition algorithms and their application to data mining, bioinformatics, speech recognition, natural language processing, robotic control, autonomous navigation, text and web processing.
Grade Mode: Normal Grading Mode

CS 645 Advanced Topics Bioinformatics **3 Credit hours**
Study of advanced algorithms, data structures, and architectures required for solving complex problems in Bioinformatics. Focus is on analysis of patterns in sequences and 3D-structures. Team taught seminar course.
Grade Mode: Normal Grading Mode

CS 650 Special Topics **1-4 Credit hours**
Study of emerging and advanced topics in Computer Science. Topics vary with instructor and change from one semester to another.
Grade Mode: Normal Grading Mode

CS 651 Special Topics **1-4 Credit hours**
Study of emerging and advanced topics in Computer Science. Topics vary with instructor and change from one semester to another.
Grade Mode: Normal Grading Mode

CS 652 Special Topics **1-4 Credit hours**
Study of emerging and advanced topics in Computer Science. Topics vary with instructor and change from one semester to another.
Grade Mode: Normal Grading Mode

CS 653 Special Topics **1-4 Credit hours**
Study of emerging and advanced topics in Computer Science. Topics vary with instructor and change from one semester to another.
Grade Mode: Normal Grading Mode

CS 660 Big Data Systems **3 Credit hours**
Learn high performance computing architectures and methods for developing and querying databases for Big Data.
Grade Mode: Normal Grading Mode

CS 670 Visual Analytics **3 Credit hours**
Study of approaches, algorithms, and tools for Big Data exploration, analysis, and interpretation to enable novel discoveries and innovation. Integrating analytic capabilities of computers and domain knowledge of human analysts.
Grade Mode: Normal Grading Mode

CS 681 Thesis **1-6 Credit hours**
Investigate a research problem of theoretical interest and practical value under mentorship of a computer science faculty.
Attributes: No Textbook Required
Grade Mode: Credit/No Credit Grade Only

CS 685 Independent Study **1-4 Credit hours**
Pursue faculty supervised, individualized course of study of a topic which is not currently a part of the Computer Science graduate curriculum.
Grade Mode: Normal Grading Mode

CS 686 Independent Study **1-4 Credit hours**
Pursue faculty supervised, individualized course of study of a topic which is not currently a part of the Computer Science graduate curriculum.
Grade Mode: Normal Grading Mode

CS 687 Independent Study **1-4 Credit hours**
Pursue faculty supervised, individualized course of study of a topic which is not currently a part of the Computer Science graduate curriculum.
Grade Mode: Normal Grading Mode

CS 688 Independent Study **1-4 Credit hours**
Pursue faculty supervised, individualized course of study of a topic which is not currently a part of the Computer Science graduate curriculum.
Grade Mode: Normal Grading Mode

CS 690 Comprehensive Project **3 Credit hours**
Develop expertise in an emerging area of computer science through guided study under faculty mentorship.
Attributes: No Textbook Required
Grade Mode: Credit/No Credit Grade Only

CS 698 Internship **1-3 Credit hours**
Supervised work experience in computer science or related fields.
Attributes: No Textbook Required
Grade Mode: Credit/No Credit Grade Only

Electrical Engineering

EE 502 Instrumentation **3 Credit hours**
Grade Mode: Normal Grading Mode

EE 503 Power Systems **3 Credit hours**
Grade Mode: Normal Grading Mode

EE 504 Principles and Practices-EE **2 Credit hours**
Grade Mode: Normal Grading Mode

EE 510 Design Digital Systems **3 Credit hours**
This course provides fundamental understanding of Digital circuits. Students learn the essentials of digital circuit operation, design and simulate digital circuits using the techniques of practicing electrical and computer engineers.
Grade Mode: Normal Grading Mode

EE 511 Analog Computation **3 Credit hours**
Grade Mode: Normal Grading Mode

EE 514 Linear Systems **3 Credit hours**
Grade Mode: Normal Grading Mode

EE 515 Digital Signal Processing **3 Credit hours**
Grade Mode: Normal Grading Mode

EE 529 Linear Systems & Control **3 Credit hours**
The course provides a rigorous introduction to the analysis and control of linear dynamical systems in the time domain. The course introduces the fundamentals of linear spaces and linear operator theory.
Grade Mode: Normal Grading Mode

EE 530 Cyber-Physical Systems **3 Credit hours**
This course provides an introduction to modeling and analysis of cyber-physical systems. Several models of continuous-time systems and discrete-time systems are introduced.
Grade Mode: Normal Grading Mode

EE 535 Power System Protection **3 Credit hours**
This course covers the power system faults and application of relays for power system protection. Symmetrical components as applied fault currents. Introduction to digital filtering, microprocessor, computer simulation for relays.
Grade Mode: Normal Grading Mode

EE 585 Independent Study **1-4 Credit hours**
Grade Mode: Normal Grading Mode

EE 586 Independent Study **1-4 Credit hours**
Grade Mode: Normal Grading Mode

EE 587 Independent Study **1-4 Credit hours**
Grade Mode: Normal Grading Mode

EE 588 Independent Study **1-4 Credit hours**
Grade Mode: Normal Grading Mode

EE 601 Power Systems Analysis **3 Credit hours**
Grade Mode: Normal Grading Mode

EE 602 Random Signals & Noise **3 Credit hours**
This course provides an introduction to the fundamentals of random variables, random signals, and simulation of random phenomena.
Grade Mode: Normal Grading Mode

EE 603 Protectve Relaying in Powr Sys **3 Credit hours**
Grade Mode: Normal Grading Mode

EE 604 Electrical Machinery **3 Credit hours**
Grade Mode: Normal Grading Mode

EE 605 Comptr Meth in Power Sys Anly **3 Credit hours**
Grade Mode: Normal Grading Mode

EE 606 Electrical Analysis **3 Credit hours**
This course covers Laplace transform for boundary-value problem, applications to control theory, frequency response of ordinary differential equations, linear algebra techniques; eigenvalue analysis of linear systems and in multivariate optimization.
Grade Mode: Normal Grading Mode

EE 607 Adv Electrical Engr **3 Credit hours**
This course covers complex functions, complex integration, vectors, matrices, functions of matrices, Cayley-Hamilton theorem, state-space modeling, optimization techniques, least squares technique, total least squares, and numerical techniques.
Grade Mode: Normal Grading Mode

EE 608 Research Methods **3 Credit hours**
Overview of research methods in engineering. Research theory, design, ethics, and practice. Research plan and proposal. Experimental, numerical, and analytical research. Reviewing literatures, collect and analyze data quantitatively and qualitatively.
Grade Mode: Normal Grading Mode

EE 611 Digital Design **3 Credit hours**
This course covers the CMOS circuits. Design approaches with emphasis placed on structured full custom design, MOS device, critical interconnect and gate characteristics. CMOS logic design from transistor to fabrication.
Grade Mode: Normal Grading Mode

EE 615 Real Time Systems **3 Credit hours**
This course covers the Designing real-time embedded systems from a hardware and software perspective. Communications and signal processing systems. Applications to seismic monitoring, process control, and biomedical systems.
Grade Mode: Normal Grading Mode

EE 618 Data & Comm Networks **3 Credit hours**
This course introduces the underlying concepts behind networking using the internet and its protocols as examples.
Grade Mode: Normal Grading Mode

EE 624 Wireless Communication **3 Credit hours**
This course introduces fundamental technologies for wireless communication.
Grade Mode: Normal Grading Mode

EE 630 Robust Control **3 Credit hours**
Linear systems, norms for signals and systems, stability and performance, uncertainty and robustness, parameterization of stabilizing controllers, algebraic Riccati equations, H2 control, and H infinity control.
Grade Mode: Normal Grading Mode

EE 631 Optimal Control **3 Credit hours**
The course introduces the theory of Optimal Control. It covers evaluation methods for control signals that satisfy some physical constraints and minimize or maximize some performace measures.
Grade Mode: Normal Grading Mode

EE 636 Power System Operation **3 Credit hours**
This course covers modern power systems, operational, control problems, solution techniques. State estimation, contingency analysis, load-frequency control and automatic generation control, load flow analysis and external equivalents for steady-state operations.
Grade Mode: Normal Grading Mode

EE 638 Nonlinear Sys & Control **3 Credit hours**
The course provides a rigorous introduction to the analysis and control of nonlinear dynamical systems in time domain.
Grade Mode: Normal Grading Mode

EE 639 Renew Energy & Dist Generation **3 Credit hours**
This course covers the fundamentals of energy and sustainability; power efficiency; hydro, wind, solar, fuel systems; Converters and controllers for integration of renewable energy sources; Smart grid, hybrid generation systems.
Grade Mode: Normal Grading Mode

EE 642 Pattern Recognition 1 **3 Credit hours**
Grade Mode: Normal Grading Mode

EE 643 Pattern Recognition 2 **3 Credit hours**
Grade Mode: Normal Grading Mode

EE 650 Special Topics **1-4 Credit hours**
Subject matter to be selected from topics of current interest.
Grade Mode: Normal Grading Mode

EE 651 Special Topics **1-4 Credit hours**
Subject matter to be selected from topics of current interest.
Grade Mode: Normal Grading Mode

EE 652 Special Topics **1-4 Credit hours**
Subject matter to be selected from topics of current interest.
Grade Mode: Normal Grading Mode

EE 653 Special Topics **1-4 Credit hours**
Subject matter to be selected from topics of current interest.
Grade Mode: Normal Grading Mode

EE 656 Semiconductr Switchng Circuits **3 Credit hours**
Grade Mode: Normal Grading Mode

EE 658 Linear Syst-State Space Appro **3 Credit hours**
Grade Mode: Normal Grading Mode

EE 661 Continuous & Digital Cntrl Sys **3 Credit hours**
Grade Mode: Normal Grading Mode

EE 681 Microprocessors-Prin & Appl 1 **3 Credit hours**
Grade Mode: Normal Grading Mode

EE 682 Microprocessors-Prin & Appl 2 **3 Credit hours**
Grade Mode: Normal Grading Mode

EE 683 Microcomputer-Based Design **3 Credit hours**
Surface and subsurface geology, geotechnical properties of soil and rock. Geotechnical engineering design aspects of landfills, groundwater barriers, tunneling. Mechnics of ground movements, sediment and erosion control. (PR: Engine- ering or Geology degree)
Grade Mode: Normal Grading Mode

EE 684 Unknown **3 Credit hours**

EE 685 Independent Study **1-4 Credit hours**
Independent study in which a student meets regularly with a faculty member to discuss assignments.
Grade Mode: Normal Grading Mode

EE 686 Independent Study **1-4 Credit hours**
Independent study in which a student meets regularly with a faculty member to discuss assignments.
Grade Mode: Normal Grading Mode

EE 687 Independent Study **1-4 Credit hours**
Independent study in which a student meets regularly with a faculty member to discuss assignments.
Grade Mode: Normal Grading Mode

EE 688 Independent Study **1-4 Credit hours**
Independent study in which a student meets regularly with a faculty member to discuss assignments.
Grade Mode: Normal Grading Mode

EE 690 Special Topics **1-6 Credit hours**
Grade Mode: Normal Grading Mode

EE 698 Design Project **3 Credit hours**
The course introduces the principles of product design: specifications, evaluation of design alternatives, technical reports and oral presentations. Intellectual property, industry standards and conventions, engineering economics, reliability, safety, engineering ethics.
Grade Mode: Normal Grading Mode

EE 699 Thesis **1-6 Credit hours**
This represents the course designation for a Master's Degree Research Thesis. Successful completion of a thesis fulfills the research requirement for the M.S. degree in Electrical Engineering.
Grade Mode: Normal Grading Mode

EE 790 Advanced Independent Study **3 Credit hours**

Engineering Management

EM 601 The Management Process **3 Credit hours**
This course covers the management process and the structural, organizational and behavioral principles needed by managers to function effectively in organizational environments.
Grade Mode: Normal Grading Mode

EM 620 Mgt Tech HR & Orgs **3 Credit hours**
Principles leading to better management and development of technical human resources and organizations. Included are concepts technical managers need to positively change themselves and to lead others toward desired bahavior.
Grade Mode: Normal Grading Mode

EM 640 Personnel Administration **3 Credit hours**
Grade Mode: Normal Grading Mode

EM 642 Industrial Psychology **3 Credit hours**
Grade Mode: Normal Grading Mode

EM 644 Organizational Behavior **3 Credit hours**
Grade Mode: Normal Grading Mode

EM 650 Special Topics **1-4 Credit hours**
Study of special topics of an advanced nature. (PR: Consent)
Grade Mode: Normal Grading Mode

EM 651 Special Topics **1-4 Credit hours**
Study of special topics of an advanced nature. (PR: Consent)
Grade Mode: Normal Grading Mode

EM 652 Special Topics **1-4 Credit hours**
Study of special topics of an advanced nature. (PR: Consent)
Grade Mode: Normal Grading Mode

EM 653 Special Topics **1-4 Credit hours**
Study of special topics of an advanced nature. (PR: Consent)
Grade Mode: Normal Grading Mode

EM 660 Project Management **3 Credit hours**
Provides the student with a practical knowledge of how to integrate effectively the functional efforts of many in the execution of programs and projects.
Attributes: No Textbook Required
Grade Mode: Normal Grading Mode

EM 661 Advanced Project Management **3 Credit hours**
Course is designed to increase proficiency in the advanced aspects of project management. Participants will become aware of the project management processes in PMI's Project Management Body of Knowledge.
Grade Mode: Normal Grading Mode

EM 662 Organization Theory **3 Credit hours**
Grade Mode: Normal Grading Mode

EM 664 Mgt Res & Devel Organizations **3 Credit hours**
Techniques and methods for effective management of research and development organizations, projects, and personnel. (PR: EM 601)
Grade Mode: Normal Grading Mode

EM 665 Mgt Engineering Organizations **3 Credit hours**
Techniques and methods for effective management of engineering firms, departments, and personnel. (PR: EM 601)
Grade Mode: Normal Grading Mode

EM 668 Operations Management **3 Credit hours**
Examination of the quantitative and conceptual tools for generating goods and services in manufacturing and non-manufacturing organizations.
Grade Mode: Normal Grading Mode

EM 670 Seminar in Engineering Mgt **3 Credit hours**
Provides the student an opportunity to examine issues in engineering management and to evaluate their consequences in organizations, in the profession, and in society. (PR: Consent)
Grade Mode: Normal Grading Mode

EM 675 Engineering Economics **3 Credit hours**
The concepts and methods for the financial calculations involving time, value of money and uncertainty. Capital and departmental budgeting processes and engineering inputs to cost accounting. (PR: Consent)
Attributes: No Textbook Required
Grade Mode: Normal Grading Mode

EM 682 Management Information Systems **3 Credit hours**
Grade Mode: Normal Grading Mode

EM 683 Systems Analysis Technique **3 Credit hours**
Grade Mode: Normal Grading Mode

EM 684 Systems Design for Tech Info **3 Credit hours**
Grade Mode: Normal Grading Mode

EM 694 Engineering Law **3 Credit hours**
The American legal system, contracts and specifications, liability of professional engineers, product liability, agency relationships, patent and proprietary rights, and special problems in contracts are studied.
Grade Mode: Normal Grading Mode

EM 699 Comprehensive Project in EM **3 Credit hours**
Grade Mode: Satisfactory/Unsatisfactory

EM 770 Sem in Engineering Management **3 Credit hours**
Grade Mode: Normal Grading Mode

EM 780 Special Topics **3-6 Credit hours**
Grade Mode: Normal Grading Mode

EM 790 Final Project/Engr Management **3 Credit hours**
Grade Mode: Normal Grading Mode

EM 799 RESEARCH **1-6 Credit hours**
Grade Mode: Normal Grading Mode

Engineering & Science

ENGR 502 Microcomputer Wordprocessing **1 Credit hour**

ENGR 503 Microcomputer Telecommunicati **1 Credit hour**

ENGR 504 Microcomputer Database Appl **1 Credit hour**

ENGR 509 Microcomputer Applications **3 Credit hours**

ENGR 511 Technical Seminars **3 Credit hours**

ENGR 570 Finite Elements **3 Credit hours**
Theory and applications of the finite element method to problems in the area of static and dynamic structural analysis, heat transfer, fluids, and analogous solution.
Attributes: No Textbook Required
Grade Mode: Normal Grading Mode

ENGR 610 Applied Statistics **3 Credit hours**
Practical application of statistical techniques to decision-making, forecasting, optimization, experimental design. Interpretation of data using central tendency and dispersion, t-test, F-test, variance analysis, correlation, and linear regression.
Grade Mode: Normal Grading Mode

ENGR 620 Computer Applications **3 Credit hours**
Introduction to current software technology to solve problems of interest to technical professionals. Covers the use of tables, databases, modeling, curve fitting, and solution of equations.
Grade Mode: Normal Grading Mode

ENGR 650 Special Topics **1-4 Credit hours**
Formal study of engineering topics of current interest. (PR: Consent)
Grade Mode: Normal Grading Mode

ENGR 651 Special Topics **1-4 Credit hours**
Formal study of engineering topics of current interest. (PR: Consent)
Grade Mode: Normal Grading Mode

ENGR 652 Special Topics **1-4 Credit hours**
Formal study of engineering topics of current interest. (PR: Consent)
Grade Mode: Normal Grading Mode

ENGR 653 Special Topics **1-4 Credit hours**
Formal study of engineering topics of current interest. (PR: Consent)
Grade Mode: Normal Grading Mode

ENGR 670 Advanced Stress Analysis **3 Credit hours**
Three-dimensional stress and strain, failuer criteria, advanced topics in structural mechanics, energy methods, introduction to the theory of elasticity, fundamentals of fracture mechanics.
Grade Mode: Normal Grading Mode

ENGR 682 Research **1-6 Credit hours**
Completion of research under the supervision of a faculty member. Six semester hours of credit in research are applied toward the Thesis Option in the engineering MS degrees.
Grade Mode: Credit/No Credit Grade Only

ENGR 685 Independent Study **1-4 Credit hours**
An approved study of special interest concerning engineering under the supervision of a faculty member. (PR: Consent)
Grade Mode: Normal Grading Mode

ENGR 686 Independent Study **1-4 Credit hours**
An approved study of special interest concerning engineering under the supervision of a faculty member. (PR: Consent)
Grade Mode: Normal Grading Mode

ENGR 687 Independent Study **1-4 Credit hours**
An approved study of special interest concerning engineering under the supervision of a faculty member. (PR: Consent)
Grade Mode: Satisfactory/Unsatisfactory

ENGR 688 Independent Study **1-4 Credit hours**
An approved study of special interest concerning engineering under the supervision of a faculty members. (PR: Consent)
Grade Mode: Normal Grading Mode

ENGR 695 Internship in Engineering **3 Credit hours**
Supervised on-the-job experience. The student will work in a technology or engineering company or department with an organization. (PR: Permission)
Grade Mode: Credit/No Credit Grade Only

ENGR 699 Comprehensive Project **3 Credit hours**
Completion of comprehensive project under the supervision of a faculty member. Includes final written submittal and public oral presentation. Fulfills engineering MS requirement for Project Option.
Attributes: No Textbook Required
Grade Mode: Normal Grading Mode

Environmental Engineering

ENVE 600 Special Topics in Envr Engr **1-3 Credit hours**
Grade Mode: Normal Grading Mode

ENVE 611 Air Pollution Design I **3 Credit hours**
An introduction to absorption, condensation, incineration, absorption, and process modification relevant to the design of abatement systems for gaseous air pollutant emissions. (PR: unit operations, thermodynamics and calculus)
Grade Mode: Normal Grading Mode

ENVE 612 Air Pollution Design II **3 Credit hours**
An introduction to equipment, processes, and basic principles relevant to the design of particulate collection systems including electostatic precipitators, fabric filtration units, cyclones, and high energy scrubbers. (PR: ES 604 or courses in physics, fluid mechanics, and process design)
Grade Mode: Normal Grading Mode

ENVE 615 Environmental Chemistry **3 Credit hours**
Fundamental principles governing the various aspects of chemistry relevant to the environment will be addressed. The chemistry of waste treatment, cycle processes and other applications will be evaluated. (PR: Consent)
Grade Mode: Normal Grading Mode

ENVE 616 Wastewater Treatment Fac Dsgn **3 Credit hours**
Fundamental principles and applied practices of wastewater treatment facilities. Includes performance analysis, component selection, and system design for physical, chemical, and biological processes. (PR: ENVE 615)
Pre-req: ENVE 615.
Grade Mode: Normal Grading Mode

ENVE 617 Water Treatment Fac Design **3 Credit hours**
Fundamental principles and applied practices of water quality and water treatment facilities. Includes analysis of source waters, and design of physical and chemical system components. (PR: ENVE 615)
Grade Mode: Normal Grading Mode

ENVE 618 Pollution Prevention **3 Credit hours**
Introduces the student to the basic understanding and criteria required for establishing a pollution prevention program, including a review of successful industry practices Emphasis on management strategies. (PR: Undergraduate degree in science or engineering)
Grade Mode: Normal Grading Mode

ENVE 620 Solid Waste Management **3 Credit hours**
Solid waste management and minimization: options, methods, laws and regulations. Landfill design, testing, operation, monitoring, and closure. Use of composting in landfills. Incinerator design and operation. Separation and recycling approaches.
Grade Mode: Normal Grading Mode

ENVE 625 Hazardous Waste Manangement **3 Credit hours**
Options and methods of managing hazardous waste. Landfill design, testing, operation, monitoring, and closure. Incinerator design, testing, operation, and monitoring. Design and operation of treatment facilities. Waste reduction practices.
Grade Mode: Normal Grading Mode

ENVE 650 Special Topics **1-4 Credit hours**
Occasional special offerings in Environmental Engineering. (PR: Consent)
Grade Mode: Normal Grading Mode

ENVE 651 Special Topics **1-4 Credit hours**
Occasional special offerings in Environmental Engineering. (PR: Consent)
Grade Mode: Normal Grading Mode

ENVE 652 Special Topics **1-4 Credit hours**
Occasional special offerings in Environmental Engineering. (PR: Consent)
Grade Mode: Normal Grading Mode

ENVE 653 Special Topics **1-4 Credit hours**
Occasional special offerings in Environmental Engineering. (PR: Consent)
Grade Mode: Normal Grading Mode

ENVE 663 Environmental Permitting **3 Credit hours**
The permit process for the construction and operation of facilities, including stream crossing, wetlands, etc.; permits under Clean Air Act, Clean Water Act, NPDES, RCRA and TSCA.
Grade Mode: Normal Grading Mode

ENVE 670 Hydrology and Drainage Control **1-6 Credit hours**
The goal of this course is to develop an understanding of watershed processes, including precipitation, generation of runoff, infiltration, stream flow, soil erosion, sediment transport and deposition, and fluvial geomorgphology. The course provides students with an overview of hydrologic concepts, such as precipitation and runoff flow, with an emphasis on practical applications such as modeling and control of runoff and sedimentation. Additional practical applications covered in the course are highway drainage concepts, including calculation of runoff and design of channels, culverts and other control structures.
Grade Mode: Normal Grading Mode

ENVE 671 Hydraulic Structures **3 Credit hours**
Analysis and design of water conveyance channels and hydraulic structures, such as siphons, chutes, weirs, flumes, dams, spillways, gates, locks, storm surge barriers, and outlet works.
Grade Mode: Normal Grading Mode

ENVE 672 Watershed Modeling **3 Credit hours**
Setup, execution, and calibration of numerical watershed models. Includes the rational method, TR-55, HEC-1, and HEC-HMS. Emphasis on watershed analysis for decision making and drainage design.
Grade Mode: Normal Grading Mode

ENVE 673 Industrial Ventilation **3 Credit hours**
The design and analysis of industrial ventilation systems, including properties of air contaminants; hood, duct, and fan design; system performance; mine ventilation; air cleaning devices; testing; diagnosis; troubleshooting, cost analysis. (PR: Consent)
Grade Mode: Normal Grading Mode

ENVE 675 Industrial Noise Control **3 Credit hours**
Physics of sound, absorption and reflection, sound level measurements and instruments, and noise control criteria; audiometry and the physiology of hearing; community noise abatement; laws and regulations. (PR: undergraduate degree in science or engineering)
Grade Mode: Normal Grading Mode

ENVE 680 Air Poll Disper Meteoro Model **3 Credit hours**
Meteorological concepts with emphasis on air pollution; atmospheric dynamics, adiabatic processes; temperature profiles, behavior of stack effluent, atmospheric chemistry, attenuation of solar radiation, and climatology application to dispersion models. (PR: undergraduate course in physics, and spreadsheet capability)
Grade Mode: Normal Grading Mode

ENVE 681 Environmental Engr Design **3 Credit hours**
Principles of engineering design of water and waste- water treatment systems and processes, including physical, chemical and biological treatment and handling of treatment residuals. Includes coverage of relevant water quality concepts.
Grade Mode: Normal Grading Mode

ENVE 682 Environmental Remediation Tech **3 Credit hours**
Decontamination or removal of pollutants from soil. Aeration of excavated soil on site. Use of solvants and surfactants as removal aids. Removal of soil for treatment at an off-site facility. (PR: ES 651)
Grade Mode: Normal Grading Mode

ENVE 683 Environmental Geotechnology **3 Credit hours**
Surface and subsurface geology; geotechnical properties of soil and rock. Geotechnical engineering design aspects of landfills, groundwater barriers, tunneling. Mechanics of ground movement; sediment and erosion control. (PR: engineering or geology degree)
Grade Mode: Normal Grading Mode

Environmental Science

ES 514 Environmental Risk Assessment **3 Credit hours**
Attributes: No Textbook Required
Grade Mode: Normal Grading Mode

ES 550 Environmental Law & Policy **3 Credit hours**
Introduction to major federal environmental legislation and related state programs, judicial review, and practical effects, and to processes for formulation and development of environmental policy.
Grade Mode: Normal Grading Mode

ES 554 Watershed Protection **3 Credit hours**
This course reviews key components of watershed structure and functions before investigating and applying concepts for managing and restoring aquatic ecosystems.
Grade Mode: Normal Grading Mode

ES 575 Intro to Environmental Science **3 Credit hours**
The principles of chemistry, geology and mathematics used in pollution control. Topographic maps, environmental regulations, field testing and compliance. Econonmics of use of pollution control devices.
Grade Mode: Normal Grading Mode

ES 582 Special Topics **1-4 Credit hours**
Grade Mode: Normal Grading Mode

ES 583 Special Topics **1-4 Credit hours**
Grade Mode: Normal Grading Mode

ES 585 Independent Study **1-4 Credit hours**
Grade Mode: Normal Grading Mode

ES 586 Independent Study **1-4 Credit hours**
Grade Mode: Normal Grading Mode

ES 587 Independent Study **1-4 Credit hours**
Grade Mode: Normal Grading Mode

ES 588 Independent Study **1-4 Credit hours**
Grade Mode: Normal Grading Mode

ES 602 Study of WV Environment **3 Credit hours**
An overview of the diversity of the local natural environment, including the plants, insects, amphibians, reptiles, other wildlife, and the impact of human activities on the local environment.
Grade Mode: Normal Grading Mode

ES 603 Seminar In Current Envr Issues **3 Credit hours**
The influence of environmental laws, common law, contract law, tort law, and regulatory interpretations, as well as the impact of citizens' groups, professional societies, and trade associations on current practice. (PR: Consent)
Grade Mode: Normal Grading Mode

ES 604 Air Pollution **3 Credit hours**
Major air pollution sourcs; meteorological concepts; physical and chemical characterization; effects on plant and animal life; and development of air pollution laws, with emphasis on West Virginia regulations. (PR: Consent)
Grade Mode: Normal Grading Mode

ES 605 Analy Prin Environ Sampling **3 Credit hours**
Identifying and measuring contaminants in air, water, soil, and sludge. Methods of analysis including gas chromatography nuclear magnetic resonance, colorimetry, infrared absorption untraviolet absorption, atomic absorption, and mass spectroscopy. (PR: Chemistry and ES 600, or equivalent experience)
Grade Mode: Normal Grading Mode

ES 609 Topics in Bioscience Education **1-6 Credit hours**
Selected topics of interest to teachers of biology. (PR: Consent)
Grade Mode: Normal Grading Mode

ES 610 Envr Sampling Practice **3 Credit hours**
Current practice in environmental testing and monitoring. Traditional wastewater tests, bioassay analysis, aquatic toxicity. Current procedures in gas chromatographic analysis, mass spectrometry. Sample preservation, quality control, and quiality assurance. (PR: analytical chemistry and instrumental methods, or ES 605)
Grade Mode: Normal Grading Mode

ES 620 Environmental Management Sys **3 Credit hours**
EMS principles and elements; environmental, health and safety regulatory issues; ISO 14000 EMS specifications and guidelines; environmental auditing; environmental performance evaluation; life cycle assessment and environmental labeling.
Attributes: No Textbook Required
Grade Mode: Normal Grading Mode

ES 626 Remote Sensing & Map Use **3 Credit hours**
Introduction to topographic, soil, and geologic maps and aerial and satellite photography as sources of environmental information. Application of various data sources to specific types of environmental problems.
Grade Mode: Normal Grading Mode

ES 630 Environmental Site Assessment **3 Credit hours**
Site inspection and investigation, emphasizing the "due diligence" clause of Saction 107 of the Comprehensive Environmental Response Compensation Liability Act of 1980, site remediation, and data analysis and reporting.
Grade Mode: Normal Grading Mode

ES 640 Groundwater Princ & Monitoring **3 Credit hours**
Introduction to groundwater hydrogeology; including porosity hydraulic conductivity, aquifers, groundwater flow, well hydraulics, groundwater geology, and water chemistry. (PR: A background in environmental science or geology is recommended)
Grade Mode: Normal Grading Mode

ES 645 Applied Hydrogeology **3 Credit hours**
The fundamentals of hydrogeology are utilized to implement a case study investigation of a contaminated groundwater site from the planning stage through a final report. (PR: ES 640 or equivalent experience)
Grade Mode: Normal Grading Mode

ES 646 Dynamics of Ecosystems **3 Credit hours**
Species interaction; population, community and ecosystem ecology; productivity; nutrient cycling; physiological ecology, population dynamics; pollution and conservation; and aquatic, marine, and terrestrial ecosystems. (PR: Consent)
Grade Mode: Normal Grading Mode

ES 648 Vegetation of West Virginia **3 Credit hours**
Grade Mode: Normal Grading Mode

ES 651 Environmental Microbiology **3 Credit hours**
Grade Mode: Normal Grading Mode

ES 652 Special Topics **1-4 Credit hours**
Grade Mode: Normal Grading Mode

ES 655 Environmental Ethics **3 Credit hours**
Introduction to the subject of ethics, environmental ethical theory, moral reasoning, free market regulation, right to know, proprietary information, product liability cost-benefit analysis, risk assessment, waste disposal, and resource depletion. (PR: Consent)
Grade Mode: Normal Grading Mode

ES 656 Prep Eval Environ Impact State **3 Credit hours**
A practical course designed to provide students with the ability to prepare and evaluate impact statements. The course is based on the concepts of the environment as a single interrelated system.
Grade Mode: Normal Grading Mode

ES 660 Environmental Law I **3 Credit hours**
Introduction to major federal environmental legislation and related state programs, including policy issues, judicial review, and practical effects. Includes CERCLA, RCRA, Clean Water Act, NEPA, ESA and SDWA.
Grade Mode: Normal Grading Mode

ES 661 Environmental Regulations **3 Credit hours**
Practical applications and concentrated study of regulations under all major federal environmental programs, including permitting, reporting, and other compliance issues. Includes discussion of procedures used in development of regulations.
Grade Mode: Normal Grading Mode

ES 663 Environmental Law II **3 Credit hours**
Course covers three general topic areas: environmental assessment and biodiversity assessment (NEPA and ESA), risk management and the regulation of toxic substances (TSCA, FIFRA, and SDWA), and international environmental law.
Pre-req: ES 660.
Grade Mode: Normal Grading Mode

ES 665 Water Resources Management **3 Credit hours**
Course surveys the processes that govern the earth's hydrologic cycle and the human activities which effect that cycle. It seeks to provide an integrated science/managment/policy approach to water resource issues.
Grade Mode: Normal Grading Mode

ES 670 Sustainable Energy **3 Credit hours**
The course focuses on the technological and cost fundamentals of what is generally considered sustainable energy technologies, including solar, wind, biomass and other energy sources.
Grade Mode: Normal Grading Mode

ES 674 Epidemiological Hlth Res Tech **3 Credit hours**
An introduction to techniques of epidemiological health research. The primary focus will be health problems in the industrial setting.
Grade Mode: Normal Grading Mode

ES 675 Brownfields Management **3 Credit hours**
Environmental management and development of abandoned, idoled or underused industrial or commercial facilities where expansion or redevelopment is complicated by real or perceived environmental contamination.
Grade Mode: Normal Grading Mode

ES 680 Thesis **1-6 Credit hours**
Students completing ES 680 must defend their thesis in an oral examination.
Attributes: No Textbook Required
Grade Mode: Credit/No Credit Grade Only

Information Systems

IS 502 Advanced Programming **3 Credit hours**
Grade Mode: Normal Grading Mode

IS 510 Comptr Sys & Structured Prgm 2 **3 Credit hours**
A continuation of IS 500. Topics include aglorithm develop- ment, manipulation of arrays and an introduction to dynamic data structures. (PR: IS 500 or consent)
Pre-req: IS 500.
Grade Mode: Normal Grading Mode

IS 535 Applied Healthcare DB **3 Credit hours**
To understand the logical and physical design of data stored and retrieved from relational databases, how it applies to healthcare, and how HIM professionals can effectively communicate business requirements.
Grade Mode: Normal Grading Mode

IS 545 Healthcare Data Analytics **3 Credit hours**
The course focuses on the systems, techniques, strategies and methods of big data analysis, data mining and machine learning algorithms and data visualization in healthcare settings.
Grade Mode: Normal Grading Mode

IS 580 Special Topics **1-4 Credit hours**
Occasional offerings of current topics in information systems, providing important supplementary material for participating students.
Grade Mode: Normal Grading Mode

IS 581 Special Topics **1-4 Credit hours**
Occasional offerings of current topics in information systems, providing important supplementary material for participating students.
Grade Mode: Normal Grading Mode

IS 582 Special Topics **1-4 Credit hours**
Occasional offerings of current topics in information systems, providing important supplementary material for participating students.
Grade Mode: Normal Grading Mode

IS 583 Special Topics **1-4 Credit hours**
Occasional offerings of current topics in information systems, providing important supplementary material for participating students.
Grade Mode: Normal Grading Mode

IS 585 Independent Study **1-4 Credit hours**
An approved study of special interest, that is appropriate for the student's program of study, concerning information systems. Carried out under the supervision of a faculty member.
Grade Mode: Normal Grading Mode

IS 586 Independent Study **1-4 Credit hours**
An approved study of special interest, that is appropriate for the student's program of study, concerning information systems. Carried out under the supervision of a faculty member.
Grade Mode: Normal Grading Mode

IS 587 Independent Study **1-4 Credit hours**
An approved study of special interest, that is appropriate for the student's program of study, concerning information systems. Carried out under the supervision of a faculty member.
Grade Mode: Normal Grading Mode

IS 588 Independent Study **1-4 Credit hours**
An approved study of special interest, that is appropriate for the student's program of study, concerning information systems. Carried out under the supervision of a faculty member.
Grade Mode: Normal Grading Mode

IS 600 Management Information Systems **3 Credit hours**
The course examines personal, work group, and enterprise information systems with respect to their value, their components, and the process of developing them.
Grade Mode: Normal Grading Mode

IS 603 Program for Artificial Intell **3 Credit hours**
An introduction to programming for artificial intelligence applications using Prolog.
Grade Mode: Normal Grading Mode

IS 605 Systems Analysis and Design **3 Credit hours**
This course focuses on analysis and design of information systems. Topics include system development approaches, UML design, system integration, system-oriented architecture and foundation. Introduction to information systems from system implementor's viewpoint; information systems life cycle; techniques of analysis; data dictionaries and data flow diagrams; computer-oriented system description. (PR: Admission to program)
Grade Mode: Normal Grading Mode

IS 610 Systems Quality Assurance **3 Credit hours**
This course will cover the steps in developing enterprise IT policies, standards, guidelines and procedures while ensuring quality and compliance responsible for the design, implementation, and evaluation, and monitoring of a comprehensive system. Physical design of information systems; hardware selection; software design, database considerations; program development; software structuring techniques; cost/ performance trade-offs; system implementation; evaluation and optimization techniques. (PR: IS 605)
Pre-req: IS 605 or IS 605G.
Grade Mode: Normal Grading Mode

IS 615 System Simulation **3 Credit hours**
An introduction to discrete-event computer modeling and simulation. Probability distributions, model verification and validation, input data collection, output analysis. Simulation languages and software. (PR: Programming capability and quantitative skills)
Grade Mode: Normal Grading Mode

IS 618 Computer Appl in Engi & Sci I **3 Credit hours**
Computational and algorithmic methods in engineering and science, optimization and numerical analytic techniques including gradient and search methods, linear programming, simulation, and data base mechanics. (PR: Admission to the program)
Grade Mode: Normal Grading Mode

IS 620 Intro to Operating Systems **3 Credit hours**
General principles of managing jobs, processes and storage (real, virtual, auxiliary) in multiprogramming operating systems; interconnection and management of processors in multi-processing and distributed computing system configurations; operating systems comparison. (PR: IS 621 and IS 630, or consent)
Pre-req: IS 621 or IS 520G.
Grade Mode: Normal Grading Mode

IS 621 Information Structures I **3 Credit hours**
Representation and manipulation of numeric and non-numeric information, linear lists, strings, multilinked structures; sorting and searching; storage management; data structures in programming language. Relevant aspects of discrete mathematics. (PR: IS 510 or equivalent)
Grade Mode: Normal Grading Mode

IS 622 Emerging Tech in Info Systems **3 Credit hours**
This course will explore the emerging technologies in information systems. These technologies are generally new but include older technologies that are still controversial and relatively undeveloped in potential (PR: IS 621) A continuation of IS 621. Tree, graph, and set structures; file structures for secondary storage; aspects of discrete mathematics. (PR: IS 621)
Pre-req: IS 621.
Grade Mode: Normal Grading Mode

IS 623 Database Management **3 Credit hours**
Review of information structures and of relationships among data elements and objects. Relational database theory; design and organization of databases, retrieval structures, and query mechanisms. (Prerequisite: IS 622 or consent)
Pre-req: IS 621 (may be taken concurrently).
Concurrent PR: IS 621
Grade Mode: Normal Grading Mode

IS 624 Data Warehousing **3 Credit hours**
A hand-on introduction to the concepts and techniques of data warehousing and data mining.
Pre-req: IS 623.
Grade Mode: Normal Grading Mode

IS 625 Software Engineering **3 Credit hours**
The process of developing complex software products. Includes the software life cycle, methods and tools for life cycle phases. Application of concepts, methods, and tools in a class project.
Grade Mode: Normal Grading Mode

IS 630 Comp Arch & Assembly Lang **3 Credit hours**
An introduction to the composition and operation of electronic digital computers and to assembly language programming. (PR: IS 510 or equivalent)
Pre-req: IS 510.
Grade Mode: Normal Grading Mode

IS 631 Information Security **3 Credit hours**
This course provides foundation knowledge in information security, including protecting information assets, risk mitigation strategies, response to security incidents, and designing secure systems.
Grade Mode: Normal Grading Mode

IS 635 Computer Graphics **3 Credit hours**
An introduction to the areas of computer graphics that are necessary to understand, evaluate, and develop graphics applications. (PR: Admission to program)
Pre-req: IS 500.
Grade Mode: Normal Grading Mode

IS 640 Programming Languages **3 Credit hours**
Definition of program environment, program sequence and control, subroutines and other secondary sequences; statement structures, parsing, grammers, etc.; classes of programming languages. (PR: IS 622 or consent)
Grade Mode: Normal Grading Mode

IS 645 Geographic Information Systems **3 Credit hours**
Covers the elements of GIS hardware, software, data and infrastructure needs. Input data issues; data types, sources, error, preprocessing, manipulation and analysis, GIS tools and applications. (PR: Consent)
Grade Mode: Normal Grading Mode

IS 646 Computer Sys Security **3 Credit hours**
This course is designed to provide the technical and analytical skills to implement computer security. Students review how to manage computer security, current security technologies, and incident response.
Grade Mode: Normal Grading Mode

IS 647 IT Disaster Plan and Recovery **3 Credit hours**
This course provides the skills necessary to manage IT disaster recovery planning. The course focuses on the protection of information. Students will analyze risk, design a plan, and explore available technologies.
Grade Mode: Normal Grading Mode

IS 650 Special Topics **1-4 Credit hours**
Different transmission media, digital communications, telecommunications services, types of networks and topologies, network protocols, components, and applications. (PR IS 521 or TM 660 or Permission)
Grade Mode: Normal Grading Mode

IS 651 Special Topics **1-4 Credit hours**
Varies according to interests of students and instructor. (PR: Consent)
Grade Mode: Normal Grading Mode

IS 652 Special Topics **1-4 Credit hours**
Varies according to interests of students and instructor. (PR: Consent)
Grade Mode: Normal Grading Mode

IS 653 Special Topics **1-4 Credit hours**
Occasional offerings of current topics in information systems, providing important supplementary material for participating students.
Grade Mode: Normal Grading Mode

IS 655 Multimedia & Elec Dissem **3 Credit hours**
Components of multimedia, such as data, voice, pictures, animations, and videos, and their production, manipulation, dissemination processes. Technologies, processes, and services for electronic dissemination. Applications and current trends. (TM 660 or permission)
Grade Mode: Normal Grading Mode

IS 656 Comm & Network Technologies **3 Credit hours**
Different transmission media, digital communications, telecommunications services, types of networks and topologies, network protocols, components, and applications. (PR: IS 622, or TM 660, or permission)
Grade Mode: Normal Grading Mode

IS 660 Models of Computation **3 Credit hours**
Switching algebra and relationship to computers; finite automata; Turing machines; recursion; computability and unsolvability. (PR: IS 622, math maturity)
Grade Mode: Normal Grading Mode

IS 665 Health Care Enterpr Info Syst **3 Credit hours**
A hands-on introduction to using a health care enterprise information system providing students opportunity to work with elements of an EIS
Grade Mode: Normal Grading Mode

IS 670 Lang Translators & Concepts **3 Credit hours**
Formal language concepts, syntactic analysis; types of translators; detailed review of assemblers, interpreters, and compilers, and techniques of their construction. (PR: IS 622)
Grade Mode: Normal Grading Mode

IS 680 Social Issues in Info Systems **3 Credit hours**
Aspects of the interaction of computer systems and society including such topics as system security, respect of privacy, changing job requirements, ergonomics, and moral and ethical considerations. (PR: Completion of core, or consent of instructor)
Grade Mode: Normal Grading Mode

IS 681 Thesis **1-6 Credit hours**
Investigate a research problem of theoretical interest and practical value under mentorship of a information systems and computer science faculty.
Grade Mode: Credit/No Credit Grade Only

IS 685 Independent Study **1-4 Credit hours**
An approved study of special interest, that is appropriate for the student's program of study, concerning information systems. Carried out under the supervision of a faculty member.
Grade Mode: Normal Grading Mode

IS 686 Independent Study **1-4 Credit hours**
An approved study of special interest, that is appropriate for the student's program of study, concerning information systems. Carried out under the supervision of a faculty member.
Grade Mode: Normal Grading Mode

IS 687 Independent Study **1-4 Credit hours**
An approved study of special interest, that is appropriate for the student's program of study, concerning information systems. Carried out under the supervision of a faculty member.
Grade Mode: Normal Grading Mode

IS 688 Independent Study **1-4 Credit hours**
An approved study of special interest, that is appropriate for the student's program of study, concerning information systems. Carried out under the supervision of a faculty member.
Grade Mode: Normal Grading Mode

IS 690 Prin of Artificial Intelligncе **3 Credit hours**
A survey of the field of artificial intelligence and expert systems. Students will work together designing and implementing a project. (PR: Permission)
Grade Mode: Normal Grading Mode

IS 691 Comprehensive Project **3 Credit hours**
Develop expertise in an emerging area of information systems through guided study under faculty mentorship.
Grade Mode: Credit/No Credit Grade Only

IS 692 Image Processing **3 Credit hours**
Image Processing focuses on the application of technology to scientific analysis of images. Topics include: measurement techniques, scientific methods of reconstruction and interpretation of images; enhancement of images and video.
Grade Mode: Normal Grading Mode

IS 695 Expert Systems **3 Credit hours**
A review of expert systems techniques and applications. Participants will develop small expert systems using several different personal computer expert systems development programs (shells)
Grade Mode: Normal Grading Mode

IS 698 Internship **1-3 Credit hours**
Supervised work experience in information systems or related fields.
Attributes: No Textbook Required
Grade Mode: Credit/No Credit Grade Only

IS 699 Final Project **1-6 Credit hours**
Grade Mode: Normal Grading Mode

Mechanical Engineering

ME 502 Principles and Practices-ME **2 Credit hours**
Grade Mode: Normal Grading Mode

ME 515 Vehicle Dynamics **3 Credit hours**
Deals with ground vehicle stability and control. Contribution of tire lateral force, stiffness, and aligning torque to stability. Effects of suspension geometry, chassis stiffness, and roll stiffness.
Grade Mode: Normal Grading Mode

ME 520 Intro Comp Fluid Dynamic **3 Credit hours**
This course covers governing equations, ordinary differential equations (ODEs), numerical integration; finite difference and finite volume methods for parabolic, ellipitic, hyperbolic partial differential equations (PDEs), numerical linear algebra; turbulence modeling.
Grade Mode: Normal Grading Mode

ME 530 Renewable Energy **3 Credit hours**
Basic principles and technical details of various renewable energy technologies for the sustainable future. Process design, energy analysis, engineering economics and environmental assessment of renewable energy systems.
Grade Mode: Normal Grading Mode

ME 545 Nano-Materials **3 Credit hours**
Covers fundamentals of nanomaterial and nanotechnology. Unique properties of nanomaterials. Synthesis methods of various nanomaterials. Nano and microfabrication techniques. Applications of nanomaterials in various technologies, environmental science, biotechnology and biomedicine.
Grade Mode: Normal Grading Mode

ME 560 Automation and Control **3 Credit hours**
This course provides an overview of the principles of automation and concept of system control, including instrumentation, control, human interface, and communication subsystems.
Grade Mode: Normal Grading Mode

ME 601 Advanced Engr Analysis I **3 Credit hours**
The core of this course is to learn advance analytical and computational methods to solve multi-dimensional conduction, convection-advection, mechanical vibration, and elasticity equations.
Grade Mode: Normal Grading Mode

ME 602 Advanced Engr Analysis II **3 Credit hours**
This is the second course in a two-course sequence to learn advanced analytical and computational methods to solve multi-dimensional diffusion, heat, biharmonic, and elasticity equations.
Pre-req: ME 601.
Grade Mode: Normal Grading Mode

ME 604 Research Methods **3 Credit hours**
Research methods in engineering conducting critical reviews of research literature, preparing pre-proposal, and initiating background research on a thesis topic. Student is expected to submit a thesis pre-proposal.
Attributes: No Textbook Required
Grade Mode: Normal Grading Mode

ME 617 Additive Manufacturing **3 Credit hours**
Additive manufacturing (AM), rapid prototyping, rapid tooling, joining processes, direct digital manufacturing to form 3D parts with applications ranging from prototyping to production in aerospace, defense, and biomedical industries.
Grade Mode: Normal Grading Mode

ME 621 Corrosion Engineering **3 Credit hours**
Covers the causes and mechanisms of aqueous corrosion, electrochemistry and thermodynamicsof corrosion. Materials selection, design for minimization of corrosion, and corrosion protection. Case studies are discussed.
Grade Mode: Normal Grading Mode

ME 625 Tribology **3 Credit hours**
Detailed coverage of the mechanisms of friction, material wear, and major lubrication techniques - liquids, solids, and gases - with traditional and modern applications. Coverage of micro/nanotribology, MEMS, and magnetic surface storage applications.
Grade Mode: Normal Grading Mode

ME 628 Applied Biomaterials **3 Credit hours**
Covers the knowledge needed to select and design biomaterials used in medical devices with emphasis on metallic, ceramic, polymeric, and composite biomaterials. Explains the difference between materials science and materials engineering.
Grade Mode: Normal Grading Mode

ME 630 Manufacturing Systems **3 Credit hours**
This course covers tool design and metal cutting theory, CAD/CAM, CIM, CNC m/c, CNC programming, fixture design, metal forming, gear manufacturing, non-tradtional machining, PLC, flexible manufacturing, robotics, rapid prototyping/tooling.
Grade Mode: Normal Grading Mode

ME 635 Advanced Vibrations **3 Credit hours**
Modeling of vibratory motion of advanced mechanical and structural systems, including continuous systems, nonlinear systems and systems with random excitations.
Grade Mode: Normal Grading Mode

ME 640 System Modeling **3 Credit hours**
Overview of system modeling and simulation of complex systems with mechanical, hydraulic, thermal and/or electrical elements. Frequency response analysis, stability, and numerical analysis of system modeling.
Grade Mode: Normal Grading Mode

ME 645 Nonlinear Dynamics **3 Credit hours**
Nonlinear dynamical systems, including concepts of chaos, fractal and classic dynamics equations, one dimension systems, two dimension systems, phase plane, limit cycle, bifurcation, Lorenz equation, and fractals.
Grade Mode: Normal Grading Mode

ME 649 Sustainable Energy Management **3 Credit hours**
Sustainable energy management, provides an overview of mechanical and control systems within buildings with sub-systems which possess a visible energy signature in terms of energy usage, inefficiency, and impact.
Attributes: No Textbook Required
Grade Mode: Normal Grading Mode

ME 650 Special Topics **1-4 Credit hours**
Subject matter to be selected from topics of current interest.
Grade Mode: Normal Grading Mode

ME 651 Special Topics **1-4 Credit hours**
Subject matter to be selected from topics of current interest.
Grade Mode: Normal Grading Mode

ME 652 Special Topics **1-4 Credit hours**
Subject matter to be selected from topics of current interest.
Grade Mode: Normal Grading Mode

ME 653 Special Topics **1-4 Credit hours**
Subject matter to be selected from topics of current interest.
Grade Mode: Normal Grading Mode

ME 699 Thesis **1-6 Credit hours**
This course covers the communication problems encountered in researching and writing a thesis: the scientific writing of a research paper, the speaking and presenting skills, and the organization skills.
Grade Mode: Normal Grading Mode

Safety Technology

SFT 536 Safety Ed for Elem Teachers **1 Credit hour**
Grade Mode: Normal Grading Mode

SFT 540 Indust Fire Protection **3 Credit hours**
An introductory course that explores the relationship between engineering and fire prevention. Topics include: water supplies, sprinkler systems, behavior of fire and materials, fire protection, fire extinguishers, and other systems.
Grade Mode: Normal Grading Mode

SFT 553 International Safety & Health **3 Credit hours**
The course covers the impact of globalization on worldwide safety and health programs, and a wide variety of safety and health programs for various countries and multi-national organizations.
Grade Mode: Normal Grading Mode

SFT 554 Indust Hygiene I **3 Credit hours**
Environmental protection as related to industrial settings. Air/water quality, noise and chemical pollution and hazardous material control.
Grade Mode: Normal Grading Mode

SFT 555 Environmental Prog/Sampling **3 Credit hours**
Grade Mode: Normal Grading Mode

SFT 558 Hospital Safety **3 Credit hours**
The course covers the various aspects of safety and health in professional health care services.
Grade Mode: Normal Grading Mode

SFT 561 Workers Comp **3 Credit hours**
Introductory principles of workers' compensation and how it relates to the safety professional.
Grade Mode: Normal Grading Mode

SFT 565 Incident Investigation Tech **3 Credit hours**
An introductory course in accident investigation designed to give insight into the recognition and collection of evidence, collection and recording data and reconstructing the accident based on the facts.
Grade Mode: Normal Grading Mode

SFT 575 System Safety Engineering **3 Credit hours**
Grade Mode: Normal Grading Mode

SFT 580 Special Topics **1-4 Credit hours**
Grade Mode: Normal Grading Mode

SFT 581 Special Topics **1-4 Credit hours**
Grade Mode: Normal Grading Mode

SFT 582 Special Topics **1-4 Credit hours**
Grade Mode: Normal Grading Mode

SFT 583 Special Topics **1-4 Credit hours**
Grade Mode: Normal Grading Mode

SFT 585 Independent Study **1-4 Credit hours**
Grade Mode: Normal Grading Mode

SFT 586 Independent Study **1-4 Credit hours**
Grade Mode: Normal Grading Mode

SFT 587 Independent Study **1-4 Credit hours**
Grade Mode: Normal Grading Mode

SFT 589 Process Safety Mgmt **3 Credit hours**
A study of the latest industrial safety information which will assist the student in designing a program to reduce or eliminate all incidents which downgrade the system.
Grade Mode: Normal Grading Mode

SFT 591 Workshop **1-4 Credit hours**
Grade Mode: Normal Grading Mode

SFT 592 Workshop **1-4 Credit hours**
Grade Mode: Normal Grading Mode

SFT 593 Workshop **1-4 Credit hours**
Grade Mode: Normal Grading Mode

SFT 594 Workshop **1-4 Credit hours**
Grade Mode: Normal Grading Mode

SFT 597 Occup Sft & Health Prog Dev **3 Credit hours**
Safety functions in industry. Principles of organization and application of safety programs. Prevention, correction, and control methods are outlined and evaluated.
Grade Mode: Normal Grading Mode

SFT 599 Dev & Mgt of Occup Safety Prog **3 Credit hours**
A study of safety programs at the state and local levels including the administrative, instructional, and protective aspects of a comprehensive safety program in schools, occupations, home and public.
Grade Mode: Normal Grading Mode

SFT 601 Safety in Transportation **3 Credit hours**
Concerned with safe, efficient movement of people and goods. Involves highway, air, water, pipeline, and rails.
Grade Mode: Normal Grading Mode

SFT 606 Field Esp Safety Specialist **3 Credit hours**
Grade Mode: Normal Grading Mode

SFT 610 Intro to Prof Safety & Health **3 Credit hours**
An analysis of the educational philosophies and the application of these philosophies to occupational safety. A study of the effect of occupational safety on modern living.
Grade Mode: Normal Grading Mode

SFT 630 Current Lit & Res in Safety **3 Credit hours**
An analysis and study of selected works of national and international authors concerning significant works in Occupational Safety.
Attributes: No Textbook Required
Grade Mode: Normal Grading Mode

SFT 645 Saf Engineering Equip Design **3 Credit hours**
The design and engineering of facilities and equipment to meet the physical needs of the human as well as enhancing production.
Grade Mode: Normal Grading Mode

SFT 647 Industrial Hygiene II **3 Credit hours**
Concerned with environmental health and safety hazards that arise out of or occur during work of employees.
Grade Mode: Normal Grading Mode

SFT 647L Quan Indus Hygiene Lab **3 Credit hours**
A laboratory course designed to complement Industrial Hygiene.
Grade Mode: Normal Grading Mode

SFT 648 Industrial Ventilation **3 Credit hours**
This course will cover the techniques of development, design maintenance, and troubleshooting of industrial ventilation systems. Also the types of ventilation systems used for different types of toxic materials.
Pre-req: SFT 647 or SED 647.
Grade Mode: Normal Grading Mode

SFT 649 Biophysical Hazards & Monitor **3 Credit hours**
Grade Mode: Normal Grading Mode

SFT 650 Internship Safety Specialist **3-12 Credit hours**
Attributes: No Textbook Required
Grade Mode: Credit/No Credit Grade Only

SFT 651 Toxicology & Epidemiology **3 Credit hours**
Grade Mode: Normal Grading Mode

SFT 652 Industrial Noise & Vibration **3 Credit hours**
Pre-req: (SFT 554 or SED 554) or (SFT 647 or SED 647).
Grade Mode: Normal Grading Mode

SFT 660 Appl Ergon and Hum Factors Eng **3 Credit hours**
A study of how humans interact with the work environment, focusing on human capabilities and limitations, repetitive motion disorders, the human/machine interface and workspace design.
Attributes: No Textbook Required
Grade Mode: Normal Grading Mode

SFT 661 Adv Occup Ergonomics **3 Credit hours**
Pre-req: SFT 660 or SED 660.
Grade Mode: Normal Grading Mode

SFT 662 Methods in Work Analysis **3 Credit hours**
Grade Mode: Normal Grading Mode

SFT 663 Work Environment Issues **3 Credit hours**
An examination of the aspects of the work environment that can affect health: time pressure, machine pacing, control etc. The recognition, measurement and control of these factors will be discussed.
Grade Mode: Normal Grading Mode

SFT 669 Traffic Safety Management **3 Credit hours**
Grade Mode: Normal Grading Mode

SFT 679 Problem Report **1-3 Credit hours**
Grade Mode: Normal Grading Mode

SFT 681 Thesis **1-6 Credit hours**
Attributes: No Textbook Required
Grade Mode: Normal Grading Mode

SFT 690 Seminar **1-4 Credit hours**
Grade Mode: Normal Grading Mode

SFT 691 Seminar **1-4 Credit hours**
Grade Mode: Normal Grading Mode

SFT 692 Seminar **1-4 Credit hours**
Grade Mode: Normal Grading Mode

Technology and Engineering

TE 600 Orientation CITE Grad Studies **0 Credit hours**
Orientation course covering skills such as technical communication, quantitative reasoning, research methods, ethics and professionalism, team work, and discipline-specific information.
Grade Mode: Credit/No Credit Grade Only

TE 650 Special Topics **4 Credit hours**
Occasional offerings of current topics in technology and engineering, providing important supplementary material for participating students.
Grade Mode: Credit/No Credit Grade Only

TE 651 Special Topics **1-4 Credit hours**
Occasional offerings of current topics in technology and engineering, providing important supplementary material for participating students.
Grade Mode: Normal Grading Mode

TE 652 Special Topics **1-4 Credit hours**
Occasional offerings of current topics in technology and engineering, providing important supplementary material for participating students.
Grade Mode: Normal Grading Mode

TE 653 Special Topics **1-4 Credit hours**
Occasional offerings of current topics in technology and engineering, providing important supplementary material for participating students.
Grade Mode: Normal Grading Mode

TE 685 Independent Study **1-4 Credit hours**
An approved study of special interest, that is appropriate for the student's program of study, concerning technology and engineering. Carried out under the supervision of a faculty member.
Grade Mode: Normal Grading Mode

TE 686 Independent Study **1-4 Credit hours**
An approved study of special interest, that is appropriate for the student's program of study, concerning technology and engineering. Carried out under the supervision of a faculty member.
Grade Mode: Normal Grading Mode

TE 687 Independent Study **1-4 Credit hours**
An approved study of special interest, that is appropriate for the student's program of study, concerning technology and engineering. Carried out under the supervision of a faculty member.
Grade Mode: Normal Grading Mode

TE 688 Independent Study **1-4 Credit hours**
An approved study of special interest, that is appropriate for the student's program of study, concerning technology and engineering. Carried out under the supervision of a faculty member.
Grade Mode: Normal Grading Mode

TE 698 Comp Project Formulation **3 Credit hours**
Comprehensive project proposal is developed, approved, and work begun, under supervision. Technical report writing, oral presentations, and communication skills. (PR: EM 660) S/U Grading.
Pre-req: EM 660.
Grade Mode: Credit/No Credit Grade Only

TE 699 Comprehensive Project **3 Credit hours**
Completion of comprehensive project under the supervision of a faculty member. Includes final written submittal and public oral presentation. (PR: TE 698) S/U Grading.
Attributes: No Textbook Required
Grade Mode: Credit/No Credit Grade Only

Technology Management

TM 600 Program Introduction Seminar **1 Credit hour**
This course reviews fundamental mathematical and statistical methods, presentations, report writing, group project skills and use of case studies. An orientation and overview to the degree program are also provided.
Pre-req: TM 610 (may be taken concurrently).
Concurrent PR: TM 610
Grade Mode: Normal Grading Mode

TM 610 Mgmt of Innovation & Tech **3 Credit hours**
Provides a comprehensive introduction to technology and innovation managment. Considers issues relating to international markets, innovation, and rapidly changing technology. Also covers effective organizational and managerial approaches to technology.
Grade Mode: Normal Grading Mode

TM 612 Econ & Financial Analysis **3 Credit hours**
Tools and techniques for analyzing companies and their financial statements and for evaluating financial alter- natives, including discounted cash flow, net present value and return on investment. (PR: TM 610)
Attributes: No Textbook Required
Grade Mode: Normal Grading Mode

TM 615 Info Tech Strategies **3 Credit hours**
This course provides sound principles for managing infor- mation technology computers and telecommunications systems as well as the processes and procedures for applying the principles. (PR: TM 610)
Grade Mode: Normal Grading Mode

TM 620 Technology Planning **3 Credit hours**
Methods of technology planning, strategic management, and forecasting for use in technology intensive organizations are discussed, including technology life cycles and strategies for commercializing products. (PR: Full Admis- sion to TM program, or permission of TM Program Director)
Grade Mode: Normal Grading Mode

TM 630 Qual & Prod Methods **3 Credit hours**
Study of quality and productivity improvement methods with emphasis on applications to knowledge worker organizations. Examines total quality management, and personal and organizational productivity improvement processes. (PR: TM 610)
Grade Mode: Normal Grading Mode

TM 640 Intelligent Transpor Systems **3 Credit hours**
Overview of transportation telemetrics and introduction to intelligent transportation systems. Communications and computing technologies in transportation. Overview of issues: traffic safety, public transportation.
Grade Mode: Normal Grading Mode

TM 650 Special Topics **1-4 Credit hours**
Ocasional offerings of current topics in technology man- agement, providing important supplementary material for participating students. (PR: Full Admission to TM program or permission of TM Program Director).
Grade Mode: Normal Grading Mode

TM 651 Special Topics **1-4 Credit hours**
Occasional offerings of current topics in technology man- agement, providing important supplementary material for participating students. (PR: Full Admission to TM program or permission of TM Program Director).
Grade Mode: Normal Grading Mode

TM 652 Special Topics **1-4 Credit hours**
Occasional offerings of current topics in technology man- agement, providing important supplementary material for participating students. (PR: Full Admission to TM program or permission of TM Program Director).
Grade Mode: Normal Grading Mode

TM 653 Special Topics **1-4 Credit hours**
Occasional offerings of current topics in technology man- agement, providing important supplementary material for participating students. (PR: Full Admission to TM program or permission of TM Program Director).
Grade Mode: Normal Grading Mode

TM 659 Digital Access Pol & Strats **3 Credit hours**
An introductory course for creating digital accessibility policies and plans for the workplace. Includes strategies to create accessible documents, evaluate web site accessibility, and investigate assistive technologies.
Grade Mode: Normal Grading Mode

TM 660 Computing & Info Sys Tech **3 Credit hours**
Provides a broad understanding of computing and information systems technologies with emphasis on development, current trends, strategic and tactical management, and legal and regulatory issues. (PR: TM 615)
Pre-req: TM 615 (may be taken concurrently).
Concurrent PR: TM 615
Grade Mode: Normal Grading Mode

TM 664 Health Informatics **3 Credit hours**
Introduction of various aspects of medical informatics, including medical literature search and retrieval, management and analysis of data, modeling and simulation, data communications, on-line databases, and clinical decision analysis.
Grade Mode: Normal Grading Mode

TM 667 Mod Mfg Concepts **3 Credit hours**
The course covers modern manufacturing concepts, analysis, and tools such as Just-In-Time, MRP systems, Lean Manufacturing, inventory management, total quality manufacturing, factory physics, and operating and control philosophies.
Grade Mode: Normal Grading Mode

TM 668 Computer Integrated Mfg **3 Credit hours**
Grade Mode: Normal Grading Mode

TM 685 Independent Study **1-4 Credit hours**
An approved study of special interest concerning technology management, under the supervision of a faculty member. (PR: Full Admission to TM program, or permission of TM Program Director).
Grade Mode: Normal Grading Mode

TM 686 Independent Study **1-4 Credit hours**
An approved study of special interest concerning technology management, under the supervision of a faculty member. (PR: Full Admission to TM program, or permission of TM Program Director).
Grade Mode: Normal Grading Mode

TM 687 Independent Study **1-4 Credit hours**
An approved study of special interest concerning technology management, under the supervision of a faculty member: (PR: Full Admission to TM program, or permission of TM Program Director).
Grade Mode: Normal Grading Mode

TM 688 Independent Study **1-4 Credit hours**
An approved study of special interest concerning technology management, under the supervision of a faculty member. (PR: Full Admission to TM program, or permission of TM Program Director).
Grade Mode: Normal Grading Mode

TM 698 TM Internship **3 Credit hours**
Supervised on-the-job experience. The student will work in a technology company or technical department within an organization. (PR: Permission)
Attributes: No Textbook Required
Grade Mode: Credit/No Credit Grade Only

TM 699 TM Capstone Project **3 Credit hours**
An individualized technology management capstone project, which will be planned and carried out under the supervision of a faculty member and a work-site supervisor. (PR: Full Admission to TM program, and completion of 28 hrs. min. toward TM degree).
Grade Mode: Credit/No Credit Grade Only