TEXAS TECH UNIVERSITY

Edward E. Whitacre Jr.
College *of* Engineering™

Distance Learning Program Catalog

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08/09-Rev.12

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Engineering Distance Learning at Texas Tech

Introduction to the Program

Companies employing engineers recognize that an educated, well-trained workforce is imperative to competing in modern markets that require high-quality goods and services and very short time-to-market development. The dilemma this situation poses is *how can employees upgrade their educations without losing the time it takes to return to college?*

The Distance Learning Program at Texas Tech University (TTU) College of Engineering is designed to meet the needs of both practicing engineers and industry. Students enrolled in the program can earn one of a number of Masters Degrees in engineering without attending classes on campus, allowing them to manage career and family commitments while earning graduate credentials and upgrading their engineering skills. Additionally, career transfers do not pose a problem for students in this program because courses are offered via distance education. Students who move or are transferred can continue to work toward and complete their degrees.

The Distance Learning Program currently offers three different Masters Degrees:

- MS in Systems and Engineering Management (MS SEM)
- MS in Software Engineering (MS SE)
- Interdisciplinary Master of Engineering (MEN)

How Courses are Delivered

Our goal in the Distance Learning program is to offer the highest quality education possible. Using the latest technology available to deliver courses to students at a distance has proven so effective that many of our faculty are adopting these technologies for teaching on-campus courses as well. In the distance program, we make no distinction between on-campus and off-campus students. Both on-campus and off-campus students are concurrently enrolled in the same courses. Off-campus students view the lecture component of the course via the Internet.

All lectures are delivered in state-of-the-art multimedia classrooms with video mixing equipment which allows for the capture of video, computer feeds and document camera images. With this technology you can actively participate in the educational experience, whether you choose the live feed or view the class at a more convenient time. This technology gives you:

Flexible Internet Environments

We use multimedia environments for activities and materials that can be more appropriately and effectively delivered there, such as administration, lecture notes, ancillary readings, class discussion, collaborative projects, interactive exercises, and many other course components. This offers both our faculty and students a high degree of flexibility in choosing when and where they participate in the course.

Asynchronous Interaction

One of the most popular features of the distance courses is Web-based asynchronous discussion. Students have a continuous opportunity to obtain feedback and interact with their professor, peers, and in many cases, outside experts. Class discussions are held in these environments, with both on- and off-campus students participating equally. This results in a significantly higher level of interaction for students and instructors than is possible in the traditional classroom setting.

Synchronous Interaction

Students in our distance program can participate in courses in real time, and interact with the professor and other students during class. Live video and audio streams are broadcast for distance courses, with a feedback mechanism in place to facilitate live interaction. The video lectures also are posted to a course website for students to view at their convenience.

Free Software and Technical Support

Working with faculty, we have developed software solutions for providing effective instruction via the Internet. Students in the program are not burdened with having to purchase software to receive course content because we use software that can be distributed at no cost. We also provide any technical support students require to participate in the program.

Up-to-Date Content

Each course is developed as the semester progresses, and no courses are "canned." Each time the course is offered, new materials are produced and Internet materials are refined, so instructors can readily respond to new developments in their fields and to student questions.

Commitment to Quality

The College of Engineering is committed to growth in the use of distance education tools by our faculty. This commitment will allow us to provide more courses utilizing the distance education model for our students both on-campus and off-campus. By increasing the number of courses that utilize the distance education model, we are making a real difference in the quality and availability of higher education.

Graduate Admissions Information

Graduate Admissions Information

As with all TTU graduate students, students entering the Distance Learning program must apply and be accepted to the TTU Graduate School; you can apply either as a degree-seeking or a nondegree-seeking student.

Admission as a Degree-Seeking Student

To enter a graduate degree program, you must take the Graduate Record Exam (GRE), submit transcripts to the Graduate School, and complete the graduate application form.

GRE Requirements

To be admitted to the Texas Tech University Graduate School, you will have to take the GRE. To be accepted, your scores must be less than five years old. The admission process is considered holistically, and GRE scores—particularly the math and verbal sections—are a part of that holistic process.

Application Fee

A $50 nonrefundable application fee ($60 international application fee) is required of all students seeking admission to the Graduate School for the first time.

Procedure for Masters Degree Program Admission

Admission to any graduate degree program is granted by the Dean of the Graduate School upon the recommendation of the department of proposed study. The applicant must have been in good standing at all previously attended institutions. To apply, you must submit to the Office of Graduate Admissions:

1. A formal application (preferably at least three months prior to date of intended enrollment). The application is available online at www.gradschool.ttu.edu

2. Official transcripts of all previous college-level study. A student who, because of current enrollment, cannot provide final transcripts at the time of application must submit transcripts of all completed study, as well as incomplete transcripts from the current institution. Consideration may then be given for tentative admission upon the condition that final transcripts are provided within the initial semester of enrollment at Texas Tech.

3. Official GRE score report. This is a requirement for all applicants for degree programs regardless of educational background. Information about the GRE may be obtained from the Educational

Testing Service, P.O. Box 6000, Princeton, NJ 08541-6000, phone (609) 771-7670 (GRE), (866) 473-4373, or online www.ets.org/gre/

Application files will not be evaluated until all of the above requirements have been met. Applicants will be notified by the Director of Graduate Admissions when their applications have been forwarded to the department for consideration and also when an admissions decision has been made. *Falsification of application information will void admission to Texas Tech University.*

Admission as a Nondegree Student

There are two categories of nondegree admission:

1. **GTMP** This temporary admission is designed to allow students to take up to 12 graduate credits while completing the application process for applying to a degree program. *Note: Students may register in this classification up to 12 credits, seeking extensions each semester from the Graduate Admissions Office.*

2. **CPED** This category is designed to meet the needs of professionals in fields that require continuing professional development. In addition to applying to Graduate Admissions, students must request permission for this nondegree status from the graduate advisor of the faculty administering the program in their department.

Applicants seeking nondegree admission in either category must submit:

1. A formal application as far in advance of intended enrollment as possible. The application is available online at www.gradschool.ttu.edu

2. Official transcripts of **all** previous college level study; students must have been in good standing at all institutions attended.

The GRE is not required for this type of admission.

Students who are in nondegree status have no assurance that credits earned while in this status will apply toward degree requirements should admission to a degree program be granted later. Prospective students should be aware that some departments give preference for course enrollments to students in degree programs.

Important: A student enrolled with GTMP status can take only 12 credit hours (4 courses) before being admitted into a degree program. A student enrolled with CPED status can take unlimited credit hours but must sign a form stating that he or she understands that those courses may not all transfer to a degree program at a later time.

Readmission to Graduate School

If a previously enrolled student has not enrolled in a spring or fall semester, but has been enrolled within the last 12 months, the student may complete the "Request to be Readmitted" form.

If it has been longer than 12 months, a new application must be completed.

If a student in a graduate degree program has been awarded that degree and wishes to continue taking coursework, the student must then request further admission as a nondegree student in one of the nondegree categories by contacting the Office of Graduate Admissions.

Contacting the Office of Graduate Admissions

Texas Tech University
Office of Graduate Admissions
P.O. Box 41030
Lubbock, TX 79409-1030
(806) 742-2787
Fax: (806) 742-4038
http://www.gradschool.ttu.edu/

Registration Procedures

Registration Procedures

Registration procedures include applying to the Graduate School as well as choosing the courses you wish to take each semester. The following explanations will guide you through all necessary steps.

New Students

1. Fill out the online Graduate Application form at http://www.gradschool..ttu.edu to apply to the Texas Tech University Graduate School. You will be required to pay a $50 non-refundable application fee; this fee must be received by the Graduate School before they will process your application.

2. View a listing of the current course offerings and their descriptions at http://aln.coe.ttu.edu.

3. Read the Registration Procedures Information on the website to begin registering for courses using the Raiderlink system.

Students Previously Enrolled Who Have Been Out of the Program for One or More Semester(s)

1. Reapply to the Texas Tech University Graduate School by filling out the online application form at http://www.gradschool.ttu.edu/
2. View a listing of the current course offerings and their descriptions at http://aln.coe.ttu.edu.
3. Read the Registration Procedures Information on the website to begin registering for courses using the TTU portal, Raiderlink.

Students Who Were Enrolled During the Previous Semester, Or New Students Who Have Already Filed a Graduate Application

1. View a listing of the current course offerings and their descriptions at http://aln.coe.ttu.edu.

2. Read the Registration Procedures Information on the website to begin registering for courses using the TTU portal, Raiderlink.

Tuition

Tuition costs may vary depending on the semester for which you enroll and the department offering the course(s) that you take. Tuition and fees are subject to change without notification.

Approximate In-State Tuition and Fees: $1,000 for one 3-hour course
Approximate Out-of-State Tuition and Fees: $1,700 for one 3-hour course

Students who are legal residents of New Mexico, Oklahoma, Arkansas, and Louisiana and who reside in a county adjacent to Texas are eligible for in-state tuition.

You must pay your tuition and fees in the semester that you are enrolled for the course even if your company will not reimburse you until after you have completed the course.

Tuition and fees may be paid using one of the following options:

1. Payment of the total amount due.

2. Payment of one-half of the amount due initially, one-fourth prior to the sixth class week, and the final one-fourth prior to the eleventh class week.

Do not send your payment to us. You will pay either using Raiderlink or by contacting Student Business Services at (806) 742-3272 or by mail at:

Student Business Services
Texas Tech University
MS 41099
Lubbock, TX 79409-1099

Textbooks

Textbook information may be obtained online through the Texas Tech University Bookstore at http://www.texastech.bkstore.com/ and also through the Double T Bookstore at http://www.doubletbookstore.com/. If textbooks are not listed for the distance section of a class, distance students should purchase the same textbook(s) listed for the on-campus section.

Textbook information also will be available on the course syllabus once it has been posted on the Engineering Courseware (ECW) website.

Registration Deadline

Registration materials should be received at least two weeks prior to the beginning of classes to ensure registration for the upcoming semester. Evaluation of the Distance Learning Course sections will be made at this time. If sections do not have enough students registered, they will be canceled at this time, so please register early.

Withdrawing from a Course

You will use Techsis to drop your course(s). You should be aware that you may drop a course through the 12th class day and receive a full refund of tuition and fees. After the 12th class day, students taking more than one course will not be eligible to receive any of the tuition and fees back for individual courses they choose to drop.

Students wishing to drop all of the courses for which they are enrolled will withdraw from the university. Depending on the date that you drop the course, you may be eligible to receive a refund of some of your tuition and fees according to the following schedule:

Before the 1st class day	Full refund
1st five class days	80% refund
2nd five class days	70% refund
3rd five class days	50% refund
4th five class days	25% refund
21st class day and after	No refund

Students who have paid less than the amount due at the time of withdrawal will be required to pay the balance of that amount. Refunds will be mailed no later than the 35th class day.

You may visit the Office of the Registrar's Web site at http://www.reg.ttu.edu and click on the Withdrawal Information link. This web page will give specific withdrawal dates for the current semester, as well as information and instructions for the withdrawal process.

If you have questions about your payments or wish to discuss extenuating circumstances, contact Student Business Services at (806) 742-3272.

Master of Science in Systems and Engineering Management (MS SEM)

Program Overview and Requirements

The program leading to the Master of Science in Systems and Engineering Management (MS SEM) through the Industrial Engineering department is designed to meet the growing demand for technical managers with strong engineering, science and technical backgrounds as well as a sound grounding in management and financial issues. The MS SEM program has a professional focus and provides the opportunity for students with a non-IE undergraduate degree to obtain graduate training in their specialty areas and to receive engineering management training at the same time.

Degree Requirements

Students in the MS SEM program are subject to all Master's Degree regulations as outlined in the Graduate Catalog. The program follows the same course credit restrictions as the Master of Science in Industrial Engineering. The MS SEM program can be taken as a thesis (24 credits plus 6 credits of thesis) or non-thesis (36 credits) option.

The Curriculum

There are seven courses (21 credits) that constitute the core requirements for the MS SEM:

IE 5311	Principles of Optimization
IE 5316	Simulation Models for Operations Analysis
IE 5320	Systems Theory
IE 5321	Decision Theory and Management Science
IE 5323	The Engineering Management Environment
IE 5325	Productivity and Performance Improvement in Organizations
IE 5346	Total Quality Systems

The remaining courses can be taken from those offered in the Industrial Engineering department or any of the following engineering disciplines within the College of Engineering (Civil, Computer Science, and Petroleum). These courses are listed and described in the final section of this catalog.

In addition, courses outside of the College of Engineering, such as business, math, or psychology can be applied toward the degree as long as they are approved by both the graduate advisor and the SEM program coordinator.

Program Minors

An option within the MS SEM program is to take 3-5 courses as a minor. The courses do not have to come from the same department, but they must be focused on a specific speciality area, and the minor must be approved by the SEM Program Coordinator.

Sample Minors

Following are some sample minors; you are not limited to these choices, however.

Software Engineering Minor

CS 5363	Software Project Management
CS 5373	Software Modeling and Architecture
CS 5374	Software Verification and Validation

Power Systems Minor

EE 5316	Power Electronics
EE 5343	Power Systems Engineering
EE 5345	Pulsed Power
EE 5391	Electric Machines and Drives

Drilling and Production Operation Minor

PETR 5380	Drilling Engineering Methods
PETR 5381	Production Engineering Methods
PETR 5382	Well Logging Fundamentals

Formation Evaluation Minor

PETR 5380	Drilling Engineering Methods
PETR 5382	Well Logging Fundamentals
PETR 5384	Basic Fluids and Rock Properties

Transfer of Courses

Graduate transfer credits from other institutions are contingent upon approval of the Graduate School and the graduate advisor; decisions will be based on the current policy guidelines established by the College of Engineering, the Industrial Engineering Department, and the Graduate School.

For More Information

The SEM graduate advisor is Dr. Mario Beruvides. If you have questions about the degree program, please contact him at:

Mario Beruvides, Ph.D., P.E.
SEM Graduate Advisor
Industrial Engineering
Texas Tech University
MS 43061
Lubbock, TX 79409-3061
T (806) 742-3543 | F (806) 742-3411
Email: Mario.Beruvides@ttu.edu

The distance learning program director is Brent Guinn. If you have questions about the distance learning program, please contact him at:

Brent Guinn
Distance Learning Program Director
Edward E Whitacre Jr. College of Engineering
Texas Tech University
P.O. Box 43103
Lubbock, TX 79403-3103
T (806) 742-3451 | F (806) 742-3493
Email: Brent.Guinn@ttu.edu

Master of Science in Software Engineering (MS SE)

Program Overview and Requirements

The Master of Science in Software Engineering (MS SE) through the Computer Science department is intended to give the graduate a firm foundation in the definition, development and maintenance of complex software systems using traditional engineering process methods.

Degree Requirements

Students in the MS SE program are subject to all Master's Degree regulations as outlined in the Graduate Catalog. The MS SE program for distance students is a non-thesis degree program.

The Curriculum

The degree plan for students pursuing a MS SE degree must include the following courses:
CS 5363 Software Project Management
CS 5373 Software Modeling and Architecture
CS 5374 Software Verification and Validation

In addition, students select electives from the following categories:

SE Electives

CS 5332 Special Topics in Software Engineering
CS 5355 Real Time and Time Sharing Systems
CS 5377 Distributed Systems
CS 5379 Parallel Processors and Processing
CS 5380 Fault-Tolerant Computer Systems
IE 5320 Systems Theory
Other Software Engineering electives

Computer Science Electives

CS Graduate courses

Students must take five courses from the SE electives and four courses from the CS electives. As non-thesis students, distance students cannot apply CS 6000 or CS 7000 toward their degrees.

In addition, students must pass a written comprehensive examination near the end of their studies.

For More Information

The Software Engineering program coordinator is Dr. Richard Watson. If you have questions about the degree program please contact him at:

Richard Watson, Ph.D.
Graduate Advisor
Texas Tech University
Computer Science
MS 43104
Lubbock, TX 79409-3104
T (806) 742-3527 | F (806) 742-3519
email: richard.watson@ttu.edu

The distance learning program director is Brent Guinn. If you have questions about the distance learning program, please contact him at:

Brent Guinn
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Email: Brent.Guinn@ttu.edu

Master of Engineering Degree (MEN)

Program Overview and Requirements

The program leading to the Master of Engineering (MEN) degree is an undifferentiated (interdisciplinary), nonthesis one, designed primarily for practicing engineers. For such practicing engineers, credit for graduate course work completed in residence at another graduate school may be accepted for as much as 15 hours of the 36 semester hour requirements for the Master of Engineering degree.

All work credited toward the degree must be completed within nine calendar years. In addition to the regulations governing admission to the Graduate School, a baccalaureate degree in engineering, or its equivalent, is required for entrance to the Master of Engineering Program.

Degree Requirements

Students in the Master of Engineering program are subject to all Masters Degree regulations as outlined in the Graduate Catalog. Due to its interdisciplinary nature, the Master of Engineering program does not require specific major and minor subjects. However, the program does allow up to six hours of course work to be taken outside of engineering, upon the approval of the graduate advisor.

Students in the Master of Engineering program do not have any language or tool-subject requirements. Every candidate for a Masters Degree is required to pass a final comprehensive examination. Students will write a report and complete 33 hours of coursework and three hours of a reports course.

Transfer of Courses

As stated above, students are permitted to transfer courses into the Master of Engineering program upon approval of their graduate advisor. The student should seek approval of the transfer courses prior to registering for such courses. Courses taken without prior approval and prior to enrolling in the Master of Engineering program will be accepted at the discretion of the graduate advisor.

All transfer courses are subject to the same time limitations as courses taken in the program (a maximum of nine years from the first course in the plan of study until graduation).

The Curriculum

The curriculum for the Master of Engineering program consists of 36 semester credit hours of coordinated graduate level course work. No more than 15 credit hours (5 courses) can be taken from any one engineering

program, e.g., Industrial Engineering or Software Engineering.

Special Cases

Any student who does not have an undergraduate degree in engineering is considered a special case. To provide the student with a solid program and to ensure that the student has the background necessary to complete the program, the following background is required:

Basic Sciences: Students must have at least 15 semester hours of basic sciences including 12 hours of chemistry and/or physics.

Mathematics: Twelve semester hours above algebra and trigonometry are required. Normally this will mean completion of the engineering mathematics for engineers and scientists (which includes ordinary differential equations and Laplace transforms).

Engineering Sciences: The student must complete 27 hours of engineering science courses. Applications-oriented advanced science coursework may be included as well as up to 12 semester hours of engineering technology technical sciences courses.

Engineering Analysis, Design and Synthesis: The need for courses in these areas will be judged on an individual basis, considering the student's educational background, work experience, and field of interest.

Humanities and Social Sciences: The equivalent of 16 semester hours of coursework in the humanities and/or social sciences.

For More Information

The MEN program advisor is Dr. Jeff Woldstad. If you have questions about the degree program, please contact him at:

John E. Kobza, Ph.D., P.E.
Senior Associate Dean
Edward E. Whitacre Jr. College of Engineering
Texas Tech University
MS 43103
Lubbock, TX 79409-3103
T (806) 742-3451 | F (806) 742-3493
Email: John.Kobza@ttu.edu

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Course Descriptions

Computer Science

CS 5301 Foundations of Computer Science I

Prerequisite: Programming proficiency.

An accelerated survey of computer science: computer organization, high level and assembler languages, job control, software design, data structures, file organization, machines, and formal languages.

CS 5302 Foundations of Computer Science II

Prerequisite: CS 5301.

Second part of an accelerated survey of computer science. Provides an introduction to object-language programming, concepts of programming languages, advanced data structures, and an overview of system programming.

CS 5303 Fundamentals of Computer Engineering

Prerequisite: Programming proficiency.

An accelerated survey of computer science. Computer organization, high level and assembler languages, job control, software design, data structures, file organization, machines, and formal languages.

CS 5332 Special Topics in Software Engineering

Prerequisite: Consent of instructor.

Studies in advanced software engineering.

CS 5352 Advanced Operating Systems Design

Topics on distributed operating systems, such as synchronization, communication, file systems, and memory sharing are discussed. Several programming projects are implemented.

CS 5355 Real Time and Time Sharing Systems

Prerequisite: Consent of instructor.

Study of the functional needs in real time and time sharing systems. Basic techniques and display concepts, random-access fields, computer networks, simultaneous operations, multiprogramming and multiprocessing.

CS 5356 Advanced Database Management Systems

Systems aspects of relational databases are emphasized. Topics include relational database design, index and access structures implementation and performance evaluation, query processing and optimization, transaction management, and concurrency control.

CS 5357 Multimedia Systems

Multimedia digital audio processing; image and video data compression; and processing for multimedia presentations. Time-based media represen-

tation and synchronization; multimedia communication systems; and hypertext and programming.

CS 5360 Software Construction and Evolution

Prerequisite: CS 5362, 5363, and 5364.
Theory and practice of the construction, testing, and maintenance of software. Emphasis placed on techniques to evolve software over time to meet the changing needs of users during the life of the software.

CS 5362 Software Specification and Design

Prerequisite: CS 2365, its equivalent, or consent of instructor.
Examination of the development of the specifications, architecture, and design of software. Analysis, software architeture, design patterns, architectural design and detailed design.

CS 5363 Software Project Management

Prerequisite: CS 2365, its equivalent, or consent of instructor.
Methodologies for the management of projects involving software components. The larger context of systems development is studied, along with business management and engineering principles. Technical as well as people issues are explored.

CS 5364 Software Metrics

Prerequisite: CS 2365, IE 341, equivalent or consent of the instructor.
In-depth study of the use and application of software measurement to improve software products, resources, and processes. Topics include investigative techniques, data collection, and analysis.

CS 5366 Software Process Improvement

Corequisite: CS 5302 or equivalent.
Theory and practice for software process improvement and certification at the organiational, project team, and individual level.

CS 5369 Web-Based Software Systems

Prerequisite: CS 3365, equivalent, or consent of instructor.
In-depth study of how to engineer Web-based software systems. Topics include process, development, testing, and performance issues.

CS 5375 Computer Systems Organization and Architecture

Introduction to the architecture, organization, and design of computer systems. Topics include processor, control and memory design, computer arithmetic, I/O, and a brief introduction to multiprocessors.

CS 5376 Communication Networks

Networks in the context of parallel and distributed systems. Information theory applied to networks. Network topology. Problems and approaches in design, development, and management of communications networks.

CS 5377 Distributed Computing
Introduction to distributed systems. Topics include communications, distributed operating systems, fault-tolerance, and performance issues. Case studies and term projects supplement this course.

CS 5379 Parallel Processors and Processing
Theory, architectures, and algorithms for the design and implementation of parallel computing systems. Operating system and programming language requirements for parallel computing; approaches and applications.

CS 5380 Fault-Tolerant Computer Systems
Introductory course to methodologies for specifying, designing, and modeling fault-tolerant computer systems. Includes fault classification, design techniques for fault detection and recovery, and reliability modeling techniques.

CS 5388 Neural Networks
Prerequisite: Consent of instructor.
Neural network theory, models, and implementation. Applications to real-time systems, robotics, pattern recognition, computer vision, and event-driven systems.

CS 5389 Advanced Neural Networks
Prerequisite: CS 5388 or consent of instructor.
Recurrent neural networks, information processing, dissipative systems, applications to time series analysis and chaotic systems.

Industrial Engineering

IE 5305 Cognitive Engineering
Prerequisite: Consent of instructor.
Implications of human perceptual, cognitive, and psycho-motor capabilities for the design of systems for effective human use and control.

IE 5306 Safety Engineering
Prerequisite: Consent of instructor.
Loss prevention principles, practice, and regulations; accident factors, models, costs, and analysis; systems safety; product safety; safety and health-related workplace hazards.

IE 5311 Principles of Optimization
Prerequisite: Consent of instructor.
Linear optimization models: theory and application. Includes simplex, revised simplex, dual, and primal-dual algorithms, sensitivity and paramet-

ric analysis, duality theory, decomposition, linear complementarity problem, assignment and transportation problems, and Karmarkar's algorithm.

IE 5316 Simulation Models for Operations Analysis

Prerequisite: Any scientific programming language.

Application of simulation techniques to analysis of large scale operations: production-distribution models, model construction, validation of simulation models, limitations of simulation techniques; and programming with simulation languages.

IE 5317 Statistical Analysis for Digital Simulation

Prerequisite: IE 5316 or proficiency in a current discrete event simulation language.

The generation of random variants; statistical tests for randomness in random number streams; the collection and analysis of data for input parameters and distributions; the detection and removal of transients in simulation model data; the computation of the variance of simulation model output; and variance reduction techniques.

IE 5318 Operations Research Modeling with Spreadsheets

Development of models for linear, integer, and nonlinear programming; problem formulation, solution, and analysis. Monte Carlo models; sampling methods; and accuracy. Software for current spreadsheet packages.

IE 5320 Systems Theory

Examines theoretical foundations of general systems theory applied to engineering and organizational enterprises, addressing issues of systems efficiency, effectiveness, productivity, economics, innovation, quality, and QWL.

IE 5321 Decision Theory and Management Science

Prerequisite: Consent of instructor.

Philosophy, theory, and practice of management; decision theory and social responsibility.

IE 5322 Industrial Cost Analysis

Prerequisite: Consent of instructor.

Cost analysis and/or control of industrial enterprises. Economic budgeting, planning, decision making, and financial analysis for engineering and engineering management.

IE 5323 The Engineering Management Environment

Management of research and development; the legal, financial, and professional interrelationships of the engineers and their environment in relation to the modern production organization.

IE 5325 Productivity and Performance Improvement in Organizations

Productivity and performance improvement (including efficiency, effectiveness, quality, QWL, innovation, profitability, and budgetability) theories, techniques, analysis, and applications for industrial systems.

IE 5329 Project Management

Technical, organizational, and personnel project management examination including planning, estimating, budgeting, scheduling, resources management, control. Risk analysis and management using software for project performance evaluation.

IE 5342 Design of Experiments

Prerequisite: Either IE 3341 or IE 5381, or the equivalent.
Single factor, factorial, blocked, and split plot designs; means comparisons, contrasts, and estimates of variation; and confounding and fractional factorials.

IE 5344 Statistical Data Analysis

Prerequisite: IE 3341 or equivalent.
Exploratory data analysis, graphical displays and analysis. Linear and nonlinear regression, response surfaces. Selected mainframe and microcomputer packages.

IE 5346 Total Quality Systems

Prerequisite: Consent of instructor.
Total Quality philosophy, customer definition and demands, quality strategies, planning and integration, benchmarking, team structures and interaction, supplier qualification, and quality audits.

Petroleum Engineering

PETR 5380 Drilling Engineering Methods

Prerequisite: Consent of instructor.
Drilling equipment, components, description, operation; drilling fluids; hydraulic calculations; casing design; hole problem; cost control, penetration rate, well planning; pressure control; directional drilling; bit; cement.

PETR 5381 Production Engineering Methods

Prerequisite: Consent of instructor.
Artificial lift, inflow performance relationships, well design and application of stimulation practices, processing equipment, separator problems, emulsions, treating, and transmission systems.

PETR 5382 Well Logging Fundamentals
Prerequisite: Consent of instructor.
Use of open-hole logs, survey of induction and lateralog suites to determine reserves.

PETR 5383 Reservoir Engineering Fundamentals
Prerequisite: Consent of instructor.
Reservoir performance predictions, computation of in place gas, condensate and oil reservoirs, applications of ME for reservoir mechanisms, decline curves, EOR methods, fluid flow in porous media.

PETR 5384 Basic Fluids and Rock Properties
Prerequisite: Consent of instructor.
Reservoir fluids and rock properties, fluid sampling, phase behavior, reservoir drives mechanisms, concepts of porosity, permeability, saturations, capillary pressure and compressibility for gas-oil production.

MS SEM Program Minor Courses

Minor courses that are also part of another degree program are listed under the department offering them.

EE 5316 Power Electronics
Switch mode power conversion, converters and inverters, power supplies and regulators, and power semiconductor circuits.

EE 5343 Power Systems Engineering
Electrical power transmission and distribution systems; power generation systems; system modeling, planning, management and protection.

EE 5345 Pulsed Power
Fundamentals of pulsed power circuits, components, and systems. Pulse forming lines, energy storage, voltage multipliers, switching, materials, grounding and shielding, measurements, and applications.

EE 5391 Electric Machines and Drives
Analysis and control of DC machines and induction machines. Space vector theory. Field oriented control. Modeling of machine and controller dynamics.

PSS 5335 Soil Physics

Prerequisite: Consent of instructor.
Physical characteristics of soils and porous media and principles underlying flow and distribution of water, air, and heat in soils.

PSS 5371 Structure and Functionalization of Cotton Fibers

Fundamental understanding of the structure of cotton fibers and their characterization. Presents techniques used to functionalize the cotton fabric to create "smart" textiles.

PSS 5372 Textile Manufacturing Systems

Fundamental principles and processes for converting fibers into textile structures and evaluating and optimizing performance criteria in yarn and fabric production. Advanced process and quality control.

PSS 5376 Advanced Studies in Cotton Fibers

Examination of the structure of cotton fibers, meaning and measurement of fiber properties, and issues related to increasing cotton's use-value as an industrial raw material.