THE UNIVERSITY RESERVES THE RIGHT TO REVISE
ANY INFORMATION LISTED IN THIS TIMETABLE OF CLASSES

The University of Tennessee Space Institute
Spring 2015 Course Listings

AEROSPACE ENGINEERING

AE 500 Master's Thesis (1-15)
SEC. 009 CRN 24511 Abedi
011 CRN 24512 Antar
012 CRN 24513 Anusonti-Inthra
013 CRN 24514 Majdalani
014 CRN 24515 Moeller
015 CRN 24516 Solies
016 CRN 24517 Vakili
021 CRN 24522 Zhang
022 CRN 25707 Schmisseur

Grading Restriction: P/NP only.
Repeatability: May be repeated.
Credit Level Restriction: Graduate credit only.
Registration Restriction(s): Minimum student level – graduate.

AE 502 Registration for Use of Facilities (1-15)
SEC. 002 CRN 24524 Moeller

Required for the student not otherwise registered during any semester when student uses university facilities and/or faculty time before degree is completed.
Grading Restriction: Satisfactory/No Credit grading only.
Repeatability: May be repeated.
Credit Restriction: May not be used toward degree requirements.
Credit Level Restriction: Graduate credit only.
Registration Restriction(s): Minimum student level – graduate

AE 517 Finite Elements for Engineering Applications (3)
SEC. 001 CRN 28919 (Same as ME 517 001 CRN 28886)
TEXT: K. J. Bathe; *Finite Element Procedures*. Cambridge, MA: Klaus-Jurgen Bathe, 2007. ISBN: 9780979004902
T. J. R. Hughes; *The Finite Element Method: Linear Static and Dynamic Finite Element Analysis*, Dover Publications, 2000. ISBN: 978-0486411811
TIME: Monday & Wednesday 8:40 – 9:55 E-110
PROF: Dr. Reza Abedi

Modern computational theory applied to conservation principles across the engineering sciences. Weak forms, extremization, boundary conditions, discrete implementation via finite element, finite difference, finite volume methods. Asymptotic error estimates, accuracy, convergence, stability. Linear problem applications in 1, 2 and 3 dimensions, extensions to non-linearity, non-smooth data, unsteady, spectral analysis techniques, coupled equation systems. Computer projects in heat transfer, structural mechanics, mechanical vibrations, fluid mechanics, heat/mass transport.

Cross-listed: (Same as Mechanical Engineering 517)
Comment(s): Bachelor's degree in engineering or natural science required.
Registration Permission: Consent of instructor.

AE 518 Computational Fluid Dynamics (3)
SEC. 002 CRN 30818 (Same as BME 518 002 CRN 30820; ME 518 002 CRN 30819)
TEXT: TBD
TIME: Tuesday & Thursday 8:40 – 9:55 E-110
PROF: Dr. Eivanc Ekici

Finite difference and finite volume techniques for solving compressible and incompressible fluid flow problems. Classification of partial differential equations and their discrete approximations. Explicit and Implicit techniques for solving unsteady Euler and Navier-Stokes equations including finite volume and finite difference formulations. Formulation of boundary conditions, artificial viscosity and multigrid acceleration. Stability analysis and convergence. Grid generation.
Cross-listed: (Same as Biomedical Engineering 518; Mechanical Engineering 518.)
Recommended Background: Fluid mechanics, differential equations, and compressible flows.
Registration Permission: Consent of instructor.

AE 522 Aerodynamics of Compressible Fluids II (3)
SEC. 001 CRN 26276
TEXT: John D. Anderson; *Modern Compressible Flow: With Historical Perspectives*; 3rd Edition; McGraw Hill; ISBN 0-07-242443-5.
H.W. Leipmann and A. Roshko; *Elements of Gasdynamics*; Dover Publications; ISBN-10: 0486419630; ISBN-13: 978-0486419633
› Visit Amazon's H. W. Liepmann Page
TIME: Monday & Wednesday 1:10 – 2:25 E-110
PROF: Dr. Trevor Moeller

One-dimensional internal and external flow; waves; small perturbation theory; slender body theory; similarity rules; method of characteristics.
(DE) Prerequisite(s): 521.

*AE 532 Introduction to Turbulence (3) **CANCELLED**
SEC. 001 CRN 30840
TEXT: TBD
TIME: Tuesday & Thursday 10:10 – 11:25 E-114
PROF: Dr. John Schmisseur

Macroscopic effects, analogies, statistical treatment, correlation functions, energy spectra, diffusion; application of turbulent jets and pipe flow.
(DE) Prerequisite(s): 511 and 512.

AE 535 Mechanical Vibrations (3)
SEC. 003 CRN 29385 (Same as ME 534 003 CRN 29386)
TEXT: TBD
TIME: Monday & Wednesday 10:10 – 11:25 E-110
PROF: Dr. Stephanie TerMaath

Vibrations of linear, discrete, undamped and damped systems. Lagrange's equations for holonomic systems. Modal analysis. Laplace transform. Response to mechanical transients.

Cross-listed: (Same as Mechanical Engineering 534)
Recommended Background: An undergraduate vibrations course.

AE 542 Fluid Mechanics II (3)
SEC. 001 CRN 24528 (Same as ME 542 001 CRN 21891)
TEXT: *Fundamentals of Fluid Mechanics*; 6th Edition or 7th Edition; Munson et al; John Wiley and Sons; ISBN 978-1-118-11613-5
TIME: Thursday 7:30 – 10:00 E-210
PROF: Dr. Steven Brooks

Equations of viscous fluid flows. Basic concepts and equations of turbulent flow. Separation, stability and transition. Laminar and turbulent boundary-layer flows. Exact, approximate, and numerical solutions.
Cross-listed: (Same as Mechanical Engineering 542.)
(DE) Prerequisite(s): 541.

AE 566 Electric Propulsion (3)
SEC. 001 CRN 30618
TEXT: *Physics of Electric Propulsion* (textbook is available from Amazon.com); Robert G. Jahn; Dover Publications (May 26, 2006); ISBN 10:0486450406; 13: 978-0486450407
TIME: Tuesday & Friday 1:00 – 2:15 E-113
PROF: Dr. Trevor Moeller

Engineering concepts of electric propulsion and its application to modern satellites and deep space probes. Topics include physical principles, practical designs, and performance levels of electrically-powered space propulsion thrusters including: ion engines; pulsed and steady-state (fixed field) plasma and MHD thrusters, including Hall Thrusters, and others.
Recommended Background: Rocket propulsion.
Registration Permission: Consent of Instructor.

AE 590 Selected Engineering Problems (2-6)
SEC. 001 CRN 24530 Abedi
003 CRN 24531 Antar
004 CRN 26279 Anusonti-Inthra
005 CRN 26280 Majdalani
006 CRN 26281 Moeller
007 CRN 26282 Solies
008 CRN 26283 Vakili
009 CRN 26284 Zhang

Repeatability: May be repeated. Maximum 6 hours.
Comment(s): Enrollment limited to students in problems option.
Registration Permission: Consent of advisor.

AE 595 Aerospace Engineering Seminar (1)
SEC. 001 CRN 24532
TEXT: None
TIME: Will be announced through email
PROF: Dr. Ahmad Vakili

All phases of aerospace engineering, reports on current research at the University of Tennessee, Knoxville, and UTSI.

Grading Restriction: Satisfactory/No Credit grading only.
Repeatability: May be repeated. Maximum 20 hours.

AE 599 Special Topics in AE: Atmospheric Sciences for AE and ME (3)
SEC. 001 CRN 24534 (Same as ME 599 002 CRN 27956)
TEXT: *Atmospheric Science: An Introductory Survey;* Wallace and Hobbs; Academic Press; 2nd Edition; February 15, 2006; ISBN 13: 978-0127329512
TIME: Monday & Wednesday 10:10 – 11:25 E-114
PROF: Dr. Steve Brooks

Structure of the atmosphere, energy balance, turbulent boundary layer, solar forcing, satellite drag, aero-maneuvers and de-orbits, and hypersonic flight in the upper atmosphere. These will be extended to the Venusian, Martian and Jovian atmospheres.
Repeatability: May be repeated. Maximum 6 hours.

*AE 599 Special Topics in AE: Intro to Fluid Structure Interactions (3) **CANCELLED**
SEC. 003 CRN 27955 (Same as ME 599 005 CRN 28025)
TEXT: Recommended material: ANSYS Fluid-Structure Interaction Simulation Guides
TIME: Tuesday & Thursday 1:10 – 2:25 E-110
PROF: Dr. Phuriwat Anusonti-Inthra

This class will serve as an introductory class for students who are interested in learning about fluid-structure interaction simulations. Different types of one-way and two-way fluid-structure interactions will be covered; including conjugate heat transfer problems, pressure-deformation interactions, and force-deformation interactions. Some background in Finite Element Method (FEM) and Computational Fluid Dynamics (CFD) will be covered.
Repeatability: May be repeated. Maximum 6 hours.

AE 599 Special Topics in AE: Aircraft Flight Controls (Same as AVSY 516 001 CRN 24611) (3)
SEC. 005 CRN 26116 (Video Recorded)
TEXT: Nelson, Robert C; *Flight Stability and Automatic Control*; 2nd Edition 1988 or later; McGraw-Hill, NY; ISBN 0-07-046273-9
TIME: Wednesday 1:00 – 3:30 E-111
PROF: Dr. Peter Solies

Static and dynamic longitudinal, directional, and lateral stability of aerospace vehicles will be investigated. Topics include contribution of vehicle components to stability and control, motion with fixed and free control surfaces, steady flight and maneuvering flight, flight test techniques, and introduction to control theory and design of automatic controls.
Repeatability: May be repeated. Maximum 6 hours.

AE 599 Aircraft Design (Same as AVSY 506 001 CRN 24608) (3)
SEC. 013 CRN 30797 (Video Recorded)
TEXT: D. P. Raymer*; Aircraft Design: A Conceptual Approach;* AIAA Education Series, 3rd Edition 1998, or later; ISBN 1-56347-281-0
TIME: Tuesday & Friday 1:00 – 2:15 E-111
PROF: Dr. Peter Solies

Design process, compromise of conflicting requirements, economical, industrial, and legal aspects. Definition of mission requirements, synthesis and optimization techniques, safety and reliability, systems integration, standards and regulations, teamwork, and decision-making process.

Repeatability: May be repeated. Maximum 6 hours.

AE 599 Experimental Flight Mechanics: Fixed Wing Performance (3)
SEC. 014 CRN 30799 (Same as AVSY 521 001 CRN 24612)
TEXT: *Flight Testing of Fixed Wing Aircraft*; Ralph D. Kimberlin; AIAA; First Edition; ISBN 1-56347-564-2
TIME: Tuesday & Friday 10:30 – 11:45 Airport Classroom
PROF: Dr. Peter Solies

Fundamental theories, flight test techniques, and data collection and analyses for fixed wing aircraft performance. Topics: air data system calibration, takeoff and landing performance, turn performance, cruise performance, energy concepts, and aerodynamic modeling. Weekly classroom academics with approximately 4-6 flight labs.
(RE) Prerequisite(s): 503 or Aerospace Engineering 515.
Repeatability: May be repeated. Maximum 6 hours.

AE 599 Special Topics in AE: Introduction to Micro/Nano Manufacturing (3)
SEC. 015 CRN 30801 (Same as BME 599 007 CRN 30831; ME 599 015 CRN 30802)
TEXT: Provided by instructor
TIME: Tuesday & Thursday 2:40 – 3:55 E-110
PROF: Dr. Anming Hu and Dr. Feng-Yuan Zhang

Fundamentals of micro-nano-manufacturing with an emphasis on the relationships between unique functions of micro-nano-materials, designed architectures, and appropriate manufacturing strategies will be discussed. This course will well blend the knowledge of nanotechnology, advanced manufacturing and additive manufacturing (3D printing). Students will conduct independent literature review research on micro-nano-manufacturing techniques they selected. The group project will be conducted in the Instructor labs.
This interactive course is designed for both undergraduate and graduate students.
Prerequisites and Co-requisites:
Basics of manufacturing sciences and mechanical engineering will be required. If in doubt, please ask instructor for approval. Number of seats will be limited to 15 for effective group projects at the Instructor's lab.
Major: Open to all Engineering Majors [seniors and graduate students]
Repeatability: May be repeated. Maximum 6 hours.

AE 600 Doctoral Research/Dissertation (3-15)
SEC. 006 CRN 24541 Abedi
007 CRN 24542 Antar
008 CRN 24543 Anusonti-Inthra
009 CRN 24544 Flandro
010 CRN 24545 Majdalani
013 CRN 24548 Moeller
015 CRN 26285 Solies
017 CRN 24550 Vakili
018 CRN 25994 Zhang
019 CRN 30865 Schmisseur

Grading Restriction: P/NP only.
Repeatability: May be repeated.
Registration Restriction(s): Minimum student level – graduate.

AE 601 Doctoral Research Methodology (3)
SEC. 002 CRN 30628
TEXT: TBD
TIME: TBD
PROF: Dr. Kivanc Ekici

Methods of planning and conducting original research and proposal writing.
Registration Restriction(s): Minimum student level – graduate / doctoral students.
Registration Permission: Departmental approval.

AE 681 Advanced Viscous Flow Theory (3)
SEC. 001 CRN 30805
TEXT: Handouts will be provided
TIME: Monday & Thursday 1:00 – 2:15 E-211
PROF: Dr. Ahmad Vakili

Critical review of significance to governing equations. Nature of boundary layer approximation as singular perturbation problem. Uniqueness and existence of solutions. Applications of group theory. Special problem areas of interest to students.
(DE) Prerequisite(s): 512, continuum mechanics, and Mathematics 562.
Registration Restriction(s): Minimum student level – graduate.

AVIATION SYSTEMS

AVSY 500 Master's Thesis (1-15)
SEC. 001 CRN 24600 Brooks
003 CRN 24601 Martos
004 CRN 24602 Solies

Grading Restriction: P/NP only.
Repeatability: May be repeated.
Credit Level Restriction: Graduate credit only.
Registration Restriction(s): Minimum student level – graduate.

AVSY 502 Registration for Use of Facilities (1-15)
SEC. 001 CRN 24604 Brooks
003 CRN 24605 Martos
004 CRN 24606 Solies

Required for the student not otherwise registered during any semester when student uses university facilities and/or faculty time before degree is completed.
Grading Restriction: Satisfactory/No Credit grading only.
Repeatability: May be repeated.
Credit Restriction: May not be used toward degree requirements.
Credit Level Restriction: Graduate credit only.
Registration Restriction(s): Minimum student level – graduate.

AVSY 506 Aircraft Design (Same as AE 599 013 CRN 30797) (3)
SEC. 001 CRN 24608 (Video Recorded)

TEXT: D. P. Raymer*; Aircraft Design: A Conceptual Approach;* AIAA Education Series, 3rd Edition 1998, or later; ISBN 1-56347-281-0
TIME: Tuesday & Friday 1:00 – 2:15 E-111
PROF: Dr. Peter Solies

Design process, compromise of conflicting requirements, economical, industrial, and legal aspects. Definition of mission requirements, synthesis and optimization techniques, safety and reliability, systems integration, standards and regulations, teamwork, and decision-making process.

AVSY 516 Aircraft Flight Controls (Same as AE 599 005 CRN 26116) (3)
SEC. 001 CRN 24611 (Video Recorded)
TEXT: Nelson, Robert C; *Flight Stability and Automatic Control*; 2nd Edition 1988 or later; McGraw-Hill, NY; ISBN 0-07-046273-9
TIME: Wednesday 1:00 – 3:30 E-111
PROF: Dr. Peter Solies

Static and dynamic longitudinal, directional, and lateral stability of aerospace vehicles will be investigated. Topics include contribution of vehicle components to stability and control, motion with fixed and free control surfaces, steady flight and maneuvering flight, flight test techniques, and introduction to control theory and design of automatic controls.

AVSY 521 Experimental Flight Mechanics: Fixed Wing Performance (3)
SEC. 001 CRN 24612
TEXT: *Flight Testing of Fixed Wing Aircraft*; Ralph D. Kimberlin; AIAA; First Edition; ISBN 1-56347-564-2
TIME: Tuesday & Friday 10:30 – 11:45 Airport Classroom
PROF: Dr. Peter Soilies

Fundamental theories, flight test techniques, and data collection and analyses for fixed wing aircraft performance. Topics: air data system calibration, takeoff and landing performance, turn performance, cruise performance, energy concepts, and aerodynamic modeling. Weekly classroom academics with approximately 4-6 flight labs.
(RE) Prerequisite(s): 503 or Aerospace Engineering 515.

AVSY 526 Introduction to Avionics II (3)
SEC. 001 CRN 28882 (Video Recorded)
TEXT: *Principles of Avionics*; 7th Edition or latest; Albert Helfrick; Avionics Communications (http://www.avionics.com); ISBN 13:9781885544278
TIME: TBD
PROF: Dr. Monty Smith

Electronic instrumentation, navigation, communication, guidance and control systems used in aviation. The primary topics to be covered in the second semester include: surveillance systems, airborne communication systems, onboard communications, indicators, air data sensors, and flight control systems.
(DE) Prerequisite(s): 525.

AVSY 550 Project in Aviation Systems (3)
SEC. 001 CRN 24613 Brooks
003 CRN 24614 Martos
004 CRN 24615 Solies

Repeatability: May be repeated. Maximum 15 hours.
Credit Restriction: Maximum of 3 hours may be applied toward degree requirements.
Comment(s): Non-thesis aviation systems majors only.
Credit Level Restriction: Graduate credit only.
Registration Restriction(s): Minimum student level - graduate.

BIOMEDICAL ENGINEERING

BME 500 Master's Thesis (1-15)
SEC. 012 CRN 26938 Johnson

Grading Restriction: P/NP only.
Repeatability: May be repeated.
Credit Level Restriction: Graduate credit only.
Registration Restriction(s): Minimum student level – graduate.

*BME 518 Computational Fluid Dynamics (3) **CANCELLED**
SEC. 002 CRN 30820 (Same as AE 518 002 CRN 30818; ME 002 CRN 30819)
TEXT: TBD
TIME: Tuesday & Thursday 8:40 – 9:55 E-110
PROF: Dr. Eivanc Ekici

Finite difference and finite volume techniques for solving compressible and incompressible fluid flow problems. Classification of partial differential equations and their discrete approximations. Explicit and Implicit techniques for solving unsteady Euler and Navier-Stokes equations including finite volume and finite difference formulations. Formulation of boundary conditions, artificial viscosity and multigrid acceleration. Stability analysis and convergence. Grid generation.
Cross-listed: (Same as Aerospace Engineering 518; Mechanical Engineering 518.)
Recommended Background: Fluid mechanics, differential equations, and compressible flows.
Registration Permission: Consent of instructor.

BME 529 Applications of Linear Algebra in Engineering Systems (3)
SEC. 001 CRN 24641 (Video Recorded)
TEXT: *Advanced Linear Algebra for Engineers with MATLAB*; Sohail A. Dianat and Eli S. Saber; CRC Press; Latest Edition; ISBN 978-1-4200-9523-4
TIME: Tuesday & Friday 9:15 – 10:30 E-113
PROF: Dr. Monty Smith

Fundamental concepts of linear algebra to problems in engineering systems: steady state and dynamic systems. Geometric and physical interpretations of relevant concepts: least square problems, LU, QR, and SVD decompositions of system matrix, eigenvalue problems, and similarity transformations in solving difference and differential equations; numerical stability aspects of various algorithms; application of linear algebra concepts in control and optimization studies; introduction to linear programming. Computer projects.

Methods of linear algebra with application to engineering problems. Systems of linear equations: matrix-vector notation, solutions to linear equations, determinants, matrix inversion. Vector spaces: spanning sets, orthogonality, matrix decompositions, linear transformations. Eigenvalues and eigenvectors: characteristic polynomials, singular value decomposition. The Cayley-Hamilton theorem: matrix polynomials, functions of matrices. Optimization: least-squares and weighted least-squares methods.

Cross-listed: (Same as Chemical and Biomolecular Engineering 529; Civil Engineering 529, Electrical and Computer Engineering 529; Environmental Engineering 529; Industrial Engineering 529; Materials Science and Engineering 529; Mechanical Engineering 529; Nuclear Engineering 529).
Comment(s): Graduate standing or consent of instructor required.

BME 578 Advanced Biomaterials; Biological Applications of Nanomaterials (3)
SEC. 002 CRN 30821 (Same as MSE 002 CRN 30822)
TEXT: TBD
TIME: Tuesday & Thursday 10:10 – 11:25 E-110
PROF: Dr. Michael L. Simpson

Focuses on the biological/medical uses of nanoscale materials. Includes the following topics: 0-d, 1-d, and 2-d nanomaterials synthesis and characterization with an emphasis on surface properties. Chemical and biological functionalization of nanomaterials and nano-bio interfaces. Biological and biomedical application of nanomaterials.
Cross-listed: (Same as Material Science Engineering 578.)
Recommended Background: 474.
Comment(s): Prior knowledge may satisfy prerequisites, with consent of instructor.

*BME 587 Dynamic Modeling and Simulation (3) **CANCELLED**
SEC. 002 CRN 29380 (Same as ME 587 002 CRN 29379)
TEXT: TBD
TIME: Tuesday & Thursday 2:40 – 3:55 E-110
PROF: Dr. Gary V. Smith

Modeling and analysis of physical systems. Systems and parameter identification. Mathematical modeling methods and approximations. Digital simulation techniques and practices. Design and control applications.
Cross-listed: (Same as Mechanical Engineering 587.)
Recommended Background: 363.

BME 590 Selected Biomedical Engineering Problems (2-6)
SEC. 001 CRN 28069 Johnson

Grading Restriction: Satisfactory/No Credit grading only.
Repeatability: May be repeated. Maximum 6 hours.
Comment(s): Enrollment is limited to students in the non-thesis option.
Credit Level Restriction: Graduate credit only.
Registration Restriction(s): Minimum student level – graduate.
Registration Permission: Consent of instructor.

BME 595 Biomedical Seminar (1)
SEC. 002 CRN 27109
TEXT: None
TIME: Will be announced through email
PROF: Dr. Jacqueline Johnson

All phases of biomedical engineering, reports on current research at UTK and UTSI.
Grading Restriction: Satisfactory/No Credit grading only.
Repeatability: May be repeated. Maximum 20 hours.

PROF: Dr. Eric Boder

Intensive, individualized experience in reviewing literature, evaluating experimental or theoretical methods, planning a research project, and presenting research project plans orally and in writing.
Registration Restriction(s): Minimum student level – graduate. PhD students only.
Registration Permission: Consent of instructor.

ELECTRICAL ENGINEERING AND COMPUTER SCIENCE

ECE 600 Doctoral Research/Dissertation (3-15)
SEC. 031 CRN 30472 Bomar

Grading Restriction: P/NP only.
Repeatability: May be repeated.
Registration Restriction(s): Minimum student level – graduate.

ECE 529 Applications of Linear Algebra in Engineering Systems (3)
SEC. 001 CRN 30600 (Video Recorded)
TEXT: *Advanced Linear Algebra for Engineers with MATLAB*; Sohail A. Dianat and Eli S. Saber; CRC Press; Latest Edition; ISBN 978-1-4200-9523-4
TIME: Tuesday & Friday 9:15 – 10:30 E-113
PROF: Dr. Monty Smith

Fundamental concepts of linear algebra to problems in engineering systems: steady state and dynamic systems. Geometric and physical interpretations of relevant concepts: least square problems, LU, QR, and SVD decompositions of system matrix, eigenvalue problems, and similarity transformations in solving difference and differential equations; numerical stability aspects of various algorithms; application of linear algebra concepts in control and optimization studies; introduction to linear programming. Computer projects.

Methods of linear algebra with application to engineering problems. Systems of linear equations: matrix-vector notation, solutions to linear equations, determinants, matrix inversion. Vector spaces: spanning sets, orthogonality, matrix decompositions, linear transformations. Eigenvalues and eigenvectors: characteristic polynomials, singular value decomposition. The Cayley-Hamilton theorem: matrix polynomials, functions of matrices. Optimization: least-squares and weighted least-squares methods.
Cross-listed: (Same as Chemical and Biomolecular Engineering 529; Civil Engineering 529, Environmental Engineering 529; Industrial Engineering 529; Materials Science and Engineering 529; Mechanical Engineering 529; Nuclear Engineering 529).
Comment(s): Graduate standing or consent of instructor required.

ENGINEERING MANAGEMENT

EM 500 Master's Thesis (1-15)
SEC. 001 CRN 28887 Simonton
002 CRN 30473 Tolk
003 CRN 30474 Yu

Grading Restriction: P/NP only.
Repeatability: May be repeated.
Credit Level Restriction: Graduate credit only.
Registration Restriction(s): Minimum student level – graduate.

EM 501 Capstone Project (3-6)
SEC. 001 CRN 22287 Simonton
002 CRN 28888 Tolk
003 CRN 30475 Yu

Application-oriented project to show competence in major academic area.
Grading Restriction: Satisfactory/No Credit grading only.
Repeatability: May be repeated. Maximum 6 hours.
Comment(s): Requires enrollment in engineering management.
Credit Level Restriction: Graduate credit only.
Registration Restriction(s): Minimum student level – graduate.

EM 502 Registration for Use of Facilities (1-15)
SEC. 001 CRN 22288 Simonton

Required for the student not otherwise registered during any semester when student uses university facilities and/or faculty time before degree is completed.
Grading Restriction: Satisfactory/No Credit grading only.
Repeatability: May be repeated.
Credit Restriction: May not be used toward degree requirements.
Credit Level Restriction: Graduate credit only.
Registration Restriction(s): Minimum student level – graduate.

EM 533 Theory and Practice of Engineering Management (3)
SEC. 001 CRN 22289 Students participating at Tullahoma classrooms
002 CRN 22290 Students participating by distance ed.
003 CRN 22291 Students participating at Knoxville DE classrooms
TEXT: *Paradigms: The Business of Discovering the Future*, J. A. Barker, (1993), Harper Business Press, New York, ISBN# 10: 0887306470 13: 978-0887306471
Productive Workplaces Revisited: Dignity, Meaning and Community in the 21st Century, M. R. Weisbord, (2004) Pfeifer, ISBN # 0787971170
TIME: Wednesday 4:00 – 6:35 E-113
PROF: Dr. James L. Simonton

Principles of engineering management, including: business and organization design, culture, leadership, marketing and competition in global economy, motivation and performance management, empowerment, organizational behavior, and diversity. Systems thinking, learning organizations, and systems dynamics modeling. Principle application to work settings and case studies.

EM 534 Financial Management for Engineering Managers (3)
SEC. 001 CRN 22293 Students participating at Tullahoma classrooms
002 CRN 22294 Students participating by distance ed.
003 CRN 22295 Students participating at Knoxville DE classrooms
TEXT: *Introduction to Management Accounting*, 15th Edition, C. T. Horngren, G. L. Sundem, W. Stratton, D. Burgstahler, J. Schatzberg, ISBN-13: 978-0-13-610265-6
TIME: Monday 4:00 – 6:35 E-113
PROF: Dr. Andrew Yu

Financial and managerial accounting in engineering and technology management. Transaction recording, financial statements, ratios and analysis, activity-based accounting, and standard practices for costing, budgeting, assessment, and control.

EM 538 New Venture Formation (3)
SEC. 001 CRN 28897 Students participating at Tullahoma classrooms
002 CRN 28898 Students participating by distance ed.
003 CRN 28899 Students participating at Knoxville DE classrooms
TEXT: *Technology Ventures: From Idea to Enterprise*, Thomas H. Byers, Richard C. Dorf, Andrew Nelson, (2011), 3rd edition, McGraw-Hill, ISBN # 13: 9780073380186
TIME: Thursday 4:00 – 6:35 E-113
PROF: Dr. James Simonton

Factors other than mechanical or chemical which enter into successful establishment of manufacturing or service enterprise. Organizational and financial planning and evaluation. Cost and location studies and market analysis to determine commercial feasibility of new ventures.
(RE) Prerequisite(s): 539.

EM 541 Managing Change and Improvement in Technical Organizations (3)
SEC. 001 CRN 22297 Students participating at Tullahoma classrooms
002 CRN 22298 Students participating by distance ed.
003 CRN 22299 Students participating at Knoxville DE classrooms
TEXT: *The Prince*, Niccolo Machiavelli, Anthony Grafton, George Bull, Penguin Classics, Reissue edition (Feb 4, 2003), ISBN# 0140449159
The New Economics, W. Edwards Deming, MIT Press, 2nd ed, ISBN# 9780262541169
Organizational Culture & Leadership, Edgar H. Schein, Jossey-Bass Publisher, 4th ed, ISBN# 9780470190609
TIME: Tuesday 4:00 – 6:35 E-113
PROF: Dr. Janice Tolk

Current topics, theories, and applications for managing change and innovation for performance improvement in organizations. Multi-initiative approaches: quality management, organizational effectiveness, employee empowerment, performance measurement, and application of statistical tools and techniques. Self-assessment and Baldrige criteria for performance excellence. Change agent, team building, and leadership issues. Case studies.
(RE) Prerequisite(s): Industrial Engineering 516

EM 600 Doctoral Research/Dissertation (3-15)
SEC. 001 CRN 25960 Simonton
005 CRN 30808 Tolk
003 CRN 30486 Yu

Grading Restriction: P/NP only.
Repeatability: May be repeated.
Registration Restriction(s): Minimum student level – graduate.

INDUSTRIAL ENGINEERING

IE 517 Reliability of Lean Systems
SEC. 001 CRN 27976 UTK students participating at Knoxville DE classrooms
002 CRN 27977 UTK students participating elsewhere
003 CRN 28015 UTSI students participating elsewhere

TIME: Monday & Wednesday 12:20 – 1:35 (Eastern Time) UTK
TEXT: TBD
PROF: Dr. R. Sawhney

Course is divided into two major components. First half of the course will focus on introducing the students to the concepts of reliability and maintainability and the impact of lean on the reliability of complex systems. The concepts of reliability engineering are utilized to address lean system failures, including equipment failures, human failures, material failures and scheduling failures. Will develop the ability to design systems that are both lean and reliable. The second half of the course will introduce students to specific case studies of systems failures and ask student to develop solutions by considering different dimensions including financial, technical feasibility, risk, safety, security and others. Multi criteria decision making methodologies will be presented to allow students to make decisions when different criteria lead to conflicting solutions.
(RE) Prerequisite(s): 516.
Recommended Background: Background in lean and reliability.

IE 518 Advanced Engineering Economic Analysis (3)
SEC. 001 CRN 21966 UTK students participating at Knoxville DE classrooms
002 CRN 21967 UTK students participating elsewhere
003 CRN 21968 UTSI participating elsewhere
TIME: Monday & Wednesday 2:10 – 3:35 (Eastern Time) UTK
TEXT: *Engineering Economy*, 15th Edition, W. Sullivan, E. Wicks, C. Koelling, ISBN-13: 978-0-13-255490-9
PROF: Dr. R. Kress

Application of engineering economic analysis in complex decision situations. Inflation and price changes;uncertainty evaluation using non-probabilistic techniques; capital financing and project allocation; evaluations involving equipment replacement, investor-owned utilities, and public works projects;probabilistic risk analysis including computer simulation and decision trees; multi-attribute decision analysis; and other advanced topics.
(RE) Prerequisite(s): 405.
Recommended Background: Statistics 251.

IE 522 Optimization Methods in Industrial Engineering (3)
SEC. 001 CRN 21970 UTK students participating at Knoxville DE classrooms
002 CRN 21971 UTK students participating elsewhere
003 CRN 21972 UTSI students participating elsewhere
TIME: Tuesday & Thursday 11:10 – 12:25 (Eastern Time) UTK
TEXT: TBD
PROF: Dr. Mingzhou Jin

Classical optimization applied to constrained and unconstrained, non-linear, multi-variable functions; search techniques; decision making under uncertainty; game theory; and dynamic programming.
(RE) Prerequisite(s): Engineering Management 537.
Recommended Background: 301.

IE 529 Applications of Linear Algebra in Engineering Systems (3)
SEC. 001 CRN 21978 (Video Recorded)
TEXT: *Advanced Linear Algebra for Engineers with MATLAB*; Sohail A. Dianat and Eli S. Saber; CRC Press; Latest Edition; ISBN 978-1-4200-9523-4
TIME: Tuesday & Friday 9:15 – 10:30 E-113

PROF: Dr. Monty Smith

Fundamental concepts of linear algebra to problems in engineering systems: steady state and dynamic systems. Geometric and physical interpretations of relevant concepts: least square problems, LU, QR, and SVD decompositions of system matrix, eigenvalue problems, and similarity transformations in solving difference and differential equations; numerical stability aspects of various algorithms; application of linear algebra concepts in control and optimization studies; introduction to linear programming. Computer projects.

Methods of linear algebra with application to engineering problems. Systems of linear equations: matrix-vector notation, solutions to linear equations, determinants, matrix inversion. Vector spaces: spanning sets, orthogonality, matrix decompositions, linear transformations. Eigenvalues and eigenvectors: characteristic polynomials, singular value decomposition. The Cayley-Hamilton theorem: matrix polynomials, functions of matrices. Optimization: least-squares and weighted least-squares methods.
Cross-listed: (Same as Chemical and Biomolecular Engineering 529; Civil Engineering 529, Electrical and Computer Engineering 529; Environmental Engineering 529; Materials Science and Engineering 529; Mechanical Engineering 529; Nuclear Engineering 529).
Comment(s): Graduate standing or consent of instructor required.

IE 550 Graduate Seminar (1)
SEC. 003 CRN 28016
TIME: Friday 2:30 – 3:20 (Eastern Time) UTK
TEXT: NA
PROF: Dr. Mingzhou Jin

Seminar provides an opportunity for Master's and Doctoral students to acquaint themselves with research being conducted by both faculty and graduate students in the Industrial and Systems Engineering Department, as well as select campus-wide and off-campus researchers from both academia and industry. Research work and relevant results are presented in a professional environment that promotes continued interaction among interested parties. Presentations are not restricted to thesis and dissertation work.
Grading Restriction: Satisfactory/No Credit grading only.
Comment(s): Admission to graduate program required.

MATERIAL SCIENCE ENGINEERING

MSE 529 Applications of Linear Algebra in Engineering Systems (3)
SEC. 001 CRN 21806 (Video Recorded)
TEXT: *Advanced Linear Algebra for Engineers with MATLAB*; Sohail A. Dianat and Eli S. Saber; CRC Press; Latest Edition; ISBN 978-1-4200-9523-4
TIME: Tuesday & Friday 9:15 – 10:30 E-113
PROF: Dr. Monty Smith

Fundamental concepts of linear algebra to problems in engineering systems: steady state and dynamic systems. Geometric and physical interpretations of relevant concepts: least square problems, LU, QR, and SVD decompositions of system matrix, eigenvalue problems, and similarity transformations in solving difference and differential equations; numerical stability aspects of various algorithms; application of linear algebra concepts in control and optimization studies; introduction to linear programming. Computer projects.
Methods of linear algebra with application to engineering problems. Systems of linear equations: matrix-vector notation, solutions to linear equations, determinants, matrix inversion. Vector spaces: spanning

sets, orthogonality, matrix decompositions, linear transformations. Eigenvalues and eigenvectors: characteristic polynomials, singular value decomposition. The Cayley-Hamilton theorem: matrix polynomials, functions of matrices. Optimization: least-squares and weighted least-squares methods.

Cross-listed: (Same as Biomedical Engineering 529; Chemical and Biomolecular Engineering 529; Civil Engineering 529, Electrical and Computer Engineering 529; Environmental Engineering 529; Industrial Engineering 529; Nuclear Engineering 529).

Comment(s): Graduate standing or consent of instructor required.

MSE 578 Advanced Biomaterials; Biological Applications of Nanomaterials (3)
SEC. 002 CRN 30822 (Same as BME 002 CRN 30821)
TEXT: TBD
TIME: Tuesday & Thursday 10:10 – 11:25 E-110
PROF: Dr. Michael L. Simpson

Focuses on the biological/medical uses of nanoscale materials. Includes the following topics: 0-d, 1-d, and 2-d nanomaterials synthesis and characterization with an emphasis on surface properties. Chemical and biological functionalization of nanomaterials and nano-bio interfaces. Biological and biomedical application of nanomaterials.
Cross-listed: (Same as Material Science Engineering 578.)
Recommended Background: 474.
Comment(s): Prior knowledge may satisfy prerequisites, with consent of instructor.

MATHEMATICS

*MATH 435 Partial Differential Equations (3) **CANCELLED**
SEC. 002 CRN 20425
TEXT: Richard Haberman; *Applied Partial Differential Equations with Fourier Services and Boundary Value Problems*; 4th Edition; Prentice Hall; ISBN 013-065243-1
TIME: Tuesday 2:00 – 4:30 F-253
PROF: Dr. Jan Zijlstra

Separation of variables, Fourier series, solution of Laplace, wave, and heat equations.
(RE) Prerequisite(s): 231; 241 or 247.

MATH 512 Methods in Applied Mathematics II (3)
SEC. 001 CRN 28934 (Video Recorded)
TEXT: Applied Analytic Mathematics for Physical Scientists; Cushing; Wiley; 2nd Edition.
Essential Mathematical Methods for the Physical Sciences; K.F. Riley and M.P. Hobson; Cambridge University Press.
TIME: Monday & Thursday 1:00 – 2:15 E-113
PROF: Dr. Horace Crater

Fundamentals and techniques associated with continuous models of physical, engineering, and biological systems: development, solution and qualitative analysis of ordinary and partial differential equations, and calculus of variations. Also included will be studies of orthogonal polynomials, special functions, quaternions, mathematical topics in Hamiltonian mechanics, perturbation theory, and nonlinear dynamics.
(DE) Prerequisite(s): 511.

MATH 517 Mathematical Methods in Physics I (3)
SEC. 001 CRN 26536 (Same as Physics 571 001 CRN 26548
TEXT: *Mathematical Methods for Physicists;* Elsevier 2012; 7th Edition; ISBN 13: 978-0123846549; Arfken, Weber, Harris.
Mathematical Methods in the Physical Sciences; Wiley 2005; 3rd Edition;
ISBN 13: 978-0471198260; Boas. These two books will serve as the primary text for this course. Other books will be used as well, e.g., *Mathematical Physics with Partial Differential Equations* by J.R. Kirkwood (Elsevier, 2013)
TIME: Monday & Thursday 12:30 – 1:45 E-111
PROF: Dr. Christian Parigger

Linear vector spaces, matrices, tensors, curvilinear coordinates, functions of a complex variable, partial differential equations and boundary value problems, Green's functions, integral transforms, integral equations, spherical harmonics, Bessel functions, calculus of variations.
Cross-listed: (Same as Physics 517.)
Recommended Background: Advanced calculus and differential equations.
Comment: This course can be used for the Interdisciplinary Graduate Minor in Computational Science (see http://igmcs.utk.edu)

MECHANICAL ENGINEERING

ME 500 Master's Thesis (1-15)
SEC. 001 CRN 21848 Abedi
021 CRN 21868 Antar
022 CRN 21869 Anusonti-Inthra
023 CRN 21870 Majdalani
024 CRN 21871 Moeller
025 CRN 21872 Solies
026 CRN 21873 Vakili
034 CRN 26549 Zhang
035 CRN 28868 Schmisseur

Grading Restriction: P/NP only.
Repeatability: May be repeated.
Credit Level Restriction: Graduate credit only.
Registration Restriction(s): Minimum student level – graduate.

ME 502 Registration for Use of Facilities (1-15)
SEC. 002 CRN 26021 Moeller

Required for the student not otherwise registered during any semester when student uses university facilities and/or faculty time before degree is completed.
Grading Restriction: Satisfactory/No Credit grading only.
Repeatability: May be repeated.
Credit Restriction: May not be used toward degree requirements.
Credit Level Restriction: Graduate credit only.
Registration Restriction(s): Minimum student level – graduate.

ME 512 Heat Transfer II (3)
SEC. 001 CRN 21884
TEXT: Adrian Bejan; *Convection Heat Transfer*; 4th Edition; John Wiley
References: R.B. Bird, W.E. Stewart, and E.N. Lightfoot, *Transport Phenomena,* Second Edition*,* Wiley, 2001. F.P. Incropera, D.P. DeWitt, T.L. Bergman and A.S. Lavine, *Fundamentals of Heat and Mass Transfer, Sixth Edition,* John Wiley & Sons, 2006.
TIME: Monday & Wednesday 4:30 – 5:45 E-111
PROF: Dr. Feng Yuan Zhang

Analysis of steady-state and time-dependent heat conduction by numerical methods. Analysis of laminar and turbulent convection heat transfer in internal and external flows, forced and buoyancy driven flows. *(DE) Prerequisite(s): 541.*

ME 517 Finite Elements for Engineering Applications (3)
SEC. 001 CRN 28886 (Same as AE 517 001 CRN 28919)
TEXT: K. J. Bathe; *Finite Element Procedures*. Cambridge, MA: Klaus-Jurgen Bathe, 2007. ISBN: 9780979004902
T. J. R. Hughes; *The Finite Element Method: Linear Static and Dynamic Finite Element Analysis*, Dover Publications, 2000. ISBN: 978-0486411811
TIME: Monday & Wednesday 8:40 – 9:55 E-110
PROF: Dr. Reza Abedi

Modern computational theory applied to conservation principles across the engineering sciences. Weak forms, extremization, boundary conditions, discrete implementation via finite element, finite difference, finite volume methods. Asymptotic error estimates, accuracy, convergence, stability. Linear problem applications in 1, 2 and 3 dimensions, extensions to non-linearity, non-smooth data, unsteady, spectral analysis techniques, coupled equation systems. Computer projects in heat transfer, structural mechanics, mechanical vibrations, fluid mechanics, heat/mass transport.
Cross-listed: (Same as Aerospace Engineering 517)
Comment(s): Bachelor's degree in engineering or natural science required.
Registration Permission: Consent of instructor.

*ME 518 Computational Fluid Dynamics (3) **CANCELLED**
SEC. 002 CRN 30819 (Same as AE 518 002 CRN 30818; BME 002 CRN 30820)
TEXT: TBD
TIME: Tuesday & Thursday 8:40 – 9:55 E-110
PROF: Dr. Eivanc Ekici

Finite difference and finite volume techniques for solving compressible and incompressible fluid flow problems. Classification of partial differential equations and their discrete approximations. Explicit and Implicit techniques for solving unsteady Euler and Navier-Stokes equations including finite volume and finite difference formulations. Formulation of boundary conditions, artificial viscosity and multigrid acceleration. Stability analysis and convergence. Grid generation.
Cross-listed: (Same as Aerospace Engineering 518; Biomedical Engineering 518.)
Recommended Background: Fluid mechanics, differential equations, and compressible flows.
Registration Permission: Consent of instructor.

ME 522 Thermodynamics II (3)
SEC. 001 CRN 21886
TEXT: TBD

TIME: Monday & Wednesday 2:40 – 3:55 E-110
PROF: Dr. Joseph Wehrmeyer

Macroscopic thermodynamics, including First and Second Law analyses, availability, phase and chemical equilibrium criteria, combustion, gas mixtures, and property relations, determination of thermodynamic properties from molecular structure, spectroscopic data, kinetic theory, statistical mechanics, quantum physics, Schroedinger equation.
Recommended Background: Undergraduate thermodynamics.

ME 529 Applications of Linear Algebra in Engineering Systems (3)
SEC. 001 CRN 21888 (Video Recorded)
TEXT: *Advanced Linear Algebra for Engineers with MATLAB*; Sohail A. Dianat and Eli S. Saber; CRC Press; Latest Edition; ISBN 978-1-4200-9523-4
TIME: Tuesday & Friday 9:15 – 10:30 E-113
PROF: Dr. Monty Smith

Fundamental concepts of linear algebra to problems in engineering systems: steady state and dynamic systems. Geometric and physical interpretations of relevant concepts: least square problems, LU, QR, and SVD decompositions of system matrix, eigenvalue problems, and similarity transformations in solving difference and differential equations; numerical stability aspects of various algorithms; application of linear algebra concepts in control and optimization studies; introduction to linear programming. Computer projects.

Methods of linear algebra with application to engineering problems. Systems of linear equations: matrix-vector notation, solutions to linear equations, determinants, matrix inversion. Vector spaces: spanning sets, orthogonality, matrix decompositions, linear transformations. Eigenvalues and eigenvectors: characteristic polynomials, singular value decomposition. The Cayley-Hamilton theorem: matrix polynomials, functions of matrices. Optimization: least-squares and weighted least-squares methods.
Cross-listed: (Same as Chemical and Biomolecular Engineering 529; Civil Engineering 529, Electrical and Computer Engineering 529; Environmental Engineering 529; Industrial Engineering 529; Materials Science and Engineering 529; Nuclear Engineering 529).
Comment(s): Graduate standing or consent of instructor required.

ME 534 Mechanical Vibrations (3)
SEC. 003 CRN 29386 (Same as AE 535 003 CRN 29385)
TEXT: TBD
TIME: Monday & Wednesday 10:10 – 11:25 E-110
PROF: Dr. Stephanie TerMaath

Vibrations of linear, discrete, undamped and damped systems. Lagrange's equations for holonomic systems. Modal analysis. Laplace transform. Response to mechanical transients.
Cross-listed: (Same as Aerospace Engineering 535)
Recommended Background: An undergraduate vibrations course.

ME 542 Fluid Mechanics II (3)
SEC. 001 CRN 21891 (Same as AE 542 001 CRN 24528)
TEXT: *Fundamentals of Fluid Mechanics*; 6th Edition or 7th Edition; Munson et al; John Wiley and Sons; ISBN 978-1-118-11613-5
TIME: Thursday 7:30 – 10:00 E-210
PROF: Dr. Steve Brooks

Equations of viscous fluid flows. Basic concepts and equations of turbulent flow. Separation, stability and transition. Laminar and turbulent boundary-layer flows. Exact, approximate, and numerical solutions.
Cross-listed: (Same as Aerospace Engineering 542.)
(DE) Prerequisite(s): 541.

ME 570 Numerical Methods for Engineers (3)
SEC. 001 CRN 30848
TEXT: TBD
TIME: Monday & Wednesday 1:10 – 2:25 E-114
PROF: Dr. Phuriwat Anusonti-Inthra

Review and implementation of basic numerical techniques. Explicit and implicit solution techniques of ordinary differential equations and partial differential equations. Applications include heat transfer and fluid mechanics.
Recommended Background: Numerical analysis, fluid mechanics, heat transfer and differential equations.
Registration Permission: Consent of Instructor.

ME 585 Turbomachinery Systems II (3)
SEC. 001 CRN 21893 (Video Recorded)
TEXT: Jack D. Mattingly; *Elements of Propulsion: Gas Turbines and Rockets*; 2006; ISBN 1-56347-779-3
TIME: Tuesday & Thursday 4:00 – 5:15 E-111
PROF: Dr. Milt Davis

Ideal cycle analysis of turbine engines, real cycle analysis, component performance analysis, component design and systems integration (inlets, nozzles, combustors, compressors, turbines), flowthrough theory, turbine engine component matching, transient operation, surge and rotating stall, engine control systems, structural considerations.
Comment(s): First-year graduate standing required.
Registration Permission: Consent of instructor.

*ME 587 Dynamic Modeling and Simulation (3) **CANCELLED**
SEC. 002 CRN 29379 (Same as BME 587 002 CRN 29380)
TEXT: TBD
TIME: Tuesday & Thursday 2:40 – 3:55 E-110
PROF: Dr. Gary V. Smith

Modeling and analysis of physical systems. Systems and parameter identification. Mathematical modeling methods and approximations. Digital simulation techniques and practices. Design and control applications.
Cross-listed: (Same as Biomedical Engineering 587.)
Recommended Background: 363.

ME 590 Selected Engineering Problems (2-6)
SEC. 002 CRN 21894 Abedi
003 CRN 26537 Antar
005 CRN 26538 Anusonti-Inthra
006 CRN 26539 Majdalani
007 CRN 26540 Moeller
008 CRN 26541 Solies

009 CRN 26542 Vakili
010 CRN 26543 Zhang

Grading Restriction: Satisfactory/No Credit grading only.
Repeatability: May be repeated. Maximum 6 hours.
Comment(s): Enrollment limited to students in problems option.
Registration Permission: Consent of advisor.

ME 595 Mechanical Engineering Seminar (1)
SEC. 001 CRN 21895
TEXT: None
TIME: Will be announced through email
PROF: Dr. Ahmad Vakili

All phases of mechanical engineering, reports on current research at the University of Tennessee, Knoxville, and the University of Tennessee Space Institute.
Grading Restriction: Satisfactory/No Credit grading only.
Repeatability: May be repeated. Maximum 20 hours.

ME 599 Special Topics in ME: Atmospheric Sciences for AE and ME (3)
SEC. 002 CRN 27956 (Same as AE 599 001 CRN 24534)
TEXT: *Atmospheric Science: An Introductory Survey;* Wallace and Hobbs; Academic Press; 2nd Edition; February 15, 2006; ISBN 13: 978-0127329512
TIME: Monday & Wednesday 10:10 – 11:25 E-114
PROF: Dr. Steve Brooks

Structure of the atmosphere, energy balance, turbulent boundary layer, solar forcing, satellite drag, aero-maneuvers and de-orbits, and hypersonic flight in the upper atmosphere. These will be extended to the Venusian, Martian and Jovian atmospheres.
Repeatability: May be repeated. Maximum 6 hours.
Registration Permission: Consent of instructor

*ME 599 Special Topics in ME: Intro to Fluid Structure Interactions (3) **CANCELLED**
SEC. 005 CRN 28025 (Same as AE 599 003 CRN 27955)
TEXT: Recommended material: ANSYS Fluid-Structure Interaction Simulation Guides
TIME: Tuesday & Thursday 1:10 – 2:25 E-110
PROF: Dr. Phuriwat Anusonti-Inthra

This class will serve as an introductory class for students who are interested in learning about fluid-structure interaction simulations. Different types of one-way and two-way fluid-structure interactions will be covered; including conjugate heat transfer problems, pressure-deformation interactions, and force-deformation interactions. Some background in Finite Element Method (FEM) and Computational Fluid Dynamics (CFD) will be covered.
Repeatability: May be repeated. Maximum 6 hours

ME 599 Special Topics in ME: Introduction to Micro/Nano Manufacturing (3)
SEC. 015 CRN 30802 (Same as BME 599 007 CRN 30831; AE 599 015 CRN 30801)
TEXT: Provided by instructor
TIME: Tuesday & Thursday 2:40 – 3:55 E-110
PROF: Dr. Anming Hu and Dr. Feng-Yuan Zhang

Fundamentals of micro-nano-manufacturing with an emphasis on the relationships between unique functions of micro-nano-materials, designed architectures, and appropriate manufacturing strategies will be discussed. This course will well blend the knowledge of nanotechnology, advanced manufacturing and additive manufacturing (3D printing). Students will conduct independent literature review research on micro-nano-manufacturing techniques they selected. The group project will be conducted in the Instructor labs.
This interactive course is designed for both undergraduate and graduate students.
Prerequisites and Co-requisites:
Basics of manufacturing sciences and mechanical engineering will be required. If in doubt, please ask instructor for approval. Number of seats will be limited to 15 for effective group projects at the Instructor's lab.
Major: Open to all Engineering Majors [seniors and graduate students]
Repeatability: May be repeated. Maximum 6 hours.

ME 600 Doctoral Research/Dissertation (3-15)
SEC. 015 CRN 21913 Abedi
016 CRN 21914 Antar
018 CRN 21916 Anusonti-Inthra
019 CRN 21917 Flandro
027 CRN 21925 Majdalani
028 CRN 21926 Moeller
029 CRN 26545 Solies
030 CRN 26546 Vakili
031 CRN 28869 Zhang
032 CRN 28938 Schmisseur

Grading Restriction: P/NP only.
Repeatability: May be repeated.
Registration Restriction(s): Minimum student level – graduate.

ME 601 Doctoral Research Methodology (3)
SEC. 002 CRN 30630
TEXT: TBD
TIME: TBD
PROF: Dr. Kivanc Ekici

Methods of planning and conducting original research and proposal writing.
Registration Restriction(s): Minimum student level – doctoral student.
Registration Permission: Departmental approval.

PHYSICS

PHYS 500 Master's Thesis (1-15)
SEC. 002 CRN 23994 Davis
003 CRN 23995 Lewis
004 CRN 23996 Parigger

Grading Restriction: P/NP only.
Repeatability: May be repeated.

Credit Level Restriction: Graduate credit only.
Registration Restriction(s): Minimum student level – graduate.

PHYS 503 Physics Colloquium (1)
SEC. 002 CRN 24002
TEXT: None
TIME: 2nd & 4th Thursday 3:30 – 5:00 H-111
PROF: Dr. Lloyd Davis

Lectures and discussion on current research topics. Continuous registration required for current graduate students.
Grading Restriction: Satisfactory/No Credit grading only.
Repeatability: May be repeated. Maximum 6 hours.

PHYS 541 Electromagnetic Theory (3)
SEC. 002 CRN 25561
TEXT: TBD
TIME: Monday and Thursday 10:45 – 12:00 E-113
PROF: Dr. Horace Crater

Review of electrostatics, magnetostatics, and quasi-static problems; Maxwell's field equations and their solutions in dielectric and conducting media; electrodynamics and relativity, retarded potentials and gauge transformations, radiation produced by accelerating charges.
(DE) Prerequisite(s): 571.

PHYS 571 Mathematical Methods in Physics I (3)
SEC. 001 CRN 26548 (Same as Math 517 001 CRN 26536)
TEXT: *Mathematical Methods for Physicists;* Elsevier 2012; 7th Edition; ISBN 13: 978-0123846549; Arfken, Weber, Harris.
Mathematical Methods in the Physical Sciences; Wiley 2005; 3rd Edition;
ISBN 13: 978-0471198260; Boas. These two books will serve as the primary text for this course. Other books will be used as well, e.g., *Mathematical Physics with Partial Differential Equations* by J.R. Kirkwood (Elsevier, 2013)
TIME: Monday & Thursday 12:30 – 1:45 E-111
PROF: Dr. Christian Parigger

Linear vector spaces, matrices, tensors, curvilinear coordinates, functions of a complex variable, partial differential equations and boundary value problems, Green's functions, integral transforms, integral equations, spherical harmonics, Bessel functions, calculus of variations.
Cross-listed: (Same as Mathematics 517.)
Recommended Background: Advanced calculus and differential equations.
Comment: This course can be used for the Interdisciplinary Graduate Minor in Computational Science (see http://igmcs.utk.edu)

PHYS 599 Seminars (1)
SEC. 007 CRN 24020
TEXT: None
TIME: 2nd & 4th Thursday 3:30 – 5:00 H-111
PROF: Dr. Lloyd Davis

(a) Mechanics; (b) Radiation; (c) Heat and Thermodynamics; (d) Electricity and Magnetism; (e) Modern Physics.
Repeatability: May be repeated with consent of department. Maximum 18 hours.

PHYS 599 Seminars (1)
SEC. 010 CRN 30619
TEXT: None
TIME: 2nd & 4th Thursday 3:30 – 5:00 H-111
PROF: Dr. Christian Parigger

(a) Mechanics; (b) Radiation; (c) Heat and Thermodynamics; (d) Electricity and Magnetism; (e) Modern Physics.
Repeatability: May be repeated with consent of department. Maximum 18 hours.

PHYS 600 Doctoral Research/Dissertation (3-15)
SEC. 002 CRN 24023 Davis
003 CRN 24024 Parigger

Grading Restriction: P/NP only.
Repeatability: May be repeated.
Registration Restriction(s): Minimum student level – graduate.

PHYS 606 Nonlinear Optics
SEC. 001 CRN 26957
TEXT: http://www.amazon.com/Nonlinear-Optics-Third-Edition-Robert/dp/0123694701
TIME: Monday and Thursday 8:15 – 9:30 CLA Conf. Room
PROF: Dr. Lloyd Davis

Nonlinear optical susceptibilities, wave propagation in nonlinear media, sum-frequency and difference frequency generation, harmonic generation, parametric amplification and oscillation, stimulated Raman processes, two- and multi-photon processes, four-wave mixing and phase conjugation, transient coherent optical effects and free induction decay, optical breakdown and nonlinear effects in plasmas.
(DE) Prerequisite(s): 522.
Registration Restriction(s): Minimum student level – graduate.