Spring
2019
Registration Announcement

The University of Tennessee Space Institute

411 B.H. Goethert Parkway
Tullahoma, TN 37388-9700
888-822-8874 ext. 37228
www.utsi.edu

BIG ORANGE BIG IDEAS

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CALENDAR - 2019 SPRING SEMESTER

Priority Registration ..... October 15, 2018 – January 7, 2019
Admission to Candidacy Forms for Spring 2019 Commencement ..... December 4, 2018
Spring 2019 Graduation Application Deadline (submit online) ..... December 4, 2018
Graduation Fee Payment Deadline (MS $30, PhD $75) ..... December 4, 2018
Priority registration payment deadline 4:30 p.m. EST ..... January 7, 2019
Late Registration and late fee begins ($100 Late Fee) ..... January 9, 2019
Classes begin ..... January 9, 2019
Last Day to final register, add, change grading options or drop without a "W" ..... January 18, 2019
Martin Luther King Holiday ..... January 21, 2019
Late Registration and late fee begins (after 14th day) ($200 Late Fee) ..... January 23, 2019
Preliminary Thesis/Dissertation Review Deadline ..... February 19, 2019
Spring Break (No Classes) ..... March 18 - 22, 2019
Last day to schedule final exam (non-thesis/thesis/dissertation) ..... March 28, 2019
Drop with a "W" ..... April 2, 2019
Last day to take final exam (non-thesis/thesis/dissertation) ..... April 4, 2019
Thesis/Dissertation Deadline 5:00 p.m. EST ..... April 16, 2019
Submit report of final examination (Pass/Fail) form ..... April 16, 2019
Spring Recess (No Classes) ..... April 19, 2019
All "INCOMPLETE" must be removed for Graduation ..... April 26, 2019
Deadline for Submission of Admission to Candidacy for students
Graduating Summer 2019 and Graduation Application ..... April 26, 2019
Classes End ..... April 26, 2019
Total Withdraw from the University Deadline ..... April 26, 2019
Study Period ..... April 29, 2019
Exam Period ..... April 30, May 1 & 2, 2019
Graduate Hooding Ceremony (UTK) ..... May 9, 2019
COMMENCEMENT (UTK) ..... May 9 - 11, 2019
Official Graduation Date ..... May 11, 2019

Second thesis/dissertation deadlines
Defense Completed by April 26, 2019
Second Deadline Application Submitted by April 26, 2019
https://gradschool.utk.edu/forms-central/second-deadline-graduation-application/
Thesis/Dissertation Submitted and Accepted by May 16, 2019
(Student will receive diploma summer 2019 semester, but will not be required to register for thesis/dissertation credits)

SUMMER SEMESTER 2019

Priority Registration ..... TBD
Final Registration ..... TBD
Memorial Day Holiday ..... May 27, 2019
Classes begin ..... May 30, 2019
July 4th Holiday ..... July 4, 2019
Classes End ..... August 9, 2019
Summer Graduation Date on Transcript (No Ceremony) ..... August 10, 2019

Dates may be revised without notice. Please refer to the following sites for updates:
https://gradschool.utk.edu/graduation/
http://registrar.tennessee.edu/academic_calendar/index.shtml

SPRING SEMESTER 2019
FINAL STUDY DAY AND EXAM SCHEDULE

LAST DAY OF CLASSES.....April 26, 2019

STUDY PERIOD .....April 29, 2019

FINAL EXAMS

REGULAR CLASS TIME	(Same Classroom)	EXAM TIME
1st Day – Tuesday, April 30, 2019		
7:45 - 9:00	M/Th	7:45 - 9:45
10:45 - 12:00	M/Th	10:15 - 12:15
9:15 - 10:30	M/Th	1:00 - 3:00
2:30 - 3:45	M/Th	3:30 - 5:30
2nd Day – Wednesday, May 1, 2019		
9:15 - 10:30	Tu/Fri	7:45 - 9:45
10:45 - 12:00	Tu/Fri	10:15 - 12:15
1:00 - 2:15	Tu/Fri	1:00 - 3:00
2:30 - 3:45	Tu/Fri	3:30 - 5:30
3rd Day – Thursday, May 2, 2019		
7:45 - 9:00	Tu/Fri	7:45 - 9:45
1:00 - 2:15	M/Th	10:15 - 12:15

**** ATTENTION ****

ALL STUDENTS TAKING VIDEOTAPE COURSES
CONTACT INSTRUCTOR FOR DATE AND TIME OF FINAL EXAM

NO CLASSES WILL BE IN SESSION
AT THIS TIME

Graduation and Graduate Hooding Ceremony dates to be announced go to:
http://gradschool.utk.edu/graduation/graduate-hooding-ceremony/

REGISTRATION ANNOUNCEMENT
SPRING SEMESTER 2019

REGISTRATION PROCEDURE

GRADUATE ACADEMIC ADVISING

Graduate students should contact your departmental faculty to arrange an advising appointment. If you're not accepted into a specific program, the assistant to the dean of graduate studies or the designee may act as your advisor. When the web registration system asks if you've discussed your program with your advisor, you must answer yes to continue with the registration process.

REGISTRATION

Students will register at http://my.utk.edu. You will need to log in using your NetID and your NetID password. If you do not know your NetID and NetID password, go to http://onestop.utk.edu/your-classes/registering-for-classes/ .

*Log in to MyUTK. You can find a link by looking under "M" on the A-Z index (http://www.utk.edu/alpha/) or by typing myutk.utk.edu directly into your browser. You will need to log in by typing utk\your NetID in the "username" field and then your NetID password in the "password" field.

*Before you attempt to register, clear and pay any financial holds (parking tickets, library fines, fees, etc.).

*Look under the "For Your Review" heading on the MyUTK portal page (located in the upper right-hand corner) for notification of any holds you may have.

*Once you are logged into "My UTK," scroll down to "UTK Student Registration Links." Click on "Search for Classes" to look up sections and then register.

*Print a copy of your schedule when you are finished registering.

If you have any questions, call the Office of the University Registrar at 865-974-2101 or contact Charlene Hane in Student Services room D-100, phone 931-393-7228, email chane@utsi.edu.

TOLL-FREE NUMBERS

For a specific office: .....1-888-822-UTSI (8874) and the extension number.
For general information: 1-888-822-UTSI (8874)
Admissions Office: ..... 1-888-822-UTSI (8874)-37234
Budget and Finance Office: ..... 1-888-822-UTSI (8874)-37297
Student Services..... 1-888-822-UTSI (8874)-37228

APPLICATION FOR ADMISSION

No student will be allowed to register unless a completed Application to the Graduate School of the University of Tennessee, Knoxville (UTK) is on file in the Registrar's Office. An Application for Admission to the UTK Graduate School must be completed online at https://www.applyweb.com/utg and accompanied by a $60.00 non-refundable application fee made payable to The University of Tennessee Space Institute. All applicants are required to

provide one official transcript of all undergraduate and graduate records, GRE test scores and three letters of recommendation when applying. International applicants will also need to include TOEFL scores. GRE scores are a requirement of all departments at UTSI except the Master of Science degree in Industrial Engineering/Engineering Management concentration. Please select UT Space Institute if you plan to attend the Tullahoma campus location. All applications need to be submitted online to the office of Graduate Admissions Knoxville, TN.

Graduate Research Assistantship applications need to be submitted to Clara Ferguson, Office of Admissions and Recruiting, University of Tennessee Space Institute, MS-6, Tullahoma, TN 37388-9700. Assistantship applications must include GRE test scores and three letters of recommendation. All International applicants will need to provide TOEFL test scores in addition to GRE's. Official transcripts and test scores should be sent to College Code 1843, Graduate Admissions Office, 201 Student Services Building, Knoxville, TN 37996-0221. Once admitted, a full admission will not be granted until all official test scores and degree confirmation are received in the Graduate Admissions Office in Knoxville. Please contact Clara Ferguson at (931) 393-7234 or 888-822-8874 ext. 37234 if you have questions.

TOTAL WITHDRAWAL FROM THE UNIVERSITY

If, after registering for classes and either returning your fee payment or your Confirmation of Attendance form to the Bursar's Office, you decide not to enroll for this term, you must immediately notify Charlene Hane, Student Services, at UTSI. If you withdraw officially on or before a Change of Registration deadline, but after the no "W" deadline for a particular session, the grade of "W" will be issued.

GRADES

Students may obtain their grades through the web at MyUTK or contact Charlene Hane, Student Services, Office D-100, (931) 393-7228.

GRADUATE STUDENTS CHANGE OF REGISTRATION AFTER THE DEADLINE

To change registration in any way after the deadline, a graduate student must present a request, signed by the instructor(s) and adviser as evidence of their knowledge of the request to Charlene Hane, Student Services at UTSI. Graduate students must verify that ALL changes have been approved by their academic adviser. If the Office of Graduate Student Services approves the change of registration, the change will be noted on the student's permanent record. THE DROP DEADLINE FOR GRADES AND THE DROP DEADLINE FOR FEE REFUNDS ARE NOT THE SAME.

FULL-TIME STUDENTS

Students enrolled in at least 9 semester hours during the Fall/Spring/Summer semesters are considered full-time. Full-time enrollment for two consecutive semesters is required to full fill the admission to candidacy doctoral degree residency requirement. Graduate Research Assistants (GRAs) must be enrolled for 9 hours during the Fall/Spring semesters and 6 hours during the Summer. GRAs must also enroll in one of the MABE 595 seminars or a PHYS 599 seminar each semester in which seminars are offered, unless a waiver is granted by the Associate Executive Director.

REMOVAL OF INCOMPLETE GRADES

All Incomplete Grades (I) must be removed prior to graduation. The instructor, in consultation with the student, decides the terms for the removal of the I, including the time limit for removal. If the I is not removed within one calendar year, the grade will be changed to an F. The course will not be counted in the cumulative grade point average until a final grade is assigned. No student may graduate with an I on the record. Students planning to graduate Spring Semester 2019 must remove all INCOMPLETE GRADES by April 26, 2019. Contact Charlene Hane, Student Services, to remove an Incomplete Grade.

REPEATING A COURSE

No graduate student may repeat a course for the purpose of raising a grade already received, with the exception of a NC course. A graduate student cannot do additional work nor repeat an examination to raise a final grade.

ADMISSION TO CANDIDACY

MASTER OF SCIENCE DEGREE:

Each M.S. student, including IE Capstone Project students, is responsible for submitting a completed and signed Admission to Candidacy Application at least one semester prior to receiving the degree.

Candidacy committee changes or course changes must be submitted to the committee chairman using a Revision form. If changing from a thesis option to a non-thesis option or vice versa, a new Admission to Candidacy Application must be submitted. All forms must be processed through Student Services.

DOCTORAL DEGREE:

A Doctoral Committee should be formed during the student's first year of doctoral study. Any changes to the doctoral committee (deletions or additions) must be submitted to the Committee Chairman using a Revision form for approval. Each doctoral student is responsible for submitting a completed Admission to Candidacy form signed by the doctoral committee at least one semester prior to receiving the degree. All forms must be processed through Student Services.

CONTINUOUS ENROLLMENT

All degree-seeking graduate students are expected to make a full commitment to their graduate and professional study in order to ensure that they can complete all degree requirements without unnecessary delay. Graduate students are therefore required to maintain an active status through continuous enrollment from the time of first enrollment until graduation.

Continuous enrollment is maintained by registering for a minimum of one graduate credit hour per semester (excluding the summer, unless stipulated otherwise by the program or department). However, students who have started taking dissertation hours (course 600) must maintain a minimum of three credit hours per semester during all semesters, including the summer, as stipulated in the policy on "Registration for Course 600 (Doctoral Research and Dissertation)" in order to comply with the Continuous Enrollment requirement (see under Doctoral Programs for details).

The minimum enrollment for international students may be different, and international students always need to check with the Center for International Education (CIE) in order to determine what minimum enrollment they need to maintain in order to satisfy all enrollment requirements attached to their specific visa.

CONSEQUENCES OF NON-ENROLLMENT WITHOUT LEAVE OF ABSENCE

Graduate students who do not maintain continuous enrollment as stipulated in the "Continuous Enrollment" policy will lose their active student status. A student who has lost his or her active status without having been granted a Leave of Absence for the period of non-enrollment ahead of time will not be allowed to continue in his her graduate program until readmitted. (see policy on "Readmission" in the Graduate Catalog for more details).

Non-enrollment other than during an approved Leave of Absence (LOA) does not alter or affect any of the milestone deadlines, such as admission to candidacy, time to degree, etc.

Upon approval for readmission to complete the interrupted degree program, students will be retroactively enrolled in every semester of missed enrollment for one graduate credit hour of Course 502 or for three graduate credit hours of Course 600 (whichever is appropriate). Students will be responsible for paying the past tuition charges and fees as well as the current university per semester late registration penalty. All past due charges will need to be paid before the Graduate School will approve the student for any future enrollment.

FINAL EXAM FOR NON-THESIS, CAPSTONE PROJECT STUDENTS, THESIS AND DISSERTATION STUDENTS

A candidate presenting a thesis or dissertation must pass a final oral examination on all work offered for the degree. The examination is scheduled through Student Services. Failure to notify Student Services of the examination date will put the student at risk for graduating that semester. Final examinations not properly scheduled MUST be repeated. The final draft of the thesis must be distributed to the committee members at least two weeks prior to the date of the final examination. In case of a grade of "Fail", the candidate may not apply for re-examination until the following semester. The result of the second examination is final.

UT POLICY ON INSURANCE FOR INTERNATIONAL STUDENTS

All foreign national students registered with the University of Tennessee, Knoxville, are required to have comprehensive medical insurance. The policy for the 2018-2019 academic year is provided by United HealthCare Student Resources. The premium must be paid before registration. Contact the Student Services Office (room D-100 ext. 37228) for further information.

GENERAL SEMINAR

A number of seminars of interest to all UTSI students and general public will be offered throughout the semester.

FINAL EXAM DATES

Study Day – April 29, 2019
Final Exams – April 30, May 1 & 2, 2019

FINANCIAL CALENDAR, FEES, REFUNDS, AND TUITION

Please click http://onestop.utk.edu/tuition-fees/ link to the most current information. You may also contact Tonya Travis in the Business and Finance Office at ttravis@utsi.ed or phone number 931-393-7297.

The UTSI Budget and Finance Accounts Receivable Office will no longer accept payment for tuition and fees by credit card. All students will need to login to MyUTK One Stop to make secure payments online. Priority registration payment deadline is January 7, 2018 by 4:30 p.m. Eastern Time.

Please see One Stop - Paying Tuition and Fees webpage for more details http://onestop.utk.edu/pay/ .

Credit or Debit Cards

There is a 2.75% service fee for these payments. UT has a contract with an outside vendor to provide this service. The vendor retains the fee in full.

HONOR STATEMENT

The following Honor Statement is signed by all students applying to The Graduate School:

"An essential feature of The University of Tennessee, Knoxville is a commitment to maintaining an atmosphere of intellectual integrity and academic honesty. As a student of the University, I pledge that I will neither knowingly give nor receive any inappropriate assistance in academic work, thus affirming my own personal commitment to honor and integrity."

For official information on all UTK Graduate School policies, refer to the current UTK Graduate Catalog available at http://catalog.utk.edu. The student handbook "Hilltopics" is available online at https://hilltopics.utk.edu/

The University of Tennessee Space Institute reserves the right to cancel any class with an insufficient number of students, or for other reasons.

THE UNIVERSITY OF TENNESSEE POLICY ON A DRUG-FREE CAMPUS AND WORKPLACE

In support of the Drug-Free Workplace Act of 1988 (Public Law 100-690) and the Drug-Free Schools and communities Act of 1989, the University of Tennessee is notifying all students, faculty, and staff of the following university policy approved by the UT Board of Trustees on 21 June 1990.

It is the policy of the University of Tennessee to maintain a safe and healthful environment for its students and employees. Therefore, university policy prohibits the unlawful use, manufacture, possession, distribution, or dispensing of drugs ("controlled substances" as defined in the Controlled Substances Act, 21 U.S.C. 812) and alcohol on university property or during university activities.

Violation of this policy is grounds for disciplinary action--up to and including immediate discharge for an employee and permanent dismissal of a student. Federal and state laws provide additional penalties for such unlawful activities, including fines and imprisonment (21 U.S.C. 841

et seq.; T.C.A. 39-6-401 et seq.). Local ordinances also provide various penalties for drug- and alcohol-related offenses. The university is bound to take all appropriate actions against violators, which may include referral for legal prosecution or requiring the individual to participate satisfactorily in an approved drug use or alcohol abuse assistance or rehabilitation program.

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

The University of Tennessee Space Institute
Spring 2019 Course Listings

AEROSPACE ENGINEERING

AE 500 Master's Thesis (1-15)
SEC. 009 CRN 24020 Abedi
011 CRN 24021 Balas
012 CRN 24022 Brooks
013 CRN 24023 Moeller
014 CRN 24024 Schmisseur
015 CRN 24025 Solies
016 CRN 24026 Vakili
021 CRN 24031 Zhang

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 24033 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 512 Viscous Flow (3)
SEC. 001 CRN 24034
TEXT: *Viscous Flow*; Frank M. White; 3rd Edition
TIME: Tuesday & Thursday 1:10 – 2:25 E-110
PROF: Dr. Ahmad Vakili

Derivation of fundamental equations of compressible viscous flow; boundary conditions for viscous heat-conducting flow; exact solutions for Newtonian viscous flow (Navier-Stokes) equations for special cases; similarity solutions. Thermal boundary layers, stability of laminar flows, transition to turbulence, 2-D turbulent boundary layer equations. Incompressible-turbulent mean flow, and compressible boundary layer flow.
Registration Permission: Consent of instructor.

AE 518 Computational Fluid Dynamics (3)
SEC. 002 CRN 28911
TEXT: TBD
TIME: Tuesday & Thursday 8:40 – 9:55 E-110
PROF: Dr. Kivanc 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 Mechnaical Engineering 518; Biomedical Engineering 518.)

Recommended Background: Fluid mechanics, differential equations, and compressible flows.
Registration Permission: Consent of instructor

AE 532 Introduction to Turbulence (3)
SEC. 001 CRN 28927
TEXT: *Turbulent Flows;* S.B. Pope; Cambridge University Press · Paperback · 771 pages
ISBN**:** 0521598869
TIME: Monday & Wednesday 8:40 – 9:55 E-110
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.

AE532: Introduction to Turbulence will provide a solid foundation in the fundamentals of the theory of turbulent flows and their application within the analysis of flows of current engineering interest.
Course Goals:
• Familiarize students with the broad spectrum of current methods used to study turbulent flows
• Enable students to make discriminating choices with regard to the application of current methods

AE 581 Rocket Propulsion I (3)
SEC. 001 CRN 32506
TEXT: George P. Sutton and Oscar Biblarz, *Rocket Propulsion Elements*, 8th ed. Whiley.
http://www.amazon.com/Rocket-Propulsion-Elements-George-Sutton/dp/0470080248/ref=sr_1_1?ie=UTF8&qid=1437680444&sr=8-1&keywords=sutton+rocket+propulsion+elements
TIME: Monday & Thursday 1:00 – 2:15 E-113
PROF: Dr. Trevor Moeller

Rocket propulsion fundamentals; thermodynamics of nonreacting and chemically reacting ideal gases, rocket nozzle design; ideal rocket performance parameters; rocket heat transfer; chemistry of propellants; liquid rocket engine systems; ground testing; introduction to solid propellant rockets.
Registration Permission: Consent of Instructor.

AE 590 Selected Engineering Problems (2-6)
SEC. 001 CRN 24039 Abedi
003 CRN 24040 Balas
004 CRN 25409 Brooks

005 CRN 25410 Moeller
006 CRN 25411 Schmisseur
007 CRN 25412 Solies
008 CRN 25413 Vakili
009 CRN 25414 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 24041
TEXT: None
TIME: Will be announced through email
PROF: Dr. Trevor Moeller

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: Atmospheric Sciences for Aerospace & Mechanical Engineers (3)
SEC. 001 CRN 24043 (Same as ME 599 002 CRN 26772)
TEXT: *Atmospheric Science: An Introductory Survey;* Wallace and Hobbs; Academic Press; 2nd Edition; February 15, 2006; ISBN 13: 978-0127329512
TIME: Monday & Thursday 10:00 – 11:15 E-111
PROF: Dr. Steve Brooks

Structure of the atmosphere, energy balance, turbulent boundary layer, 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 Advanced Topics: Computer Methods in Dynamics of Continua (3)
SEC. 003 CRN 26771 (Same as ME 599 013 CRN 27831)
TEXT: There is no required textbook and I'll provide course notes to students. There are also some recommended textbooks in the syllabus which are copied here as well:

[Strikwerda, 2004] Strikwerda, J. C. (2004). Finite difference schemes and partial differential equations. SIAM.
[Hughes, 2012] Hughes, T. J. (2012). The finite element method: linear static and dynamic finite element analysis. Courier Corporation.
[Bathe, 2006] Bathe, K.-J. (2006). Finite element procedures. Klaus-Jurgen Bathe.
[Farlow, 2012] Farlow, S. J. (2012). Partial differential equations for scientists and engineers. Courier Corporation.
[LeVeque, 2002] LeVeque, R. L. (2002). Finite Volume Methods for Hyperbolic Problems. Cambridge University Press.
[Chapra and Canale, 2010] Chapra, S. C. and Canale, R. P. (2010). Numerical methods for engineers, volume 2. McGraw-Hill. 6th edition.
TIME: Monday & Wednesday 11:40 - 12:55 E-110
PROF: Dr. Reza Abedi

This course is intended to serve as a sequel to an introductory finite element or computational mechanics courses. It is designed to deepen student's understanding of the characteristics of elliptic, parabolic, and hyperbolic partial differential equations (PDE) and get familiar with solution techniques for dynamic problems.

Course Objectives
Provide sufficient mathematical background to read the current literature and understand new developments in the field.
Familiarize the students with various numerical schemes for continuum dynamics.
Relate theory to practical applications in computational science and engineering.
Develop the student's capabilities for technical communication and independent research in computational science and engineering.

Repeatability: May be repeated. Maximum 9 hours.
Registration Restriction(s): Minimum student level – graduate.
Registration Permission: Consent of instructor.

AE 599 Special Topics: Aircraft Flight Controls (3)
SEC. 013 CRN 28893
TEXT: Nelson, Robert C; *Flight Stability and Automatic Control*; 2nd Edition 1988 or newr; McGraw-Hill, NY; 1988; ISBN 0-07-046273-9
TIME: Tuesday & Friday 11:00 – 12:15 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 Special Topics: Experimental Flight Mechanics: Fixed Wing Performance (3)
SEC. 014 CRN 28895
TEXT: *Flight Testing of Fixed Wing Aircraft*; Ralph D. Kimberlin; First Edition; AIAA; 2003 ISBN 1-56347-564-2
TIME: Tuesday & Friday 1:00 – 2:15 E-111
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 several flight simulator labs.
(RE) Prerequisite(s): 503 or Aerospace Engineering 515.
Repeatability: May be repeated. Maximum 6 hours.

AE 599 Special Topics: Introduction to Computational Aerodynamics (3)
SEC. 024 CRN 32288
TEXT: *Applied Computational Aerodynamics: A Modern Engineering Approach*; Cummings et al; ISBN 13 978-1107053748
TIME: Tuesday & Thursday 2:40 – 3:55 E-110
PROF: Dr. James Coder

This course will provide an introduction to computational aerodynamics with a focus on commonly used computational fluid dynamics (CFD) approaches. The theoretical bases of these methods, which generally place an emphasis on the solution of inviscid and/or high-Reynolds number flow fields, will be presented and augmented through application-oriented activities using a CFD solver.
Repeatability: May be repeated. Maximum 6 hours.

AE 600 Doctoral Research/Dissertation (3-15)
SEC. 007 CRN 24051 Abedi
008 CRN 24052 Balas
009 CRN 24053 Brooks
010 CRN 24054 Moeller
013 CRN 24057 Schmisseur
015 CRN 25415 Solies
017 CRN 24059 Vakili
018 CRN 25171 Zhang

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 28767
TEXT: TBD
TIME: TBD
PROF: Dr. Kivanc Ekici

Methods of planning and conducting original research and proposal writing.

Grading Restriction: Satisfactory/No Credit grading only.
Repeatability: Maximum 6 hours. May be repeated once.
Registration Restriction(s): Minimum student level – graduate / doctoral students.
Registration Permission: Departmental approval.

AE 690 Advanced Topics: Nonlinear Systems Theory and Control (3)
SEC. 001 CRN 26806
TEXT: Lecture notes and H. Marques; Nonlinear Control Systems; Analysis and Design; Wiley; 2003
Reference: M. Vidyasagar; *Nonlinear Systems Analysis*; Prentice Hall; 1978;
J.P. LaSalle and S. Lefschetz; Stability by Lyapunov's Direct Method; Academic Press, 1961
TIME: Monday & Wednesday 2:30 – 3:45 E-111
PROF: Dr. Mark Balas

Topics: Linear Time-Varying Systems, Discrete-Time Nonlinear Systems, Metric Spaces , Contraction Mapping Theorem, Continuous-Time Nonlinear Systems, Lyapunov Stability Theory, LaSalle Invariance Principle, Barbalat's Lemma, Dissipativity, Differential Geometry, Feedback Linearization.

Purpose: The purpose of this course is to introduce graduate students in engineering to the basic phenomena and complex behavior of nonlinear systems. The mathematical and tools needed to understand such systems will be developed and applied. It may also be used to satisfy a graduate mathematics requirement.

Deliverables: Bi-weekly graded collaborative problem sets, midterm and final written exams (each 1 week take home)
Grading: Final Grade based on collaborative problem sets (10%), MidTerm Exam (45%), and Final Written Exam (45%). Both Exams are Take Home (1 week)
Grade Range: A 90-100; B 80-89, C 70-79; D 60-69; F 59-0.

Repeatability: May be repeated. Maximum 9 hours.
Registration Restriction(s): Minimum student level – graduate.
Registration Permission: Consent of instructor.

BIOMEDICAL ENGINEERING

BME 500 Master's Thesis (1-15)
SEC. 012 CRN 25941 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)
SEC. 002 CRN 28913
TEXT: TBD
TIME: Tuesday & Thursday 8:40 – 9:55 E-110
PROF: Dr. Kivanc 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 24141 (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
COST OF TEXTBOOK(s): $135.00 Hardback, $52.16 eBook, PDF available via UTK University Libraries OneSearch
TIME: Tuesday & Friday 9:30 – 10:45 E-111
PROF: Dr. Monty Smith

Methods of linear algebra with application to engineering problems. Systems of linear equations: matrix-vector notation, solutions to linear equations, determinants, matrix inversion, LU decomposition. Vector spaces: spanning sets, orthogonality, QR factorization, 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.

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.

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 575 Luminescent Materials for Theranostics
SEC. 001 CRN 32271
TEXT: *LUMINESCENT MATERIALS;* Blasse, G., Grabmaier, B.C.; SPRINGER;
ISBN #: ISBN 978-3-642-79017-1; COST OF TEXTBOOK(s): $109
TIME: Zoom
PROF: Dr. Jackie Johnson

Luminescent materials are crucial for diagnostic imaging. Scintillators and storage phosphors are used in x-ray imaging, computed tomography, single photon emission computed tomography, and positron emission tomography. Luminescent nanoparticles can be used for in-vivo diagnostics such as visualization of tumor margins. The first part of the course will focus on basic mechanisms of luminescence such as radiation absorption and emission, energy level diagrams, and selection rules. The second part will focus on the properties and applications of luminescent materials such as thermoluminescence, afterglow, upconversion, x-ray phosphor and scintillator materials, integrating and counting techniques as well as the above-mentioned imaging modalities.
Recommended Background: Physics 411 or some basic quantum mechanics.

BME 590 Selected Biomedical Engineering Problems (2-6)
SEC. 001 CRN 26870 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 26082
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.
Credit Level Restriction: Graduate credit only.
Registration Restriction(s): Minimum student level – graduate

BME 600 Doctoral Research/Dissertation (3-15)
SEC. 011 CRN 25942 Johnson

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

BME 601 Doctoral Research Methodology (3)
SEC. 002 CRN 28768
TEXT: TBD
TIME: TBD
PROF: Dr. Jeffery Reinbolt

Intensive, individualized experience in reviewing literature, evaluating experimental or theoretical methods, planning a research project, and presenting research project plans orally and in writing.
Grading Restriction: Satisfactory/No Credit grading only.
Repeatability: Maximum 6 hours. May be repeated once.
Registration Restriction(s): Minimum student level – graduate. PhD students only.
Registration Permission: Consent of instructor.

ENGINEERING MANAGEMENT

EM 500 Master's Thesis (1-15)
SEC. 001 CRN 27464 Simonton
002 CRN 28645 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 22010 Tolk

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 22011 Simonton
002 CRN 29389 Yu

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. 002 CRN 22013 UT Space Institute Campus
003 CRN 22014 UT Knoxville Campus
004 CRN 22015 Distance Education Campus
TEXT: Required: *Organizational Behavior*; Fred Luthans; McGraw-Hill Irvin; 13th Edition, ISBN-13: 978-1681231204 ISBN-10: 1681231204
References: *The Fifth Discipline*, Peter M. Senge, ISBN-10: 9780385517256 ISBN-13: 978-0385517256
TIME: Monday 4:00 – 6:35 E-113
PROF: Dr. Denise Jackson

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 22016 UT Space Institute Campus
002 CRN 22017 UT Knoxville Campus
004 CRN 22019 Distance Education Campus
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 10:00 – 12:30 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 27471 UT Space Institute Campus
003 CRN 27473 UT Knoxville Campus
004 CRN 32308 Distance Education Campus
TEXT: Required: *Technology Ventures: From Idea to Enterprise*, Thomas H. Byers, Richard C. Dorf, Andrew Nelson, 4th edition, McGraw-Hill, ISBN # 13: 978-0073523422
Reference only: *Entrepreneurship and New Venture Formation*, 1st edition, Thomas W. Zimmerer and Norman M. Scarborough ISBN-13: 978-0024317407
TIME: Tuesday 1:00 – 3:30 E-113
PROF: Dr. Sandra Affare

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.
Recommended Background: Graduate standing in Engineering or Business.

EM 541 Managing Change and Improvement in Technical Organizations (3)
SEC. 001 CRN 22020 UT Space Institute Campus (Pre-recorded)
003 CRN 22022 UT Knoxville Campus

004 CRN 22023 Distance Education Campus

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: TBD

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.
Recommended Background: Graduate standing in Engineering or Business.

EM 600 Doctoral Research/Dissertation (3-15)
SEC. 001 CRN 25141 Simonton
003 CRN 28655 Yu

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

EM 601 Systems Theory and Engineering (3)
SEC. 001 CRN 32309 UT Space Institute Campus
002 CRN 32310 UT Knoxville Campus
003 CRN 32311 Distance Education Campus
TIME: Thursday 10:00 – 12:30 E-113

TEXT: *Systems Engineering Principles and Practice*; Alexander Kossiakoff; William N. Sweet, Sam Seymour, Steven M. Biemer; 2nd Edition; ISBN 13: 978-1-119-09504-0

PROF: Dr. Sandra Affare

Technology course that will examine theoretical foundations of General System Theory applied to engineering and organizational enterprises addressing issues concerning systems, the effectiveness of organizations in the context of traditional management related issues, as well as incorporating the critical impact of systems thinking on the socio-technical environment. Among the topics to be covered in the course are: the meaning of General Systems Theory (GST); GST and the unity of science; the concept of Equifinality; the characteristics and modeling of open systems; the concepts of the Learning Organization; the principle of Leverage; building Learning Organizations; and issues related to Socio-Technical Systems. Systems Engineering focuses on defining customer needs and required functionality early in the development cycle, documenting requirements, then proceeding with design synthesis and system validation while considering the complete problem including operations, performance, test, manufacturing, cost, and schedule. This subject emphasizes the links of systems engineering to fundamentals of decision theory, statistics, and optimization.
(RE) Prerequisite(s): 533.
Registration Restriction(s): Minimum student level – graduate.

INDUSTRIAL ENGINEERING

IE 529 Applications of Linear Algebra in Engineering Systems (3)
SEC. 001 CRN 21734 (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
COST OF TEXTBOOK(s): $135.00 Hardback, $52.16 eBook, PDF available via UTK University Libraries OneSearch
TIME: Tuesday & Friday 9:30 – 10:45 E-111
PROF: Dr. Monty Smith

Methods of linear algebra with application to engineering problems. Systems of linear equations: matrix-vector notation, solutions to linear equations, determinants, matrix inversion, LU decomposition. Vector spaces: spanning sets, orthogonality, QR factorization, 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.

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.

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.

MATHEMATICS

MATH 578 Numerical Methods for Conservation Laws (including parallelization with MPI) (3)
SEC. 002 CRN 32505 **Cancelled**
TEXT: http://www.math.utk.edu/~vasili/578/
TIME: Tuesday & Thursday 1:10 – 2:25 Zoom
PROF: Dr. Vasilios Alexiades

Conservation Laws, expressing conservation of mass, momentum, energy, or charge, constitute the cornerstone of models of physical processes, and their numerical solution is a central problem in Scientific Computing.
An essential feature of the course is parallelization with MPI.

FEATURES
- Unified treatment of physical meaning, mathematical properties, and numerical methods
- Focused on the physically meaningful, simple to implement, and effective, Finite Volume discretization
- Emphasis on ideas, derivation, explanation of schemes, physical meaning, how they work, advantages/disadvantages, implementation issues, hands-on computing

- Parallelization via domain decomposition using MPI
- Recent advances in shock-capturing higher order schemes

Course web page: http://www.math.utk.edu/~vasili/578/

The course qualifies for UT's IGMCS program.

MECHANICAL ENGINEERING

ME 500 Master's Thesis (1-15)
SEC. 001 CRN 21608 Abedi
021 CRN 21628 Balas
022 CRN 21629 Brooks
023 CRN 21630 Moeller
024 CRN 21631 Schmisseur
025 CRN 21632 Solies
026 CRN 21633 Vakili
034 CRN 25649 Zhang

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 25192 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 Convection Heat Transfer (3)
SEC. 001 CRN 21644
TEXT: TBD
TIME: Monday & Wednesday 1:10 –2:25 E-110
PROF: Dr. Majid Keyhani

Models and equations for fluid motion, the general energy equation, and transport properties. Exact, approximate, and boundary layer solutions for laminar flow heat transfer problems. Heat transfer in internal and external forced and buoyancy driven flows. Application of similarity concepts and analogies to convection heat transfer.
Recommended Background: Undergraduate heat transfer course.

ME 518 Computational Fluid Dynamics (3)
SEC. 002 CRN 28912
TEXT: TBD
TIME: Tuesday & Thursday 8:40 – 9:55 E-110

PROF: Dr. Kivanc 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 529 Applications of Linear Algebra in Engineering Systems (3)
SEC. 001 CRN 21648 (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
COST OF TEXTBOOK(s): $135.00 Hardback, $52.16 eBook, PDF available via UTK University Libraries OneSearch
TIME: Tuesday & Friday 9:30 – 10:45 E-111
PROF: Dr. Monty Smith

Methods of linear algebra with application to engineering problems. Systems of linear equations: matrix-vector notation, solutions to linear equations, determinants, matrix inversion, LU decomposition. Vector spaces: spanning sets, orthogonality, QR factorization, 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.

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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.

ME 585 Turbomachinery II (3)
SEC. 001 CRN 21653
TEXT: Jack D. Mattingly; *Elements of Propulsion: Gas Turbines and Rockets*; 2006; ISBN 1-56347-779-3
TIME: Monday & Wednesday 10:10 – 11:25 E-110
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 590 Selected Engineering Problems (2-6)
SEC. 002 CRN 21654 Abedi
003 CRN 25637 Balas
005 CRN 25638 Brooks
006 CRN 25639 Moeller
007 CRN 25640 Schmisseur
008 CRN 25641 Solies
009 CRN 25642 Vakili
010 CRN 25643 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 21655
TEXT: None
TIME: Will be announced through email
PROF: Dr. Trevor Moeller

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 Engineers (3)
SEC. 002 CRN 26772 (Same as AE 599 001 CRN 24043)
TEXT: *Atmospheric Science: An Introductory Survey;* Wallace and Hobbs; Academic Press; 2nd Edition; February 15, 2006; ISBN 13: 978-0127329512
TIME: Monday & Thursday 10:00 – 11:55 E-111
PROF: Dr. Steve Brooks

Structure of the atmosphere, energy balance, turbulent boundary layer, 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 Advanced Topics: Computer Methods in Dynamics of Continua (3)
SEC. 013 CRN 27831 (Same as AE 599 003 CRN 26771)
TEXT: There is no required textbook and I'll provide course notes to students. There are also some recommended textbooks in the syllabus which are copied here as well:

[Strikwerda, 2004] Strikwerda, J. C. (2004). Finite difference schemes and partial differential equations. SIAM.
[Hughes, 2012] Hughes, T. J. (2012). The finite element method: linear static and dynamic finite element analysis. Courier Corporation.

[Bathe, 2006] Bathe, K.-J. (2006). Finite element procedures. Klaus-Jurgen Bathe.
[Farlow, 2012] Farlow, S. J. (2012). Partial differential equations for scientists and engineers. Courier Corporation.
[LeVeque, 2002] LeVeque, R. L. (2002). Finite Volume Methods for Hyperbolic Problems. Cambridge University Press.
[Chapra and Canale, 2010] Chapra, S. C. and Canale, R. P. (2010). Numerical methods for engineers, volume 2. McGraw-Hill. 6th edition.
TIME: Monday & Wednesday 11:40 - 12:55 E-110
PROF: Dr. Reza Abedi

This course is intended to serve as a sequel to an introductory finite element or computational mechanics courses. It is designed to deepen student's understanding of the characteristics of elliptic, parabolic, and hyperbolic partial differential equations (PDE) and get familiar with solution techniques for dynamic problems.

Course Objectives
Provide sufficient mathematical background to read the current literature and understand new developments in the field.
Familiarize the students with various numerical schemes for continuum dynamics.
Relate theory to practical applications in computational science and engineering.
Develop the student's capabilities for technical communication and independent research in computational science and engineering.

Repeatability: May be repeated. Maximum 6 hours.

ME 600 Doctoral Research/Dissertation (3-15)
SEC. 015 CRN 21673 Abedi
016 CRN 21674 Balas
018 CRN 21676 Brooks
019 CRN 21677 Moeller
027 CRN 21685 Schmisseur
028 CRN 21686 Solies
029 CRN 25645 Vakili
030 CRN 25646 Zhang
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 28769
TEXT: TBD
TIME: TBD
PROF: Dr. Kivanc Ekici

Methods of planning and conducting original research and proposal writing.

Grading Restriction: Satisfactory/No Credit grading only.
Repeatability: Maximum 6 hours. May be repeated once.
Registration Restriction(s): Minimum student level – doctoral student.
Registration Permission: Departmental approval.

PHYSICS

Phys 500 Master's Thesis (1-15)
SEC. 002 CRN 23512 Davis
003 CRN 23513 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 23520
TEXT: Classic texts and literature
TIME: 2nd & 4th Thursday 3:30 – 5:00 TBD
PROF: Dr. Christian Parigger

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 573 Numerical Methods in Physics (3)
SEC. 002 CRN 23527
TEXT: https://press.princeton.edu/titles/8704.html and current research topics
TIME: Thursday 2:30 – 5:30 E-111
PROF: Dr. Christian Parigger

Numerical methods for solution of physical problems, use of digital computers, analysis of errors.
(DE) Prerequisite(s): 571 or consent of instructor.

Phys 599 Seminars (1)
SEC. 010 CRN 28759
TEXT: None
TIME: 2nd & 4th Thursday 3:30 – 5:00 TBD
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 23539 Davis
003 CRN 23540 Parigger

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

Phys 642 Adv. Top: Nanophotonics (3)
SEC. 005 CRN 32299

TEXT: https://www.amazon.com/Principles-Nano-Optics-Lukas-Novotny-ebook/dp/B00INYGCQG/ref=mt_kindle?_encoding=UTF8&me=
Principles of Nano-Optics 2nd Edition, by Lukas Novotny (Author), Bert Hecht (Author)
TIME: Tuesday & Thursday 1:10 – 2:25 Zoom
PROF: Dr. Lloyd Davis

Optical phenomena on the nanometer scale, in nanoscience, and in nanotechnology; sub-diffraction microscopy, near-field probes, plasmonics/surface plasmons, forces in confined fields.

Advanced theoretical or experimental topics not covered in other courses.
Repeatability: May be repeated with consent of department. Maximum 9 hours.
Registration Restriction(s): Minimum student level – graduate.

Phys 642 Adv. Top: Plasma Emission Spectroscopy (3)
SEC. 003 CRN 26979
TEXT: Current literature, Current Springer Series books on Atomic, Optical and Plasma Physics
TIME: Monday & Thursday 1:00 – 2:15 E-111
PROF: Dr. Christian Parigger

Advanced theoretical or experimental topics not covered in other courses.
Repeatability: May be repeated with consent of department. Maximum 9 hours.
Registration Restriction(s): Minimum student level – graduate.

Phys 643 Computational Physics
SEC. 001 CRN 26561
TEXT: https://press.princeton.edu/titles/8704.html and current research topics
TIME: Thursday 2:30 – 5:30 E-111
PROF: Dr. Christian Parigger

Developing computer algorithms for solving representative problems in various fields of physics, celestial dynamics in astrophysics, boundary value problems in electromagnetism, atomic and nuclear structures, band structure in solid state physics, transport problems in statistical mechanics, Monte Carlo simulation of liquids, fitting and interpolation of data, correlation analysis, or optimization strategy.
(DE) Prerequisite(s): 521, 531, and 571.
Registration Restriction(s): Minimum student level – graduate.