

# *Fall 2020*

## *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](http://www.utsi.edu)*



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## CALENDAR - 2020 FALL SEMESTER

### Academic Calendar Dates are Subject to Change

Priority Registration.....	March 9, 2020 – August 18, 2020
Admission to Candidacy Forms for Fall 2020 Commencement.....	August 14, 2020
Fall 2020 Graduation Application Deadline (submit online at MyUTK).....	August 14, 2020
Graduation Fee Payment Deadline (MS \$30, PhD \$75).....	August 14, 2020
Payment Due for Priority Registration.....	August 17, 2020
Late Registration and late fees ( <b>\$100 Late Fee</b> ).....	August 19- September 1, 2020
Classes begin.....	August 19, 2020
Last Day to final register, add, change grading options or drop without a “W”.....	August 25, 2020
Payment Due for Late Registration.....	August 28, 2020
Labor Day (UTSI classes will NOT be held. UTK classes WILL be held.).....	September 7, 2020
Late Registration after 14 <sup>th</sup> day ( <b>\$200 Late Fee</b> ).....	September 3, 2020 - Forward
Preliminary Thesis/Dissertation Review Deadline ( <a href="mailto:thesis@utk.edu">thesis@utk.edu</a> ).....	September 30, 2020
Fall Break (No Classes).....	TBD
Last day to schedule final exam (non-thesis/thesis/dissertation).....	October 30, 2020
Register to attend the Graduate Hooding Ceremony ( <a href="http://gradschool.utk.edu/graduation/">http://gradschool.utk.edu/graduation/</a> ) ..	TBD
Purchase cap and gown and order hood (865-974-3459).....	TBD
Last day to take final exam (non-thesis/thesis/dissertation).....	November 13, 2020
Drop with a “W”.....	November 10, 2020
Thesis/Dissertation Deadline 5:00 p.m. EST.....	November 23, 2020
Submit report of final examination (Pass/Fail) form.....	November 23, 2020
Classes End.....	November 24, 2020
No Class Day.....	November 25, 2020
Thanksgiving Holidays.....	November 26 – 27, 2020
All "INCOMPLETE" must be removed for Graduation.....	November 30, 2020
Deadline for Submission of Admission to Candidacy for students Graduating Spring 2021 and Graduation Application.....	January 4, 2021
Total Withdraw from the University Deadline.....	November 24, 2020
Study Day.....	November 30 – December 1, 2020
Final Exam Period (fully online).....	December 2, 3 & 4, 2020
Graduate Hooding Ceremony (UTK).....	TBD
COMMENCEMENT (UTK).....	TBD
Official Graduation Date.....	TBD

#### Second thesis/dissertation deadlines

Defense Completed by November 30, 2020

Second Deadline Application Submitted by November 30, 2020

<http://gradschool.utk.edu/forms-central/>

Thesis/Dissertation Submitted and Accepted by January 5, 2021 5:00 p.m. EST

(Student will receive diploma spring 2021 semester, but will not be required to register for thesis/dissertation credits)

A new graduation application must be submitted for Spring graduation. For more

Information on graduation steps see <http://gradschool.utk.edu/graduation.shtml>

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### SPRING SEMESTER 2021

Priority Registration.....	TBD
Final Registration.....	TBD
Classes Begin.....	January 13, 2021
Martin Luther King Day (Holiday).....	January 18, 2021

Spring Break .....	March 15 – 19, 2021
No Class Day .....	April 1, 2021
Spring Recess.....	April 2, 2021
Classes End.....	April 30, 2021
Study Day .....	May 3, 2021
Exam Period.....	May 4, 5 & 6, 2021
Graduate Hooding Ceremony (UTK) .....	May 13, 2021
University College Commencement Ceremonies .....	May 13 – 15, 2021
Official Graduation Date on Transcript .....	May 15, 2021

**Dates may be revised without notice. Please refer to the following sites for updates:**  
[http://registrar.tennessee.edu/academic\\_calendar/index.shtml](http://registrar.tennessee.edu/academic_calendar/index.shtml)

**FALL SEMESTER 2020  
STUDY PERIOD AND FINAL EXAM SCHEDULE**

LAST DAY OF CLASSES.....	November 24, 2020
STUDY DAY .....	November 30 & December 1, 2020

**ONLINE FINAL EXAMS**

REGULAR CLASS TIME

EXAM TIME

1<sup>st</sup> Day – Wednesday, December 2, 2020

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

2<sup>nd</sup> Day – Thursday, December 3, 2020

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

3<sup>rd</sup> Day – Friday, December 4, 2020

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

## REGISTRATION ANNOUNCEMENT FALL SEMESTER 2020

### 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](mailto: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 Affairs ..... 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**

Nine credit hours are considered full-time for graduate students. Graduate Research Assistants (GRAs) with one-half assistantship are required to register for at least 6 credit hours during the fall/spring semesters and 3 credit hours during the summer semester. GRAs must also register 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.

The residency requirement for doctoral students is 9 credit hours for two consecutive semesters or 6 credit hours for three consecutive semesters.

### **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 Fall Semester 2020 must remove all INCOMPLETE GRADES by November 30, 2020. 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 2020-2021 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 – November 30 & December 1, 2020  
Online Final Exams – December 2, 3, & 4, 2020

## **FINANCIAL CALENDAR, FEES, REFUNDS, AND TUITION**

Please click <http://onestop.utk.edu/tuition-fees/> link to the most current information. You may also contact Tim Johnson in the Budget and Finance Office at [tjohnson@utsi.edu](mailto:tjohnson@utsi.edu) or phone number 931-393-7419.



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.

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  
Fall 2020 Course Listings**

**AEROSPACE ENGINEERING**

AE 500 Master's Thesis (1-15)  
SEC. 001 CRN 42535 Abedi  
009 CRN 42551 Brooks  
010 CRN 42555 Kreth  
011 CRN 42557 Moeller  
012 CRN 42560 Schmisser  
013 CRN 42561 Solies  
014 CRN 42562 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 42580 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 511 Inviscid Flow (3)  
SEC. 004 CRN 53577  
TEXT: TBD  
TIME: Tuesday & Thursday 3:30 – 4:45 E-110  
PROF: Dr. James Coder

Kinematics and dynamics of inviscid fluids; potential flow about body, conformal mapping.

*(DE) Prerequisite(s): 541 and Mathematics 425.*

AE 515 Air Vehicle Aerodynamics and Performance (3)  
SEC. 001 CRN 44796 (Same as Aviation System 503 001 CRN 53173)  
TEXT: M. Asselin; *An Introduction to Aircraft Performance*; AIAA Education Series, Reston, VA  
1997; 1<sup>st</sup> Edition; ISBN 1-56347-221-X  
TIME: Tuesday & Friday 11:00 – 12:15 E-111  
PROF: Dr. Peter Solies

Application of aerodynamics principles to air vehicles to provide estimates of performance, stability, and control characteristics for subsonic to hypersonic speeds. Relations among thrust, drag, lift and attitude, propulsion systems, vehicle performance characteristics, and trajectory optimization.

AE 517 Finite Elements for Engineering Applications (3)  
SEC. 001 CRN 49623 (Same as ME 517 001 CRN 49602)  
TEXT: All required course materials will be provided. Recommended references:  
Zienkiewicz, Olek C., and Robert L. Taylor. *The finite element method for solid and structural mechanics*. Elsevier, 2005  
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 12:10 – 1:25 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 521 Aerodynamics of Compressible Fluids (3)  
SEC. 001 CRN 45419  
TEXT: John D. Anderson; *Modern Compressible Flow: With Historical Perspective*; 3rd Edition; McGraw Hill; ISBN 978-0072424430  
TIME: Tuesday & Thursday 1:50 – 3:05 E-110  
PROF: Dr. Phillip Kreth

One-dimensional internal and external flow; waves; small perturbation theory; slender body theory; similarity rules; method of characteristics.

Revision of course content for AE 521: Aerodynamics of Compressible Fluids I will accelerate and broaden course content to provide a more comprehensive knowledge of compressible fluid dynamics for graduate students who have prior course experience covering compressible flows. Historically, for a non-trivial percentage of students in the course with Mechanical Engineering backgrounds, the course has been the students' first exposure to the theory of compressible flow. With ME 599: Gas Dynamics, the intent is to provide an appropriate introduction to the material for graduate students; therefore, the course content of AE 521 can be enhanced to cover a much broader range of material at an accelerated pace.

Topics to be covered in the revised AE 521 course include the following:

- A review of normal and oblique shocks and Prandtl-Meyer expansions
- A review of Fanno and Rayleigh Flow
- Shock Interactions and Reflections
- A review of nozzle flows
- Unsteady wave motion

- Crocco's Theorem and the Velocity Potential Equation
- Linearized Flow
- Conical Flow
- Method of Characteristics
- An introduction to Hypersonics / Newtonian Theory if time permits

Recommended pre-requisite is an undergraduate-level compressible flow course.

AE 532 Introduction to Turbulence (3)  
 SEC. 001 CRN 53224  
 TEXT: *Turbulent Flows*; S.B. Pope; Cambridge University Press · Paperback · 771 pages  
 ISBN: 0521598869  
 TIME: Tuesday & Thursday 8:50 – 10:05 E-110  
 PROF: Dr. John Schmisser

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 590 Selected Engineering Problems (2-6)  
 SEC. 002 CRN 42588 Abedi  
 003 CRN 42589 Brooks  
 004 CRN 45420 Kreth  
 005 CRN 45421 Moeller  
 006 CRN 45422 Schmisser  
 007 CRN 45423 Solies  
 008 CRN 45424 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 42592  
 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 in Aerospace Engineering: Experimental Flight Mechanics: Fixed Wing Performance (3)  
 SEC. 001 CRN 42595 (Same as AS 521 001 CRN 53671)  
 TEXT: *Flight Testing of Fixed Wing Aircraft*; Ralph D. Kimberlin; AIAA; First Edition; ISBN 1-56347-564-2  
 TIME: Tuesday & Friday 2:30 – 3:45 E-111  
 PROF: Dr. Peter Solies

Fundamental theories, flight test techniques, and data collection and analyses for fixed wing aircraft stability and control. Topics: static and dynamic longitudinal stability, longitudinal maneuvering stability and control, static and dynamic lateral-directional stability, lateral control power, and departure testing. Weekly classroom academics with approximately 4-6 flight labs.

(DE) Prerequisite(s): 516 and 521.

*Repeatability: May be repeated. Maximum 6 hours.*

AE 599 Special Topics in Aerospace Engineering: Data Measurement & Analysis (3)  
 SEC. 003 CRN 47357 (Same as ME 599 001 CRN 43274)  
 TEXT: *Random Data: Analysis and Measurement Procedures*; Julius S. Bendat and Allan G. Piersol; Wiley; 4th Edition; ISBN 978-0-470-24877-5  
 TIME: Tuesday & Thursday 10:00 – 11:15 E-113  
 PROF: Dr. Phil Kreth

Tools for random data analysis (including types of random data, mean values, mean-square values, probability density and distribution functions, moments and characteristic functions, spectral and correlation analyses); bias and random error estimates in data measurements; input-output system models; measurement examples.

*Repeatability: May be repeated. Maximum 6 hours.*

AE 599 Special Topics in Aerospace Engineering Advanced Engineering Mathematics (3)  
 SEC. 006 CRN 48137 (Same as BME 001 CRN 42638, ME 013 CRN 50658)  
 TEXT: No specific textbook is required for this class, as many texts on the subject exist. Students are free to choose whichever text best facilitates learning. Recommended texts include:  
 • *Advanced Engineering Mathematics* by E. Kreyszig  
 • *Advanced Mathematical Methods for Scientists and Engineers* by Bender and Orzog  
 • *Mathematical Methods for Physicists* by Arfken and Weber  
 TIME: Monday & Wednesday 8:50 – 10:05 E-110  
 PROF: Dr. Mark Gragston

This course provides an introduction and review of mathematical concepts relevant for advanced studies in engineering and science for modeling and problem solving. Applications focus on fluid dynamics and heat transfer. Topics covered include ordinary differential equations, perturbation techniques, partial differential equations, complex variable calculus, Fourier analysis, and probability/statistics.

*Repeatability: May be repeated. Maximum 6 hours.*

AE 599 Special Topics in AE: Micro/Nano Electro Mechanical Systems/Sensors (3)  
 SEC. 010 CRN 50817 (Same as ME 599 008 CRN 46512, BME 599 005 CRN 47953)  
 TEXT: Liu, C., *Foundations of MEMS*, 2nd Edition, Pearson Education: New Jersey, 2010, ISBN 10: 0132497360, ISBN 13: 9780132497367.  
 Reference:  
 Marc J. Madou, *Fundamentals of Microfabrication and Nanotechnology*, 3rd Edition, CRC Press, 2011; ISBN 9780849331800.

G. Kovacs, *Micromachined Transducer Sourcebook*, McGraw-Hill, 1998.  
Nadim Maluf, *An Introduction to Microelectromechanical Systems Engineering*, 2nd Edition, Artech House Publishers; 2004, ISBN 978-1-58053-590-8.  
Sami Franssila; *Introduction to Microfabrication*, Wiley, 2010; ISBN 978-0-470-74983-8.

TIME: Monday & Wednesday 3:30 – 4:45 E-110  
PROF: Dr. Feng-Yuan Zhang

The lectures will cover fundamentals and elements of micro/nano-scale design, fabrication, integration, and systems, including lithography, deposition, etching, thin film, surface modification, bonding, and characterization. The videos/movies will be presented to introduce the state-of-the-art fabrication process and integration. Their applications to transducers and actuators will be discussed.

*Repeatability: May be repeated. Maximum 6 hours.*

AE	600	Doctoral Research/Dissertation (3-15)	
SEC.	004	CRN 42606	Abedi
	005	CRN 42608	Brooks
	006	CRN 42610	Kreth
	007	CRN 42612	Moeller
	008	CRN 42614	Schmisser
	014	CRN 42620	Solies
	015	CRN 42621	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 48399	
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.*

## **AVIATION SYSTEMS**

AS	503	Air Vehicles (3)	
SEC.	001	CRN 53173	(Same as AE 515 001 CRN 44796)
TEXT:	M. Asselin; <i>An Introduction to Aircraft Performance</i> ; AIAA Education Series, Reston, VA 1997; 1 <sup>st</sup> Edition; ISBN 1-56347-221-X		
TIME:	Tuesday & Friday	11:00 – 12:15	E-111
PROF:	Dr. Peter Solies		

Focuses on the study of air vehicles as they evolved to enable human flight or unmanned flight missions. In a historical review the development of aviation technology, mission requirements, and economical aspects are emphasized. Fundamentals of aerodynamic principles and their application to air vehicles will be developed to determine performance in level flight, climb, glide and maneuvering flight, as well as

characteristic parameters as range and endurance. The state of the art of present air vehicles is investigated, as well as current problems in aviation and possible solutions. A technology forecast will be offered.

AS 521 Experimental Flight Mechanics: Fixed Wing Performance (3)  
SEC. 001 CRN 53671 (Same as AE 599 001 CRN 42595)  
TEXT: *Flight Testing of Fixed Wing Aircraft*; Ralph D. Kimberlin; AIAA; First Edition;  
ISBN 1-56347-564-2  
TIME: Tuesday & Friday 2:30 – 3:45 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 approximately 4-6 flight labs.

*(RE) Prerequisite(s): 503 or Aerospace Engineering 515.*

## **BIOMEDICAL ENGINEERING**

BME 500 Master's Thesis (1-15)  
SEC. 012 CRN 46288 Johnson

*Grading Restriction: P/NP only.*

*Repeatability: May be repeated.*

*Credit Level Restriction: Graduate credit only.*

*Registration Restriction(s): Minimum student level – graduate.*

BME 529 Applications of Linear Algebra in Engineering Systems (3)  
SEC. 001 CRN 42636 (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 9:30 – 10:45 E-111  
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, matrix determinants, matrix inversion, Cramer's rule, LU matrix decomposition. Vector spaces: spanning sets, vector norms, orthogonality, QR matrix decomposition, linear transformations. Eigenvalues and eigenvectors: characteristic polynomials, modal matrices, singular value decomposition. The Cayley-Hamilton theorem: matrix polynomials, functions of matrices, solutions to systems of differential and difference equations. 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 530 Thin Film Enhancement of Biomedical Devices (3)  
SEC. 001 CRN 53085  
TEXT: *Thin film coatings for biomaterials and biomedical applications*; Edited by: Hans J Griesser; Woodhead; ISBN #: 978-1-78242-453-6  
TIME: Monday & Tuesday 2:40 – 3:55 CT Live Zoom Link  
PROF: Dr. Jacqueline Johnson

Overview of the fundamentals of selected thin film deposition techniques and pertinent instrumentation with an emphasis on applications to biomaterials. Structural characterization and tailoring of thin films for implant-specific applications. Growth of thin films on biomaterial surfaces, the biological interface and biocompatibility. Uniformity, adhesion, cytotoxicity and bacterial reduction synergy. Application of thin films in tissue engineering and stem cell technologies.  
*Recommended Background: Biomaterials and cell and tissue-biomaterials interaction.*  
*Registration Permission: Consent of instructor.*

BME 590 Selected Biomedical Engineering Problems (2-6)  
SEC. 001 CRN 46527  
TEXT: TBD  
TIME: TBD  
PROF: Dr. Jacqueline 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 45998  
TEXT: None  
TIME: Will be announced through email  
PROF: Dr. Jacqueline Johnson

All phases of biomedical engineering, reports on current research at UTK and UTSL.  
*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 599 Special Topics in BME: Micro/Nano Electro Mechanical Systems/Sensors (3)  
SEC. 005 CRN 47953 (Same as AE 599 010 CRN 50817, ME 599 008 CRN 46512)  
TEXT: Liu, C. *Foundations of MEMS*, 2nd Edition, Pearson Education: New Jersey, 2010, ISBN 10: 0132497360, ISBN 13: 9780132497367.  
Reference:  
Marc J. Madou, *Fundamentals of Microfabrication and Nanotechnology*; 3rd Edition, CRC Press, 2011; ISBN 9780849331800.  
G. Kovacs, *Micromachined Transducer Sourcebook*, McGraw-Hill, 1998.



Nadim Maluf, *An Introduction to Microelectromechanical Systems Engineering*, 2nd Edition, Artech House Publishers; 2004, ISBN 978-1-58053-590-8.

Sami Franssila; *Introduction to Microfabrication*, Wiley, 2010; ISBN 978-0-470-74983-8.

TIME: Monday & Wednesday 3:30 – 4:45 E-110  
PROF: Dr. Feng-Yuan Zhang

The lectures will cover fundamentals and elements of micro/nano-scale design, fabrication, integration, and systems, including lithography, deposition, etching, thin film, surface modification, bonding, and characterization. The videos/movies will be presented to introduce the state-of-the-art fabrication process and integration. Their applications to transducers and actuators will be discussed.

*Repeatability: May be repeated. Maximum 12 hours.*

BME 599 Special Topics in BME: Advanced Engineering Mathematics (3)  
SEC. 001 CRN 42638 (Same as AE 006 CRN 48137, ME 013 CRN 50658)  
TEXT: No specific textbook is required for this class, as many texts on the subject exist. Students are free to choose whichever text best facilitates learning. Recommended texts include:

- *Advanced Engineering Mathematics* by E. Kreyszig
- *Advanced Mathematical Methods for Scientists and Engineers* by Bender and Orzog
- *Mathematical Methods for Physicists* by Arfken and Weber

TIME: Monday & Wednesday 8:50 – 10:05 E-110  
PROF: Dr. Mark Gragston

This course provides an introduction and review of mathematical concepts relevant for advanced studies in engineering and science for modeling and problem solving. Applications focus on fluid dynamics and heat transfer. Topics covered include ordinary differential equations, perturbation techniques, partial differential equations, complex variable calculus, Fourier analysis, and probability/statistics.

*Repeatability: May be repeated. Maximum 12 hours.*

BME 600 Doctoral Research/Dissertation (3-15)  
SEC. 011 CRN 45999 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 48400  
TEXT: TBD  
TIME: TBD  
PROF: Dr. Jeffrey 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 47217 Simonton  
002 CRN 48802 Yu

*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 42949 Tolk  
002 CRN 47924 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 42950 Simonton  
002 CRN 48804 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 532 Productivity and Quality Engineering (3)  
SEC. 001 CRN 44838 UT Space Institute Campus  
002 CRN 44839 UT Knoxville Campus  
003 CRN 44840 Distance Education Campus

TEXT: TBD

TIME: TBD

PROF: Dr. Lynn Reed

Productivity and quality measures defined and used to analyze current competitive position of important sectors of American industry with respect to national and international competition. Study of management theories and systems which promote or inhibit productivity or quality improvements.

EM 537 Analytical Methods for Engineering Managers (3)  
SEC. 001 CRN 44842 UT Space Institute Campus  
002 CRN 44843 Distance Education Campus  
003 CRN 44844 UT Knoxville Campus

TEXT: *Operations Management*; William Stevenson; McGraw-Hill; January 7, 2014; Edition 12<sup>th</sup>;

ISBN 13:978-0078024108, ISBN 10:0078024102

TIME: Monday

4:00 – 6:35

E-113

PROF: Dr. Denise Jackson

Survey of management analysis and control systems through industrial engineering techniques. Qualitative and quantitative systems: methods analysis, work measurement, incentive systems, wage and salary development, production and inventory control, facility layout, linear programming, and applied operations research techniques.

*Credit Restriction: No credit for student with undergraduate degrees in industrial engineering.*

EM 542 Design of Experiments for Engineering Managers (3)

SEC. 001 CRN 52431 UT Space Institute Campus

002 CRN 52432 UT Knoxville Campus

003 CRN 52433 Distance Education Campus

TEXT: TBD

TIME: TBD

PROF: Dr. Alberto Garcia

Methodology for experiments in product, service, and process improvements. Factorial experiments, screening designs, variance reduction, and other selected topics for engineering managers. Taguchi philosophy and concepts. Optimization and response surface methods. Case studies.

*(RE) Prerequisite(s): Industrial Engineering 516.*

EM 600 Doctoral Research/Dissertation (3-15)

SEC. 001 CRN 44852 Simonton UT Space Institute Campus

002 CRN 44854 Simonton Distance Education Campus

003 CRN 47993 Yu UT Space Institute Campus

004 CRN 52676 Yu Distance Education Campus

*Grading Restriction: P/NP only.*

*Repeatability: May be repeated.*

*Registration Restriction(s): Minimum student level – graduate.*

EM 602 Supply Chain and Logistics Systems Engineering (3)

SEC. 001 CRN 51376 UT Space Institute Campus

002 CRN 51377 UT Knoxville Campus

003 CRN 51378 Distance Education Campus

TEXT: Instructor will provide electronic files through Canvas

TIME: Monday 10:00 – 12:15

E-113

PROF: Dr. Andrew Yu

Introduces the concepts, methods and techniques of supply chain management and logistics support from a systems engineering perspective. The discussion of different topics in the course will focus on the different stages in a system life cycle.

*(RE) Prerequisite(s): 537*

## INDUSTRIAL ENGINEERING

IE 516 Statistical Methods in Industrial Engineering (3)

SEC. 001 CRN 44917 UT Knoxville Campus

002 CRN 44918 Distance Education Campus

003 CRN 44919 UT Space Institute Campus  
 TEXT: TBD  
 TIME: Tuesday & Thursday 11:40 – 12:55 EST E-113  
 PROF: Dr. Tony Shi

Application of classical statistical techniques to industrial engineering problems. Statistics and statistical thinking in managerial context of organizational improvement; descriptive statistics and distribution theory; relationship between statistical process control techniques and classical statistical tools; parameter estimation and hypothesis testing; goodness-of-fit testing; linear regression and correlation; analysis of variance; single and multiple factor experimental design.

*Recommended Background: Statistics 251 or equivalent*

IE 526 Advanced Applications of Systems Modeling and Simulation (3)  
 SEC. 001 CRN 44928 UT Knoxville Campus  
 002 CRN 44930 Distance Education Campus  
 003 CRN 44931 UT Space Institute Campus  
 TEXT: TBD  
 TIME: Tuesday & Thursday 9:40 – 10:55 EST UTK  
 PROF: Dr. Xueping Li

Modeling and simulation of business and industry systems to enhance management, strategic, and operational decision-making. Hands-on experiences of simulation software package (e.g., Arena) will be provided with case studies in manufacturing, supply chain and logistics, healthcare, etc.

*Recommended Background: 306.*

IE 527 Lean Production Systems (3)  
 SEC. 002 CRN 43173 Off-Campus Study US  
 TEXT: TBD  
 TIME: TBD  
 PROF: TBD

Strategies for planning, development and implementation of Lean. Emphasis on integration of people, technology, processes and information dimensions (including product development, production and extended supply chain) into unified frameworks. Applications will be implemented into industry with work to further develop lean principles.

*(RE) Prerequisite(s): 515 or consent of instructor.*

IE 529 Applications of Linear Algebra in Engineering Systems (3)  
 SEC. 001 CRN 43174 UT Knoxville Campus (Video Recorded)  
 002 CRN 46373 UT Space Institute Campus  
 003 CRN 51908 Distance Education Campus  
 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 9:30 – 10:45 E-111  
 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, matrix determinants, matrix inversion, Cramer's rule, LU matrix decomposition. Vector spaces: spanning sets, vector norms, orthogonality, QR matrix decomposition, linear transformations. Eigenvalues and eigenvectors: characteristic polynomials, modal matrices, singular value decomposition. The Cayley-Hamilton theorem: matrix polynomials, functions of matrices, solutions to systems of differential and difference equations. 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.	001	CRN 45275	UT Knoxville Campus
	002	CRN 45276	Distance Education Campus
	003	CRN 45277	UT Space Institute
TEXT:	TBD		
TIME:	Friday	2:30 – 3:30 EST	UTK
PROF:	Dr. Ming Jing		

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.*

*Repeatability: May be repeated. Maximum 6 hours.*

*Comment(s): Admission to graduate program required.*

## MECHANICAL ENGINEERING

ME	500	Master's Thesis (1-15)	
SEC.	001	CRN 43233	Abedi
	021	CRN 43253	Brooks
	022	CRN 43254	Kreth
	023	CRN 43255	Moeller
	024	CRN 43256	Schmisser
	025	CRN 43257	Solies
	034	CRN 45434	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 45437	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 511 Fundamentals of Heat Conduction (3)  
SEC. 001 CRN 45035  
TEXT: TBD  
TIME: Tuesday & Thursday 10:30 – 11:45 E-110  
PROF: Dr. Shin

Physical and mathematical formulations for Fourier heat conduction problems for lumped systems, transient and steady-state distributed systems. Solutions by separation of variables, generalized integral transforms (Fourier and Laplace) for finite and infinite domains, Green's function method, and perturbation methods for nonlinear systems.

*Recommended Background: Undergraduate heat transfer course.*

ME 517 Finite Elements for Engineering Applications (3)  
SEC. 001 CRN 49602 (Same as AE 517 001 CRN 49623)  
TEXT: All required course materials will be provided. Recommended references:  
Zienkiewicz, Olek C., and Robert L. Taylor. The finite element method for solid and structural mechanics. Elsevier, 2005  
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 12:10 – 1:25 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 524 Fracture Mechanics (3)  
SEC. 001 CRN 48158  
TEXT: T. L. Anderson, Fracture Mechanics: Fundamentals and Applications, 3rd Edition, CRC Press, USA, 2004 (main textbook).  
TIME: Monday & Wednesday 1:50 – 3:05 E-110  
PROF: Dr. Reza Abedi

Mechanisms of fracture and crack growth; stress analysis; crack tip plastic zone; energy principles in fracture mechanics; fatigue-crack initiation and propagation; fracture mechanic design and fatigue life prediction. Analytical, numerical, and experimental methods for determination of stress intensity factors. Current topics in fracture mechanics.

*Registration Permission: Consent of instructor.*

ME 525 Combustion Chemical Reaction Flows I (3)  
SEC. 001 CRN 49581  
TEXT: *An Introduction to Combustion: Concepts and Applications*; 3rd Edition;  
Stephen Turns; ISBN-13: 978-0073380193; ISBN-10: 0073380199  
Available from Amazon.com:  
[https://www.amazon.com/Introduction-Combustion-Concepts-Applications/dp/0073380199/ref=mt\\_hardcover?encoding=UTF8&me](https://www.amazon.com/Introduction-Combustion-Concepts-Applications/dp/0073380199/ref=mt_hardcover?encoding=UTF8&me)  
TIME: Tuesday & Friday 1:30 – 2:45 E-113  
PROF: Dr. Trevor Moeller

Fundamentals: thermochemistry, chemical kinetics and conservation equations; phenomenological approach to laminar flames; diffusion and premixed flame theory; single droplet combustion; deflagration and detonation theory; stabilization of combustion waves in laminar streams; flammability limits of premixed laminar flames; introduction to turbulent flames.

*(DE) Prerequisite(s): 522 and 541 or consent of instructor.*

ME 529 Applications of Linear Algebra in Engineering Systems (3)  
SEC. 001 CRN 43268 (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 9:30 – 10:45 E-111  
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, matrix determinants, matrix inversion, Cramer's rule, LU matrix decomposition. Vector spaces: spanning sets, vector norms, orthogonality, QR matrix decomposition, linear transformations. Eigenvalues and eigenvectors: characteristic polynomials, modal matrices, singular value decomposition. The Cayley-Hamilton theorem: matrix polynomials, functions of matrices, solutions to systems of differential and difference equations. 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 541 Fluid Mechanics I (3)  
SEC. 001 CRN 45038

TEXT: TBD  
TIME: Monday & Wednesday 10:30 – 11:45 E-110  
PROF: Dr. Zhili Zhang

Derivation of equations governing flow of inviscid and viscous fluids (conservation of mass, Newton's second law, conservation of energy). Equations of state and constitutive relations. Euler and Navier-Stokes forms and nondimensionalization. Exact solutions and introduction to potential and boundary-layer flows.

*Cross-listed: (Same as Aerospace Engineering 541.)*

Recommended Background: A fluid mechanics course.

ME 584 Turbomachinery Systems I (3)  
SEC. 001 CRN 45043  
TEXT: *Elements of Propulsion – Gas Turbines and Rockets*; Mattingly and Boyer; AIAA Education Series; Second Edition, 2016; ISBN #: 978-1-62410-371-1  
TIME: Monday & Wednesday 10:10 – 11:25 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.

Gas Turbine Engine propulsion, engine cycle analysis for turbojets and turbofan engines both on-design and off-design. Course analyzes ideal and real engines and uses supplied engine numerical models.

*Comment(s): First-year graduate standing required.*

*Registration Permission: Consent of instructor.*

ME 590 Selected Engineering Problems (2-6)  
SEC. 001 CRN 43270 Abedi  
002 CRN 43271 Brooks  
003 CRN 45049 Kreth  
004 CRN 45438 Moeller  
005 CRN 45439 Schmisser  
006 CRN 45440 Solies  
007 CRN 45441 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 43272  
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 Mechanical Engineering: Data Measurement & Analysis (3)  
SEC. 001 CRN 43274 (Same as AE 599 003 CRN 47357)  
TEXT: *Random Data: Analysis and Measurement Procedures*; Julius S. Bendat and Allan G. Piersol;  
Wiley; 4th Edition; ISBN 978-0-470-24877-5  
TIME: Tuesday & Thursday 10:00 – 11:15 E-113  
PROF: Dr. Phil Kreth

Tools for random data analysis (including types of random data, mean values, mean-square values, probability density and distribution functions, moments and characteristic functions, spectral and correlation analyses); bias and random error estimates in data measurements; input-output system models; measurement examples.

*Repeatability: May be repeated. Maximum 6 hours.*  
*Registration Permission: Consent of instructor.*

ME 599 Special Topics in ME: Micro/Nano Electro Mechanical Systems/Sensors (3)  
SEC. 008 CRN 46512 (Same as AE 599 010 CRN 50817, BME 599 005 CRN 47953)  
TEXT: Liu, C. *Foundations of MEMS*, 2nd Edition, Pearson Education: New Jersey, 2010, ISBN 10: 0132497360, ISBN 13: 9780132497367.  
Reference:  
Marc J. Madou, *Fundamentals of Microfabrication and Nanotechnology*, 3rd Edition, CRC Press, 2011; ISBN 9780849331800.  
G. Kovacs, *Micromachined Transducer Sourcebook*, McGraw-Hill, 1998.  
Nadim Maluf, *An Introduction to Microelectromechanical Systems Engineering*, 2nd Edition, Artech House Publishers; 2004, ISBN 978-1-58053-590-8.  
Sami Franssila; *Introduction to Microfabrication*, Wiley, 2010; ISBN 978-0-470-74983-8.  
TIME: Monday & Wednesday 3:30 – 4:45 E-110  
PROF: Dr. Feng-Yuan Zhang

The lectures will cover fundamentals and elements of micro/nano-scale design, fabrication, integration, and systems, including lithography, deposition, etching, thin film, surface modification, bonding, and characterization. The videos/movies will be presented to introduce the state-of-the-art fabrication process and integration. Their applications to transducers and actuators will be discussed.

*Repeatability: May be repeated. Maximum 6 hours.*  
*Registration Permission: Consent of instructor.*

ME 599 Special Topics: Fundamentals of Gas Dynamics for Propulsion (3)  
SEC. 009 CRN 47261  
TEXT: *Fundamentals of Gas Dynamics*; Robert Zucker; John Wiley and Sons, Inc.; Second Edition; ISBN #: 0-471-05967-6  
TIME: Monday & Wednesday 2:40 – 3:45 E-111  
PROF: Dr. Milt Davis

Fundamentals of gas dynamics including varying area flow, flow through nozzles, standing normal shocks, Oblique shocks, flow with friction, flow with heat addition and an introduction to propulsion

*Repeatability: May be repeated. Maximum 6 hours.*  
*Registration Permission: Consent of instructor.*

ME 599 Special Topics in Mechanical Engineering: Advanced Engineering Mathematics (3)

SEC. 013 CRN 50658 (Same as AE 599 006 CRN 48137, BME 599 001 CRN 42638)  
 TEXT: No specific textbook is required for this class, as many texts on the subject exist. Students are free to choose whichever text best facilitates learning. Recommended texts include:

- *Advanced Engineering Mathematics* by E. Kreyszig
- *Advanced Mathematical Methods for Scientists and Engineers* by Bender and Orzog
- *Mathematical Methods for Physicists* by Arfken and Weber

TIME: Monday & Wednesday 8:50 – 10:05 E-110  
 PROF: Dr. Mark Gragston

This course provides an introduction and review of mathematical concepts relevant for advanced studies in engineering and science for modeling and problem solving. Applications focus on fluid dynamics and heat transfer. Topics covered include ordinary differential equations, perturbation techniques, partial differential equations, complex variable calculus, Fourier analysis, and probability/statistics.  
*Repeatability: May be repeated. Maximum 6 hours.*  
*Registration Permission: Consent of instructor.*

ME 600 Doctoral Research/Dissertation (3-15)  
 SEC. 015 CRN 43291 Abedi  
 016 CRN 43292 Brooks  
 018 CRN 43294 Kreth  
 019 CRN 43295 Moeller  
 026 CRN 43302 Schmisser  
 027 CRN 43303 Solies  
 028 CRN 43304 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 48886  
 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.*

ME 613 Advanced Radiation Heat Transfer (3)  
 SEC. 001 CRN 47061  
 TEXT: *Thermal Radiation Heat Transfer*; Robert Siegel and John R. Howell; Publisher: Taylor and Francis; Edition 3rd or 4th; ISBN #: 1-56032-839-8  
 Supplemental Text: Maher I. Boulos, Pierre Fauchais, and Emil Pfender, *Thermal Plasmas: Fundamentals and Applications*, Vol. 1, Plenum Press, ISBN 0-306-44607-3  
 TIME: Monday & Thursday 1:00 – 2:15 E-113  
 PROF: Dr. Trevor Moeller

Radiation heat transfer in absorbing, emitting and scattering media; interaction of thermal radiation with conduction and convection heat transfer.

*(DE) Prerequisite(s): 511 and 512.*

*Registration Restriction(s): Minimum student level – graduate.*

### PHYSICS

Phys 531 Classical Mechanics (3)

SEC. 002 CRN 41936

TEXT: TBD

TIME: TBD

PROF: Dr. Christian Parigger

Variational formulation, Lagrange's and Hamilton's equations, constraints, canonical transformations, Hamilton-Jacobi theory and action-angle variables.

Phys 599 Seminar (1)

SEC. 009 CRN 47954

TEXT: Classic Texts and Literature

TIME: 2<sup>nd</sup>, 4<sup>th</sup> Thursday /each month 3:00 - 4:30

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 41964 Parigger

*Grading Restriction: P/NP only.*

*Repeatability: May be repeated.*

*Registration Restriction(s): Minimum student level – graduate.*