

**Fall 2018  
Registration  
Announcement**



**The University of Tennessee  
Space Institute  
411 B. H. Goethert Parkway  
Tullahoma, TN 37388-9700  
888-822-8874 Ext. 228  
[www.utsi.edu](http://www.utsi.edu)**

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## CALENDAR - 2018 FALL SEMESTER

Priority Registration.....	March 19, 2018 – August 21, 2018
Admission to Candidacy Forms for Fall 2018 Commencement.....	August 10, 2018
Fall 2018 Graduation Application Deadline (submit online at MyUTK).....	August 10, 2018
Graduation Fee Payment Deadline (MS \$30, PhD \$75).....	August 10, 2018
Payment Due for Priority Registration.....	August 20, 2018
Late Registration and late fees begin ( <b>\$100 Late Fee</b> ).....	August 22, 2018
Classes begin.....	August 22, 2018
Last Day to final register, add, change grading options or drop without a “W”.....	August 31, 2018
Payment Due for Late Registration.....	August 31, 2018
Labor Day.....	September 3, 2018
Registration after 14 <sup>th</sup> day late fee ( <b>\$200 Late Fee</b> ).....	September 5, 2018
Preliminary Thesis/Dissertation Review Deadline ( <a href="mailto:thesis@utk.edu">thesis@utk.edu</a> ).....	October 2, 2018
Fall Break (No Classes).....	October 4 - 5, 2018
Last day to schedule final exam (non-thesis/thesis/dissertation).....	October 25, 2018
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 1, 2018
Drop with a “W”.....	November 13, 2018
Thesis/Dissertation Deadline 5:00 p.m. EST.....	November 15, 2018
Submit report of final examination (Pass/Fail) form.....	November 15, 2018
Thanksgiving Holidays.....	November 22 – 23, 2018
Deadline for Submission of Admission to Candidacy for students	
Graduating Spring 2019 and Graduation Application.....	December 4, 2018
All "INCOMPLETE" must be removed for Graduation.....	December 4, 2018
Classes End.....	December 4, 2018
Total Withdraw from the University Deadline.....	December 4, 2018
Study Day.....	December 5, 2018
Final Exam Period.....	December 6, 7 & 10, 2018
Graduate Hooding Ceremony (UTK).....	December 13, 2018
COMMENCEMENT (UTK).....	December 14, 2018
Official Graduation Date.....	December 15, 2018

### Second thesis/dissertation deadlines

Defense Completed by December 4, 2018

Second Deadline Application Submitted by December 4, 2018

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

Thesis/Dissertation Submitted and Accepted by January 8, 2019 5:00 p.m. EST

(Student will receive diploma spring 2019 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 2019

Priority Registration.....	TBD
Final Registration.....	TBD
Classes Begin.....	January 9, 2019
Martin Luther King Day (Holiday).....	January 21, 2019
Spring Break.....	March 18 – 22, 2019
Spring Recess.....	April 19, 2019
Classes End.....	April 26, 2019

Study Day .....April 29, 2019  
 Exam Period..... April 30, May1, & 2, 2019  
 Graduate Hooding Ceremony (UTK) ..... May 9, 2019  
 University College Commencement Ceremonies ..... May 9 – 11, 2019  
 Official Graduation Date on Transcript ..... May 11, 2019

**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 2018  
 STUDY PERIOD AND FINAL EXAM SCHEDULE**

LAST DAY OF CLASSES.....December 4, 2018

STUDY DAY .....December 5, 2018

**FINAL EXAMS**

REGULAR CLASS TIME	(Same Classroom)	EXAM TIME
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1<sup>st</sup> Day – Thursday, December 6, 2018

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 – Friday, December 7, 2018

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 – Monday, December 10, 2018

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 2018**

**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 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 Fall Semester 2018 must remove all INCOMPLETE GRADES by December 4, 2018. 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 2017-2018 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 – December 5, 2018

Final Exams – December 6, 7, & 10, 2018

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

Please click <http://onestop.utk.edu/tuition-fees/> link to the most current information. You may also contact Jennifer Boyles in the Business and Finance Office at [jboyles@utsi.edu](mailto:jboyles@utsi.edu) 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.

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 2018 Course Listings**

**AEROSPACE ENGINEERING**

AE 500 Master's Thesis (1-15)  
SEC. 001 CRN 42572 Abedi  
009 CRN 42588 Balas  
010 CRN 42592 Brooks  
011 CRN 42594 Moeller  
012 CRN 42597 Schmisser  
013 CRN 42598 Solies  
014 CRN 42599 Vakili  
015 CRN 42602 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 42617 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. 002 CRN 45874  
TEXT: Karamcheti; *Principles of Ideal Fluid Aerodynamics*; R.E. Krieger Publishing Co;  
ISBN 0898741130  
TIME: Tuesday & Thursday 1:10 – 2:25 E-110  
PROF: Dr. Ahmad Vakili

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 44990  
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 50262 (Same as ME 517 001 CRN 50241)  
TEXT: Notes will be provided. Useful books (not required):  
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 10:10 – 11:25 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 I (3)  
SEC. 001 CRN 45678  
TEXT: John D. Anderson; *Modern Compressible Flow: With Historical Perspectives*; 3rd Edition; McGraw Hill; ISBN-13: 063-9785500452 ,ISBN-10: 0072424435. Augmented with additional material from other texts and archival research publications.  
TIME: Monday & Wednesday 8:40 – 9:55 E-110  
PROF: Dr. John Schmisser

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

Revision of the 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 the planned development of an ME599 Gas Dynamics course to provide an appropriate introduction to the material for graduate students, the course content of AE521 can be enhanced to cover a much broader range of material at an accelerated pace.

Topics to be covered in the revised AE521 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

Recommend pre-requisite compressible flow course.

AE 533 Dynamics (3)  
 SEC. 002 CRN 46824  
 TEXT: TBD  
 TIME: Monday & Wednesday 1:10 – 2:25 E-110  
 PROF: Dr. Dustin Crouch

Kinematics and dynamics of particles in three dimensions. Rotating coordinate systems. Hamilton's principle. Lagrange's equations of motion. Kinematics and dynamics of rigid bodies.

*Cross-listed: (Same as Mechanical Engineering 533.)*

*Recommended Background: 391 or Mathematics 431 and an undergraduate vibrations course.*

AE 590 Selected Engineering Problems (2-6)  
 SEC. 002 CRN 42625 Abedi  
 003 CRN 42626 Balas  
 004 CRN 45680 Brooks  
 005 CRN 45681 Moeller  
 006 CRN 45682 Schmisser  
 007 CRN 45683 Solies  
 008 CRN 45684 Vakili  
 009 CRN 45685 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 42629  
 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 UTSL.

*Grading Restriction: Satisfactory/No Credit grading only.*

*Repeatability: May be repeated. Maximum 20 hours.*

AE 599 Special Topics in AE: The Art and Science of Performing Advanced Experiments on Materials and Biomaterials at Large Facilities (3)  
 SEC. 001 CRN 42632 (Same as ME 599 001 CRN 43315, BME 001 CRN 42675)  
 TEXT: ["Introduction to Synchrotron Radiation - Techniques and Applications"](#), Philip Willmott, John Wiley and Sons, 2011

TIME: Tuesday & Thursday 11:25 – 12:40 Zoom  
PROF: Dr. Jacqueline Johnson

1. Interaction of x-rays with matter;
2. The production and physics of synchrotron and X-ray Free Electron Laser radiation;
3. X-ray optics, beamlines, and instrumentation;
4. X-ray diffraction and scattering;
5. UV and x-ray spectroscopies;
6. X-ray imaging (mainly tomography and lensless imaging/ptychography);
7. Phasing techniques in macromolecular crystallography;
8. General user proposal system.

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

AE 599 Special Topics in Aerospace Engineering: Atmospheric Sciences for AE/ME (3)  
SEC. 002 CRN 42633 (Same as ME 599 010 CRN 47776)  
TEXT: *Atmospheric Science*; Wallace and Hobbs; Academic Press; 2<sup>nd</sup> 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.

AE 599 Special Topics in Aerospace Engineering: Experimental Flight Mechanics: Fixed Wing Stability and Control (3)  
SEC. 006 CRN 48627  
TEXT: *Flight Testing of Fixed Wing Aircraft*; Ralph D. Kimberlin; AIAA; First Edition; 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 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 several flight simulator labs.

*(DE) Prerequisite(s): AVSY516 and AVSY521 or AE 599 Aircraft Flight Controls.*

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

AE 599 Special Topics in AE: Micro/Nano Electro Mechanical Systems/Sensors (3)  
SEC. 010 CRN 51696 (Same as ME 599 008 CRN 46865, BME 599 005 CRN 48426)  
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: Tuesday & Thursday 2:40 – 3:55 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 energy systems, power/propulsion devices, biomedical applications, transducers and actuators will be discussed.

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

AE	600	Doctoral Research/Dissertation (3-15)
SEC.	004	CRN 42643 Abedi
	005	CRN 42645 Balas
	006	CRN 42647 Brooks
	007	CRN 42649 Moeller
	008	CRN 42651 Schmisser
	014	CRN 42657 Solies
	015	CRN 42658 Vakili
	017	CRN 45881 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 48908
TEXT:	TBD	
TIME:	TBD	
PROF:	Dr. Kivanc Ekici	

Methods of planning and conducting original research and proposal writing.

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

*Registration Permission: Departmental approval.*

## **BIOMEDICAL ENGINEERING**

BME	500	Master's Thesis (1-15)
SEC.	012	CRN 46628 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.	002	CRN 46716 (Video Recorded)	
TEXT:	<i>Advanced Linear Algebra for Engineers with MATLAB</i> ; 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 590 Selected Biomedical Engineering Problems (2-6)  
SEC. 001 CRN 46880  
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 46320  
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: The Art and Science of Performing Advanced Experiments on Materials and Biomaterials at Large Facilities (3)  
SEC. 001 CRN 42675 (Same as AE 599 001 CRN 42632, ME 599 001 CRN 43315)  
TEXT: ["Introduction to Synchrotron Radiation - Techniques and Applications"](#), Philip Willmott, John Wiley and Sons, 2011  
TIME: Tuesday & Thursday 11:25 – 12:40 Zoom  
PROF: Dr. Jacqueline Johnson

1. Interaction of x-rays with matter;
2. The production and physics of synchrotron and X-ray Free Electron Laser radiation;
3. X-ray optics, beamlines, and instrumentation;
4. X-ray diffraction and scattering;
5. UV and x-ray spectroscopies;
6. X -ray imaging (mainly tomography and lensless imaging/ptychography);
7. Phasing techniques in macromolecular crystallography;
8. General user proposal system.

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

BME 599 Special Topics in BME: Micro/Nano Electro Mechanical Systems/Sensors (3)

SEC. 005 CRN 48426 (Same as AE 599 010 CRN 51696, ME 599 008 CRN 46865)

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: Tuesday & Thursday 2:40 – 3:55 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 energy systems, power/propulsion devices, biomedical applications, transducers and actuators will be discussed.

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

BME 600 Doctoral Research/Dissertation (3-15)

SEC. 011 CRN 46321 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 48909

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.

*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 47626 Simonton  
002 CRN 49342 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 42988 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 42989 Simonton  
002 CRN 49347 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 45042 Pre-recorded

TEXT: *Improving Performance: How to Manage the White Space on the Organization Chart*, 3<sup>rd</sup> Edition; Geary A. Rummler and Alan P. Brache.

*The Principles of Scientific Management*, Taylor, F. W. (1998, 1911). Mineola, NY: Dover Publications, Inc.

*The New Economics for Industry, Government, Education*, 2<sup>nd</sup> Edition, Deming, W. E. (1994). Cambridge, MA: The MIT Press.

TIME: TBD

PROF: Dr. Janice Tolk

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 45046 UTSI students participating at Tullahoma  
002 CRN 45047 UTSI students participating elsewhere

003 CRN 45048 UTK students participating elsewhere  
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 539 Strategic Management in Technical Organizations (3)  
SEC. 001 CRN 45050 UTSI students participating at Tullahoma  
002 CRN 45051 UTSI students participating elsewhere  
003 CRN 45052 UTK students participating elsewhere  
TEXT: *Strategic Management: Concepts & Cases*; Frank Rothaermel; 3rd<sup>t</sup> Edition; McGraw-Hill;  
ISBN - 13: 978-1259420474, ISBN-10: 1259420477  
TIME: Tuesday 1:00 – 3:30 E-113  
PROF: Dr. Sandra Affare

Strategic planning process and strategic management in practice; corporate vision and mission; product, market, organizational, and financial strategies; external factors; commercialization of new technologies; and competition and beyond.

*Recommended Background: Graduate standing in Engineering or Business.*

EM 543 Legal and Ethical Aspects of Engineering Management (3)  
SEC. 001 CRN 51240 UTSI students participating at Tullahoma  
002 CRN 51247 UTSI students participating elsewhere  
003 CRN 51248 UTK students participating elsewhere  
TEXT: *Engineering Ethics: Concepts and Cases*, Jr. Charles E. Harris and Michael S. Pritchard,  
Wadsworth Publishing, 6th ed, ISBN-10: 1337554502 ISBN-13: 9781337554503  
TIME: Thursday 1:00 – 3:30 E-113  
PROF: Dr. Sandra Affare

Legal aspects imposed by government and ethical considerations in engineering practice. Selected readings, lecture, discussion, and student presentations. Current topics from government and industry.

EM 600 Doctoral Research/Dissertation (3-15)  
SEC. 001 CRN 45056 Simonton  
002 CRN 45058 Yu

*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 52347 UTSI students participating at Tullahoma  
002 CRN 52348 UTSI students participating elsewhere  
003 CRN 52349 UTK students participating elsewhere  
TEXT: Instructor will provide electronic files through Canvas

TIME: Tuesday  
PROF: Dr. Andrew Yu

10:00 – 12:30

E-113

This course 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 529 Applications of Linear Algebra in Engineering Systems (3)  
SEC. 002 CRN 46718 (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; Materials Science and Engineering 529; Mechanical Engineering 529; Nuclear Engineering 529).*

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

## MECHANICAL ENGINEERING

ME 500 Master's Thesis (1-15)  
SEC. 001 CRN 43274 Abedi  
021 CRN 43294 Balas  
022 CRN 43295 Brooks  
023 CRN 43296 Moeller  
024 CRN 43297 Schmisser  
025 CRN 43298 Solies  
034 CRN 45700 Vakili  
035 CRN 45701 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 45703 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 45263 (Live connection – not recorded)

TEXT: It is out of print, but Amazon has used copies.

D. Poulikakos; Conduction Heat Transfer; Prentice Hall 1994, Ed. 1 (or latest edition)

ISBN-13:9780131758452; Publisher: Prentice Hall Professional Technical Reference

Publication date: 10/28/1993

TIME: Tuesday & Thursday 10:10 – 11:25 E-110

PROF: Dr. Jay Frankel

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 50241 (Same as AE 517 001 CRN 50262)

TEXT: Notes will be provided. Useful books (not required):

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 10:10 – 11:25 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 48650

TEXT: T. L. Anderson, *Fracture Mechanics: Fundamentals and Applications*, 3rd Edition, CRC Press, USA, 2004 (main textbook).

TIME: Monday & Wednesday 11:40 – 12:55 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 of Chemically Reacting Flow I (3)

SEC. 001 CRN 50217

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: Monday & Wednesday 1:00 – 2:15 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. 002 CRN 46720 (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 533 Dynamics (3)  
 SEC. 002 CRN 46825  
 TEXT: TBD  
 TIME: Monday & Wednesday 1:10 – 2:25 E-110  
 PROF: Dr. Dustin Crouch

Kinematics and dynamics of particles in three dimensions. Rotating coordinate systems. Hamilton's principle. Lagrange's equations of motion. Kinematics and dynamics of rigid bodies.  
*Cross-listed: (Same as Mechanical Engineering 533.)*  
*Recommended Background: 391 or Mathematics 431 and an undergraduate vibrations course.*

ME 560 Introduction to Nanomanufacturing (3)  
 SEC. 002 CRN 52497  
 TEXT: TBD  
 TIME: Tuesday & Thursday 8:40 – 9:55 E-110  
 PROF: Dr. Anming Hu

Fundamentals of nanotechnology and nano fabrication, experimental methods of nano science and technology, advanced manufacturing overview, additive manufacturing (3D printing), electromechanical device fabrications, printable sensors and energy devices, biomedical printing. Recommended Background: Engineering Mechanics (ME202), Introduction to Materials Science and Engineering (MSE201), Introduction to Chemical Research (CHEM 200).

ME 584 Turbomachinery Systems I (3)  
 SEC. 001 CRN 45272  
 TEXT: Mattingly and Boyer; *Elements of Propulsion: Gas Turbines and Rockets*; 2<sup>nd</sup> Edition; 2016; ISBN 978-1-62410-371-1  
 TIME: Monday & Wednesday 2:40 – 3:55 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. 001 CRN 43311 Abedi  
 002 CRN 43312 Balas  
 003 CRN 45278 Brooks  
 004 CRN 45704 Moeller  
 005 CRN 45705 Schmisser  
 006 CRN 45706 Solies  
 007 CRN 45707 Vakili  
 008 CRN 45708 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 43313  
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: The Art and Science of Performing Advanced Experiments on Materials and Biomaterials at Large Facilities (3)  
SEC. 001 CRN 43315 (Same as AE 599 001 CRN 42632, BME 001 CRN 42675)  
TEXT: ["Introduction to Synchrotron Radiation - Techniques and Applications"](#), Philip Willmott, John Wiley and Sons, 2011  
TIME: Tuesday & Thursday 11:25 – 12:40 Zoom  
PROF: Dr. Jacqueline Johnson

1. Interaction of x-rays with matter;
2. The production and physics of synchrotron and X-ray Free Electron Laser radiation;
3. X-ray optics, beamlines, and instrumentation;
4. X-ray diffraction and scattering;
5. UV and x-ray spectroscopies;
6. X-ray imaging (mainly tomography and lensless imaging/ptychography);
7. Phasing techniques in macromolecular crystallography;
8. General user proposal system.

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

ME 599 Special Topics in ME: Micro/Nano Electro Mechanical Systems/Sensors (3)  
SEC. 008 CRN 46865 (Same as AE 599 010 CRN 51696, BME 599 005 CRN 48426)  
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: Tuesday & Thursday 2:40 – 3:55 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 energy systems, power/propulsion devices, biomedical applications, transducers and actuators will be discussed.

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

ME 599 Special Topics: Fundamentals of Gas Dynamics as Applied to Propulsion Systems (3)  
 SEC. 009 CRN 47676  
 TEXT: *Fundamentals of Gas Dynamics*; Robert Zucker; John Wiley and Sons, Inc.; Second Edition;  
 ISBN #: 0-471-05967-6  
 TIME: Monday & Wednesday 10:00 – 11:15 E-113  
 PROF: Dr. Milt Davis

In this course, the student will be introduced to the fundamentals of gas dynamics. Specific topics in the course will cover varying area flow, normal and oblique shocks, expansions, duct friction and heat transfer. A wide variety of practical engineering problems can be solved with these concepts and many of these problems will be highlighted in the course. Examples of these types of problems are: off-design operation of supersonic nozzles, supersonic windtunnels, blast waves, supersonic inlets, some methods of flow measurements and choking from friction or thermal effects. The course will culminate in the study of propulsion systems since many gas dynamics issues are inherent in these types of applications.

#### Topics Covered

1. Isentropic flow
2. Varying area flow
3. Nozzles
4. Normal shocks
5. Oblique shocks
6. Prandtl-Meyer expansion
7. Fanno flow
8. Rayleigh flow
9. Introduction to gas turbine engines

Available only to students who have not had compressible flow course.

ME 599 Special Topics in Aerospace Engineering: Atmospheric Sciences for AE/ME (3)  
 SEC. 010 CRN 47776 (Same as AE 599 002 CRN 42633)  
 TEXT: *Atmospheric Science*; Wallace and Hobbs; Academic Press; 2<sup>nd</sup> 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.

ME 600 Doctoral Research/Dissertation (3-15)  
 SEC. 015 CRN 43332 Abedi  
 016 CRN 43333 Balas  
 018 CRN 43335 Brooks  
 019 CRN 43336 Moeller  
 026 CRN 43343 Schmisser  
 027 CRN 43344 Solies  
 028 CRN 43345 Vakili  
 029 CRN 47405 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 49439  
TEXT: TBD  
TIME: TBD  
PROF: Dr. Kivanc Ekici

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

## PHYSICS

Phys 500 Master's Thesis (1-15)  
SEC. 002 CRN 41866 Davis  
003 CRN 41945 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 41955  
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

Lectures and discussion on current research topics. Continuous registration required for current graduate students.

*Grading Restriction: Satisfactory/No Credit grading only.*  
*Repeatability: May be repeated. Maximum 6 hours.*

Phys 541 Electromagnetic Theory (3)  
SEC. 001 CRN 52485  
TEXT: I will use 4 references: the first one is the major course book (1) W. Greiner “Classical Electrodynamics”, Springer Verlag, New York, NY, USA, ISBN 0-387-94799-X (2) B. Thidé “Electromagnetic Field Theory”, Upsilon books, Uppsala, SWE (online book); (3) J.D. Jackson “Classical Electrodynamics”, Wiley, NH, USA, 3<sup>rd</sup> Ed. ISBN 047130932X (4) Class notes.  
TIME: TBD  
PROF: Dr. Christian Parigger

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

Phys 599 Seminars (1)

SEC. 009 CRN 48427  
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 41992 Davis  
003 CRN 41993 Parigger

*Grading Restriction: P/NP only.*

*Repeatability: May be repeated.*

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

Phys 605 Laser Spectroscopy (3)  
SEC. 001 CRN 47408  
TEXT: Laser Spectroscopy 1 (Basic Principles) and Laser Spectroscopy 2 (Experimental Techniques) 5<sup>th</sup> edition 2014 and 2015, respectively, Wolfgang Demtröder, Springer E-book, International Edition, augmented by on-line references, other classic books on the subject, and lecture and lab notes.  
TIME: TBD Zoom  
PROF: Dr. Christian Parigger

Applications of lasers to spectroscopy of atomic and molecular systems; absorption, laser-induced fluorescence, and Raman spectroscopy; molecular and atomic coherence, quantum beats, resonance fluorescence, photon echoes, self-induced transparency; saturation and Doppler-free spectroscopy; laser cooling and trapping.

*(DE) Prerequisite(s): 521 and 541.*

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

Phys 606 Nonlinear Optics (3)  
SEC. 001 CRN 51361  
TEXT: <http://www.amazon.com/Nonlinear-Optics-Third-Edition-Robert/dp/0123694701>  
TIME: Tuesday & Thursday 10:10 – 11:25 Zoom  
PROF: Dr. Lloyd Davis

Nonlinear optical susceptibilities, wave propagation in nonlinear media, sum-frequency and difference frequency generation, harmonic generation, parametric amplification and oscillation, stimulated Raman processes, two- and multi-photon processes, four-wave mixing and phase conjugation, transient coherent optical effects and free induction decay, optical breakdown and nonlinear effects in plasmas.

*(DE) Prerequisite(s): 522.*

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