Spring 2016
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
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CALENDAR - 2016 SPRING SEMESTER

Priority Registration........................................................................................................ October 12, 2015
Admission to Candidacy Forms for Spring 2016 Commencement ............................. November 2, 2015
Spring 2016 Graduation Application Deadline (submit online)............................... November 2, 2015
Graduation Fee Payment Deadline (MS $30, PhD $75) ................................................ November 2, 2015
Payment Due for Priority Registration........................................................................ January 11, 2016
Late Registration and late fees begin ($100 Late Fee)................................................. January 13, 2016
Classes begin................................................................................................................... January 13, 2016
Martin Luther King Holiday......................................................................................... January 18, 2016
Last Day to final register, add, change grading options or drop without a “W”........ January 22, 2016
Late Registration and late fees after 14th day ($200) .................................................. January 27, 2016
Register to attend the Graduate Hooding Ceremony (http://gradschool.utk.edu) ... TBD
Purchase cap and gown and order hood (865-974-3459)............................................ TBD
Spring Break (No Classes)......................................................................................... March 14 - 18, 2016
Spring Recess (No Classes)........................................................................................ March 25, 2016
Last day to schedule final exam (non-thesis/thesis/dissertation).............................. March 31, 2016
Drop with a “W”............................................................................................................ April 5, 2016
Last day to take final exam (non-thesis/thesis/dissertation)..................................... April 7, 2016
All "INCOMPLETE" must be removed for Graduation.............................................. April 15, 2016
Thesis/Dissertation Deadline 5:00 p.m. EST ......................................................... April 21, 2016
Submit report of final examination (Pass/Fail) form ............................................. April 21, 2016
Deadline for Submission of Admission to Candidacy for students
  Graduating Summer 2015 and Graduation Application........................................ TBD
Classes End................................................................................................................... April 29, 2016
Total Withdraw from the University Deadline....................................................... April 29, 2016
Study Period............................................................................................................... May 2, 2016
Exam Period.............................................................................................................. May 3, 4, & 5, 2016
Graduate Hooding Ceremony (UTK)........................................................................ May 12, 2016
COMMENCEMENT (UTK)..................................................................................... May 11 - 14, 2016
Official Graduation Date............................................................................................... May 14, 2016

Second thesis/dissertation deadlines
  Defense Completed by April 29, 2016
  Second Deadline Application Submitted by April 29, 2016
    http://gradschool.utk.edu/forms/Second%20Deadline%20Graduation%20Application.pdf
    (Student will receive diploma summer 2016 semester, but will not be required to register for
    thesis/dissertation credits)

SUMMER SEMESTER 2016

Priority Registration...................................................................................... TBD
Final Registration.......................................................................................... TBD
Memorial Day Holiday................................................................................... May 30, 2016
Classes begin..................................................................................................... June 2, 2016
July 4th Holiday.............................................................................................. July 4, 2016
Classes End..................................................................................................... August 9, 2016
Summer Graduation Date on Transcript (No Ceremony)............................... August 12, 2016

Dates may be revised without notice. Please refer to the following sites for updates:
http://gradschool.utk.edu/ddategraduation.shtml
http://registrar.tennessee.edu/academic_calendar/index.shtml
SPRING SEMESTER 2016
FINAL STUDY DAY AND EXAM SCHEDULE

LAST DAY OF CLASSES................................................................. April 29, 2016
STUDY PERIOD ................................................................. May 2, 2016

**FINAL EXAMS**

<table>
<thead>
<tr>
<th>REGULAR CLASS TIME</th>
<th>(Same Classroom)</th>
<th>EXAM TIME</th>
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<tbody>
<tr>
<td><strong>1st Day – Tuesday, May 3, 2016</strong></td>
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</tr>
<tr>
<td>7:45 - 9:00</td>
<td>M/Th</td>
<td>7:45 - 9:45</td>
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<tr>
<td>10:45 - 12:00</td>
<td>M/Th</td>
<td>10:15 - 12:15</td>
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<tr>
<td>9:15 - 10:30</td>
<td>M/Th</td>
<td>1:00 - 3:00</td>
</tr>
<tr>
<td>2:30 - 3:45</td>
<td>M/Th</td>
<td>3:30 - 5:30</td>
</tr>
</tbody>
</table>

| **2nd Day – Wednesday May 4, 2016** |                  |           |
| 9:15 - 10:30       | Tu/Fri           | 7:45 - 9:45 |
| 10:45 - 12:00      | Tu/Fri           | 10:15 - 12:15 |
| 1:00 - 2:15        | Tu/Fri           | 1:00 - 3:00  |
| 2:30 - 3:45        | Tu/Fri           | 3:30 - 5:30  |

| **3rd Day – Thursday May 5, 2016** |                  |           |
| 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  
SPRING SEMESTER 2016

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 A-206, phone 931-393-7228, email chane@utsi.edu.

TOLL-FREE NUMBERS

For a specific office: 1-888-822-UTSI (8874) and the extension number.
For general information: 1-888-822-UTSI (8874)
Admissions Office: 1-888-822-UTSI (8874)-37213
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 for Admission 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 should be completed online at https://www.applyweb.com/utg and must be accompanied by a $60.00 non-refundable application fee, 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

3
scores and 3 letters of recommendation when applying. International applicants will also need to include TOEFL scores. Please select UT Space Institute if your plans are to attend the Tullahoma campus location. Only online applications will be accepted by Graduate Admissions Knoxville, TN.

Graduate Research Assistantship applications can be sent to the Director of Admissions, University of Tennessee Space Institute, MS-1, Tullahoma, TN 37388-9700. All applications should be accompanied by undergraduate and graduate transcripts and GRE test scores are required for all departments. All International applicants will need to provide TOEFL test scores in addition to GRE’s. All official transcripts and test scores should be sent to College Code 1843, Graduate Admissions Office, 201 Student Services Building, Knoxville, TN 37996-0221. A full admission will not be granted by Graduate Admissions until all official test scores and degree confirmation are received. Please contact Dee Merriman, Director of Admissions, at (931) 393-7213 or 888-822-8874 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 A-206, (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 semesters or 6 hours in the Summer term are considered full-time students. Research Assistants must be full-time students and also enroll in one of the MABE 595 seminars or a PHYS 599 seminar each term, 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 2015 must remove all **INCOMPLETE GRADES** by **April 15, 2016**. 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 2014-2015 academic year is provided by United HealthCare Student Resources. The premium must be paid before registration. Contact the Human Resources Office (room C-106 ext. 37267) 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 PERIOD – May 2, 2016**
**FINAL EXAMS – May 3, 4, & 5, 2016**

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

Please click [FEES](#) link to the most current information. You may also contact Jennifer Boyles in the Business and Finance Office at jboyles@utk.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 starting Spring 2015. All students will need to login to MyUTK One Stop to make secure payments online.

Please see [One Stop - Paying Tuition and Fees](http://onestop.utk.edu/pay/) webpage for more details.
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 in Student Services, D-100 or online at http://dos.utk.edu/hilltopics/.

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

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

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

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

Violation of this policy is grounds for disciplinary action--up to and including immediate discharge for an employee and permanent dismissal of a student. Federal and state laws provide additional penalties for such unlawful activities, including fines and imprisonment (21 U.S.C. 841 et seq.; T.C.A. 39-6-401 et seq.). Local ordinances also provide various penalties for drug- and alcohol-related offenses. The university is bound to take all appropriate actions against violators, which may include referral for legal prosecution or requiring the individual to participate satisfactorily in an approved drug use or alcohol abuse assistance or rehabilitation program.
The University reserves the right to revise any information listed in this timetable of classes.

The University of Tennessee Space Institute
Spring 2016 Course Listings

AEROSPACE ENGINEERING

<table>
<thead>
<tr>
<th>AE</th>
<th>500</th>
<th>Master’s Thesis (1-15)</th>
</tr>
</thead>
<tbody>
<tr>
<td>SEC.</td>
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</tr>
<tr>
<td>009</td>
<td>CRN</td>
<td>24405 Abedi</td>
</tr>
<tr>
<td>011</td>
<td>CRN</td>
<td>24406 Anusonti-Inthra</td>
</tr>
<tr>
<td>012</td>
<td>CRN</td>
<td>24407 Majdalani</td>
</tr>
<tr>
<td>013</td>
<td>CRN</td>
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</tr>
<tr>
<td>014</td>
<td>CRN</td>
<td>24409 Schmisseur</td>
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<tr>
<td>015</td>
<td>CRN</td>
<td>24410 Solies</td>
</tr>
<tr>
<td>016</td>
<td>CRN</td>
<td>24411 Vakili</td>
</tr>
<tr>
<td>021</td>
<td>CRN</td>
<td>24416 Zhang</td>
</tr>
</tbody>
</table>

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

<table>
<thead>
<tr>
<th>AE</th>
<th>502</th>
<th>Registration for Use of Facilities (1-15)</th>
</tr>
</thead>
<tbody>
<tr>
<td>SEC.</td>
<td></td>
<td></td>
</tr>
<tr>
<td>002</td>
<td>CRN</td>
<td>24418 Moeller</td>
</tr>
</tbody>
</table>

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

<table>
<thead>
<tr>
<th>AE</th>
<th>512</th>
<th>Viscous Flow (3)</th>
</tr>
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<tbody>
<tr>
<td>SEC.</td>
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<tr>
<td>001</td>
<td>CRN</td>
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<tr>
<td>TEXT:</td>
<td>TBD</td>
<td></td>
</tr>
<tr>
<td>TIME:</td>
<td>TBD</td>
<td>10:10 – 11:25</td>
</tr>
<tr>
<td>PROF:</td>
<td></td>
<td>Dr. Steve Brooks</td>
</tr>
</tbody>
</table>

Derivation of fundamental equations of compressible viscous flow; boundary conditions for viscous heat-conducting flow; exact solutions for Newtonian viscous flow (Navier-Stokes) equations for special cases; similarity solutions. Thermal boundary layers, stability of laminar flows, transition to turbulence, 2-D turbulent boundary layer equations. Incompressible-turbulent mean flow, and compressible boundary layer flow.
Registration Permission: Consent of instructor.
Experimental techniques with laboratory experiments; representative experiments: hot wire anemometry and turbulence measurements, flow visualization, wind tunnel tests, water table experiments, supersonic flow experiments, boundary layer measurements, laser-optical measurements. 

(DE) Prerequisite(s): 541.

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.

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

Bachelor’s degree in engineering or natural science required. 
Registration Permission: Consent of instructor.
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  24426
TEXT: None
TIME: Will be announced through email
PROF: Dr. Ahmad Vakili

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

AE  599  Special Topics in AE: Space Environment Effects (3)
SEC.  001 CRN  24428  (Same as ME 599 002 CRN 27677)
       Various other sources provided by instructor
TIME: Tuesday and Friday 1:00 – 2:15  E-113
PROF: Dr. Trevor Moeller

This is an introductory course on the effects of the space environment on space systems. The primary focus will be on the space environment in which satellites and spacecraft are in earth orbit. This environment contains many hazards, including: photons, particle radiation, meteoroids, high-energy atoms, molecules, and ions, extreme temperature ranges, and orbital debris. This course will be split into two parts: 1) the space environment and 2) the interactions of the space environment with spacecraft.
Consent of instructor must be obtained to register.
Repeatability: May be repeated. Maximum 6 hours.

AE  599  Special Topics in AE: Computer Methods in Dynamics of Continua (3)
SEC.  003 CRN  27676  (Same as ME 599 013 CRN 28918)
TEXT: Thomas J.R. Hughes; The Finite Element Method: Linear Static and Dynamic Finite Element Analysis; Dover Civil and Mechanical Engineering, 2000
TIME: Monday & Wednesday 11:40 – 12:55  E-110
PROF: Dr. Reza Abedi
This course is intended to serve as a sequel to an introductory finite element or computational mechanics courses. It is designed to deepen student’s understanding of the characteristics of elliptic, parabolic, and hyperbolic partial differential equations (PDE) and get familiar with solution techniques for dynamic problems.

Prerequisite: ME 517

AE 599 Special Topics in AE: Aircraft Flight Controls (Same as AVSY 516 001 CRN 24502) (3)
SEC. 005 CRN 25927
TIME: Tuesday & Friday 1:00 – 2:15 E-111
PROF: Dr. Peter Solies

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

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

AE 599 Special Topics in AE: Computational Fluid Dynamics II (3) CANCELLED
SEC. 008 CRN 26861 (Same as ME 599 006 CRN 26637)
TEXT: No required text
TIME: Monday & Wednesday 11:40 – 12:55 E-110
PROF: Dr. Greg Power

This course incorporates fundamental application of CFD, grid generation and post-processing codes that are widely accepted and used in industry and government labs as a hands-on introduction to computational fluid dynamics. The course will build on the knowledge and experience gained during the 1st semester (Part-I) to develop skills for simulating more complex problems using advanced physical/turbulence models. The student will be expected to complete at least one complex CFD project and prepare a detailed report and presentation of the project efforts and results. Potential topics that will be covered include: Grid generation on (for) complex geometries; Development of custom routines/subroutines; Verification and Validation of CFD results; Advanced thermodynamic models; Chemical kinetics; Time dependent flows; Advanced turbulence modeling; Advanced post-processing techniques; Parallel processing; Other topics as may be helpful by the instructor. A personal computer with at least a 64-bit processor and 4 – 8 GB of RAM is required for this course.

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

AE 599 Aircraft Design (Same as AVSY 506 001 CRN 24499) (3)
SEC. 013 CRN 30275 (Not Video Recorded)
TIME: TBD
PROF: Dr. Peter Solies

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

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

Fundamental theories, flight test techniques, and data collection and analyses for fixed wing aircraft performance. Topics: air data system calibration, takeoff and landing performance, turn performance, cruise performance, energy concepts, and aerodynamic modeling. Weekly classroom academics with approximately 4-6 flight labs.

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

Repeatability: May be repeated. Maximum 6 hours.
solid rocket exhaust flow. Introduction to nuclear and electric propulsion; electrical resistance and electric field (ion) engine performance, magnetohydrodynamic thrusters, traveling wave thrusters; exotic propulsion systems.

(RE) Prerequisite(s): 581.

Registration Restriction(s): Minimum student level – graduate.
Registration Permission: Consent of Instructor.

**AVIATION SYSTEMS**

AVSY 500 Master’s Thesis (1-15)
SEC. 001 CRN 24491 Brooks
003 CRN 24492 Solies

*Grading Restriction: P/NP only.*
*Repeatability: May be repeated.*
*Credit Level Restriction: Graduate credit only.*

AVSY 502 Registration for Use of Facilities (1-15)
SEC. 001 CRN 24495 Brooks
003 CRN 24496 Solies

Required for the student not otherwise registered during any semester when student uses university facilities and/or faculty time before degree is completed.

*Grading Restriction: Satisfactory/No Credit grading only.*
*Repeatability: May be repeated.*
*Credit Restriction: May not be used toward degree requirements.*

AVSY 506 Aircraft Design (Same as AE 599 013 CRN 30275) (3)
SEC. 001 CRN 24499 (Not Video Recorded)

TIME: TBD
PROF: Dr. Peter Solies

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

AVSY 515 Human Factors in Aviation (3)
SEC. 001 CRN 31408
TEXT: TBD
TIME: TBD
PROF: Dr. Steven Brooks

Human factors pertinent to aviation: concept of human factors, human error, fatigue, body rhythms, performances, motivation, vision and visual illusions, communication, attitudes, training and devices, displays and controls, space and layout, anthropometry, flight deck design
and evaluation, aircraft cabin design and evaluation, flying qualities evaluation, and performance measurement techniques. Applied aviation systems.

AVSY 516 Aircraft Flight Controls (Same as AE 599 005 CRN 25927) (3)
SEC. 001 CRN 24502
TIME: Tuesday & Friday 1:00 – 2:15 E-111
PROF: Dr. Peter Solies

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

AVSY 521 Experimental Flight Mechanics: Fixed Wing Performance (3)
SEC. 001 CRN 24503 (Same as AE 599 014 CRN 30277)
TIME: Tuesday & Friday 10:30 – 11:45 Airport Classroom
PROF: Dr. Peter Solies

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

AVSY 550 Project in Aviation Systems (3)
SEC. 001 CRN 24504 Brooks
SEC. 003 CRN 24505 Solies

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

**BIOMEDICAL ENGINEERING**

BME 500 Master’s Thesis (1-15)
SEC. 012 CRN 26719 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 24532 (Video Recorded)
Fundamental concepts of linear algebra to problems in engineering systems: steady state and dynamic systems. Geometric and physical interpretations of relevant concepts: least square problems, LU, QR, and SVD decompositions of system matrix, eigenvalue problems, and similarity transformations in solving difference and differential equations; numerical stability aspects of various algorithms; application of linear algebra concepts in control and optimization studies; introduction to linear programming. Computer projects.


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

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

BME 578 Advanced Biomaterials: Biological Applications of Nanomaterials (3)
SEC. 002 CRN 30299 (Same as MSE 578 002 CRN 30300)
TEXT: Nanomaterials; Dieter Vollath; Wiley; Second; ISBN: 978-3-527-33379-0
TIME: Monday & Wednesday 1:10 – 2:25 E-110
PROF: Dr. Jackie Johnson

Focuses on the biological/medical uses of nanoscale materials. Includes the following topics: 0-d, 1-d, and 2-d nanomaterials synthesis and characterization with an emphasis on surface properties. Chemical and biological functionalization of nanomaterials and nano-bio interfaces. Biological and biomedical application of nanomaterials. The state-of-the-art research papers will be reviewed and discussed.

Cross-listed: (Same as Material Science Engineering 578.)
Recommended Background: 474.
Comment(s): Prior knowledge may satisfy prerequisites, with consent of instructor.

BME 587 Dynamic Modeling and Simulation (3)
SEC. 002 CRN 28920 (Same as ME 587 002 CRN 28919)
TEXT: TBD
TIME: Tuesday & Thursday 2:40 – 3:55 E-110
PROF: Dr. Gary V. Smith


Cross-listed: (Same as Mechanical Engineering 587.)
Recommended Background: 363.
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 26888
TEXT: None
TIME: Will be announced through email
PROF: Dr. Jacqueline Johnson

All phases of biomedical engineering, reports on current research at UTK and UTSI.
Grading Restriction: Satisfactory/No Credit grading only.
Repeatability: May be repeated. Maximum 20 hours.
Credit Level Restriction: Graduate credit only.
Registration Restriction(s): Minimum student level – graduate

BME 600 Doctoral Research/Dissertation (3-15)
SEC. 011 CRN 26720 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 30113
TEXT: TBD
TIME: TBD
PROF: Dr. Eric Boder

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

ELECTRICAL ENGINEERING AND COMPUTER SCIENCE

ECE 529 Applications of Linear Algebra in Engineering Systems (3)
SEC. 001 CRN 30085 (Video Recorded)
TIME: Tuesday & Friday 9:30 – 10:40 E-113
PROF: Dr. Monty Smith

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

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

ECE  600 Doctoral Research/Dissertation (3-15)
SEC.  031 CRN 29960 Bomar

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

ENGINEERING MANAGEMENT

EM  500 Master’s Thesis (1-15)
SEC.  001 CRN 28484 Simonton
003 CRN 29962 Yu

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

EM  501 Capstone Project (3-6)
SEC.  001 CRN 22221 Simonton
003 CRN 29963 Yu

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

EM  502 Registration for Use of Facilities (1-15)
SEC.  001 CRN 22222 Simonton
002 CRN 31001 Yu

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

EM 533 Theory and Practice of Engineering Management (3)
SEC. 001 CRN 22223 Students participating at Tullahoma classrooms
SEC. 002 CRN 22224 Students participating by distance ed.
SEC. 003 CRN 22225 Students participating at Knoxville DE classrooms

TEXT: TBD
TIME: Wednesday 4:00 – 6:35 E-113
PROF: Dr. David Dietrich

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

EM 534 Financial Management for Engineering Managers (3)
SEC. 001 CRN 22227 Students participating at Tullahoma classrooms
SEC. 002 CRN 22228 Students participating by distance ed.
SEC. 003 CRN 22229 Students participating at Knoxville DE classrooms

TIME: Tuesday 4:00 – 6:35 E-113
PROF: Dr. Andrew Yu

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

EM 538 New Venture Formation (3)
SEC. 001 CRN 28493 Students participating at Tullahoma classrooms
SEC. 002 CRN 28494 Students participating by distance ed.
SEC. 003 CRN 28495 Students participating at Knoxville DE classrooms

TIME: Thursday 4:00 – 6:35 E-113
PROF: Dr. James Simonton

Factors other than mechanical or chemical which enter into successful establishment of manufacturing or service enterprise. Organizational and financial planning and evaluation. Cost and location studies and market analysis to determine commercial feasibility of new ventures.
Recommended Background: Graduate standing in Engineering or Business.

EM 541 Managing Change and Improvement in Technical Organizations (3)
SEC. 001 CRN 22231 (Pre-recorded)

TIME: TBD
PROF: Dr. Janice Tolk


Recommended Background: Graduate standing in Engineering or Business.

EM 600 Doctoral Research/Dissertation (3-15)
SEC. 001 CRN 25777 Simonton
004 CRN 30285 Yu

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

INDUSTRIAL ENGINEERING

IE 529 Applications of Linear Algebra in Engineering Systems (3)
SEC. 001 CRN 21916 (Video Recorded)
TIME: Tuesday & Friday 9:30 – 10:45 E-113
PROF: Dr. Monty Smith

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


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.

MATERIAL SCIENCE ENGINEERING

MSE 529 Applications of Linear Algebra in Engineering Systems (3)
SEC. 001 CRN 21744 (Video Recorded)
TIME: Tuesday & Friday 9:30 – 10:45 E-113
Fundamental concepts of linear algebra to problems in engineering systems: steady state and dynamic systems. Geometric and physical interpretations of relevant concepts: least square problems, LU, QR, and SVD decompositions of system matrix, eigenvalue problems, and similarity transformations in solving difference and differential equations; numerical stability aspects of various algorithms; application of linear algebra concepts in control and optimization studies; introduction to linear programming. Computer projects.


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

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

Focuses on the biological/medical uses of nanoscale materials. Includes the following topics: 0-d, 1-d, and 2-d nanomaterials synthesis and characterization with an emphasis on surface properties. Chemical and biological functionalization of nanomaterials and nano-bio interfaces. Biological and biomedical application of nanomaterials. The state-of-the-art research papers will be reviewed and discussed.

Cross-listed: (Same as Biomedical Engineering 578.)

Recommended Background: 474.

Comment(s): Prior knowledge may satisfy prerequisites, with consent of instructor.

Separation of variables, Fourier series, solution of Laplace, wave, and heat equations.

(Re) Prerequisite(s): 231; 241 or 247.

MECHANICAL ENGINEERING

ME 500 Master’s Thesis (1-15)
SEC. 001 CRN 21786 Abedi
021 CRN 21806 Anusonti-Inthra
022 CRN 21807 Majdalani
ME  502  Registration for Use of Facilities (1-15)
SEC.  002  CRN 25837  Moeller
Required for the student not otherwise registered during any semester when student uses university facilities and/or faculty time before degree is completed.

Grading Restriction: Satisfactory/No Credit grading only.
Repeatability: May be repeated.
Credit Restriction: May not be used toward degree requirements.
Credit Level Restriction: Graduate credit only.
Registration Restriction(s): Minimum student level – graduate.

ME  512  Heat Transfer II (3)
SEC.  001  CRN 21822
TEXT: Adrian Bejan; *Convection Heat Transfer*; 4th Edition; John Wiley
TIME: Monday & Wednesday     4:10 – 5:25       E-110
PROF: Dr. Feng Yuan Zhang

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

ME  517  Finite Elements for Engineering Applications (3)
SEC.  001  CRN 28483  (Same as AE 517 001 CRN 28514)
ISBN: 9780979004902
TIME: Tuesday & Thursday     1:10 – 2:25       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  522  Thermodynamics II (3)
Macroscopic thermodynamics, including First and Second Law analyses, availability, phase and chemical equilibrium criteria, combustion, gas mixtures, and property relations, determination of thermodynamic properties from molecular structure, spectroscopic data, kinetic theory, statistical mechanics, quantum physics, Schrödinger equation.

**Recommended Background:** Undergraduate thermodynamics.

### ME 529 Applications of Linear Algebra in Engineering Systems (3)

**SEC:** 001  **CRN:** 21826  **(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-113**

**PROF:** Dr. Monty Smith

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


**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 585 Turbomachinery Systems II (3)

**SEC:** 001  **CRN:** 21831  **(Video Recorded)**

**TEXT:** Jack D. Mattingly; *Elements of Propulsion: Gas Turbines and Rockets*; 2006; ISBN 1-56347-779-3

**TIME:** Tuesday & Thursday  4:00 – 5:15  **E-111**

**PROF:** Dr. Milt Davis

Ideal cycle analysis of turbine engines, real cycle analysis, component performance analysis, component design and systems integration (inlets, nozzles, combustors, compressors, turbines), flowthrough theory, turbine engine component matching, transient operation, surge and rotating stall, engine control systems, structural considerations.

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

**Registration Permission:** Consent of instructor.

### ME 587 Dynamic Modeling and Simulation (3)

**SEC:** 002  **CRN:** 28919  **(Same as BME 587 002 CRN 28920)**

**TEXT:** Jack D. Mattingly; *Elements of Propulsion: Gas Turbines and Rockets*; 2006; ISBN 1-56347-779-3

**TIME:** Tuesday & Thursday  4:00 – 5:15  **E-111**

**PROF:** Dr. Milt Davis

Ideal cycle analysis of turbine engines, real cycle analysis, component performance analysis, component design and systems integration (inlets, nozzles, combustors, compressors, turbines), flowthrough theory, turbine engine component matching, transient operation, surge and rotating stall, engine control systems, structural considerations.

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

**Registration Permission:** Consent of instructor.

Cross-listed: (Same as Biomedical Engineering 587.)

Recommended Background: 363.

ME 590 Selected Engineering Problems (2-6)
SEC. 002 CRN 21832 Abedi
003 CRN 26338 Anusonti-Inthra
005 CRN 26339 Majdalani
006 CRN 26340 Moeller
007 CRN 26341 Schmisseur
008 CRN 26342 Solies
009 CRN 26343 Vakili
010 CRN 26344 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 21833

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: Space Environment Effects (3)
SEC. 002 CRN 27677 (Same as AE 599 001 CRN 24428)
Various other sources provided by instructor
TIME: Tuesday and Friday 1:00 – 2:15 E-113
PROF: Dr. Trevor Moeller

This is an introductory course on the effects of the space environment on space systems. The primary focus will be on the space environment in which satellites and spacecraft are in earth orbit. This environment contains many hazards, including: photons, particle radiation,
meteoroids, high-energy atoms, molecules, and ions, extreme temperature ranges, and orbital debris. This course will be split into two parts: 1) the space environment and 2) the interactions of the space environment with spacecraft. Consent of instructor must be obtained to register. Repeatability: May be repeated. Maximum 6 hours.

ME 599 Special Topics in ME: Computational Fluid Dynamics II (3) CANCELLED
SEC. 006 CRN 26637 (Same as AE 599 008 CRN 26861)
TEXT: No required text
TIME: Monday & Wednesday 11:40 – 12:55 E-110
PROF: Dr. Greg Powers

This course incorporates fundamental application of CFD, grid generation and post-processing codes that are widely accepted and used in industry and government labs as a hands-on introduction to computational fluid dynamics. The course will build on the knowledge and experience gained during the 1st semester (Part-I) to develop skills for simulating more complex problems using advanced physical/turbulence models. The student will be expected to complete at least one complex CFD project and prepare a detailed report and presentation of the project efforts and results. Potential topics that will be covered include: Grid generation on (for) complex geometries; Development of custom routines/subroutines; Verification and Validation of CFD results; Advanced thermodynamic models; Chemical kinetics; Time dependent flows; Advanced turbulence modeling; Advanced post-processing techniques; Parallel processing; Other topics as may be helpful by the instructor. A personal computer with at least a 64-bit processor and 4 – 8 GB of RAM is required for this course. Repeatability: May be repeated. Maximum 6 hours.

ME 599 Special Topics in AE: Computer Methods in Dynamics of Continua (3)
SEC. 013 CRN 28918 (Same as AE 599 003 CRN 27676)
TIME: Monday & Wednesday 11:40 – 12:55 E-110
PROF: Dr. Reza Abedi

This course is intended to serve as a sequel to an introductory finite element or computational mechanics courses. It is designed to deepen student’s understanding of the characteristics of elliptic, parabolic, and hyperbolic partial differential equations (PDE) and get familiar with solution techniques for dynamic problems. Prerequisite: ME 517

ME 600 Doctoral Research/Dissertation (3-15)
SEC. 015 CRN 21851 Abedi
016 CRN 21852 Anusonti-Inthra
018 CRN 21854 Majdalani
019 CRN 21855 Moeller
027 CRN 21863 Schmisseur
028 CRN 21864 Solies
029 CRN 26346 Vakili
030 CRN 26347 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  30114  
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  23890  Davis  
003  CRN  23891  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  23898  
TEXT:  None  
TIME:  2nd & 4th Thursday 3:30 – 5:00 H-111  
PROF:  Dr. Lloyd Davis

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

**Phys  506  Experimental Methods (3)**  
SEC.  001  CRN  30736  
TEXT:  None  
TIME:  TBD  
PROF:  Dr. Lloyd Davis

Introduction to experimental methods of spectroscopy through hands on operation of FTIR, Raman, NMR, photoelectron, laser and mass spectrometers. Principles and hazards of cw and pulsed lasers, radiation detectors, photomultiplier tubes, image intensifiers, image converters; high-vacuum systems including cryogenic-based devices, data acquisition techniques including lock-in amplifiers, box-car integrators, digital electronics methods and micro-computer data acquisition.

**Phys  599  Modern Physics Seminars (3)**  
SEC.  007  CRN  23916
(a) Mechanics; (b) Radiation; (c) Heat and Thermodynamics; (d) Electricity and Magnetism; (e) Modern Physics.

Repeatability: *May be repeated with consent of department. Maximum 18 hours.*

**Phys 599 Seminars (1)**
- **SEC. 010 CRN 30103**
- **TEXT:** None
- **TIME:** 2nd & 4th Thursday 3:30 – 5:00 H-111
- **PROF:** Dr. Christian Parigger

(a) Mechanics; (b) Radiation; (c) Heat and Thermodynamics; (d) Electricity and Magnetism; (e) Modern Physics.

Repeatability: *May be repeated with consent of department. Maximum 18 hours.*

**Phys 600 Doctoral Research/Dissertation (3-15)**
- **SEC. 002 CRN 23919 Davis**
- **SEC. 003 CRN 23920 Parigger**

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

**Phys 602 Atomic Physics (3)**
- **SEC. 001 CRN 30735**
- **TEXT:** *Theoretical Atomic Physics* (primary course book reference for spring 2015) and a variety of selected sections from other books (such as F. Schwabl Advanced Quantum mechanics) and current research literature; H.S. Friedrich; Springer Verlag; Corr. 2nd printing edition (March 1, 2004); ISBN 10:3540641246; ISBN 13:978-3540641247
- **TIME:** Monday & Thursday 1:00 – 2:15 E-111
- **PROF:** Dr. Christian Parigger

Advanced problems.
Comment(s): *For students specializing in the field.*
Registration Restriction(s): Minimum student level – graduate.