

Summer 2012

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

See Inside for Online Registration Instructions

<http://myutk.edu>

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CALENDAR - 2012 SUMMER SEMESTER

Priority Registration.....	February 29, 2012
Admission to Candidacy Forms for Summer 2012 Commencement.....	April 27, 2012
Summer 2012 Graduation Application Deadline	April 27, 2012
Late Registration and late fees begin	May 31 – June 8, 2012
Classes begin.....	May 31, 2012
Last Day to Late Register, Add, Change Grading Options or Drop Without a “W”	June 8, 2012
Graduation Fee Payment Deadline (MS \$30, PhD \$75).....	June 8, 2012
Preliminary Thesis/Dissertation Review Deadline	June 22, 2012
Independence Day Holiday.....	July 4, 2012
Last day to schedule final exam (thesis).....	July 6, 2012
Last day to schedule final exam (non-thesis/capstone students).....	July 6, 2012
Last day to schedule final exam (dissertation).....	July 13, 2012
Drop with a “W”	July 20, 2012
Last day to take final exam (thesis/dissertation students).....	July 20, 2012
Last day to take final exam (non-thesis/capstone students).....	July 20, 2012
Electronic Thesis/Dissertation due in Knoxville (5:00 P.M. EST).....	August 3, 2012
Submit report of final examination (Pass/Fail) form	August 3, 2012
Deadline for Submission of Admission to Candidacy for students Graduating Fall 2012 and Graduation Application.....	August 7, 2012
Deadline for removing "INCOMPLETE" grades	August 7, 2012
Classes End.....	August 7, 2012
Total Withdraw from the University Deadline	August 7, 2012
Exam Period (Exams are given during the regularly scheduled class meeting times.)	
Second thesis/dissertation deadline (Student will receive diploma December 2012 but will not have to register for Fall 2012) (Defense Completed by August 7 th)	August 17, 2012
No Commencement Ceremony or Graduate Hooding – Graduation Date.....	August 15, 2012

FALL SEMESTER 2012

Priority Registration.....	March 12, 2012
Late Registration	August 22 – 31, 2012
Classes Begin.....	August 22, 2012
Labor Day Holiday	September 3, 2012
Fall Break.....	October 11 -12, 2012
Thanksgiving Break.....	November 22 – 23, 2012
Classes End.....	December 4, 2012
Study Period.....	December 5, 2012
Exam Period.....	December 6, 7, & 8, 2012
Graduate Hooding Ceremony (UTK)	December 14, 2012
Commencement (UTK)	December 15, 2012

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

SUMMER SEMESTER 2012

FINAL STUDY DAY AND EXAM SCHEDULE

LAST DAY OF CLASSES.....August 7, 2012

FINAL EXAMS FOR SUMMER ARE GIVEN DURING THE REGULARLY SCHEDULED CLASS MEETING TIMES LISTED BELOW:

Monday, Thursday and Tuesday, Friday

7:45 – 9:45
10:00 – 12:00
1:00 – 3:00
3:15 – 5:15

****** ATTENTION ******

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

REGISTRATION ANNOUNCEMENT SUMMER SEMESTER 2012

REGISTRATION PROCEDURE

ADVISING

Graduate students should contact their departmental faculty to arrange an advising appointment. For students not accepted into specific programs, the Assistant to the Dean of Graduate Studies or his/her designee may act as advisor. The web registration system will ask if you have discussed your program with your advisor. Answer 'yes' if you have; otherwise, you cannot continue with the registration process. Graduate School Web Page: <http://gradschool.utk.edu/> .

REGISTRATION

Students will register at <http://myutk.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://registrar.utk.edu/registration.shtml> .

*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 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.

FINANCIAL CALENDAR FOR SUMMER TERM 2012

Statement information available on MyUTK.UTK	May 1, 2012
Priority Registration Payment/Confirmation Deadline	May 29, 2012 at 4:30 p.m. (EST)
Late Registration/Late Fees Begin	May 31, 2012
Late Registration Payment/Confirmation Deadline	June 8, 2012 at 4:30 p.m. (EST)

NOTE: PAYMENT AND THE CONFIRMATION OF ATTENDANCE FORM MUST BE RECEIVED BY THESE DEADLINES WHETHER OR NOT YOU HAVE RECEIVED A VolxPress e-STATEMENT. You may view your account at MyUTK.

*****FINAL/LATE REGISTRATION PERIOD currently unavailable, but will be listed at the link below once published**

<http://web.utk.edu/~bursar/volxfees.html#final>

CREDIT CARD PAYMENTS

**** NOTE:** If you pay your fees using MyUTK with a credit/debit card (Discover, VISA, Mastercard) you will be assessed a 2.5% service fee. To avoid this service fee you will need to make payment to the UTSI Budget and Finance Office.

SPECIAL BILLING – THIRD PARTY BILLING:

The Budget and Finance Office will generate a billing after the student has provided a letter of authorization from the third party sponsor. Authorization must include the sponsor's name and address as well as the maximum amount which will be paid for each specific term. The authorization can be mailed to UTSI Budget and Finance Office, MS#12, 411 B.H. Goethert Parkway, Tullahoma, TN 37388-9700 or email it to jboyles@utsi.edu. Since students are responsible for all University fees and charges, use of the third-party address as the student's billing address is strongly discouraged.

STUDENTS ARE ULTIMATELY RESPONSIBLE FOR ALL CHARGES. THEY MUST COMPLETE A CONFIRMATION OF ATTENDANCE FORM AND MAKE CERTAIN MINIMUM PAYMENT AMOUNTS CREDITED OR AUTHORIZED ON OR BEFORE THE PAYMENT DUE DATE IN ORDER TO AVOID LATE PAYMENT FEE ASSESSMENT AND SCHEDULE CANCELLATION.

If you have any questions concerning third-party billing please call Jennifer Boyles at 931-393-7297 or 888-822-8874 ext 37297 or by email jboyles@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 must be accompanied by a \$60.00 non-refundable application fee, payable to The University of Tennessee Space Institute. Applicants are required to provide one official transcript of all undergraduate and graduate records. Students may apply on-line at <http://admissions.utk.edu/graduate/apply.shtml> [click on APPLY ONLINE and Follow Directions]. Send Applications for Admission, transcripts, GRE scores (if required); and if international application, TOEFL scores to the Admissions Office, A-200, Mail Stop 1, UTSI, Tullahoma, TN 37388-9700.

PAYMENT OF FEES

Late fees will begin on May 31, 2012. The only credit/debit cards The University of Tennessee Space Institute accepts are Visa, MasterCard and Discover.

NEW FOR FALL 2011

In February 2011, a new fee structure for students who are enrolled in dual campus locations was approved beginning Fall 2011. The University of Tennessee, Knoxville allows students to enroll in multiple campuses which include the following: Knoxville, UTSI, Distance Education, Nashville School of Social Work and off-campus locations. Students enrolling in dual campus locations will be assessed all fees for each campus they are enrolled. For example, students enrolled in classes on the Knoxville campus and also taking Distance Education courses will be assessed the per hour rate of all the fees for the Knoxville campus (Maintenance, Out-of-State Tuition, Programs and Service, Health, Technology, Facilities, Transportation, and any course fees that may be associated with a particular class) and the per hour rate of all the fees for the Distance Education courses (Maintenance, Out-of-State Tuition, the Distance Education Course Fee, and any course fees that may be associated with a particular course). The Out-of-State Tuition will be charged only to students who are classified as out-of-state per the appropriate Admissions Office.

FEES OF DISTANCE STUDENTS

Distance students should contact their departmental coordinator to determine the amount of the access fee.

Aviation Systems	Peter Solies	931-393-7289	psolies@utsi.edu
Engineering Mgt.	Charlotte Henley	931-393-7293	chenley@utsi.edu

TUITION AND/OR MAINTENANCE FEES

Full Fees For In-State Students (per semester)

Maintenance Fee	\$4,166.00*
Programs and Services Fee	75.00
Total	\$4,241.00

Full Fees For Out-Of-State Students (per semester)

Maintenance Fee	\$4,166.00*
Programs and Services Fee	75.00
Tuition	\$8,421.00*
Total	\$12,662.00

Starting Fall 2011 an additional \$50.00 per credit hour with no cap will be charged to ALL ENGINEERING COURSES (including courses that are cross-referenced).

***All fees are subject to changes approved by the Board of Trustees prior to the beginning of the term.**

TUITION FOR PART-TIME STUDENTS

Part time students may elect to pay fees computed by the semester hour credit as follows:

IN-STATE	\$464.00 per semester hour
3 hours	\$1,392.00
OUT-OF-STATE	\$1,400.00 per semester hour
3 hours	\$4,200.00

ENGINEERING FEE

On July 1, 2007, the Computer Science Department merged with the Engineering Department. Beginning Fall 2008, a special per credit hour fee will be assessed on engineering and computer science courses offered through the College of Engineering and the College of Agricultural Sciences and Natural Resources. The additional funds will be used to acquire state-of-the-art equipment, expand first-year programs for Engineering students, and provide faculty with professional development opportunities to bring the latest knowledge into the classroom. The Colleges will retain the funds generated from this fee for their use.

PROGRAMS AND SERVICES FEE

All students enrolled in eight semester hours or more for Summer Semester are assessed an activity fee of \$75.00 per semester. Part-time students taking fewer than nine hours will be assessed at the rate of \$10.00 per semester hour. The Programs and Services Fee is non-refundable. Research assistants and fellowship/scholarship students who may have a waiver of fees (tuition), must pay appropriate University Programs and Services Fee.

Part-time students enrolled for recorded classes at off campus centers and students residing out of state are not required to pay the Programs and Services Fee.

RETURNED CHECK POLICY

All checks are deposited the day they are received. A \$30.00 service charge will be assessed when checks fail to clear the bank on which drawn. In addition, if the returned check is in payment of initial fees and charges, the late payment fee in effect at the time the check is redeemed will be added to the returned check service fee. Returned checks will not be re-deposited. Cash or a cashier's check is required for payment of a returned check, late fee, and service charges. Failure to clear returned checks will result in the forfeiture of all University services including the receipt of grades, transcripts, and schedules of classes.

DEFERRED PAYMENT PLAN

Although fees, rent and other University expenses are due and payable at the beginning of each term, a full-time student in good financial standing with a definite anticipated source of funds may request the deferment of up to 50% of the total charges at registration. The remaining balance for the term is due approximately 45 days after the first due date. All financial aid monies must be applied to fees before a deferment will be considered. A deferred payment service fee of \$20.00 is assessed when any portion of tuition, fees, and other charges are deferred with the approval of the Business Office. An additional \$35.00 late payment charge will be assessed if the second installment is not paid on or before the due date. For more details, contact the Business Office.

LATE PAYMENT FEES

A **Late Payment Fee** of \$35.00 will be added to each *VOLXpress* account if the minimum payment amount which is printed on the statement is not received by the Bursar's Office on or before the published due date. This does not include beginning of term registration statements which will result in cancellation of schedules if the minimum payment is not met. Late payment fees are exclusive of all other charges and are due when assessed whether or not the student receives a *VOLXpress* statement. Accounts are subject to a late fee of \$45.00 if there is an account balance at mid-semester. The fee is assessed in addition to the unpaid fees and charges and the account balance must be paid in order to access registration services, receive a transcript, grades, or a diploma.

TUITION/FEE POLICY FOR DROPPED COURSES OR WITHDRAWAL

THE PERCENTAGE TUITION REFUNDS SPECIFIED ON THE FOLLOWING PAGE ARE APPLICABLE WHEN A STUDENT DROPS ONE OR MORE COURSES (INCLUDING TOTAL WITHDRAWAL). Students who drop courses and continue with a reduced course load are eligible for a refund only if the total charges at the semester hour rate for the courses continued plus the percentage assessed at the semester hour rate for the courses dropped results in an amount less than that paid. The Programs and Service Fee is non-refundable.

A COURSE IS NOT OFFICIALLY DROPPED UNTIL A CHANGE OF REGISTRATION FORM HAS BEEN PROCESSED BY THE REGISTRAR'S OFFICE. CANCELED COURSES OR FAILURE TO ATTEND CLASS DOES NOT AUTOMATICALLY WITHDRAW OR DROP A STUDENT FROM THE UNIVERSITY OR CLASS --- A CHANGE OF REGISTRATION FORM MUST BE COMPLETED.

The following percentage assessments are applicable for courses dropped (if fees are assessed at the semester hour rate):

*****currently unavailable, but will be listed at <http://web.utk.edu/~bursar/regchang.html> for Summer 2012 once published**

TUITION/FEE REFUND POLICY FOR WITHDRAWALS

Withdrawal from school for the term after registration has been processed, even though classes have not been attended or fees paid, must be by official notification to the Registrar's office. The effective date of withdrawal is the date the Registrar's office is notified by completion of the Change of Registration request form. FAILURE TO ATTEND CLASS DOES NOT AUTOMATICALLY CANCEL ENROLLMENT. The appropriate percentage of fees will be charged unless the Registrar's Office is notified by the close of the last day designated for registration and before the first official day of classes for the semester or term. WITHDRAWAL DOES NOT CANCEL FEES AND CHARGES ALREADY INCURRED. THE DROP/ADD PROCEDURE CAN NOT BE USED TO WITHDRAW FROM SCHOOL FOR THE SEMESTER OR TERM. When a course is canceled by UTSI administration, the students who have registered for the course will be notified by either the instructor and/or Charlene Hane, Student Services. Any questions concerning registration, please contact Charlene Hane, UTSI, Office D-100, 931-393-7228.

The University of Tennessee Space Institute, in accordance with federal regulations, follows the policy and procedures below for calculating refunds and repayments for financial aid.

REFUNDS

Refunds are defined as the portion of maintenance and/or tuition and University housing charges due as rebate when a student withdraws or is expelled from the University. The amount of a refund is determined by the Drop Date Charge fee table.

REPAYMENTS

Repayments are defined as that portion of aid, received by a student after the University direct charges have been paid by that aid, which must be repaid by a student when a student withdraws or is expelled. The amount of the repayment is determined by the Drop Date Charge fee table.

Refunds and repayments to the Title IV programs are determined according to the formula published in the current Federal Student Financial Aid Handbook. The Business and Admissions Offices are responsible for determining the amount of the refund and/or repayment and distributing the correct amount back to the financial aid programs according to the Refund/Repayment Allocation Policy.

WITHDRAWAL (TOTAL) 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 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 Summer Semester 2012 must remove all INCOMPLETE GRADES by **August 7, 2012**. 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 REGISTRATION OF DOCTORAL STUDENTS

All doctoral students must be registered for doctoral dissertation research course 600 (minimum of 3 hrs.) on a continuous basis starting when the doctoral research proposal is approved, admission to candidacy is accepted, or registration for course 600 is begun, whichever comes first, including ALL Summer terms and the semester in which the dissertation is approved and accepted by The Graduate School. A leave of absence may be requested for extenuating circumstances. The procedure can be found in the UTK Graduate catalog.

FINAL EXAMINATION 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 2011-2012 academic year is provided by Aetna. The premium must be paid before registration. Contact the Human Resources Office (A-104 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 FOR SUMMER SEMESTER 2012

Final exams are given during the regularly scheduled class meeting times.

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/files/HT2011revised.pdf>.

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 1998 (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
Summer 2012 Course Listings**

AEROSPACE ENGINEERING

*AE 422 Aerodynamics (3) **CANCELLED**
SEC. 001 CRN 82458 (Video Recorded)
TEXT: Flandro, G.A., McMahon, H.M., Roach, L.R.; *Basic Aerodynamics – Incompressible Flow*;
Cambridge University Press, New York, NY, 2012; ISBN 978-0-521-80582-7
TIME: Tuesday & Friday 1:00 – 3:30 E-111
PROFESSOR: Dr. Peter Solies

Theory and design of aerodynamic bodies for desired characteristics. Potential flow theory, viscous effects, and compressibility effects. Subsonic, transonic, and supersonic airfoils.
(RE) Prerequisite(s): 351 and 370.

AE 500 Master's Thesis (1-15)
SEC. 002 CRN 82461 Antar
003 CRN 82462 Corda
004 CRN 82463 Flandro
005 CRN 82464 Majdalani
009 CRN 82468 Moulden
010 CRN 82469 Moeller
011 CRN 82470 Schulz
013 CRN 82472 Solies
014 CRN 82473 Steinhoff
015 CRN 82474 Vakili

AE 502 Registration for Use of Facilities (1-15)
SEC. 003 CRN 82477 Moeller

AE 532 Introduction to Turbulence (3)
SEC. 001 CRN 82479
TEXT: *Tennekes Lumley; A First Course in Turbulence*; Latest Edition; MIT Press
ISBN 0-262-200198
TIME: Tuesday & Thursday 9:30 – 11:30 E-210
PROFESSOR: Dr. Gary Flandro

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

AE 590 Selected Engineering Problems (2-6)
 SEC. 001 CRN 82480 Antar
 002 CRN 82481 Corda
 003 CRN 82482 Flandro
 004 CRN 82858 Majdalani
 005 CRN 82859 Moeller
 006 CRN 82860 Schulz
 007 CRN 82861 Solies
 008 CRN 82862 Steinhoff
 009 CRN 82863 Vakili

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

AE 599 Special Topics in AE: Selected Problems in Aerodynamics (3)
 SEC. 003 CRN 84024 (Video Recorded)
 TEXT: Flandro, G.A., McMahon, H.M., Roach, L.R.; *Basic Aerodynamics – Incompressible Flow*;
 Cambridge University Press, New York, NY, 2012;
 ISBN 978-0-521-80582-7
 TIME: Tuesday & Friday 1:00 – 3:30 E-111
 PROF: Dr. Peter Solies

The course starts with a review of basic aerodynamic principles and then focuses on problem solving in applied aerodynamics. Topics include: Standard Atmosphere, Aerostatics, Aircraft Pitot-Static System, Determination of Center of Pressure and Aerodynamic Center, Conservation Principles, Momentum Rake, Propeller Thrust, Potential Flow, Special Airfoils, High Lift Devices, Powered Lift, Lift-Induced Drag, Viscous Drag, Optimization of Wing Planforms, Stall Characteristics, Lift and Drag of Wings in Formation, Air Vehicle Aerodynamics.

AE 600 Doctoral Research/Dissertation (3-15)
 SEC. 002 CRN 82484 Antar
 003 CRN 82485 Corda
 004 CRN 82486 Flandro
 005 CRN 82487 Majdalani
 011 CRN 82493 Moeller
 012 CRN 82494 Steinhoff
 013 CRN 83505 Vakili

AE 690 Advanced Topics in AE: Advanced Radiation Heat Transfer (3) (Same as ME 613)
 SEC. 001 CRN 82495 (Video Recorded)
 TEXT: *Thermal Radiation Heat Transfer*; Siegel and Howell; CRC Press; Edition 3rd, 4th, or 5th
 TIME: Monday & Thursday 1:00 – 3:30 E-111
 PROFESSOR: Dr. Trevor Moeller

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

Repeatability: May be repeated. Maximum 9 hours.

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

Registration Permission: Consent of instructor.

AVIATION SYSTEMS

AS 500 Master's Thesis (1-15)
SEC. 001 CRN 82119 Corda
002 CRN 82120 Martos
003 CRN 82121 Muratore
004 CRN 82122 Pujol
005 CRN 82123 Solies

AS 502 Registration for Use of Facilities (1-15)
SEC. 001 CRN 82142 Corda
002 CRN 82143 Martos
003 CRN 82144 Muratore
004 CRN 82145 Pujol
005 CRN 82146 Solies

AS 550 Project in Aviation Systems (3)
SEC. 001 CRN 82150 Corda
002 CRN 82151 Martos
003 CRN 82152 Muratore
004 CRN 82153 Pujol
005 CRN 82155 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 529 Applications of Linear Algebra in Engineering Systems (3)
SEC. 001 CRN 82513 (Video Recorded)
TEXT: Sohail A. Dianat and Eli S. Saber; *Advanced Linear Algebra for Engineers with MATLAB*;
Latest Edition; CRC Press; ISBN 978-1-4200-9523-4
TIME: Monday, Wednesday & Friday 9:00 – 10:15 E-113
PROFESSOR: Dr. L. Montgomery Smith

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

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

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

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

CHEMICAL AND BIOMOLECULAR ENGINEERING

CBE 529 Applications of Linear Algebra in Engineering Systems (3)

SEC. 001 CRN 82539 (Video Recorded)

TEXT: Sohail A. Dianat and Eli S. Saber; *Advanced Linear Algebra for Engineers with MATLAB*; Latest Edition; CRC Press; ISBN 978-1-4200-9523-4

TIME: Monday, Wednesday & Friday 9:00 – 10:15 E-113

PROFESSOR: Dr. L. Montgomery Smith

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

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

Cross-listed: (Same as Biomedical Engineering 529; Electrical and Computer Engineering 529; Industrial Engineering 529; Materials Science and Engineering 529; Mechanical Engineering 529.)

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

COMPUTER SCIENCE

CS 571 Numerical Mathematics I (3)

SEC: 001 CRN 83747 (Video Recorded)

TEXT: (1) *Numerical Mathematics*; A. Quarteroni, R. Sacco, F. Saleri; Springer; 2nd Edition; ISBN-10:3540346589 ISBN-13:978-3540346586 (2) *A First Course in Computational Physics*;

P.L. DeVries, J.E. Hasbun; and selected lecture notes including Matlab introductory notes;
Jones and Bartlett; 2nd Edition; ISBN 978-0-7637-7314-4

TIME: Monday & Wednesday 10:00 – 12:00 E-111
PROFESSOR: Dr. Christian Parigger

Direct and iterative methods for linear systems. The algebraic eigenvalue problem and the singular decomposition theorem. Newton and quasi-Newton methods for systems of nonlinear equations.

Cross-listed: (Same as Math 571.)

Recommended Background: Courses in advanced calculus and basic numerical analysis.

Students wishing to count this course toward IGMCS should enroll under Math 571, since IGMCS will count it as a Math course only.

Comments: This course is part I of a trilogy, part 2 is NumMathII, part 3 is PDE methods

(A) Summer 2013: MATH572 Numerical Mathematics II: *Numerical techniques for initial value problems of ordinary differential equations. Two-point boundary value problems. Finite difference and finite element methods for selected partial differential equations. Fast Poisson solvers. Cross-listed: (Same as CS572.) (DE) Prerequisite(s): 571.*

(B) Summer 2014: MATH578 Numerical Methods for Partial Differential Equations: *Numerical approximation of solutions of partial differential equations including conservation laws and hyperbolic, parabolic, and elliptic problems. Derivation, physical meaning, and implementation of schemes.*

ELECTRICAL ENGINEERING AND COMPUTER SCIENCE

ECE 500 Master's Thesis (1-15)
SEC. 028 CRN 82678 Smith

ECE 529 Application of Linear Algebra in Engineering Systems (3)
SEC. 001 CRN 82765 (Video Recorded)

TEXT: Sohail A. Dianat and Eli S. Saber; *Advanced Linear Algebra for Engineers with MATLAB*;
Latest Edition; CRC Press; ISBN 978-1-4200-9523-4

TIME: Monday, Wednesday & Friday 9:00 – 10:15 E-113
PROFESSOR: Dr. L. Montgomery Smith

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

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

Cross-listed: (Same as Biomedical Engineering 529; Chemical and Biomolecular Engineering 529; Industrial Engineering 529; Materials Science and Engineering 529; Mechanical Engineering 529.)

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

ECE 600 Doctoral Research/Dissertation (3-15)
SEC. 028 CRN 82798 Bomar

ENGINEERING MANAGEMENT

EM 501 Capstone Project (3-6)
SEC. 001 CRN 80004
PROFESSOR: Dr. Gregory Sedrick

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 80006 Sedrick

EM 536 Project Management (3)
SEC. 001 CRN 80008 UTSI students participating at Tullahoma or Oak Ridge
002 CRN 80009 UTSI students participating elsewhere
003 CRN 80010 UTK students participating at Knoxville DE classrooms
004 CRN 80011 UTK students participating elsewhere

TEXT: *Cost Analysis and Estimating for Engineering and Management*; Phillip F. Ostwald & Timothy S. McLaren; Pearson Prentice Hall; 1st Edition; ISBN 0-13-142127-1

TIME: Monday & Wednesday 4:00 – 6:35 E113

PROFESSOR: Dr. James Simonton

Development and management of engineering and technology projects. Project proposal preparation; resource and cost estimating; and project planning, organizing, and controlling; network diagrams and other techniques. Role of project manager: team building, conflict resolution, and contract negotiations. Discussion of typical problems and alternative solutions. Case studies and student projects.

(RE) Prerequisite(s): 537 or consent of instructor.

EM 538 New Venture Formation (3)
SEC. 001 CRN 82976 UTSI students participating at Tullahoma or Oak Ridge
002 CRN 83114 UTSI students participating elsewhere
003 CRN 83115 UTK students participating at Knoxville DE classrooms
004 CRN 83116 UTK students participating elsewhere

TEXT: TBA

TIME: Tuesday & Thursday 4:00 – 6:35 E-113

PROFESSOR: Dr. Gregory Sedrick

Factors other than mechanical or chemical which enter into successful establishment of manufacturing or service enterprise. Organizational and financial planning and evaluation. Cost and location studies and

market analysis to determine commercial feasibility of new ventures.

(RE) Prerequisite(s): 539.

EM 542 Design of Experiments for Engineering Managers (3)
SEC. 001 CRN 80012 UTSI students participating at Tullahoma or Oak Ridge
002 CRN 80013 UTSI students participating elsewhere
003 CRN 80014 UTK students participating at Knoxville DE classrooms
004 CRN 80015 UTK students participating elsewhere

TEXT: *Principles of Experimental Design and Analysis*; Alberto Garcia-Diaz & Don T. Phillips; Chapman & Hall; 1995. This book is out of print but instructor will provide copies of the textbook through Blackboard.

TIME: Videotaped only

PROFESSOR: Dr. Alberto Garcia

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

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

EM 600 Doctoral Research/Dissertation (3-15)
SEC. 002 CRN 83305 Simonton

ENGINEERING SCIENCE

ES 500 Master's Thesis (1-15)
SEC. 001 CRN 80020 Antar
003 CRN 80022 Corda
004 CRN 80023 Flandro
005 CRN 80024 Majdalani
006 CRN 80025 Moeller
014 CRN 80033 Schulz
016 CRN 82980 Solies
017 CRN 82981 Steinhoff
018 CRN 82982 Vakili

ES 502 Registration for Use of Facilities (1-15)
SEC. 002 CRN 80036 Moeller

ES 600 Doctoral Research/Dissertation (3-15)
SEC. 002 CRN 80038 Antar
003 CRN 80039 Corda
004 CRN 80040 Flandro
009 CRN 80045 Majdalani
012 CRN 80048 Moeller
013 CRN 82983 Steinhoff

INDUSTRIAL ENGINEERING

IE 529 Applications of Linear Algebra in Engineering Systems (3)
SEC. 001 CRN 80169 (Video Recorded)
TEXT: Sohail A. Dianat and Eli S. Saber; *Advanced Linear Algebra for Engineers with MATLAB*;
Latest Edition; CRC Press; ISBN 978-1-4200-9523-4
TIME: Monday, Wednesday & Friday 9:00 – 10:15 E-113
PROFESSOR: Dr. L. Montgomery Smith

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

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

Cross-listed: (Same as Biomedical Engineering 529; Chemical and Biomolecular Engineering 529; Electrical and Computer Engineering 529; Materials Science and Engineering 529; Mechanical Engineering 529.)

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

MATERIAL SCIENCE AND ENGINEERING

MSE 500 Master's Thesis (1-15)
002 CRN 80216 Hofmeister

MSE 529 Applications of Linear Algebra in Engineering Systems (3)
SEC. 002 CRN 80230 (Video Recorded)
TEXT: Sohail A. Dianat and Eli S. Saber; *Advanced Linear Algebra for Engineers with MATLAB*;
Latest Edition; CRC Press; ISBN 978-1-4200-9523-4
TIME: Monday, Wednesday & Friday 9:00 – 10:15 E-113
PROFESSOR: Dr. L. Montgomery Smith

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

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

Cross-listed: (Same as Biomedical Engineering 529; Chemical and Biomolecular Engineering 529; Electrical and Computer Engineering 529; Industrial Engineering 529; Mechanical Engineering 529.)

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

MSE 600 Doctoral Research/Dissertation (3-15)
SEC. 002 CRN 80236 Hofmeister

MATHEMATICS

MATH 443 Complex Variables (3)
SEC. 001 CRN 81597 (Video Recorded)
TEXT: M. Spiegel; *Complex Variables*
TIME: Monday & Thursday 1:00 – 3:30 E-113
PROFESSOR: Dr. Horace Crater

Introduction to the theory of functions of a complex variable, including residue theory and contour integrals.

Theory of functions of complex variable (arithmetic, algebra, and trigonometry); complex differentiation and analytic functions with applications to solutions of Laplace equations; complex integration, residue theory and contour integrals with applications to Fourier and Laplace transforms, Fourier Series, and the summation of infinite series; conformal mapping and applications to solving boundary value problems in physics and engineering including applications to fluid and heat flows and electrostatics.

(RE) Prerequisite(s): 241 or 247.

MATH 500 Master's Thesis (1-15)
SEC. 001 CRN 81600 Reddy

MATH 571 Numerical Mathematics I (3)(Same as CS 571)
SEC. 001 CRN 83733 (Video Recorded)
TEXT: (1) *Numerical Mathematics*; A. Quarteroni, R. Sacco, F. Saleri; Springer; 2nd Edition; ISBN-10:3540346589 ISBN-13:978-3540346586 (2) *A First Course in Computational Physics*; P.L. DeVries, J.E. Hasbun; and selected lecture notes including Matlab introductory notes; Jones and Bartlett; 2nd Edition; ISBN 978-0-7637-7314-4
TIME: Monday & Wednesday 10:00 – 12:00 E-111
PROFESSOR: Dr. Christian Parigger

Direct and iterative methods for linear systems. The algebraic eigenvalue problem and the singular decomposition theorem. Newton and quasi-Newton methods for systems of nonlinear equations.

Cross-listed: (Same as Computer Science 571.)

Recommended Background: Courses in advanced calculus and basic numerical analysis.

Students wishing to count this course toward IGMCS should enroll under Math 571, since IGMCS will count it as a Math course only.

Comments: This course is part I of a trilogy, part 2 is NumMathII, part3 is PDE methods

(A) Summer 2013: MATH572 Numerical Mathematics II: *Numerical techniques for initial value problems of ordinary differential equations. Two-point boundary value problems. Finite difference and finite element methods for selected partial differential equations. Fast Poisson solvers. Cross-listed: (Same as CS572.)*(DE) Prerequisite(s): 571.

(B) Summer 2014: MATH578 Numerical Methods for Partial Differential Equations: *Numerical approximation of solutions of partial differential equations including conservation laws and hyperbolic, parabolic, and elliptic problems. Derivation, physical meaning, and implementation of schemes.*

MECHANICAL ENGINEERING

ME	500	Master's Thesis (1-15)
SEC.	002	CRN 80266 Antar
	003	CRN 80267 Corda
	004	CRN 80268 Flandro
	023	CRN 80297 Majdalani
	024	CRN 80298 Moeller
	027	CRN 80301 Schulz
	028	CRN 80302 Solies
	029	CRN 82985 Steinhoff
	030	CRN 82986 Vakili

ME	502	Registration for Use of Facilities (1-15)
SEC.	002	CRN 80304 Moeller

ME	529	Applications of Linear Algebra in Engineering Systems (3)
SEC.	001	CRN 80307 (Video Recorded)

TEXT: Sohail A. Dianat and Eli S. Saber; *Advanced Linear Algebra for Engineers with MATLAB*; Latest Edition; CRC Press; ISBN 978-1-4200-9523-4

TIME: Monday, Wednesday & Friday 9:00 – 10:15 E-113

PROFESSOR: Dr. L. Montgomery 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.

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Cross-listed: (Same as Biomedical Engineering 529; Chemical and Biomolecular Engineering; Electrical and Computer Engineering 529; Industrial Engineering 529; Materials Science and Engineering 529.)

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

ME	590	Selected Engineering Problems (2-6)	
SEC.	001	CRN 80329	Antar
	002	CRN 80331	Corda
	003	CRN 80333	Flandro
	004	CRN 83233	Majdalani
	005	CRN 83234	Moeller
	006	CRN 83235	Schulz
	007	CRN 83236	Solies
	008	CRN 83237	Steinhoff
	009	CRN 83238	Vakili

Grading Restrictions: 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	600	Doctoral Research/Dissertation (3-15)	
SEC.	002	CRN 80346	Antar
	003	CRN 80348	Corda
	004	CRN 80349	Flandro
	005	CRN 80350	Majdalani
	020	CRN 80365	Moeller
	025	CRN 80371	Steinhoff

ME 613 Advanced Radiation Heat Transfer (3) (Same as AE 690)

SEC. 001 CRN 83738 (Video Recorded)

TEXT: *Thermal Radiation Heat Transfer*; Siegel and Howell; CRC Press; Edition 3rd, 4th, or 5th

TIME: Monday & Thursday 1:00 – 3:30 E-111

PROFESSOR: Dr. Trevor Moeller

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

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

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

PHYSICS

PHYS 500 Master's Thesis (1-15)
SEC. 001 CRN 81798 Chen
003 CRN 81800 Crater
004 CRN 81801 Davis
005 CRN 81802 Lewis
006 CRN 81803 Parigger

PHYS 502 Registration for Use of Facilities (1-15)
SEC. 002 CRN 83446 Davis

PHYS 593 Independent Study (3)
SEC. 001 CRN 81809
TEXT: *Modern Physics*; Anderson
TIME: Monday 4:00 – 6:30 & Thursday 10:00 – 12:00 F-252
PROFESSOR: Dr. Horace Crater

This course will cover a variety of materials not normally offered in the academic year and will be tailored to individual student needs. This summer we anticipate offering material in modern physics and introductory quantum mechanics. This will aid students who wish to take the core physics courses (521-522) in quantum mechanics. It will be tailored to the individual students' needs. Engineering students, including students in material science, are encouraged as well as students who wish to enter the physics program. Independently this course will serve those students preparing for the physics preliminary exam.

Repeatability: May be repeated. Maximum 15 hours.

PHYS 594 Special Problems in Physics: Numerical Analysis (3)
SEC. 002 CRN 83149
TEXT: (1) *Measurements and Their Uncertainties*; I.G. Highes and T.P.A. Hase; Oxford University Press; 1st Edition; ISBN: 978-0-19-956633 (2) *Data Analysis, A Bayesian Tutorial*; D.S. Sivia and J. Skilling; Oxford University Press; 2nd Edition; ISBN 978-0-19-856831-5; and lecture notes, excerpts from other books
TIME: Monday & Wednesday 1:00 – 3:00 F-252
PROFESSOR: Dr. Christian Parigger

This special problems/topics course will focus on theoretical/numerical analysis of experiments with contents spawning basics of statistics, mathematics, physics (viz. sections of traditional core course books from Mathematical Methods, Statistical Mechanics, Numerical Methods, Computational Physics) to include Bayesian approaches, maximum likelihood plus sections from selected text on Singular Value Decomposition, Principal Component Analysis, Partial Least Squares including non-linear Partial Least Squares, Chemometrics, to name a few. Especially assigned theoretical or experimental work on problems not covered in other courses.

Repeatability: May be repeated. Maximum 9 hours.

PHYS 600 Doctoral Research/Dissertation (3-15)
SEC. 001 CRN 81813 Crater
003 CRN 81815 Davis
004 CRN 81816 Lewis
005 CRN 81817 Parigger