

COLLEGE OF SCIENCE

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Programs

- Biological Sciences, M.A. (<http://catalog.marshall.edu/graduate/programs-az/science/biological-sciences-ma/>)
- Biological Sciences, M.S. (<http://catalog.marshall.edu/graduate/programs-az/science/biological-sciences-ms/>)
- Chemistry, M.S. (<http://catalog.marshall.edu/graduate/programs-az/science/chemistry-ms/>)
- Criminal Justice, Accelerated Master's Degree (<http://catalog.marshall.edu/graduate/programs-az/science/criminal-justice-accelerated-masters-degree/>)
- Criminal Justice, M.S. (<http://catalog.marshall.edu/graduate/programs-az/science/criminal-justice-ms/>)
- Criminal Justice, Minor (<http://catalog.marshall.edu/graduate/programs-az/science/criminal-justice-minor/>)
- Cyber Forensics and Security, M.S. (<http://catalog.marshall.edu/graduate/programs-az/science/cyber-forensics-security/>)
- Digital Forensics, Graduate Certificate (<http://catalog.marshall.edu/graduate/programs-az/science/digital-forensics-graduate-certificate/>)
- Forensic Science, M.S. (<http://catalog.marshall.edu/graduate/programs-az/science/forensic-science-ms/>)
- Geobiophysical Science, Minor (<http://catalog.marshall.edu/graduate/programs-az/science/geobiophysical-science-minor/>)
- Mathematics, M.A. (<http://catalog.marshall.edu/graduate/programs-az/science/mathematics-ma/>)
- Mathematics, Minor (<http://catalog.marshall.edu/graduate/programs-az/science/mathematics-minor/>)
- Natural Resources and the Environment, M.S. (<http://catalog.marshall.edu/graduate/programs-az/science/natural-resources-environment-ms/>)
- Physical and Applied Sciences, M.S. (<http://catalog.marshall.edu/graduate/programs-az/science/physics-applied-sciences-ms/>)
- Physics, M.S. (<http://catalog.marshall.edu/graduate/programs-az/science/physics-ms/>)
- Physics for Teachers, Emphasis (<http://catalog.marshall.edu/graduate/programs-az/science/physics-applied-sciences-ms/physics-teachers-emphasis/>)

Courses

Biological Science

BSC 501 Ichthyology

4 Credit hours

Anatomy, physiology, ecology, zoogeography, economic importance and classification of major groups and representative local species of fishes. 2 lec-2 lab and field.

Grade Mode: Normal Grading Mode

BSC 504 Cellular Physiology

3 Credit hours

In depth analysis of the physiological and molecular processes that underly the function of cells, using examples from diverse taxa. Focus on biomedical and biotechnological implications.

Grade Mode: Normal Grading Mode

BSC 505 Economic Botany

3 Credit hours

Plants used by man for food, ornamental purposes, building materials, textiles and other industrial purposes: economic importance of conservation. No laboratory.

Grade Mode: Normal Grading Mode

BSC 508 Ornithology

4 Credit hours

An introduction to avian biology: Identification, distribution, migration and breeding activities of birds. 2 lec-4 lab.

Grade Mode: Normal Grading Mode

BSC 509 Mammalogy

4 Credit hours

A study of the structural features, evolution and classification of the mammals; other topics will include ecology, zoogeography, behavior, reproductive strategies, physiological adaptations to extreme environments and economic aspects. 2 lec-2 lab.

Grade Mode: Normal Grading Mode

BSC 510 Remote Sensing/GIS Appl

4 Credit hours

A study of the physical systems for collecting remotely sensed data. Statistical/spatial analysis and modeling using image processing/geographic information/spatial computer software systems with earth resources applications.

Grade Mode: Normal Grading Mode

BSC 511 Dgtl Image Proc/GIS Model

4 Credit hours

A study of image processing/geographic information/spatial analysis systems, concurrent and parallel image processing 3-D modeling scenarios utilizing geophysical data for computer simulation modeling.

Grade Mode: Normal Grading Mode

BSC 513 Prin of Organic Evolution

3 Credit hours

The facts and possible mechanisms underlying the unity and diversity of life with emphasis on Neo-Darwinian concepts of the role of species in evolutionary phenomena.

Grade Mode: Normal Grading Mode

BSC 516 Plant Taxonomy

4 Credit hours

Identification and classification of seed plants and ferns of eastern United States. Readings in history and principles of taxonomy, rules of nomenclature and related topics. 2 lec-4 lab.

Grade Mode: Normal Grading Mode

BSC 517 Biostatistics

3 Credit hours

Statistical skills for biological/biomedical research, with emphasis on applications. Experimental design/survey sampling, estimation/hypothesis testing procedures, regression, ANOVA, multiple comparisons. Implementation using statistical software such as SAS, BMDP. Permission (consistent with MTH 518 description)

Grade Mode: Normal Grading Mode

BSC 520 Plant Physiology

4 Credit hours

Experimental study of plant life processes to include applicable biophysical and biochemical principles. 2 lec-4 lab.

Grade Mode: Normal Grading Mode

BSC 521 Phycology

4 Credit hours

Taxonomy and morphology of algae. Techniques used in the study of algae with emphasis upon application of ecological principles to current water quality problems. 2 lec-4 lab.

Grade Mode: Normal Grading Mode

BSC 522 Animal Physiology	3 Credit hours	BSC 556 Genes and Development	3 Credit hours
A comparative study of physiological principles in animal cells, organs, and systems. Focus on animal's reactions to their environment, and how comparative physiology applies to natural ecosystems and human health.		An in depth study of the genetic mechanisms of complex organismal development including cell specification, induction and morphogenesis.	
Grade Mode: Normal Grading Mode		Grade Mode: Normal Grading Mode	
BSC 524 Animal Parasitology	4 Credit hours	BSC 560 Conservation Biology	3 Credit hours
Morphology, life histories, classification, and host relationships of common parasites. 2 lec-4 lab.		This course focuses on the North American model of wildlife conservation (and its history), principles of biology diversity, threats to habitats and species of concern, and conservation policy.	
Grade Mode: Normal Grading Mode		Grade Mode: Normal Grading Mode	
BSC 525 Systematics	3 Credit hours	BSC 565 Biology of Reptiles	4 Credit hours
Biosystematics is a unifying discipline that combines taxonomy (collecting, describing, and naming organisms), phylogenetics (evolutionary relationships among species), and classification (organization of taxa into groups which ultimately reflect evolutionary relationship).		A survey of the reptiles of the world with special emphasis placed on forms resident to West Virginia, including aspects of ecology, physiology, zoogeography, anatomy, taxonomy, and behavior.	
Grade Mode: Normal Grading Mode		Grade Mode: Normal Grading Mode	
BSC 528 Neuroscience	3 Credit hours	BSC 566 Biology of Amphibians	4 Credit hours
The fundamentals of cellular and systems neuroscience, with application towards understanding current research and biomedical problems.		A survey of the amphibians of the world with special emphasis placed on forms resident to West Virginia, including aspects of ecology, physiology, zoogeography, anatomy, taxonomy, and behavior.	
Grade Mode: Normal Grading Mode		Grade Mode: Normal Grading Mode	
BSC 530 Plant Ecology	4 Credit hours	BSC 580 Special Topics	1-4 Credit hours
The study of plants and their interactions with their environment at different levels of ecological organization: individuals, populations, communities, and ecosystems. Emphasis on quantitative analysis of ecological data.		(PR: Permission)	
Grade Mode: Normal Grading Mode		Grade Mode: Normal Grading Mode	
BSC 531 Limnology	4 Credit hours	BSC 581 Special Topics	1-4 Credit hours
The study of inland waters; ecological factors affecting lake and stream productivity and various aquatic communities. 2 lec-4 lab.		(PR: Permission)	
Grade Mode: Normal Grading Mode		Grade Mode: Normal Grading Mode	
BSC 538 Emerging Infectious Diseases	3 Credit hours	BSC 582 Special Topics	1-4 Credit hours
Introduces students to infectious diseases that are either newly emergent or have returned to prominence within the last decade.		(PR: Permission)	
Grade Mode: Normal Grading Mode		Grade Mode: Normal Grading Mode	
BSC 543 Microbial Genetics	3 Credit hours	BSC 583 Special Topics	1-4 Credit hours
Microbial Genetics covers the essential functions of DNA replication and gene expression in prokaryotic cells. The course includes molecular genetics of bacteria and phages, bioinformatics and discussion of laboratory techniques.		(PR: Permission)	
Grade Mode: Normal Grading Mode		Grade Mode: Normal Grading Mode	
BSC 545 Microbial Ecology	3 Credit hours	BSC 585 Independent Study	1-4 Credit hours
This course introduces students to the vital roles that microbes play in sustaining life on earth. Includes both theoretical and practical concepts ranging from the origin of life to biodegradation.		(PR: Permission)	
Grade Mode: Normal Grading Mode		Grade Mode: Credit/No Credit Grade Only	
BSC 550 Molecular Biology	3 Credit hours	BSC 586 Independent Study	1-4 Credit hours
Advanced principles in molecular function emphasizing current research using recombinant DNA methodology. (PR: BSC 322 or equivalent)		(PR: Permission)	
Grade Mode: Normal Grading Mode		Grade Mode: Credit/No Credit Grade Only	
BSC 551 Molecular Medicine	3 Credit hours	BSC 587 Independent Study	1-4 Credit hours
This course focuses on molecular biology as applied to the causes, diagnosis and treatment of select human and veterinary diseases. Therapies that are new and still in clinical trials will also be covered.		(PR: Permission)	
Grade Mode: Normal Grading Mode		Grade Mode: Credit/No Credit Grade Only	
		BSC 588 Independent Study	1-4 Credit hours
		(PR: Permission)	
		Grade Mode: Credit/No Credit Grade Only	
		BSC 601 Vertebrate Embryology	4 Credit hours
		Vertebrate development based on frog, chick and pig embryos. 2 lec-4 lab.	
		Grade Mode: Normal Grading Mode	
		BSC 608 Plant Growth & Development	4 Credit hours
		Comprehensive advanced study of correlative growth in plants with emphasis on germination, dormancy, growth substances and physiological phenomena associated with phases of development.	
		Grade Mode: Normal Grading Mode	

BSC 610 Adv Vert Morphology	3 Credit hours	BSC 660 Seminar I	2 Credit hours
AVM is an intensive, laboratory-based course in vertebrate morphology. Core responsibilities include detailed dissection and comparative cranial osteology. Each student must complete an independent dissection project and term paper.		Topics relevant to preparation for a career in the life sciences including: literature mining and interpretation, scientific ethics, preparation and delivery of scientific presentations, and career development tools.	
Grade Mode: Normal Grading Mode		Attributes: No Textbook Required	
		Grade Mode: Normal Grading Mode	
BSC 620 Taxonomy Vascular Plants	1-2 Credit hours	BSC 661 Topics in Biological Sciences	2 Credit hours
Field studies in the taxonomy of higher plants. (Limited to 4 hours credit per student).		In depth group discussion of current biological issues.	
Co-req: BSC 622		Attributes: No Textbook Required	
Grade Mode: Normal Grading Mode		Grade Mode: Normal Grading Mode	
BSC 621 Taxonomy Vascular Plants	1-2 Credit hours	BSC 662 Seminar II	1 Credit hour
Field studies in the taxonomy of higher plants. (Limited to 4 hours credit per student).		Oral presentation of individual topics.	
Grade Mode: Normal Grading Mode		Pre-req: BSC 660 with a minimum grade of C.	
		Attributes: No Textbook Required	
		Grade Mode: Normal Grading Mode	
BSC 622 Taxonomy Vascular Plants	1-2 Credit hours	BSC 679 Problem Report	1-4 Credit hours
Field studies in the taxonomy of higher plants. (Limited to 4 hours credit per student).		Preparation and completion of a written report from experimental or field research in biological sciences. (PR: permission)	
Co-req: BSC 620		Grade Mode: Normal Grading Mode	
Grade Mode: Normal Grading Mode		BSC 680 Special Topics	1-4 Credit hours
		Attributes: No Textbook Required	
		Grade Mode: Normal Grading Mode	
BSC 625 Advanced Physiology	4 Credit hours	BSC 681 Thesis	1-9 Credit hours
Lecture, current literature and introduction to research in physiological systems. 3 lec-3 lab.		By permission of adviser.	
Grade Mode: Normal Grading Mode		Attributes: No Textbook Required, Thesis	
		Grade Mode: Normal Grading Mode	
BSC 631 Animal Ecology	4 Credit hours	BSC 716 Adv Cell Phys Nurse Anesthesia	2 Credit hours
A study of population and behavior ecology; community dynamics and field techniques. 2 lec-4 lab.		Study of structure and function of human cells, including protein synthesis, metabolism and reproduction. Study of genetic disorders and anesthesia. Study of anti-cancer drugs. Analyze types and rules of various cell membrane receptors on anesthesia process.	
Grade Mode: Normal Grading Mode		Grade Mode: Normal Grading Mode	
BSC 640 Cellular/Molecular BioMedicine	4 Credit hours	BSC 717 Adv Ana Phy Path Nurse 1	3 Credit hours
This course uses an integrated lecture/journal club format to familiarize students with advanced techniques and multidisciplinary approaches in biomedical research. Intended for science and biomedical graduate students.		Anatomy, Physiology, pathophysiology and anesthetic considerations related to the respiratory and renal systems.	
Grade Mode: Normal Grading Mode		Grade Mode: Normal Grading Mode	
BSC 644 Quantitative Ecology	3 Credit hours	BSC 718 Adv Ana Phy Path Nurse 2	3 Credit hours
An introduction to statistical analyses using presence absence, mark-recapture, and count data to estimate population parameters, such as occupancy and survival.		Anatomy, physiology, pathophysiology and anesthetic considerations related to the cardiovascular system.	
Grade Mode: Normal Grading Mode		Grade Mode: Normal Grading Mode	
BSC 648 Landscape Ecology	3 Credit hours	BSC 719 Adv Ana Phy Path Nurse 3	3 Credit hours
Landscape ecology is the study of landscapes at multiple scales with a focus on discerning how landscape structure affects ecological processes. Students will learn foundational concepts, methods, and computer applications.		Anatomy, physiology, pathophysiology and anesthetic considerations related to the nervous and endocrine systems.	
Grade Mode: Normal Grading Mode		Grade Mode: Normal Grading Mode	
BSC 649 Wetland Ecology	3 Credit hours	Chemistry	
Grade Mode: Normal Grading Mode		CHM 511 Modern Instrument Methods	4 Credit hours
BSC 650 Special Problems	1-3 Credit hours	This course investigates the theory and functional aspects of modern analytical instrumentation. Emphasis is placed on the components of instruments and the applicability of various techniques to specific analytical problems.	
By permission of adviser.		Pre-req: CHM 307 with a minimum grade of C or CHM 357 with a minimum grade of C.	
Grade Mode: Credit/No Credit Grade Only		Grade Mode: Normal Grading Mode	
BSC 651 Special Problems	1-3 Credit hours	CHM 540 Thermodynamics	3 Credit hours
By permission of adviser.		An introduction to chemical thermodynamics and statistical mechanics. 3 lec.	
Grade Mode: Credit/No Credit Grade Only		Grade Mode: Normal Grading Mode	
BSC 652 Special Problems	1-3 Credit hours		
By permission of adviser.			
Grade Mode: Credit/No Credit Grade Only			

CHM 542 Quantum Mechanics	3 Credit hours	CHM 607 Theoretical Organic Chem	2 Credit hours
An introductory course in quantum mechanics. 3 lec.		The application of quantitative methods to problems in structure and dynamics. 2 lec.	
Grade Mode: Normal Grading Mode		Pre-req: CHM 565.	
CHM 548 Adv Inorganic Chemistry I	4 Credit hours	Grade Mode: Normal Grading Mode	
Study of physical and chemical properties and periodic relationships of inorganic materials. 3 lec, 2 lab (PR: CHM 356, CHM 307, or CHM 357)		CHM 618 Kinetics	3 Credit hours
Grade Mode: Normal Grading Mode		An advanced study of reaction rates and mechanisms.	
CHM 549 Adv Inorganic Chem II	3 Credit hours	Grade Mode: Normal Grading Mode	
A detailed consideration of bonding, structure, reaction rates and equilibrium involving inorganic materials. 3 lec.		CHM 628 Special Topics-Inorganic	1-3 Credit hours
Grade Mode: Normal Grading Mode		Offered on demand.	
CHM 551 Biological Mass Spectrometry	4 Credit hours	Grade Mode: Normal Grading Mode	
This course investigates the theory and applications of mass spectrometry. It includes a laboratory component in which you will learn to run the mass spectrometers and interpret mass spectral results.		CHM 629 Special Topics-Organic	1-3 Credit hours
Grade Mode: Normal Grading Mode		Offered on demand.	
CHM 565 Adv Organic Chemistry I	3 Credit hours	Grade Mode: Normal Grading Mode	
Studies of the dynamics of organic reactions with emphasis on mechanisms and stereo chemistry. 3 lec.		CHM 630 Special Topics-Physical	1-3 Credit hours
Grade Mode: Normal Grading Mode		Offered on demand.	
CHM 566 Adv Organic Chemistry II	3 Credit hours	Grade Mode: Normal Grading Mode	
A continuation of Chemistry 565 with emphasis on synthetic methods. 3 lec.		CHM 631 Seminar	1 Credit hour
Pre-req: CHM 565.		Attributes: No Textbook Required	
Grade Mode: Normal Grading Mode		Grade Mode: Normal Grading Mode	
CHM 567 Intermediate Biochemistry	3 Credit hours	CHM 632 Seminar	1 Credit hour
A survey course including introduction to basic biochemical concepts, bioenergetics, and information transfer.		Attributes: No Textbook Required	
Pre-req: CHM 365 with a minimum grade of C or BSC 365 with a minimum grade of C.		Grade Mode: Normal Grading Mode	
Grade Mode: Normal Grading Mode		CHM 678 Applied Micr in Research	4 Credit hours
CHM 580 Special Topics	1-4 Credit hours	A combined lecture/lab/self-motivated research course that results in a microscopy based project to be presented by each student at an open forum (can augment thesis project).	
Grade Mode: Normal Grading Mode		Grade Mode: Normal Grading Mode	
CHM 581 Special Topics	1-4 Credit hours	CHM 679 Problem Report	3 Credit hours
Grade Mode: Normal Grading Mode		Preparation of a comprehensive written report on a topic in Chemistry of current importance. Registration only by permission of Department.	
CHM 582 Special Topics	1-4 Credit hours	Grade Mode: Normal Grading Mode	
Grade Mode: Normal Grading Mode		CHM 682 Research	1-12 Credit hours
CHM 583 Special Topics	1-4 Credit hours	Credit in the course is earned by pursuing a directed original investigation in a field of chemistry. Twelve semester hours credit in research are applied toward the M.S. degree. Students may sign for one or more credit hours per semester depending upon the time to be spent on research. A grade of PR may be reported at the close of each term or semester.	
Grade Mode: Normal Grading Mode		Attributes: Thesis	
CHM 585 Independent Study	1-4 Credit hours	Grade Mode: Normal Grading Mode	
Attributes: No Textbook Required		CHM 685 Independent Study	1-4 Credit hours
Grade Mode: Normal Grading Mode		Individual study of topics not offered in regularly scheduled classes.	
CHM 586 Independent Study	1-4 Credit hours	Grade Mode: Normal Grading Mode	
Grade Mode: Normal Grading Mode		CHM 686 Independent Study	1-4 Credit hours
CHM 587 Independent Study	1-4 Credit hours	Individual study of topics not offered in regularly scheduled classes.	
Grade Mode: Normal Grading Mode		Grade Mode: Normal Grading Mode	
CHM 588 Independent Study	1-4 Credit hours	CHM 687 Independent Study	1-4 Credit hours
Grade Mode: Normal Grading Mode		Individual study of topics not offered in regularly scheduled classes.	
CHM 604 Theories Analytical Chem	2 Credit hours	Grade Mode: Normal Grading Mode	
Offered on demand.		CHM 688 Independent Study	1-4 Credit hours
Pre-req: CHM 556.		Individual study of topics not offered in regularly scheduled classes.	
Grade Mode: Normal Grading Mode		Grade Mode: Normal Grading Mode	

CHM 723 Chemistry and Physics**3 Credit hours**

Scientific principles and clinical application of properties of matter, gas laws, vaporization, fluid dynamics, explosion hazards, electrical safety, acid-base balance, blood gas analysis, biochemistry in anesthesia, mechanisms of narcosis. Analyze the molecular basis for molecular bonding, stereochemistry, protein confirmation, enzyme-substrate reactions.

Grade Mode: Normal Grading Mode**Criminal Justice****CJ 500 Applied Ethics in CJ****3 Credit hours**

Examines ethical issues and moral dilemmas faced by criminal justice professionals. Traditional ethical theories and practices designed to foster public trust in the criminal justice system are examined and applied.

Grade Mode: Normal Grading Mode**CJ 503 Understanding Cybercrime****3 Credit hours**

Examination of hacking, piracy, cyber stalking, cyber bullying, identity theft, and other cybercrimes through the lens of various criminological theories with an emphasis on research methodology and criminal justice policy.

Grade Mode: Normal Grading Mode**CJ 504 Theoretical Criminology****3 Credit hours**

A critical analysis of the major criminological theories and their empirical foundations. Current theory and research receive greater emphasis than historical development.

Grade Mode: Normal Grading Mode**CJ 505 Women and the CJS****3 Credit hours**

Examines factors surrounding women and the criminal justice system from a theoretical and practical perspective. Explores feminist ideologies, plus women as victims, offenders, and professionals in the justice system.

Grade Mode: Normal Grading Mode**CJ 506 Race, Ethnicity, Class, & Crime****3 Credit hours**

Examines the impact and relationship of race, ethnicity, and social class within the criminal justice system.

Grade Mode: Normal Grading Mode**CJ 510 Police Administration****3 Credit hours**

This course studies the functions and activities of police agencies, including police department organizations and responsibilities of police administrators. Current administrative and management techniques and theories are also explored.

Grade Mode: Normal Grading Mode**CJ 515 Rural Criminology****3 Credit hours**

Critical analysis of rural crime and the criminological sub-field of rural criminology. Examines the economic, racial, and cultural conditions in rural America which reproduce exploitive economies and overall destructive behaviors.

Grade Mode: Normal Grading Mode**CJ 516 Terrorism****3 Credit hours**

This course provides students with a working knowledge of the history of terrorism, the current status of terrorist groups, terrorism tactics, and methods to counteract terrorism.

Grade Mode: Normal Grading Mode**CJ 517 CJ Decision Making****3 Credit hours**

Focuses on theories of criminal justice decision-making and decision points across the criminal justice system. Topics include the decision to report crime, police decisions, jury decisions, and sentencing decisions.

Grade Mode: Normal Grading Mode**CJ 518 Crime and Pop Culture****3 Credit hours**

A critical examination of the popular culture presentations of crime, offenders, victims, and the criminal justice processes.

Grade Mode: Normal Grading Mode**CJ 520 Homeland Security****3 Credit hours**

This course takes a comprehensive approach to studying the facets of homeland security, the complexity of homeland security and terrorism, defeating terrorists, and Homeland Security's response to terrorist threats.

Grade Mode: Normal Grading Mode**CJ 522 Law of Evidence****3 Credit hours**

Leading rules and principles of exclusion and selection; burden of proof, nature and effect of presumptions; proof of authenticity and contents of writing; examinations competency and privilege of witnesses.

Grade Mode: Normal Grading Mode**CJ 524 Computer Crime****3 Credit hours**

Students will identify and define criminal acts committed with computers or directed toward computer systems, electronic search and seizure and electronic evidence.

Grade Mode: Normal Grading Mode**CJ 526 Civil Liability Issues CJ****3 Credit hours**

This course examines various theories of civil liability that relate to Criminal Justice professionals, the civil justice system, and preventing and defending civil liability claims.

Grade Mode: Normal Grading Mode**CJ 533 Correctional Administration****3 Credit hours**

Objectives of correctional institutions; records; personnel, program development, security; educational programs.

Grade Mode: Normal Grading Mode**CJ 540 CJ Response to Dom Violence****3 Credit hours**

This course focuses on the legal response to child abuse, domestic violence, and elder abuse. Examines dynamics of abusive relationships, the effects of victimization, and current research on these issues.

Grade Mode: Normal Grading Mode**CJ 550 Bus & Industry Security****3 Credit hours**

Selection, training and staffing of a security force; security devices available, techniques of internal security; ground security; security techniques applicable to personnel selection; legal problems.

Grade Mode: Normal Grading Mode**CJ 553 Seminar Crime Prevention****3 Credit hours**

This course examines theory, operation, and evaluation of crime prevention as a function of the criminal justice system. Techniques for crime prevention are analyzed from various orientations, including environmental design.

Grade Mode: Normal Grading Mode**CJ 560 Miscarriages of Justice****3 Credit hours**

This course provides a critical examination of the processes and procedures used by police, prosecutors, defense attorneys, judges, and corrections agents which may potentially produce errors or "miscarriages" of justice.

Grade Mode: Normal Grading Mode

CJ 580 Special Topics	1-4 Credit hours	CJ 656 Applied Statistics in CJ	3 Credit hours
A study of special interest criminal justice topics under the supervision of a qualified faculty member.		Principles of statistical techniques with emphasis upon their application in the Criminal Justice system. (PR: Undergraduate statistics course and permission)	
Grade Mode: Normal Grading Mode		Pre-req: CJ 655 with a minimum grade of C.	
CJ 581 Special Topics	1-4 Credit hours	Grade Mode: Normal Grading Mode	
A study of special interest criminal justice topics under the supervision of a qualified faculty member.		CJ 679 Problem Report	3 Credit hours
Grade Mode: Normal Grading Mode		The preparation of a written report on a research problem or field study in Criminal Justice. (PR: CJ 655 and Permission)	
CJ 582 Special Topics	1-4 Credit hours	Pre-req: CJ 655.	
A study of special interest criminal justice topics under the supervision of a qualified faculty member.		Grade Mode: Normal Grading Mode	
Grade Mode: Normal Grading Mode		CJ 681 Thesis	1-6 Credit hours
CJ 583 Special Topics	1-4 Credit hours	Attributes: Thesis	
A study of special interest criminal justice topics under the supervision of a qualified faculty member.		Grade Mode: Credit/No Credit Grade Only	
Grade Mode: Normal Grading Mode		CJ 699 Capstone Experience	3 Credit hours
CJ 585 Independent Study	1-4 Credit hours	A culminating experience where students will apply knowledge and skills learned in their program of study to create, in collaboration with an agency or organization in the field, an original, scholarly work that addresses a current issue of concern.	
This course permits the student to undertake supervised research (field or library) in any area where there is no appropriate course.		Pre-req: CJ 601 and CJ 604 and CJ 655 and CJ 656.	
Grade Mode: Normal Grading Mode		Grade Mode: Normal Grading Mode	
CJ 586 Independent Study	1-4 Credit hours	Forensic Science	
This course permits the student to undertake supervised research (field or library) in any area where there is no appropriate course.		FSC 600 Molecular Biology	3 Credit hours
Grade Mode: Normal Grading Mode		A study of the molecular biology of the cell and its organelles, cell interactions, and differentiation.	
CJ 587 Independent Study	1-4 Credit hours	Grade Mode: Normal Grading Mode	
This course permits the student to undertake supervised research (field or library) in any area where there is no appropriate course.		FSC 603 Genetics-DNA Lab	1 Credit hour
Grade Mode: Normal Grading Mode		Laboratory to be offered in conjunction with FSC 604 Genetics and DNA Technology stressing techniques and methods required for DNA analysis used in forensic case investigations, in CODIS laboratories and in paternity testing.	
CJ 588 Independent Study	1-4 Credit hours	Grade Mode: Normal Grading Mode	
This course permits the student to undertake supervised research (field or library) in any area where there is no appropriate course.		FSC 604 Genetics & DNA Technology	3 Credit hours
Grade Mode: Normal Grading Mode		A comprehensive lecture series that covers the genetics and biochemistry of DNA to include the analysis, ethical considerations and quality assurance techniques used to analyze DNA for identification purposes. This course serves as a core course in the forensic science curriculum.	
CJ 590 Internship	1-6 Credit hours	Grade Mode: Normal Grading Mode	
The placement of an individual into a criminal justice agency (police, probation, courts, jails) to observe and participate in its operation. Grading is CR/NC.		FSC 605 F S Digital Imaging	3 Credit hours
Grade Mode: Credit/No Credit Grade Only		Introductory course in digital image processing. Covers techniques used in forensic laboratory to enhance, analyze, and catalog digital images. Instruction in lab setting.	
CJ 601 Seminar Criminal Justice	3 Credit hours	Grade Mode: Normal Grading Mode	
A forum to acquaint students, faculty and guests with each others' research and experiences in dealing with criminal justice issues.		FSC 606 Crime Scene/Death Investiga	3 Credit hours
Grade Mode: Normal Grading Mode		Establishes foundations and techniques for proper crime scene investigation with or without a victim's body. Logical approach for collecting evidence and documenting scene and collection process.	
CJ 604 Adv Theory Criminal Just	3 Credit hours	Grade Mode: Normal Grading Mode	
Course is designed to provide the student already familiar with the basic concepts of criminological theory the opportunity to examine in depth a selected set of theories.		FSC 607 Blood Stain Pattern Analysis	3 Credit hours
Grade Mode: Normal Grading Mode		A comprehensive bloodstain pattern analysis course including bullet trajectory, courtroom testimony, and report writing. This course is taught as a combination of lectures, laboratories, and practical exercises.	
CJ 621 Contemporary Law & Society	3 Credit hours	Pre-req: FSC 606.	
A review of contemporary legislation and court decisions relating to its impact on the justice system, justice officials, and members of society.		Grade Mode: Normal Grading Mode	
Attributes: No Textbook Required			
Grade Mode: Normal Grading Mode			
CJ 655 Research Methods in CJ	3 Credit hours		
Elements of scientific research; interaction between research and theory; use of data processing resources.			
Grade Mode: Normal Grading Mode			

- FSC 608 Forensic Toxicology** **3 Credit hours**
An in-depth analysis of both clinical and forensic aspects of toxicology from the viewpoint of the forensic and medical examiner's toxicology laboratories.
Grade Mode: Normal Grading Mode
- FSC 609 Network Forensics** **3 Credit hours**
Teaches the basics of how computers and networks function, how they can be involved in crimes as well as used as a source of evidence.
Grade Mode: Normal Grading Mode
- FSC 610 Bioterrorism: Forensics** **3 Credit hours**
Course traces the historical development, current status, and future threats of bioterrorism in the U.S. and on a global scale. Issues addressed include microbiology, surveillance, detection and post-event investigation.
Grade Mode: Normal Grading Mode
- FSC 612 Intro Foren Micro/Trace** **2 Credit hours**
Introduction to various types of microscopy used in forensics, including scanning electron microscopy, light and fluorescence microscopy and polarizing microscopy. Photographic techniques used for documentation will also be discussed.
Grade Mode: Normal Grading Mode
- FSC 615 Adv Crime Investigation** **3 Credit hours**
This course addresses various areas of crime scene investigation not or minimally addressed in the FSC 606 introductory course. Topics include arson/explosives, body excavation, forensic entomology, advanced impression evidence, wound analysis.
Pre-req: FSC 606.
Grade Mode: Normal Grading Mode
- FSC 617 Adv Crime Photo & Document** **2 Credit hours**
This series of lectures and practical exercises introduces the student to sophisticated crime scene documentation techniques including sketching, surveying, photography and crime scene management techniques.
Pre-req: FSC 606.
Grade Mode: Normal Grading Mode
- FSC 618 Forensic Comparative Sciences** **2 Credit hours**
Introduction to comparative methods used by forensic scientists for analysis of fingerprints, questioned documents, and firearms.
Grade Mode: Normal Grading Mode
- FSC 619 Forensic Statistics** **3 Credit hours**
Basic theory of probability and statistics, odds from Bayes' theorem for transfer evidence, likelihood ratio, population and statistical genetics, statistical issues in paternity testing and mixtures, and presenting evidence.
Grade Mode: Normal Grading Mode
- FSC 622 Forensic Analytical Chem** **3 Credit hours**
Analytical chemistry instrumentation and methods used by forensic scientists for analysis of drugs, toxicology, arson, explosives, trace evidence and sample collection and processing.
Grade Mode: Normal Grading Mode
- FSC 623 Forensic Chemistry Laboratory** **1 Credit hour**
Laboratory practicum will develop skill set needed in the forensic analysis of physical evidence using standard methods and modern analytical instrumentation.
Grade Mode: Normal Grading Mode
- FSC 624 Biochemistry: Forensic Science** **4 Credit hours**
This comprehensive course in biochemistry focuses on concepts appropriate to forensic science and designed to meet forensic science educational standards at a national level.
Grade Mode: Normal Grading Mode
- FSC 626 Advanced Drug Analysis** **2 Credit hours**
Concentration on modern analytical methods used in the isolation and the identification of illicit drugs and their metabolites in biological samples and other forensic evidence. (PR: FSC 622 or permission of instructor)
Grade Mode: Normal Grading Mode
- FSC 627 Human Genetics** **2 Credit hours**
Human Genetics serves as an introduction to the study of heritable traits in humans and their molecular basis; basic genetic principles, statistics, and probability; population database analyses; principles of population genetics and laws of Mendelian genetics as they relate to human identification; application of paternity testing and identification of human remains; use of single nucleotide polymorphisms (SNPs) and mtDNA profiling in forensic applications.
Pre-req: FSC 624.
Grade Mode: Normal Grading Mode
- FSC 628 Chem Analysis Trace Evidence** **2 Credit hours**
A continuation of FSC 622 emphasizing additional types of evidence including paint, inks, fibers, and plastics. Methods Include pyrolysis-GCMS, micro-FTIR, GPC and capillary electrophoresis. Required course for Forensic Chemistry emphasis.
Grade Mode: Normal Grading Mode
- FSC 629 Advanced DNA Technologies** **2 Credit hours**
This course will provide advanced instruction in DNA technologies to assist in the preparation for a career in a forensic DNA laboratory.
Pre-req: (FSC 603 or FSC 643) and FSC 604.
Grade Mode: Normal Grading Mode
- FSC 630 Internship** **5 Credit hours**
A 10 week internship in a crime lab or other forensic science related research laboratory. Application of principles and techniques learned during first year of program.
Grade Mode: Normal Grading Mode
- FSC 632 Found Fund Digital Forensics** **3 Credit hours**
The course provides fundamental information to lay the foundation for the Digital Forensics Area of Emphasis. A range of topics includes laws and regulations relating to stored digital data, quality assurance and ethics in a digital laboratory, basic terminology, computer hardware and various storage media, software, including operating and file systems, and basics concepts of computer security. The course is taught primarily in a lecture format. Class discussions and participation in practical exercises supplement lectures.
Grade Mode: Normal Grading Mode
- FSC 634 Comp Search & Seizure** **3 Credit hours**
Topics covered in this course will expand upon material covered in FSC 632. Additional areas include affidavits and warrants, national information security concepts, evidence collection, transport and preservation, computer networks, e-mail traces, imaging of original evidence, introduction to forensic tools, Window registry, malware and spyware, virtualization and hand held devices. Classes are presented in a lecture format and culminates with a mock, digital crime scene exercise.
Grade Mode: Normal Grading Mode

- FSC 636 Mobile Phone Forensics** **2 Credit hours**
This course addresses the complexity and structure of modern smart phones and focuses on data evidence storage and extraction for criminal case investigations.
Grade Mode: Normal Grading Mode
- FSC 640 Firearms Toolmarks I** **1 Credit hour**
This course provides an enhanced learning experience designed to reduce the time to competency typical of the knowledge required component for a firearms examiner training program. FSC 640 is the first of two firearms and toolmarks examiner training courses.
Grade Mode: Normal Grading Mode
- FSC 641 Firearms Toolmarks II** **1 Credit hour**
This course provides an enhanced learning experience designed to reduce the time to competency typical of the knowledge required component of a firearms examiner training program. FSC 641 is the second of two firearms and toolmarks examiner training courses.
Grade Mode: Normal Grading Mode
- FSC 642 DNA Tech Assistance I** **2 Credit hours**
The goal of the DNA Technical Assistance Program (DNA TAP) is to prepare select students for placement in host forensic laboratories for validation and evaluation research studies. The student undergoes accelerated lectures and intense hands-on laboratory exercises including analytical procedures, instrument training, and data analysis.
Grade Mode: Normal Grading Mode
- FSC 643 DNA Tech Assistance II** **2 Credit hours**
The goal of the DNA Technical Assistance Program (DNA TAP) is to prepare select students for placement in host forensic laboratories for validation and evaluation research studies. The student undergoes accelerated lectures and intense hands-on laboratory exercises including analytical procedures, instrument training, and data analysis.
Grade Mode: Normal Grading Mode
- FSC 646 Lab Management** **2 Credit hours**
This course provides a foundation in management theory, principles & application necessary for forensic scientists who aspire to assume future positions as crime lab supervisors, managers, technical leaders, quality managers, directors or other roles as leaders in their field. This course addresses management theory as well as its practical application to the crime laboratory setting from an ISO/IEC 17025 perspective.
Grade Mode: Normal Grading Mode
- FSC 650 Special Topics** **1-4 Credit hours**
Present course material on special areas of research or topics which are not routinely covered in existing courses.
Grade Mode: Normal Grading Mode
- FSC 651 Special Topics** **1-4 Credit hours**
Present course material on special areas of research or topics which are not routinely covered in existing courses.
Grade Mode: Normal Grading Mode
- FSC 652 Special Topics** **1-4 Credit hours**
Present course material on special areas of research or topics which are not routinely covered in existing courses.
Grade Mode: Normal Grading Mode
- FSC 653 Special Topics** **1-4 Credit hours**
Present course material on special areas of research or topics which are not routinely covered in existing courses.
Grade Mode: Normal Grading Mode
- FSC 660 Independent Study** **1-4 Credit hours**
Grade Mode: Normal Grading Mode
- FSC 665 Legal Court in Forensic** **3 Credit hours**
Covers the American legal system with specific emphasis on expert witnessing by forensic scientists. Mock trials provide experience in the courtroom.
Grade Mode: Normal Grading Mode
- FSC 676 Adv Dig Evid Detect Recovery** **2 Credit hours**
This advanced Digital Evidence Detection and Recovery course will provide an overview of the advanced procedures and techniques used by investigators working with digital evidence. This course will be taught as a combination of lectures, lab and practical exercises.
Grade Mode: Normal Grading Mode
- FSC 679 Special Problems** **1-4 Credit hours**
Students will be assigned specific areas of study for independent investigation. (PR: Consent of advisor)
Grade Mode: Normal Grading Mode
- FSC 680 Seminar** **1 Credit hour**
Faculty, student and guest speaker presentations of topics pertinent to forensic science.
Grade Mode: Normal Grading Mode
- FSC 681 Thesis** **1-6 Credit hours**
Research conducted in the laboratories at MU which is focused on a problem of forensic importance. The original research problem will be written up as a formal document and submitted as part of the requirements to fulfill a MS degree in the research track.
Attributes: Thesis
Grade Mode: Normal Grading Mode
- FSC 685 Intro Research** **1-6 Credit hours**
Directed research which can be used to satisfy requirements for a Master's Degree in Forensic Science.
Grade Mode: Normal Grading Mode
- ## Geology
- GLY 510 Big Bend Field Excursion** **2 Credit hours**
Field trip to Big Bend National Park, Texas to study the structure, stratigraphy, igneous geology, metamorphic geology, paleontology and natural history of this national park.
Grade Mode: Normal Grading Mode
- GLY 518 Invertebrate Paleontology** **4 Credit hours**
Taxonomy, morphology, and paleoecology of body and trace fossils representing the major invertebrate phyla; analysis and interpretation of faunal assemblages; evolution and extinction of species. (PR: GLY 201)
Grade Mode: Normal Grading Mode
- GLY 520 Geochemistry** **3 Credit hours**
Introduction to the principles of geochemistry. The application of chemistry to the study of the earth and to geologic problems.
Grade Mode: Normal Grading Mode
- GLY 521 Petrology** **4 Credit hours**
Identification and classification of igneous, sedimentary and metamorphic rocks, their origin and occurrence; their geologic and economic. 2 lec-4 lab.
Grade Mode: Normal Grading Mode
- GLY 523 Sedimentary Petrography** **4 Credit hours**
Megascopic and microscopic identification and a depositional and post-depositional interpretation of the sedimentary rocks. 3 lec-2 lab.
Grade Mode: Normal Grading Mode

GLY 527 Fossil Fuels	4 Credit hours	GLY 642 Chemical Aspects Geology	1-4 Credit hours
The origin and occurrence of petroleum, coal, and natural gas; the relationships of accumulations to depositional environments and structural history; methods used in exploration, evaluation and recovery. 3 lec-2 lab.		Grade Mode: Normal Grading Mode	
Pre-req: GLY 200.		GLY 681 Thesis	1-6 Credit hours
Grade Mode: Normal Grading Mode		Attributes: Thesis	
		Grade Mode: Normal Grading Mode	
Mathematics			
GLY 530 Computer Methods Geology	4 Credit hours	MTH 500 Structure of Algebra	3 Credit hours
The computer will be used for compilation, reduction, data analysis and modelling from a wide range of geological problems. Existing and student developed programs will be used.		Emphasis on the language of Modern Elementary Algebra.	
Grade Mode: Normal Grading Mode		Recommended for preservice elementary teachers and for elementary and secondary in-service teachers. May not be used for a degree offered by the Department of Mathematics of in the twelve hour content block of the Secondary Education MA Degree program for students with mathematics certification in grades 7-12.	
GLY 551 Principles Geomorphology	4 Credit hours	Grade Mode: Normal Grading Mode	
Identification and analysis of the earth's surficial features in terms of stratigraphy, structure, processes, tectonics, and time. 3 lec 2 lab.		MTH 501 Structure Modern Geometry	3 Credit hours
Grade Mode: Normal Grading Mode		Informal development of geometry. Recommended for preservice elementary teachers and for elementary and secondary in-service teachers. May not be used for a degree offered by the Department of Mathematics or in the twelve hour content block of the Secondary Education MA Degree program for students with mathematics certification in grades 7-12.	
GLY 555 Hydrogeology	3 Credit hours	Grade Mode: Normal Grading Mode	
The properties of water, the hydrologic cycle with emphasis on surface and groundwater processes. The uses, needs and problems associated with water resources.		MTH 527 Advanced Calculus I	3 Credit hours
Grade Mode: Normal Grading Mode		The number system, limits, sequences, partial differentiation with applications, maxima and minima of functions of several variables.	
GLY 555L Hydrogeology Laboratory	1 Credit hour	Theory of definite integrals, multiple integrals, line and surface integrals, improper integrals, infinite series.	
Laboratory and field experiments studying principles and concepts of hydrology. 2 lab.		Grade Mode: Normal Grading Mode	
Grade Mode: Normal Grading Mode		MTH 528 Advanced Calculus II	3 Credit hours
GLY 556 Environmental Geology	4 Credit hours	The number system, limits, sequences, partial differentiation with applications, maxima and minima of functions of several variables.	
Consideration of risks posed by natural geo-hazards and from physical/chemical contamination of geological media.		Theory of definite integrals, multiple integrals, line and surface integrals, infinite series.	
Grade Mode: Normal Grading Mode		Grade Mode: Normal Grading Mode	
GLY 557 Engineering Geology	4 Credit hours	MTH 548 Modern Geometries	3 Credit hours
Consideration of geotechnical problems faced by geologists and engineers. Major topics include mechanics and classification of soil and rock, and geotechnical aspects of groundwater.		Finite geometrics, basic background material for the modern development of Euclidean Geometry, other geometries.	
Grade Mode: Normal Grading Mode		Grade Mode: Normal Grading Mode	
GLY 580 Special Topics	1-4 Credit hours	MTH 549 Projective Geometry	3 Credit hours
Grade Mode: Normal Grading Mode		Projective geometry using both synthetic and algebraic methods.	
GLY 581 Special Topics	1-4 Credit hours	Attributes: No Textbook Required	
Grade Mode: Normal Grading Mode		Grade Mode: Normal Grading Mode	
GLY 582 Special Topics	1-4 Credit hours	MTH 550 Modern Algebra I	3 Credit hours
Grade Mode: Normal Grading Mode		Structure of the abstract mathematical systems; groups, rings, fields, with illustrations and applications from Number Theory.	
GLY 583 Special Topics	1-4 Credit hours	Grade Mode: Normal Grading Mode	
Grade Mode: Normal Grading Mode		MTH 552 Modern Algebra II	3 Credit hours
GLY 585 Independent Study	1-4 Credit hours	Structure of the abstract mathematical systems; groups, rings, fields, with illustrations and application from Number Theory.	
Grade Mode: Normal Grading Mode		Pre-req: MTH 550 with a minimum grade of C.	
GLY 586 Independent Study	1-4 Credit hours	Grade Mode: Normal Grading Mode	
Grade Mode: Normal Grading Mode		MTH 580 Special Topics	1-4 Credit hours
GLY 587 Independent Study	1-4 Credit hours	Courses on special topics not listed among the current course offerings.	
Grade Mode: Normal Grading Mode		Attributes: No Textbook Required	
GLY 588 Independent Study	1-4 Credit hours	Grade Mode: Normal Grading Mode	
Grade Mode: Normal Grading Mode			
GLY 640 Physical Aspects Geology	1-4 Credit hours		
Grade Mode: Normal Grading Mode			
GLY 641 Biological Aspect Geology	1-4 Credit hours		
Grade Mode: Normal Grading Mode			

MTH 585 Independent Study	1-4 Credit hours	MTH 650 Real Variables I	3 Credit hours
Attributes: No Textbook Required		A study of measure and integration and related topics.	
Grade Mode: Normal Grading Mode		Pre-req: MTH 528 with a minimum grade of C.	
MTH 589 Graduate Mathematics Seminar	1 Credit hour	Grade Mode: Normal Grading Mode	
A seminar on topics relevant to graduate students in mathematics, including college-level teaching, conducting research, professional ethics, and mathematics careers. This course does not satisfy any degree requirements.		MTH 655 Number Theory	3 Credit hours
Attributes: No Textbook Required		A survey of some basic properties of the integers: divisibility (prime numbers, factorization, perfect numbers), congruences (modular arithmetic, linear and quadratic congruences, the Chinese Remainder Theorem), and Diophantine equations.	
Grade Mode: Credit/No Credit Grade Only		Grade Mode: Normal Grading Mode	
MTH 615 Partial Differential Equations	3 Credit hours	MTH 667 Num Partial Diff Equations	3 Credit hours
Elementary partial differential equations. Heat equation, Laplace's equation, separation of variables, Fourier series, vibrating strings, eigenvalue problems, finite differences, Bessel functions, Legendre polynomials.		Finite difference methods for elliptic, parabolic, and hyperbolic PDEs. Study of properties such as consistency, convergence, and stability. Computer implementation.	
Grade Mode: Normal Grading Mode		Pre-req: MTH 527 with a minimum grade of C.	
MTH 616 Advanced Differential Equations	3 Credit hours	Grade Mode: Normal Grading Mode	
Differential equations are studied qualitatively. Topics include the existence and uniqueness of solutions and the behavior of solutions including the stability of nonlinear systems, periodic solutions, and approximation using perturbation methods.		MTH 670 Independent Study	1-4 Credit hours
Grade Mode: Normal Grading Mode		An independent program of study of advanced topics not normally covered in other courses. The topics are chosen upon mutual agreement between the student and the instructor	
MTH 630 Topology I	3 Credit hours	Attributes: No Textbook Required	
General topology including separation axioms, connectedness, compactness, convergence, continuity, metric spaces, product and quotient spaces.		Grade Mode: Normal Grading Mode	
Grade Mode: Normal Grading Mode		MTH 681 Thesis	1-6 Credit hours
MTH 631 Topology II	3 Credit hours	Attributes: No Textbook Required, Thesis	
General topology including separation axioms, connectedness, compactness, convergence, continuity, metric spaces, product and quotient spaces.		Grade Mode: Normal Grading Mode	
Pre-req: MTH 630 with a minimum grade of C and MTH 550 with a minimum grade of C.		MTH 690 Special Topics	1-4 Credit hours
Grade Mode: Normal Grading Mode		Courses on special topics not listed among the current course offerings. (PR: Permission of Instructor)	
MTH 635 Graph Theory and Combinatorics	3 Credit hours	Grade Mode: Normal Grading Mode	
The course is designed to introduce students in mathematical sciences to the theorems, techniques and applications of graph theory and combinatorics.		Nat Resources & Environment	
Grade Mode: Normal Grading Mode		NRE 500 Soil Fertility/Plant Nutrition	4 Credit hours
MTH 640 Complex Variables I	3 Credit hours	This course will examine properties of soil fertility, its relationship to plan nutrition, and practices in nutrient management and fertilizer application.	
A study of algebra, topology, and geometry of the complex plane; holomorphic functions; conformal mapping; analytic functions and analytic continuation; complex integration; representation theorems; convergence theorems and related topics.		Grade Mode: Normal Grading Mode	
Attributes: No Textbook Required		NRE 502 Sustainable Agriculture	3 Credit hours
Grade Mode: Normal Grading Mode		This course will examine the principles of sustainable agriculture and its relationship with natural resources while identifying challenges to agricultural sustainability and frontiers in the field.	
MTH 642 Numerical Linear Algebra	3 Credit hours	Grade Mode: Normal Grading Mode	
Direct and iterative methods for numerical solution of linear systems of equations. Eigenvalues and eigenvectors. Error analysis and norms. Related Topics.		NRE 525 Water Policy & Regulations	3 Credit hours
Attributes: No Textbook Required		Examination of how aquatic resources are protected for humans and species of concern by current regulatory framework.	
Grade Mode: Normal Grading Mode		Grade Mode: Normal Grading Mode	
MTH 643 Numerical Analysis	3 Credit hours	NRE 531 Aqua Toxicology	4 Credit hours
The theory and technique of numerical computation involving the difference calculus, the summation calculus, interpolation methods, solutions of equations, and methods of solution of ordinary differential equations.		This course will introduce students to the principles of aquatic toxicology including regulations driving biological criteria, development of laboratory toxicity testing and test methodology.	
Grade Mode: Normal Grading Mode		Grade Mode: Normal Grading Mode	
		NRE 540 Seminar I	1 Credit hour
		Introduction to graduate research and individual topics, development of literature research skills, reading and discussion of keystone papers, support for research project prospectus development and beginning the literature portfolio for the thesis.	
		Grade Mode: Normal Grading Mode	

NRE 560 Seminar II	1 Credit hour	NRE 681 Thesis	1-8 Credit hours
This course focus is discussion of fundamental and cornerstone literature from the field of nature resources. Emphasis will be given to research methods and individual student project development.		Thesis	
Grade Mode: Normal Grading Mode		Grade Mode: Normal Grading Mode	
NRE 580 Special Topics	1-4 Credit hours	Physics	
Study of an advanced topic not normally covered in other courses.		PHY 505 Optics Lab	
Grade Mode: Normal Grading Mode		2 Credit hours	
NRE 581 Special Topics	1-4 Credit hours	A course in optical experiments encompassing geometrical and physical optics. This course is to be taken with Physics 304.	
Study of an advanced topic not normally covered in other courses.		Pre-req: PHY 304 (may be taken concurrently).	
Grade Mode: Normal Grading Mode		Concurrent PR: PHY 304	
NRE 582 Special Topics	1-4 Credit hours	Grade Mode: Normal Grading Mode	
Study of an advanced topic not normally covered in other courses.		PHY 508 Thermal and Stat Physics	
Grade Mode: Normal Grading Mode		3 Credit hours	
NRE 583 Special Topics	1-4 Credit hours	Introduction to Thermodynamics, kinetic theory of gases, classical and quantum statistical mechanics, Bose-Einstein and Fermi-Dirac statistics, and application. 3 cr. lec.	
Study of an advanced topic not normally covered in other courses.		Grade Mode: Normal Grading Mode	
Grade Mode: Normal Grading Mode		PHY 515 Electronics Lab	
NRE 585 Independent Study	1-4 Credit hours	2 Credit hours	
Independent Study (1-4 hrs)		A course in laboratory measurements encompassing transistors, integrated circuits, and their associated circuits. This course is to be taken with Physics 314.	
Grade Mode: Normal Grading Mode		Grade Mode: Normal Grading Mode	
NRE 586 Independent Study	1-4 Credit hours	PHY 520 Astrophysics	
Independent Study (1-4 hrs)		3 Credit hours	
Grade Mode: Normal Grading Mode		A detailed study of core problems in Astrophysics such as orbital dynamics, radiation processes, stellar structure and evolution, galactic dynamics, and cosmology.	
NRE 587 Independent Study	1-4 Credit hours	Grade Mode: Normal Grading Mode	
Independent Study (1-4 hrs)		PHY 521 Modern Physics Lab	
Grade Mode: Normal Grading Mode		2 Credit hours	
NRE 588 Independent Study	1-4 Credit hours	Laboratory exercises on modern physics topics encompassing both experiments of historic significance and current applications. To be taken with Physics 320, or equivalent.	
Independent Study (1-4 hrs)		Grade Mode: Normal Grading Mode	
Grade Mode: Normal Grading Mode		PHY 525 Solid State Physics	
NRE 640 Seminar III	1 Credit hour	3 Credit hours	
The course utilizes relevant literature from the Natural Sciences to investigate data analysis and presentation methods. Topics include statistical methods selection, graphical presentations, journal selection and interpretation of data outcomes.		The purpose of this course is to provide a broad introduction to the structures and physical properties of solids, which are of extraordinary importance in the modern world.	
Grade Mode: Normal Grading Mode		Grade Mode: Normal Grading Mode	
NRE 660 Seminar IV	1 Credit hour	PHY 535 Computational Physics	
The course focuses on transition to professional opportunities beyond graduate school. Discussions will include scientific publication and public presentation in multiple venues and formats, expectations of various career options and applications of science in decision making.		3 Credit hours	
Grade Mode: Normal Grading Mode		A course in using numerical methods and computer programming languages for solving complex physics problems and for the simulation of various physical processes. 2 lec-2 lab.	
NRE 670 Independent Study	1-4 Credit hours	Grade Mode: Normal Grading Mode	
Independent Study		PHY 542 Quantum Mechanics	
Grade Mode: Normal Grading Mode		3 Credit hours	
NRE 671 Independent Study	1-4 Credit hours	Mathematical formalism of quantum mechanics, particles in potential fields, perturbation theory and other approximation methods, scattering, applications to simple systems. 3 lec.	
Independent Study		Grade Mode: Normal Grading Mode	
Grade Mode: Normal Grading Mode		PHY 543 Quantum Mechanics II	
NRE 672 Independent Study	1-4 Credit hours	3 Credit hours	
Independent Study		This is the second part of a two-semester introduction to quantum mechanics. Emphasis is on applications of quantum theory including approximation techniques and the study of more realistic quantum systems.	
Grade Mode: Normal Grading Mode		Grade Mode: Normal Grading Mode	
NRE 673 Independent Study	1-4 Credit hours		
Independent Study			
Grade Mode: Normal Grading Mode			
NRE 680 Special Topics	1-4 Credit hours		
Study of an advanced topic not normally covered in other courses.			
Grade Mode: Normal Grading Mode			

PHY 544 Advanced Lab	2 Credit hours	PHY 610 Special and Gen Relativity	3 Credit hours
Developments in producing and detecting correlated photon pairs has enabled implementation of undergraduate laboratories demonstrating fundamental quantum mechanical principles. This laboratory also incorporates fundamental solid state and materials science experiments.		General relativity, the classical theory of one of the four fundamental forces, is not a standard course offer. This course of Special and General Relativity intends to fill this gap by introducing the key concepts that lead to a revolution in our understanding of space and time. The students will learn about spacetime curvature, metrics, geodesics, black holes, gravitational waves, and cosmology.	
Pre-req: PHY 525 (may be taken concurrently) with a minimum grade of D and PHY 542 (may be taken concurrently) with a minimum grade of D.		Grade Mode: Normal Grading Mode	
Concurrent PR: PHY 525 and PHY 542		PHY 620 Modern Astrophysics I	3 Credit hours
Grade Mode: Normal Grading Mode		Modern Astrophysics is firmly grounded in the fundamental principles of physics, and will offer students the opportunity to use the physics they have learned in understanding the nature of the universe. This course provides a graduate-level introduction to astrophysics, focusing on stellar structure and evolution.	
PHY 545 Math Methods of Physics	3 Credit hours	Grade Mode: Normal Grading Mode	
An introduction to the theory of orthogonal functions, curvilinear coordinate systems, vector and tensor fields and their applications in Physics. Problems are drawn from different areas of physics. 3 lec.		PHY 625 Condensed Matter Physics	3 Credit hours
Grade Mode: Normal Grading Mode		This course studies complex phenomena that occur in solids and quantum liquids, and exposes the students to some theoretical tools used to describe the basic interactions behind these phenomena.	
PHY 546 MTH Methods of Physics II	3 Credit hours	Grade Mode: Normal Grading Mode	
A second semester of a full year course on methods of solving problems in physics: calculus of variations, ordinary partial differential equations and special functions with real physics problems.		PHY 630 Classical Mechanics	4 Credit hours
Pre-req: PHY 545.		Study of variational principles and Lagrange's equations, the two-body central force problem, the kinematics and dynamics of rigid-body motion, Hamilton equations of motion, canonical transformations, Hamilton-Jacobi theory, and small oscillations.	
Grade Mode: Normal Grading Mode		Grade Mode: Normal Grading Mode	
PHY 547 Mechanics for Teachers	4 Credit hours	PHY 631 Seminar	1 Credit hour
An indepth study of mechanics for education majors specializing in Physics with emphasis on problem solving techniques, demonstrations, experiments and computer applications. (PR: PHY 203, MTH 122 and MTH 140)		Grade Mode: Normal Grading Mode	
Grade Mode: Normal Grading Mode		PHY 632 Seminar	1 Credit hour
PHY 580 Special Topics	2-4 Credit hours	Grade Mode: Normal Grading Mode	
Grade Mode: Normal Grading Mode		PHY 640 Fundamentals of Physics	4 Credit hours
PHY 581 Special Topics	1-4 Credit hours	A course in fundamental concepts of physics. Subject content varies. Designed primarily to strengthen conceptual understanding of teachers.	
Grade Mode: Normal Grading Mode		Grade Mode: Normal Grading Mode	
PHY 582 Special Topics	1-4 Credit hours	PHY 642 Adv Quantum Mechanics	4 Credit hours
Grade Mode: Normal Grading Mode		This course covers advanced topics of quantum mechanics at the graduate level. Topics include fundamental issues, approximation methods and applications.	
PHY 583 Special Topics	1-4 Credit hours	Pre-req: PHY 630 (may be taken concurrently) with a minimum grade of D.	
Grade Mode: Normal Grading Mode		Concurrent PR: PHY 630	
PHY 585 Independent Study	1-4 Credit hours	Grade Mode: Normal Grading Mode	
Grade Mode: Normal Grading Mode		PHY 645 Methods of Math. Physics	4 Credit hours
PHY 586 Independent Study	1-4 Credit hours	This course will review and develop theories of real and complex analysis, group theory, tensors, special functions, differential and integral transforms, emphasizing their application to electrodynamics, quantum statistical mechanics, etc.	
Attributes: No Textbook Required		Grade Mode: Normal Grading Mode	
Grade Mode: Normal Grading Mode		PHY 661 Special Topics	1-3 Credit hours
PHY 587 Independent Study	1-4 Credit hours	Grade Mode: Normal Grading Mode	
Grade Mode: Normal Grading Mode		PHY 662 Special Topics	1-3 Credit hours
PHY 588 Independent Study	1-4 Credit hours	Grade Mode: Normal Grading Mode	
Grade Mode: Normal Grading Mode		PHY 682 Thesis Research	1-6 Credit hours
PHY 600 Electricity and Magnetism I	4 Credit hours	Attributes: Thesis	
A study of electrostatics and associated boundary-value problems, electric multipoles and macroscopic media, dielectrics, magnetostatics, time-varying fields, Maxwell equations and conservation laws, plane electromagnetic waves and wave propagation.		Grade Mode: Normal Grading Mode	
Grade Mode: Normal Grading Mode			
PHY 608 Statistical Mechanics	4 Credit hours		
The course introduces thermodynamics and statistical mechanics to graduate students of physics and other science and engineering disciplines as two complimentary approaches to study physical properties of systems in equilibrium.			
Grade Mode: Normal Grading Mode			

PHY 685 Independent Study 1-4 Credit hours

Advanced Independent Study in Physics.

Attributes: No Textbook Required

Grade Mode: Normal Grading Mode

PHY 686 Independent Study 1-4 Credit hours

Advanced Independent Study in Physics.

Grade Mode: Normal Grading Mode

Statistics**STA 512 Regression Analysis 3 Credit hours**

Determining regression models; deriving parameter estimates using calculus; detailed coverage of tests of assumptions and remedial procedures (transformations and weighted least-squares); multiple and polynomial regression; tests and corrections for autocorrelation.

Pre-req: STA 545 with a minimum grade of C.

Grade Mode: Normal Grading Mode

STA 513 Experimental Designs 3 Credit hours

Principles of experimentation; Analysis of variance; Latin square and related designs; Factorial designs, Response Surface; Robustness; Nested and Split-Plot designs.

Pre-req: STA 545 with a minimum grade of C.

Grade Mode: Normal Grading Mode

STA 518 Biostatistics 3 Credit hours

Statistical skills for biological/biomedical research, with emphasis on applications. Experimental design/survey sampling, estimation/hypothesis testing procedures, regression, ANOVA, multiple comparisons. Implementation using statistical software such as SAS, BMDP. May not be used for any degree offered by the Department of Mathematics.

Grade Mode: Normal Grading Mode

STA 520 Nonparametric Statistics 3 Credit hours

Coverage of a variety of nonparametric or distribution-free markets for practical statistical inference problems in hypothesis testing and estimation, including rank procedures and randomization procedures.

Pre-req: STA 545 with a minimum grade of C.

Grade Mode: Normal Grading Mode

STA 525 Sampling Design & Estimation 3 Credit hours

Coverage of the theory and applications of a variety of sampling designs; sample size determination; ratio and regression estimates; comparisons among the designs.

Grade Mode: Normal Grading Mode

STA 535 Statistical Data Mining 3 Credit hours

Introduction to statistical learning techniques for analyzing high dimensional data. Topics include data mining strategy, explanatory analysis, predictive modeling techniques and model assessment.

Grade Mode: Normal Grading Mode

STA 545 Probability and Statistics I 3 Credit hours

Probability spaces, conditional probability, and applications. Random variables, distributions, expectations, and moments.

Grade Mode: Normal Grading Mode

STA 546 Probability and Statistics II 3 Credit hours

Probability spaces, conditional probability, and applications. Random variables, distributions, expectations, and moments.

Pre-req: STA 545 with a minimum grade of C.

Grade Mode: Normal Grading Mode

STA 564 Statistical Computing 3 Credit hours

Introduction to the commonly used statistical computing techniques, procedures and methods, with extensive use of R language and environment, and SAS for statistical computing and graphics. (CR/PR: STA 545 or STA 546)

Pre-req: STA 545 with a minimum grade of C.

Grade Mode: Normal Grading Mode

STA 570 Applied Survival Analysis 3 Credit hours

Survival and hazard functions, parametric and non-parametric methods, models and inferences for survival data, proportional hazard, and regression diagnosis.

Pre-req: STA 545 with a minimum grade of C.

Grade Mode: Normal Grading Mode

STA 580 Special Topics 1-4 Credit hours

Courses on special topics in statistics not listed among current course offerings.

Attributes: No Textbook Required

Grade Mode: Normal Grading Mode

STA 585 Independent Study 1-4 Credit hours

A faculty supervised, individualized course of study of a topic in statistics.

Attributes: No Textbook Required

Grade Mode: Normal Grading Mode

STA 634 Stat Mtds for Researchers 3 Credit hours

Aspects of statistical modeling including model building, adequacy assessment, inference, and prediction. Applications to social biological, and medical sciences; engineering; and industry.

Grade Mode: Normal Grading Mode

STA 660 Stochastic Processes 3 Credit hours

Theory and applications of Markov chains. (PR: MTH 545)

Pre-req: STA 545 with a minimum grade of C.

Grade Mode: Normal Grading Mode

STA 661 Adv Math Statistics 3 Credit hours

Topics in mathematical statistics including distribution theory for functions of random variables, convergence concepts, sufficient statistics, finding optimal estimates for parameters, optimal test of hypotheses. (PR: MTH 546)

Pre-req: STA 546 with a minimum grade of C.

Grade Mode: Normal Grading Mode

STA 662 Appl Multivariate Stat Methods 3 Credit hours

Introduction to multivariate statistical analyses and methodologies of various types of datasets that are commonly encountered in medical, business, engineering, science, and any other data intensive disciplines.

Pre-req: STA 546 with a minimum grade of C.

Attributes: No Textbook Required

Grade Mode: Normal Grading Mode

STA 663 Time Series Forecasting 3 Credit hours

Finding statistical models to represent various time-dependent phenomena and processes; coverage of a variety of forecasting techniques, with an emphasis on adaptive, regression, and Box-Jenkins procedures.

Pre-req: STA 545 with a minimum grade of C.

Grade Mode: Normal Grading Mode

STA 664 Bayesian Statistics **3 Credit hours**

An introduction to Bayesian Statistics with focus on Bayesian Modeling, inference and Data Analysis. Applications will be studies with appropriate statistical software.

Pre-req: STA 545 with a minimum grade of D.

Grade Mode: Normal Grading Mode

STA 665 Advanced Stat Learning **3 Credit hours**

An overview of concepts and techniques in advanced statistical learning. Topics include supervised/unsupervised learning, kernel smoothing methods, trees, random forests, association rules, neural networks and support vector machines.

Pre-req: STA 535 with a minimum grade of D.

Grade Mode: Normal Grading Mode

STA 670 Independent Study **1-4 Credit hours**

A faculty supervised, individualized course of study of a topic in statistics.

Grade Mode: Normal Grading Mode

STA 681 Thesis **1-6 Credit hours**

Investigate a theoretical or applied statistics problem under faculty mentorship.

Attributes: No Textbook Required, Thesis

Grade Mode: Normal Grading Mode

STA 690 Special Topics **1-4 Credit hours**

Courses on special topics in statistics not listed among the current course offerings.

Grade Mode: Normal Grading Mode