SCHOOL OF SCIENCE AND TECHNOLOGY

Dr. Mark G. Hardy, Associate Dean
P.O. Box 18750
Telephone: (601) 979-2153
Fax: (601) 979-2058
E-mail: mark.g.hardy@jsums.edu

Departments

- Biology
- Chemistry
- Mathematics
- Physics, Atmospheric Sciences & General Science
- Technology

The School of Science and Technology resulted from the merger of the School of Industrial and Technical Studies and the Division of Natural Sciences, previously in the School of Liberal Studies. This reorganization was authorized July 1, 1983 for the purpose of consolidating the scientific and technical resources of the University into an efficiently focused endeavor capable of meeting the demands of new technology.

The departments comprising the School of Science and Technology are: (1) Department of Biology, (2) Department of Chemistry, (3) Department of Mathematics, 4) Department of Physics, Atmospheric Science and General Science, and (5) Department of Technology. The school offers graduate programs in various areas leading to the M.S., M.S.T., and Ph. D. degrees.

Active research programs in all departments are consistently maintained. The School of Science and Technology is also actively involved in a number of cooperative external programs with national and international institutions designed to enhance student and faculty development. The cooperative programs serve to broaden faculty and student exposure as well as give national and international visibility to Jackson State University.

DEPARTMENT OF BIOLOGY

Dr. Paul B. Tchounwou, Distinguished Professor and Chair
P.O. Box 18540
Telephone: (601) 979-2586
Fax: (601) 979-5853
e-mail: paul.b.tchounwou@jsums.edu

Faculty

Dr. G. Begonia, Professor
Dr. M. Begonia, Associate Professor
Dr. J. Cameron, Professor
Dr. P. Chigbu, Associate Professor
Dr. S. Ekunwe, Associate Professor
Dr. I. Farah, Associate Professor
Dr. K. Goldman, Assistant Professor
Dr. M. Hardy, Professor
Dr. E. Hamadain, Associate Professor
Dr. C. Howard, Assistant Professor
Dr. H. Hwang, Professor
Dr. E. Izevbigie, Associate Professor
Dr. R. Kafoury, Assistant Professor
Dr. A. Mohamed, Professor
Dr. J. Stevens, Assistant Professor
Dr. B. Wilson, Associate Professor

The Department of Biology offers graduate study leading toward the following advanced degrees: Master of Science (M.S.), Master of Science in Environmental Science (M.S.), and Master of Science in Teaching (M.S.T.).

Program Objectives

1. To provide academic and practical training of high quality at the master's degree level,
2. To contribute to the pool of biologists qualified to undertake doctoral degree programs, and to obtain employment in industry, government and academic institutions, and
3. To offer a program that will enable environmental science majors to obtain the necessary classroom, laboratory and field experiences required for entering areas in and related to environmental science directly upon graduation.

Degree Programs

The M.S. is research-oriented; the M.S.T. is generally a course-oriented degree. All are designed to satisfy academic requirements for those students intending eventually to seek degree(s) beyond master's or specialist's level.

Admissions Requirements

All applicants seeking admission to the Master of Science program in Biology must meet the following minimum admission requirements:

1. An undergraduate degree in biology or related field.
2. A passing grade (C or better) in undergraduate biology courses with a grade point average of 3.00 or higher as evidenced by an official transcript
3. Three letters of recommendation from former college professors sent directly to the department.
4. Satisfactory score on the GRE, sent directly to the department.
5. Applicants must also meet all the requirements as set forth by the Graduate School

Transfer of Credits

Course for which transfer credit are sought must have been completed with a grade of "B" or better. Approval is required by the Chair of the Department and Director of the MS program.

Time Limit

No student will be granted an MS degree unless all requirements are completed within a period of eight (8) consecutive calendar years from the time of admission to the program.

Residence

Students are required to spend one academic year in resident study on the campus. One academic year may include two adjacent regular semesters or one regular semester and one adjacent summer session. To satisfy the continuous residence requirement, the student must complete a minimum of eighteen (18) hours for the required period.

Master of Science in Biology

Courses available for the M.S. degree in Biology provide appropriate preparation for:

1. Biological, marine and environmental sciences.
2. Advanced professional degrees elsewhere in zoology, plant science, marine science, environmental biology, environmental health, toxicology and meteorology, physiology, microbiology, biochemistry, anatomy and other associated areas.
3. Research careers in industry, government and academic institutions.
4. Professional degrees in medicine, dentistry, veterinary medicine, pharmacy and related health fields.

Degree Requirements

A student is required to complete a minimum of thirty (30) semester hours with a "B" or better average and submit an acceptable thesis. Six (6) of the required credits must be in "Thesis Research".

Required Courses

Course	Title	Semester Hours
BIO 511	Biostatistics	3
BIO 515	Molecular Biology, or	
BIO 540	Cell Biology, or	
CHEM 531	Biochemistry	4
BIO 589	Graduate Seminar	1
BIO 599	Thesis Research	6
	Total Hours	14

Elective Concentration Courses

A student in consultation with his/her advisor and guidance committee must select a minimum of sixteen (16) semester hours from departmental course offerings to complete degree requirements with emphasis in one of the following areas.

Molecular and Developmental Biology
Genetics and Microbiology
Anatomy and Physiology
Plant Science
Environmental and Marine Biology
Invertebrate Zoology

Master of Science in Teaching Degree

The Master of Science in Teaching degree provides: (1) M.S.T. at Jackson State University, (2) Advanced certification for teacher education in the biological sciences, (3) Careers in educational administration, and (4) Advanced degrees in science education and related fields.

Degree Requirements

A student seeking the M.S.T. degree may select from one of three programs options, i .e.

1. Thirty (30) semester hours plus an acceptable thesis. Six (6) of the required credits must be in BIO 599-Thesis Research.
2. Thirty-three (33) semester hours plus an acceptable research project. Three of the required credits must be in BIO 587-Independent Study.
3. Thirty-six (36) semester hours.

Required Core

Course	Title	Semester Hours
EDFL 511	History and Philosophy of Education	3
PSY 566	Advanced Educational Psychology	3
EDFL 568	Curriculum Methods	3
EDFL 515	Methods of Educational Psychology	3
EDFL 514	Elementary Statistics	3
	Total hours	15
BIO 509	General Genetics	4
BIO 515	Molecular Biology	4
BIO 523	Ecology	4
BIO 589	Graduate Seminar	1
	Total hours	13

*Any student who does not have a Class "A" teaching certificate must also complete the following course requirements for certification.

PSY 305	Adolescent Psychology	3
BIO 401	Biology in Secondary Schools or	4
BIO 505	Biology for Teachers	
EDCI 591	Practicum and Student Teaching	9
	Total Hours	16

Elective and Concentration Courses

A student selecting program options No. 2 or 3 in consultation with his/her advisor and guidance committee must select sufficient electives (see below) from departmental courses to complete degree requirements with emphasis in one of the following areas.

Molecular and Developmental Biology
Plant Science
Genetics and Microbiology
Environmental and Marine Biology
Invertebrate Zoology
Anatomy and Physiology

Total Required Hours Brought Forward (All Options)		21
Option 1:		
BIO 599	Thesis Research	6
	Elective in biology, environment or general sciences	3
	Total Hours	30
Option 2:		
Bio 587	Independent Study	2
	Electives in biology, environment or general sciences	10
	Total Hours	33
Option 3:		
	Electives in biology, environment or general sciences	15
	Total Hours	36

Master of Science
ENVIRONMENTAL SCIENCE

Dr. Huey-Min Hwang, Director and Professor
P.O. Box 18540
Telephone: (601) 979-2595
Fax: (601) 979-6856
e-mail: hwang@ccaix.jsums.edu

Faculty

Dr. G. Begonia, Professor
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Dr. K. Goldman, Assistant Professor
Dr. E. Hamadain, Associate Professor
Dr. M. Hardy, Professor
Dr. R. Kafoury, Assistant Professor
Dr. E. Izevbigie, Associate Professor
Dr. P. Tchounwou, Distinguished Professor
Dr. B. Wilson, Associate Professor

Program Objectives

More than ever, responsible decision making in an age of global awareness requires more information on the consequences of our actions. Decisions based on new information need to be global, cooperative and interdisciplinary if we are to chart a course toward a sustainable world. The MS Environmental Science Program helps provide the student with the tools and knowledge to ask the proper questions and help provide acceptable answers. Research is needed in the federal, state and private sectors to raise consciousness, arouse curiosity, and provide information for environmental evaluation. Qualified professionals are required by government agencies to carry out and enforce mandated laws in the protection of the environment. The Environmental Science Masters program is located academically in the Department of Biology and serves students in the School of Science and Technology.

Objectives of this program are:

- to provide an education that allows for greater opportunities in employment and further education in the diverse field of environmental science, particularly as the need relates to minorities and women.
- to provide a cadre of trained individuals committed to using their environmental literacy toward the betterment of the environment and mankind.

Admission Requirements

Admission is open to persons holding an undergraduate degree in a science with the following prerequisites:

1. An undergraduate science degree from an accredited institution with a grade point average of 3.00 or higher as evidenced by an official transcript.
2. Demonstrated satisfactory performance on the Graduate Record Examination (GRE) taken preferably before entrance into the program.
3. Three letters of recommendation.
4. A career goals essay.
5. A personal and/or telephone interview may be required
6. Other considerations such as work or life experiences which are directly related to potential success for completion of the program may be factored into the admission criteria.

Degree Requirements

The student will be required to complete a minimum of 30 semester hours, 24 of these hours will include course work whereby a B of higher will be maintained. A minimum of 6 semester hours will be taken in Thesis Research leading toward the completion of an acceptable thesis. The student will follow a testing schedule consisting of written graduate comprehensive and the thesis defense.

The student in consultation with her/his advisor and committee will select elective courses from those areas and departments offering appropriate instruction. It is the student's responsibility to fill out and return all forms at the appropriate times during the student's tenure in the department.

Core Course Requirements

Course	Title	Semester Hours
BIO 506	Human Environments and Natural Systems	4
BIO 511	Biostatistics	3
BIO 523	Ecology	4
BIO 589	Graduate Seminar	1
	Total Hours	12

Elective Courses

BIO 514	Methods in Environmental Analysis	4
BIO 515	Molecular Biology	4
BIO 516	Marine Botany	4
BIO 512	Natural Resources and Conservation	4
BIO 531	Invertebrate Zoology	4
BIO 533	Biology of Water Pollution	4
BIO 534	Ichthyology	4
BIO 540	Cell Biology	4
BIO 546	Selected Topics in Marine/Env Sc	1
BIO 547	Introduction to Oceanography	4
BIO 553	Tropical Marine Ecology	4
BIO 580	Limnology	4
BIO 602	Special Problems in Env Science	1-4
BIO 610	Environmental Microbiology	4
BIO 615	Principles of Bioremediation	3
CHEM 515	Environmental Chemistry	4
ITHM 520-531	Industrial/Technical Hazardous Materials Management courses	3-6
BIO 599	Thesis Research	6

DESCRIPTION OF COURSES

BIO 501 Environmental Science (3 Hours). An introductory course for non-major graduate students dealing with the science of the environment and man's relationships through political, social, economic, and ethical processes.

BIO 506 Human Environments and Natural Systems (3 Hours). Emphasis placed on fundamental problems that confront man from day to day. Topics among others for discussion are ecology, population, energy, food, transportation and land pollution.

BIOL 506 Human Environments and Natural Systems Lab. (1 Hour) Selected laboratory exercises, visiting lectures and field trips are designed to provide a broad view of applications and concepts in environmental science.

BIO 507 Biology for Elementary Teachers. (3 Hours) Prerequisites: None. The application of biological procedures and techniques at the elementary school level with emphasis on selected topics in biology.

BIOL 507 Biology for Elementary Teachers Laboratory. (1 hour) Prerequisite: Bio 101. Laboratory designed to expand and illustrate subject-matter areas stressed in Bio 507.

BIO 508 Fundamentals of Electron Microscopy. (4 hours) Prerequisites: Senior, graduate level, and consent of instructor. To introduce the students to the techniques of electron microscopy so that they may be able to initiate their own biological investigations. Emphasis will be placed on laboratory work.

BIO 509 General Genetics. (4 Hours) Prerequisite: Bio 318. A study of the principal concepts of heredity to include the application of classical and modern genetics.

BIO 511 Biostatistics. (3 Hours) This course is designed for students in biological sciences with no advanced training in mathematics. Basic concepts in statistical methods and experimental techniques and their general applicability in biology will be stressed.

BIO 512 Natural Resources and Conservation (3 hours) A study of our natural resources with emphasis on their origin, properties, use and misuse and good conservation practices.

BIOL 512 Natural Resources and Conservation Lab. (1 hour) Students are involved in the collection of data concerning the use and the analysis of conservation practices for both domestic and public waste, water, and energy resources.

BIO 513 Advanced Human Nutrition. (3 Hours) Prerequisites: Bio 233 or 218 and CHEM 241. Review of nutrient sources, requirements and deficiency diseases of man. Emphasis on nutritional metabolism under normal and pathological conditions, and current research.

BIO 514 Methods of Environmental Analysis. (3 Hours) Theory, methods and techniques for identifying and qualifying environmental contaminants. Sampling methods are discussed and some coverage is provided on methods for separation and concentration.

BIO 515 Molecular Biology. (3 Hours) Study of the structure, synthesis, isolation and interactions of macromolecules of biological interest.

BIOL 515 Molecular Biology Laboratory. (1 Hour) Prerequisite: Must be taken concurrently with Bio 515. Laboratory techniques used to purify proteins, DNA, and RNA and the methods used to analyze these macromolecules.

***BIO 516 Marine Botany.** (3 Hours) Prerequisites: Bio 119, Biol 119, Bio 416; open to qualified undergraduates. Survey of seaweeds (marine algae), marine phytoplankton and maritime vascular plants, treating structure, reproduction, life histories, distribution and ecology. Lecture and laboratory to be taken during same semester.

***BIOL 516 Marine Botany Laboratory.** (1 Hour) Prerequisite: Must be taken with lectures in Bio 516. Collection, preservation and preparation and microscopic examination with purpose of emphasizing identification of seaweeds.

BIO 520 Biological Photography. (3 Hours) Prerequisite: Consent of instructor. The course is designed to equip students with the knowledge and expertise to produce high quality prints and slides. Emphasis is placed on laboratory work (darkroom).

BIOL 520 Biological Photography Laboratory. (1 Hour) Laboratory activities give the student experience in exposing and developing black and white films and making prints with various print papers. Must be taken concurrently with Bio 520.

BIO 521 Plant Morphology. (3 Hours) Prerequisite: Bio 119. Study of anatomical, reproductive, ontogenetic and phylogenetic aspects of vascular and non-vascular plants.

BIOL 521 Plant Morphology Laboratory. (1 Hour) Selection of exercises involving the structures, developments and relationships of nonvascular and vascular plants.

BIO 522 Plant Taxonomy. (3 Hours) Prerequisite: Bio 119. Classification and nomenclature of flowering plants; introductory method of collection; laboratory and field studies of representative plant families.

BIOL 522 Plant Taxonomy Laboratory. (1 Hour) Prerequisites: Botany 118, 119. Exercises on collection, classification and nomenclature of flowering plants.

BIO 523 Ecology. (3 Hours) Prerequisite: Senior standing or consent of instructor. A study of the trophic relationships and energy transfer in ecosystems.

BIOL 523 Ecology Lab. (1 Hour) This lab course is designed to be, and should be, taken concurrently with the Ecology lecture course (BIO 523). The ecology laboratory sesions are structured to reinforce topics discussed in lecture and provide a treatment of technical topics not covered in the lecture. Methods common to the laboratory and field will be taught. Students will 1) gain a deeper understanding of the main concepts of ecology and ecological processes and 2) develop critical and analytical thinking skills along with reasoning and logical thinking skills, and apply them to ecological concepts.

BIO 524 Plant Physiology. (3 Hours) Prerequisite: Bio 119. Principal physiological processes of plants including water relation, synthesis, and use of foods and growth phenomena are discussed.

BIOL 524 Plant Physiology Laboratory. (1 Hour) Laboratory exercises will be continued to verify the principles of Plant Physiology.

***BIO 525 Introduction to Marine Geology. (1 Hour)** Prerequisites: Bio 408, 408A, or permission of instructor; open to advanced undergraduates. Introductory geology from the marine viewpoint; morphology and origin of ocean basins, plate tectonics, marine sedimentation, coastal features and marine georesources. Lecture and laboratory to be taken during same semester.

***BIOL 525 Introduction to Marine Geology Laboratory.** (1 Hour) Prerequisite: Must be taken with lectures in Bio 525. Field and laboratory exercises in recognition of geological features and specimens, study of techniques, core samples, mapping and marine topographic profiles.

BIO 526 Mycology. (3 Hours) Prerequisite: Bio 119. A survey of the principal fungal classes. Morphology and cytology of fungi and their relation to industry and agriculture.

BIO 528 Evolution. (3 Hours) Prerequisite: Bio 409 or the equivalent. A study of the processes of organic change. Historical developments of the major concepts and mechanisms. (S)

BIO 529 Plant Anatomy. (3 Hours) An introduction to cell division, development, and maturation of the structures of the vascular plants.

BIOL 529 Plant Anatomy Laboratory. (1 Hour) Selection of exercises involving cell division, development and maturation of the structures of vascular plants.

BIO 530 Advanced Microbiology. (3 Hours) Prerequisites: Bio 313; CHEM 242. Special techniques for culturing microorganisms. Includes a survey of some of the important microbes in medicine, industry and public health.

BIOL 530 Advanced Microbiology Laboratory. (1 Hour) Teaches the student special methods in isolating, culturing, and identifying certain microorganisms of medical and industrial importance. Must be taken concurrently with Bio 530.

BIO 531 Invertebrate Zoology. (3 Hours) Prerequisites: Bio 114, CHEM 142. Intended for students who wish to obtain a comprehensive knowledge of the invertebrates.

BIOL 531 Invertebrate Zoology Laboratory. (1 Hour) Prerequisite: Must be taken concurrently with Bio 531 . A taxonomy consideration of the invertebrate fauna. Students are also introduced to empirical observation in such areas as ecology, physiology and behavior.

BIO 532 Advanced Parasitology. (3 Hours) Prerequisites: Bio 331; CHEM 142, 242. The physiology of specific parasite and host-parasite relationships will be studied in great detail. Clinical specimens will be studied.

BIOL 532 Advanced Parasitology Laboratory. (1 Hour) Prerequisite: Bio 331 and/or consent of the instructor. The course will emphasize the experimental approach to Parasitology. Important parasites of man and other animals will be studied from clinical specimens. Must be taken with Bio 532.

BIO 533 The Biology of Water Pollution (3 hours) Biological approaches to water pollution problems are discussed. The effect of pollution on life in aquatic environments is emphasized.

BIOL 533 The Biology of Water Pollution Lab. (1 hour) Selected laboratory exercises, instrument use, and field trips are designed to further enhance the student's awareness in water pollution effects, analysis and problem solving.

BIO 534 Ichthyology. (3 Hours) Prerequisites: Bio 115, Biol 115; open to advanced undergraduates. Biology and classification of marine and freshwater fish; emphasis on identification and collecting. Lecture and laboratory to be taken during same semester.

BIOL 534 Ichthyology Laboratory. (1 Hour) Prerequisites: Bio 115, Biol 115. Must be taken with lecture in Bio 534. Field collecting, sorting, preserving, classification of marine fish; emphasis on identification.

***BIO 539 Marine Microbiology.** (3 Hours) Prerequisites: Bio 313, Biol 313, 416, Biol 416. Open to advanced undergraduates. A survey of the most important marine microorganisms; emphasis on bacteria, sampling techniques, enumeration of indicator organisms, isolation of pathogenic organisms from seafood. Lecture and laboratory to be taken during same semester.

***BIOL 539 Marine Microbiology Laboratory.** (1 Hour) Prerequisites: 313, 416. Must be taken with lectures in Bio 539. Techniques in sampling, isolation, culture and enumeration of pathogenic and nonpathogenic marine microorganisms.

BIO 540 Cell Biology. (3 Hours) Prerequisites: Bio 111, 119 or 121, 313, and CHEM 241. Study of cell anatomy as revealed by electron microscopy. Emphasis on bioenergetics, cell metabolism and current cell research.

BIOL 540 Cell Biology Laboratory. (1 Hour) Prerequisites: Bio 112,119, 313. Must be taken concurrently with Bio 540. Laboratory activities which develop techniques for isolation of cellular organelles and quantitative analyses of biomolecules.

BIO 544 Arthropod Disease. (3 Hours) Prerequisites: Bio 115, 427. Emphasis is given to the control and prevention of insect and other arthropod borne diseases, the physiology, taxonomy, life-cycles and ecology of important vectors.

BIOL 544 Arthropod Disease Laboratory. (1 Hour) Study the external structure and make outline sketches to indicate the characteristics used in classification of representative forms and unknown specimens of organisms important to medicine and veterinary science.

BIO 546 Selected Topics in Marine and Environmental Studies. (1-2 Hours) Prerequisites: None; open to advanced undergraduates or others on consent of instructor. Lectures on a broad range of marine and environmental topics of general interest having special application to students in both marine sciences program. No separate laboratory.

***BIO 547 Introduction to Oceanography.** (3 Hours) Prerequisites: Bio 407, Biol 407. CHEM 254 and CHML 254, or consent of instructor; open to advanced undergraduates. Broad view of the marine world, geological, geographical, chemical, physical and biological; field trips aboard research vessels and laboratories introducing applied uses of oceanographic gear, instruments and sampling techniques. Lecture and laboratory to be taken during same semester.

***BIOL 547 Introduction to Oceanography Laboratory.** (1 Hour) Prerequisite: Must be taken with lectures in Bio 547. Introduction to oceanographic gear, its application methodology and sampling techniques; field work in practical applications.

BIO 550 Immunology and Serology. (3 Hours) The study of antibodies that are elicited in response to antigens and the difference between the protoplasm of one organism and another as reflected in the blood.

BIOL 550 Immunology and Serology Laboratory. (1 hour) Prerequisite: Bio 313 Experimental application of immunology and serology in diagnosis of microbial diseases In vitro and in vivo techniques in immune response will be investigated.

BIO 553 Tropical Marine Ecology (3 hours) Opportunity for practical field exercises in selected tropical environments.

BIO 570 Human Physiology. (3 Hours) Prerequisites: Bio 115, CHEM 242. The study of physiological processes related to the human. The physiological systems to be examined are: gastro-intestinal, renal, endocrine, neural, and reproductive.

BIOL 570 Human Physiology Laboratory. (1 Hour) Selected studies of the physiological processes of mammals with emphasis on man. Must be taken concurrently with Bio 570.

BIO 575 Endocrinology. (3 Hours) Prerequisites: Bio 115, 218; CHEM 142, 242. The basic fundamentals of endocrinology. The role of the endocrine glands and their products (hormones) in the maintenance of a constant internal environment in living organisms.

BIOL 575 Endocrinology Laboratory. (1 Hour) Prerequisites: Bio 115, 218; CHEM 142, 242. Must be taken concurrently with Bio 575, or with the consent of instructor. Experimental analysis of normal and abnormal endocrine functions. Emphasis is placed on basic laboratory techniques employed in the study of endocrine function.

BIO 576 Histopathology. (3 Hours) Prerequisites: Bio 115, 218, and 441. Provides general consideration of the principal concepts of tissues and cellular pathology, with emphasis on human tissues and pathology. The course prepares students for further studies in medicine, dentistry, and allied health fields.

BIOL 576 Histopathology Laboratory. (1 Hour) Exercises studying gross and microscopic diseased tissues and clinical cases.

BIO 580 Limnology (3 hours) Physical and chemical factors affecting the biology of ponds, reservoirs, and streams is presented. A research project in limnology will be required.

BIOL 580 Limnology Lab. (1 hour) Both chemical and biological monitoring of aquatic systems will be explored. Hack kits, conductivity meters, oxygen probes, BOD's, COD's and map surveys will be utilized.

BIO 587 Independent Study. (2 for M.S. students) Prerequisite: Graduate standing in biology. Students will elect a specific topic that is not covered in other biology courses. The student, working independently, will be required to submit a research paper that includes an exhaustive review of literature.

BIO 589 Graduate Seminar. (1 for M.S. students) A course designed for survey of biological literature. The student will be required to prepare and present reports and assigned projects. Required of all students.

BIO 590 Reproductive Physiology. (3 Hours) Prerequisites: Bio 115, CHEM 142, 242. Some prerequisites may be waived with approval of instructor. An advanced assessment of the physiology metabolism and histology of the reproductive system. The etiology of abnormal functions will be presented.

BIOL 590 Reproductive Physiology Laboratory. (1 Hour) Prerequisites: Bio 112, 218, CHEM 142, 242. Must be taken concurrently with Bio 590 or with consent of instructor. Experimental analyses of the mammalian reproductive system. Emphasis is placed on basic methodologies employed in anatomical and physiological studies of the reproductive system.

BIO 591 Advanced Developmental Biology. (3 Hours) Prerequisites: Bio 112, CHEM 242. Current experimental findings in the field of developmental biology will be presented. Theories on the mechanisms regulating differentiation and abnormal growth pattern will be discussed.

BIOL 591 Advanced Developmental Biology Laboratory. (1 Hour) Advanced laboratory techniques in the field of developmental biology will be presented and analyzed.

BIO 599 Thesis Research. (required for M.S. students) (6 Hours) Thesis representing original research.

BIO 600 Graduate Seminar Advanced topics investigated are presented by students. The student will be required to prepare and present reports and assigned projects. Required of all students.

BIO 601 Environmental Science Seminar Advanced topics of special interest, current research, field trips, demonstrations, and guest lectures in the areas of environmental science, limnology, ecology, water and air pollution, populations, solar energy, earth resources, and others.

BIO 602 Environmental Science Special Problems (4 hours) Each student will select an aspect of the environment beyond the limits of the campus. The student will define the problem, analyze it, and report on his findings and possible solutions. This problem will sometimes include on the job training with an environmental agency.

BIO 609 Advanced Genetics. (4 Hours) Prerequisite: Bio 509. Provides detailed considerations of genetic analysis, quantitative inheritance, chromosomal engineering and some concepts in genetics.

BIO 610 Environmental Microbiology (3 hours) The study of the roles of microorganisms in natural systems with attention given to the examination of nutrient cycles, methods of analysis of microbial biomass and activities as well as the functional roles of microorganisms.

BIOL 610 Environmental Microbiology Lab. (1 hour) Laboratory is designed to acquaint students with modern techniques for measuring microbial biomass and microbial degradative activities of natural and xenobiotic chemicals in natural environments. Specific projects of microbial analysis will be assigned to students.

BIO 615 Principles of Bioremediation (3 Hours) This course uses modern knowledge in life sciences, as well as new developments in biotechnology to address important issues related to environmental clean-up of hazardous wastes. The nature of environmental pollution is reviewed, and basic concepts in molecular biology, biochemistry, microbiology and plant physiology are applied to demonstrate the significance of bioremediation and phytoremediation in pollution control. Therefore, an

emphasis is put on the use of biological methods and processes for the remediation of contaminated soils and water resources.

BIOL 615 Principles of Bioremediation (1 Hour) Laboratory and field experiments conducted to familiarize students and methodologies. Identification and classification of microorganisms, use of bacteria in toxicity assessment, biodegradation of organic contaminants, and phytoremediation ot toxic metals are dicussed.

BIO 620 Independent Study Students will elect a specific topic that is not covered in other biology courses. The student, working independently, will be required to submit a research paper that includes an exhaustive review of literature.

BIO 621 Advanced Plant Morphology. (4 Hours) Prerequisite: Bio 521. Analysis and morphology of vascular plants ranging from pteridophyta through angiosperms with phylogenetic considerations.

BIO 650 Analysis of Hormone Action. (3 Hours) Prerequisite: Graduate status and consent of the instructor. An analysis of the cellular mechanisms of hormone action. The role of target tissues, receptors, hormone analogs and metabolic inhibitors in studies of hormone action will be discussed.

BIO 630 Thesis Research. Thesis representing original research.

*These courses (or close equivalents) also may be taken during summers at the Gulf Coast Research Laboratory, Ocean Springs, Mississippi; Dauphin Island Sea Laboratory, Alabama, or other coastal teaching/research laboratory for credit at JSU subject to approval on individual basis by JSU administration and coastal laboratory administrators.

Doctor of Philosophy
ENVIRONMENTAL SCIENCE

Dr. Paul Tchounwou, Distinguished Professor and Director
P.O. Box 18540
Telephone: (601) 979-3321
Fax: (601) 979-2349
e-mail: paul.b.tchounwou@jsums.edu
URL: http://ccaix.jsums.edu/~envsci/

Dr. Gregorio Begonia, Professor and Associate Director
e-mail: gregorio.begonia@jsums.edu

Faculty

(Interdisciplinary, listed by their Primary Department)

Biology:
Dr. M. T. Begonia, Assoicate Professor
Dr. P. Chigbu, Associate Professor
Dr. I. Farah, Associate Professor
Dr. E. Hamadain, Associate Professor
Dr. M. Hardy, Professor
Dr. H. Hwang, Professor
Dr. R. Isokpehi, Assistant Professor
Dr. R. Kafoury, Assistant Professor
Dr. A. Mohamed, Professor
Dr. A. Patolla, Assistant Professor
Dr. D. Sutton, Assistant Professor

Chemistry:
Dr. Z. Arslan, Assistant Professor
Dr. A. Hamme, Assistant Professor
Dr. J. Leszczynski, Distinguished Professor
Dr. Y. Liu, Associate Professor
Dr. H. Tachikawa, Professor
Dr. H. Yu, Associate Professor

Civil and Environemtal Engineering
Dr. F. Amini, Professor
Dr. Y. Li, Assistant Professor

Computer Engineering
Dr. M. Manzoul, Professor
Dr. R. Whalin, Professor

Computer Science
Dr. W. Brown, Associate Professor
Dr. Q. Malluhi, Professor
Dr. L. Moore, Associate Professor

Mathematics
Dr. T. Kwembe, Professor
Dr. R. Gompa, Professor

Physics, Atmospheric Sciences and General Science
Dr. Y. Li, Assistant Professor
Dr. S. Reddy, Associate Professor
Dr. Q. Williams, Associate Professor

Technology
Dr. I. Mosley, Associate Professor
Dr. P. C. Yuan, Professor

Program Mission

To produce highly skilled environmental scholars who in turn will provide for policy makers and the general public, scientific and factual information derived from laboratory and field applied research encompassing basic sciences, engineering and technology. As such, it is related to the assessment of water contamination, food contamination, air pollution, global warming, toxic and hazardous substances releases and associated environmental issues; and the development of cost-effective methodologies and strategies to protect the environment and human health.

Program Objectives

1. To provide graduate students with essential knowledge, skills and aptitudes needed for successful careers in environmental science related jobs at various institutions including government agencies, academia and the environmental industry.
2. To protect the environment and human health by educating and training students on the interactions between the various components/systems of the environment, the complex and fragile nature of the environment, and how to sustain ecosystem integrity and protect human health.
3. To establish applied environmental science research initiatives that will lead to an authoritative base of knowledge concerning the State of Mississippi's environment and natural resources; by assessing and understanding the mechanisms by which physical, chemical, and biological agents generated by nature many cause alterations of ecosystem integrity, disability and diseases in man and other life forms.
4. To develop and understand cost-effective methodologies and means whereby the impact of various environmental pollutants may be prevented and/or controlled, and to integrate important knowledge and technologies in the physical, chemical, biological and social sciences needed to set policies and guidelines for appropriate utilization and management of vital resources.
5. To render services to the community through outreach programs, technology transfer for the protection of natural resources and the development of the economy, and communication to convey environmental science education to the public.

Admission Requirements

Admission to the doctoral program in Environmental Science is open to persons holding the master's degree in science, technology, engineering, or agriculture; demonstrated satisfactory performance on the Graduate Record Examination (GRE), and the Test of English as Foreign Language (TOEFL) for international students; and acceptable academic records.

All students seeking admission to this Ph.D. Program must meet the following criteria:

1. A Master's degree in natural sciences or related sciences from an accredited university. *An applicant with a Bachelor's degree only may be admitted when that student shows exceptional potential as determined by a GPA of 3.5 or better, a satisfactory GRE, and extraordinary work experience*,
2. A completed program application submitted to the Graduate School,
3. An official score on the Graduate Record Examination (GRE),
4. An overall GPA of 3.25 or above (on a 4.0 scale) on the highest earned degree,
5. Transcripts for all post secondary and graduate work attempted prior to a program application,
6. Recommendations from three major graduate professors knowledgeable of the applicant's professional academic ability, job experiences, and leadership and research potential,
7. Acceptable evidence of a student's writing ability as determined by a writing sample,
8. A satisfactory TOEFL score for international students,
9. A successful interview with the program screening committee, and
10. Recommendation for admission by the program screening committee.

All applications received are reviewed by a standing Environmental Science Doctoral Advisory Committee which recommends acceptance or denial of admission to the Graduate School. The Graduate School officially informs the prospective student of its decision for the University.

Transfer Credits

A maximum number of nine credit hours can be transferred into the Program. Courses for which transfer credits are sought must be at least 700-Level; must have been completed with a grade of B or better; and must be approved by the student's Advisory Committee, the Environmental Science Advisory Committee, the Dean of the School of Science and Technology, and the Dean of the Division of Graduate Studies. Credit for thesis or dissertation research as well as "internship" course work in any form is not transferable.

Time Limit

No student will be granted a doctoral degree unless all requirements are completed within a period of ten (10) consecutive calendar years from the time of admission to the program.

Financial Aid

Graduate research and teaching assistantships are available on a competitive basis to highly qualified students.

Residence

Students are required to spend one academic year in resident

study on the campus. One academic year may include two adjacent regular semesters or one regular semester and one adjacent summer session. To satisfy the continuous residence requirement, the student must complete a minimum of eighteen (18) hours for the required period.

Candidacy Requirements

To be admitted to candidacy for the doctoral degree, a student must have:

1. Completed the formal coursework with a GPA of 3.0 or better.
2. Passed the Comprehensive Examination.
3. Filed with the Dean of the Graduate School, the dissertation proposal approved by the student's Advisory Committee, the Program Director and the Academic School Dean.

Degree Requirements

The program requires approximately two years of course work (40 semester hours) and a minimum of twenty (20) semester hours of dissertation research credit beyond the MS degree. The exact program of study will be determined by the student's graduate committee. Additional requirements include:

1. Satisfactory performance on the Comprehensive Examination administered after the student has completed all course work; and
2. Successful defense of the dissertation research. The final basis for granting the degree shall be the candidate's grasp of the subject matter in a specialized area of environmental science, and a demonstrated ability to express thoughts clearly and forcefully in both oral and written languages.

Required Courses		**Semester**
Course	**Title**	**Hours**
ENV 700	Environmental Systems	3
ENV 701	Environmental Chemistry	4
ENV 702	Environmental Health	3
ENV 711	Applied Environmental Biostatistics	3
ENV 751	Water Quality Management	3
ENV 755	Air Quality Management	3
ENV 800	Environmental Toxicology	4
ENV 801	Risk Assessment and Management	3
ENV 900	Environmental Science Seminar	2
ENV 999	Dissertation Research	20
	Total Hours	48

In addition to the required courses shown above, the student must complete a minimum of 12 semester hours selected from the elective courses listed below. Other electives in biological sciences, physical sciences, engineering, technology, and public policy will be added as developed.

Elective Courses		**Semester**
Course	**Title**	**Hours**
CSC 700	Computer modeling	3
CSC 800	Image Interpretation	3
MATH 700	Statistics and Experimental Design	3
MET 800	Environmental Meteorology	3
ENV 715	Principles of Bioremediation	4
ENV 721	Solid Waste Management	3
ENV 780	Environmental Epidemiology	3
ENV 802	Environmental Physiology	4
ENV 803	Wetland Ecology	4
ENV 830	Environmental Microbiology	4

The minimum total semester hours required for the doctoral degree is 60.

DESCRIPTION OF COURSES

ENV 700 Environmental Systems. (3 hours). A groundwork of environmental science, environmental awareness and ecological literacy for the incoming Ph.D. students is presented. The environment and its living and non living components, and the interactions of these component areas studied. The course is set in a thermodynamic perspective and is based on a nested hierarchy of systems. Key concepts and principles that govern how we think the environment works are presented while learning how to apply these concepts to possible solutions of various environmental degradation, pollution and resource problems.

ENV 701 Environmental Chemistry. (3 hours). Prerequisites: One year of general Chemistry and one year of organic chemistry. Studies of the basic concepts of environmental chemistry; the nature of chemical compounds; organic and inorganic; chemical reactions; their effects, and fate of chemical species, in aquatic systems. This include: Studies of equilibrium phenomena of acids, bases, salts, complex compounds, and oxidation/reduction reactions. Studies of water pollution, environmental chemistry of water and its properties.

ENVL 701 Environmental Chemistry (1 hour). Experiments done for the purpose of water quality control and assessment, such as the determination of alkalinity, acidity, water hardness, biochemical oxygen demand (BOD), and other important parameters. The laboratory is coordinated to go with the lecture material.

ENV 702. Environmental Health. (3 hours). This course focuses on the impact of environmental problems on human health. Health issues related to water pollution/contamination by physical, chemical and biological agents; wastewater discharges; radiations; air pollution; municipal, and industrial wastes; food contamination; pesticides; occupational hazards; and vector-borne diseases are discussed.

ENV 711 Applied Environmental Biostatistics. (3 hours) Prerequisite: Biostatistics (Bio 511) or equivalent. This course is designed as an applied, advanced biostatistics course for students in the Environmental Science Ph.D. Program. Students will learn how to apply important concepts and principles of environmental biostatistics in the conduct of their research, from the initial designing of experiments to proper data collection and analysis, inferences, interpretation of results in applied terms, reporting and presentation of the results. The statistical computer software (SAS) will be used to analyze and interpret results.

ENV 751 Water Quality Management. (3 hours). This course provides students with basic concepts and principles in Water Quality Management. The effects of organic, inorganic, biological and thermal pollutants/contaminants in various systems of the hydrologic cycle including streams, reservoirs, and estuaries; eutrophication; water quality criteria and standards; monitoring concepts; methods in water quality management; regulatory considerations; and non point source pollution control, are discussed.

ENV 755 Air Quality Management. (3 hours). This course provides students with basic concepts and principles of air quality management. Contaminant classification, pollutant sources, criteria pollutants, health effects, exposure and risk assessment are discussed. Pollutant measurements and air quality assessment techniques are considered with regard to atmospheric effects on dispersion and transport. Identification of, and control strategies for, stationary and mobile sources, and environmental regulations are studied, and indoor air quality considered.

ENV 800 Environmental Toxicology. (3 hours). Prerequisites: ENV 701, ENV 702. This course is designed to provide an overview of the basic principles and concepts of toxicology including : exposure characterization, dose-response relationship, kinetics and distribution of toxicants in a biological system; to understand the fate, behavior and toxicities of xenobiotic chemicals, and the mechanisms by which they affect cells and organs; and to identify the sources and discuss the effects of various groups of environmental toxicants including heavy metals, pesticides and other industrial byproducts.

ENVL 800 Environmental Toxicology. (1 hour). This course is designed to familiarize the students with important laboratory and field procedures and methods used in toxicological testing of environmental toxicants; and to discuss the strengths and weaknesses of major methodologies including acute, subacute, subchronic and chronic bioassays.

ENV 801 Risk Assessment and Management. (3 hours). Prerequisites: ENV 800, MATH 700. This course is designed to provide students with qualitative and quantitative skills necessary to evaluate the probability of injury, disease and death in humans and other life forms, from exposure to various environmental contaminants. Hazard identification, exposure assessment, dose-response evaluation and risk characterization are emphasized. Regulatory and technical aspects of risk assessment in the promulgation of public and environmental safety standards are discussed.

ENV 900 Seminar. (0.5 hr x 4 semesters =2) (Lecture). This course focuses on contemporary issues in environmental health science. The student is expected to review, discuss, and present orally a report on a topic related to contemporary environmental issues. Topic areas for selection include (but not limited to): environmental biology, environmental chemistry, environmental microbiology, environmental toxicology, atmospheric science, water quality management, solid and hazardous waste management, computer modeling and remote sensing. Students are required to attend all scheduled seminars.

ENV 999 Dissertation Research. (20 hours). Original research in one of several subdisciplines in Environmental Science. Credit per academic session allowable is 1-6 hours. Student must produce, present and defend a document of publication quality.

Elective Courses

CSC 700 Computer Modeling. (3 hours). The purpose of this course is to provide the student with the fundamental knowledge of simulation models, writing programs to generate random numbers from various probability distributions using differential methods, and testing the statistical properties of random number generators. The student will also be trained to write simple programs to simulate real life situation models using GPSS language.

CSC 800 Image Interpretation. (3 hours). This course presents a broad overview of various image processing concepts and techniques. Topics include the history of remote sensing, image digitation, data formats, hardware and software functions, commercial and public available digital processing systems, image preprocessing (radiometric and geometric correction), image enhancement, image classification, change detection, interfaces of remote sensing and geographical information system (GIS), and the future of digital image processing.

MATH 700 Statistics and Experimental Design. (3 hours) Prerequisite: MATH 272. Or 2 semesters of Introductory Statistics. Probability; random variables; expectation of a function of random variables; sampling distribution; estimation; hypothesis testing; designed experiments; completely randomized design; randomized complete block design; Latin square design; factorial experiments; statistical software application to statistical analysis, are discussed.

MET 801 Environmental Meteorology. (3 hours). Principles of atmospheric science as applied to gaussian modeling of pollutants. Includes source review and receptor identification and modeling, National Ambient Air Quality Standards and human health and welfare impacts, plume

behavior, and access of EPA models, running of EPASCREEN, and web site information. Special topics covered include: scavenging; acid precipitation; weather modification, green house enhancement; stratospheric ozone; scrubbers; and indoor air quality.

ENV 715 Principles of Bioremediation. (3 hours). This course uses modern knowledges in life sciences, as well as new developments in biotechnology to address important issues related to environmental clean-up of hazardous wastes. The nature of environmental pollution is reviewed, and basic concepts in molecular biology, biochemistry, microbiology and plant physiology are applied to demonstrate the significance of bioremediation and phytoremediation in pollution control. Therefore, an emphasis is put on the use of biological methods and processes for the remediation of contaminated soils and water resources.

ENVL 715 Principles of Bioremediation. (1 hour). Laboratory and field experiments conducted to familiarize students with relevant bioremediation techniques and methodologies. Identification and classification of microorganisms, use of bacteria in toxicity assessment, biodegradation of organic contaminants, and phytoremediation of toxic metals are discussed.

ENV 721 Solid Waste Management. (3 hours). This course emphasizes on waste control methodologies for both municipal and industrial wastes including hazardous and nonhazardous waste under the Resource Conservation and Recovery Act (RCRA). The students are familiarized with environmental legislation regulating these wastes at state and federal levels. A thorough review is done on waste handling, transport, treatment technologies including chemical, physical, biological and thermal treatments, and disposal options such as land disposal of wastes. Waste minimization techniques such as source reduction and recycling are also discussed.

ENV 780 Environmental Epidemiology. (3 hours) This course is designed to provide students with the basic knowledge and skills required to develop and apply epidemiologic principles and concepts to the study of adverse effects of various environmental factors on both human and ecological health. Emphasis is put on the study of the health effects of physical, chemical and biologic factors in the external environment, broadly conceived from the epidemiologic point of view. As such, it enables students to interpret epidemiological data and understand the approaches used in the epidemiologic investigations of acute and chronic diseases. The course also covers the basic methods and issues involved in epidemiologic investigation of disease conditions in human populations.

ENV 802 Environmental Physiology. (3 hours). This course provides students the basic concepts of homeostasis and adaptation to the environment. Discussions are designed to provide an understanding of the physiological responses to various types of pollutants in The different environmental systems including aerospace, hyperbaric, marine and terrestrial environments. Emphasis is placed on homeostatic responses at cellular, organ and organ system levels to various environmental stresses.

ENVL 802 Environmental Physiology. (1 hour). Laboratory exercises are performed to introduce students to instrumental techniques necessary in the understanding of homeostatic regulatory mechanisms that permit adaptation of organisms to varied and peculiar habitats.

ENV 803 Wetland Ecology. (3 hours). This course is designed to provide scientific knowledge for a better understanding of interactions between biological, physical and chemical components of wetlands. The structure and function of various types of wetlands; their biodiversity, biogeochemistry, and the impact of pollution on their ecological characteristics are discussed. Discussions are also done on how constructed wetlands can be used as water quality enhancers.

ENVL 803 Wetland Ecology. (1 hour). Emphasis is placed on field works designed to evaluate the physical, chemical and biological characteristics of wetlands.

ENV 830 Environmental Microbiology. (3 hours). The general objective of this course is to study the roles of microorganisms in natural ecosystems. Attention is given to the examination of nutrient cycles, methods of analysis of microbial biomass and activities, and the functional roles of microorganisms. In addition, this course offers in-depth examination of the role of microbial processes related to environmental deterioration, its control and remediation, and ultimately its prevention.

ENVL 830 Environmental Microbiology. (1 hour). Laboratory designed to acquaint students with modern techniques for measuring microbial biomass and microbial degradative activities of natural and xenobiotic chemicals in natural environments. Specific projects of microbial analysis will be assigned to students.

DEPARTMENT OF CHEMISTRY

Dr. Hongtao Yu, Associate Professor and Chair

P.O. Box 17910
Telephone: (601) 979-2171
Fax: (601) 979-3674
e-mail: yu@jsums.edu

Faculty

Dr, Z. Arslan, Assitant Professor
Dr. N. Campbell, Associate Professor
Dr. A. Hamme, Assistant Professor
Dr. G. Hill, Assistant Professor
Dr. M. Huang, Assistant Professor
Dr. K. Lee, Professor
Dr. J. Leszczynski, Distinguished Professor
Dr. Y. Liu, Asociate Professor
Dr. E. Noe, Professor
Dr. P. Ray, Assistant Professor
Dr. H. Tachikawa, Professor
Dr. R. Venkatraman, Associate Professor
Dr. J. Watts, Professor
Dr. J. Zubkowski, Professor

The Department of Chemistry offers the Doctor of Philosophy degree and the Master of Science degree in Chemistry. The Ph.D. degree program in chemistry requires the existence of high quality scientific research and teaching in the department. It covers all modern areas of chemistry including analytical, biochemistry, computational, organic, inorganic, and physical.

Program Mission

The Department of Chemistry seeks to provide comprehensive graduate programs in chemistry that aim for national distinction. The Department offers M.S. and Ph.D. degrees in all field of chemistry. These aim for intense graduate training through courses, hands-on experience of research methods, and development of an independent research thesis and dissertation. Graduates will be trained and capable of independent research in an academic or industrial setting.

Program Objectives

- To provide students with an environment that is conducive to learning and scholarly activities.
- To provide opportunities in which students can develop methods of independent and systematic investigation.
- To prepare students to develop a successful career in chemistry.
- To promote the professional growth and development of the faculty.

Doctoral Program in Chemistry

Admission Requirements

In addition to the requirements of the Graduate School, applicants must:

1. The minimum requirement for admission is a B.S. degree in chemistry or related field. The student must have passed the following courses, with labs, with a passing grade, 'C' or better:
   - 2 semesters of General Chemistry
   - 2 semesters of Organic Chemistry
   - 1 semester of Analytical Chemistry
   - 1 semester of Physical Chemistry
   - 1 semester of Inorganic Chemistry
2. Submit an official GRE Score.
3. The M.S. degree is not a prerequisite for the Ph.D. degree.

Degree Candidacy Requirements

The comprehensive examination and the independent research proposal are required for a student to be an official Ph.D. candidate. The comprehensive examination of 3 subjects must be taken and passed during the second year. The independent research proposal must be prepared and defended during the first semester of the third year.

Graduation Requirements

The minimum number of credit hours for the Ph.D. in Chemistry is 60 credit hours.

1. 18 credit hours from graduate Chemistry lecture courses
2. 2 credit hours for Seminars
3. 40 credit hours for Dissertation

The 60 credit hours must include three out of five possible core courses for a total of 9 credit hours required in core courses. The core courses are:

CHEM 723	Advanced Analytical Chemistry
CHEM 731	Advanced Biochemistry I
CHEM 736	Physical Organic Chemistry
CHEM 741	Advanced Inorganic Chemistry
CHEM 758	Quantum Chemistry

The student will be required to teach at least one undergraduate laboratory course and must have a dissertation in chemistry, which has to be defended in public.

Masters' Program in Chemistry

The M.S. degree is offered by the Department in the areas of analytical, biological, computational, inorganic, organic, and physical chemistry.

Admission Requirements

Applicants for the Master's Degree Program must meet the requirements of the Graduate School.

Retention Requirements

The student must satisfy the basic requirements of the Graduate School and must maintain GPA 3.00 or higher every semester. The chemistry department will calculate the GPA based on the 500 level chemistry lecture courses. Grades from the Thesis Research are excluded from calculating the GPA.

Degree Requirements

A student pursuing a M.S. degree in Chemistry is required to complete a minimum of 30 hours and a thesis in chemistry.

1. Within the 30 hours, the student must complete three (3) out of five (5) possible core courses for a total of nine (9) hours required in the core courses, and two semesters of seminar. The core courses are:

CHEM 523	Advanced Analytical Chemistry
CHEM 541	Advanced Inorganic Chemistry
CHEM 531	Biochemistry
CHEM 558	Quantum Chemistry
CHEM 536	Physical Organic Chemistry

2. The student will fulfill the remaining 20 hours from Chemistry electives with no more than 11 hours in CHEM 580 - Thesis Research. It is possible to take some courses in related fields upon recommendation of the advisor.
3. Pass the Graduate Area Comphrensive Examination in three core areas.
4. The student must participate as a teaching assistant in the chemistry department for at least one semester.

Non-Thesis Masters' Degree

Graduate students who fulfill the following requirments will be awarded a non-thesis masters' degree in Chemistry.

1. A minimum of 36 credit hours, including at least 18 hours of graduate level lecture courses and two hours of seminar with a GPA of 3.0 or better. The graduate lecture courses should include at least three of the five core courses: Advanced Analytical Chemistry, Advance Inorganic Chemistry, Biochemisty, Quantum Chemistry, and Physical Organic Chemistry.
2. Pass the Graduate Area Comphrensive Examination in three core areas.
3. Pass an oral defense covering the student's research before a committee of four faculty members.

DESCRIPTION OF COURSES

Master-level Courses

CHEM 511 Chemistry Seminar. (1 Hour) Presentation and discussion of current chemical topics and research by students, faculty and visiting speakers. Prerequisite: Permission of instructor.

CHEM 523 Advanced Analytical Chemistry. (3 Hours) Prerequisites: Courses in Analytical Chemistry and Physical Chemistry. Principles and application of selected analytical methods including electrochemistry, spectroscopy and selected topics of unusual current interest.

CHEM 526 Electroanalytical Chemistry. (3 Hours) Prerequisite: Advanced Analytical Chemistry. Discussion of potentiometric, conductometric, polarographic, amperometric, coulometric, controlled potential and stepping analysis and related techniques. Emphasis is also placed on theoretical considerations and applications to studies of chemical and charge transfer equilibria and kinetics.

CHEM 531, 532 Biochemistry. (3 Hours) Prerequisite: One year of Organic Chemistry. The chemical composition of living matter and the chemical mechanics of life processes.

CHML 531, 532 Biochemistry Laboratory. (1 Hour) Prerequisite: Chemistry 531 and 532. Basic purification and characterization techniques in Biochemistry.

CHEM 536 Physical Organic Chemistry. (3 Hours) Prerequisites: Physical Chemistry and Organic Chemistry. A study of organic molecular structure, Woodward Hoffmann Rules, substituents effects, intra- and intermolecular forces, kinetics and stereochemistry.

CHEM 541 Advanced Inorganic Chemistry. (3 Hours) Prerequisite: An undergraduate course in Physical Chemistry. A study of inorganic compounds with the application of Physical Chemistry principles to thermodynamic, kinetic and structural problems.

CHEM 553 Thermodynamics. (3 Hours) Prerequisite: Physical Chemistry. Principles of thermodynamics and their application to chemical and phase equilibria.

CHEM 558 Quantum Chemistry. (3 Hours) Prerequisite: Physical Chemistry. Principles and applications of quantum theory.

CHEM 580 Thesis Research. (Variable 1-6 Hours) Prerequisite: Permission of adviser. Selected topics arranged in consultation with the staff; includes literature, research, and laboratory investigation of a problem.

Doctoral-level Courses

CHEM 711 Seminar (0.5 Hour) Presentation and discussion of current chemical topics and research by visiting speakers, faculty and students.

CHEM 721 Advanced Instrumental Analysis (3 Hours). Prerequisite: Analytical Chemistry and Physical Chemistry (two semesters). Theoretical principles and laboratory techniques involved in characterization of chemical systems using instrumental methods. This one semester course will present the following topics of interest: absorption and emission spectrometry, mass spectrometry, liquid and gas chromatography, and

electrophoresis. A laboratory series on spectro-photometry, fluorometry, atomic absorption spectrometry, inductively coupled plasma atomic emission spectrometry, FT-IR, gas chromatography-mass spectroscopy, and high performance liquid chromatography are included in this

CHEM 723 Advanced Analytical Chemistry (3 hours) Prerequisite: Analytical Chemistry and Physical Chemistry (two semesters). Principles and application of analytical methods including acid-base titrations, redox titrations, titrations which involve metal-ligand complexes, gravimetric analysis, separation methods (chromatography), and electroanalytical chemistry.

CHEM 726 Electroanalytical Chemistry (4 hours) Prerequisite: Advanced Analytical Chemistry. Principles and application of all modern electrochemical methods such as voltammetrics, chronoamperometry, spectroelectrochemistry, and thin layer electrochemistry etc. Electrode kinetics and mass transfer are discussed in detail.

CHEM 729 Spectroscopic Methods (3 hours) Prerequisite: Analytical Chemistry. Study of the theoretical principles of advanced spectroscopic topics used in analytical chemistry. Some examples of the topics to be covered are: X-ray methods (absorption, fluorescence, diffraction), surface spectroscopy and chemical analysis of surfaces, (Ion Scattering Spectroscopy, ISS), Auger Emission Spectroscopy (AES), electron Spectroscopy for chemical analysis (ESCA), Secondary Ion Mass Spectrometry (SIMS), Electron Spin Spectroscopy (ESR), Nuclear Magnetic Resonance Spectroscopy (NMR).

CHEM 731 Advanced Biochemistry I (3 hours) Prerequisite: Organic Chemistry (two semesters). Comprehensive coverage of major areas of biochemistry. Topics covered include proteins, enzymology, bioenergetics, the chemistry and intermediary metabolism of carbohydrates, lipids, proteins and nucleic acids.

CHEM 732 Advanced Biochemistry II (3 hours) Prerequisite: Advanced Biochemistry I. Comprehensive coverage of major areas of biochemistry. Topics covered include storage, transmission, and expression of genetic information, molecular immunology, membrane transport and hormone action.

CHML 731 Advanced Biochemistry Laboratory (1 hour) Corequisite: Advanced Biochemistry I. Selected techniques in areas covered in CHEM 731.

CHML 732 Advanced Biochemistry Laboratory (1 hour) Corequisite: Advanced Biochemistry II. Selected techniques in areas covered in CHEM 732.

CHEM 733 Advanced Molecular Biology (3 hours) Molecular mechanisms involved in replication, expression and regulation of prokaryotic genes. Topics include: DNA replication, repair, recombination, restriction-modification, recombinant DNA technology, plasmids and transposons, RNA transcription, processing and message splicing.

CHEM 734 Physical Biochemistry (3 hours) Characterization of macromolecules, hydrodynamic methods, multiple equilibria, maromolecule-ligand interactions.

CHEM 736 Physical Organic Chemistry (3 hours) Prerequisite: Organic Chemistry (two semesters). A study of organic molecular structure, Woodward Hoffmann Rules, substituents effects, intra- and intermolecular forces, kinetics and stereochemistry.

CHEM 738 Organic Synthesis (3 hours) Prerequisite: Organic Chemistry (two semesters). The course covers the formation of carbon-carbon and carbon-heteroatom bonds, functionalization and interconversion of functional groups, reactions of organic reagents, protective groups, total synthesis and asymmetric synthesis in organic synthesis.

CHEM 741 Advanced Inorganic Chemistry (3 hours) Prerequisite: Advanced Inorganic Chemistry (CHEM 441). A study of symmetry and group theory, bonding and structures of inorganic compounds, coordination chemistry and acid-base chemistry.

CHEM 743 Structural Inorganic Chemistry (3 hours) Prerequisite: Any 700 level course. A study included concepts of the solid state as explored by crystallography. It covers symmetry, polyhedra, sphere packing, tetrahedral and octahedral structures of inorganic compounds.

CHEM 747 Inorganic Reaction Mechanisms (3 hours) Prerequisite: Any 700 level course. The topics include mechanism of reactions of certain inorganic compounds, stereochemical changes in complexes, redox reactions, homogeneous and heterogeneous catalysts.

CHEM 749 Organometallic Chemistry (3 hours) Prerequisite: Physical Organic Chemistry (CHEM 736) or equivalent. A study of formation, stability, and reactivity of metal-carbon bond of main group and transition metal. It will covers the usage of organometallics in organic synthesis and catalysis.

CHEM 752 Atomic and Molecular Spectroscopy (3 hours) Prerequisite: Physical Chemistry (two semesters). A comprehensive course covering concepts and methods of modern atomic and molecular spectroscopy. Subjects covered include electric phenomena, absorption and emission of radiation, atomic spectroscopy, rotational spectroscopy, vibrational spectroscopy, electronic spectroscopy, and magnetic resonance spectroscopy.

CHEM 753 Thermodynamics (3 hours) Prerequisite: Physical Chemistry (two semesters). Laws of thermodynamics and their chemical applications. Introduction to chemical kinetics and statistical mechanics.

CHEM 754 Kinetics (3 hours) Prerequisite: Physical Chemistry (two semesters). Mechanics of chemical reactions, cross sections, and rate constants. Elastic, inelastic, and rearrangement channels are discussed, using quantum and semiclassical techniques.

CHEM 755 Mechanisms of Organic Chemistry (3 hours) Prerequisite: Organic Chemistry (two semesters). A study of mechanistic aspects of organic reactions included the rate theory, and reaction mechanism, experimental methods and treatment of data.

CHEM 758 Quantum Chemistry (3 hours) Prerequisite: Physical Chemistry (two semesters). (Computational Chemistry) Important concepts of quantum chemistry at the intermediate level, including angular momentum, perturbation theory, electronic structure of molecules, and radiation matter interaction. Applications will vary from year to year.

CHEM 763 Statistical Mechanics (3 hours) Prerequisite: Physical Chemistry (two semesters) A study of statistical mechanical ensembles, partition functions and their relationship to thermodynamics, lattice statistics, molecular distribution and correlation functions, the theories of liquids and solutions, phase transitions, and cluster theory.

CHEM 780 Dissertation - (1 - 9 hours)

CHEM 782 Special Topics in Analytical Chemistry - (3 hours) Selected topics not covered in regularly scheduled courses, and current research topics in analytical chemistry.

CHEM 783 Special Topics in Biochemistry - (3 hours) Selected topics not covered in regularly scheduled courses, and current research topics in biochemistry.

CHEM 784 Special Topics in Organic Chemistry - (3 hours) A course in a specific area of organic chemistry such as structure determination in organic chemistry, or current research subject not covered in regularly scheduled courses presented to fit the interests of advanced students.

CHEM 785 Special Topics in Inorganic Chemistry - (3 hours) Topics include subjects of current research in inorganic chemistry, but not covered in regularly scheduled courses.

CHEM 786 Special Topics in Physical Chemistry - (3 hours) Topics vary from year to year will include subjects such as photochemistry, solid state, surface chemistry, and radiation chemistry.

DEPARTMENT OF MATHEMATICS

Dr. Tor Kwembe, Professor and Chair
P.O. Box: 17610
Telephone: (601) 979-2161
Fax: (601) 979-5852
e-mail: tor.a.kwembe@jsums.edu

Faculty

Mr. D. Course, Assistant Professor
Dr. R. Gentry, Professor
Mr. M. Harbour, Assistant Professor
Ms. E. Holbrook, Assistant Professor
Dr. M. R. Khadivi, Professor
Dr. Y. Pan, Professor

The Department of Mathematics in the School of Science and Technology in cooperation with the School of Education offers a program leading to the Master of Science in Teaching (MST) degree, in mathematics. This department also offers a master of Science (MS) degree in pure mathematics for students who seek careers in college or university teaching, government, industry, business, etc.

Based on the certification requirements of the State of Mississippi as stated in *Bulletin 130,* and upon the stated principles and guidelines of The National Council of Teachers of Mathematics, The Mathematics Association of America, and The Mississippi Council of Teachers-Mathematics, the successful candidate for graduation with the MST degree should be able to perform the following competencies:

1. Expose students to various teaching aids in teaching and learning of mathematics at the junior high, high school, and college levels.
2. Show the basic structure of an idea by means of displays and examples.
3. Explain abstract ideas and relate them to concrete models by using the most modern techniques.
4. Bring ideas together to form new concepts in mathematics.
5. Turn ideas into words by means of displays, diagrams, and examples. Improve the oral and written expression of students in mathematics.
6. Stimulate a greater interest in mathematics to improve the performance of students. Share the idea of teaching and learning with other teachers in the field of mathematics by being active in professional organizations.
7. Properly counsel students in the field of mathematics.
8. Supervise programs in mathematics education.
9. Provide the kind of experiences in mathematics that will be relevant to the needs of today's youth.

10. Construct programs in mathematics that meet the needs of students in modern schools.
11. Demonstrate the nature of problem solving , proofs and processes involved in the solution of problems, and proofs of theorems in general.

These degree programs are designed for persons with an adequate background in mathematics and who wish additional preparation for mathematics teaching or mathematics supervision.

Admission Requirements

Admission to a graduate program in mathematics requires at least 15 semester hours of undergraduate mathematics above the regular calculus sequence.

Master of Science in Teaching Degree

Retention Requirements

By the end of the first semester, students should have taken the Graduate Record Exam (G.R.E.) and the Graduate English Competency Exam

Degree Requirements

1. Thirty six (36) hours are required with a thesis, i.e. ten (10) courses plus six (6) hours for a thesis.
2. Thirty six (36) are required with a project, i.e. eleven (11) courses plus three (3) hours for a project.
3. Thirty six (36) hours are required if neither a thesis nor a project is done.
4. A "B" average is required for graduation.

Core Educational

Courses	Titles	Semester Hours
EDFL 511	History and Philosophy of Education (R)	3
EDFL 515	Methods of Educational Research (R)	3
EDFL 514	Elementary Statistics (R*)	3
EDFL 568	Curriculum Methods (R)*	3
	Total Hours	*15*

(R)- Required
(R*) -Required for students without an undergraduate Statistics course, and it is a prerequisite for EDSE 515.

Required Courses

Math 501	Topics in Geometry	3
Math 510	Topics & Issues	3
Math 511	Basic Algebra I	3
Math 513	Linear Algebra I	3
Math 531	Basic Real Analysis I	3
	Total Hours	15

Other Requirements

Math elective		3
Math 590	Thesis or	
Math 584	Independent Study (Project)	3
	(and 3 hrs. from List I), or	
Six hours from List I and three hours		
	from List II or List III	9
	Total Hours	36

List I

Math 503	Foundations of Mathematics I	3
Math 504	Foundations of Mathematics II	3
Math 512	Basic Algebra II	3
Math 513	Linear Algebra I	3
Math 514	Linear Algebra II	3
Math 532	Basic Real Analysis II	3
Math 541	Basic Complex Analysis I	3
Math 542	Basic Complex Analysis II	3
Math 561	Basic Probability and Statistics I	3
Math 562	Basic Probability and Statistics II	3
Math 551	Basic General Topology I	3
Math 552	Basic General Topology I-II	3
Math 581	Number Theory I	3
Math 582	Number Theory II	3

List II

Math 505	Mathematics for Secondary Teachers	3
Math 506	Basic Concepts for Teachers	3
Math 507	Basic Concepts for Teachers	3
Math 509	Mathematical Structures	3
Math 519	Topic in Mathematics Education I	3
Math 520	Topics in Mathematics Education II	3

List III

CSC 511	Computers and Programming	3
CSC 512	Intro. to Computer Systems and Organ.	3
CSC 515	Data Structures and File Management	3
CSC 518	Principles of Operating Systems	3
CSC 531	Com.Simulation Methods and Models	3
CSC 561	Probability and Statistical Inference I	3

MASTER OF SCIENCE

Retention Requirements

By the end of the first semester, students should have taken the Graduate Record Exam (G.R.E.) and the Graduate English Competency Exam

Degree Requirements

1. Thirty six (36) hours are required with a thesis, i.e. ten (10) courses plus six (6) hours for a thesis.
2. A "B" average is required for graduation.

Core Courses

Course	Title	Hours
Math 511	Basic Algebra I	3
Math 513	Basic Abstract Algebra I	3
Math 531	Basic Real Analysis I	3

Math 541	Basic Complex Analysis I	3
Math 551	Basic General Topology I	3
Math 599	Thesis	6
Electives- Three (3) courses from the list below:		
Math 501	Topics in Geometry	3
Math 503	Foundations of Mathematics I	3
Math 512	Basic Algebra II	3
Math 514	Linear Algebra II	3
Math 542	Basic Complex Analysis II	3
Math 552	Basic General Topology II	3
	Elective	3
	Total Hours	36

A student may concentrate in Applied Mathematics by taking the four (4) elective courses from this list: Math 513, 514, 541, 542, CSC 511, 512, 515, 518, 531, 561.

A concentration in Foundations of Mathematics consists of four (4) courses from this list: Math 501, 503, 513, 541, CSC 511, 512, 515, 518, 531, 561.

Notes

1. The Class 'A' Certificate must be held before receiving the Class 'AA' Certificate.
2. Math courses should be taken first because of their sequential nature, and the fact that they are not offered every term. However, Core Educational Courses are offered every term.
3. File Form II—Petition for Graduate Degree Candidacy if at least 15 semester hours have been completed.
4. File Form III—Application for Degree before the dates listed in the Graduate Calander for May and August graduations.
5. File Form IV—Application for Clearance following the completion of all work.

DESCRIPTION OF COURSES

MATH 500 Mathematics for Elementary Teachers. (3 Hours) Prerequisite:Approval of department. A course emphasizing content and techniques employed in the teaching of mathematics in the elementary school . Stress is placed on current trends and philosophy, content and methodologies.

MATH 501 Topics in Geometry. (3 Hours) Prerequisite: Approval of department. A survey of geometries and their structures. Emphasis is on both synthetic and analytic methods.

MATH 502 Topics in Algebra. (3 Hours) Prerequisite: Approval of department. An amalgamation of classical and modern theory, stressing the synthesis of ideas in areas from equation solvability, special algebraic forms (permutations, combinations, arrangements, binomial and multinomial theorems, partial fractions, progressions, groups, rings, domains of integrity, and ideas of interest).

MATH 503-504 Foundations of Mathematics I-II. (3-3 Hours) The fundamental elements of set theory and finite mathematical structures; cardinals and ordinals; logical deduction, elements of probability; vectors and matrices, linear programming, theory of games and applications.

MATH 505 Mathematics for Secondary Teachers. (3 Hours) Prerequisite: Approval of department. The basis of the content, philosophy and methodology employed in the teaching of secondary school mathematics is of prime interest here.

MATH 506-507 Basic Concepts for Teachers I-II. (3-3 Hours) Prerequisite: Approval of department. Higher mathematics for teachers reviewing the fundamental areas of algebra, geometry and analysis, with stress on rigor and validity of ideas.

MATH 508 Elementary School Topics. (3 Hours) Special topics and problems of elementary school mathematics and its teaching.

MATH 509 Mathematical Structures. (3 Hours) A course surveying the ideas of algebras, geometries, topology, set theory and other areas of interest. The course serves to strengthen the foundations of the learner, as well as to provide a rigorous basis for the areas under discussion.

MATH 510 Topics and Issues in Mathematics. (3 Hours) This course is designed for in-service teachers who are interested in the renewal of teaching licenses and the pursuit of graduate studies in the teaching of mathematics. Emphasis is on individualized research dealing with the stages of development of mathematics, new trends in the teaching of mathematics, and the exploration of teaching theories resulting from the work of experimental psychologists such as Piaget, Aushel and Bruner. Because of the individualized nature of the course, students with diverse backgrounds in mathematics can be accommodated.

MATH 511-512 Basic Algebra I-II. (3-3 Hours) Groups, (homomorphisms), rings, integral domains, modules and fields, elementary linear algebra, number theory.

MATH 513-514 Linear Algebra I-II. (3-3 Hours) Vector spaces, matrices, linear transformations, determinants and linear equations. Selected topics on eigenvalues, canonical forms, inner products, inner product spaces, bilinear and quadratic forms.

MATH 515-516 Abstract Algebra III-IV. (3-3 Hours) Prerequisite: Mathematics 512. Special topics in groups, rings and fields, factorization theory, extensions of rings and fields, modules, elementary theory of fields.

MATH 517-518 Topics in Mathematics Education I-II. (3-3 Hours) Elementary. Counting and numerical concepts, problem solving, equipment, achievement, examinations.

MATH 519-520 Topics in Mathematics Education I-II. (3-3 Hours) Secondary. Aims and problems, techniques, arousing and maintaining interest, aids and trends, tests and measurements, traditional and non-traditional courses, operation, geometry.

MATH 521-522 Basic Geometry I-II. (3-3 Hours) Prerequisite: Mathematics 511, concurrent enrollment or approval of department. Historical development; sets and projective planes and geometries; vectors, transformations, axiomatic affine, projective and plane geometry.

MATH 523-524 Modern Geometry III-IV. (3-3 Hours) Prerequisite: Mathematics 523 or approval of department. Motions and transformations, projective and topological transformations, projective plane, analytic projective geometry; absolute, ordered, affine and hyperbolic geometries; elementary differential geometry, topology of surfaces.

MATH 525-526 Introduction to Differential Geometry I-II. (3-3 Hours) Prerequisite: Mathematics 523 or approval of department. Curves and surfaces in three dimensions by classical methods, introduction to corresponding problems in n-dimensions involving tensor methods.

MATH 527-528 Projective Geometry I-II. (3-3 Hours) Prerequisite: Mathematics 512 or approval of department. The projective plane, polarities and conic sections, affine geometry, projective metrics, non-Euclidean Geometry, spatial geometry.

MATH 529-530 Systems Analysis I-II. (3-3 Hours) Prerequisite: Approval of department. An analysis of the numerical and abstract systems of mensuration. Stress is placed on the metric and English systems, conversion analysis and other systems of interest.

MATH 531-532 Basic Real Analysis I-II. (3-3 Hours) Prerequisite: Mathe 511 or approval of department. Metric spaces, regulated functions and integrals; integrals of Riemann and Lebesque; trigonometrical and Fourier Series; differentiation and Stieltjes Integrals.

MATH 533-534 Advanced Analysis I-II. (3-3 Hours) Prerequisite: Mathematics 532 or approval of department. Further treatment of limits, continuity, differentiability and integrability of functions of one and more variables. Infinite series and products, power and trigonometric series; selected topics.

MATH 535-536 Introduction to Measure and Integration I-II. (3-3 Hours) Prerequisite: Mathematics 531 or approval of department. Lebesgue measure of linear sets, measurable functions, definite integral, convergence, integration and differentiation, spaces of functions, orthogonal expansions, multiple integrals and the Stieltjes Integral.

MATH 537-538 Introduction to Functional Analysis I-II. (3-3 Hours) Prerequisites: Mathematics 512, 531, or approval of department. Fundamentals of the theory of vector spaces; Banach spaces; Hilbert spaces. Linear functionals and operators in such spaces; spectral resolution of operators, applications.

MATH 539-540 Infinite Series I-II. (3-3 Hours) Prerequisites: Mathematics 511 and approval of department. Complex numbers, sets and functions; limits and continuity; analytic functions of a complex variable, elementary functions; integration; power and Laurent series, calculus of residues, conformal representation, special topics.

MATH 541-542 Basic Complex Analysis I-II. (3-3 Hours) Complex numbers, sets and functions; limits and continuity; analytic functions of a complex variable, elementary functions; integration; power and Laurent series, calculus of residues, conformal representation, special topics.

MATH 544 Entire Functions. (3 Hours) Prerequisite: Mathematics 541. Entire functions, maximum absolute value and order, zeroes of entire functions, fundamental theorem of algebra, Picard's Little Theorem, algebraic relationships and addition theorem; special theorems and functions.

MATH 545 Laplace Transforms. (3 Hours) Prerequisites: Math 534 and approval of department. The Stieltjes Integral; fundamental formulae; moment problem, Tauberian theorems, bilateral Laplace Transform, inversion and representation problems, the Stieltjes Transform.

MATH 546 Special Functions. (3 Hours) Prerequisites: Math 535 and approval of department. Infinite products, Gamma and Beta functions, series, polynomials, functions, relations and sets of analysis and differential equations.

MATH 547-548 Integral Equations I-II. (3-3 Hours) Prerequisites: Math 534, 542, and approval of department. Theory of Fredholm and Volterra equations; Hilbert-Schmidt theory; singular integral equations and some applications.

MATH 549-550 Methods In Applied Mathematics I-II. (3-3 Hours) Prerequisite: Approval of department. Elements of linear algebra; applications to systems of linear variables; function spaces; tensor analysis, applications to geometry, electromagnetic theory, Lagrangian and Hamiltonian formulations of mechanics; other topics of interest.

MATH 551-552 Basic General Topology I-II. (3-3 Hours) Prerequisites: Mathematics 223 and approval of department. Elementary set theory, ordinals and cardinals; topological spaces; cartesian products; connectedness; special topologies; separation axioms; covering axioms, metric spaces; convergence; compactness; function spaces; spaces of continuous functions and complete spaces; homotopy; maps into spheres; topology of En; homotopy type; introduction to algebraic topological ideas.

MATH 553-554 Introductory Algebraic Topology I-II. (3-3 Hours) Prerequisites: Mathematics 552 and approval of department. Complexes, simplicial,

singular and Cech Homology Theory. Homotopy groups and basic theorems of algebraic topology.

MATH 555-556 Combinatorial Topology I-II. (3-3 Hours) Prerequisites: Mathematics 553 and approval of department. Properties of topological spaces; Jordan's theorem, surfaces, complexes, coverings, dimension; the Betti Groups, homology theory, manifolds, the duality theorems, cohomology groups of compacta, introduction to theory of continuous mappings of polyhedra.

MATH 557-558 Introduction to Algebraic Geometry I-II. (3-3 Hours) Prerequisites: Mathematics 512, 521, or approval of the department. Algebraic preliminaries, local rings valuation theory, power series, rings, geometry of algebraic varieties with emphasis on curves and surfaces.

MATH 559-560 Linear Programming I-II. (3-3 Hours) Basic Concepts, graph theory, theory of games, Markov Chains, Leontief Economic Models, Optimizing linear functions of variables subject to constraints, a geometric approach, simplex method, convex sets duality, applications.

MATH 561-562 Basic Probability and Statistics I-II. (3-3 Hours) Prerequisite: Mathematics 532 or approval of department. Basic concepts of measure theory and integration axiomatic foundations of probability theory, distribution functions and characteristics functions, central limit problem, modern statistical inference, analysis, variance, decision functions.

MATH 563-573 Design I-II. (3-3 Hours) Prerequisite: Mathematics 272. Experimental Design: Completely randomize design, randomize block designs, factorial experiments split plot design. confounding.

MATH 564 Linear Models. (3 Hours) Prerequisite: Mathematics 562 or departmental approval. Linear statistical models, some noise-reducing experimental designs, an example-of a volume-increasing design, fitting the general linear model, inference making, multiparameter hypothesis: the analysis of variance, the effect of coding on the analysis, seeking a maximum or minimum response, fractional factorial experiments and incomplete block designs, an example of a completely random model, mixed models.

MATH 565 Multivariate Analysis. (3 Hours) Prerequisites: Mathematics 562 and approval of department. General linear hypothesis; least square estimation; confidence regions, multiple comparison; analysis of complete layouts; effects of departures from underlying assumptions. Analysis of convariance.

MATH 566-566W Operations Research. (3-3 Hours) Prerequisite: Math 232, 355. Linear programming, network analysis, PERT-CPM, dynamic programming, queuing theory and decision analysis.

MATH 567-568 Nonparametric Statistics I-II. (3-3 Hours) Prerequisites: Mathematics 562 and approval of department. Problems of estimating testing hypotheses when the functional form of the underlying distribution is unknown. Robust methods; sign test, rank test and confidence procedures based on these tests; tests based on permutations of observations. Non-parametric tolerance limits; large sample properties of the tests, multisample problems; ranking methods in analysis of variance; Bivariate and multivariate procedures, efficience comparisons.

MATH 569-570 Functions of Several Real Variables I-II. (3-3 Hours) Prerequisites: Mathematics 533 and approval of department. Euclidean spaces, Mapping and differentials, manifolds, differential forms, vector analysis.

MATH 571-572 Numerical Analysis I-II. (3-3 Hours) Prerequisite: Approval of department. Approximation and interpolations; numerical differentiation, quadrature and summation; numerical solutions of ordinary differential equations; functional approximation techniques; solutions of equations; eigenvalues and eigenvectors.

MATH 573 Fractal Geometry. (3 Hours) Prerequisite: Math 511 or departmental approval. Metric spaces, equivalent spaces, classification of subsets, and the Space of Fractals. Transformations on metric spaces, contraction mappings, and the Construction of Fractals. Chaotic Dynamics of Fractals, Fractal Dimension. Fractal Interpolation. Julia Sets. Parameter Spaces and Mandelbort Sets. Measures on Fractals.

MATH 574 Numerical Linear Algebra. (3 Hours) Prerequisite: Approval of department. Elementary numerical analysis; matrix algebra; elimination and compact elimination methods; orthogonalization methods; condition, accuracy, and precision; comparison of methods; iterative and gradient methods; iterative and transformation methods for latent roots and vectors; error analysis for latent roots and vectors.

MATH 575-576 Approximation and Interpolation I-II. (3-3 Hours) Prerequisite: Approval of department. Interpolation, remainder theory; convergence theorems; infinite interpolation; uniform approximation; best approximation; least squares approximation; Hilbert space; orthogonal polynomials; closure and completeness.

MATH 577-578 Ordinary Differential Equation I-II. (3-3 Hours) Ordinary differential equations: basic theorems of existence, uniqueness, and continuous dependence of the solutions; linear differential equations and systems; stability theory; topology of integral curves; differential equations in the complex domain, asymptotic integration; boundary value problems. Partial differential equations; equations of first order method of characteristics, Hamilton-Jacobi theory; equations of second order-classification according to type; elliptic equations-potential equation, maximum principle, characteristics, and other topics of interest.

MATH 579-580 Partial Differential Equations I-II. (3-3 Hours) Prerequisite: Mathematics 577 or departmental approval. Linear equations with constant coefficients in two independent variables, applications, eigenfunction expansions, homogeneous and nonhomogeneous equations. Fourier series, existence, solution uniqueness and representation, Initial boundary value problems, Laplace's equation, special topics.

MATH 581-582 Number Theory I-II. (3-3 Hours) Prerequisites: Approval of department. Diophantine analysis, primes, residue classes, theorems of Euler, Fermat, and Wilson, Continued Fractions, Chinese Remainder Theorem, quadratic reciprocity, valuations, extensions of valuations, local and global fields, discriminant.

MATH 583 Advanced Number Theory. (3 Hours) Prerequisite: Mathematics 581 or departmental approval. Quadratic and Cyclotomic extensions, elementary class field theory, and selected topics.

MATH 584 Independent Study. (3 Hours) Prerequisite: Departmental consent. Intensive study and research of a subject selected in accordance with student needs and arranged in consultation with the staff. Topics will vary. Student will make periodic reports on his/her reading and will-prepare a scholarly paper on a problem.

MATH 585-586 Introductory Algebraic Number Theory I-II. (3-3 Hours) Prerequisites: Mathematics 512, 582, and approval of department. Valuations, fields of algebraic functions, cohomology of groans, local and global class field theory are introduced as topics.

MATH 586A Special Projects: Mathematics Curriculum Planning. (3 Hours) Prerequisite: Departmental consent. This course is designed primarily for inservice personnel in education desiring enrichment activities in mathematics curriculum planning K-12. Students taking this course will be engaged in activities directed toward planning, developing, and evaluating curricular materials that may be used for teaching grades K-12.

MATH 587 Introductory Analytic Number Theory. (3 Hours) Elements from prime number theory,prime number theory for arithmetic progressions,additive number theory, density theorems.

MATH 588-589 Sampling Methods I-II. (3-3 Hours) Prerequisite: Mathematics 272. Sampling methods: Simple random sampling, sampling for proportions and percentages, estimation of sample size, stratified random sampling ratio estimates.

MATH 590 Thesis. (3 Hours) The candidate for the Master of Science in Teaching degree must present a Thesis embodying the results of his research. The candidate chooses his problem, but approval by his adviser is required.

MATH 591-592 Basic Modern Logic I-II. (3-3 Hours) Prerequisite: Approval of department. Elementary introduction to classical first order theory (completeness, deduction theorem, Godel completeness, Herbrand's Theorem), presentation of basic model theory; axiomatic set theory, cardinal and ordinal numbers to the consistency results of Godel and the independence results of Cohen, Incompleteness Results (Godel's, Rossi's and Church's Theorem).

MATH 593 Theory of Models. (3 Hours) Prerequisites: Mathematics 592 and approval of department. Infinitary languages, ultraproducts, compactness, saturated structures, applications to mathematical theories; other topics as time permits.

MATH 594 Decidability and Undecidability. (3 Hours) Prerequisites: Mathematics 592 and approval of department. Godel's incompleteness theorem for arithmetic, recursive nonaxiomatizability of second-order logic, Church's Undecidability Theorem for first-order logic, decidable first-order theories; other topics as time permits.

MATH 595-596 Foundations of Set Theory I-II. (3-3 Hours) Prerequisite: Mathematics 591 or approval of department. Axiom systems, ordinal and cardinal arithmetic, model theory of set theory, constructible sets, relative consistency and independence of Axiom and Choice and generalized continuum hypothesis.

MATH 597-598 Theory of Recursive Functions I-II. (3-3 Hours) Prerequisites: Mathematics 592 and approval of department. Turing machines, recursive functions, recursive and recursively enumerable sets, Post's Problem and degrees of unsolvability, recursion theorem, lattice of r.e. sets, hierarchies.

MATH 599 Thesis. (3 Hours) The candidate for the Master's degree must present a Thesis embodying the results of his research. The candidate chooses his problem, but approval by his adviser is required.

MATH 600 Research. (3 Hours) Prerequisite: Department approval. Mathematics research.

MATH 611-612 Algebra I-II. (3-3 Hours) Prerequisite: Approval of department. Groups and operator groups; basic constructions; isomorphism theorems; Jordan-Holder theorem. Rings and ideals, polynomial rings and group rings; integral domains, factorization theory. Modules and vector spaces, linear mappings; theory of fields and field extensions; normal extensions; separability, Galois theory, finite fields, algebraic closure. Advanced topics.

MATH 613-614 Homological Algebra I-II. (3-3 Hours) Prerequisites: Mathematics 512 and approval of department. Categories, functions, spectral sequences, cohomology of groups. Abstract category theory.

MATH 615-616 Finite Groups I-II. (3-3 Hours) Prerequisites: Mathematics 512 and approval of department. Permutation representations. Sylow's theorems, commutator calculus, nilpotent groups; p-groups. Finiteness conditions; Burnside problem. Solvable groups; theorems of Hall and Cunihin. Special topics.

MATH 617-618 Ring Theory I-II. (3-3 Hours) Prerequisite: Mathematics 511 or departmental approval. Definition and examples of rings, some special classes of rings, homomorphisms, ideals and quotient rings, more ideals and quotient rings. The field of quotients and integral domains, Euclidean Rings, polynomial rings, polynomials over the rational field, polynomial rings over commutative rings, localization, principal rings, selected topics.

MATH 619-620 Universal Algebra I-II. (3-3 Hours) Prerequisites: Mathematics 512 and approval of department. Basic definitions. Subalgebras, congruences and homomorphisms. Direct products, lattices, Boolean algebras, Stone's representation theorem; varieties of algebras, free algebras; special topics.

MATH 621-622 Modern Geometry I-II. (3-3 Hours) Prerequisite: Approval of department. Geometries and their properties. Emphasis on properties and comparisons with systems. Analytic and synthetic projective geometry; structural systems. Advanced topics.

MATH 623-624 Differential Geometry I-II. (3-3 Hours) Survey of minimal surfaces, submanifolds, plateau's problem, Bernstein's problem; complex manifolds, Kahler metric. The Charn class. Albanese and Picard varieties. Holomorphic vector fields, automorphism group. Hodge manifolds.

MATH 625-626 Algebraic Geometry I-II. (3-3 Hours) A study in the plane, based on homogeneous point and line coordinates; a study of algebraic curves and envelopes, including such topics as invariants, singularities, reducibility, genus polar properties, Pascal and Brianchon theorems, and Jacobian, Hessian and Pluker Formulas.

MATH 629-630 Theory of Fields I-II. (3-3 Hours) Prerequisites: Mathematics 511, 512 or departmental approval. Extension fields, the transcendence of e, roots of polynomials, construction with straight-edge and compass, Galois Theory, solvability by radicals, real fields, absolute values, applications, selected topics.

MATH 631-632 Real Variables I-II. (3-3 Hours) Prerequisite: Mathematics 532 or approval of department. The Lebesgue integral, Function Spaces and Banach Spaces, Differentiation, integration of Product Spaces, Lebesgue Stieltjes Integral, linear functionals, implicit and inverse function theorems, Fubini's Theorem, Stokes' Theorem Lp classes; applications to Fourier Series.

MATH 633-634 Functional Analysis I-II. (3-3 Hours) Prerequisite: Mathematics 541 or departmental approval. Advanced Topics. Fundamentals of the theory of vector spaces, Banach Spaces; Functional equations; applications to fields of analysis. Non-linear problems. Schauder-Leray fixed-point theorem and its applications to fundamental existence theorems of analysis, convex sets and weak topologies, operators and their adjoints, semi-norms. Orthogonal projection and Liesz's Representation Theorem, the Hahn-Banach Theorems, normed ring, Ergodic and diffusion theory.

MATH 635-636 Ordinary Differential Equations I-II (3-3 Hours) Prerequisite: Mathematics 541. Approval of department. Existence theorem; linear systems; regular and irregular singular points; special topics.

MATH 637-638 Partial Differential Equations I-II. (3-3 Hours) Prerequisite: Mathematics 541. Approval of department. Classical theory of partial differential equations, together with an introduction to the modern theory based on functional analysis.

MATH 639-640 Theory of Integration I-II. (3-3 Hours) Prerequisite: Mathematics 632 or approval of department. Differentiation and integration, classical Banach spaces, abstract spaces, compact spaces, Banach spaces, measure and integration, measure and outer measure, the Daniell Integral, measure and topology, mappings and measurable spaces.

MATH 641-642 Complex Variables I-II. (3-3 Hours) Prerequisite: Approval of department. The plane and sphere of complex numbers, Differentiability and Cauchy-Riemann differential equations; Cauchy's integral theorem and integral formula. Series of analytic functions. Expansion in power series. Laurent expansion. Singularities, residue theorem, conformal mapping, Riemann mapping theorem, complex manifolds. Reflection principles, theorem of Mittag-Leffler product theorem of Weierstrass theorems of Runge and Poincare. Poisson's Integral Formula, other topics of interest.

MATH 643-644 Functions of Several Complex Variables I-II. (3-3 Hours) Prerequisites: Mathematics 642 and approval of department. Definition of homomorphic and meromorphic functions. Sequences of holomorphic functions. Analytic sets. Theorems of Cousin I, II, and Poincare. Kneser-Weierstrass integral. Functions of finite order, Jacobian Functions, Analytical continuation. Singularities of function and analytic sets on analytic sets. Integral representations of holomorphic functions. Envelopes of holomorphy. Complex manifolds and complex spaces; special topics.

MATH 645-646 Several Complex Variables I-II. (3-3 Hours) Prerequisites: Mathematics 644 and approval of department. Elementary properties of holomorphic functions. Local theory of homorphic functions and analytic sets. Analytic continuation. Coherent analytic sheaves. Cohomology with coefficients in sheaves. Stein spaces. Theorems A and B of Cartan. Theorems of Poincare and Cousin. Embedding theorems. Theorem of Runge. Envelopes of holomorphy, Levi's problem. Holomorphic maps. Compact complex spaces.

MATH 647 Entire Functions. (3 Hours) Prerequisites: Mathematics 642 and approval of department. First and Second Main Theorem of Nevanlinna. Functions of finite order. Hadamard's Theorem, functions of the exponential type. Functions of regular growth. Functions in the unit disk, Blasche Product. First and Second Main Theorem of Nevanlinna for functions for several variables, special topics.

MATH 649-650 Several Real Variables I-II. (3-3 Hours) Prerequisite: Mathematics 641 or approval of department. Necessary and sufficient conditions for an extremum, variations of Hamilton's Principle, the nonparametric problem of Bolza, parametric problems, direct methods, measure, integrals and derivatives, Lebesgue Integrals, Hamilton-Jacobi Theory, applications, nonclassical problems, selected topics.

MATH 651-652 General Topology I-II. (3-3 Hours) Prerequisite: Approval of department. Fundamentals of set theory, topological spaces, metric spaces, Function spaces and separation axioms. Complexes, homotopy and basic theorems in algebraic topology.

MATH 653-654 Algebraic Topology I-II. (3-3 Hours) Prerequisite: Mathematics 652 or 554. Approval of department. Fibre spaces, extension problems, obstruction theory.

MATH 655-656 Combinatorial Topology I-II. (3-3 Hours) Prerequisite: Mathematics 553 or departmental approval. Advanced properties of topological spaces, homology theory, cohomology groups of compacta, selected topics.

MATH 657-658 Differential Topology I-II. (3-3 Hours) Prerequisites: Mathematics 652 and 525 or 623. Study of differential manifolds from a viewpoint approximately midway between topology and differential geometry. Embedding manifolds in Euclidean spaces, transverse regularity of mappings, vector space bundles, universal bundles, characteristic classes, and the Thom Theory of Cobordism. Morse Theory of non-degenerate functions on a manifold, Morse Theory of geodesics, spherical modifications, theory of differentiable homotopy spheres, theory of handlebodies.

MATH 659-660 Algebraic Topology III-IV. (3-3 Hours) Prerequisite: Mathematics 654 or departmental approval. Sheaves and extraordinary cohomology theories, selected topics.

MATH 668 Topics in Statistics. (3 Hours) Prerequisite: Mathematics 562 or departmental approval. Topics in the advanced theory of statistics.

MATH 671-672 Advanced Numerical Analysis I-II. (3-3 Hours) Prerequisite: Mathematics 572 or departmental approval. Selected topics in advanced numerical analysis.

MATH 673-674 Approximation and Interpolation I-II. (3-3 Hours) Prerequisite: Mathematics 576 or departmental approval. Expansion theorems, degree of approximation of linear functions, selected topics.

MATH 677-678 Advanced Set Theory I-II. (3-3 Hours) Prerequisite: Mathematics 596 or departmental approval. Many equivalencies of the Axiom of Choice, selected topics.

MATH 681-682 Infinite Series I-II. (3-3 Hours) Prerequisite: Mathematics 540 or departmental approval. Selected topics are covered.

MATH 683-684 Theory of Summability I-II. (3-3 Hours) Prerequisite: Mathematics 539 or departmental approval. Advanced summability theory of series such as the Karamata-Lototsky-Jakimovski types, selected topics.

MATH 687-688-689 Research I-II-III. (3-3-3 Hours) Research in Mathematics.

MATH 690 Topics in Mathematics Education. (3 Hours) Prerequisite: Departmental approval. Selected topics are covered.

MATH 691 Topics in Algebra. (3 Hours) Prerequisite: Departmental approval.

MATH 692 Topics in Geometry. (3 Hours) Prerequisite: Departmental approval.

MATH 693 Topics in Real Analysis. (3 Hours) Prerequisite: Departmental approval.

MATH 694 Topics in Complex Analysis. (3 Hours) Prerequisite: Departmental approval.

MATH 695 Topics in Probability and Statistics. (3 Hours) Prerequisite: Departmental approval.

MATH 696 Topics in Number Theory. (3 Hours) Prerequisite: Departmental approval.

MATH 697 Topics in Numerical Analysis. (3 Hours) Prerequisite: Departmental approval.

MATH 698 Topics in Logic and Foundations. (3 Hours) Prerequisite: Departmental approval.

MATH 699 Dissertation. (3 Hours) Prerequisite: Departmental approval. Research in Mathematics.

DEPARTMENT OF PHYSICS, ATMOSPHERIC SCIENCE AND GENERAL SCIENCE

Dr. Quinton Williams, Associate Professor and Chair
P.O. Box 17660
Telephone: (601) 979-7012
Fax: (601) 979-3630
e-mail: quinton.l.williams@jsums.edu

Faculty

Dr. M. Fadavi, Associate Professor
Dr. E. Heydari, Assistant Professor
Dr. M. Longmire, Associate Professor

The Department of Physics, Atmospheric Sciences and General Science has the major teacher training responsibility in the School of Science and Technology. This program leads to the (MST) degree in Science Education with a concentration in one of the following areas: (Astronomy, Biology, Chemistry, General Science, Physics and Physical Science). The Department also offers for credit graduate science education and science content courses for graduate students of other programs. Several courses are offered for inservice teachers and other educators for professional development. These courses are often used toward certification and further degrees.

Accreditation

This program is accredited by the National Council for Accreditation of Teacher Education (NCATE).

Program Objectives

1. To provide additional preparation for science teachers and science supervisors in scientific content and supervision techniques.
2. To enable teachers of science to gain insight into the kinds of science experiences that are relevant to the needs of today's youth.
3. To develop in science teachers an awareness of the modern trends and problems in science teaching.
4. To enrich current and potential science teachers and educators with content and pedagogy in science and science education areas.
5. To offer courses of use to different non-departmental graduate degree programs.

Admission Requirement

Hold a baccalaureate degree with a major or minor in one of the natural sciences from an accredited college or university. Student maybe admitted conditionally if the Graduate Record Examination (GRE) is not taken.

Degree Requirements

A total of 30 semester hours plus a thesis (6 hours), 33 semester hours plus a project (3 hours), or 36 semester hours with neither a thesis or project.

By the end of the first year, the student should complete the Graduate English Competency Examination (GECE). Students should take the Gradsuate Area Comprehensive Examination in all core science courses.

Master of Science in Teaching

Core Courses

Course	Title	Semester Hours
EDFL 515	Methods of Educational Research	3
EDFL 514	Elementary Statistics	3
EDFL 568	Curriculum Methods	3
	Hours	9

Science Education Core Courses

SCI 502	General Science for Teachers	3
SCI 507	Earth Science	3
SCI 513	Computer Applications in the Teaching of Science	3
SCI 522	Environmental Science	3
SCI 563	Problems and Issues in Science	3
SCI 581	Operation Physic I	3
	Hours	21
SCI 599	Thesis, *or*	6
SCI 587	Independent Study	3
	Science Elective, *or*	3
	Two Science Electives	6
	Total Hours	36

DESCRIPTION OF COURSES

SCI 502 General Science for Teachers. (3 Hours) A study of topics in astronomy, chemistry, geology, meteorology and physics.

SCI 507 Earth Science. (3 Hours) An exploratory course dealing with basic concepts in geology, meteorology, and astronomy.

SCIL 507 Earth Science for Teachers Lab. (1 Hour) Laboratory experiments designed to expand subject matter taught in SCi 507.

SCI 508 Cosmology for Non-Scientists. (3 Hours) A study of the structure, makeup origin, and evolution of the universe and objects in it.

SCI 509 Earth History (3 Hours) The course studies history of the continents and oceans and the changes to the atmosphere through time.

SCI 513 Computer Applications in the Teaching of Science. (3 Hours) This course includes computer concepts; programming in the Basic language;

building modules for computer assisted instruction and computer aided instruction; problem solving on a microcomputer system.

SCI 515 Earth and Space Science (3 Hours) This course is the study of Earth Science, Geology, and Meteorology.

SCI 516 Physical Science I for Middle School Teachers (3 Hours) This course is the study of properties and reactions of matter.

SCI 517 Physical Science II for Middle School Teachers (3 Hours) This course is the study of Physics, Astronomy and Technology that includes: (in Physics) measurment, force, motion, energy, simple and compound machines, electricity and magnetism, sound, light and heat; (in Astronomy) stars in the night sky, solar system, lunar phases, eclipses, earth seasons, galaxies and universe.

SCI 518 Life Science for Teachers (3 Hours) This course is the study of biochemistry, the cell, genetics, organ systems, natural selection, diversity, ecology and the property and reaction of matter.

SCI 519 Environmental Science and Chemistry for Teachers (3 Hours).

SCI 520 Methodology for Science Teaching (3 Hours) This course includes exemplary teaching strategies and research-based methods, i.e. Inquiry-based learning, cooperative learning, and the use of technology.

SCI 522 Environmental Science. (3 Hours) A general study of environmental problems created by various kinds of pollution and the effects of man's bio-physical environment.

SCI 523 Seminar in Science (3 Hours) Provides the opportunity to discuss the most pertinent trends in science and to become familiar with current research.

SCI 524 Elements of Astronomy (3 Hours) Survey of solar and stellar systems, with emphasis on the historical and scientific development of astronomy.

SCI 525 Hands-on Activity in Astronomy (3 Hours) This course is support for instructional competency in astronomy in Mississippi.

SCI 551 Hands-on Universe in Mississippi I. (3 Hours) This course integrates mathematics, science and technology in the context of exciting astronomical explorations. This course addresses many of the goals set by the National Council of Teachers of Mathematics and the National Research Council for Math and Science Education.

SCI 563 Problems and Issues in Science. (3 Hours) Content in elementary science; aims and methods of instruction, new curricular developments.

SCI 581 Operation Physics I . (3 Hours) This course is the study of mechanics that includes: measurement, force and motion, simple machines and forces, and fluids.

SCI 552 Hands-on Universe in Mississippi II. (3 Hours) Prerequisite: SCI 551. This course integrates mathematics, science and technology in the context of exciting astronomical explorations. This course addresses many of the goals set by the National Council of Teachers of Mathematics and the National Research Council for Math and Science Education.

SCI 580 Science Technology and Environment (3 Hours) An overview of contemporary topics in science and technology. The scientific and technical materials will be covered in detail, then the social consequences of applying or misapplying that knowledge will be examined.

SCI 582 Operation Physics II. (3 Hours) This course is the study of sound and light that include: measurement, sound, behavior of light, color and vision.

SCI 583 Operation Physics III. (3 Hours) This course is the study of electricity and magnetism that include: measurement, electricity, magnets, and magnetism.

SCI 584 Operation Physics IV. (3 Hours) This Course is the study of modern physics that include: measurement, structure of matter, atoms, molecules, nuclei, elementary particles, and special and general relativity.

SCI 587 Independent Study. (1-3 Hours) For students who are actively working on special projects and consulting with their major professor.

SCI 592-592W Seminar in Meteorology. (3 Hours) Presentation and discussion of special topics and research in meteorology by staff members, students and guest lecturers.

SCI 599 Thesis (6 Hours). A minimum of 40 hours of research for the thesis must be scheduled. The thesis must show (a) mastery of the techniques of research, and (b) a very distinct contribution to the field under investigation and study.

SCI 601W Seminar in Environmental Science. (3 Hours) Advanced topics of special interest, current research, field trips, demonstrations and guest lecturers.

SCI 602 Construction of Teaching Materials for Secondary Science Instruction. (3 Hours) Special work in models, charts, graphs, photography, electrical apparatus, mechanical equipment, etc.

SCI 603 Special Topics in Science. (3 Hours) Topics of current interest, both theoretical and experimental.

SCI 604 Advanced Methods—Secondary School Science. (3 Hours) Experience with science teaching. Major trends in the new science courses and methodology programs.

SCI 605 Analysis of Science Curriculum. (3 Hours) A critical examination of contemporary and potential science curricular projects.

DEPARTMENT OF TECHNOLOGY

Dr. J. Ejiwale , Associate Professor and Acting Chair
P.O. Box 18480
Telephone: (601) 979-2466
Fax: (601) 979-4110

Faculty

Dr. I. T. Mosley, Sr., Associate Professor
Dr. P. C. Yuan, Professor

The Department of Technology offers the Master of Science in Education and the Master of Science in Hazardous Materials Management. The Master of Science in Education degree with a concentration in technology education is designed to improve the competencies of technology educators and administrators in secondary and post-secondary schools.

Admission Requirements

Admission to the graduate degree program in Hazardous Materials Management and Technology Education is governed by the regulations of the Graduate School.

Hazardous Materials Management

Degree Requirements

The degree options are 30 semester hours plus a thesis; 33 semester hours plus a project; or 36 semester hours of course credit.

Course	Title	Semester Hours
ITHM 520	Introduction of Hazardous Materials Management	3
ITHM 523	Statistics/Data Analysis	3
ITHM 524	Public Issues in Hazardous Materials	3
ITHM 525	Natural Resources and Conservation	3
ITHM 529	Env Toxicology and Risk Assessment	3
	Hours	15

Elective Courses

ITHM 521	System Modeling	3
ITHM 522	Chemistry of Hazardous Materials	3
ITHM 526	Environmental Regulations	3
ITHM 527	Water and Wastewater Treatment	3
ITHM 528	Waste Minimization	3
ITHM 530	Industrial Waste Treatment and Tech.	3
	Total Hours	30, 33 or 36

Technology Education

Degree Requirements

The degree options are 30 semester hours plus a thesis; 33 semester hours plus a project; or 36 semester hours of course credit.

Course	Title	Semester Hours
TE 501	Current Literature, Issues and Research	3
TE 504	Laboratory Planning and Management	3
TE 505	History and Philosophy of Technology Education	3
TE 512	Administration and Funding	3
TE 513	Instructional Aids	3
	Hours	15

Courses in Education

PSY 531	Elementary Statistics	3
EDFL 515	Methods of Educational Research	3
EDFL 568	Curriculum Methods	3
	Hours	9

Elective Courses

TE 511	Technical Education	3
TE 515	Career Education	3
TE 516	Curriculum Development	3
TE 521	Problems in Electronics	3
TE 522	Problems in Drafting	3
TE 523	Problems in Metals	3
TE 524	Problems in Woods	3
	Total Hours	30, 33 or 36

DESCRIPTION OF COURSES

Hazardous Materials Management

ITHM 500 Graduate Research/Thesis. (1-4 hours) The student is required to select an appropriate topic with approval from advisor and do a presentation.

ITHM 520 Introduction of Hazardous Materials Management. (3 Hours) (For Non-hazardous Materials Management Majors). An introduction to contemporary national problems of air and water pollution, environmental monitoring, toxicology, hazardous waste; general problems of environmental contamination; legal and political aspects of current regulations; general scientific principles applied to the evaluation and control of specific problems.

I**THM 521 System Modeling.** (3 Hours) Practical application of simulation to diverse environmental systems including air, land, surface, sub-surface, water systems and also, the hazardous materials management models.

ITHM 522 Chemistry of Hazardous Materials. (3 Hours) This course shows how chemistry can be applied to hazardous materials. The course is designed to introduce and train students' awareness of the unique requirements involved in handling hazardous materials when they are encountered in different situations, thus reducing the loss of lives and property. Prerequisite: Chemistry 135 & 235.

ITHM 523 Statistics/Data Analysis. (3 Hours) This course is designed for the development and maintenance of proficiency in statistical interface. It contains a

comprehensive overview of how statistics work in actual cases and how it can be applied in hazardous materials management. Prerequisite: Math 111, CSC 115, & 203.

ITHM 524 Public Issues In Hazardous Materials/Waste. (3 Hours) This course is an overview of the strategies, tactics and techniques regarding environmental affairs, both public and private.

ITHM 525 Natural Resources and Conservation. (3 Hours) This course is designed to give students pertinent information of our natural resources with emphasis on their origin, properties, use, misuse and conservation practices.

ITHM 526 Environmental Regulations. (3 Hours) A study of Federal Laws and Regulations concerning hazardous materials and wastes. This course will introduce students to laws and regulations in Mississippi and the nation. The course emphasizes how to implement and comply with laws.

ITHM 527 Water and Wastewater Treatment. (3 Hours) Students will be given an overview on waste/wastewater treatment through discussions of various selected topics. The primary focus of these topics will be to introduce students to treatment methods. Prerequisite: BIO 115 and CHEM 142.

ITHM 527 Water and Wastewater Laboratory. (1 hour) This course is the supplementary course of ITHM 527; laboratory activities which develop techniques for testing water and wastewater. This will involve tests for COD, BOD, Alkalinity, Nitrogen, Colonial Count, TCLP and several other tests. Prerequisite: Bio 101, CHEM 135 & 235, and ITHM 401.

ITHM 528 Waste Minimization. (3 Hours) This course is designed to make students aware of the vast number of problems encountered as a result of disposing waste. Also, students will be given lectures on methods of recycling, reuse and reducing our waste.

ITHM 529 Environmental Toxicology and Risk Assessment. (3 Hours) This course will involve studying chemicals and harmful actions of chemicals on biological issues. This will include understanding chemical reactions and interactions of biological organisms. Students will also be introduced to scientific data and methods currently used to access human risk to environmental chemicals.

ITHM 530 Industrial Waste Treatment and Technology. (3 Hours) This course is an advanced course for hazardous waste treatment technology. It includes training in pretreatment of hazardous materials, chemical/physical process, stabilization, recovery processes, final disposal of, and secured landfill stabilization. EPA requirements for each process will be addressed in this class. Prerequisite: ITHM 302.

Technology

TE 500 Seminar/Workshop. (3 Hours) Designed for offering courses on subjects which are current and important to industrial education.

TE 501 Current Literature, Issues and Research. (3 Hours) Identification, analysis, and discussion of the periodicals, topical books, major issues, and research in the field of industrial education.

TE 504 Laboratory Planning and Management. (3 Hours) Designing various industrial education laboratories and facilities. Includes attention to purpose, recommended sizes and other specifications.

TE 505 History and Philosophy of Technology Education. (3 Hours) Factors involved in developing the trends and leaders in industrial and vocational education. Analysis of objectives, current concepts, practices and anticipated policies in industrial education.

TE 511 Technical Education. (3 Hours) Emphasis on trends, community surveys, curricula, definitions, and needs of post-secondary technical education programs.

TE 512 Administration and Funding. (3 Hours) Identifying current legislation and funding practices concerning industrial education. Function and relationship of directors, supervisors and instructors in all fields of industrial education.

TE 513 Instructional Aids. (3 Hours) Studying the many instructional aids available for teaching industrial subjects. The course includes instruction in the common audio-visual aids but also making models, cutaways and other industrial teaching aids.

TE 515 Career Education. (3 Hours) Current career education programs and their relationship to industrial education. Emphasis on integrating career education goals in industrial education with attention to the goals of each field.

TE 516 Curriculum Development. (3 Hours) Principles and techniques of designing and writing industrial education curricula. Attention will be given to goals, behavioral objectives, designing programs to meet objectives and evaluating results.

TE 521 Problems in Electricity/Electronics (3 Hours) Opportunity to study problems related to the area of electricity/electronics. Problems based on needs of students with approval of the advisor and the Dean of the School.

TE 522 Problems in Drafting. (3 Hours) Opportunity to study problems related to the area of drafting. Problems based on needs of students with approval of the Dean of the School and his advisor.

TE 523 Problems in Metals. (3 Hours) Opportunity to study problems related to the area of metals. Problems based on needs of students with approval of the Dean of the School and his adviser.

TE 524 Problems in Woodworking. (3 Hours) Opportunity to study problems related to the area of woodworking. Problems based on needs of students with approval of the Dean of the School and his adviser.

TE 581W Residential Plumbing. (3 Hours) Residential Plumbing is designed to acquaint the student with the fundamentals of basic residential and commercial plumbing. Much of the class time will be given to hands-on activities. Graduate students in residual plumbing are

required to do a research project in air-conditioning and refrigeration.

TE 590 Thesis. (3 Hours) The candidate selects an appropriate topic with approval of adviser and his committee.

TE 599 Independent Research. (1-3 Hours) Opportunities for studying special problems and doing research in the major area. Developed and defined in consultation with the professor.

TE 600 Seminar in Industrial Education. (3 Hours) Seminar in the various fields of industrial and technical education.

TE 601 Selection and Organization of Subject Matter. (3 Hours) Analysis and selection of materials for junior and senior high school, and also, adult industrial technical education.

TE 602 Evaluation of Programs of Industrial and Technical Education. (3 Hours) Evaluation principles and practices in the specialized areas of industrial arts, technical and industrial education.

TE 603 Research in Industrial Education. (3 Hours) Rationale for and methods of research in education. Emphasis is given to the identification of researchable problems and interpretation of research studies in industrial education.

TE 621 Coordination in Occupational Training and Placement Program. (3 Hours) Analysis of objectives and scope of trade and industrial cooperative education program, apprenticeship, and general education work experiences.

TE 622 Developing Occupational Curricula in Two-Year Colleges. (3 Hours) Approaches to occupational curriculum development and course construction in junior colleges. For prospective teachers and administrative personnel.

TE 688 Internship. (variable credit) Supervised graduate internship and externship in various areas of industrial education.

TE 699 Reading and Independent Study. (variable credit) Study on an individual or group basis in industrial education.