THE SCHOOL OF COMPUTER, MATHEMATICAL, AND NATURAL SCIENCES

School of Computer, Mathematical and Natural Sciences

Dr. Alvin Kennedy, Interim Dean

Dr. Gaston N'Guerekata, Associate Dean for Undergraduate Studies

Dr. Kadir Aslan, Assistant Dean for Research and Graduate Studies

The School of Computer, Mathematical and Natural Sci- ences (SCMNS) consists of the following departments: Biology/Medical Technology, Chemistry, Computer Science, Mathematics/Actuarial Science and Physics/Engineering Physics. In addition, the School houses several science research training and academic enhancement programs, an Honors program, a Student Development program, a Transfer/ Pre-Professional program, as well as community-outreach programs. These departments and support programs all work in concert under the leadership of the Dean of the School to prepare academically sound and well-versed science and mathematics graduates to succeed, thrive and serve in tomorrow's changing scientific and technological world. The School also offers General Education Requirement courses in the sciences and mathematics to all Morgan students, regardless of their major field of study.

PHILOSOPHY AND OBJECTIVES

Excellence in teaching, productivity in research, and abundant student support and outreach services are benchmarks that embrace this School's philosophy. Together, they serve as the School's guiding force in educating Morgan science and mathematics majors to become the next generation of not only scientists and mathematicians but also community and world leaders. The primary goal of the School of Computer, Mathe- matical and Natural Sciences is therefore to recruit and maintain a cadre of learned, capable and dedicated faculty who are: (1) creative and innovative in their thinking and teaching; (2) passionate and meticulous in transmitting current and relevant subject matter in their classes; (3) productive in creating new scientific knowledge in their research laboratories; and (4) caring and knowledgeable in their roles as faculty advisors to students. Toward this end and in keeping with the three pronged mission of teaching, research and service of the University, the major objectives of the School are:

- to maintain cohesive and productive programs that focus on advancing frontiers in science, mathematics and technology;

- to recruit and retain highly qualified and productive faculty who demonstrate scholarly activities and compassion in teaching students, and who also provide demonstrated service to the university and the broader community;

- to recruit students with demonstrated potential for leadership, service and research roles in science and mathematics;

- to provide sound and up-to-date curricula that em- phasize competency in the sciences and mathematics that can be interrelated with the various other academic disciplines;

- to provide an integrated core of instruction in science and mathematics that ensures proficiency and understanding of the basic concepts of these disciplines;

- to provide state-of-the-art teaching and research fa- cilities that promote academic excellence and encourage faculty and student involvement in basic research; and

- to instill in students the desire to become scientifically and technologically literate to meet the challenges of a changing global society.

Degree Programs And Pre-Professional Agreements

The School of Computer, Mathematical and Natural Sciences offers nine (8) undergraduate degree programs leading to the Bachelor of Science (B. S.) degree. They include degrees in Actuarial Science, Biology, Chemistry Computer Science, Engineering Physics, Mathematics, Medical Technology, and Physics.

In addition, the Pre-professional Program facilitates an early selection program in medicine with the Boston University School of Medicine through the Early Medical School Selection Program (EMSSP). Morgan's
EMSSP with Boston University School of Medicine is an accelerated program that entails three years of resident study at Morgan State University. Students then transition to Boston in their senior year. In this transition year students must complete a prescribed course of study at Boston and perform satisfactorily on the MCAT in order to be fully admitted into Boston's School of Medicine. Upon successful completion of all requirements at both institutions, students will receive their bachelors degree at the end of the senior year (transition year) then be promoted to their first year of medical school.

MSU also enjoys a partnership with George Washington University School of Medicine and Health Sciences. This agreement allows the opportunity for Early Selection into the GWU Medical program. Students are expected to complete all

four years at MSU before full acceptance into the medical Selection at GWU. Students must also have attained a minimum cumulative GPA of 3.6 and maintain a B or better in all science coursework at MSU. Upon acceptance into the GWU Early Selection Program students are expected to use their summers for professional and pre-health development. The **MCAT is not required for students who matriculate from the MSU Early Selection partnership to GWU School of Medicine and Health Sciences**. Students must meet all other admission requirements.

Upon completion of the MD program, students will be awarded the MD degree by the respective medical school.

See the school's website for more details under the Pre-Professional Program.

Admission to Degree Programs

Students who meet the admission requirements of the University are eligible for admission to degree programs in the School of Computer, Mathematical and Natural Sciences. Unless specifically prohibited by University regulations, students should declare their majors as early as possible and should contact the appropriate department for further directions.

Retention in Degree Programs

In order to remain in good academic standing as majors in degree programs in the School of Computer, Mathematical and Natural Sciences, students must meet the University's standards for satisfactory academic progress outlined under the Academic Policies. According to University standards, students who attain less than a 2.0 cumulative grade point average are placed on academic probation. Students on academic probation are required to: (1) repeat all courses for which they earned less than a "C" grade, and concurrently (2) pursue no more than 13 credits until they raise their cumulative grade point average to 2.0 or better. Students who are academically dismissed by the University for unsatisfactory progress are also dismissed as degree candidates in their majors. Readmission to the University constitutes readmission as a degree candidate in the major.

Grade Change Policy

The School of Computer, Mathematical and Natural Sciences adheres strictly to the university policy concerning grade change. It does not make any exceptions to this policy.

"I" Grade Policy

"Incomplete" ("I") is given in exceptional cases to stu- dents who have satisfactorily completed at least seventy- five percent (75%) of the course requirements, and, due to documented illness or other documented emergencies beyond their control, have been unable to complete the requirements for the course. Students must completethe remaining twenty-five percent (25%) or less of the course work by the end of the next semester program. To apply for Early
of their en- rollment at the University. Otherwise, the "I" grade is changed to "F." Although a petition for "I" grade may be initiated by the student or the faculty member, the record- ing of the "I" grade must be approved by the Chairperson and the Dean. Forms are available in the Office of the Dean.

Academic Advising

Academic advising is an important part of the students' undergraduate education. In the School of Computer, Mathematical and Natural Sciences, academic advising is high on the list of priorities and is a requirement for retention in the major. The Department Chairpersons assign students faculty advisors from the point of their matriculation as majors in one of the degree programs in the School. Students are required to hold conferences with their faculty advisor a prescribed number of times per semester, depending on their classification and/or their academic standing.

Office of Student Development

The Office of Student Development focuses on improving student success, student retention and graduation rates. This Office provides materials and workshops covering academic skills-building via tutorials, time management and test taking strategies, and career opportunities for all SCMNS students.

Requirements for Graduation

Students earning degrees in the School of Computer, Mathematical and Natural Sciences must meet the following graduation requirements:

(1) **GENERAL EDUCATION REQUIREMENTS**:
In order to qualify for graduation, students must complete the courses outlined as "General Education Requirements" and "Requirements for Graduation" in the University catalog.

(2) **COMPLEMENTARY STUDIES**:
All students earning degrees in programs in the School of Computer, Mathematical and Natural Sciences must complete a six-credit Complementary Studies Program of two (2) three-credit courses or any (credit) combination thereof totaling six credits, designed to broaden their college exposure and education. Courses used to meet the Complementary Studies requirement may not be used simultaneously to satisfy other requirements. In order to qualify for graduation, students must choose any two courses that are different from those already selected to satisfy their General Education Requirements and that are not included within their Major and University Requirements.

(3) **MAJOR REQUIREMENTS**: In order to qualify for graduation, students must complete the requirements specified in the programs in which they are majoring.

(4) **REQUIRED AVERAGE**:
In order to qualify for graduation, students must have earned a cumulative average of 2.0 or better, must have a major average of 2.0 or better, and must have no outstanding grades below "C" in the major (which includes all required courses taken in the major and required supporting courses).

(5) **JUNIOR AND SENIOR LEVEL COURSES**:
In order to qualify for graduation, students must have taken two thirds of their junior and senior level (300 and 400 level) requirements in the major at Morgan State University, unless granted prior written permission by the Dean to take courses elsewhere.

(6) **SENIOR COMPREHENSIVE EXAMINATION**:
In order to qualify for graduation, students must pass the Departmental Senior Comprehensive Examination with a score of 70 or higher.

OTHER SCHOOL-WIDE POLICIES

(1) **INDEPENDENT STUDY:**
The School of Computer, Mathematical and Natural Sciences approves independent study for students only when the course has not been offered regularly enough for the student to complete degree requirements within the statute of limi- tations. In addition, the School does not approve independent study for students who have taken the course previously and failed it.

(2) **TAKING COURSES AT OTHER INSTITUTIONS**: Once students have matriculated at Morgan State University, they may not take courses at other institutions for the purpose of transferring them to Morgan, without prior writ- ten permission from the Dean of the School of Computer, Mathematical and Natural Sciences. Once prior written permission has been given, students may transfer credits, but not grades, for those courses to Morgan. As a general rule, the School of Computer, Mathematical and Natural Sciences does not grant permission for students to take a course at another institution if stu- dents have taken and failed the same course at Morgan or if students have a cumulative grade point average of less than 2.0. In addition, it does not permit students to take courses at another institution if the same courses are being offered at Morgan during that semester or session. This policy applies to CO-OP programs, as well.

(3) **EXCESS CREDITS**: The School of Computer, Mathematical and Natural Sciences adheres strictly to the university policy concerning granting permission to take excess credits during any semester. It does not make exceptions for the purpose of enabling seniors to graduate. The Dean grants permission to pur- sue excess credits only to students with a cumulative average of 3.0 or higher.

(4) **STATUTE OF LIMITATIONS ON TRANSFER EVALUATIONS**: Transfer students admitted to a program in the School of Computer, Mathematical and Natural Sciences must appeal the evaluation of their transfer credits within one (1) year of the date onwhich the transfer evaluation is issued to them. After that date, the evaluation becomes permanent, and it may not be challenged later for the purpose of meeting requirements for graduation.

(5) **REPEATING COURSES TRANSFERRED TO THE UNIVERSITY**: Students who repeat Morgan courses for which they have been given transfer credit will automatically lose those corresponding transfer credits. Once the course has been taken ay Morgan, it will not be expunged from the record.

(6) **FAMILIARITY WITH ACADEMIC POLICIES**:
In the School of Computer, Mathematical and Natural Sciences, students are held responsible for being knowledgeable of published policies and procedures at the University. Under no circumstances will ignorance of published policies and procedures be accepted as a reason for making exceptions to them.

SCMNS FRESHMAN ORIENTATION (ORNS) PROGRAM

ORNS 106 FRESHMAN ORIENTATION FOR MAJORS IN THE SCHOOL OF COMPUTER, MATHEMATICAL AND NATURAL SCIENCES
— *Two hours; 1 credit*. This course introduces students to the expectations and demands of higher education, to the legacy and tradition of Morgan State University, to college survival strategies, and to the broad array of career opportunities in the science, mathematical and technological fields. Students enrolled in this class are required to attend all university convocations and other prescribed extracurricular activities. They are also required to hold conferences with their faculty or staff advisors in order to pass the course. Students transferring 24 or more credits to the university when admitted are exempted from this requirement. (FORMERLY ORIE 106)

COURSE OFFERING

SCMNS HONORS PROGRAM

The following courses are offered by the School of Computer, Mathematical and Natural Sciences:

HONR 106 – SCMNS FRESHMAN HONORS COLLOQUIUM
Two hours lecture; 2 credits. —The purpose of this course is to teach Science Honors Program students important personal, social, and academic skills needed to succeed in education and future careers. Emphasis is placed on 1) developing self-discipline, 2) tools to stay motivated until graduation, and 3) planning and preparing for a future career in the sciences. Open to Honors students in the School of Computer, Mathematical and Natural Sciences only. This course may be substituted for ORNS 106. (FALL).

HONR 206– SCMNS SOPHOMORE HONORS COLLOQUIUM
—*Two hours lecture; 2 credits.* This course is intended to enrich the thinking of SCMNS Honors Program students by strengthening critical thinking skills through writing exercises and analysis of literature in their particular field of study. Students will also learn to think critically of their future and career aspirations through the construction of an lectronic portfolio (e-portfolio), which will allow them to connect the dots of their education and reflect upon their undergraduate career and future career endeavors. Open to honor students in the School of Computer, Mathematical and Natural Sciences only. (SPRING).

HONR 306– SCMNS HONORS THESIS SEMINAR—*Two hours lecture; 2 credits.* This course is a workshop on technical writing geared toward getting SCMNS Honors Program students started on their Honors thesis. It includes discussions of library resources, prudent use of the internet, and data analysis. (FALL/SPRING).

COURSE OFFERINGS
The following courses are offered by the interdisciplinary faculty of the School of Computer, Mathematical and Natural Sciences:

HONR 106 – FRESHMAN HONORS COLLOQUIUM
Two hours; 2 credits. —The purpose of this course is to enhance the freshman year experience of Science Honors Program students by encouraging them to think broadly about the personal and social values of a scientific education and about what it means to be an educated person. This course may be substituted for ORNS 106. (FALL/SPRING).

HONR 206–SOPHOMORE HONORS COLLOQUIUM
—*Two hours; 2 credits.* This course is designed to enrich the thinking of SCMNS Honors Program students by introducing them to research projects and other scholarly endeavors currently being conducted by SCMNS faculty members. (FALL/SPRING).

HONR 306–HONORS THESIS SEMINAR—*Two hours; 2 credits.* This course is a workshop on technical writing geared toward getting SCMNS Honors Program students started on their Honors thesis. It includes discussions of library resources, prudent use of the internet, and data analysis. (FALL/SPRING).

BIOLOGY DEPARTMENT

Chairperson of Department: Associate Professor CLEO HUGHES-DARDEN; Associate Chairperson of Department: Associate Professor LISA D. BROWN. Professors: GLORIA E. HOFFMAN, CHRISTINE F. HOHMANN, KENNETH P.

SAMUEL, JOSEPH WHITTAKER - Associate Director, GESTAR Program; Associate Professors: YUN-CHI CHEN, FRANK DENARO, CHUNLEI FAN, MICHAEL KOBAN, GABRIELLE McLEMORE, SAROJ PRAMANIK, MATHUMATHI RAJAVEL, GERALD RAMEAU, ERNEST C. STEELE, JR., JAMES WACHIRA, JONATHAN WILSON - Director of the Baltimore Urban Systemic Initiative, Assistant Professors: ROBERT JAVONILLO, SIMON NYAGA, VIJI SITTHER; Lecturers: ADEDAYO ARIYIBI, DWAYNE HILL, SANJEEDA JAFAR, HARUNA SESAY, ERIKA WHITNEY

MISSION OF THE DEPARTMENT

Our mission is to provide a rich educational and training environment for the engagement of students in interactive learning and exploration of the fundamental principles of biological systems. A faculty diverse in educational and research expertise is available for students to partner with and contribute to the expansion and deepening of our collective understanding of these principles and systems. A primary goal of the department is to continuously produce a diverse population of exceptionally qualified and trained students who are capable of securing admission into the nation's most prestigious post-baccalaureate STEM educational and training programs and ultimately identify their unique place as leaders with the full spectrum of the nations' STEM workforce.

The Department offers the following degrees:
Bachelor of Science (B.S.) in Biology
General Biology Concentration
Biomedical/Pre-Professional Track
Bachelor of Science (B.S.) in Medical Technology
Master of Science (M.S.) in Biology
Ph.D. in Bio-Environmental Science

OBJECTIVES OF THE DEPARTMENT

The objectives of the Biology Department are:

- To train students in the fundamental concepts and principles of biology;
- To develop critical thinking skills and strong quantitative and analytical laboratory skills necessary for discovering, understanding, testing, and demonstrating biological concepts and principles;
- To develop effective communication skills necessary to transmit scientific ideas and concepts in the biological sciences clearly and logically to a broad audience; and
- To give all students the opportunity to develop an intellectual and creative appreciation of living things as entities of nature's beauty and as products of evolutionary change and adaptation to the environment.

- **THE MAJOR IN BIOLOGY School Requirements**

In addition to meeting the requirements in General Education and in the major, students must also complete six (6) credits in the Complementary Studies Program required of all majors in the School of Computer, Mathematical and Natural Sciences. Options for satisfying this requirement are outlined under the section on the School of Computer, Mathematical and Natural Sciences. Also, in order to qualify for graduation, students must pass the Senior Departmental Comprehensive Examination as well as the Speech and Writing Proficiency examinations; must have taken all of their junior-and senior-level requirements in the major at Morgan (unless granted prior written permission by the Dean to take courses elsewhere); and must have earned a cumulative average of 2.0 or better and a major average of 2.0 or better, with no outstanding grades below "C" in the major (which includes all courses required for the major and required supporting courses).

Required Courses for the Major in Biology

In order to satisfy requirements for the major in Biology, students must complete the courses listed below. Students are expected to complete the core courses in Biology (105-106, 2XX, 303, 310 and BIOL 3XX or 4XX) by the end of the Junior year. In the Senior year, they are to select a minimum of eight (8) credits from courses numbered BIOL 400 AND HIGHER TO COMPLETE THE MAJOR REQUIREMENTS. BIOL 450-451 may not be used to satisfy the 400 level biology requirement. Students should note that MATH 241 and 242 are prerequisites for PHYS 205:

Course	*Description*	*Credits*
BIOL 106	Introductory Biology II (majors only) or	
(or BIOL 112)	Honors Introductory Biology II	4
BIOL 204	Developmental Biology	4
BIOL 2XX	200-level Biology course	4
BIOL 303	Genetics	4
BIOL 310	Cell and Molecular Biology	4
BIOL 3XX	300- or 400-level Biology course	4
or 4XX		
BIOL 4XX	400-level Biology course	4
BIOL 4XX	Biology course	4
or CHEM XXX	Chemistry course	
XXX	Quantitative Analysis course	4
BIOL 450/451	Critical Analysis/Senior Res Thesis	3
or BIOL 453	Scientific Communication	
CHEM 106	Principles of General Chemistry II or	4
(or CHEM 112)	General Chemistry and	
Qualitative Analysis II(Honors)**		4
CHEM 203	Organic Chemistry I	5
CHEM 204	Organic Chemistry II	5
PHYS 203	General Physics I or Univ. Phys I	4
or 205		
PHYS 204	General Physics II or Univ. Phys II	4
Free elective		4
or 206		
TOTAL CREDIT HOURS		**65**

REQUIRED GENERAL EDUCATION COURSES

BIOL 105	Introductory Biology for Majors I or	4

(or BIOL 111)**	Honors Introductory Biology I	
CHEM 105	Principles of General Chemistry I or	4
(or CHEM 111)	General Chemistry and Qualitative Analysis I (Honors)**	
MATH 113 or higher	Math Analysis I or higher**	4
TOTAL CREDIT HOURS		**12**

** The two courses chosen in each area must be sequential.
*** Exclusive of BIOL 450-451.

For CHEM elective, students may choose CHEM 202 or CHEM 304. For the quantitative analysis course, students may choose one of the following courses: ACCT 201, ECON 212, PSYC 316, PSYC 317, MATH 120. MATH 241, MATH 242, or MATH 331.

For the free elective, students may choose a course that is not being used to concomitantly fulfill another Biology curriculum requirement, a University general education requirement, or the complementary studies requirement. It is in the best interest to choose a course that is directly pertinent to and adds breadth to the students' particular interest and continued education or career goals.

The total number of Biology credits taken to satisfy the major must total 77. In addition, students are expected to complete all Biology courses except the Biology Electives by the end of their Junior year.

Honors Curriculum in Biology
In order for Honors Biology majors to satisfy their biology requirements in the Honors Program, they must complete the courses listed below: Biology 111 - 112 (versus BIOL 105 - 106).

ADDITIONAL REQUIREMENTS FOR MARC STUDENTS: Students in the MARC Program must take BIOL 452, BIOL 454, BIOL 455, MATH 241 and MATH 242.

The Minor in Biology

Students minoring in Biology must complete the following course requirements:

BIOL 105-106	Introductory Biology	8

Choose three of the five courses; at least one course at the 300 level:

BIOL 204	Developmental Biology	4
BIOL 205	Ecology and Adaptation	4
BIOL 209	Animal Physiology	4
BIOL 303	Genetics	4
BIOL 310	Cell & Molecular Biology	4
TOTAL CREDITS		**20**

UNDERGRADUATE RESEARCH PROGRAMS

Minority Biomedical Research Support (MBRS) Research Initiative for Scientific Enhancement (RISE) Program

The MBRS RISE Program is a biomedical research support program funded by a grant from the National Institute of General Medical Science (NIGMS) that is geared to increasing the number of minority scientists engaged in biomedical research. It enables faculty and students at Morgan State University to participate in biomedical research. MBRS faculty in the Department of Biology include: Drs. Lisa D. Brown, Yun-Chi Chen, Gloria Hoffman, Christine Hohmann, Cleo Hughes-Darden, Michael Koban, Simon Nyaga, Saroj Pramanik, Kenneth Samuel, Viji Sitther, Ernest Steele, and James Wachira

BIOLOGY COURSE OFFERINGS

BIOL 101 INTRODUCTORY BIOLOGY I—*Three hours lecture plus laboratory; 4 credits.* This course involves the study of the fundamental principles and concepts of biology with emphasis on molecular, cellular biology, and heredity and is designed for **non-majors** only. **Co-requisite**: MATH 106 or higher. (FALL/SPRING)

BIOL 102 INTRODUCTORY BIOLOGY II— *Three hours lecture plus laboratory; 4 credits.* This course covers the biology of plants, animal development, animal form and function, and basic principles of evolution, and is designed for **non-majors** only. **Co-requisite**: MATH 106 or higher. (FALL/SPRING)

BIOL 105 INTRODUCTORY BIOLOGY FOR MAJORS I—*Three hours lecture plus laboratory; 4 credits.* This course involves the study of the fundamental principles and concepts of biology with emphasis on molecular and cellular biology and is designed for **biology majors** only. **Co-requisite**: MATH 106 or higher. (FALL/SPRING)

BIOL 106 INTRODUCTORY BIOLOGY FOR MAJORS II— *Three hours lecture plus laboratory; 4 credits.* This course is a continuation of BIOL 105. Topics covered include the biology of plants, animal development, animal form and function, and basic principles of heredity and evolution biology. It is designed for **biology majors** only. **Prerequisite:** BIOL 105 with a grade of "C" or better; **Co-requisite**: MATH 106 or higher. (FALL/SPRING)

BIOL 111 HONORS INTRODUCTORY BIOLOGY I —*Three hours lecture plus laboratory; 4 credits.* This course involves the study of the fundamental principles and concepts of biology with emphasis on molecular and cellular biology, and is designed for students in the **Honors Program** only. This course will include supplemental lectures by visiting scientists, journal article readings and student presentations. **Co-requisite**: MATH 113 or higher. (FALL)

BIOL 112 HONORS INTRODUCTORY BIOLOGY II— *Three hours lecture plus laboratory; 4 credits.* This course is a continuation of BIOL 111. Topics covered include biology of plants, animal development, animal forms and function, and basic principles of heredity and evolution biology. It is designed for students in the **Honors Program** only. This course will in- clude supplemental lectures by visiting scientists, journal article readings and student presentations. **Prerequisite:** BIOL 111 with a grade of "C" or better; **Co-requisite**: MATH 114 or higher. (SPRING)

BIOL 201 ANATOMY AND PHYSIOLOGY I—*Three hours lecture plus laboratory; 4 credits.*) **(Major credit not given)**. This is a course in human anatomy and physiology. Consideration is given to the cells, tissues, and organs of the body and their relation to the skeletal, muscular, nervous and endocrine systems and their integration. **Prerequisites:** BIOL 101 or 105 or 111 with a grade of "C" or better and BIOL 102 or 106 or 112 with a grade of "C" or better(FALL/SPRING)

BIOL 202 ANATOMY AND PHYSIOLOGY II — *Three hours lecture laboratory; 4 credits.* **(Major credit not given).** This course is a continuation of BIOL 201 with emphasis on the circulatory, respiratory, digestive, urinary, and reproductive systems and their integration. **Prerequisites:** BIOL 101 or 105 or 111 with a grade of "C" or better, and BIOL 102 or 106 or 112 with a grade of "C" or better; and BIOL 201 with a grade of "C" or better. (FALL/SPRING)

BIOL 204 DEVELOPMENTAL BIOLOGY—*Three hours lecture plus laboratory; 4 credits.* This course serves to introduce the student to the principles, processes and problems of embryonic development in plants and animals. It also includes discussions and analyses of selected topics in developmental biology. **Prerequisites:** BIOL 105 or 111 with a grade of "C" or better and BIOL 106 or 112 with a grade of "C" or better. **Co-requisite:** MATH 113 or higher. (FALL/ SPRING)

BIOL 205 ECOLOGY AND ADAPTATIONS —*Three hours lecture plus laboratory; 4 credits.* This course is an analysis of the environmental factors affecting the evolution, adaptation, distribution and functional processes of plant and animal communities. Considerable emphasis will be placed on the Eco-system Concept. **Prerequisites:** BIOL 105 or 111 with a grade of "C" or better and BIOL 106 or 112 with a grade of "C" or better. (FALL/SPRING)

BIOL 209 PRINCIPLES OF ANIMAL PHYSIOLOGY – *Three hours of lecture plus laboratory; 4 credits.* This introductory course will emphasize the basic principles of vertebrate function at several levels of structural organization: cellular, organ system, and whole organism. Focus will be on the physiological concepts dealing with general mechanisms, while also considering the diversity of physiological adaptation among animals. Online laboratory exercises will integrate lecture material, experimental techniques and physiological variables. **Prerequisite:** BIOL 106, with a grade of "C" or better. (FALL)

BIOL 303 GENETICS — *Three hours lecture plus laboratory; 4 credits*. This course will cover fundamental principles of each of the three branches of genetics: classical/transmission, molecular and population, and will supplement the theoretical concepts given in lectures with practical laboratory experiences and genetics problem sets. Prerequisites: BIOL 105 or 111 with a grade of "C" or better and BIOL 106 or 112 with a grade of "C" or better. (FALL/SPRING)

BIOL 310 CELL AND MOLECULAR BIOLOGY — *Three hours lecture plus laboratory; 4 credits*. This is a one-semester course in cellular and molecular biology emphasizing membrane structure and function, structure of genetic material, control of gene expression and protein synthesis, cell division and differentiation. **Prerequisite:** BIOL 105 or 111 with a grade of "C" or better and BIOL 106 or 112 with a grade of "C" or better; CHEM 105 or 111 with a grade of "C" or better and CHEM 106 or 112 with a grade of "C" or better. **Co-requisite:** CHEM 203.

(FALL/SPRING)

BIOL 404 HISTOLOGY AND MICROTECHNIQUE
— Three hours lecture plus laboratory; 4 credits. This course is a microscopic study of cells, tissues, and organs for preparing slides and the use of electron micrographs utilizing animal and/or plant tissues. **Prerequisite:** BIOL 105 or 111 with a grade of "C" or better and BIOL 106 or 112 with a grade of "C" or better. (SPRING)

BIOL 405 MICROBIOLOGY *—Three hours lecture plus laboratory; 4 credits*. This course offers a study of the fundamental concepts and techniques of microbiology, bacterial anatomy and physiology, principles of microbial growth, nutrition, and metabolism. **Prerequisite:** BIOL 101 or 105 or 111 with a grade of "C" or better and BIOL 102 or 106 or 112 with a grade of "C" or better and CHEM 101 or or higher with a grade of "C" or better. (FALL/SPRING)

BIOL 406 IMMUNOLOGY AND SEROLOGY *—Three hours lecture plus laboratory*; *4 credits*. This course covers the principle theories and application of immunology, including the immune response, principles of antigen-antibody reactions, and the principles of serological procedures. The fundamentals of immunity and the immune response, including antibody structure and interactions, the complement system, hypersensitivity reactions and disorders of the immune responses are included. The application of immunological and serological techniques to the diagnosis of diseases is emphasized. **Prerequisite:** BIOL 405 with a grade of "C" or better. (FALL/ SPRING)

BIOL 408 MOLECULAR MARKERS IN BIOTECHNOLOGY *— Three hours lecture plus laboratory; 4 credits*. Students will acquire knowledge of various types of molecular markers and DNA fingerprinting methods in determination of genetic variation. Focus will be on integrating knowledge of these techniques in a hands-on setting in the laboratory. **Prerequisite:** BIOL 310 with a grade of "B" or better. (FALL/SPRING)

BIOL 411 PLANT PHYSIOLOGY *—Three hours lecture plus laboratory; 4 credits*. This course is a study of the molecular basis for the physiology of development and growth in plants. Emphasis will be on the comparative structure and function of plant organs, regulatory mechanisms and reproductive processes. **Prerequisite:** BIOL 310 with a grade of "C" or better. (FALL)

BIOL 423 PARASITOLOGY *— Three hours lecture plus laboratory; 4 credits.* This course is concerned with the identification, morphology, life cycle and relationships of parasitic protozoa, helminths and arthropods affecting man and other vertebrates. **Prerequisites:** BIOL 105 or 111 with a grade of "C" or better and BIOL 106 or 112 with a grade of "C" or better. (SPRING)

BIOL 425 ADVANCED MOLECULAR AND CELLULAR PHYSIOLOGY *— Three hours lecture plus laboratory; 4 credits.* This course employs a quantitative biophysical approach of neurons and muscles as excitable cells and tissues, and of graded and action potentials, neutrotransmission, and muscle excitation-contraction coupling. Hormonal action in cell signaling pathways and modulation of biological function is also studied. **Prerequisites:** BIOL 209 and BIOL 310 with a grade of "C" or better, MATH 114 or 141 with a grade of "C" or better, or consent of course instructor or Department of Biology Chairperson. (SPRING)

BIOL 450 CRITICAL ANALYSIS OF SCIENTIFIC LITERATURE *— Three hours lecture; 3 credits*. This is an interdisciplinary course designed to enable students with an interest in biologically relevant research to critique and present research data in their respective fields of study. The capstone experience for the class is a paper and related oral presentation, based on a review of the original research literature in the student's selected area of interest. **Prerequisite:** Consent of the course Director or Departmental Chairperson. (FALL)

BIOL 451 SENIOR SEMINAR *— Three hours lecture; 3 credits*. This course integrates skills students have acquired in hands-on research experiences with knowledge of relevant research literature to culminate in a research paper. Students will learn how to write an original research paper, based on their own data, and will present and defend their work in oral presentation format in front of an audience of faculty and fellow students. **Prerequisite:** BIOL 450 and consent of the course Director or Departmental Chairperson. (SPRING)

BIOL 453 SCIENTIFIC COMMUNICATION *— Three hours lecture; 3 credits.* This course will emphasize the mechanics of scientific writing and oral research presentations, literature search strategies, as well as the preparation of job and professional school applications. In addition, ethical and legal issues related to scientific communication will be addressed. **Prerequisite:** BIOL 105, 106, and 204 with a grade of "C" or better; and BIOL 201, 202, 205, or 209 with a grade of "C" or better. (FALL/SPRING)

BIOL 454 CONCEPTS IN COMPUTATIONAL BIOLOGY *— Three hours lecture; 3 credits.* This is a one-semester undergraduate level course that combines targeted lectures covering selected topics in basic computing techniques, computational statistical analysis, bioinformatics, genomics, and proteomics, accompanied with hands-on computational exercises in the computer laboratory. Thus, students will learn to use basic computational biology tools to perform a number of biological tasks, including nucleic acid and protein sequence analysis; structure-function relationships; molecular modeling tasks; database searches and information retrieval on the Internet; macromolecular and ligand interactions; computational statistical analysis; and mathematical modeling tasks. This is an interdisciplinary course that includes participation from the departments of Biology, Chemistry, Computer Science, and Mathematics. **Prerequisites:** BIOL 310, CHEM 203, MATH 241 or Higher, PHYS 205. All prerequisites must be passed with a grade of "C" or better. (SPRING)

BIOL 455 BIOLOGY HONORS SEMINAR —*One hour lecture; 1 credit*. This course is designed to expose students to cutting edge biomedical research by securing high quality scientists to present their current research findings during a weekly seminar. Students will also have an opportunity to meet and interact with speakers on an informal basis to discuss their career aspirations. This course can only be taken by students in the **Honors Program**, and biology majors. (FALL/SPRING)

BIOL 498 SENIOR INTERNSHIP —*Twelve hours; 4 credits*. This course provides the opportunity for the student to obtain supervised work experience in the major at an on- or off-campus site selected and approved by the Departmental Chairperson. (FALL/SPRING)

BIOL 499 SENIOR RESEARCH OR TEACHING/ TUTORIAL ASSISTANTSHIP — *Twelve hours; 3 credits.* This course provides the opportunity for the student to attain first-hand research or teaching/tutorial experience under the supervision and mentorship of a faculty member. Registration is limited to seniors with a minimum 3.0 cumulative and major grade point averages. Approval by the Departmental Chairperson and/or Dean is required for enrollment. Exceptions may be approved by the Dean. (FALL/SPRING)

INSTITUTIONAL SKILLS-BUILDING COURSES

BIOL 332 GRE MATH SKILLS--*Two hours lecture; 2 credits.* This course is designed to impart a strong foundation in mathematical skills that are geared towards successful completion of the MATH section of the GRE General Exam. (OFFERED AS NEEDED)

BIOL 333 GRE VERBAL AND ANALYTICAL WRITING SKILLS--*Two hours lecture; 2 credits.* This course is designed to provide a solid foundation in reading and writing skills that are geared towards successful completion of the verbal and analytical writing sections on the GRE General Exam. (OFFERED AS NEEDED)

MORGAN STATE UNIVERSITY
DEPARTMENT OF BIOLOGY
BACHELOR OF SCIENCE DEGREE IN BIOLOGY
GENERAL
SUGGESTED CURRICULUM SEQUENCE

FRESHMAN YEAR (FIRST SEMESTER)

BIOL 105–BP	Intro to Biology I	4
or BIOL 111	(Honors)	
CHEM 105–BP	General Chemistry	4
or CHEM 111	(Honors)	
ENGL 101–EC	English	3
MATH 113–MQ	Math Analysis I	4
ORNS 106	Freshman Orientation	1
		16

SOPHOMORE YEAR (FIRST SEMESTER)

BIOL 204	Developmental Biology	4
CHEM 203	Organic Chemistry I	5
or CHEM 205	(Honors)	
XXXX– SB	Social and Behavioral Sci Core	3
XXXX-AH	Arts & Humanities Core	3
		15

JUNIOR YEAR (FIRST SEMESTER)

BIOL 303	Genetics and Population Biology	4
PHYS 203	Fundamentals of Physics	4
XXXX - CI	Contemporary & Global Issues	3
PHIL 109-CT	Introduction to Logic	3
XXXX– SB	Social and Behavioral Sci Core	3
		17

SENIOR YEAR (FIRST SEMESTER)

XXXX	General BIOL 4XX / *CHEM Elec.	4
XXXX	Complementary Studies	3
XXXX	**Quantitative Analysis Course	4
XXXX-HH	Health & Healthful Living	3
		14

FRESHMAN YEAR (SECOND SEMESTER)

BIOL 106	Intro to Biology II	4
or BIOL 112	(Honors)	
CHEM 106	General Chemistry	4
or CHEM 112	(Honors)	
MATH 114–MQ	Math Analysis II	4
ENGL 102–EC	English	3
		15

SOPHOMORE YEAR (SECOND SEMESTER)

BIOL 2XX	200 Level Biology Course	4
CHEM 204	Organic Chemistry II	5
or CHEM 206	(Honors)	
XXXX-AH	Arts & Humanities Core	3
COSC 110-IM	Introduction to Computer Science	3
		15

JUNIOR YEAR (SECOND SEMESTER)

BIOL 310	Cell and Molecular Biology	4
PHYS 204	Fundamentals of Physics	4
BIOL 4XX	Biology Course (400 level)	4
PHEC XXX	Physical Education	1
		13

SENIOR YEAR (SECOND SEMESTER)

BIOL 4XX	Biology Course (400 level)	4
XXXX	Complementary Studies	3
BIOL 4XX	Scientific Writing Course	3
XXXX	Free Electives	5
		15

TOTAL CREDIT HOURS **120**

*For CHEM elective, students may choose CHEM 202 or CHEM 304

** For the quantitative analysis course, students may choose one of the following courses: ACCT 201, ECON 212, PSYC 316, PSYC 317, MATH 120. MATH 241, MATH 242, or MATH 331

MORGAN STATE UNIVERSITY
DEPARTMENT OF BIOLOGY
BACHELOR OF SCIENCE DEGREE IN BIOLOGY
BIOMEDICAL/ PRE-PROFESSIONAL
SUGGESTED CURRICULUM SEQUENCE

FRESHMAN YEAR (FIRST SEMESTER)

BIOL 105-BP	Intro to Biology I	4
or BIOL 111	(Honors)	
CHEM 105-BP	General Chemistry	4
or CHEM 111	(Honors)	
ENGL 101-EC	English	3
XXX- SB	Social & Behavioral Science Core	3
ORNS 106	Freshman Orientation	1
		15

SOPHOMORE YEAR (FIRST SEMESTER)

BIOL 204	Developmental Biology	4
CHEM 203	Organic Chemistry I	5
or CHEM 205		
XXXX-SB	Social & Behavioral Science Core	3
XXXX-AH	Arts & Humanities Core	3
		15

JUNIOR YEAR (FIRST SEMESTER)

BIOL 303	Genetics and Population Biology	4
PHYS 203	Fundamentals of Physics	4
XXXX - CI	Contemporary & Global Issues	3
PHIL 109-CT	Introduction to Logic	3
PHEC XXX	Physical Education Elective	1
		15

SENIOR YEAR (FIRST SEMESTER)

BIOL 205	Ecology & Adaptation	4
CHEM 304	Biochemistry	4
BIOL 4XX	400 Level Biology Course	4
XXXX	*Statistics Elective	3
XXXX-HH	Health & Healthful Living	3
		18

FRESHMAN YEAR (SECOND SEMESTER)

BIOL 106	Introduction to Biology II	3
or BIOL 112	(Honors)	
CHEM 106	General Chemistry II	3
Or CHEM 112	(Honors)	
MATH 241-MQ	Calculus I	4
ENGL 102-EC	English	3
		15

SOPHOMORE YEAR (SECOND SEMESTER)

BIOL 209	Animal Physiology	4
CHEM 204	Organic Chemistry	5
or CHEM 206		
XXXX-AH	Arts & Humanities Core	3
COSC 110-IM	Introduction to Computer Science	3
		15

JUNIOR YEAR (SECOND SEMESTER)

BIOL 310	Cell and Molecular Biology	4
PHYS 204	Fundamentals of Physics	4
XXXX	Complementary Studies	3
PYSC 108	Scientific Method in PSY	3
		14

SENIOR YEAR (SECOND SEMESTER)

BIOL 4XX	400 Level Biology Course	4
XXXX	Complementary Studies	3
XXXX	Free Elective	3
BIOL 4XX	Scientific Writing Course	3
		13

TOTAL CREDIT HOURS
120

***Students can choose from the following to satisfy the Statistics elective: Math 120, PSYC 316**

Students are strongly advised to see their major advisor and the Director of Pre-Professional Programs for advising.

THE MEDICAL TECHNOLOGY PROGRAM
(Under the auspices of the Department of Biology)

Director of Medical Technology Program: Associate Professor DIANE WILSON; Assistant Professor: MATHUMATHI RAJAVEL

THE MAJOR IN MEDICAL TECHNOLOGY

School Requirements: In addition to meeting the requirements in General Education and in the major, students must also complete six (6) credits in the Complementary Studies Program required of all majors in the School of Computer, Mathematical, and Natural Sciences. Also, in order to qualify for graduation, students must pass the Senior Departmental Comprehensive Examination, as well as the Speech and Writing Proficiency Examinations; must have taken all of their junior- and senior-level medical technology requirements in the major at Morgan (unless granted prior written permission by Dean to take courses elsewhere); and must have earned a cumulative average of 3.0 or better and a major average of 3.0 or better, with no outstanding grades below "C" in the major (which includes all courses required for the major and required supporting courses).

Medical Technology/Medical Laboratory Sciences is a rapidly evolving health care profession. Medical Technologists/Medical Laboratory Scientists perform chemical, hematological, immunological, microscopic and microbiological testing on body fluids using various instruments to obtain results. These data are essential for medical decisions, prevention and treatment of diseases.
The Medical Technology/ Medical Laboratory Sciences curriculum is a four- year, undergraduate professional program approved and accredited
by the National Accrediting Agency for Clinical Laboratory Sciences (NAACLS)*
* National Accrediting Agency for Clinical Laboratory Sciences (NAACLS)
5600 N. River Road, Suite 700, Rosemnont, IL 60018
Phone: 733-714-8880
www.naacls.org
Upon successful completion of this four-year program, the student is awarded the B.S. Degree in Medical Technology by Morgan State University.

Required Courses in the Major in Medical Technology
In order to satisfy requirements for the major in Medical Technology, students must complete the courses listed below, which include applied clinical laboratory experiences under the direction of qualified medical laboratory technologists:

Course	*Description*	*Credits*
	Major Courses	
BIOL 209	Principles of Animal Physiology	4
BIOL 405	Microbiology	4
CHEM 106	Principles of General Chemistry II	4
CHEM 201	Org. Chem. for Allied Health Major	4
CHEM 202	Biochemistry for Allied Health Major	4
MATH 114	Introduction to Mathematical Analysis II	4
MDTC 100	Introduction to Medical Laboratory Science	1
MDTC 300	Principles of Medical Technology	3
MDTC 305	Clinical Chemistry I	3
MDTC 320	Clinical Hematology I	3
MDTC 321	Clinical Microscopy	2
MDTC 330	Clinical Immunoserology	4
MDTC 331	Clinical Immunohematology I	3
MDTC 335	Pathogenic Bacteriology	4
MDTC 410	Clinical Chemistry II	4
MDTC 420	Clinical Hematology II	3
MDTC 431	Clinical Immunohematology II	2
MDTC 440	Clinical Microbiology	5
MDTC 450	Medical Technology Seminar	1
MDTC 470	Intro to Molecular Diagnostics	2
MDTC 480	Clinical Laboratory Science Review	1

APPLIED CLINICAL LABORATORY PRACTICUM

MDTC 411	Clinical Chemistry Practicum	3
MDTC 422	ClinicalHematology Practicum	3
MDTC 432	Immunohematology Praticum	3
MDTC 441	Clinical Microbiology Practicum	3

TOTAL CREDITS		**77**

REQUIRED GENERAL EDUCATION COURSES

BIOL 105		Introductory Biology I	4
CHEM 105	or	Principles of General Chemistry I or	4
CHEM 111		General Chemistry (Honors)	
MATH 113		Introduction to Mathematical Analysis	4

TOTAL CREDITS	**12**

MEDICAL TECHNOLOGY COURSE OFFERINGS
(Open only to Medical Technology majors and to be taken in the sequence indicated)

MDTC 100 INTRODUCTION TO MEDICAL LABORATORY SCIENCE
— *1 credit*. This is an introductory course to the clinical laboratory profession. Topics include clinical laboratory organization, personnel and regulatory agencies and issues. Professional interactions with practicing Medical Laboratory Professionals are required. Basic clinical laboratory procedures will be performed. (SPRING).

MDTC 300 PRINCIPLES OF MEDICAL TECHNOLOGY — 3 *credits.* This is an integrated lecture and laboratory course to introduce concepts and techniques in the clinical laboratories. Topics include laboratory safety and mathematics, glassware, pipets, principles of instrumentation and quality assurance. Students will develop basic laboratory techniques and skills in the laboratory sessions. **Prerequisite:** CHEM 201 (FALL).

MDTC 305 CLINICAL CHEMISTRY I — *3 credits*. This is an introductory lecture/laboratory course to introduce the basic principles of clinical chemistry. Topics include carbohydrates, proteins and lipid metabolism, pathophysiology and testing of body fluids to evaluate the metabolic processes. Manual and automated methods of measurement of the clinically significant analytes will be performed in the laboratory sessions. **Prerequisite:** MDTC 300 (SPRING).

MDTC 320 CLINICAL HEMATOLOGY I — *3 credits.* An introductory course to the basic principles of hematology and the study of anemias. Topics include hematopoiesis, erythropoiesis, anemias, and hemoglobinopathies. Students will learn to evaluate normal and abnormal cellular morphology through a systematic evaluation of the peripheral smear and all of its components. Additionally, students will learn to integrate these findings into the clinical picture. Reference intervals (Normal values), the laboratory evaluation of hematological diseases and treatment plans will be presented in detail. Manual and automated procedures for components of the blood will be performed in the laboratory session. Laboratory exercises, case studies, and integrated discussions will complement the course. **Prerequisite:** MDTC 300 (SPRING)

MDTC 321 CLINICAL MICROSCOPY — *2 credits*. This lecture and laboratory course introduces the students to the concepts and principles in the analysis of urine and other body fluids. Routine biochemical and microscopic examination of body fluids and correlation of results will be done in the laboratory. Case studies are used to correlate the lecture and lab results. (FALL).

MDTC 330 CLINICAL IMMUNOSEROLOGY — 4 *credits*. The purpose of this lecture/laboratory course is to introduce the clinical immunology concepts and the essential principles of serologic techniques that are commonly employed in the clinical laboratory. The course is organized into four critical parts: 1) the organization and applications of the soluble mediators of the immune system; complement, 2) hypersensitivity and the Major Histocompatibility Complex; 3) diseases associated with the deficiency of the Immune system; and, 4) serologic testing methodologies for the bacterial, viral, fungal and parasitic diseases and basic immunologic procedures. This course also contains a laboratory component that introduces the practical applications of the serologic testing for diseases such as syphilis, streptococcal infections, and infectious mononucleosis. **Prerequisites**: MDTC 300, BIOL 405. Open to non-majors with permission of the Program Director. (SPRING)

MDTC 331 IMMUNOHEMATOLOGY I — *3 credits.* This course is designed to introduce the student to basic concepts in transfusion medicine. Basic blood group serology will be stressed as well as immunologic techniques which apply to blood banking. Additionally, donor screening and component preparation and handling will be stressed. **Prerequisite:** MDTC 300 (SPRING).

MDTC 335 PATHOGENIC BACTERIOLOGY — *4 credits.* This is an integrated lecture/laboratory course of Part I of Clinical Microbiology. The lecture emphasis is on the understanding of the pathogenic bacteria and its role in the pathogenesis of human disease. The focus of the laboratory course will primarily be on the sample handling, culturing and identifying some of the clinically relevant pathogenic bacteria. Information on the types of diseases, epidemiology and transmissions, and the prophylactic and therapeutic methods of dealing with these organisms will be presented. **Prerequisite:** BIOL 405 (SPRING). Open to non-majors with permission of the Program Director.

MDTC 410 CLINICAL CHEMISTRY II — *4 credits.* This course is a continuation of Clinical Chemistry I. Students will be presented the role, clinical significance and method of measurement for clinically significant electrolytes, enzymes, hormones and non-protein nitrogenous substances. Concepts on blood gases, therapeutic drugs and drugs of abuse will be presented. Operational and methodology principles, maintenance and trouble shooting of the instrumentation used in the measurement of the analytes will be performed in the laboratory sessions. **Prerequisites:** MDTC 300 and MDTC 305 (SUMMER).

MDTC 411 CLINICAL PRACTICE: CHEMISTRY
— *3 credits.* This course consists of applied experience in the clinical chemistry section of the hospital or clinical

laboratory. Students will perform all routine procedures under the direction of a qualified laboratory medical technologist/clinical laboratory scientist. Correlation of laboratory results with pathological conditions will be done by the students. **Prerequisites:** MDTC 300, MDTC 305 and MDTC 410 (SPRING)

MDTC 420 CLINICAL HEMATOLOGY II — *3 credits.* This course introduces the student to advanced concepts of hematology and hemostasis (coagulation). Reference intervals (Normal values) and basic hemato- logic testing will be stressed and principles of myelo- proliferative disorders, the leukemias and the lympho-proliferative disorders will be explained. Students will be introduced to the principle of electronic counting and will learn to interpret scatterplots or other graphical material. The concepts of hemostasis basics and advanced will be developed through laboratory exercises, case studies and classroom discussions. **Prerequisite:** MDTC 320 (FALL)

MDTC 422 CLINICAL PRACTICE: HEMATOLOGY/MICROSCOPY — *3 credits.* This course consists of applied experience in the hematology section of the hospital laboratory or clinical laboratory. Students will perform all routine procedures under the direction of a qualified laboratory technologist. This instruction will enable the students to develop confidence and proficiency in the performance of laboratory tests. **Prerequisites:** MDTC 320 and MDTC 420 (SPRING).

MDTC 431 IMMUNOHEMATOLOGY II — *2 credits*. This course is designed to introduce and build upon practical and theoretical concepts presented in Immuno-hematology I. Additional topics to be covered include investigations and management of hemolytic disease of the fetus and newborn (HDFN), transfusion reactions and autoimmune hemolytic anemias. **Prerequisite:** MDTC 331 (FALL).

MDTC 432 CLINICAL PRACTICE:TRANSFUSION MEDICINE/BLOOD BANK — *3 credits.* This course consists of applied experience in the blood bank/transfusion medicine section of the hospital laboratory or clinical laboratory. Students will perform all routine procedures under the direction of a qualified medical technologist/clinical laboratory scientist. **Prerequisites:** MDTC 331 and MDTC 431 (SPRING).

MDTC 440 CLINICAL MICROBIOLOGY — *5 credits*. This is an integrated lecture and laboratory course of Part II Clinical Microbiology. This course will introduce the student to diagnostic methods of Bacteriology, Mycology, Virology and Parasitology. Clinical specimens will be cultured to differentiate normal flora from pathogenic organisms in the identification process. A discussion of antimicrobial testing and therapy will be included. Pathogenic fungi, yeasts, and parasites will be incorporated. **Prerequisites:** MDTC 330 and MDTC 335 (FALL).

MDTC 441 CLINICAL PRACTICE: MICRO-BIOLOGY — *3 credits*. This course consists of applied experience in the microbiology/immunology section of the hospital laboratory or clinical laboratory. Students will perform all routine procedures under the direction of a qualified medical technologist/clinical laboratory scientist. Students may also be exposed to molecular techniques in hospital setting. **Prerequisites:** MDTC 330, MDTC 335, MDTC 440 and MDTC 470 (SPRING).

MDTC 450 MEDICAL TECHNOLOGY SEMINAR— *1 credit*. This course consists of a laboratory management, education, and research design component. Basic principles and concepts for each of the components will be presented. Students will make several presentations from selected topics on the components. **Prerequisites:** MDTC 330, MDTC 410, MDTC 420, MDTC 431, MDTC 440 (FALL).

MDTC 470 INTRODUCTION TO MOLECULAR DIAGNOSTICS - *2 credits*. This course is a three-week integrated lecture and laboratory course. The emphasis is on the understanding of the molecular methodologies that are employed in clinical applications which include diagnosis of infectious diseases, inherited disorders, cancers, prenatal, paternity and forensics testing. **Prerequisites:** MDTC 300, MDTC 330, BIOL 405, BIOL 406 (FALL). Open to non-majors with permission of the Program Director.

MDTC 480 CLINICAL LABORATORY SCIENCE REVIEW — *1 credit*. This course will provide an in-depth review of subject areas in Clinical Chemistry, Hematology, Immunohematology, Immunology, Urinalysis/Body Fluids and Microbiology. Assessment will be done for each of the six aforementioned disciplines after completion of the related clinical rotation practicums. The ultimate goal of this course is preparation for the senior comprehensive examination, which will be given near the end of the spring semester, and the certification examination. **Prerequisites:** MDTC 300, 305, 320, 330, 331, 335, 410, 420, 429, 431, and 440 (SPRING).

MORGAN STATE UNIVERSITY
DEPARTMENT OF BIOLOGY
BACHELOR OF SCIENCE DEGREE IN MEDICAL TECHNOLOGY
SUGGESTED CURRICULUM SEQUENCE

Pre-Professional Phase

FRESHMAN YEAR (FIRST SEMESTER)

ENGL 101-EC	English	3
XXXX-SB	Social & Behavioral Science Core	3
CHEM 105-BP	General Chemistry	4
or CHEM 111	(Honors)	
MATH 113-MQ	Math. Analysis I	4
ORNS 106	Freshman Orientation	1
		15

SOPHOMORE YEAR (FIRST SEMESTER)

XXXX-AH	Arts & Humanities Core	3
BIOL 105-BP	Intro. to Biology I	4
CHEM 201	Organic Chemistry (Allied Hlth.)	4
PHIL 109-CT	Introduction to Logic	3
INSS 141	Intro. to Computer-Based Info. Sys	3
		17

***Professional Phase**

JUNIOR YEAR (FIRST SEMESTER)

BIOL 405	Microbiology	4
HIST 350-CI	African Diaspora	3
MDTC 321	Clinical Microscopy	2
XXXX	Complementary Studies	3
MDTC 300	Principles of Medical Technology	3
		15

SENIOR YEAR (SUMMER SEMESTER)

MDTC 410	Clinical Chemistry	4
		4

SENIOR YEAR (FIRST SEMESTER)

MDTC 420	Clinical Hematology II	3
MDTC 431	Immunohematology II	2
MDTC 440	Clinical Microbiology	5
MDTC 450	Med. Tech. Seminar	1
MDTC 470	Intro. Molecular Diag.	2
		13

*** Admission to program is required to take Professional Phase MT courses**

**** Courses do not run concurrently**

FRESHMAN YEAR (SECOND SEMESTER)

ENGL 102-EC	English	3
XXXX-SB	Social & Behavioral Science Core	3
CHEM 106	General Chemistry II	4
or CHEM 112	(Honors)	
MATH 114-MQ	Math. Analysis II	4
MDTC 100	Introduction to Medical Lab Sci.	1
		15

SOPHOMORE YEAR (SECOND SEMESTER)

XXXX-AH	Arts & Humanities Core	3
BIOL 209	Animal Physiology	4
CHEM 202	Biochemistry (Allied Hlth.)	4
XXXX-HH	Health & Healthful Living	3
PHEC XXX	Physical Education	1
		15

JUNIOR YEAR (SECOND SEMESTER)

XXXX	Complementary Studies	3
MDTC 330	Clinical Immunoserology	4
MDTC 305	Introduction to Clinical Chemistry	3
MDTC 335	Path. Microbiology	4
******MDTC 320	Clinical Hematology I	3
******MDTC 331	Immunohematology	3
		20

CLINICAL ROTATIONS

SENIOR YEAR (SECOND SEMESTER)

MDTC 411	Clinical Practicum (Chemistry)	3
MDTC 422	Clinical Practicum (Hema/Micro)	3
MDTC 432	Clinical Practicum (Immunohem)	3
MDTC 441	Clinical Practicum (Microbiology)	3
MDTC 480	Clinical Lab. Science Review	1
		13

TOTAL CREDIT HOURS **127**

CHEMISTRY DEPARTMENT

Interim Chairperson of Department: Angela Winstead

Professors: Kadir Aslan, Maurice Iwunze, Santosh Mandal, Angela Winstead
Associate Professors: Mohammad Hokmabadi, Roosevelt Shaw, Yongchao Zhang
Assistant Professors: Pumtiwitt McCarthy
Lecturers: Elizabeth Akinyele, Friedrich Burnett, Gregory Haynes, Louise Hellwig, Niangoran Koissi, Richard Williams
Laboratory Assistants: Cole Grinnell, Solomon Tadesse
Storekeeper: Abisola Akinyele

OBJECTIVES OF THE DEPARTMENT

The program of courses in Chemistry is primarily intended to provide a sound education, as well as excellent research and technical training. The general aim of the Department is to afford thorough instruction in the fundamental theories and principles and in the basic techniques of science. Particular emphasis is placed upon precision of observation and measurement and upon the application of the scientific method.

Two majors are offered by the Department. 1) The Major in Chemistry (ACS). This major is accredited by the American Chemical Society. 2) The General major in Chemistry. Students who plan to continue their studies in graduate and professional school should elect the ACS option, while those who plan to pursue an advanced degree in health sciences may elect the General major in Chemistry.

THE MAJOR IN CHEMISTRY ACS

School Requirements: In addition to meeting the requirements in General Education and in the major, students must also complete six (6) credits in the Complimentary Studies Program required of all majors in the School of Computer, Mathematical and Natural Sciences. Options for satisfying this requirement are outlined under the section on the School of Computer, Mathematical and Natural Sciences. To qualify for graduation, students must pass the Senior Departmental Comprehensive Examination; must have taken all of their junior- and senior-level requirements in the major at Morgan (unless granted prior written permission by the Dean to take courses elsewhere); and must have earned a cumulative average of 2.0 or better and a major average of 2.0 or better, with no outstanding grades below "C" in the major (which includes all courses required for the major and required supporting courses).

ACS ACCREDITATION

Students who wish to be certified by the American Chemical Society must choose MATH 340 (Differential Equations), MATH 243, MATH 331, or MATH 312 as an elective, along with one other advanced mathematics, or advanced physics, or computer science course. Please note that MATH 340 is a prerequisite for CHEM 308.

Required Courses in the Major in Chemistry ACS

Course	*Description*	*Credits*
CHEM 105	Principles of General Chemistry I	4
or 111	General Chemistry (Honors)	
CHEM 106	Principles of General Chemistry II	
or 112	General Chemistry and Qualitative Analysis (Honors)	4
CHEM 203	Organic Chemistry I	5
CHEM 204	Organic Chemistry II	5
CHEM 207	QuantitativeAnalysis	4
CHEM 304	Biochemistry	4
CHEM 307	Physical Chemistry I	4
CHEM 308	Physical Chemistry II	4
CHEM 309	Physical Inorganic Laboratory	3
CHEM 312	Advanced Inorganic Chemistry	3
CHEM 314	Instrumental Methods of Analysis	4
CHEM 404	Senior Seminar	1
CHEM 407	Advanced Physical Chemistry	4
CHEM 408	Advanced Organic Chemistry	4
MATH 242	Calculus II	4
PHYS 206	University Physics II	5
Chem 300	Effective Technical Presentations	
or Chem 401|402	Undergraduate Research	1

Chemistry Proficiency Examination at beginning of Junior year.

TOTAL: 63

Required General Education Courses

Course	*Description*	*Credits*
BIOL 105	Introductory Biology	4
or 111	Introductory Biology (Honors)	
MATH 241	Calculus I	4
PHYS 205	University Physics	5
	TOTAL:	**13**

THE MAJOR IN CHEMISTRY
GENERAL

School Requirements: In addition to meeting the requirements in General Education and in the major, students must also complete six (6) credits in the Complimentary Studies required of all majors in the School of Computer, Mathematical, and Natural Sciences. Options for satisfying this requirement are outlined under the section on the School of Computer, Mathematical, and Natural Sciences. Also, to qualify for graduation, students must pass the Senior Departmental Comprehensive Examination; must have taken all of their junior-and senior-level requirements in the major at Morgan (unless granted prior written permission by the Dean to take courses elsewhere); and must have earned a cumulative average of 2.0 or better and a major average of 2.0 or better, with no outstanding grades below "C" in the major (which includes all courses required for the major and required supporting courses).

This degree option provides an opportunity for students to prepare for the study of medicine, pharmacy, dentistry, and for careers in secondary education. Students who complete this major will not be certified by the department for graduate study in Chemistry.

Required Courses for the Major in Chemistry- General

Course	Description	Credits
CHEM 105	Principles of General Chemistry I	4
or 111	General Chemistry (Honors)	
CHEM 106	Principles of General Chemistry II	
or 112	General Chemistry and Qualitative Analysis (Honors)	4
CHEM 203	Organic Chemistry I	5
CHEM 204	Organic Chemistry II	5
CHEM 207	Quantitative Analysis I	4
CHEM 304	Biochemistry	4
CHEM 307	Physical Chemistry I	4
CHEM 309	Physical Inorganic Laboratory	3
CHEM 320	Polymer Chemistry	3
CHEM 404	Senior Seminar	1
CHEM 408	Advanced Organic Chemistry	4
MATH 114	Introduction to Math Analysis II Or Higher	4
MATH 241	Calculus I or Higher	4
MATH 242	Calculus II or Higher	4
PHYS 206	University Physics II	5
CHEM 300	Effective Technical Presentations	
or 401/402	Undergraduate Research	1

Chemistry Proficiency Examination at beginning of junior year.

TOTAL: 59

REQUIRED GENERAL EDUCATION COURSES

BIO 105/ 111	Introductory Biology (Honors)	4
MATH 113	Intro to Mathematical Analysis or Higher	3/4
PHYS 205	University Physics I	5
	TOTAL:	**12/13**

REQUIRED COURSES FOR A MINOR IN CHEMISTRY

Students minoring in chemistry must complete the following required courses:

CHOOSE ONE COURSE

Description	Course	Credits
CHEM 106	Principles of General Chemistry II	4
or 112	General Chemistry and Qualitative Analysis (Honors)	

CHOOSE ADDITIONAL COURSES ***14***

CHEM 203	Organic Chemistry I	5
CHEM 204	Organic Chemistry II	5
CHEM 207	Quantitative Analysis I	4
CHEM 211	Environmental Chemistry	3
CHEM 304	Biochemistry	4
CHEM 307	Physical Chemistry I	4
CHEM 309	Physical Inorganic Laboratory	3
CHEM 311	Enviro Analytical Chemistry	4
CHEM 320	Polymer Chemistry	3
CHEM 408	Advanced Organic Chemistry	4
	TOTAL:	**18**

COURSE OFFERINGS

PREREQUISITE COURSES LISTED IN THE DESCRIPTIONS BELOW MUST BE COMPLETED WITH A GRADE OF C OR BETTER IN ORDER TO TAKE THE INDICATED COURSE. IT IS EXPECTED THAT ALL PRIOR PREREQUISITE COURSES TO THE ONES LISTED HAVE ALSO BEEN SATISFIED WITH A GRADE OF C OR BETTER.

CHEM 101/101L GENERAL CHEMISTRY--- *Three hours lecture (3 credits), 3 hours laboratory (1 credit); total 4 credits.* A careful study of the fundamental principles of chemistry with emphasis on mathematical manipulations, symbols, formulas and equations, the structure of atoms and the Periodic Law, Chemical bonding, Molecular Structure, the Gaseous State and Kinetic Molecular Theory, and the Liquid and Solid States. Laboratory work introduces students to basic chemical techniques and includes introductory inorganic qualitative and quantitative analyses.

CHEM 105/105L PRINCIPLES OF GENERAL CHEMISTRY I---*Three hours lecture (3 credits), 3 hours laboratory (1 credit); total 4 credits*. This is the first semester of a two semester Principles of General Chemistry course. This course is for all majors which require 200 level chemistry courses or higher. The main goal of this course is to learn core topics of fundamental principles of chemistry. This includes modern atomic theory, the chemical bonding and the periodic law, stoichiometry, chemical reactions, theromchemistry, chemical reactions, molecular structure, kinetic molecular theory, and behavior of gases. Laboratory work introduces students to basic chemical techniques and includes development of good and safe laboratory techniques. Prerequisite: High School Chemistry. Corequisite: Math 113 or higher.

CHEM 106/106L PRINCIPLES OF GENERAL CHEMISTRY II---*Three hours lecture (3 credits), 3 hours laboratory (1 credit); total 4 credits*. This course is the continuation of Principles of General Chemistry I, Chem 105. This course is designed for all majors which require 200 level chemistry courses or higher. Topics discussed are properties of solutions, chemical kinetics and chemical equilibrium, acid-base equilibria, chemical thermodynamics, electrochemistry, coordination chemistry, and organic chemistry. Laboratory work for the first half of the semester is devoted to experiments that parallel the topics of this course list above. The remainder of the semester involves teaching students principles of semi-micro-qualitative analysis and to relate these experiences to "real world" occurrences. Prerequisite: CHEM 105 or 111 and CHEM 105L OR CHEM 111L. **Prerequisite courses listed must be completed with a grade of C or better in order to take the indicated course. It is expected that all prior prerequisite courses to the ones listed have also been satisfied with a grade of C or better.**

CHEM 110/110L GENERAL CHEMISTRY FOR ENGINEERING STUDENTS--- *Three hours lecture (3 credits), 3 hours laboratory (1 credit); total 4 credits.* This course in General Chemistry is designed for engineering majors. The topics covered include chemical principles and concepts from CHEM 105 and CHEM 106. Corequisite: Math 113 or higher.

CHEM 111/111L GENERAL CHEMISTRY (HONORS)--- *Three hours lecture (3 credits), 3 hours laboratory (1 credit); total 4 credits.* This course in General Chemistry is designed for honors-level students. The topics treated are basically the same as CHEM 106, but they are discussed in greater depth and at a higher level of sophistication. Corequisite: Math 113 or higher.

CHEM 112/112L GENERAL CHEMISTRY AND QUALITATIVE ANALYSIS (HONORS)--- *Three hours lecture (3 credits), 3 hours laboratory (1 credit); total 4 credits* This course is a continuation of CHEM 111. Prerequisite: CHEM 106/106L or 110/110L or 111/111L. **Prerequisite courses listed must be completed with a grade of C or better in order to take the indicated course. It is expected that all prior prerequisite courses to the ones listed have also been satisfied with a grade of C or better.**

CHEM 201 ORGANIC CHEMISTRY FOR ALLIED HEALTH SCIENCE MAJORS--- *Three hours lecture (3 credits), 3 hours laboratory (1 credit); total 4 credits.* This is a one-semester organic chemistry course. The course stresses the concept of organic compounds related to biological processes. Organic chemical nomenclature, structure, and properties of carbon compounds are illustrated by applications to human life. Laboratory work includes methods of separation, purification, testing, and spectroscopy of biologically interesting organic compounds. The course is designed for allied health science majors and will not carry credit towards a major or minor in chemistry. **Prerequisite:** CHEM 106 or CHEM 112 AND CHEM 106L or CHEM 112L **AND** all prior prerequisites for these courses. **Prerequisite courses listed must be completed with a grade of C or better in order to take the indicated course. It is expected that all prior prerequisite courses to the ones listed have also been satisfied with a grade of C or better.**

CHEM 202 BIOCHEMISTRY FOR ALLIED HEALTH SCIENCE MAJORS--- *Three hours lecture (3 credits), 3 hours laboratory (1 credit); total 4 credits.* This course presents an introduction to the chemical structure of cellular components, namely carbohydrates, amino acids and proteins, lipids and biomembranes, enzymes, and nucleic acids. The metabolism of carbohydrates and other foodstuffs that store and supply energy to the body are explored. The overview of metabolism includes a review of nutrition and vitamins. The course is designed for allied health science majors and will not carry credit towards a major or minor in chemistry. Prerequisite: CHEM 201 or 204/204L AND all prior prerequisites for these courses. **Prerequisite courses listed must be completed with a grade of C or better in order to take the indicated course. It is expected that all prior prerequisite courses to the ones listed have also been satisfied with a grade of C or better.**

CHEM 203/203L ORGANIC CHEMISTRY I-- *Three hours lecture (3 credits), 4 hours laboratory (2 credits); total 5 credits.* A systematic study of the compounds of carbon. Topics include the properties, synthesis and structural elucidation of organic compounds, modern structural theory and mechanisms of reactions. Laboratory work includes methods of separation and purification (including chromatography), synthesis, spectroscopy and kinetics. Prerequisite: CHEM 106/106L or 112/112L **AND** all prior prerequisites for these courses. **Prerequisite courses listed must be completed with a grade of C or better in order to take the indicated course. It is expected that all prior prerequisite courses to the ones listed have also been satisfied with a grade of C or better.**

CHEM 204/204L ORGANIC CHEMISTRY II--- *Three hours lecture (3 credits), 4 hours laboratory (2 credits); total 5 credits.* This course is a continuation of CHEM 203. Prerequisite: CHEM 203/CHEM 203L **AND** all prior prerequisites for these courses. **Prerequisite courses listed must be completed with a grade of C or better in order to take the indicated course. It is expected that all prior prerequisite courses to the ones listed have also been satisfied with a grade of C or better.**

CHEM 205/205L ORGANIC CHEMISTRY I (HONORS)--- *Three hours lecture (3 credits), 4 hours laboratory (2 credits); total 5 credits.* This is an introductory organic chemistry course designed for honor students. The topics treated are analogous to those in CHEM 203, but are covered in more depth. The course involves a systematic study of organic compounds. Topics include properties and synthesis of organic compounds, modern techniques in spectroscopic structural elucidation, stereochemistry, and conformational analysis. The laboratory covers purification, separation, synthesis, and kinetic experiments. **Prerequisites:** CHEM 112/112L **AND** all prior prerequisites for these courses. **Prerequisite courses listed must be completed with a grade of C or better in order to take the indicated course. It is expected that all prior prerequisite courses to the ones listed have also been satisfied with a grade of C or better.**

CHEM 206/206L ORGANIC CHEMISTRY II (HONORS)--- *Three hours lecture (3 credits), 4 hours laboratory (2 credits); total 5 credits*. This is a continuation of CHEM 205 and is for honor students only. Topics include properties, synthesis, and reactions of alcohols, ethers, carbonyl compounds, amines, and sugars. The laboratory covers synthesis, spectroscopy, and the identification of unknowns. **Prerequisites:** CHEM 205/205L **AND** all prior prerequisites for these courses. **Prerequisite courses listed must be completed with a grade of C or better in order to take the indicated course. It is expected that all prior prerequisite courses to the ones listed have also been satisfied with a grade of C or better.**

CHEM 207 QUANTITATIVE ANALYSIS I---*Two hours lecture and six hours laboratory; 4 credits.* This course covers the fundamental theory and practice of volumetric, gravimetric and electrochemical methods. The student is trained in chemical calculations as applied to quantitative analysis. Prerequisite: CHEM 106/106L or 112/112L **AND** all prior prerequisites for these courses. **Prerequisite courses listed must be completed with a grade of C or better in order to take the indicated course. It is expected that all prior prerequisite courses to the ones listed have also been satisfied with a grade of C or better.**

CHEM 211 ENVIRONMENTAL CHEMISTRY--- *Three hours lecture; 3 credits.* An introduction to the Chemistry of the elements and inorganic compounds which are involved in natural biogeological cycles. Topics discussed are ozone depletion, greenhouse effect and global warming, acid rain, thermal pollution, water pollution, and introduction to geochemistry. Prerequisite: CHEM 105/105L or CHEM111/111L. **Prerequisite courses listed must be completed with a grade of C or better in order to take the indicated course. It is expected that all prior prerequisite courses to the ones listed have also been satisfied with a grade of C or better. Course is offered at Chair's discretion or as needed.**

CHEM 300 EFFECTIVE TECHNICAL PRESENTATIONS---*One hour lecture; 1 credit.* This course is designed as a preparatory course for science students who are planning to pursue careers in science. The student is taught the rudiments of searching, analyzing, and critiquing scientific literature and the methods for preparing reports for skillful presentation. Effective methods of data reporting,

graphing techniques, and poster presentations are discussed and practiced. Prerequisite: ENGL 102, CHEM 204/204L, **AND** all prior prerequisites for these courses. **Prerequisite courses listed must be completed with a grade of C or better in order to take the indicated course. It is expected that all prior prerequisite courses to the ones listed have also been satisfied with a grade of C or better.**

CHEM 304 BIOCHEMISTRY ---*Three hours lecture, four hours laboratory; 4 credits.* This course is designed to meet the needs of Chemistry and Biology students and students in related pre-professional fields. Its scope includes a study of the fundamental chemical processes of living matter, emphasizing the structure, biosynthesis and metabolism of carbohydrates, enzymes, nucleic acids and lipids. Prerequisite: CHEM 204/204L or CHEM 206/206L, BIO 105 or BIO 111, **AND** all prior prerequisites for these courses. **Prerequisite courses listed must be completed with a grade of C or better in order to take the indicated course. It is expected that all prior prerequisite courses to the ones listed have also been satisfied with a grade of C or better.**

CHEM 307 PHYSICAL CHEMISTRY - *Three hours lecture, four hours laboratory; 4 credits.* 3 hours lecture, 4 hours laboratory; 4 credits: This course deals with the theory and application of the laws of thermodynamics. Prerequisites: CHEM 204/204L or 206/206L, MATH 242 and PHYS 206, **AND** all prior prerequisites for these courses. **Prerequisite courses listed must be completed with a grade of C or better in order to take the indicated course. It is expected that all prior prerequisite courses to the ones listed have also been satisfied with a grade of C or better.** (FALL)

CHEM 308 PHYSICAL CHEMISTRY---*Three hours lecture, four hours laboratory; 4 credits.* This course is designed to teach the concepts of chemical kinetics, quantum chemistry, statistical mechanics and spectroscopy. Prerequisites: CHEM 307; CHEM 204/204L or 206/206L, MATH 242 and PHYS 206, **AND** all prior prerequisites for these courses. **Prerequisite courses listed must be completed with a grade of C or better in order to take the indicated course. It is expected that all prior prerequisite courses to the ones listed have also been satisfied with a grade of C or better.** (SPRING)

CHEM 309 PHYSICAL INORGANIC LABORATORY---*One hour lecture, four hours laboratory; 3 credits.* This course involves the syntheses and analyses of inorganic and organometallic compounds, with emphasis on modern techniques, such as infrared and ultraviolet-visible spectrophotometry, mass spectrometry, magnetic susceptibility, polarimetry, etc., for studying the properties of these compounds. Electrolytic synthesis and high temperature thermometry will be included. Prerequisite: CHEM 204/204L or CHEM 206/206L **AND** all prior prerequisites for these courses. **Prerequisite courses listed must be completed with a grade of C or better in order to take the indicated course. It is expected that all prior prerequisite courses to the ones listed have also been satisfied with a grade of C or better.**

CHEM 311 ENVIRONMENTAL ANALYTICAL CHEMISTRY-*Three hours lecture and laboratory; 4 credits.* This course is designed to use the technique of analytical chemistry to study the cause and effect of environmental pollutants, their distribution and remediation. Air, land and sea pollutants, their generation and distribution will be covered. Instrumental techniques for analyses of environmental pollutants which will include gravimetric, spectroscopic, chromatographic and electrochemical techniques will be covered. Prerequisite: CHEM 207, CHEM 211, MATH 114 or higher, **AND** all prior prerequisites for these courses. **Prerequisite courses listed must be completed with a grade of C or better in order to take the indicated course. It is expected that all prior prerequisite courses to the ones listed have also been satisfied with a grade of C or better.**

CHEM 312 ADVANCED INORGANIC CHEMISTRY---*Three hours lecture; 3 credits.* An advanced course in systemetric inorganic chemistry considered from the standpoint of the periodic law and supplemented by the study of selected topics on recent advances in the subject. Prerequisite: CHEM 308, CHEM 309, PHYS 206, **AND** all prior prerequisites for these courses. **Prerequisite courses listed must be completed with a grade of C or better in order to take the indicated course. It is expected that all prior prerequisite courses to the ones listed have also been satisfied with a grade of C or better.**

CHEM 314 INSTRUMENTAL METHODS OF ANALYSIS---*Three hours lecture and six hours laboratory per week; 4 credits.* This course covers the fundamental principles of basic electronic and instrument components of use in analytical chemistry, theory and techniques in atomic and molecular spectrometry in chemical analysis, thermal, electrochemical and chromatographic methods. *Prerequisite:* CHEM 204/204L, CHEM 207, CHEM 308, PHYS 206, **AND** all prior prerequisites for these courses. **Prerequisite courses listed must be completed with a grade of C or better in order to take the indicated course. It is expected that all prior prerequisite courses to the ones listed have also been satisfied with a grade of C or better.**

CHEM 320 POLYMER CHEMISTRY---*Three hours lecture; 3 credits.* This course is designed for students who are interested in industrial careers and who need a

basic understanding of the chemical and physical aspects of polymers. Prerequisite: CHEM 204/204L or CHEM 206/206L, **AND** all prior prerequisites for these courses. **Prerequisite courses listed must be completed with a grade of C or better in order to take the indicated course. It is expected that all prior prerequisite courses to the ones listed have also been satisfied with a grade of C or better.**

CHEM 401-402 UNDERGRADUATE RESEARCH---*1-3 credits.* Optional for Chemistry majors. Admission only by permission of the Department Chairperson. A student enrolled in the course is required to submit a written report of his/her research activities to the chairperson at the end of each semester.

CHEM 404 SENIOR SEMINAR---*1 credit.* Registration in this course is limited to prospective graduates. Students give talks on items of current interest in the field of Chemistry.

CHEM 407 ADVANCED TOPICS IN PHYSICAL CHEMISTRY---*Three hours lecture; 3 credits.* This course deals with the basic concepts of Quantum

in order to take the indicated course. It is expected that all prior prerequisite courses to the ones listed have also been satisfied with a grade of C or better.

CHEM 408 ADVANCED ORGANIC CHEMISTRY---*Three hours lecture, three hours laboratory; 4 credits.* Registration in this course is limited to prospective graduates or approval of the Departmental Chairperson. This course covers the theory and application of modern spectroscopy, such as infrared, nuclear magnetic resonance, ultraviolet-visible and mass spectrometry. The laboratory includes structure identification, separations, as well as a small research project that includes a search of the literature. Prerequisite: CHEM 204/204L, or 206/206L, CHEM 207, **AND** all prior prerequisites for these courses. **Prerequisite courses listed must be completed with a grade of C or better**

CHEM 498 SENIOR INTERNSHIP---*Five hours; 3 credits.* This course provides the opportunity for the student to obtain supervised work experience in the major at an off-campus site selected and approved by the Departmental Chairperson. Registration is limited to seniors with minimum 3.0 cumulative and major averages and requires approval of the Departmental Chairperson. Exceptions may be approved by the Dean.

CHEM 499 SENIOR RESEARCH OR TEACHING/TUTORIAL ASSISTANTSHIP---*Five hours; 3 credits.* This course provides the opportunity for the student to attain first-hand research or teaching/tutorial experience under the supervision and mentor ship of a tenure/tenure-track faculty member. Registration is limited to seniors with a minimum of 3.0 cumulative and major averages and requires the approval of the Departmental Chairperson.


A
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ACS
Chemist

MORGAN STATE UNIVERSITY
DEPARTMENT OF CHEMISTRY
BACHELOR OF SCIENCE DEGREE IN CHEMISTRY
ACS
SUGGESTED CURRICULUM SEQUENCE

FRESHMAN YEAR (FIRST SEMESTER)

CHEM 105–BP	General Chemistry I	4
or CHEM 111	(Honors)	
ENGL 101–EC	English	3
MATH 241–MQ	Calculus I	4
XXXX– SB	Social and Behavioral Sci Core	3
ORNS 106	Freshman Orientation	1
		15

FRESHMAN YEAR (SECOND SEMESTER)

CHEM 106	General Chemistry	4
or CHEM 112	(Honors)	
ENGL 102–EC	English	3
MATH 242	Calculus II	4
XXXX– SB	Social and Behavioral Sci Core	3
XXXX-HH	Health & Healthful Living	3
		17

SOPHOMORE YEAR (FIRST SEMESTER)

CHEM 203	Organic Chemistry I	5
or CHEM 205		
PHYS 205-BP	University Physics I	5
BIOL 105-BP	Intro to Biology I	4
PHEC XXX	Physical Education	1
		15

SOPHOMORE YEAR (SECOND SEMESTER)

CHEM 204	Organic Chemistry II	5
or CHEM 206	(Honors)	
PHYS 206	University Physics II	5
BIOL 106	Intro to Biology II	4
CHEM 207	Quantitative Analysis I	4
		18

JUNIOR YEAR (FIRST SEMESTER)

CHEM 304	Biochemistry	4
CHEM 307	Physical Chemistry I	4
MATH 340	Introduction to Differential Eq.	3
XXXX- AH	Arts & Humanities Core	3
		14

JUNIOR YEAR (SECOND SEMESTER)

CHEM 308	Physical Chemistry II	4
CHEM 309	Physical Inorganic Chem.	3
XXXX- AH	Arts & Humanities Core	3
XXXX- CI	Contemporary & Global Issues	3
		13

SENIOR YEAR (FIRST SEMESTER)

CHEM 312	Advanced Inorganic Chemistry	3
CHEM 314	Instrumental Methods & Analysis	4
PHIL 109-CT	Quantitative Analysis Course	3
XXXX	Complementary Studies	3
CMEM 300	Technical Presentations or	
CHEM 401-402	Undergraduate Research	1
		14

SENIOR YEAR (SECOND SEMESTER)

CHEM 404	Senior Seminar	1
CHEM 408	Advanced Organic Chemistry	4
CHEM 407	Advanced Physical Chemistry	3
XXXX	Complementary Studies	3
COSC 110-IM	Introduction to Computer Science	3
		14

TOTAL CREDIT HOURS 120

MORGAN STATE UNIVERSITY
DEPARTMENT OF CHEMISTRY
BACHELOR OF SCIENCE DEGREE IN CHEMISTRY
GENERAL/PRE-PROFESSIONAL
SUGGESTED CURRICULUM SEQUENCE

FRESHMAN YEAR (FIRST SEMESTER)

CHEM 105	General Chemistry I	4
or CHEM 111	(Honors)	
ENGL 101–EC	English	3
MATH 113–MQ	Math Analysis I	4
XXXX– SB	Social and Behavioral Sci Core	3
ORNS 106	Freshman Orientation	1
		15

FRESHMAN YEAR (SECOND SEMESTER)

CHEM 106	General Chemistry	4
or CHEM 112	(Honors)	
ENGL 102–EC	English	3
MATH 114	Math Analysis II	4
XXXX– SB	Social and Behavioral Sci. Core	3
XXXX-HH	Health & Healthful Living	3
		17

SOPHOMORE YEAR (FIRST SEMESTER)

CHEM 203	Organic Chemistry I	5
or CHEM 205		
PHYS 205–BP	University Physics I	5
MATH 241	Calculus I	4
PHIL 109-CT	Introduction to Logic	3
		17

SOPHOMORE YEAR (SECOND SEMESTER)

CHEM 204	Organic Chemistry II	5
or CHEM 206	(Honors)	
PHYS 206	University Physics II	5
MATH 242	Calculus II	4
CHEM 207	Quantitative Analysis I	4
		18

JUNIOR YEAR (FIRST SEMESTER)

CHEM 307	Physical Chemistry I	4
MATH 320	Polymer Chemistry	3
BIOL 105-BP	Intro to Biology I	4
XXXX- AH	Arts & Humanities Core	3
		14

JUNIOR YEAR (SECOND SEMESTER)

BIOL 106	Intro to Biology II	4
CHEM 309	Physical Inorganic Chem.	3
XXXX	Complementary Studies	3
XXXX	Advised Elective	3
		13

SENIOR YEAR (FIRST SEMESTER)

CHEM 304	Biochemistry	4
CMEM 300	Technical Presentations or	
CHEM 401-402	Undergraduate Research	1
XXXX- CI	Contemporary & Global Iss.	3
XXXX	Advised Chemistry Elective	3
PHEC XXX	Physical Education	1
		12

SENIOR YEAR (SECOND SEMESTER)

CHEM 404	Senior Seminar	1
CHEM 408	Advanced Organic Chemistry	4
XXXX	Complementary Studies	3
XXXX- AH	Arts & Humanities Core	3
COSC 110-IM	Introduction to Computer Science	3
		14

TOTAL CREDIT HOURS 120

COMPUTER SCIENCE DEPARTMENT

Interim Chairperson of Department: Associate Professor VOJISLAV STOJKOVIC
Associate Professors: ERIC SAKK and SAMIR TANNOURI;
Assistant Professor: MAHMUDUR RAHMAN
Lecturers: GHOLAM KHAKSARI, ROSHAN PAUDEL, SCHINNEL SMALL, and GRACE STEELE
Adjunct Lecturer: HASSANE DRABO, HARRIETT GANTT, HELENE NGUEWOU-HYOUSSE, JOSHUA ROBINSON, and JAMAL THEODORE

OBJECTIVES OF THE DEPARTMENT
The undergraduate program in Computer Science prepares students for entry into the computing profession, for graduate study in computer, computational, and data sciences, and for the many challenges that will confront them in their professional and personal life.
The Computer Science program also prepares students to apply their knowledge and training to produce solutions to specific and esoteric problems. Students learn to define the problem clearly; to determine its tractability; to determine when consultation with outside experts is appropriate; to evaluate and choose an appropriate solution strategy; and then to study, specify, design, implement, test, modify, and document that solution; to evaluate alternatives and perform risk analysis on that design; to integrate alternative techniques and technologies into that solution; and finally to communicate that solution to colleagues, to professionals in other fields, and to the general public. Key to all of this is the ability of the problem-solver to work within a team environment throughout the entire problem-solving process.

THE MAJOR IN COMPUTER SCIENCE

School-wide Requirements

To qualify for graduation, students must have satisfied

- Computer Science Major Requirements
- General Education Requirements
- Earned six (6) credits in the Complementary Studies Program required for all majors in the School of Computer, Mathematical and Natural Sciences.
- Passed the Senior Departmental Comprehensive Examination
- Taken all of their junior and senior-level requirements in the major at Morgan State University (unless granted prior written permission by the Dean to take courses elsewhere)
- Earned a cumulative average of 2.0 or better and a major average of 2.0 or better, with no outstanding grades below "C" in the major (which includes all courses required for the major and required supporting courses).

Required Courses for Computer Science Major
In order to satisfy Computer Science Major Requirements, students must complete the courses listed below:

Course	*Course Description*	*Credits*
COSC 112	Introduction to Computer Science II	4
COSC 220	Data Structures and Algorithms Anal.	3
COSC 237	Advanced Programming I	4
COSC 241	Computer Systems	3
COSC 243	Computer Architecture	3
COSC 281	Discrete Structures	3
COSC 350	Foundation of Comp Security and IA	3
COSC 351	Cybersecurity	3
COSC 352	Organization of Programming Lang.	3
COSC 353	Major Operating Systems	3
COSC 354	Operating Systems	4
COSC 385	Automata Theory	3
COSC XXX	Computer Science Elective 1	3
COSC XXX	Computer Science Elective 2	3
COSC 413	Parallel Algorithms	3
COSC 458	Software Engineering	3
COSC 460	Computer Graphics	3
COSC 470	Artificial Intelligence	3
MATH 242	Calculus II	4
MATH 312	Linear Algebra I	3
MATH 331	Applied Probability and Statistics	3
MATH 340	Introduction to Differential Equations	3
TOTAL CREDITS		**70**

Required Courses for General Education
In order to satisfy General Education Requirements, students must complete the courses listed below:

Course	*Description*	*Credits*
COSC 111	INTRO TO COMP SCI I (IM)	4
ENGL 101/111	FRESHMAN COMPOSITI I (EC)	3
ENGL 102/112	FRESHMAN COMPOSITI II (EC)	3
PHIL 109/119	INTRO TO LOGIC (CT)	3
MATH 241	CALCULUS I (MQ)	4
XXXX YYY	ARTS & HUMANITI ELEC (AH)	3
XXXX YYY	ARTS & HUMANITI ELEC (AH)	3
XXXX- BP	Biological & Physical Sci. (w/ lab)	4
XXXX- BP	Biological & Physical Sci.	3
XXXX YYY	SOCIAL & BEH SCIS ELEC (SB)	3
XXXX YYY	SOCIAL & BEH SCIS ELEC (SB)	3
XXXX YYY	HEALTH & HEAL LIVING (HH)	3
HIST 350/360	AFRICAN DIASPORA (CI)	3
TOTAL CREDITS		**42**

Required Courses for a Minor in Computer Science
The following are required courses for those students desiring to minor in Computer Science:

Course Description	*Credits*
COSC 111 Introduction to Computer Science I	4
COSC 112 Introduction to Computer Science II	4
COSC 220 Data Structures and Algorithms Analys	3
COSC 241 Computer Systems	3
COSC 243 Computer Architecture	3
TOTAL CREDITS:	**17**

COURSE OFFERINGS

COSC 010, 020, 030, 040 COOPERATIVE WORK PROGRAM— *0-3 credits.*

COSC 110 INTRODUCTION TO COMPUTING— Three hours lecture: 3 credits. This course is designed to introduce students with no prior experience with computers and programming to the organization and characteristics of a digital computer and to the existence and uses of computers in everyday life experiences. If time permits, students may be given the opportunity to become familiar with computers via the use of electronic mail and the writing of short programs in a high level language. (FALL/ SPRING).

COSC 111 INTRODUCTION TO COMPUTER SCIENCE I— *Four hours lecture; 4 credits.* A first course in the Computer Science sequence, it is required for all Computer Science majors. Course objectives include: introduction to problem-solving methods and algorithm development; definition of language syntax and semantics of a high-level programming language; and development of the ability to design, code, debug, document and successfully execute programs. An imperative programming language is the language of illustration. (FALL/SPRING).

COSC 112 INTRODUCTION TO COMPUTER SCIENCE II— *Four hours lecture; 4 credits.* This is the second computer science course in a two-semester course sequence for computer science majors. Course objectives include software design considerations, simple data structures and a brief introduction to analysis of algorithms. **Prerequisite:** COSC 111 with grade of "C" or better. (FALL/SPRING).

COSC 151 COMPUTATIONAL SCIENCE AND DATA ANALYSIS – *One hour of lecture, two hours of laboratory; 3 credits.* The course introduces undergraduates to computational and analytical tools/techniques needed to analyze/communicate scientific knowledge. Content will be covered through laboratory exercises and lectures designed to reinforce relevant scientific concepts. Different software tools and techniques applicable to the STEM disciplines will be examined. **Prerequisite:** No prerequisite.

COSC 220 DATA STRUCTURES AND ALGORITHMS ANALYSIS— *Three hours lecture; 3 credits.* This course focuses on applying analysis and design techniques to nonnumeric algorithms which act on data structures and select data relationships and storage representations. Basic concepts of data structures such as strings, lists, arrays, stacks, queues, trees and graphs, and analysis and design of efficient algorithms for searching, sorting, and merging are examined. **Prerequisite:** COSC 112. (SPRING).

COSC 230 OBJECT-ORIENTED PROGRAMMING FOR ENGINEERS — *Four hours lecture; 4 credits.* This course is designed to introduce the fundamental concepts of object-oriented programming. Students learn the essentials of classes, objects, inheritance, polymorphism, access protection, fields, and methods. This course is not intended for Computer Science majors. (OFFERED AS NEEDED).

COSC 231 FORTRAN 90 PROGRAMMING —*Four hours lecture; 4 credits.* This course emphasizes programming in a scientific environment using FORTRAN 90 syntax and semantics. It will broaden students' computer backgrounds and problem solving concepts, data types, input/output, loops, decision making, arrays, manipulating characters, functions and subroutines, file input/ output, use of storage and other common FORTRAN 90 statements. **Prerequisite:** COSC 112. (OFFERED AS NEEDED).

COSC 234 LISP PROGRAMMING— *Four hours lecture; 4 credits.* This course provides an up-to-date and didactically coherent introduction to LISP language and a brief but self-contained introduction to interactive programming with the LISP language. Programming tools and methodology are further developed. **Prerequisite:** COSC 112. (OFFERED AS NEEDED).

COSC 235 PROLOG PROGRAMMING —*Four hours lecture; 4 credits.* This course provides an up-to-date and didactically coherent introduction to PROLOG language and a brief but self-contained introduction to interactive programming with the PROLOG language. Programming tools and methodology are further developed. **Prerequisite:** COSC 112. (OFFERED AS NEEDED).

COSC 237 ADVANCED PROGRAMMING I— *Four hours lecture; 4 credits.* This course will provide students with a thorough knowledge of advanced concepts of a programming language. Structured programming will be introduced and emphasized throughout the semester. It will offer an overview of a language, including syntax, semantics, primary data types, storage classes, input/ output and library functions, program looping, decision making, functions, arrays, structures and unions, string handling, file input/output, use of editors and compiling large programs. **Prerequisite:** COSC 112. (OFFERED AS NEEDED).

COSC 238 OOP, C++— *Four hours lecture; 4 credits.* This course involves problem solving using advanced pointers and dynamic data structures, object oriented programming in C++,

classes, message passing, and inheritance using C++. **Prerequisite:** COSC 112. (OFFERED AS NEEDED).

COSC 239 JAVA PROGRAMMING — *Four hours lecture; 4 credits.* An examination of a modern programming language emphasizing programming concepts and design methodology. **Prerequisite:** COSC 112. (OFFERED AS NEEDED).

COSC 241 COMPUTER SYSTEMS — *Three hours lecture; 3 credits.* This course introduces basic concepts of computer systems and is a first course in computer architecture and ASSEMBLY language programming. **Prerequisite:** COSC 112 or by permission of the Department Chairperson. (OFFERED AS NEEDED).

COSC 243 COMPUTER ARCHITECTURE — *Three hours lecture; 3 credits.* This course is an introduction to computer organization and architecture. The computer is described as a hierarchy of levels, each performing some well-defined function. Comparisons are made in the way the levels and functions are implemented in various computer systems. The system design and ASSEMBLY language programming presented in COSC 241, Computer Systems, will be used extensively as a reference and comparison. Programming assignments using ASSEMBLY language will be given to illustrate concepts and examples in this course. **Prerequisite:** COSC 241. (SPRING).

COSC 247 DIGITAL LOGIC — *Three hours lecture; 3 credits.* This is a first course in digital systems, including a treatment of logic and digital circuits as well as design using register level components. Data representation, device characteristics, and register transfer notation are covered in a manner that stresses application of basic problem- solving techniques to both hardware and software design. Required specification, the design process and issues associated with use of graphical interfaces are also discussed. **Prerequisite:** COSC 243. (OFFERED AS NEEDED).

COSC 251 INTRODUCTION TO DATA SCIENCE – *Three hours of lecture, 3 credits*. This course introduces the use of computers for the analysis, interpretation and visualization of both simple and complex, high-volume, high-dimensional and structured/unstructured data from varying sources based on applying data analysis, modeling, data mining, data visualization and search techniques. **Prerequisite:** COSC 151

COSC 255 INTRODUCTION TO UNIX — *Four hours lecture; 4 credits.* This course deals with concepts of operating systems, concurrent processes, process synchronization and communication, resource allocation, kernels, deadlock, memory management and file systems. **Prerequisite:** COSC 112. (OFFERED AS NEEDED).

COSC 281 DISCRETE STRUCTURES—*Three hours lecture: 3 credits.* The purpose of this course is to provide an up-to-date and didactically coherent introduction to discrete structures. This course is designed to introduce the mathematical techniques which are of the greatest importance to theoretical computer science. Topics to be discussed include correctness proofs, partially ordered structures, Boolean algebra, prepositional logic, predicate logic, graphs, Turing machines, analysis of algorithms and complexity of algorithms, and coding theory. **Prerequisite:** COSC 112. (SPRING).

COSC 332 COMPUTER GAMING – *Three hours lecture; 3 credits.* This course uses sophisticated programming techniques, high efficiency, real time algorithms, and complex program architectures to deliver user-friendly applications and programs to the user. (OFFERED AS NEEDED).

COSC 341 ADVANCED PROGRAMMING II, *Four hours lecture; 4 credits.* This course will provide students with a thorough knowledge of advanced concepts of a programming language. Structured programming techniques will be used and emphasized throughout the semester. This is a follow on to Advanced Programming I and prepares students for competitive competition programming. (OFFERED AS NEEDED)

COSC 343 MICROCOMPUTER SYSTEMS AND APPLICATIONS—*Three hours lecture; 3 credits.* A comprehensive study of the components of microcomputer systems and their peripheral devices, features, and trends in the operating systems which govern their operation, including a survey of the application software avail- able for such systems. This course is designed to include hands-on experience on several commercially popular microcomputers and the software packages which run on them. **Prerequisite:** Some knowledge of computer programming or consent of the instructor. (FALL/SPRING).

COSC 345 INTRODUCTION TO SUPERCOMPUTERS—*Three hours lecture; 3 credits.* This course offers a general introduction to supercomputers, the problems for which they were designed and the languages used to control them. Topics include a history of large-scale computation and architectural classification of the various machines currently available. After measurements of program performance and general methods of optimization have been introduced, a study of dependencies and their influences upon vectorization and parallelism will be considered. **Prerequisites:** COSC112, MATH 241, MATH 312. (FALL/SPRING).

COSC 349 NETWORK COMMUNICATIONS — *Three hours lecture; 3 credits.* This course covers the theory and practice of computer networks, emphasizing the principles underlying the design of network software and the role of the communications system in distributed computing. Topics include data representation, channel, semantics, synchronization, resource (FALL/SPRING).

COSC 350 FOUNDATIONS OF COMPUTER SECURITY AND INFORMATION ASSURANCE — *Three hours lecture; 3 credits*. Principles of information security which relate to computer science are addressed. Topics covered include identification and authentication, access control, and security models. Practical aspects of

security and assurance are addressed relative to UNIX, Windows NT, and approaches to security attainment. **Prerequisites:** COSC 241. (OFFERED AS NEEDED).

COSC 351 CYBERSECURITY – *Three hours of lecture, zero hours of laboratory; 3 credits.* This course presents threads analyzing and prediction, vulnerabilities and risks. Topics include identification and authentication, encryption and certifications, security in UNIX and Windows environments, malicious software, trusted computer systems, network attacks and defenses, firewalls, intrusion detection and prevention, database security. **Prerequisite:** COSC 350, minimum grades of C. (SPRING)

COSC 352 ORGANIZATION OF PROGRAMMING LANGUAGES— *Three hours lecture; 3 credits.* This course explores concepts of programming languages including the following topics: syntax and basic characteristics of grammars, constructs for specifying and manipulating data types, control structures and data flow, and run-time considerations. Examples will be drawn from languages such as FORTRAN 90, JAVA, ALGOL, SNOBOL 4 and APL. **Prerequisite:** COSC 220. (FALL).

COSC 353 MAJOR OPERATING SYSTEMS – *Three hours of lecture, zero hours of laboratory; 3 credits*. The course presents major operating systems: Microsoft windows, unix, Mac OS X, iOS, and Google Chrome OS. Topics cover concepts, structures, working with the command line, installing and maintaining operating systems and software packages, editing, compiling, etc. **Prerequisite**: COSC 237 and COSC 243, minimum grades of C. (FALL)

COSC 354 OPERATING SYSTEMS— *Four hours lecture; 4 credits.* Principles underlying computer operating systems are presented from a computer designer's perspective. Concepts explained include process concurrence, synchronization, resource management, input/ output scheduling, job and process scheduling, scheduling policies, deadlock, semaphore, consumer/ producer relationship, storage management (real storage management policies in a multiprogramming environment), virtual memory management (segmentation and paging), and an overview of contemporary operating systems with these principles. Students program in a high level language. **Prerequisites:** COSC 220, COSC 241. (SPRING).

COSC 356 COMPILERS – *Four hours lecture; 4 credits.* This course is an introduction to the principles, techniques and tools for design and implementation of compilers. The course covers: introduction to compiling, a simple one-pass compiler, lexical analysis - scanning, syntax analysis - parsing, semantic analysis, syntax-directed translation, intermediate code generation, code generation, code optimization, and symbol table management. **Prerequisite:** COSC 385. (OFFERED AS NEEDED)

COSC 357 STRATEGY AND CONCEPTS OF NETWORK SYSTEMS— *Three hours lecture; 3 credits.* This course is an introduction to local and wide-area network topologies. It investigates the design considerations and bandwidth management of network systems. The course includes Internet connectivity with the World Wide Web, Gopher, Veronica, FTP, Archie, Usenet, Telnet, etc. In addition, techniques for developing home pages, bulletin boards and list services are also presented. **Pre- requisites:** COSC 220. (OFFERED AS NEEDED)

COSC 358 NETWORK SECURITY FUNDAMENTALS--- *Three hours lecture; 3 credits* Creates an awareness of security related issues and the essential skills needed to implement security in a given network. Students are introduced to various protocols, and will learn to develop and implement security measures in router based networks and across different platforms. It focuses on some of the techniques commonly used by network attackers and how to respond to these attacks. **Prerequisite:** COSC 349 (OFFERED AS NEEDED)

COSC 359 DATABASE DESIGN— *Three hours lecture; 3 credits.* A student selecting this course will study functions of a database system, and data modeling and logical database design. Query languages and query optimization, efficient data storage and access, as well as concurrency control and recovery will also be covered. **Prerequisite:** COSC 220. (FALL/SPRING).

COSC 360 INTRODUCTION TO DATABASE SECURITY--- *Three hours lecture; 3 credits,* The course focuses on the integration and flow of security knowledge within the organization. Areas addressed include: How are secure network protocols designed and how are vulnerabilities discovered? What are the effects of system vulnerabilities and how may they be minimized. Protocols/systems that are covered in detail are TCP/IP, SSL/TLS. IPsec, SSH, firewalls. (OFFERED AS NEEDED)

COSC 372 INTRODUCTION TO BIOPROGRAMMING *Three lecture hours; 3 credits.* No background in genetics or biology is assumed. The course involves students doing a few projects which typically involve some computer programming in a programming language of the student's choice. (OFFERED AS NEEDED)

COSC 373 FOUNDATIONS OF BIOINFORMATICS--- *Four hours lecture; 4 credits.* This multidisciplinary course explains the extraordinarily broad scope of bioinformatics, discusses the theory and practice of computational methods, strategies and software tools for sequence analysis, and protein structure prediction and provides insights to gain a more sophisticated understanding of the applicability and limitations of those approaches. (OFFERED AS NEEDED)

COSC 383 NUMERICAL METHODS AND PROGRAMMING —*Three hours lecture; 3 credits.* This course derives and applies techniques for approximation numerical variables and parameters. Mathematical procedures for numerical approximation are analyzed for computational efficiency and error accumulation. Algorithms for implementation of numerical methods are derived and applied in a high-level computer language. **Prerequisite:** MATH 242.

(OFFERED AS NEEDED)

COSC 385 AUTOMATA – *Three hours lecture; 3 credits.* This course is an introduction to the theory of automata, languages, grammars, and computability. The course covers: math preliminaries (sets, functions, and relations), languages, automata, and grammars; Chomsky hierarchy; finite automata, regular expressions, and regular languages; push-down automata and context- free languages; and Turing machines. **Prerequisites:** COSC 220, COSC 237, COSC 281 and COSC 352. (FALL).

COSC 413 PARALLEL ALGORITHMS— *Three hours lecture; 3 credits.* This course consists of fundamental concepts of concurrent programming; synchronization mechanisms based on shared variables and message passing; systematic development of correct programs; and paradigms for distributed programming. **Prerequisite:** COSC 220. (OFFERED AS NEEDED)

COSC 458 SOFTWARE ENGINEERING— *Three hours lecture; 3 credits.* This course develops the techniques for designing a large software project and for organizing and managing a programming team. Students will be organized into teams to develop a large software project. **Prerequisites:** COSC 220 and COSC 352. (FALL).

COSC 460 COMPUTER GRAPHICS— *Three hours lecture; 3 credits.* This course involves discussion of some basic types of computer graphic devices, graphics and text modes, point plotting and line drawing, area filling, image array plotting, mathematics and generation of two and three dimensional transformations: translations, rotations, scaling, rendering reflections, orthogonal and perspective projections. **Prerequisite:** COSC 220. (SPRING).

COSC 470 ARTIFICIAL INTELLIGENCE – *Three hours lecture; 3 credits.* This course is an introduction to the agent-oriented approach to artificial intelligence. The course covers: foundations and history of artificial intelligence, intelligent agents, search techniques, knowledge and reasoning, logic (propositional and predicate logic), reasoning with logic, forward and back- ward chaining, resolution, and applications (mechanical theorem proving and expert systems). (OFFERED AS NEEDED)

COSC 471 EXPERT SYSTEMS— *Three hours lecture; 3 credits.* This course will include a study of knowledge engineering, featuring the unified treatment of computation and software design. The essentials of computing concepts, artificial intelligence, logic programming, share engineering in the development of expert know- ledge systems. **Prerequisite:** COSC 470. (OFFERED AS NEEDED)

COSC 490 SENIOR PROJECT— *Three hours; 3 credits.* Graduating seniors selecting this course will conduct research or participate in special projects on topics reflecting new and latest developments in computer science, under the guidance of a member of the Department. (SPRING).

COSC 491 CONFERENCE COURSE— *Three hours lecture: 3 credits.* A student selecting this course will study an advanced topic in computer science individually under the guidance of a member of the Department. **Prerequisite:** Permission of Department Chairperson. (OFFERED AS NEEDED).

COSC 498 SENIOR INTERNSHIP— *Nine hours; 3 credits.* This course provides the opportunity for the student to obtain supervised work experience in the major at an off-campus site selected and approved by the Department Chairperson. Registration is limited to seniors with minimum 3.0 cumulative and major averages and requires approval of the Department Chairperson. The Dean may approve exceptions. (OFFERED AS NEEDED).

COSC 499 SENIOR RESEARCH OR TEACHING/TUTORIAL ASSISTANTSHIP— *Nine hours; 3 cred- its.* This course provides the opportunity for the student to attain first-hand research or teaching/tutorial experience under the supervision and mentorship of a tenure-track faculty member. Registration is limited to seniors with minimum of 3.0 cumulative and major averages and requires the approval of the Departmental Chairperson. The Dean may approve exceptions.

MORGAN STATE UNIVERSITY
DEPARTMENT OF COMPUTER SCIENCE
BACHELOR OF SCIENCE DEGREE IN COMPUTER SCIENCE
SUGGESTED CURRICULUM SEQUENCE

FRESHMAN YEAR (FIRST SEMESTER)

COSC 111- IM	Introduction to Computer Science I	4
MATH 241-MQ	Calculus I	4
ENGL 101-EC	English	3
PHIL 109-CT	Introduction to Logic	3
ORNS 106	Freshman Orientation	1
		15

FRESHMAN YEAR (SECOND SEMESTER)

COSC 112	Intro to Computer Science II	4
MATH 242	Calculus II	4
ENGL 102-EC	English	3
XXXX-HH	Health & Healthful Living	3
PHEC XXX	Physical Education	1
		15

SOPHOMORE YEAR (FIRST SEMESTER)

COSC 220	Data Structure and Alg Analysis	3
COSC 241	Computer Systems	3
COSC 281	Discrete Structures	3
XXXX-AH	Arts & Humanities Core	3
XXXX-SB	Social & Behavioral Science Core	3
		15

SOPHOMORE YEAR (SECOND SEMESTER)

COSC 237	Advanced Programming I	4
COSC 243	Computer Architecture	3
MATH 312	Linear Algebra I	3
XXXX-AH	Arts & Humanities Core	3
XXXX-SB	Social & Behavioral Science Core	3
		16

JUNIOR YEAR (FIRST SEMESTER)

COSC 350	Found. Of Comp. Sci & Info. Sys.	3
COSC 352	Org. of Prog. Language	3
COSC 353	Major Operating System	3
COSC XXX	Computer Science Elective	3
MATH 331	Probability & Statistics	3
		15

JUNIOR YEAR (SECOND SEMESTER)

COSC 351	Cybersecurity	3
COSC 385	Automata	3
COSC 354	Operating Systems	4
COSC XXX	Computer Science Elec	3
MATH 340	Introduction to Differential Eq.	3
		16

SENIOR YEAR (FIRST SEMESTER)

COSC 413	Parallel Algorithms	3
COSC 458	Software Engineering	3
XXXX- BP	Biological & Physical Sci. (w/ lab)	4
XXXX	Complementary Studies	3
XXXX - CI	Contemporary & Global Issues	3
		16

SENIOR YEAR (SECOND SEMESTER)

COSC 460	Computer Graphics	3
COSC 470	Artificial Intelligence	3
XXXX- BP	Biological & Physical Sci.	3
XXXX	Complementary Studies	3
		12

TOTAL CREDIT HOURS
120

MATHEMATICS DEPARTMENT

Chairperson of Department: Professor A S A M O A H N K W A N T A ; Professors: GASTON M. N'GUEREKATA, A S A M O A H N K W A N T A , ALEXANDER PANKOV; Associate Professors: JONATHAN FARLEY, XIAO-XIONG GAN, BHAMINI NAYAR, LEON WOODSON, XUMING XIE, GUOPING (DAVID) ZHANG; Assistant Professor: MINGCHAO CAI, ISABELLE KEMAJOU-BROWN, NAJAT ZIYADI; Instructors: CORNELIA HSU, , SHIRLEY K. RUSSELL; NADEZHDA ENURAH, SAMUEL N. ENURAH, JULIAN FULLER, VAN R. JONES, RODNEY KERBY, JEAN- PIERRE LIAMBA, PETER MCCALLA, ARON REZNIK, SYAFRIDA SYAFRIDA, AHLAM ELHAGE TANNOURI, , GUVEN YILMAZ, KARIM ZAMINI; ADJUNCT FACULTY: ASHRAF.AHMED, ARNOLD SPICINETSKIY; Visiting Professor: MARSHALL M. COHEN. -

PHILOSOPHY OF THE DEPARTMENT

Mathematical methods have become indispensable to the proper functioning of our increasingly scientific and technological society. In view of this, the Department aims to assist students to develop an appreciation for the power and orderliness of logical thought, precision of expression, and the utility of mathematics. By properly selecting a major and supporting courses, the student can prepare for careers in a variety of fields, including research, business, government and teaching. Recognizing the symbiosis among academic disciplines, the Department provides courses designed to meet the mathem- atical needs prescribed for majors in other departments.

THE MAJOR IN MATHEMATICS

School-wide Requirements

In addition to meeting the requirements in General Edu- cation and in the major, students must also complete six (6) credits in the Complementary Studies Program required of all majors in the School of Computer, Mathematical and Natural Sciences. Options for satisfying this requirement are outlined under the section on the School of Computer, Mathematical and Natural Sciences. Also, in order to qualify for graduation, students must pass the Senior Departmental Comprehensive Examination; must have taken all of the junior- and senior-level requirements in the major at Morgan (unless granted prior written permission by the Dean to take courses elsewhere); and must have earned a cumulative average of 2.0 or better and a major average of 2.0 or better, with no outstanding grades below "C" in the major (which includes all courses required for the major and required supporting courses).

REQUIRED COURSES FOR THE MAJOR IN MATHEMATICS (Pure)

Entering students should select a mathematics course in consultation with a faculty advisor. Qualified students intending to major in mathematics are generally advised to begin with MATH 215 and MATH 241. Students not at this level are to begin with MATH 141, followed by MATH 215 and MATH 241. All required courses must be completed with a final grade of "C" or better.

Students majoring in Mathematics (Pure) must take the following courses:

Course	Description	Credits
For General Education*		
MATH 215	Found. for Adv Math I	3
FOR THE MAJOR		
MATH 216	Found. for Adv Math II	3
MATH 241	Calculus I	4
MATH 242	Calculus II	4
MATH 243	Calculus III	4
MATH 312	Linear Algebra I	3
MATH 340	Intro. to Diffeerential Eq.	3
MATH 341	Adv. Calculus I	3
MATH 343	Complex Variables	3
MATH 413	Algebraic Structures I	3
MATH 431	Math. Theory of Stats.	3
CHOOSE ONE MATH COURSE (3 credits)		
MATH 450	Senior Seminar	
MATH 451	Honors Conference Course	
MATH 452	Conference Course	
MATH 479	Point Set Topology	
COMPLETE ADDITIONAL COURSES		
MATH XXX	3 (Math 300/400 level)	9
PHYS 206	University Physics II	5
	TOTAL CREDITS	**56**

* Mathematics majors must select this course to fulfill the Mathematics requirements under General Education.

THE MAJOR IN MATHEMATICS WITH A CON- CENTRATION IN MATHEMATICS EDUCA- TION OR WITH TEACHER CERTIFICATION

To attain certification to teach mathematics, students must complete the mathematics major in one of the concen- trations or tracks above and complete the following courses:

Course	Description	Credits
MATH 361**	Introduction to Math Modeling	3
MATH 371**	History of Mathematics	3
MATH 421**	Higher Geometry	

3		
MATH 481	Algebra & Analysis w/Connect. & Anal.	3
MATH 482	Geometry w/Connect. to Algebra & Anal.	3
COSC 111	Introduction to Computer Science	4

TOTAL CREDITS 19

MINOR IN MATHEMATICS (PURE)
(For Science and Engineering Majors)
Students who minor in Mathematics (Pure) for Science and Engineering majors must complete the following courses:

Course	Description	Credits
MATH 341	Advanced Calculus I	3
MATH 343	Complex Variables	3
MATH 413	Algebraic Structures I	3
MATH 431	Mathematical Theory of Statistics I	3
MATH 450	Senior Seminar	3
MATH 479	Point Set Topology	3

TOTAL CREDITS 18

MINOR IN MATHEMATICS (PURE)
(For Non-Science and Non-Engineering Majors) Students who minor in Mathematics (Pure) for Non-Science and Non-Engineering majors must complete the following courses:

Course	Description	Credits
MATH 215	Found. for Adv Math I	3
MATH 241	Calculus I	4
MATH 242	Calculus II	4
MATH 243	Calculus III	4
MATH 312	Linear Algebra I	3

TOTAL CREDITS 62

REQUIRED COURSES FOR A MAJOR IN MATHEMATICS (STATISTICS TRACK)

Course	Description	Credits
For General Education*		
MATH 215	Found. for Adv Math I	3

For The Major

MATH 216	Found. for Adv Math II	3
MATH 241	Calculus I	4
MATH 242	Calculus II	4
MATH 243	Calculus III	4
MATH 312	Linear Algebra I	3
MATH 331	Applied Probability & Statistics	3
MATH 333	Applied Regression & Cor. Anal.	3
MATH 337	Nonparametric Stat. Methods	3
MATH 340	Intro. to Differential Eq.	3
MATH 341	Adv. Calculus I	3
MATH 343	Complex Variables	3
MATH 413	Algebraic Structures I	3
MATH 431	Math. Theory of Stats.	3
MATH 432	Math. Theory of Statistics II	3

CHOOSE ONE MATH COURSE (3 CREDITS)

MATH 450	Senior Seminar	3
MATH 451	Honors Conference Course	3
MATH 452	Conference Course	3
MATH 479	Point Set Topology	3

CHOOSE ONE COURSE (3 CREDITS)

MATH 334	Applied Analysis of Variance	3
MATH 339	Survey Sampling Techniques	3
MATH 345	Math for Insurance, Bus. & Inv.	3
MATH 435	Design & Analy. of Experiment	3
MATH 436	Quality Control	3
PHYS 206	University Physics II	3

TOTAL CREDITS 62

For The Minor in Mathematics (Statistics Track)

Course	Description	Credits
MATH 242 **	Calculus II	4
MATH 312**	Linear Algebra I	3
MATH 331**	Applied Probability & Statistics	3
MATH 333	Applied Regression & Cor. Anal.	3
MATH 337	Nonparametric Stat. Methods	3

CHOOSE ONE MATH COURSE (3 CREDITS)

MATH 334	Applied Analysis of Variance	3
MATH 339	Survey Sampling Techniques	3
MATH 345	Math for Insurance, Bus. & Inv.	3
MATH 431	Math. Theory of Stats.	3
MATH 432	Math. Theory of Statistics II	3
MATH 435	Design & Analy. of Experiment	3
MATH 436	Quality Control	3

TOTAL CREDITS 19

****See Department Chair for Substitution**

HONORS PROGRAM

After a student has completed MATH 215 and MATH 242, he/she may be invited by the Department of Mathematics to study for Honors. In order to be eligible for participation in this program, a student's scholastic standing in terms of grade points shall not be less than 3.0 in general average and not less than 3.0 in all mathematics courses completed. The following mathematics courses on the upper level must be completed with a "B" or better by the time recommended on the curriculum sequence: MATH 312; 341; 343; 413; 451 or 452; 479. It is recommended that both MATH 451 and MATH 452 be completed.

MATHEMATICS HONOR SOCIETY

Pi Mu Epsilon is the mathematics honor society. To be eligible,

one must be a junior having a 3.00 GPA overall with a 3.00 GPA in mathematics, or a sophomore who has maintained a 4.00 GPA in at least fifteen (15) hours of mathematics courses, as well as having an overall GPA of at least 3.00. MATH 215 is the lowest numbered course which may be used in the GPA computation.

A SUGGESTED COURSE SEQUENCE FOR MATHEMATICS MAJORS

Advisors will help you select courses for your first year. They will use the record of courses taken previously, test scores, and your expressed interests. The outline is a guide, not a rigid pattern. As you become better informed of the opportunities that exist for graduate study and/or employment after graduation, consult advisors on how adaptations might be made in your plan of studies.

MATHEMATICS COURSE OFFERINGS

MATH 010, 020, 030, 040 Cooperative Work Program - *0 Credit.*

MATH 106 FUNDAMENTALS OF MATHEMATICS - *Three hours; 3 credits.* This is a beginning algebra course. Topics include numbers, algebraic expressions, polynomials, exponents, radicals, linear equations and quadratic equations. This course does not count towards graduation. Freshman studies sections meet five hours. (FALL/SPRING).

MATH 107 THE NUMBER SYSTEMS - *Three hours; 3 credits.* This is a concept-building course. It studies the structure of the following number systems: the counting numbers, the whole numbers, the integers, the fractions and the rational numbers, i.e. the meanings of the various types of numbers and of addition, subtraction, multiplication, division and less than, together with their interrelationships; and methods for transmitting the concepts to children. This course is restricted to elementary education majors, unless departmental permission is given. (FALL/SPRING).

MATH 108 GEOMETRY AND MEASUREMENT - *Three hours; 3 credits.* This is a concept-building course. Topics discussed include: parallelism, perpendicularity, congruence, basic ruler-and-compass constructions, basic geometric transformations, similarity and proportion, and an introduction to geometric proof. Other topics include: linear, area, volume and angular measurement; approximation, precision and accuracy; and the derivation of certain formulas for area and volume; and methods for transmitting these concepts to children. **Prerequisite:** MATH 107 with a grade of "C" or better. This course is restricted to elementary education majors unless departmental permission is given. (FALL/SPRING).

MATH 109 MATHEMATICS FOR THE LIBERAL ARTS - *Four hours; 4 credits.* A course designed to help students develop an understanding of the role of mathematics in modern society. It also provides practice in the application of elementary mathematical skills and concepts to real life problems. Topics to be discussed include sets, logic, numbers, algebra, geometry, statistics, and consumer mathematics. Optional topics are probability and computers. (FALL/SPRING).

MATH 110 ALGEBRA, FUNCTIONS, AND ANALYTIC GEOMETRY - *Three hours; 3 credits.* This is a concept-building course. Topics discussed include: algebra as an abstraction from arithmetic; equations and functions and their relationships and differences; inequalities; the Cartesian coordinate system as a link between algebra and geometry; the linkage between certain geometric objects and their algebraic counterparts; and methods for transmitting these concepts to children. **Prerequisite:** Math 108 with a grade of "C" or better. This course is restricted to elementary education majors unless departmental permission is given. (FALL/SPRING).

MATH 112 HONORS MATHEMATICS FOR THE LIBERAL ARTS - *Four hours, 4 credits.* This course is designed to help honors students develop an understanding of the role of mathematics in modern society. It also provides practice in the application of elementary mathematical skills and concepts to real-life problems. Topics to be discussed include sets and logic, numbers, algebra, geometry, statistics, and consumer mathematics. Other topics include probability and computers. Students may not receive credit for both MATH 109 and MATH 112. (FALL/SPRING).

MATH 113 INTRODUCTION TO MATHEMATICAL ANALYSIS I - *Four hours; 4 credits.* This is the first half of a unified course in algebra, trigonometry, and analytic geometry. Topics to be discussed include: fundamentals of algebra, functions and graphs, ex- ponential and logarithmic functions, analytic geometry, and introduction to the conic sections. (FALL/SPRING).

MATH 114 INTRODUCTION TO MATHEMATICAL ANALYSIS II - *Four hours; 4 credits.* This course is a continuation of Mathematics 113. Topics discussed include: analytic geometry, systems of equations and inequalities, coordinate geometry in the plane, conic sections, polar coordinates and parametric equations, sequences and series, and limits and continuity. **Prerequisite:** MATH 113 with a grade of "C" or better. (FALL/SPRING).

MATH 118 FINITE MATHEMATICS - *Three hours; 3 credits.* This course is designed to cover the following topics: statement calculus, set operations, counting prin- ciples, probability, statistics, matrices, systems of linear equations and inequalities, and linear programming with applications involving optimization utilizing the simplex method. **Prerequisite:** MATH 113 with a grade of "C" or better. (FALL/ SPRING).

MATH 120 AN INTRODUCTION TO PROBABIL- ITY AND DECISION MAKING - *Three Hours; 3 credits.* This is a first course in probability theory and should

be of interest to students with little mathematical background. The course is intended to expose majors in psychology, sociology, biology, chemistry, physics, business administration, political science as well as mathematics to sound decision making in their respect- ive fields. **Prerequisite:** MATH 113 or MATH 141 with a grade of "C" or better. (FALL/SPRING).

MATH 126 ANALYTIC GEOMETRY - *Four hours; 4 credits.* This course is designed to cover the following topics: two and three dimensional rectangular coordinate systems, lines and conic sections, translations and rotation of axes, parametric equations of loci, surfaces and solids in 3- dimensions. **Prerequisite:** MATH 113 with a grade of "C" or better, or departmental permission. (FALL/SPRING).

MATH 130 INTRODUCTION TO ACTUARIAL SCIENCE – *Two hours; 2 credits.* This course is an introduction to Actuarial Science from the point of view of practicing life insurance, casualty insurance and interaction with professionals; theory of interest; applications of calculators and computers to problems involving interest theory; guidance on program and curriculum requirements. **Prerequisite:** MATH 113 with a grade of "C" or better or departmental permission. (FALL/SPRING).

MATH 141 PRECALCULUS - *Four hours; 4 credits.* A course designed to cover the following topics: review of algebra, trigonometry, and analytic geometry; equations and inequalities; sequences and series; functions and relations including algebraic, logarithmic, exponential, and trigonometric functions; analytic geometry including conic sections and parametric equations. **Prerequisite:** Departmental Permission. (FALL/SPRING).

MATH 201 CALCULUS FOR NON-SCIENCE MA-JORS - *Three hours; 3 credits.* This course discusses the basic concepts of calculus including functions, limits, continuity, and techniques of differentiation, with applications to the managerial, life, and social sciences. Topics include also an introduction to the techniques of integration with applications, and multivariable calculus. **Prerequisite:** MATH 113 with a grade of "C" or better. (FALL/SPRING).

MATH 205 PROBABILITY, STATISTICS AND DISCRETE MATHEMATICS - *Three hours; 3 credits.* This is an introductory course in probability and statistics. Topics include: basic counting techniques, basic probability and statistics, basic logic, set theory and an introduction to algorithms. **Prerequisite:** Math 110 with a grade of "C" or better. This course is restricted to elementary education majors unless departmental permission is given. (FALL/SPRING).

MATH 215 FOUNDATIONS FOR ADVANCED MATHEMATICS I - *Three hours; 3 Credits.* Basic logic, axiomatic treatment of sets, construction of the real number system from the Zermelo-Frankel axioms of set theory. **Prerequisite:** Departmental Permission. (FALL).

MATH 216 FOUNDATIONS FOR ADVANCED MATHEMATICS II - *Three hours; 3 credits.* Topics to be discussed include graph theory, techniques for proving algorithm and program correctness, formal languages and formal machines, complexity of algorithms, coding theory, Boolean algebra and logic networks. **Prerequisite:** MATH 215 with a grade of "C" or better. (SPRING).

MATH 241 CALCULUS I - *Four hours; 4 credits.* Topics to be discussed include limits and continuity of real functions of one variable; differentiation and anti- differentiation of algebraic, trigonometric, exponential, and logarithmic functions; the chain rule, the Rolle's Theorem, and the Mean Value Theorem; applications of differentiation to various problems including optimization problems and curve sketching; and an introduction to definite and indefinite integrals. **Prerequisite:** MATH 114 or MATH 141 with a grade of "C" or better or departmental permission. (FALL/SPRING).

MATH 242 CALCULUS I I - *Four hours; 4 Credits.* This course is the continuation of MATH 241 and is designed to cover the following topics: definite integrals and their applications, fundamental theorem of calculus, techniques of integration, approximate integration, and improper integrals. Integrals yielding inverse trigonometric functions, infinite sequences and series, and other topics are also discussed. **Prerequisite:** MATH 241 with a grade of "C" or better or departmental permission. (FALL/SPRING).

MATH 243 CALCULUS III - *Four hours; 4 credits.* Topics to be discussed include partial differentiation, directional derivatives, gradients and line integrals, multiple integrals, applications, Green's Theorem and Stokes' Theorem. **Prerequisite:** MATH 242 with a grade of "C" or better. (FALL/ SPRING).

MATH 298 HONORS SEMINAR I - *One hour; 1 credit.* This course is designed to introduce the honors student to deductive reasoning. The seminar will feature a mix of outside speakers, faculty speakers and student presentations. These talks and presentations will highlight the use of deductive reasoning in mathematics. The student will write a paper that illustrates the use of deductive reason- ing in an elementary setting. (OFFERED AS NEEDED).

MATH 299 HONORS SEMINAR II - *One hour; 1 credit.* This course is designed as a continuation of MATH 298; therefore it continues the process of intro- ducing the student to deductive reasoning. The seminar will feature a mix of outside speakers, faculty speakers and student presentations. These talks and presentations will highlight the use of deductive reasoning in mathematics. The student will write a paper that illustrates the use of deductive reasoning in an elementary setting and will be required to give an oral presentation to the class in MATH 298 when both seminar

courses are offered in the same semester.(OFFERED AS NEEDED).

MATH 300 INDEPENDENT STUDY IN MATHEMATICS I - *Three hours; 3 credits.* Under this heading, a student may agree to a course with a particular faculty member on a topic not covered in the regular curriculum. The arrangements must be made with the faculty member and approved by the Department Chair before the student registers for the course. (OFFERED AS NEEDED).

MATH 312 LINEAR ALGEBRA I - *Three hours; 3 credits.* This course is designed to cover the following topics: a study of linear transformations and matrices, vector spaces, eigenvalues and canonical forms and other topics as time permits. **Prerequisite:** MATH 241 with a grade of "C" or better. (FALL/SPRING).

MATH 313 LINEAR ALGEBRA II - *Three hours; 3 credits.* This is a follow-up course to MATH 312. Special topics, applied and abstract, are studied. These topics include Hermitian Matrices, Quadratic Forms, Positive Definite Matrices, Canonical Forms, and other applications as time permits. **Prerequisite:** MATH 312 with a grade of "C" or better. (OFFERED AS NEEDED).

MATH 322 SOLID ANALYTIC GEOMETRY - *Three hours; 3 credits.* This course is designed to use matrix theory and vector algebra to discuss the following topics: lines, planes and transformation of coordinates in space; quadric surfaces, the general equation of the second degree,
and properties of quadrics. **Prerequisite:** MATH 242 with a grade of "C" or better. (OFFERED AS NEEDED).

MATH 331 APPLIED PROBABILITY AND STATISTICS – *Three hours; 3 credits.* This is a first course in statistics with emphasis on applications in engineering and the sciences, including the role of statistics in quality control, descriptive statistics, basic probability, discrete and continuous probability models, sampling distributions, drawing inferences from population samples via estimation and significance tests, brief exposure to regression and analysis of variance. Students are required to complete computer projects using statistical software systems. **Prerequisite:** MATH 242 with a grade "C" or better. (FALL/SPRING).

MATH 333 APPLIED REGRESSION, CORRELA- TION, AND TIME SERIES ANALYSIS – *Three hours; 3 credits.* This course represents a study of relationships among variables, including linear regression with one or more variables, methods of estimating parameters and testing hypothesis, selection of independent variables, time series, and other topics. Students are required to complete computer projects using statistical software systems. **Prerequisite:** MATH 331 with a grade of "C" or better. (FALL).

MATH 334 APPLIED ANALYSIS OF VARIANCE – *Three hours; 3 credits.* This course is designed to cover a study of relation between a dependent variable and one or more independent variables. It will study quantitative or qualitative attributes of data without requiring assumption about the nature of the statistical relation. The course will emphasize single and multifactor models analysis, analysis of factor effects, implementation of models, analysis of variance, and analysis of covariance. Students are required to complete computer projects using statistical software systems. **Prerequisite:** MATH 331 with a grade of "C" or better or departmental permission. (FALL/SPRING).

MATH 337 NONPARAMETRIC STATISTICAL METHODS - *Three hours; 3 credits.* This course empha- sizes an applied study of many of the popular nonparametric tests that do not require the knowledge of the population in question. It emphasizes procedures that utilize data from a single sample, or two or more independent and related samples. The course will also cover Chi-square tests of independence, homogeneity, goodness-of-fit, rank correlation, and other measures of association, including exposure to loglinear-logit analysis of categorical data. Students are required to complete computer projects using statistical software systems. **Prerequisite:** MATH 331 with a grade of "C" or better or departmental permission. (FALL).

MATH 339 SURVEY SAMPLING TECHNIQUES - *Three hours; 3 credits.* This course will cover methods of designing and interpreting survey investigations with emphasis on simple random, stratified, systematic, cluster and double sampling from populations to determine un- certainties. In addition, it will cover construction of sample frames, sampling for estimating proportions, means and variances, sample size determination, computer scoring, and analysis of questionnaire data. Students are required to complete computer projects using statistical software sys- tems. **Prerequisite:** MATH 331 with a grade of "C" or bet- ter or departmental permission. (OFFERED AS NEEDED).

MATH 340 INTRODUCTION TO DIFFERENTIAL EQUATIONS - *Three hours; 3 credits.* This is a first course dealing with methods of solving ordinary differ- ential equations (ODE) with modeling applications. The following topics are included: first order ordinary differential equations, second and higher order linear ordinary differential equations, (homogeneous and non-homogeneous), Laplace Transforms, systems of linear ordinary differential equations. **Prerequisite:** MATH 242 with a grade of "C" or better. (FALL/SPRING).

MATH 341 ADVANCED CALCULUS I - *Three hours; 3 credits.* This course discusses in a rigorous manner the following topics: topology of the real line, sequences of real numbers, theory of limits and continuity, theory of differentiation and integration of functions of one variable, infinite series. **Prerequisites:** MATH 216 and MATH 242 with a grade of "C" or better or departmental permission. (FALL/SPRING).

MATH 342 ADVANCED CALCULUS II - *Three hours; 3 credits.* This course is a continuation of MATH 341. The following topics will be covered: sequences of functions, improper integrals, and functions of several variables. **Prerequisite:** MATH 341 with a grade of "C" or better. (OFFERED AS NEEDED).

MATH 343 COMPLEX VARIABLES – *Three hours; 3 credits.* This course is designed as a study of functions of a complex variable. Topics are: elementary functions, analytic functions, Cauchy-Riemann equations, harmonic functions, contour integral, Cauchy-Goursat Theorem, Cauchy integral formula, Maximum modulus theorem, poles and residues, Laurent series, conformal mapping. **Prerequisite:** MATH 341 with a grade of "C" or better. (SPRING).

MATH 345 MATHEMATICS FOR INSURANCE AND INVESTMENT – *Three hours; 3 credits.* This course is designed to cover the following topics: theory of life insurance, life annuities, premiums, financial derivatives and related fields, with emphasis on applications of current insurance and investment principles, exposure to health, disability, long-term care and property/casualty insurance, presentations by speakers and stock market labs. **Prerequisite:** MATH 331 with a grade of "C" or better or departmental permission. (OFFERED AS NEEDED).

MATH 346 FINANCIAL MATHEMATICS – *Four hours; 4 credits.* This course provides an understanding of financial mathematics and financial economics as well as their applications to real world business situations and risk management. Provides preparation for the Society of Actuaries/Casualty Actuarial Society (SOA/ CAS) Actuarial Exam FM/2. **Prerequisite:** MATH 242 with a grade of "C" or better. (FALL).

MATH 352 NUMERICAL ANALYSIS – *Three hours; 3 credits.* This course is designed to cover the following topics: methods of deriving numerical results for mathematical procedures with attention given to the precision of the results. Computer programming techniques will also be included. **Prerequisite:** MATH 242 with a grade of "C" or better. (FALL).

MATH 361 INTRODUCTION TO MATHEMATICAL MODELING - *Three hours; 3 credits.* This course is an introduction to the basic principles of formulation, analysis, and simulation of mathematical models. Deterministic, dynamic, and stochastic models will be discussed. **Prerequis- ite:** MATH 242 with a grade of "C" or better. (SPRING).

MATH 363 ACTUARIAL AND STOCHASTIC MODELING I – *Three hours; 3 credits.* This course develops mathematical models for analyzing fluctuations in stock market indices, interest rates, weekly insurance claims, inventory levels, and many other random phe- nomena. It is restricted to systems that can be modeled as discrete time Markov Chains. **Prerequisite:** MATH 312 and MATH 331 with a grade of "C" or better. (FALL).

MATH 364 ACTUARIAL AND STOCHASTIC MODELING II – *Three hours; 3 credits.* This course deals with continuous time Markov chains. These chains are used to model the behavior of queuing systems like wait- ing lines at bank teller windows, restaurants, and tele- phone call centers. The course also develops continuous time models for analyzing other random fluctuations. In particular, it develops the Black-Scholes model for pricing stock options, and the stochastic calculus used for pricing insurance premiums and annuity products. **Prerequisite:** MATH 363 with a grade of "C" or better or departmental permission. (SPRING)

MATH 371 HISTORY OF MATHEMATICS - *Three hours; 3 credits.* Topics include the origins of the concepts of numbers, algebra, geometry, applied arith- metic. The contributions of famous 19th and 20th century mathematicians will also be discussed. (FALL).

MATH 390 SPECIAL TOPICS IN MATHEMATICS I - *3 hours; 3 credits.* Under this heading, courses on topics and applications not covered in the regular curriculum or that span several areas of mathematics will be offered. (OFFERED AS NEEDED).

MATH 399 MATHEMATICS IN AFRICAN CULTURE - *Three hours; 3 credits.* This course is an introductory look at the relationship between mathematics and culture. Specific attention will be given to the African expression and development of certain mathematical ideas. (OFFERED AS NEEDED).

MATH 400 INDEPENDENT STUDY IN MATHEMATICS II - *Three hours; 3 credits.* Under this heading, a student may agree to a course with a particular faculty member on a topic not covered in the regular curriculum. The arrangements must be made with the faculty member and approved by the department chair before the student registers for the course. (OFFERED AS NEEDED).

MATH 401 GROUPS AND GEOMETRY - *Three hours; 3 credits.* This course is an introduction to group theory, geometry of complex numbers, symmetries of the plane and two-dimensional crystallographic groups. These topics demonstrate the unity of mathematics and help students develop proof techniques. **Prerequisites:** MATH 243 and MATH 312 with a grade of "C" or better. (OFFERED AS NEEDED).

MATH 413 ALGEBRAIC STRUCTURES I - *Three hours; 3 credits.* This course is designed to cover the following topics: elementary theory of groups, rings, in- tegral domains, fields and ideals. An introduction to polynomials and matrices over a field will be considered. **Prerequisite:** MATH 215 or MATH 312 with a grade of "C" or better or Departmental Permission. (FALL)

MATH 414 ALGEBRAIC STRUCTURES II - *Three hours; 3 credits.* A continuation of MATH 413. Topics drawn from Galois theory, Sylow theory, finite abelian groups, and applications. **Prerequisite:** MATH 413 with a grade of "C" or better. (OFFERED AS NEEDED).

MATH 415 INTRODUCTION TO DIFFERENTIAL GEOMETRY - *Three hours; 3 credits.* This course deals with differential geometry of curves and surfaces, curvature and geodesics and an introduction to n-dimensional Riemannian manifolds. Multivariable calculus is used to study geometry. This central subject in modern mathematics underlies Einstein's relativity theory and modern string theory in physics. **Prerequisites:** MATH 243, MATH 312 and MATH 340 with a grade of "C" or better. (FALL/SPRING).

MATH 419 COMBINATORICS AND GRAPH THEORY - *Three hours; 3 credits.* General enumeration methods, difference equations, and generating functions. Elements of graph theory including transport networks, matching theory, and graph algorithms. **Prerequisite:** MATH 215 with a grade of "C" or better. (OFFERED AS NEEDED).

MATH 421 HIGHER GEOMETRY - *Three hours; 3 credits.* This course introduces the student to projective, advanced Euclidean and non-Euclidean geometries and is designed to cover the following topics: transformation theory, projective theory of conics, Desargues' Theorem, duality, projective, parabolic, hyperbolic, and elliptic geometries. **Prerequisite:** MATH 242 with a grade of "C" or better, or by permission of the instructor. (SPRING).

MATH 425 INTRODUCTION TO NUMBER THEORY - *Three hours; 3 credits.* Divisibility and primes, congruences, quadratic reciprocity, arithmetic functions, and arithmetic in quadratic fields. **Prerequisite:** MATH 242 with a grade of "C" or better. (OFFERED AS NEEDED).

MATH 431 MATHEMATICAL THEORY OF STATISTICS I – *Three hours; 3 credits.* This course is designed to cover the following: general probability, Bayes' Theorem, discrete and continuous random variables, mathematical expectation, moments and moment generating functions, density functions for single and multiple random variables, marginal and conditional probability distributions, some particular distributions, sampling theory and the Central Limit Theorem. **Prerequisite:** MATH 242 with a grade of "C" or better. (FALL).

MATH 432 MATHEMATICAL THEORY OF STATISTICS II – *Three hours; 3 credits.* This course is a continuation of MATH 431. It is designed to cover the following: normal correlation and regression, theory of estimation with emphasis on uniformly minimum un- biased estimators and the maximum likelihood method, theory of hypothesis testing with emphasis on Nyman- Pearson Lemma and the likelihood ratio tests, power function, deriving distributions of one and two random variables, small sample distributions with emphasis on the chi-square, t and F distributions. **Prerequisite:** MATH 431 with a grade of "C" or better. (SPRING).

MATH 433 PROBLEM SOLVING TECHNIQUES AND APPLICATIONS IN PROBABILITY – *Two hours; 2 credits.* The purpose of this course is to teach techniques for problem solving in probability theory, which are relevant to the actuarial sciences. Materials from MATH 331, MATH 337, MATH 431 as well as past Actuarial Exam 1/P exams will be reviewed. These materials will be used to help students acquire a better understanding of what is required of them in the business and actuarial profession. This course is open to all students and highly recommended for all Actuarial Science majors and Mathematics majors (with a concentration in Actuarial Science). **Prerequisites:** MATH 242, MATH 331, MATH 337, MATH 431 with a grade of "C" or better. **Corequisite:** MATH 432. (SPRING)

MATH 435 DESIGN AND ANALYSIS OF EXPERIMENTS – *Three hours; 3 credits.* Modern statistical techniques useful for doing research by experimentation, with emphasis on design of experiments via randomized block designs, nested and partially nested designs, repeated measures designs, latin square designs, factorial designs, fractional factorial designs, response surface methodology. Computer projects via statistical software systems. **Prerequisite:** MATH 432 with a grade of "C" or better. (OFFERED AS NEEDED).

MATH 436 QUALITY CONTROL – *Four hours, 4 credits.* Statistical process control, including principles of control charts, control charts for attributes and variables, and special control charts; process capability studies; methods for quality improvement; acceptance sampling, including single, double, sequential and multiple attribute sampling plans, and sampling plans by variables; reliability, life testing and exposure to industrial experimentation. Computer projects via statist- ical software systems. **Prerequisite:** MATH 432 with a grade of "C" or better. (OFFERED AS NEEDED).

MATH 440 INTRODUCTION TO PARTIAL DIFFERENTIAL EQUATIONS – *Three hours, 3 credits.* Initial value problems of wave and heat equations, Fourier series and transforms, initial and boundary problems of wave and heat equations, eigenfunction expansions, energy estimates, boundary value problems of Laplace equations, Green functions, variation of calculus, classification of linear second order PDE. **Prerequisites:** MATH 243, MATH 312 and MATH 340 with a grade of "C" or better. (OFFERED AS NEEDED).

MATH 450 SENIOR SEMINAR - *Three hours; 3*

credits. Under the direction of a faculty member, the student must write an acceptable mathematics paper. In addition, an oral presentation based on the paper must be made to a departmental audience. **Prerequisite:** Senior standing in the Mathematics Major or departmental permission. (SPRING AND OFFERED AS NEEDED).

MATH 451 HONORS CONFERENCE COURSE - *Three hours; 3 credits.* This course is designed for seniors in the Honors Program and others admitted by the chairperson and is devoted to one or more topics in advanced mathematics. Much of this work is done through independent study with timely conferences with the instructor. **Prerequisite:** Senior standing in the Mathematics Major or departmental permission. (OFFERED AS NEEDED).

MATH 452 HONORS CONFERENCE COURSE - *Three hours; 3 credits.* This course is designed to expose seniors to research in Mathematics. Students will work on research projects with a designated mentor, and present their findings at local and national conferences. **Prerequisite:** MATH 451 with a grade "C" or better. (OFFERED AS NEEDED).

MATH 461 OPERATIONS RESEARCH I - *Three hours; 3 credits.* Linear programming including the simplex method. Transportation, assignment, and trans- shipment problems. Network problems, sensitivity analysis, and a brief introduction to dynamic programming. **Prerequisite:** MATH 312 with a grade of "C" or better. (OFFERED AS NEEDED).

MATH 462 OPERATIONS RESEARCH II - *Three hours; 3 credits.* Integer programming, game theory, dynamic programming. Introduction to nonlinear programming. **Prerequisite:** MATH 461 with a grade of "C" or better. (OFFERED AS NEEDED).

MATH 479 POINT SET TOPOLOGY - *Three hours; 3 credits.* This course is designed to cover the following topics: point set theory of the line and plane, topological spaces and properties, mappings. **Prerequisite:** MATH 341 with a grade of "C" or better. (FALL/SPRING).

MATH 481 ALGEBRA AND ANALYSIS WITH CONNECTIONS TO GEOMETRY - *Three hours; 3 credits.* This is the first semester of a two-semester capstone course for prospective or experienced secondary school mathematics teachers. The course seeks to bring together most of the mathematical and much of the pedagogical material that the students have learned. It will apply the concepts of geometry, including congruence, symmetry and transformations, distance and similarity, trigonometry, area and volume to analysis and algebra. The course will also explore the concept of an axiomatic system. **Prerequisite:** Senior standing in the Mathematics Major. (OFFERED AS NEEDED).

MATH 482 GEOMETRY WITH CONNECTIONS TO ALGEBRA AND ANALYSIS - *Three hours; 3 credits.* This is the second semester of a two-semester capstone course for prospective or experienced secondary school mathematics teachers. The course seeks to bring together most of the mathematical and much of the pedagogical material that the students have learned. It will apply the concepts of the Real and Complex Number Systems, Functions and Equations to other concepts in mathematics including geometry. It will draw together ideas on the structure of number systems learned in various courses and show their connections to topics taught in high school. **Prerequisite:** MATH 481 with a grade of "C" or better. (OFFERED AS NEEDED).

MATH 490 SPECIAL TOPICS IN MATHEMATICS II - *Three hours; 3 credits.* Under this heading, courses on topics and applications not covered in the regular curriculum or that span several areas of math- ematics will be offered. (OFFERED AS NEEDED).

MORGAN STATE UNIVERSITY
DEPARTMENT OF MATHMATICS
BACHELOR OF SCIENCE DEGREE IN MATHEMATICS
SUGGESTED CURRICULUM SEQUENCE

FRESHMAN YEAR (FIRST SEMESTER)

ENGL 101-EC	English	3
XXXX-SB	Social & Behavioral Science Core	3
MATH 215- MQ	Foundations of Advanced Math	3
MATH 241	Calculus I	4
ORNS 106	Freshman Orientation	1
		14

FRESHMAN YEAR (SECOND SEMESTER)

ENGL 102-EC	English	3
XXXX-HH	Health & Healthful Living	3
XXXX-SB	Social & Behavioral Science Core	3
MATH 216	Foundations of Advanced Math II	3
MATH 242	Calculus II	4
PHEC XXX	Physical Education Elective	1
		17

SOPHOMORE YEAR (FIRST SEMESTER)

XXXX-AH	Arts & Humanities Core	3
MATH 243	Calculus III	4
PHIL 109-CT	Introduction to Logic	3
PHYS 205-BP	University Physics	5
		15

SOPHOMORE YEAR (SECOND SEMESTER)

XXXX- BP	Biological & Physical Sci.	4
XXXX-AH	Arts & Humanities Core	3
MATH 312	Linear Algebra	3
PHYS 206	University Physics II	5
		15

JUNIOR YEAR (FIRST SEMESTER)

MATH 340	Introduction to Differential Eq.	3
MATH 341	Advanced Calculus	3
MATH 413	Algebraic Structures	3
MATH 431	Mathematical Theory of Stat.	3
XXXX-SB	Social & Behavioral Science Core	3
		15

JUNIOR YEAR (SECOND SEMESTER)

HIST 350-CI	Intro to African Diaspora	3
MATH 343	Complex Variables	3
MATH 479	Point Set Topology	3
XXXX – IM	Info. Tech & Media Lit. Core	3
XXXX	Advised Elective	3
		15

SENIOR YEAR (FIRST SEMESTER)

MATH XXX	Math Elective	3
MATH XXX	Math Elective	3
XXXX	Social & Behavioral Science Elec	6
XXXX	Complementary Studies	3
		15

SENIOR YEAR (SECOND SEMESTER)

MATH 450	Senior Seminar	3
XXXX	Free Elective	5
XXXX	Complementary Studies	3
MATH XXX	Math Elective	3
		14

TOTAL CREDIT HOURS 120

MORGAN STATE UNIVERSITY
DEPARTMENT OF MATHMATICS
BACHELOR OF SCIENCE DEGREE IN MATHEMATICS
STATISTICS
SUGGESTED CURRICULUM SEQUENCE

FRESHMAN YEAR (FIRST SEMESTER)

ENGL 101-EC	English	3
XXXX-HH	Health & Healthful Living	3
XXXX-SB	Social & Behavioral Science Core	3
MATH 215- MQ	Foundations of Advanced Math	3
MATH 241	Calculus I	4
ORNS 106	Freshman Orientation	1
		17

FRESHMAN YEAR (SECOND SEMESTER)

ENGL 102-EC	English	3
XXXX-SB	Social & Behavioral Science Core	3
MATH 216	Foundations of Advanced Math II	3
MATH 242	Calculus II	4
PHEC XXX	Physical Education Elective	1
		14

SOPHOMORE YEAR (FIRST SEMESTER)

XXXX-AH	Arts & Humanities Core	3
MATH 243	Calculus III	4
PHIL 109-CT	Introduction to Logic	3
PHYS 205-BP	University Physics	5
		15

SOPHOMORE YEAR (SECOND SEMESTER)

XXXX- BP	Biological & Physical Sci.	4
XXXX-AH	Arts & Humanities Core	3
MATH 312	Linear Algebra	3
PHYS 206	University Physics II	5
		15

JUNIOR YEAR (FIRST SEMESTER)

MATH 331	Applied Probability and Statistics	3
MATH 340	Introduction to Differential Eq.	3
MATH 341	Advanced Calculus	3
MATH 431	Mathematical Theory of Stat.	3
XXXX	Social & Behavioral Science Elec.	3
		15

JUNIOR YEAR (SECOND SEMESTER)

HIST 350-CI	Intro to African Diaspora	3
XXXX	Humanities Elective	3
MATH 333	Applied Regress & Cor. Ana.	3
MATH 432	Math Theory Statistics	3
MATH 479	Point Set Topology	3
		15

SENIOR YEAR (FIRST SEMESTER)

MATH 337	Non Para. Stat. Method	3
MATH 413	Algebraic Structures	3
XXXX	Free elective	6
XXXX	Complementary Studies	3
		15

SENIOR YEAR (SECOND SEMESTER)

MATH XXX*	Restricted Elective	3
MATH 343	Complex Variables	3
MATH 450	Senior Seminar	3
XXXX	Complementary Studies	3
XXXX	Free Elective	2
		14

Restricted Elective courses: Math 334,345,435 or 436

TOTAL CREDIT HOURS 120

THE ACTUARIAL SCIENCE PROGRAM

(under the auspices of the Mathematics Department)

Director: Traci Allotey

Program Mission: The mission of the Morgan State University Actuarial Science Program is to increase the number of highly qualified students, especially among underrepresented populations, entering careers in actuarial and actuarial-related fields by encouraging the development and use of statistics, probability, decision-making and risk management.

Actuarial Science is the discipline that applies mathematical and statistical methods to assess risk of events occurring and help formulate policies that minimize risk and its financial impact on companies and clients. Actuaries find employment with insurance companies, government agencies, human resources departments of large corporations, hospitals, accounting and consulting firms as well as with banks and investment firms.

The Actuarial Science Program at Morgan State University is the only formalized Actuarial Science Program in the state of Maryland approved by Maryland Higher Education Commission (MHEC). It uniquely incorporates the disciplines of Mathematics, Finance, Accounting and Economics to create a synergistic program that fully equips our graduates for the workforce. The program offers a Bachelor of Science in Actuarial Science, a Bachelor of Science in Mathematics with a concentration in Actuarial Science as well as a minor in Actuarial Science. The curricula for these programs include courses approved by the Society of Actuaries (SOA) to fulfill the Validation by Educational Experience credits and courses covering the learning objectives described in the SOA Basic Education Catalogue for Preliminary Actuarial Examination Probability (P), Financial Mathematics (FM), Financial Economics (MFE), Life Contingencies (MLC) and Construction and Evaluation of Actuarial Models (C). Full and partial tuition scholarships are available through the Actuarial Science Program for students who qualify. The program encompasses extensive exam prep for actuarial exams and valid internship experience will also be made available to students.

Program Requirements: Retention in the Actuarial Science Program requires students pursuing any of the offered major, concentration or minor degree options to maintain a cumulative GPA of 2.50, or higher. Any student whose GPA drops below 2.50 may be dropped from the program and may not take additional actuarial science courses. To qualify for graduation with a major, concentration or minor in actuarial science, students must have outstanding grades below "C" in the major/concentration/minor (which includes all courses required for the major/concentration/minor and required supporting courses).

Major Requirements: Students must have completed all Validation by Educational Experience (VEE) requirements for Applied Statistical Methods, Corporate Finance and Economics; students must sit in on at least one of the Society of Actuaries' examinations before graduation; and must prepare and present a senior thesis on an insurance/ actuarial science-related topic that will be conducted under the supervision of a qualified faculty member and/ or professional actuary. Students will give an oral presentation of their research to the Mathematics Department and School of Computer, Mathematical and Natural Sciences. Students may be able to substitute their senior thesis for a full technical report and presentation on an internship experience where students were immersed in the capacity of an actuarial science analyst or job-specific trainee.

School Requirements: In addition to meeting University, General Education and major requirements, students must also complete six (6) credits in the Complementary Studies Program required of all majors in the School of Computer, Mathematical and Natural Sciences (SCMNS). Additionally, in order to qualify for graduation, students must pass the Senior Departmental Comprehensive Examination, as well as the Speech and Writing Proficiency Examinations; students must have taken all of their junior- and senior- level actuarial science requirements in the Major at Mor- gan State University (unless granted prior written permis- sion by the Dean of SCMNS to take courses elsewhere).

Upon successful completion of this four-year program, the student is awarded the B.S. Degree in Actuarial Science by Morgan State University.

THE MAJOR IN ACTUARIAL SCIENCE

REQUIRED COURSES FOR A MAJOR IN ACTUARIAL SCIENCE

Entering students should select all their courses in consultation with the Director of the Actuarial Science Program.

Students majoring in Actuarial Science must meet the following requirements:

Course	*Description*	*Credits*
	FOR GENERAL EDUCATION *	
MATH 241	Calculus I	4
INSS 141	Digital Literacy & App Software	3
	MAJOR REQUIREMENTS	
MATH 130	Introduction to Actuarial Science	3
MATH 242	Calculus II	4
MATH 243	Calculus III	4
MATH 312	Linear Algebra I	3
MATH 331	Applied Probability and Statistics	3
MATH 333	Applied Regression, Correlation & Time Series Analysis**	3
MATH 337	Nonparametric Statistical Methods	3
MATH 340	Intro to Differential Equations	3
MATH 346	Financial Mathematics	4
MATH 363	Actuarial and Stochastic Modeling I	3
MATH 364	Actuarial and Stochastic Modeling II	3

MATH 431	Mathematical Theory of Statistics I	3
MATH 432	Mathematical Theory of Statistics II	3
MATH 433	Problem Solving Techniques and Applications	2
MATH 45X (CHOOSE ONE COURSE)		3
MATH 450 Senior Seminar (directed reading in AS)		
MATH 451 Honors Conference Course		
MATH 452 Conference Seminar		
ACCT 201	Principles of Accounting I	3
ACCT 202	Principles of Accounting II	3
ECON 211	Principles of Economics I Macroeconomics)**	3
ECON 212	Principles of Economics II (Intro to	
FIN 343	Managerial Finance**	3
FIN 344	Security Analysis**	3
FIN 422	Portfolio Management**	3
BUAD 361	Fundamentals of Risk Management	3
BUAD 362	Life and Health Insurance	3
TOTAL CREDITS	**80**	

* Actuarial Science majors must select this course to fulfill the Mathematics requirements under General Education.
** Validation by Educational Experience (VEE) course.

THE MAJOR IN MATHEMATICS (ACTUARIAL SCIENCE TRACK)
REQUIRED COURSES FOR A MAJOR IN MATHEMATICS (ACTUARIAL SCIENCE TRACK)

Students majoring in Mathematics (Actuarial Science Track) must meet the following requirements:

Course	***Description***	***Credits***
FOR GENERAL EDUCATION*		
MATH 215	Foundations for Advanced Math	
INSS 141	Intro to Comp Sys.	3
FOR THE MAJOR		
MATH 130	Introduction to Actuarial Science	2
MATH 216	Foundations for Advanced Math matics II	3

Exam FM: Financial Mathematics (2.5 hours) MATH 346 (You should take this class in the spring followed by the exam in May)

Exam MFE: Financial Economics (2.5 hours)
BUAD 361, FIN 423

Exam MLC: Life Contingencies (3 hours)
MATH 363, MATH 364, BUAD 362

Exam C: Construction and Evaluation of Actuarial Models (4 hours)
MATH 333, MATH 363, MATH 364, MATH 432

NOTE: *The CAS has its own third exam. They will accept the SOA Exams MFE + MLC, but NOT vice versa.*

COURSES APPROVED FOR VALIDATION BY EDUCATIONAL EXPERIENCE (VEE) CREDIT BY THE SOCIETY OF ACTUARIES (SOA)

VEE- Corporate Finance: FIN 343 Managerial Finance FIN 344 Security Analysis **Or**
FIN 343 Managerial Finance FIN 422 Portfolio Management

VEE-Applied Statistical Methods- Time Series: MATH 333 Applied Regression, Correlation and Time Series Analysis
Or
ECON 414 Econometrics

VEE- Economics:
ECON 211 Principles of Economics (Micro) ECON 212 Principles of Economics (Macro) **Or**
ECON 317 Intermediate Economics (Micro) ECON 318 Intermediate Economics (Macro)

(The Society of Actuaries strongly recommends students complete as many VEE courses as they can before graduation. Students will receive credit for VEE courses completed with a grade of B or higher after they have passed Exam 1/P and Exam 2/FM).

THE MINOR IN ACTUARIAL SCIENCE
The Actuarial Science Minor allows students from all disciplines to follow a particular sequence of courses that will afford them a well-rounded academic experience in Mathematics, Statistics, Finance and Economics. This minor gives students the opportunity to explore the actuarial science field and the flexibility to apply decision-making, risk assessment and management concepts within their discipline and chosen careers. Additionally, the courses within the minor will help students understand many of the concepts covered in the first two actuarial exams (P/ 1 and FM/2). Additionally, many of the courses in the minor meet VEE requirements. Taking these courses while at Morgan State University means that students will not have to take them somewhere else after they graduate.

ALL STUDENTS MUST MEET WITH THE DIRECTOR OF THE ACTUARIAL SCIENCE PROGRAM FOR ADVISEMENT TO ENROLL I N THE ACTUARIAL SCIENCE MINOR.

MORGAN STATE UNIVERSITY
DEPARTMENT OF MATHMATICS
ACTUARIAL SCIENCE MAJOR
CURRICULUM SEQUENCE

FRESHMAN YEAR (FIRST SEMESTER)

ENGL 101-EC	Freshman Composition I	3
XXXX-SB	Social & Behavioral Sciences	3
ACSC 130	Intro to Actuarial Science	3
INSS 141-IM	Digital Lit & App Software	3
MATH 241-MQ	Calculus I	4
ACSC 105	ACSC Prof Dev Intro I	0
		16

FRESHMAN YEAR (SECOND SEMESTER)

ENGL 102-EC	Freshman Composition II	3
PHIL 109-CT	Intro to Logic	3
ACCT 201	Prin. of Acct I	3
MATH 242	Calculus II	4
XXXX-HH	Health & Healthful Living	3
ACSC 106	ACSC Prof Dev Intro II	0
		16

SOPHOMORE YEAR (FIRST SEMESTER)

MATH 243	Calculus III	4
MATH 312	Linear Algebra I	3
XXXX-AH	Arts & Humanities	3
ACCT 202	Prin of Acct II	3
XXXX	Complementary Studies	3
ACSC 205	ACSC Prof. Dev. Inter I	0
		16

SOPHOMORE YEAR (SECOND SEMESTER)

MATH 331	App Probability & Stat.	3
XXXX	Complementary Studies	3
ECON 211-SB	Principles of Economics	3
ACSC 346	Financial Mathematics	4
XXXX-AH	Arts & Humanities	3
ACSC 206	ACSC Prof. Dev Inter II	0
		16

JUNIOR YEAR (FIRST SEMESTER)

ECON 212	Principles of Economics II	3
FIN 343	Managerial Finance	3
XXXX-BP	Intro Biology I or II	4
MATH 431	Math Theory of Stats I	3
MATH 337	Non Para Stat Methods	3
ACSC 305	ACSC Prof Dev Adv I	0
		16

JUNIOR YEAR (SECOND SEMESTER)

PHYS 205-BP	University Physics	5
MATH 433	Prob. Solving Tech & Apps	2
MATH 432	Math Theory of Stats II	3
BUAD 361	Fund of Risk Mgmt	3
PHEC XXX	Physical Education Elective	1
ACSC 306	ACSC Prof Dev Adv II	0
		14

SENIOR YEAR (FIRST SEMESTER)

MATH 333	App Reg & Time Analysis	3
FIN 344	Security Analysis	3
MATH 363	Act & Stochastic Models I	3
HIST 350-CI	Intro to African Diaspora	3
ACSC 405	ACSC Prof Dev Senior I	1
		13

SENIOR YEAR (SECOND SEMESTER)

BUAD 362	Life & Health Insurance	3
MATH 450/490	Senior Sem/ACSC Research	3
MATH 340	Intro to Diff Equations	3
MATH 364	Act & Stochastic Model II	3
ACSC 406	ACSC Prof Dev Senior II	1
		13

TOTAL CREDIT HOURS 120

To satisfy the Complementary Studies for the Actuarial Science Degree it is strongly recommended that students complete the following courses:
BUAD 202 Business Leadership Seminar (3), BUAD 381 Legal and Ethical Business (3)

MORGAN STATE UNIVERSITY
DEPARTMENT OF MATHMATICS
ACTUARIAL SCIENCE MAJOR (WITH PURE MATHEMATICS CONCENTRATION)
CURRICULUM SEQUENCE

FRESHMAN YEAR (FIRST SEMESTER)

ENGL 101-EC	Freshman Composition I	3
ACSC 130	Intro to Actuarial Science	3
XXXX-SB	Social & Behavioral Sciences	3
MATH 215	Foundations Advanced Math I	3
MATH 241-MQ	Calculus I	4
ACSC 105	ACSC Prof Dev Intro I	0
		16

FRESHMAN YEAR (SECOND SEMESTER)

ENGL 102-EC	Freshman Composition II	3
XXXX-HH	Health & Healthful Living	3
INSS 141-IM	Digital Lit & App Software	3
MATH 242	Calculus II	4
MATH 216	Foundations Advanced Math II	3
ACSC 106	ACSC Prof Dev Intro II	0
		16

SOPHOMORE YEAR (FIRST SEMESTER)

XXXX-BP	Intro Biology I or II	4
MATH 243	Calculus III	4
PHIL 109-CT	Intro to Logic	3
XXXX	Complementary Studies	3
PHEC XXX	Physical Ed Elective	1
ACSC 205	ACSC Prof Dev Inter I	0
		15

SOPHOMORE YEAR (SECOND SEMESTER)

MATH 331	App Probability & Stat	3
ACSC 346	Financial Mathematics	4
ECON 211-SB	Principles of Economics	3
MATH 312	Linear Algebra I	3
ACCT 201	Prin. of Accounting I	3
ACSC 206	ACSC Prof Dev Inter II	0
		16

JUNIOR YEAR (FIRST SEMESTER)

ECON 212	Principles of Economics II	3
XXXX-AH	Arts & Humanities	3
ACCT 202	Prin of Accounting II	3
MATH 333	App Reg, Corr & Time Anal	3
MATH 431	Math Theory Statistics I	3
ACSC 305	ACSC Prof Dev Advance I	0
		15

JUNIOR YEAR (SECOND SEMESTER)

XXXX	Complementary Studies	3
MATH 432	Math Theory Statistics II	3
MATH 341	Adv Calculus I	3
XXXX-AH	Arts & Humanities	3
MATH 433	Prob. Solving Tech & Apps	2
ACSC 306	ACSC Prof Dev Advance II	0
		14

SENIOR YEAR (FIRST SEMESTER)

MATH 337	Non Para Stat Methods	3
XXXX	Advised ACSC Elective	3
FIN 343	Managerial Finance	3
PHYS 205-BP	University Physics	5
ACSC 405	ACSC Prof Dev Senior I	1
		15

SENIOR YEAR (SECOND SEMESTER)

MATH XXX	Math Elective	3
MATH 450/490	Senior Sem/ACSC Research	3
MATH 340	Intro to Diff Equations	3
HIST 350-CI	Intro to African Diaspora	3
ACSC 406	ACSC Prof. Dev. Senior II	1
		13

TOTAL CREDIT HOURS 120

To satisfy the Complementary Studies for the Actuarial Science Degree it is strongly recommended that students complete the following courses:
BUAD 202 Business Leadership Seminar (3), BUAD 381 Legal and Ethical Business (3)

PHYSICS AND ENGINEERING PHYSICS DEPARTMENT

Chairperson: KEITH JACKSON

Professors: DEREJE SEIFU, CONRAD WILLIAMS,

Associate Professors: YUCHENG LAN, ABDELLAH LISFI

Assistant Professors: WINDSOR MORGAN, BIROL OZTURK

Lecturers: ANTONY KINYUA, ARADHYA KUMAR, ROMAN SERBYN

Laboratory Technician:

Store Keeper: JOHNNY NORRIS

Administrative Assistant: CYNTHIA CLEMMONS

Emeritus Professor: JULIUS TAYLOR, FREDERICK OLIVER

Emeritus Associate Professor: EUGENE HOFFMAN

Emeritus Assistant Professor: ERNEST HAMMOND

OBJECTIVES OF THE DEPARTMENT

Physics is the study of the laws of the universe and these laws are expressed using mathematical equations. Courses included in this program are selected with the purpose of providing the student a broad acquaintance with the different fields of physics and familiarity with experimental techniques and skills with scientific instrumentation.

Engineering Physics is a course of study that emphasizes fundamental courses in Physics, Mathematics and Engineering. The curriculum will prepare students to work in areas that require knowledge from several of the traditional Engineering disciplines as well as Physics. Engineering Physics is meant to provide a more thorough grounding in applied physics of any area chosen by the student (such as optics, nanotechnology, mechanical engineering, electrical engineering, control theory, aerodynamics, or solid-state physics). This course of study will also prepare students for graduate study in the Engineering disciplines, as well as Physics.

THE MAJOR IN PHYSICS

School-wide Requirements

In addition to meeting the requirements in General Education and in the major, students must also complete six (6) credits in the Complementary Studies Program required of all majors in the School of Computer, Mathematical, and Natural Sciences (SCMNS). Options for satisfying this requirement are outlined under the section on the SCMNS. In order to qualify for graduation, students must pass the Senior Departmental Comprehensive Examination; must have taken all of their Junior- and Senior-level requirements in the major at Morgan (unless granted written permission by the Department Chair and Dean to take courses elsewhere); and must have earned a cumulative average of 2.0 or better and a major average of 2.0 or better, with no outstanding grades below "C" in the major (which includes all courses required for the major and required supporting courses).

REQUIRED COURSES FOR THE MAJOR IN PHYSICS

Students majoring in Physics must complete the following required courses:

Course	*Description*	*Credits*
REQUIRED GENERAL EDUCATION COURSES*		
CHEM 105/ 111	(Honors) General Chemistry	4
CHEM 106/ 112	(Honors) General Chemistry and Qualitative Analysis	4
COSC 111	Intro. To Computing (or higher)	4
TOTAL		**12**
REQUIRED FOR THE MAJOR		
PHYS 205	University Physics I	4
PHYS 205L	University Physics Laboratory I	1
PHYS 206	University Physics II	4
PHYS 206L	University Physics Laboratory II	1
MATH 241	Calculus I	4
MATH 242	Calculus II	4
MATH 243	Calculus III	4
MATH 340	Differential Equations	3
PHYS 300	Modern Physics I	3
PHYS 301	Analytical Mechanics I	3
PHYS 302	Analytical Mechanics II	3
PHYS 303	Electricity and Magnetism I	3
PHYS 304	Electricity and Magnetism II	3
PHYS 305	Mathematical Physics I	3
PHYS 406	Mathematical Physics II	3
PHYS 308	Thermodynamics & Stat. Physics	3
PHYS 401	Optics	3
PHYS 408	Quantum Mechanics I	3
PHYS 409	Experimental Physics	3
PHYS 412	Laboratory Use of Computers	3
TOTAL		**61**
ELECTIVES (CHOOSE COURSES TOTALING AT LEAST 6 CREDITS):		
PHYS 306	Electr. for Experimental Physicist	3

MATH 341	Advanced Calculus I	3
EASC 201	Physical Geology	3
EASC 301	Planetary Science	3
CHEM 203/ 205	Organic Chemistry I	5
CHEM 204/206	Organic Chemistry II	5
PHYS 312	Properties of Materials	3
PHYS 410	Techniques and Applications of Radioisotopes	4

Other 300 or 400 level math and science courses approved by academic advisor.

TOTAL CREDITS 79

*Physics majors must select this course to fulfill General Education Requirements in Physical Sciences.

SUGGESTED ELECTIVE COURSES FOR PHYSICS MAJORS INTERESTED IN ATTENDING MEDICAL SCHOOL

Five courses suggested, one as part of the SCMNS Complementary Studies requirement, and four as electives:

PHYS 311 Acoustics and You (3 credits, lecture), which can be taken as part of the SCMNS Complementary Studies requirement
BIOL 105/106, *or* BIOL 111/112 (4 credits lecture and lab) that is, one semester of biology beyond the General Education requirement;
CHEM 203 Organic Chemistry (5 credits lecture and lab) *Please note a full two semesters (one year) of Organic Chemistry with the accompanying laboratory is required for admission to accredited schools of medicine)*
PHYS 326 Biophysics (3 credits lecture)
PHYS 410 Techniques and Applications of Radioisotopes (4 credits lecture and lab) *For students planning to apply to Medical School, Dental School, or Schools of Veterinary Medicine we strongly advise that you take Organic Chemistry series CHEM 203, and CHEM 204 or (HONORS) CHEM 205, and CHEM 206*

SUGGESTED ELECTIVE COURSES FOR PHYSICS MAJORS, INTERESTED IN GRADUATE SCHOOL IN EARTH OR SPACE SCIENCES

Four courses suggested, one as part of the SCMNS requirement, and three as electives:

PHYS 310 Astronomy and Space Science (3 credits, lecture), which can be taken as part of the SCMNS Complementary Studies requirement.
PHYS 312 Properties of Materials (3 credits, lecture)
EASC 201 Physical Geology (3 credits, lecture and lab)
EASC 301 Planetary Science (3 credits, lecture and lab)

FOR THE MINOR IN PHYSICS

PHYS 300	Modern Physics I	3
PHYS 408	QUANTUM MECHANICS I	3
PHYS 409	Experimental Physics	3
PHYS 3XX (or 4XX)	Upper-Level Physics Course	3
PHYS 3XX (or 4XX)	Upper-Level Physics Course	3
PHYS 3XX (or 4XX)	Upper-Level Physics Course	3
TOTAL CREDITS		**18**

THE MAJOR IN ENGINEERING PHYSICS
School-wide Requirements
In addition to meeting the requirements in General Education and in the major, students must also complete six (6) credits in the Complementary Studies Program required of all majors in the School of Computer, Mathematical, and Natural Sciences (SCMNS). Options for satisfying this requirement are outlined under the section on the SCMNS. In order to qualify for graduation, students must pass the Senior Depart-mental Comprehensive Examination; must have taken all of their Junior-and Senior-level requirements in the major at Morgan (unless granted prior written permission by the Dean to take courses elsewhere); and must have earned a cumulative average of 2.0 or better and a major average of 2.0 or better, with no outstanding grades below "C" in the major (which includes all courses required for the major and required supporting courses).

REQUIRED COURSES FOR A MAJOR IN ENGINEERING PHYSICS

Students majoring in Engineering Physics must complete the following required courses:

Course	***Description***	***Credits***
REQUIRED GENERAL EDUCATION COURSES*		
CHEM 110 & 110L	Gen. Chem. For Engineering Students	5
COSC 111	Intro. To Computing (or higher)	4
	TOTAL	**9**

FOR THE MAJOR IN ENGINEERING PHYSICS

PHYS 205	University Physics I	4
PHYS 205L	University Physics Laboratory I	1
PHYS 206	University Physics II	4
PHYS 206L	University Physics Laboratory II	1
MATH 241	Calculus I	4
MATH 242	Calculus II	4

MATH 243	Calculus III	4
MATH 340	Intro. to Differential Equations	3
PHYS 300	Modern Physics I	3
PHYS 301	Analytical Mechanics I	3
PHYS 302	Analytical Mechanics II	3
PHYS 303	Electricity and Magnetism I	3
PHYS 304	Electricity and Magnetism II	3
PHYS 305	Mathematical Physics I	3
PHYS 406	Mathematical Physics II	3
PHYS 308	Heat and Thermodynamics	3
PHYS 312	Properties of Materials	3
PHYS 409	Experimental Physics	3
PHYS 412	Lab use of Microcomputers	3
EEGR XXX	Electronics/Circuits Course	3
XXX	Engineering Science Courses **	3
XXX	Engineering Design Courses **	6
TOTAL		70

TOTAL CREDITS 79

*Engineering Physics majors must select these courses to fulfill General Education Requirements in physical sciences and computer literacy.

**Engineering Science and Design Courses should be selected after consultation with your academic advisor.

SUGGESTED ELECTIVE COURSES FOR ENGINEERING PHYSICS MAJORS, CONSIDERING ATTENDING GRADUATE OR PROFESSIONAL SCHOOLS

EEGR.202 (4 credits) and its lab EEGR.203 (1 credit), rather than EEGR.310 for the Electronics/Circuits requirement.
EEGR.215 (4 credits) as an Engineering Science elective. One of these credits is for laboratory and can be credited toward the Engineering Design requirement.
PHYS.408 Quantum Mechanics I (3 credits lecture) as an extra elective
PHYS 311 Acoustics and You (3 credits, lecture), which can be taken as part of the SCMNS Complementary Studies requirement
PHYS 312 Properties of Materials (3 credits, lecture)
PHYS 410 Techniques and Applications of Radioisotopes (3 credits, lecture)

FOR THE MINOR IN ENGINEERING PHYSICS

PHYS 300	Modern Physics I	3
PHYS 408	QUANTUM MECHANICS I	3
PHYS 409	Experimental Physics	3
PHYS 3XX (or 4XX)	Upper-Level Physics Course	3
PHYS 3XX (or 4XX)	Upper-Level Physics Course	3
PHYS 3XX (or 4XX)	Upper-Level Physics Course	3
TOTAL CREDITS		**18**

COURSE OFFERINGS

PHYS 101 INTRODUCTION TO PHYSICS – *Six hours; 4 credits.* This is a one-semester course exploring concepts in mechanics, heat, sound, optics electricity, magnetism and atomic and nuclear physics. (FALL/SPRING).

PHYS 102 ASTRONOMY – *Two hours lecture; 2 credits.* This is a study of heavenly bodies, constellations, time, celestial navigation and astrophysics. (SPRING).

PHYS 105 ENERGY, TRANSPORTATION AND POLLUTION I – *Three hours; 3 credits.* This is the first of a two-semester sequence designed to discuss humans in relationship to their environment. The course presents physical principles and concepts to aid the student in understanding, assessing and appreciating the environment. (FALL).

PHYS 106 ENERGY, TRANSPORTATION AND POLLUTION II – *Three hours; 3 credits.* This is the second of a two-semester sequence designed to discuss humans in relationship to their environment. The course presents physical principles and concepts to aid the student in understanding, assessing and appreciating the environment. **Prerequisite:** PHYS 105 (SPRING)

PHYS 111 INTRODUCTION TO PHYSICS – *Six hours; 4 credits.* This is a one-semester course exploring concepts in mechanics, heat, sound, optics electricity, magnetism, atomic and nuclear physics for honor students. Several of the laboratories will be computer based. Students will use the web to research many physics topics. Students may not receive credit for both PHYS 101 and PHYS 111. (FALL/SPRING).

PHYS 203 GENERAL PHYSICS: FUNDAMENTAL OF PHYSICS I – *Three hours lecture; 3 credits.* This is a course designed for students in the life sciences. Mechanics, thermodynamics, optics, electromagnetism, atomic and nuclear physics are covered. **Prerequisite:** MATH 114.(FALL/SPRING).

PHYS 203L GENERAL PHYSICS: FUNDAMENTALS OF PHYSICS I LABORATORY – *Two hours laboratory; 1 credit.* This course is designed to be taken concurrently with its lecture counterpart, PHYS 203 (FALL/SPRING)

PHYS 204 GENERAL PHYSICS: FUNDAMENTAL

OF PHYSICS II – *Three hours lecture;3 credits.* This is the second of a two-semester sequence designed for students in the life sciences. Mechanics, thermodynamics, optics, electromagnetism, atomic and nuclear physics are covered. **Prerequisite:** PHYS 203. (FALL/SPRING).

PHYS 204L GENERAL PHYSICS FUNDAMENTALS OF PHYSICS II LABORATORY – *Two hours laboratory; 1 credit.* This course is designed to be taken concurrently with its lecture counterpart, PHYS 204. (FALL/SPRING).

PHYS 205 UNIVERSITY PHYSICS I – *Four hours lecture; 4 credits.* This is a calculus-based course designed for students in the natural sciences and engineering. Mechanics, sound, and thermodynamics. **Corequisite:** MATH 241. (FALL/SPRING).

PHYS 205L UNIVERSITY PHYSICS I LABORATORY
– *Three hours laboratory; 1 credit.* This course is designed to be taken concurrently with its lecture counterpart, PHYS 205. (FALL/SPRING).

PHYS 206 UNIVERSITY PHYSICS II – *Four hours lecture; three hours laboratory; 5 credits.* This is the second semester of a two-semester sequence. Electricity, magnetism, and optics. **Co-requisite:** MATH 242. (FALL/SPRING).

PHYS 206L UNIVERSITY PHYSICS II LABORATORY
– *Three hours laboratory; 1 credit.* This course is designed to be taken concurrently with its lecture counterpart, PHYS 206. (FALL/SPRING).

PHYS 300 MODERN PHYSICS I - *Three hours lecture; 3 credits.* The topics studied include photoelectric effect, Bohr's theory of the H atom, deBroglie waves and wave mechanics, electron spin, and Pauli exclusion principles. **Prerequisites:** MATH 242 and PHYS 206. (FALL/SPRING).

PHYS 301 ANALYTICAL MECHANICS I - *Three hours lecture; 3 credits.* This is part one of an intermediate course including particle motion, the statics and dynamics of rigid bodies, motion under central forces, and vibratory motion. This course is recommended for students interested in Physics, Applied Mathematics, and Engineering. **Prerequisites:**
MATH 242 and PHYS 206. (FALL/SPRING).

PHYS 302 ANALYTICAL MECHANICS II – *Three hours; 3 credits.* This is part two of an intermediate course including particle motion, the statics and dynamics of rigid bodies, motion under central forces, and vibratory motion. This course is recommended for students interested in Physics, Applied Mathematics, and Engineering. **Prerequisites:** PHYS 301. (FALL/SPRING)

PHYS 303 ELECTRICITY AND MAGNETISM I -
Three hours; 3 credits. Part I of two-semester sequence. Topics covered include: electricity and the electrostatic field, magnetism and the magnetic field, potential, capacity, electrical circuit theory, inductive circuits, alternating current networks, transformers, electromagnetic waves, and Maxwell's equations. **Prerequisites:** MATH 242 and PHYS 206. (FALL).

PHYS 304 ELECTRICITY AND MAGNETISM II –
Three hours; 3 credits. Part II of two-semester sequence. Topics covered include: electricity and the electrostatic field, magnetism and the magnetic field, potential, capacity, electrical circuit theory, inductive circuits, alternating current networks, transformers, electromagnetic waves, and Maxwell's equations. **Prerequisite:** PHYS 303 (SPRING).

PHYS 305 MATHEMATICAL PHYSICS I - *Three hours lecture; 3 credits.* The content includes the fundamental operations of vector analysis, scalar and vector products, differentiation of vectors, and the differential operators. There is an application of the derivations to problems in electricity, dynamics, hydrodynamics, and mechanics.
Prerequisite: MATH 242 (OFFERED AS NEEDED)

PHYS 308 HEAT AND THERMODYNAMICS -
Three hours lecture; 3 credits. This course is a study of thermometry, specific heats, transfer of heat, change of state, kinetic theory, the laws of thermodynamics, thermodynamic potentials and Maxwell's relations.
Prerequisite: MATH 242 (SPRING).

PHYS 309 INTRODUCTION TO THE PHILOSOPHY AND HISTORY OF THE NATURAL SCIENCES -
Three hours lecture; 3 credits. This course is designed to introduce the science and non-science major to the intellectual, experimental, and historical events surrounding selected critical scientific concepts and discoveries. The course will examine scientists and the social, political, and economic parameters that have influenced their discoveries. Special emphasis is placed on the contributions of Africans, African-Americans, and third world contributors to modern science and technology. The course will survey the fundamental foundations in the areas of physics, chemistry, mathematics, biology, and computer science, from antiquity to the present. (FALL/SPRING).

PHYS 310 ASTRONOMY AND SPACE SCIENCE - *Three hours lecture; 3 credits.* This is a three-credit course in astronomy and space science with emphasis on a descriptive and conceptual approach rather than a mathematical one. It can be used to meet part of the six-credit science requirement for students in the School of Computer, Mathematical, and Natural Sciences. (OFFERED AS NEEDED).

PHYS 311 ACOUSTICS AND YOU – *Three hours lecture; 3 credits.* This course is designed for science and engineering majors with an interest in acoustics, the science of sound. It explores the physical principles of sound and its applications in such diverse fields as architecture, biology, music, and psychology. The lecture seminar format is supplemented by demonstrations, laboratory experiments, and guest speakers. Basic mathematical literacy is presumed. **Prerequisites:** PHYS 203 or 205, and MATH 114. (OFFERED AS NEEDED).

PHYS 312 PROPERTIES OF MATERIALS - *Three hours lecture; 3 credits.* This course covers basic principles, nature and properties of materials, as well as correlation of the structure of solids with their physical properties. **Prerequisite:** PHYS 204 or 206. **Corequisite:** one semesterof chemistry. (SPRING).

PHYS 326 BIOPHYSICS – *Three hours lecture; 3 credits.* In this course students will learn, at an advanced introductory level, how to apply the basic principles of mechanics, fluidics, electricity, magnetism and optics to living biological and physiological systems. **Prerequisite:** PHYS 204. (FALL/SPRING).

PHYS 401 OPTICS - *Three hours lecture; 3 credits.* This is an intermediate course in the study of lenses, aberrations, polarization, interference, diffraction, line spectra, thermal radiation, lasers, photometry and color. **Prerequisites:** MATH 242 and PHYS 206. (SPRING).

PHYS 403 ADVANCED LABORATORY - *Four hours laboratory; 2 credits.* This course is designed to give the students advanced experimental sophistication in modern laboratory techniques in modern and nuclear physics. (FALL).

PHYS 405 MODERN PHYSICS II - *Three hours lecture; 3 credits.* This course deals mainly with nuclear and relativistic physics. Topics considered are the nuclear force, nuclear structure and elementary particles of modern physics. (ALTERNATE YEARS - SPRING).

PHYS 406 MATHEMATICAL PHYSICS II: - *Three hours lecture; 3 credits.* The contents of this course are centered around mathematical techniques related to solutions of problems in advance physics courses such as classical mechanics, electromagnetic theory, and quantum mechanics. This course includes vector calculus, linear algebra, calculus of residues, second order partial differential equations, Laplace Transforms, Strum Liouville Theory, Bessel Functions, Legendre Functions, and Fourier Series. Upon completion of the course students will be able to apply all of the above to applied problems in physics and engineering. (OFFERED AS NEEDED).

PHYS 407 ADVANCED TOPICS IN PHYSICS – *Three hours lecture; 3 credits.* This course deals with current topics in physics and/or undergraduate physics research. (FALL/SPRING).

PHYS 408 INTRODUCTION TO QUANTUM MECHANICS - *Three hours lecture; 3 credits.* This course covers the basic principles of quantum mechanics. Problems in one-dimensional motion, the hydrogen atom and molecule, and perturbation theory are studied. **Prerequisite:** MATH 340. (OFFERED AS NEEDED).

PHYS 409 EXPERIMENTAL PHYSICS – *Two hours lecture, four hours laboratory; 3 credits.* In this course students study the basics of instrumentation for physics research and reproduce some of the critical experiments that established special relativity, atomic structure, and the structure and properties of condensed matter. **Prerequisite:** PHYS 300 or permission of the department (OFFERED AS NEEDED).

PHYS 410 TECHNIQUES AND APPLICATION OF RADIOISOTOPES - *Two hours lecture, four hours laboratory; 4 credits.* This course is designed to include the basic laboratory experiences in radioisotopes technology with an adequate amount of lecture material to provide the necessary background for understanding the experiments.
Prerequisite: PHYS 204 or 206. **Corequisite:** one semester of chemistry (OFFERED AS NEEDED)

PHYS 412 LABORATORY USE OF MICROCOMPUTERS
- *One hour lecture; four hours laboratory; 3 credits.* This course emphasizes the use of microcomputers as laboratory instruments and as laboratory data collectors/ analyzers. Topics to be covered include computer-simulated experiments, computer-assisted design, op-amps, analog-to-digital and digital-to-analog conversion, machine and assembly language programming, and microcomputer controlled stepper motors and switches. (SPRING).

PHYS 413-414 INTRODUCTION TO ELECTRODYNAMICS
- *Six hours lecture; 6 credits.* The topics

covered include: electricity and the electrostatic field, magnetism and the magnetic field, potential, inductive circuits, electromagnetic waves, and Maxwell's equations. **Corequisite:** PHYS 406. (FALL/SPRING).

PHYS 498 SENIOR INTERNSHIP - *Nine hours; 3 credits.*
This course provides the opportunity for the student to obtain supervised work experience in the major at an off-campus site selected and approved by the Departmental Chairperson. Registration is limited to seniors with minimum 3.0 cumulative and major averages and requires approval of the Departmental Chairperson. Exceptions may be approved by the Dean. (FALL/SPRING).

PHYS 499 SENIOR RESEARCH OR TEACHING/ TUTORIAL ASSISTANTSHIP - *Nine hours; 3 credits.* This course provides the opportunity for the student to attain first-hand research or teaching/tutorial experience under the supervision and mentorship of a tenure-track faculty member. Registration is limited to seniors with minimum of 3.0 cumulative and major averages and requires the approval of the Departmental Chairperson. Exceptions may be approved by the Dean. (FALL/SPRING).

EARTH SCIENCE COURSE OFFERINGS

EASC 101 STELLAR ASTRONOMY - *Two hours lecture, two hours laboratory; 3 credits.* This is a laboratory-oriented course designed to explore the astronomical aspects of the earth as a part of the solar system. Also, it includes a detailed study of the sun, stellar phenomena, stellar evolution, galactic phenomena and cosmology. (OFFERED AS NEEDED).

EASC 102 METEOROLOGY - *Two hours lecture, two hours laboratory; 3 credits.* This is a laboratory-oriented course stressing a minimally quantitative introduction to the physical processes which govern the movement and effects of our atmosphere. Included will be detailed discussions of weather features, weather systems, air masses, atmospheric heating, global atmospheric circulation and local weather determinations. (SPRING).

EASC 201 PHYSICAL GEOLOGY - *Two hours lecture, two hours laboratory; 3 credits.* This is a laboratory-oriented, minimally quantitative introduction to a study of the planet Earth with particular emphasis on the composition of the earth; formation of igneous, sedimentary and metamorphic rocks; the structure and interior of the earth; gradation of the crust and weathering processes; the geologic time scale; and topographic mapping. Fieldwork is an integral part of the course. (OFFERED AS NEEDED).

EASC 202 HISTORICAL GEOLOGY - *Two hours lecture, two hours laboratory; 3 credits.* This course is an analysis of the earth's history including basic concepts of historical geology; the nature of the rock record; Precambrian history; physical history of North America; the origin of life and the theory and trend of evolution; and the theory of plate tectonics. (SPRING)

EASC 203 MINERALOGY - *Two hours lecture, two hours laboratory; 3 credits.* This is a laboratory-oriented course designed to provide knowledge of the ccurrences, chemical/ physical properties and mega-scopic identification of minerals of the earth. (OFFERED AS NEEDED)

EASC 205 INTRODUCTORY EARTH SCIENCE - *Three hours lecture, three hours laboratory; 4 credits.* This laboratory-oriented course is structured to develop an understanding of the methods of scientific inquiry and critical thought with respect to investigations in astronomy, geology, meteorology, and oceanography. Special emphasis is made on the interrelationships between earth science, technology, and society, particularly with respect to the environment. This course is designed to meet certification requirements in earth science for elementary education majors. (FALL/SPRING).

EASC 301 PLANETARY SCIENCE - *Two hours lecture, two hours laboratory; 3 credits.* This course is designed to study in depth the motion, structure and atmospheric phenomena associated with planets of our solar system. Also, the effects solar disturbances and solar wind have on the earth is discussed. The course is structured to take advantage of the most recent information obtained from man's space explorations. **Prerequisite:** EASC 101. (OFFERED AS NEEDED).

EASC 302 STRUCTURAL GEOLOGY - *Two hours lecture, two hours laboratory; 3 credits.* This course is designed to develop an understanding of the structure of the earth. Emphasis will be placed on factors controlling behavior of materials in the earth, structures produced and methods of studying them. Special attention will be given to the mechanics and classifications of folds, faults and joints. **Prerequisites:** EASC 201 and EASC 202. (SPRING).

EASC 305 STRATIGRAPHY AND SEDIMENTATION - *Two hours lecture, two hours laboratory; 3 credits.* This course is designed to develop an understanding of the classification and composition of sediments; interpretation of sedimentary rocks; stratification and vertical sequence; and stratigraphic classification. **Prerequisites:** EASC 201 and EASC 202.

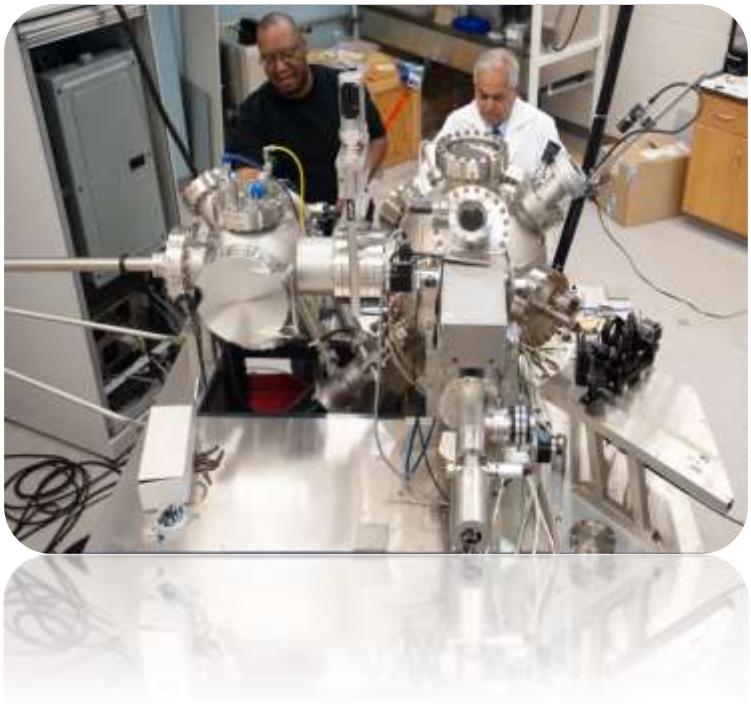
(FALL).

EASC 306 GEOMORPHOLOGY - *Two hours lecture, two hours laboratory; 3 credits.* This course will investigate the development and distribution of the earth's topographic features. Emphasis will be placed upon agents such as running water, wind, glaciers, currents, waves and mass movements to understand the landforms that they sculpt. **Prerequisites:** EASC 201, EASC 202 and EASC 305. (SPRING).

EASC 402 ECONOMIC GEOLOGY - *Two hours lecture, two hours laboratory; 3 credits.* This is a descriptive course designed to examine, in depth, the principles and formation of metallic and non-metallic **&** mineral deposits. Specifically, the course will deal with processes of formation, classification, structural controls and the economic uses of mineral deposits. **Prerequisites:** EASC 201 and EASC 202. (FALL).

EASC 403 ENVIRONMENTAL SCIENCE - *Two hours lecture, Two hours laboratory; 3 credits.* This is a laboratory-oriented course involving the study of ecology, pollution and the environment. Specific topics to be discussed include an introduction to ecology, agricultural environments, pesticides, radioactive wastes, air pollution, water pollution, noise pollution, thermal pollution and solid wastes. Fieldwork will be an integral part of the course. **Prerequisites:** PHYS 203 or PHYS 205, CHEM 105, BIOL 101 and BIOL 102. (SPRING).

EASC 488-489 PRACTICUM IN SCIENCE - *Thirty-six hours; 12 credits.* This course will provide the student an opportunity to refine and broaden specific career related skills through on-the-job application in community institutions of Natural Science, such as science centers, museums, aquaria, environmental centers, and other related agencies. It will also enable the student to gain professional experience while pursuing the undergraduate degree, thus increasing his or her level of competitiveness for job placement upon graduation. (FALL/ SPRING).



MORGAN STATE UNIVERSITY
DEPARTMENT OF PHYSICS
BACHELOR OF SCIENCE DEGREE IN PHYSICS

SUGGESTED CURRICULUM SEQUENCE

FRESHMAN YEAR (FIRST SEMESTER)

PHYS 205-BP	University Physics	5
MATH 241	Calculus I	4
ENGL 101-EC	English	3
ORNS 106	Freshman Orientation	1
XXXX-HH	Health & Healthful Living	3
		16

SOPHOMORE YEAR (FIRST SEMESTER)

PHYS 305	Mathematical Physics I	3
MATH 243	Calculus III	4
PHYS 300	Modern Physics	3
CHEM 105- BP	Chemistry I (w/lab)	4
XXXX-AH	Arts & Humanities Core	3
		17

JUNIOR YEAR (FIRST SEMESTER)

PHYS 302	Analytical Mechanics II	3
PHYS 303	Electricity & Magnetism I	3
XXXX-SB	Social & Behavioral Science Core	3
PHYS 406	Mathematical Physics II	3
PHYS 306	Electronics for Experimental Phys.	3
		15

SENIOR YEAR (FIRST SEMESTER)

PHEC XXX	Physical Education	1
PHYS 408	Quantum Mechanics I	3
PHYS XXX	Physics Elective	2
PHYS 409	Experimental Physics	3
XXXX	Complementary Studies	3
		12

FRESHMAN YEAR (SECOND SEMESTER)

PHYS 206	University Physics II	5
MATH 242	Calculus II	4
ENGL 102-EC	English	3
COSC XXX-IM	Computer Science (111 / higher)	4
		16

SOPHOMORE YEAR (SECOND SEMESTER)

MATH 340	Differential Equations	3
XXXX-SB	Social & Behavioral Science Core	3
PHYS 301	Analytical Mechanics I	3
CHEM 106	Chemistry II (w/lab)	4
XXXX- BP	Biological & Physical Sci.	4
		17

JUNIOR YEAR (SECOND SEMESTER)

PHYS 304	Electricity & Magnetism II	3
PHYS 308	Thermodynamics & Stat. PHYS	3
PHYS 412	Laboratory Micro Computers	3
XXXX-AH	Arts & Humanities Core	3
PHIL 109-CT	Introduction to Logic	3
		15

SENIOR YEAR (SECOND SEMESTER)

HIST 350-CI	African Diaspora	3
PHYS 401	Optics	3
PHYS XXX	Physics Elective	3
XXXX	Complementary Studies	3
		12

TOTAL CREDIT HOURS 120

MORGAN STATE UNIVERSITY
DEPARTMENT OF PHYSICS
BACHELOR OF SCIENCE DEGREE IN ENGINEERING PHYSICS
SUGGESTED CURRICULUM SEQUENCE

FRESHMAN YEAR (FIRST SEMESTER)

PHYS 205-BP	University Physics I	5
MATH 241	Calculus I	4
ENGL 101-EC	English	3
XXXX-SB	Social & Behavioral Science Core	3
ORNS 106	Freshman Orientation	1
		16

SOPHOMORE YEAR (FIRST SEMESTER)

PHYS 305	Mathematical Physics I	3
MATH 243	Calculus III	4
CHEM XXX	Chemistry 110 (w/lab)	5
XXXX	Complementary Studies	3
		15

JUNIOR YEAR (FIRST SEMESTER)

PHYS 302	Analytical Mechanics II	3
PHYS 303	Electricity & Magnetism I	3
PHYS 300	Modern Physics	3
HIST 350-CI	African Diaspora	3
PHIL 109-CT	Introduction to Logic	3
		15

SENIOR YEAR (FIRST SEMESTER)

PHEC XXX	Physical Education	1
PHYS 308	Thermodynamics & Stat. Physics	3
PHYS 408	Quantum Mechanics I	3
PHYS 409	Experimental Physics	3
XXXX-SB	Social & Behavioral Science Core	3
		12

FRESHMAN YEAR (SECOND SEMESTER)

PHYS 206	University Physics II	5
MATH 242	Calculus II	4
ENGL 102-EC	English	3
COSC XXX-IM	Computer Science (111 / higher)	4
		16

SOPHOMORE YEAR (SECOND SEMESTER)

MATH 340	Differential Equations	3
PHYS 406	Mathematical Physics II	3
PHYS 301	Analytical Mechanics I	3
XXXX-AH	Arts & Humanities Core	3
ENGR XXX	(202&203) Electric Circuits	5
		17

JUNIOR YEAR (SECOND SEMESTER)

PHYS 312	Properties of Materials	3
PHYS 304	Electricity & Magnetism II	3
XXXX-AH	Arts & Humanities Core	3
XXXX	Complementary Studies	3
XXXX- BP	Biological & Physical Sci.	4
		16

SENIOR YEAR (SECOND SEMESTER)

PHYS 412	Laboratory Micro Computers	3
ENGR XXX	Engr. Science.	3
ENGR XXX	Engineering Design	3
XXXX-HH	Health & Healthful Living	3
		12

TOTAL CREDIT HOURS **120**