CHEMICAL ENGINEERING
UNDERGRADUATE STUDENT HANDBOOK

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NORTH CAROLINA AGRICULTURAL AND TECHNICAL STATE UNIVERSITY

DEPARTMENT OF CHEMICAL AND BIOENGINEERING

COLLEGE OF ENGINEERING

GREENSBORO, NORTH CAROLINA 27411
Phone (336) 285-3661

http://www.ncat.edu/academics/schools-colleges1/coe/cbbe/index.html

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INTRODUCTION

This handbook represents a compilation of information about the Chemical Engineering curriculum, graduation requirements, and regulations that affect Chemical Engineering majors at NC A&T State University. It serves as a guide to the students and faculty in the department and must be followed to ensure the quality and uniformity of the Chemical Engineering program.

Each student is responsible for informing themselves of the academic regulations and requirements set forth in this handbook. Failure to meet the requirements or comply with regulations because of lack of knowledge thereof does not excuse the student from meeting the academic regulations and requirements.

GENERAL PROGRAM REQUIREMENTS

The Chemical Engineering B.S. Program is accredited by the Engineering Accreditation Commission of ABET, http://www.abet.org. The program requirements are defined in this handbook.

PROGRAM MISSION

The mission of the BSChE program at North Carolina A&T State University is to provide students with a learning experience in chemical engineering that will instill in them a lifelong sense of learning, social responsibility, and commitment to improving the quality of life for all people. The Department seeks to provide an atmosphere of dedicated service to the student by providing instruction, counseling, program planning, career guidance, and any other supportive student services to facilitate their growth and success in the academic and professional communities.

PROGRAM EDUCATIONAL OBJECTIVES

Graduates of the Bachelor of Science in Chemical Engineering Program are expected within a few years of graduation to have:

1) Performed effectively in a chemical engineering related position in industry or in graduate/professional schools.
2) Demonstrated teamwork and leadership skills in using interdisciplinary approaches for solving problems.
3) Been active in their communities and professional societies.
4) Enhanced their professional credentials through life long learning.

DEGREES OFFERED

Chemical Engineering – Bachelor of Science
Chemical Engineering – Master of Science *

**See the Graduate School Bulletin*

PROGRAM OUTCOMES

The department is also guided by a set of program outcomes that must be demonstrated in the BSChE program graduates. The outcomes include general outcomes and chemical engineering outcomes that have been put in place to ensure the continuing improvement of the program and our graduates. The BSChE program outcomes list the knowledge and skills that graduates are expected to possess at graduation. The BSChE program outcomes are:

a) CHEN graduates will have the ability to apply the knowledge of mathematics, science and engineering;
b) CHEN graduates will have the ability to design and conduct experiments; to analyze and interpret data;

c) CHEN graduates will have the ability to design a system, component or process to meet desired needs;
d) CHEN graduates will have the ability to function on multidisciplinary teams;
e) CHEN graduates will have the ability to identify, formulate and solve engineering problems;
f) CHEN graduates will have an understanding of professional and ethical responsibility;
g) CHEN graduates will have the ability to effectively communicate orally and in writing;
h) CHEN graduates will have the understanding of engineering solutions in global and social context;
i) CHEN graduates will have recognition of the need for and an ability to engage in life-long learning;
j) CHEN graduates will have the knowledge of contemporary issues;
k) CHEN graduates will have the ability to use computers to solve engineering problems; and will be proficient in the use of computers, computer software and computer-based information systems;
ChE1) CHEN graduates will have a working knowledge of safety and environmental aspects of the chemical engineering profession;
ChE2) CHEN graduates will have a working knowledge of topics and subject in Chemical Engineering applied to chemical systems and as appropriate to biological systems.

PROGRAM OVERVIEW

The chemical engineering curriculum is designed to provide students with a strong foundation in chemistry, physics, and mathematics. The program emphasis gradually shifting toward chemical engineering courses in the junior and senior years. The program provides you with the knowledge to apply basic skills and sound judgments to develop designs for economically converting materials and energy into useful products for the benefit of our society and culture. The senior design sequence acts as a "capping stone" which coordinates all aspects of the chemical engineering curriculum. A strong component in English, social sciences and humanities background is included so that you will obtain a broad-based education. The chemical engineering curriculum will prepare you for a career in industry or to go on to graduate school. It is also intended to be flexible enough to accommodate a broad range of educational interests. Sufficient electives have been provided so that you can select a senior area option based on your interests.

The discussion that follows will provide you with a detailed overview of what you can expect as you proceed through the program.

A. GENERAL EDUCATION CORE

Effective Fall 2012, the University Studies (UNST) requirements have been phased out. The new general education requirements are as follows:

Written Communications (ENG 100 and ENG 101) required – 6 credit hours
Social/Behavioral Sciences (SBS) electives required– 6 credit hours
Humanities/Fine Arts (HFA) electives required – 6 credit hours

Of these 12 total credit hours of SBS and HFA, at least 3 credit hours in African-American Studies (AA) and 3 credit hours in Global Studies (GL) are required.

For students under the 2006-2010 and 2010-2012 CHEN Curricula, the basic requirement of the UNST core is described below:

University Studies (UNST) is the interdisciplinary general education curriculum of North Carolina Agricultural and State University and provides the intellectual foundation for the University's degree-granting programs. Its goal is to provide students with a framework for critical inquiry that serves as a foundation for continuing academic development and life-long learning. Motivated by the principle that scholarship is best learned by the way it is practiced; University Studies applies discovery, inquiry, analysis, and application in the classroom to promote:

- broad-based critical-thinking skills,
- effective written and oral communication of ideas,
- appreciation for diverse cultures, and
- commitment to ongoing civic engagement and social responsibility.

Through coursework and co-curricular experiences, the University Studies core curriculum develops in students an understanding of the interdisciplinary nature of knowledge, encourage cross-disciplinary dialogue, and promotes the development of intentional learners who take responsibility for their learning.

The general education program is accredited by the Southern Association of Colleges and Schools (SACS).

The University Studies program requires a minimum of 37 credit hours of coursework, as specified below. Incoming freshmen are required to complete 13 credit hours of UNST foundation courses (UNST 100, 110, 120, 130, and 140) during their first 32 credit hours of study at NC A&T including: 12 credit hours of theme-based courses, 9 credit hours of major-specified courses that support University Studies learning objectives, and 3–6 credit hours of a senior capstone experience (typically specified by the student's major department.)

Freshman students who do not meet freshman proficiency competency requirements (see below) in English composition and/or mathematics must successfully complete UNST 103 (Basic Writing) and/or MATH 099 (Intermediate Mathematics) with a passing grade before being allowed to enroll in any University Studies foundation courses.

Theme-based University Studies courses are taken only after a student has completed all University Studies foundation courses. Students choose a University Studies thematic cluster in consultation with their advisor or major department chair prior to completing University Studies foundation coursework. Students are required to complete 12 credit hours in a single thematic cluster prior to the senior capstone experience. Students wishing to switch clusters must still complete 12 credit hours in a single thematic cluster, unless otherwise approved by the Dean of University Studies.

In addition to the 37 credit hour requirement, all North Carolina A&T State University students are required to complete 50 hours of service/experiential learning prior to the senior capstone experience. Student service/experiential learning hours will be monitored in conjunction with the Division of Student Affairs.

Students are reminded that performance in University Studies courses may influence eligibility for some majors. Many competitive majors require minimum grade point averages (GPAs).

Incoming freshmen are required to complete 13 credit hours of University Studies (UNST) foundation-level courses during their first 32 credit hours of study at North Carolina A&T State University, including the following:

UNST 100. University Experience
UNST 110. Critical Writing
UNST 120. The Contemporary World
UNST 130. Analytical Reasoning
UNST 140. The African-American Experience: An Interdisciplinary Perspective

For a description of the theme based clusters and the courses in each of the clusters, please refer to the NC A&T website or NC A&T Undergraduate Bulletin.

B. ORAL AND WRITTEN COMMUNICATION EXPERIENCE

All freshmen must take and pass ENGL 100 and ENGL 101(UNST 110 in previous curricula). These courses provide training in English writing skills beyond High School level English. In addition, the Department provides instruction and practice in report writing and oral communication in two chemical engineering laboratory courses. The students are required to make oral presentations and write reports in the laboratory courses and several of the lecture courses that have projects.

The Department recognizes the importance that effective communication skills have on career performance and advancement by cultivating good communication skills in its students.

C. MATHEMATICS AND SCIENCE EXPERIENCE

Engineering is founded in the principles of mathematics and science. Because of ABET requirements, studies in mathematics begin with calculus and emphasize mathematical concepts and principles rather than computation. Your mathematics experience includes a 4-semester sequence, MATH 131, 132, 231, and 431, which covers differential calculus and integral calculus along with methods for solving differential equations that are needed to solve many advanced engineering applications. You will also learn about numerical analysis in CHEN 220.

You will study a two-semester sequence in physics. You will study mechanics, heat and light in PHYS 241 and electricity, magnetism, wave motion and modern physics in PHYS 242. ***Since most of your math and physics courses must be completed before you begin your junior year, it is critical to attend summer school if you are behind in mathematics or physics.*** Sophomores also take a course in materials science (MEEN 260).

Chemical engineering has its roots in chemistry. As such, your experiences in chemistry distinguish you from other engineers and will continue throughout your program. The chemistry courses you take are the same courses taken by chemistry majors in their professional program. Your experience begins with a year of general chemistry. Your experience in chemistry continues with courses in organic chemistry and organic chemistry laboratory. In addition, you must take a course in physical chemistry and an additional six credits of advanced chemistry.

D. COMPUTER EXPERIENCE

The use of computers is emphasized throughout the chemical engineering program. You will learn MATLAB programming and computer aided numerical methods in CHEN 220. You will be introduced to the ASPEN PLUS flow sheet simulator in CHEN 325. This design tool will be used in several unit operations and design courses to develop your design skills.

The use of a PC is emphasized in the chemical engineering laboratory sequence. All lab reports are required to be word-processed and graphs are expected to be computer generated.

You will use simulators, canned programs and computer-aided design packages in a number of upper-level courses. For example, you will use CONTROL STATION, a control system simulator and design program, in CHEN 340.

E. LABORATORY EXPERIENCE

Laboratory experience is integrated throughout the program. The experience begins with a year of general chemistry laboratory, two 1-credit courses. The curriculum also has an organic chemistry lab. A two-semester sequence of physics laboratory courses is also included.

The curriculum contains two courses that have chemical engineering laboratory experiences. CHEN 330 and CHEN 410 are separate laboratory courses. They are 2-credit courses that meet twice a week for 2½-hour sessions. Part of the chemical engineering laboratory experience is devoted to technical writing, report preparation, oral communication and laboratory safety. A course (CHEN 318) where students learn statistical methods to analyze chemical process data is included in the sophomore year and is a prerequisite to the two unit operations laboratory courses.

Your safety is of paramount importance. All undergraduate experiments are designed to minimize safety hazards and to minimize the use of chemicals and the disposal of chemicals to the environment. The development of laboratory safety awareness and skills are important parts of the chemical engineering laboratory experience. Safety instruction in the laboratory courses includes several lectures by the instructor and showing several video tapes obtained from industry or from the Center for Chemical Process Safety. Students are also asked to perform a safety audit. Safety sections are included in your pre-lab notebook and lab reports. Laboratory safety is monitored by the laboratory instructor who includes questions on lab safety as part of the pre-lab oral exam and observes safety practices during experimentation.

Each student has the opportunity to study a wide variety of equipment and instrumentation in chemical engineering laboratory while working in groups of 3 or 4 students. Each of the experiments is open-ended. Students develop an experimental procedure and plan for their study. Students also complete a laboratory project that can be a scale-up application of the data measured in the lab or a development project on one of the newer experiments.

F. ENGINEERING SCIENCE EXPERIENCE

Your chemical engineering science experience is aimed at using your knowledge of mathematics and science to bridge the gap to engineering practice. The goal of engineering science is creative application. The chemical engineering curriculum is a coherent plan to provide you instruction and knowledge in chemical engineering science.

Instruction in engineering science begins in GEEN 100 where you will be given an overview of the engineering profession. In CHEN 200 you will develop basic skills in material and energy balancing of chemical processes. You will also complete a flowsheet development project in this course. In CHEN 220, you will learn to apply numerical methods to the solution of engineering problems. In CHEN 312, you will learn the fundamentals of thermodynamics including the first and second laws of thermodynamics and apply them to study the thermodynamics of phase and chemical reaction equilibria. You will learn about unit operations and transport processes in CHEN 300 (Fluid Mechanics), CHEN 320 (heat transfer) and CHEN 400 (Stagewise Separation Processes). In the mass transfer sequence, you will study both stagewise separation operations and diffusional operations. The concepts of process dynamics and how to control a chemical process will be covered in CHEN 340. In CHEN 422, you will study chemical reaction engineering, which is unique to chemical engineers. Finally, you will have two chemical engineering electives in your senior year.

G. ENGINEERING DESIGN EXPERIENCE

Engineering design is viewed as the process of devising a system, component, procedure or process to meet desired needs. It is a decision making process (often iterative), in which the basic sciences, mathematics, and engineering sciences are applied to convert resources optimally to meet a stated objective. Among the fundamental elements of the design process are the establishment of objectives and criteria of the process, synthesis, analysis, construction, testing, and evaluation. The engineering design component of the curriculum includes the following features: development of student creativity, use of open-ended problems, development and use of design methodology, formulation of design problem statements and specifications, consideration of alternatives, feasibility considerations, and detailed system descriptions. In addition, a variety of realistic constraints such as economic factors, safety, ethical and reliability limitations are included in design projects. An engineering design component is incorporated into many of the undergraduate courses.

Design instruction begins in the freshman year in GEEN 100, where we introduce you to the design process. In CHEN 200, you will work in groups to solve an open-ended problem. Your group will develop a flow sheet and complete mass and energy balance calculations. In the transport processes, mass transfer and reactor design courses, you will complete one or more design projects based on the equipment or procedures studied in the engineering science part of the course.

You will conduct open-ended experimental studies in each of the chemical engineering laboratory courses, CHEN 330 and 410. In each lab experiment you will be given general statements about the capability of the equipment and you will develop a detailed experimental procedure and list the safety considerations. Finally, you can complete a semester-long project to design, build, operate or improve a laboratory scale experiment.

In the process control course, an extensive amount of problem solving is done in the selection and design of controllers and control systems. You will also complete a control system design project and extensive control system designs using CONTROL STATION.

A major part of the design component in your program occurs in the capstone experience, which occurs in a two-course senior sequence and consists of Process Design I (CHEN 430) and Process Design II (CHEN 440). The primary objective of the Process Design I and II course sequence is the development of student engineering and conceptual abilities to design a process sequence and to evaluate its economic feasibility. One of the most difficult tasks involves the effective use of the library and vendors to research the necessary information. The major process design effort effectively

incorporates economic factors, safety, toxicity and environmental hazards and equipment reliability factors, ethics and social impact during class discussions and group conferences. At least one of the projects in Process Design II will contain an extensive economics and profitability analysis. NSPE ethics will be reviewed. Videotapes on ethics, social impact and safety are shown.

You will complete your design experience as a senior by selecting two chemical engineering technical elective courses that contain engineering design.

H. RESEARCH AND INDUSTRIAL EXPERIENCES

These experiences are optional, but they might be the most important part of your development. Each of the chemical engineering faculty is involved in research and encourages your involvement. Faculty research areas are detailed in the Faculty Profiles part of the Appendix. Many of the faculty have financial resources and all will accept volunteers. Getting involved on a research project will give you insight as to how research is conducted and whether you should pursue an advanced degree. You should also pursue getting industrial experience through one or more summer internships or co-op assignments. A summer internship does not extend an academic program, but getting an assignment is very competitive. Co-op involves alternating terms in industry and college and is normally completed in five years, but you graduate with about 1½ years of industrial experience that is very attractive to employers. If they have had at least 3 co-op sessions, students may receive credit for one of their chemical engineering electives by completing the requirements for MCEN 550.

More and more companies are emphasizing industrial experience in selecting graduates for permanent assignments. They cite that students with experience have better insight as to what they want and what industry needs. Employers also feel that students have already learned the industrial culture and have been screened by the industry. Students interested in an industrial assignment should register with career services as soon as their registration is complete.

I. COLLOQUIUM

A chemical engineering program colloquium will be held once a week for most of the academic year. The purpose of the colloquium is to facilitate good communication between students and faculty and to provide students with career development opportunities. Topics may include advising, scholarships, curriculum, AIChE, ISPE, SPE, co-op and internship opportunities, career planning, contemporary issues in chemical engineering, and gaining stakeholder input from students. All students are encouraged to attend all colloquium meetings. To graduate, students are required to have enrolled in and received a satisfactory grade in at least two of the five semesters of colloquium CHEN 208/209, 308/309, and 408). Grading is based on attendance. To obtain a satisfactory grade, students must attend 75% of the colloquium meetings during a semester. To be counted as present, a student must be present at the beginning and not leave before the colloquium is over.

Effective Fall 2012, colloquiums (GEEN 110, GEEN 120, CHEN 208, CHEN 209, CHEN 308, CHEN 309, and CHEN 408) have been removed from CHEN curriculum. Students entering in Fall 2012 will require two 1 credit hour colloquiums (GEEN 111 and GEEN 121) during their freshman year.

DEPARTMENT ACADEMIC REQUIREMENTS

Chemical engineering majors must maintain a 2.0 grade point average overall and a 2.0 major grade point average to graduate. A minimum grade of "C" must be achieved in the following chemical engineering courses

before you can proceed to the next course:

CHEN 200 CHEN 300 CHEN 320

A. B.S. ChE GRADUATION REQUIREMENTS

A minimum of 128 credit hours is required. The requirements are outlined below:

General Education Requirements ..... 18 hours
Written Communication courses (6 credits); Social/Behavioral Science courses (6 credits); Humanities/Fine Art courses (6 credits)

Mathematics and Basic Science ..... 51 hours
Math 131, 132, 231, 431; MEEN 260; Chemistry 106, 116, 107, 117, 221, 223, 441; Physics 241, 242, 251, 252; BIOL 101 and Advanced Chemistry Electives (6 credits)

Engineering Support Courses ..... 10 hours
GEEN 100, 111, 121; MEEN 313 and ECEN 340

Chemical Engineering Courses ..... 49 hours
CHEN 200, 220, 300, 312, 318, 320, 325, 330, 340, 400, 410, 422, 430, 440, 448; and CHEN Senior Electives (2)

B. CHEMICAL ENGINEERING CURRICULUM

In addition to the current (Fall 2012 – Present) curriculum, two other curricula (Fall 2006 – Summer 2010), and (Fall 2010 – Summer 2012) are given in the Appendix. These curricula reflect all the curricular revisions that the program undertook in the last seven years. The distinguishing features of the three curricula are listed below:

<u>Fall 2006 – Summer 2010 curriculum:</u>
General education requirements were revised to include new UNST core. Requirements changed from 20 credit hours to 25 credit hours.
3 credit hour technical elective requirements were dropped.
128 total credit hours required for graduation.
This curriculum applies to some 2013–14 seniors and some transfer students.

<u>Fall 2010 – Summer 2012 curriculum:</u>
GEEN 161 has been dropped
CHEN 220 is revised removing 1 credit of statistics and adding 1 credit of programming with MATLAB
2 new courses are added: CHEN 318 (Analysis of chemical process data – 2 credit) and CHEN 325 (Introduction to Chemical Process Simulation – 1 credit)
Thermodynamics sequence is changed from 2 3-credit courses (CHEN 310 and CHEN 311) to 1 4-credit course (CHEN 312)
127 total credit hours are required for graduation
This curriculum applies to most 2013–14 sophomore, and juniors, some seniors and some transfer students.

<u>Fall 2012 – Present:</u>

UNST general education and UNST cluster themes have been removed and are replaced by 6 credit hours of written communication courses (ENG 100 and 101); Social/Behavioral Sciences (6 credit hours); Humanities/Fine Arts (6 credit hours).
Colloquium I & II (GEEN 111, 112) are required courses (2 credit) and they replace GEEN 110 and 120 (0 credit).
BIOL 101 (4 credit) is added as basic science course.
CHEN 208, 209, 308, 309, and 409; CHEN 450, and 501 have been dropped.
CHEN 318 (2 credit) is changed to a 3 credit course and listed as CHEN 218 (3 credit) with additional course contents.
One of the three CHEN senior electives has been removed and is replaced by CHEN 448 Process Safety, Health and Environment (3 credit).
128 total credit hours are required for graduation
This curriculum applies to all students starting the program from Fall, 2012.

Catalog descriptions of all chemical engineering courses and program support courses are given in the Appendix.

C. ELECTIVE COURSES

The chemical engineering program includes a total of 8 elective courses. The courses must be distributed in four areas as follows:

1. Chemical Engineering Electives (6 credits)

The chemical engineering curriculum includes two (2) chemical engineering elective courses that are generally taken in the senior year. Both courses must be engineering courses and must contain engineering design component. The list of recommended elective courses (all 3-credit courses) and their design content is as follows:

CHEN 505	Selected Topics
CHEN 506	Introduction to Biochemical Engineering
CHEN 508	Introduction to Bioseparations
CHEN 510	Independent Study
CHEN 515	Overview of Energy and Fuels
CHEN 522	Introduction to Green Engineering
CHEN 525	Basic Food Process Engineering
CHEN 535	Introduction to Process Scaleup
CHEN 540	Computer-Aided Process Design
CHEN 545	Introduction to Environmental Remediation
MCEN 550	Co-operative Industrial Experience in Engineering
CHEN 555	Eng. Applications of Nanostructured Materials
CHEN 560	Selected Topics in Chemical Engineering
CHEN 564	Nuclear Fluid Mechanics and Heat Transfer
CHEN 565	Introduction to Polymer Science and Engineering
CHEN 570	Introduction to Solids Processing and Particle Technology

2. Advanced Chemistry Elective (6 credits)

The following list of courses has been approved to satisfy the six (6) advanced chemistry

elective credits.

CHEM 222	Organic Chemistry II (3 credits)
CHEM 224	Organic Chemistry Lab II (2 credits)
CHEM 231	Quantitative Analysis I (3 credits)
CHEM 232	Quantitative Analysis I Lab (2 credits)
CHEM 431	Quantitative Analysis II (3 credits)
CHEM 432	Quantitative Analysis II Lab (2 credits)
CHEM 442	Physical Chemistry II (3 credits)
CHEM 443	Physical Chemistry I Laboratory (1 credit)
CHEM 444	Physical Chemistry II Lab (1 credit)
CHEM 451	Biotechniques in Biochemistry (3 credits)
CHEM 452	Biotechniques in Biochemistry Lab (2 credits)
CHEM 503	Chemical Research (4 credits)
CHEM 504	Independent Study (4 credits)
CHEM 511	Inorganic Chemistry (3 credits)
CHEM 545	Physical Chemistry III (3 credits)

D. PREREQUISITE AND COREQUISITE COURSES

Prerequisites are courses that a student must have completed successfully prior to enrolling in a course. Some courses require a minimum grade of C for successful completion. Prerequisites as well as corequisites have been set forth in the University Undergraduate Bulletin and are summarized in Table 2 as they apply to chemical engineering majors.

Corequisites are courses that the student must be taking concurrently or have successfully completed prior to taking the course. **Corequisite courses become prerequisite courses for course sequels.** These prerequisites might not be listed in the catalog. If you drop a course that is a corequisite to a course you are taking, you cannot take the next course until the dropped corequisite course has been completed. For example, MATH 132 is a corequisite for PHYS I. If a student drops MATH 132, he/she can complete PHYS I, but PHYS II cannot be taken until MATH 132 is passed.

A student who is taking a CHEN course as an elective, and is not a chemical engineering major, cannot be held to the CHEN prerequisite provisions. However, permission of the instructor of the course and the department chairperson are required. Students considering transferring to chemical engineering are advised to follow all CHEN prerequisites.

The following courses in the CHEN curriculum must be passed with a grade of 'C' or higher:

CHEM 106	MATH 132	GEEN 100
CHEM 107	MATH 231	GEEN 111
PHYS 241	MATH 431	GEEN 121
PHYS 242	ECEN 340	CHEN 200
BIOL 101	MEEN 260	CHEN 300
MATH 131	MEEN 313	CHEN 320

For prerequisite purposes, a grade of **D** in any of the above courses is treated in the same manner as an **F**. The course must be repeated and a **C** grade must be earned.

E. CHEN CLASS ATTENDANCE POLICY

The chemical engineering faculty feels that class attendance is a critical factor in the learning process. The faculty assumes that students selecting chemical engineering as a major are motivated to master the skills required to practice the profession. In view of these principles, the Department has a compulsory class attendance policy. **All students in chemical engineering courses are required to attend every scheduled class period and be punctual for every class**. Late arrivals by students for class will not be tolerated by the faculty. Tardiness will be considered an absence. Failure to attend class will directly affect performance in class as well as the final grade. The student must assume the responsibility for regular attendance and must accept the consequences of failure to attend class. Instructor's and Student's responsibilities are detailed below. The student should understand his/her responsibilities to participate in the learning process.

Student's Responsibility

1. The student is expected to report to each class at the beginning of the term with a textbook validated registration schedule.

2. It is the student's responsibility to attend every class and to be on time for each class.

3. The student is responsible for all material covered in each course for which he or she is registered. Absence from class does not relieve him or her of this responsibility.

4. The student is also expected to be present for all laboratory periods, scheduled examinations, and other activities that may require special preparation.

5. The student is responsible for initiating any request to make up an examination, a laboratory exercise or other work missed because of a class absence. If the instructor requests a statement concerning the reason for the absence, the student should obtain it from the appropriate officer (e.g., the University Physician, the Vice Chancellor for Student Affairs). Make-up work is at the discretion of the instructor.

Instructor's Responsibility

1. At the beginning of the term, the instructor is responsible for explaining to the class any specific consequences for absences or tardiness.

2. By the end of the first week of classes, the instructor is responsible for providing the student with a syllabus, a schedule of examinations and other class requirements that will provide the basis for evaluating performance.

3. The instructor is responsible for maintaining an attendance record of students in the class.

The chemical engineering faculty recommends that students follow department attendance regulations for all of their classes. For specific regulations concerning non-CHEN courses, the student is referred

to their instructors, the student handbook and the University catalog.

COLLEGE OF ENGINEERING REQUIREMENTS

A. MINIMUM 'C' GRADE POLICY

The following courses in the curriculum must be passed with a grade of 'C' or higher:

CHEM 106	MATH 431
CHEM 107	GEEN 100
PHYS 241	GEEN 111
PHYS 242	GEEN 121
MATH 131	ECEN 340
MATH 132	MEEN 260
MATH 231	MEEN 313

For prerequisite purposes, a grade of **D** in any of the above courses is treated in the same manner as an **F**. The course must be repeated until a **C** grade is earned.

B. FUNDAMENTALS OF ENGINEERING (FE) EXAMINATION

The FE is the first test that must be passed to begin the process to become a registered professional engineer. **Students are encouraged to take the FE Exam during their senior year.** State boards of professional engineers for Engineer-in-Training (EIT) certification give the examination. For further information, please visit: www.ncees.org .

The chemical engineering curriculum is designed to give students the knowledge and skills needed to pass the FE exam.

ADVISING AND REGISTRATION

When a student is majoring in Chemical Engineering or working toward becoming a CHEN major, he or she is assigned a permanent faculty advisor by the department director. The advisor: (a) provides information, advice, and recommendations in academic and related areas, (b) directs the student to sources which explain in detail academic regulations, course prerequisites and graduation requirements, (c) helps the new student to understand the degree to which one should assume responsibility for one's own program planning, (d) provides vocational guidance and occupational information in one's area of specialty, and (e) refers the student to the appropriate individual, office or agency when further assistance is indicated.

The chemical engineering program director advises all transfer students to assure consistency in transfer credit evaluation. In conjunction with the Office of Admission, the contents of the courses taken elsewhere are carefully examined to make sure that they are equivalent to courses offered at North Carolina A&T State University before they are transferred.

Aggie Access is A&T's on-line registration process. Students utilize this process each semester to register for the courses they will need for the upcoming semester. Each student is assigned a unique Personal Identification Number (PIN) to access Aggie Access. PIN numbers are changed each semester during early registration. Students must obtain their advisor's approval for all course enrollment transactions including early registration, registration and course drop/add. At the end of an advising meeting, the advisor will approve the student's proposed schedule. The student turns in the request form to the department office to get their PIN

number to complete the registration process. This policy is strictly enforced. It is the student's responsibility to ensure that he/she has passed the required prerequisites for each course listed on the course request form and is registered for the co-requisite course(s).

After the end of each semester, students and faculty advisors receive student grades. At that point they check for any failed or dropped courses which may have an impact on their schedule for the next semester. If a problem is detected, the student meets with their advisor at the beginning of the next semester (during the registration period) and makes the necessary changes to the schedule. If no change is made to the schedule, the department will administratively drop the student from courses where requisites have not been met.

Students are expected to meet with their advisor regularly so they can get to know each other. The department also maintains an up-to-date list of advisors, which is posted on the CHEN bulletin board on the sixth floor of McNair Hall.

All registration or drop/add procedures are initiated by the advising process. Registration is time designated each semester to allow the student and his or her advisor to review the student's records and plan a program for the next semester. The student has an opportunity to discuss academic problems with the advisor. Early registration helps to ensure that the courses requested will be available to the students the following semester. Students who are enrolled in the University during the early registration period are expected to register during the period designated for this purpose. **Students who register must pay their bill by a specified date or their registration will be canceled.**

Students are expected to complete registration (including the payment of all required fees) on the dates listed on the University Calendar. The payment of fees is part of the registration process. No student is eligible to attend classes until the required fees have been paid. **Students who fail to complete registration during the scheduled dates will be required to pay a late registration fee.**

A. DROP/ADD PROCEDURES

Students may change their schedule by dropping or adding courses. A change in a student's program may be made only with the consent of his or her advisor or the department director. Courses may be added or dropped during the drop/add period during the early part of each semester (about two weeks). Program changes made during the drop/add period do not appear on the student's permanent transcript.

Students can drop courses, after consultation with their advisor, up until the 'last day to drop', which is published in the schedule of classes for the semester. All courses dropped during this period appear on the permanent record with a grade of 'W'. The course credits are also counted in the total used by the University to determine if a student must pay the tuition surcharge.

Changes in schedule after the drop date are rarely approved. If a student wants to drop a course after the drop date, he/she must first complete a change of schedule and obtain support from the advisor. A letter is then written to the program director explaining why a late drop should be granted. If the program director supports the request, he writes a letter asking for the support of the Dean.

B. AUDITS

Regular students may audit a course upon the written approval of the instructor and his or her faculty advisor. They must register officially for the course and pay an audit fee to the University Cashier. Attendance, preparation, and participation in the classroom discussion and laboratory exercises shall

be at the discretion of the instructor. Auditors are not required to take examinations and tests and they receive no credit. Audited courses do not satisfy prerequisite requirements.

C. COURSE LOAD

The normal course load in chemical engineering is from 15 to 17 semester credit hours per semester. Students must carry a minimum of twelve semester credit hours in order to be a full-time student. The maximum course load that a student may carry at the University is eighteen credit hours, unless the student has a cumulative grade point average of 3.0 or higher or has a 3.2 semester average in twelve or more hours the immediate preceding semester. The maximum course load that a student may carry who has a cumulative grade point average of 3.0 or higher is 21 hours.

The maximum course load that a student may carry who is on academic probation is 12 semester hours. Undergraduate students on academic probation who have a cumulative grade point average at or above the minimum level that is required based on the number of semesters completed are exempted from the twelve-hour course load limit.

TRANSFER CREDIT

Transfer credit is the awarding of credits at A&T for courses taken prior to matriculation at A&T. When a student transfers to A&T, the Office of Admissions evaluates courses taken at other institutions and awards advanced standing credits at A&T. Generally, a course must contain essentially the same content and have the same (or greater) number of credit hours as the North Carolina A&T State University course for which credit is being given. The student must have also earned at least a grade of "C" for the course to be transferred. A student who wishes to transfer to A&T State University to study chemical engineering must meet all of the University requirements for transfer and the student must have a cumulative GPA of 2.5 or above. The chemical engineering program director reviews all transfer credits with the new student and handles all appeals to the Admissions Office. Transfer students who choose chemical engineering after being enrolled in another program at A&T will have their advanced standing reviewed by the chemical engineering program director to ensure that department and ABET standards are met.

RESOLUTION OF PROBLEMS AND COMPLAINTS

If you have an academic problem with an instructor, you must try to solve the problem at that level. If you have any other problem, you must get help from the Department by seeing the Program Director, Chairperson or Secretary. If the Department cannot solve the problem to your satisfaction, they will let you know where to go next. If you take a problem to the Dean or higher, you will be told to first follow the above procedure.

PERMISSION TO TAKE COURSES ELSEWHERE

Enrolled A&T students who wish to take a course at another institution, during the summer or while on a Co-op assignment, must obtain **prior** approval from the University. He/she must present a catalog description of the chosen course(s) and make a formal request for approval using the official request form that can be obtained in the Department office. The student must demonstrate to the chemical engineering chairman that the course is equivalent to a course offered at A&T. Courses approved by the chemical engineering program director are sent to the Dean of Engineering for review and to the Admissions Office for University approval. If the student receives a "C" or better in the course, the course will be transferred to A&T. **The student must request that a transcript be sent to the Admissions office to complete the process.** The student is given credit for the course, but no grade is awarded.

Courses may be taken at an accredited junior college only if completed prior to the conclusion of the student's sophomore year at A&T or if the courses are SS/H electives. In general, students may transfer credit for a maximum of two courses each summer, as long as the residence requirement for graduation is met.

COOPERATIVE EDUCATION

Participation in Cooperative Education (Co-op) is highly recommended for students in the Chemical Engineering program. The program is an effective means of providing industrially relevant experience beyond that which can be accomplished in the classroom. Participation in the program serves not only as a form of financial aid for students, but also provides them an advantage in seeking full-time employment opportunities. To facilitate student participation in the program, most department courses required for graduation are offered at least twice per year with some also offered in the summer. At least three semesters of work are required alternating with academic semesters. After qualifying for the Co-op Program your first year (GPA above 2.8), you continue to be eligible to remain in the program by maintaining satisfactory academic (GPA above 2.8) and work records.

Cooperative Education (co-op) is a carefully organized and supervised program of "Experiential Learning" in which the participating student enriches his or her education by alternating periods of classroom study with periods of work related to his or her academic major. It is **OPTIONAL** on the part of the student. The objective of the program is to enrich the total educational experience of the student. The Co-op program normally takes five (5) years to complete. Co-op graduates command more job offers and a premium starting salary because of their experience.

Students normally apply for a co-op assignment during their freshman year or early in their sophomore year. Although no minimum GPA is specified by the University, corporate sponsors often set a minimum GPA for their company - generally 2.7 - 3.0. Students must recognize that they are selected for co-op assignment by an industrial sponsor. Chemical engineering majors interested in co-op must plan their schedules with advise from the Program Director so that courses needed are available when they are in school. Senior co-op students can gain academic credit (3 credit hours toward chemical engineering senior elective requirement) for work completed while on three or more co-op assignments by registering for MCEN 550 and meeting all course requirements.

INDEPENDENT STUDY

Independent Study, CHEN 510, is a senior chemical engineering elective that allows a student to complete a project with an A&T faculty advisor. Students must develop a complete project plan with the help of an advisor, form a three-member faculty committee, and begin work on the project **prior to enrolling in the course.** The chemical engineering program director or chairman must approve the project plan form. The course will be graded by the Project Advisor based on the quality of an oral presentation and a written final report and input from the other members of the committee.
The committee will consist of:

1. Project Advisor
2. Faculty member selected by the Project Advisor and student.
3. Chemical engineering program director, chairperson, or a faculty member selected by the program director, if both director and chairperson are already selected.

COLLEGE CONSORTIUM

Seven institutions in the Greensboro area have formed a College Consortium so that students enrolled at each of the seven colleges can take courses at any of the other colleges during the academic year. North Carolina A&T State University, Bennett College, Guilford College, Guilford Technical Community College, High Point College, Greensboro College and the University of North Carolina at Greensboro make up the Consortium. During the summer, only A&T and UNC-G are in the Consortium. All regulations concerning transfer credit apply to the Consortium except that both the course credits and the grade become part of your record. A grade of "D" is acceptable if it meets program and College of Engineering requirements.

A&T students who wish to enroll in courses at one of more of the above named institutions may obtain the necessary consortium form from the Office of Registration and Records. Approval of the advisor, department chairperson and the cashier are required before reporting to the registrar's office. After the registrar has signed the form, the student must take the remaining three copies to the Host Institutions Registrar's office and follow their procedure for registering for the course(s). Students should present the approval forms at the Consortium station in Corbett Hall Gymnasium during regular registration. During late registration, the consortium forms are to be turned in at the Office of Registration and Records in Dowdy Building. The schedule of classes for each of the participating schools is available in the Office of Registration and Records. Consortium students who make changes in their schedules must satisfy the drop/add procedures at the home and the host campuses. The student should keep a copy of the consortium form after final approval is obtained, which will be needed for use of library facilities, obtaining a parking decal and to drop a course.

SCHOLARSHIPS

Scholarship funds available to the Mechanical & Chemical Engineering Department are the result of corporate donations and are awarded on the basis of academic performance. Scholarships are given for one semester and are not renewable. Students must reapply each semester to be considered. Students planning to apply for a chemical engineering scholarship must complete an application form, available in the department office, and are encouraged to apply early. Scholarship award decisions are generally made in July for the following academic year. If funds are available, scholarship decisions are also made in early January.

Scholarship restrictions are set by the corporate donor and by the department. The department standards are a minimum GPA of 3.00, overall and in chemical engineering, to obtain or retain a scholarship. Because the demand for scholarships is often greater than the supply of scholarship funds, the GPA needed could be higher than 3.0. Minimum GPA standards are often set by corporate sponsors of specific scholarships. Many corporate sponsors also add restrictions such as class level, summer work requirements, or for minorities only.

The department expects all students on CHEN scholarships to apply for other corporate scholarships whenever they are announced so that more students can receive financial aid.

STUDENT ORGANIZATIONS

AIChE Student Chapter

The American Institute of Chemical Engineers (AIChE) is the official professional society for chemical engineers. The basic objectives of the Institute are "the advancement of chemical engineering in theory and practice and the maintenance of high professional standards among its members." The AICHE:

1. Provides means for the publication and exchange of technical information in the field of chemical engineering.
2. Establishes a professional standard of conduct and draws its members from those who have subscribed to this standard.

3. Provides an organization which promotes the wider recognition of chemical engineering as a profession and which is effective in improving the professional and economic status of chemical engineers individually.
4. Provides forums where members may meet with their colleagues to discuss mutual interest and problems.

The Institute authorizes Local Sections and Student Chapters. The local AIChE Section is the Triad Section. The Triad Section covers the Triad region and meets five times each year. At least one meeting is held on the A&T campus to present the outstanding chemical engineering senior award. The Triad section selects and awards the outstanding senior from our program after interviewing 3-5 seniors nominated by the CHEN faculty. CHEN faculty are active participants of the Triad Section and most have served as section officers. Members of the Student Chapters are eligible to participate in all the activities of the Local Sections except voting for officers.

The Institute also authorizes AIChE Student Chapters at Universities with accredited programs. We have one Student Chapter at A&T. The objectives of the Student Chapter are: 1) promoting the professional development of their members by their programs and by their relations with other Student Chapters and with the parent body, the American Institute of Chemical Engineers, 2) contributing to the development of chemical engineering through activities involving the faculty and student members and students, and 3) counseling high school students interested in the chemical engineering profession. The administrative functions of the Student Chapter are carried out by the officers, who are elected annually by the membership. All CHEN majors are eligible for membership in the Student Chapter and National AIChE. The department recommends that all majors join and actively participate in the Student Chapter. Currently, Dr. Shamsuddin Ilias serves as faculty advisor.

Omega Chi Epsilon *(OXE)*

OXE is the national chemical engineering honor society. It promotes and recognizes high scholarship, encourages original investigation in chemical engineering and recognizes the valuable traits of character, integrity and leadership. The society serves both undergraduate and graduate students within the Chemical Engineering Department. *OXE* chartered the CHEN honor society as the Beta Gamma Chapter of *OXE* in 1992.

Membership in *OXE* is by invitation based on academic performance. Second-semester junior CHEN majors having an overall grade point average and a chemical engineering average of 3.30/4.00 or more shall be eligible for election. Seventh semester seniors become eligible for membership if they have maintained a 3.20 GPA in CHEN and overall. Eight semester seniors shall be eligible for election if they have maintained a 3.00 overall grade point average and chemical engineering grade point average. This Beta Gamma chapter of *OXE* is administered by a set of officers and an advisor who are elected annually. Currently, Dr. Franklin G. King serves as *OXE* advisor.

Society of Plastics Engineers (SPE)

A new student section of SPE will be started in 2004. The objective of the Society is to promote the scientific and engineering knowledge relating to plastics (www.4spe.org). Student member benefits include:

Subscription to *Plastics Engineering* magazine
Newsline, student newsletter
Position Wanted ad in *Plastics Engineering*
Registration to select SPE conferences

Reduced registration for SPE seminars and training programs
Access to SPE scholarship competitions

Dr. Jianzhong Lou serves as faculty advisor

COLLEGE AND UNIVERSITY ACADEMIC REGULATIONS

A. REPETITION OF COURSES

A student who has received a failing grade in a required course must repeat and pass the course. In cases where a student earns a "D" and is required to repeat the course to earn a passing grade of "C", the "D" is treated in the same manner as an "F". That is, the "D" is dropped in the computation of the GPA for the purpose of meeting graduation requirements in chemical engineering.

For updated policy on repetition of courses, please refer to University Catalog. The web-link of current policy is given below:

http://www.ncat.edu/legal/policies/sec2-acad-affairs/Reptition%20of%20Courses%20and%20Grade%20Forgiveness.pdf

B. ACADEMIC RETENTION

The average load for an undergraduate CHEN student is sixteen (16) credit hours per semester. The minimum load for a full-time undergraduate student is twelve (12) credit hours per semester. The student is expected to make normal progress toward a degree. Normal progress means the completion of sixteen or more semester hours each semester with a 2.0 grade point average or higher for a full-time student. These 16 hours must consist of courses that count toward graduation for a full-time student.

To be in good academic standing, a full-time student must have the following minimum grade point average and the following semester hours passed:

Semester Number	GPA	Semester Hours
One	1.40	12
Two	1.50	24
Three	1.60	36
Four	1.80	48
Five	1.90	60
Six	2.00	72
Seven	2.00	84
Eight	2.00	96

A student is eligible to register if he or she has a minimum overall grade point average of 2.0 and has attended the University less than the maximum number of semesters allowed for the degree program.

A student must achieve a minimum semester grade point average of 2.0 each semester enrolled beyond the sixth (6th) semester to be in good academic standing. A student is eligible to continue to work toward an undergraduate degree until he has attended eleven (11) semesters as a full-time student (not

including summer session) or until he has attempted 152 semester hours. At that point the student becomes ineligible to continue at the University unless approved by the Dean of Engineering.

The student should be aware of his or her academic status each semester. Failure to meet the minimum academic requirements (given above) results in immediate suspension. A student who is suspended for a given semester may apply for re-admission for the next semester. The application for re-admission should reach the Office of Registrar 30 days prior to the beginning of the semester that the student wishes to re-enroll. Upon enrolling, the student is required to achieve a minimum semester grade point average of 2.0.

The student who fails to meet the minimum academic requirements after having been suspended and re-admitted is subject to permanent academic dismissal, subject to the provisions of the academic appeal procedure.

A part-time undergraduate student enrolled in a degree program must maintain the following cumulative grade point average at the end of the cumulative semester hours indicated:

PART-TIME SEMESTER HOURS	GRADE POINT AVERAGE
24	1.5
48	1.8
72	2.0
96	2.0

A part-time undergraduate student is defined as one who enrolls in less than twelve (12) hours during a semester. The part-time student who fails to maintain the minimum average is subjected to the actions prescribed for full-time students. A part-time student who enrolls in the university after an academic suspension must achieve a minimum semester grade point average of 2.0.

C. INCOMPLETE GRADES

Students are expected to complete all requirements of a particular course during the semester in which they are registered. However, if at the end of the semester, a small portion of the work remains unfinished and must be deferred because of some serious circumstances beyond the control of the student, an "I" may be submitted by the instructor. Students should note that "I" grades are counted as "F" grades when the semester GPA is computed and do not satisfy course prerequisites.

An "I" for a prolonged illness may be submitted only after the written approval of the Vice Chancellor for Student Affairs has been secured. An "I" for other causes may be submitted only with the approval of the Dean of the School.

Along with the recording of the incomplete grade, the instructor must also file with the head of the department, the student's average grade and a written description of the work which must be completed before the incomplete is removed.

An incomplete grade must be removed within SIX WEEKS after the beginning of the next semester. If the student has not removed the incomplete within the time specified, the instructor is required to submit the appropriate final grade. Developmental, thesis and research courses are exempted from this six-week time limit. Incomplete grades in prerequisite courses must be removed before registration can

be completed.

D. ACADEMIC DISHONESTY POLICY

This Department strongly upholds and enforces the absolute **"ACADEMIC DISHONESTY POLICY"** of the University. Examples of Academic Dishonesty include but are not limited to:

- Cheating or knowingly assisting another student in committing an act of academic dishonesty;
- Plagiarism (unauthorized use of another person's words or ideas as one's own) which includes but is not necessarily limited to submitting examinations, theses, reports,drawings, laboratory notes or other materials as one's own work when such work has been prepared by another person or copied from another person;
- Unauthorized possession of examinations or reserve library materials, destruction or hiding of source materials, library materials, or laboratory materials or experiments or any other similar action;
- Unauthorized changing of grades or marking on an examination or in an instructor's grade book, or such change of any grade record;
- Aiding or abetting in the infraction of any of the provisions anticipated under the general standards of student conduct; or
- Assisting another student in violating any of the above rules.

A student who has committed an act of academic dishonesty has failed to meet a basic requirement of satisfactory academic performance. Thus, academic dishonesty is not only a basis for disciplinary action but may also affect the evaluation of the student's level of performance. Any student who commits an act of academic dishonesty is subject to disciplinary action as defined below.

In instances where a student has been clearly identified as having committed an academic act of dishonesty, the instructor may take appropriate punitive action including a loss of credit for an assignment, an examination or project, or award a grade of "F" for the course subject to the review and endorsement of the chairperson and the dean. Repeated offenses can even lead to dismissal from the University.

E. DISRUPTIVE BEHAVIOR IN THE CLASSROOM

The instructor may withdraw a student from a course for behavior he deems to be disruptive to the class. The grade assigned will be "W" if the behavior occurs before the deadline for dropping a course without academic penalty, and the instructor has the option of giving a "W" or a "F" if the behavior occurs after the deadline.

The instructor must provide an opportunity for the student to he heard. In providing this opportunity, the instructor must follow the procedure descried below:

1. The student should be notified in writing at the next class attended that the instructor proposes to drop the student from the course for disruption of the class, and the instructor should provide the student with written instructions regarding the time and place for a meeting with the instructor. A copy of this written notification must be sent to the instructor's department head at the same time.
2. A time limit of five working days (M-F) from the time written notification is given for the student's opportunity to be heard by the instructor.

3. The date of notification establishes whether the withdrawn student will be given a "W" or "F". "W" is appropriate before the 8-week drop date and either "W" or "F" is appropriate after the date, at the instructor's discretion.
4. The instructor may suspend the student from class until the instructor takes action to withdraw the student from class or to allow the student to continue in the class. The final decision to withdraw or continue the student is the instructor's.
5. Either party in the resolution of this dispute may invite one other person of the university community to be present as an observer.

F. GRADUATION UNDER A GIVEN CATALOG

A student may expect to earn a degree in accordance with the requirements of the curriculum outlined in the curriculum in force when he or she was first enrolled into the Department provided the courses are still being offered. Moreover, he or she must complete all requirements within six years. On the other hand, he or she may graduate under any subsequent curriculum published while he or she is a student. If a student elects to meet the requirements of a curriculum other than the one in force at the time of his or her original entrance, he/she must meet all requirements of the curriculum he/she elects.

G. FINAL EXAMINATIONS

It is University policy that a final examination is given in every course. In order that students may complete semester projects, take lab tests, and prepare for final examinations, faculty members are urged to **avoid** giving major tests during the final week of the semester.
Final exam papers are not returned to students, but the instructor shall keep the returned papers at least until the first month of the next regular semester. During this period, any student shall have an opportunity to review his/her exam paper.
Absences from final examinations are excused only in **very exceptional** circumstances, such as serious illness certified by a medical official of the University or other conditions beyond the control of the student. A student who misses a final examination must notify the instructor **within 24 hours** after the scheduled time of the examination. Failure to so notify and to present an **acceptable reason** for his absence from the examination will result in the student's receiving an "F" on the final exam.

H. GRADUATION WITH HONORS

Undergraduate candidates who complete all requirements for graduation in accordance with the following stipulations earn the following honors:
1. Those who maintain a general average within the range of 3.00 to 3.24 will receive CUM LAUDE.
2. Those who maintain a general average within the range of 3.25 to 3.49 will receive a MAGNA CUM LAUDE.
3. Those who maintain a general average within the range of 3.50 to 4.00 will receive SUMMA CUM LAUDE.

All hours attempted are included in the grade point average computation for determination of honors. This means that when a course is repeated, both grades are counted in the computation for the honors GPA. For a transfer student, a minimum of 60 percent of the credit hours required for a degree program must be earned at A&T State University to be considered for honors. For example, if the program requires a total of 128 credit hours, 77 of those hours must be earned at A&T.

APPENDIX

Chemical Engineering Faculty Profiles

Yusuf G. Adewuyi, Professor, PhD, University of Iowa; AIChE Fellow
Research Interests:

Chemical Reaction Engineering	Catalysis and Benign Chemical Synthesis
Environmental Remediation	Advanced Oxidation Processes

Shamsuddin Ilias, Professor and Director, PhD, Queen's University at Kingston; Professional Engineer (PE); AIChE Fellow.
Research Interests:

Computational Fluid and Particle Dynamics	Environmental Engineering
Membrane Separations and Membrane Reactors	

Jianzhong Lou, Professor, PhD, University of Utah.
Research Interests:

Polymer Processing	Polymer Characterization
Membrane Transport	

Vinayak N. Kabadi, Professor, PhD, Pennsylvania State University.
Research Interests:

Thermodynamics by Computer Simulations	Thermodynamics of Coal Liquids
Environmental Engineering	

Franklin G. King, Professor, D.Sc., Stevens Institute of Technology; Professional Engineer (PE); AIChE Fellow.
Research Interests:

Process Dynamics and Control	Diffusion through Porous Media
Biochemical Engineering	Pharmacokinetics

Gary B. Tatterson, Professor, PhD, The Ohio State University; Professional Engineer (PE).
Research Interests:

Turbulence and Mixing	Multiphase Flow
Plant Design	

Leonard C. Uitenham, Professor and Chairperson, PhD, Case Western Reserve University.
Research Interests:
Polymer Processing

Directory of Chemical Engineering (CHEN) Courses

CHEN 200. Chemical Process Principles **Credits 4 (3-2)**
This course is an introduction to the analysis of chemical processes with an emphasis on mass and energy balances. Stoichiometric relationships, ideal and real gas behavior are also covered. Topics also include an introduction to the first law of thermodynamics for open and closed systems and the solution of problems with comprehensive mass and energy balance equations. Prerequisites: CHEM 106, GEEN 100 (with a grade of "C" or higher). Corequisites: CHEM 107, MATH 132, and PHYS 241. **(F;S;SS)**

CHEN 208/209. Chemical Engineering Sophomore Colloquium I & II **Credits 0 (0-0)**
Topics of interest to sophomores majoring in chemical engineering are presented and discussed. Topics include advising, retention, scholarships, curriculum, AIChE, coop, industrial internships, career planning, contemporary issues in chemical engineering and gaining stakeholder input from students. The course also provides a forum for students to interact with CHEN faculty and the Department Chair. Prerequisites: Sophomore standing in CHEN. **[CHEN 208 (F); CHEN 209 (S)]**

CHEN 218. Analysis of Chemical Process Data **Credits 3 (2-2)**
The course introduces contemporary computational methods and tools for designing experiments and analysis of data, frequency distribution and probability concepts. The course covers statistical inference, empirical models, strategies for efficient experimentation and their applications in chemical engineering process analysis. Statistical methods including error analysis, curve fitting and regression, analysis of variance, confidence intervals, hypothesis testing, and control charts are covered. Prerequisites: MATH 132 (with C or higher grade) **(F;S;SS)**

CHEN 220. Analytical Methods in Engineering **Credits 3 (2-2)**
This course introduces contemporary computational methods and tools for numerical analysis in engineering. It includes numerical methods in differentiation, integration, interpolation, root-finding, linear and nonlinear regression. Linear algebra topics include matrix manipulation, solution of linear simultaneous equations, and solution of ordinary differential equations. Each topic involves projects with numerical computations using MATLAB. Prerequisites: MATH 132 (with a grade C or higher) and course equivalent to MEEN 210. **(F;S;SS)**

CHEN 300. Fluid Mechanics **Credits 3 (2-2)**
This course examines the continuum concept, fluid statics, mass and momentum balances, the Bernoulli Equation, dimensional analysis, pipe flow problems, the design and the selection of pumps and the three forms of drag. Boundary layer flows, compressible flow and flow measurement devices are reviewed. Prerequisites: MATH 231, PHYS 241 (both with C or higher), and course equivalent to MEEN 416. **(F;S;SS)**

CHEN 308/309. Chemical Engineering Junior Colloquium I & II **Credits 0 (0-0)**
Topics of interest to juniors majoring in chemical engineering are presented and discussed. Topics include advising, retention, scholarships, curriculum, AIChE, coop, industrial internships, career planning, contemporary issues in chemical engineering and gaining stakeholder input from students. The course also provides a forum for students to interact with CHEN faculty and the Department Chair. Prerequisite: Junior standing in CHEN. **[CHEN 308 (F); CHEN 309 (S)]**

CHEN 310. Fundamentals of Thermodynamics **Credits 3 (2-2)**
This is a basic course in fundamental thermodynamic principles. The topics covered include energy, heat and work, thermodynamic properties of substances, real and ideal gases, first and second laws of thermodynamics, introduction of power cycle and refrigeration cycle. Prerequisites: CHEN 200, MATH 231, PHYS 241 (all with C or higher) and course equivalent to MEEN 441. **(F;S;SS)**

CHEN 311. Thermodynamics of Chemical and Phase Equilibria **Credits 3 (2-2)**
This course consists of a systematic study of chemical reaction equilibria and phase equilibria. Use of fugacity, activity and chemical potential concepts for predicting the effect of such variables as temperature and pressure on equilibrium compositions are studied. Methods for measuring and estimating thermodynamic properties important to equilibrium calculations in real systems are also examined. Single component and multi-component systems are addressed. Students

are introduced to the ASPEN PLUS chemical process simulation package and are trained to use the package to access and estimate thermodynamic properties of pure components and mixtures. Prerequisite: CHEN 310 **(F;S)**

CHEN 312. Chemical Engineering Thermodynamics **Credits 4 (3-2)**
The course is a study of thermodynamics principles with special emphasis on chemical process applications and equilibria. Topics included are the first and second laws, properties of single and multi-component systems, expansion and compression of fluids, heat engines, thermodynamics of flow processes, phase equilibria and chemical reaction equilibria. Prerequisites: CHEN 200, MATH 231 (both with C or higher grade) **(F;S;SS)**

CHEN 320. Heat Transfer **Credits 3 (2-2)**
The course covers the fundamentals of heat conduction, convection, radiation, boiling and condensation, and heat exchangers. Design and safety aspects of heat transfer equipment will be covered. Prerequisites: CHEN 300, MATH 431 (with a grade of "C" or higher), and course equivalent to MEEN 562. **(F;S;SS)**

CHEN 325. Introduction to Chemical Process Simulation **Credits 1 (0-2)**
The course is an introduction to the use of a chemical process simulator. Computer-aided mass and energy balances are emphasized. Ideal models for mixing, reaction and separation are used. Students learn to prepare process streams to feed the above processing operations. Students are introduced to computer-aided thermodynamic property analysis for pure and multi-component systems. Students study vapor-liquid and liquid-liquid equilibrium using various thermodynamic models. Currently, the ASPEN PLUS simulation package is used. Prerequisites: CHEN 200 (with C or higher grade), Corequisite: CHEN 312 **(F;S;SS)**

CHEN 330. Chemical Engineering Laboratory I **Credits 2 (0-5)**
Students conduct laboratory studies on unit operations involving fluid mechanics, thermodynamics, and heat transfer. The studies include open-ended experiments and comparisons between theory and experimental results. Statistical analysis of data, experimental design, laboratory safety and quality reporting are stressed. Students are required to complete formal and informal reports and make oral presentations with visual aids. Prerequisites: CHEN 318, Corequisite: CHEN 320. **(F;S)**

CHEN 340. Process Dynamics and Control **Credits 3 (2-2)**
The course covers the methods for controlling chemical process equipment including the dynamic response of process equipment and systems. Simulation methods are stressed in the design of control systems. Modes of control, controller characteristics and control loop design are stressed. Computer control and statistical process control are introduced. Prerequisites: MATH 431, CHEN 300 (with a grade of "C" or higher) and 312. Corequisite: CHEN 320. **(S)**

CHEN 400. Mass Transfer Operations **Credits 3 (2-2)**
The course is a study of diffusion, diffusional operations and stagewise separation principles. Topics include the quantitative treatment and design of mass transfer equipment involving equilibrium stage contacting. Operations included are distillation, absorption, and extraction. Additional operations, such as, ion exchange, drying, humidification, chromatography and membrane separation may be included at the instructor's discretion. Prerequisite: CHEN 320 (with a grade of "C" or higher), CHEN 220, CHEN 312. **(F,S,SS)**

CHEN 408. Chemical Engineering Senior Colloquium **Credits 0 (0-0)**
Topics of interest to first semester seniors majoring in chemical engineering are presented and discussed. This course provides monthly meetings to present and discuss topics of interest to seniors majoring in chemical engineering. Topics include advising, retention, scholarships, curriculum, AIChE, coop, industrial internships, career planning, contemporary issues in chemical engineering and gaining stakeholder input from students. The course also provides a forum for students to interact with CHEN faculty and the department chairperson. Prerequisite: Senior standing in CHEN. **(F)**

CHEN 410. Chemical Engineering Laboratory II **Credits 2 (0-5)**
The course is a continuation of CHEN 330 with emphasis on open-ended laboratory studies and comparisons between theory and experimental results. Topics include mass transfer, process dynamics and control, reaction kinetics, and reactor design. Statistical analysis of data, experimental design, laboratory safety and quality reporting are stressed. Students are required to complete formal and informal reports and make oral presentations with visual aids. Prerequisites: CHEN 320 (with a grade of "C" or higher), CHEN 330. Corequisites: CHEN 400, CHEN 422. **(F;S)**

CHEN 422. Chemical Reaction Engineering **Credits 3 (2-2)**
This course covers the fundamentals of chemical kinetics, rate theories and chemical reactor design. Homogeneous reactors are emphasized. Heterogeneous systems and catalysis are introduced. Students design chemical reactors for batch and flow systems. Prerequisites: CHEN 320 (with a grade of "C" or higher), CHEN 312, CHEM 221. **(F;S)**

CHEN 430. Process Design I **Credits 3 (2-2)**
The steps in creating a chemical process design from concept to completion and plant operation are studied. Topics included are engineering economics, simulation, process equipment design, ethics, and process safety. Students complete an open-ended process component design. Prerequisites: CHEN 320 (with a grade of "C" or higher), CHEN 312, CHEN 325;. Corequisites: CHEN 400 , CHEN 422. **(F;S)**

CHEN 440. Process Design II **Credits 3 (1-4)**
This capstone design course emphasizes the design of a complete chemical process including a literature survey, mass and energy balances, flow diagrams, equipment selection and design, and cost and economic analysis. Students develop and use computer-aided simulation to model process equipment design. Projects include extensive use of the ASPEN PLUS simulation package. Oral and written presentations of the design projects are required. Prerequisites: CHEN 400, 422, 430, CHEM 441; Corequisite: CHEN 340 **(F;S)**

CHEN 448. Process Safety, Health and Environment **Credits 3 (3-0)**
Fundamentals of chemical process safety and designing for the environment are introduced in this course. Topics include toxicology, industrial hygiene, source models, toxic release and dispersion models, fires and explosions, relief systems, hazard identification and risk analysis, environmental fate and transport, waste generation, pollution prevention, and regulatory requirements. Prerequisite: Senior standing in CHEN or consent of instructor **(F;S;SS)**

CHEN 450. Chemical Engineering Topics Review **Credits 1 (1-2)**
This course reviews all of the CHEN topics in the BS program. The course prepares the student to pass the CHEN comprehensive exam and the CHEN specified part of the fundamentals of engineering exam. Senior standing in chemical engineering. **(F;S)**

CHEN 501. General Engineering Topics Review **Credits 1 (0-3)**
The course covers and reviews the engineering topics included in the General Engineering sections of the Fundamentals of Engineering (FE) exam. The course emphasizes extensive problem solving and helps students prepare for the FE exam. Senior Standing in chemical engineering. **(F;S;SS)**

CHEN 505. Selected Topics in Chemical Engineering **Credits 3 (3-0)**
An in-depth lecture course covering several advanced topics in chemical engineering. Topics will be selected to match student interest and faculty expertise. A specific course description will be available at the beginning of each semester that the course is offered. Prerequisite: Senior standing in CHEN courses. **(F;S)**

CHEN 506. Introduction to Biochemical Engineering **Credits 3 (3-0)**
This course explores the use of living organisms or parts of them (e.g., enzymes) for the production of chemical or biological materials. The course emphasis is upon bioprocess development and bioreactor design. Topics covered include enzyme kinetics and biocatalysts, microbial growth and product formation, immobilization of enzymes and whole cells, bioreactor scale-up and design of batch and continuous bioreactors. Students are required to complete a bioprocess design or project with the option of using a process simulator such as Aspen. Prerequisite: Senior standing in CHEN or permission of instructor **(F;S;SS)**

CHEN 508. Introduction to Bioseparations **Credits 3 (3-0)**
The course is an introduction to the separation and purification of biochemicals. Separation processes are characterized as removal of insolubles, isolation of products, and purification or polishing. Processes covered include filtration, centrifugation, cell disruption, extraction, absorption, elution chromatography, precipitation, ultrafiltration, electrophoresis and crystallization. Students are required to complete a design project on a bioseparation process. Prerequisite: Senior standing in CHEN or consent of instructor **(F;S;SS)**

CHEN 510. Independent Study in Chemical Engineering **Credits 3 (0-6)**
An independent study project is completed on a single topic in chemical engineering. Topics are arranged to fit the mutual interests of the student and a faculty advisor. The study includes the design of an apparatus, a process, or a procedure. Final written and oral presentations of the work to a faculty committee are required. Prerequisites: Permission of instructor. **(F;S)**

CHEN 515. Overview of Energy and Fuels **Credits 3 (3-0)**
Students are exposed to the estimates of past and current fuel consumption in the United States and the world. Future projections of the global energy needs and the fuels likely to be utilized to meet these needs are discussed. These fuels include fossil fuels, synfuels, and fuels from renewable resources, such as, wind, solar and biomass. Students learn about processing of fuels for energy production. The course includes design of a fuel process with emphasis on economic and environmental impact. Prerequisite: Senior standing in CHEN or consent of instructor **(F;S;SS)**

CHEN 522. Introduction to Green Engineering **Credits 3 (3-0)**
Students are introduced to the concept of green engineering and its application through industrial ecology, risk assessment and life-cycle assessment methodologies. Topics include green engineering at the macroscale (industrial sector), mesocale (unit operations), and microscale (molecular interactions). Students will design an engineering process with emphasis on preserving and improving environmental quality. Prerequisite: Senior standing in CHEN or consent of instructor **(F;S;SS)**

CHEN 525. Basic Food Process Engineering **Credits 3 (3-0)**
This course covers basic food processing and development. Topics include the different food groups, food preparation operations, process operations, new food developments, health hazards and their effects on humans. Prerequisite: Senior standing in CHEN or consent of instructor **(F;S;SS)**

CHEN 535. Introduction to Process Scaleup **Credits 3 (3-0)**
This course is designed to teach students how to 1) scaleup a process or model and 2) perform model, pilot and plant studies for translation of processes from model, laboratory and pilot plant information to the plant. The course will cover the different scaleup methods and how to establish viable process objectives. A general scaleup method is presented and a number of examples are worked as illustrations. Prerequisite: Senior standing in CHEN or consent of instructor **(F;S;SS)**

CHEN 540. Computer-Aided Process Design **Credits 3 (3-0)**
Computer models of varying complexity are used to simulate the behavior of many unit-operations. Students complete computer-aided mass and energy balances for complete chemical plants. Selecting the best computer model for each process step is stressed. Simulation of the computer-aided design of a chemical process is included. Students learn to retrieve and plot physical property, thermodynamic and VLE data. Currently, the ASPEN PLUS simulation package is used. Prerequisite: Senior standing in CHEN or consent of instructor **(F;S;SS)**

CHEN 545. Introduction to Environmental Remediation **Credits 3 (3-0)**
The course introduces students to traditional and developmental methods for removal and detoxification of hazardous wastes at contaminated sites and from industrial waste streams. Chemical, thermal, biological and physical methods of remediation are covered. The course deals with hazardous wastes in soils, groundwater, surface water, wastewater ponds and tanks. The emphasis is on destruction, removal and containment methods using mathematical models for contaminate fate and transport. Recent advances in emerging technologies are also discussed. Each student will complete an environmental remediation design project. Prerequisite: Senior standing in CHEN or consent of instructor **(F;S;SS)**

CHEN 555. Engineering Applications of Nanostructured MaterialsCredits **Credits 3 (3-0)**
This course introduces students to modern chemical engineering material processing technologies. Chemical vapor deposition, crystallization, electrochemical deposition, electroplating and supercritical fluid-based processing techniques for the production of nanostructured materials are discussed. This course also reviews the effects of parameters (such as lattice structure, material composition, nucleation, crystal growth phenomena, chemical bonding, etc.) on the catalytic, electronic, optical and physical properties of metallic and ceramic materials. Prerequisite: Senior standing in CHEN or consent of instructor **(F;S;SS)**

CHEN 560. Selected Topics in Chemical Engineering **Credits 3 (3-0)**
This course consists of selected chemical engineering topics of interest to students and faculty. The topics will be defined in the course syllabus at the time when the course is offered. Prerequisite: Senior standing in CHEN or consent of instructor **(F;S;SS)**

CHEN 564. Nuclear Fluid Mechanics and Heat Transfer **Credits 3 (3-0)**
This course provides discussions of thermal hydraulic characteristics of power reactors, thermal design principles, reactor heat generation, transport equations for single phase flow and two-phase flow. Analyses of fuel elements, two phase flow dynamics, two phase heat transfer, single heated channels, steady state flow and heat transfer analysis are given. Prerequisite: Senior standing in CHEN or consent of instructor **(F;S;SS)**

CHEN 565. Introduction to Polymer Science and Engineering **Credits 3 (3-0)**
This course introduces students to engineering technology of polymeric materials, and science and engineering of large molecules. Students learn about control of significant variables in polymer synthesis, and physical methods for characterization of molecular weight, morphology, rheology and mechanical behavior. Engineering applications include additives, blends and composites, natural polymers and fibers, thermoplastics, elastomers and thermosets, polymer degradation and stability, polymers in the environment, and polymers for advanced technologies , such as, membrane separations, biomedical devices, electronic and photonic industry. Prerequisite: Senior standing in CHEN or consent of instructor **(F;S;SS)**

CHEN 570. Introduction to Solids Processing and Particle Technology **Credits 3 (3-0)**
This course is an introduction to solids processing and particle technology. Topics included are properties of particles, size reduction, size enlargement, filtration, drying of solids, crystallization and flotation. Industrial examples will be emphasized. Prerequisite: Senior standing in CHEN or consent of instructor **(F;S;SS)**

CHEN 574. Interdisciplinary Design **Credits 3 (1-4)**
This course gives senior students the opportunity to work in interdisciplinary teams. Lectures will include ethics, teamwork and professional practice. Student teams complete an industry-based design pro9ject that is broader in scope than is normally available in CHEN 440. An oral presentation and a written report are required. This course may be taken as a substitute for CHEN 440. Prerequisite: CHEN 430. **(F;S)**

Directory of Mechanical & Chemical Engineering (MCEN) Courses

MCEN 310 Introduction to Biological Applications of Engineering **Credits 3 (3-0)**
This course is an introduction to the application of engineering principles and methods to problems in medicine, the integration of engineering with biology, and the emerging industrial opportunities. Examples from a variety of engineering disciplines will be provided. The ethical concerns associated with some emerging life science applications will be explored. Lab experiments will be utilized in the course to provide hands-on experience with life science concepts. Prerequisite: CHEM106, MATH 431, PHYS 242 (all with grades of C or higher) **(S)**

MCEN 550 Co-operative Industrial Experience in Engineering **Credits 3 (3-0)**
This course is a supervised learning experience in a specified private or governmental facility. Students who have completed at least three co-op sessions with the same company may enroll in this course. Course requirements include employer evaluations of the student for each co-op session and student evaluations of the employer for each session. Written reports for each co-op session and an oral report summarizing the work experiences will be presented to a faculty committee. Prerequisite: Senior standing in engineering or permission of instructor. **(F;S;SS)**

Program Support Courses

Chemistry (CHEM)

CHEM 106 General Chemistry VI **Credits 3 (3-0)**
This is a course that emphasizes basic principles and important theoretical concepts of chemistry. Topics will include

atomic structure, electronic configuration, the wave mechanical model of the atom, chemical bonding, states of matter, chemical equilibria, systems of acids and bases, and electrochemistry. Prerequisites: 2 units of high school algebra or equivalent and 1 unit of high school chemistry or Chemistry 099. **(F;S;SS)**

CHEM 107 General Chemistry VII **Credits 3 (3-0)**
This is a continuation of Chemistry 106. Includes chemistry of important metals and nonmetals and a rigorous treatment of qualitative inorganic analysis. Prerequisite: CHEM 106. **(F;S;SS)**

CHEM 116 General Chemistry VI Laboratory **Credits 1 (0-3)**
This is a course that emphasizes quantitative studies of chemical reactions such as acid-base studies, redox reactions, and equilibrium reactions. Emphasis is also placed on the development of manipulative skills in laboratory. Corequisite: CHEM 106.**(F;S;SS)**

CHEM 117 General Chemistry VII Laboratory **Credits 1(0-3)**
This is a continuation of CHEM 116 with an introduction of qualitative analysis. Corequisite: CHEM 107. Prerequisite: CHEM 116. **(F;S;SS)**

CHEM 221 Organic Chemistry I **Credits 3 (3-0)**
This course is a study of the hydrocarbons (aliphatic and aromatic) and introduction to their derivatives. Prerequisite: CHEM 107. **(F;S;SS)**

CHEM 222 Organic Chemistry II **Credits 3 (3-0)**
This course is a continuation of the study of derivatives of hydrocarbons and more complex compounds. Prerequisite: CHEM 221. **(F;S;SS)**

CHEM 223 Organic Chemistry I Laboratory **Credits 2 (0-4)**
This laboratory course emphasizes the study of physical and chemical properties of aliphatic and aromatic compounds. Modern instrumentation such as gas and column chromatography, infrared and ultraviolet analysis are used. Corequisite: CHEM 221. **(F;S;SS)**

CHEM 231 Quantitative Analysis I **Credits 3 (3-0)**
This course covers titrimetric and gravimetric analyses including theory and calculations associated with acid-base equilibria, oxidation-reduction, nucleation, and precipitation-complexation processes. Corequisite: MATH 131. Prerequisite: CHEM 107. **(S)**

CHEM 232 Quantitative Analysis I Lab **Credits 2 (0-4)**
This laboratory course emphasizes the basic principles of chemical separations. Laboratory studies of gravimetric and titrimetric analyses are also encountered. Corequisite: CHEM 231. Prerequisite: CHEM 117. **(S)**

CHEM 441 Physical Chemistry I **Credits 3 (3-0)**
This is a study of the fundamental laws governing matter in the gaseous state, and the laws of thermodynamics and their applications to chemistry; includes an introduction to statistical thermodynamics. Prerequisites: MATH 132, PHYS 241, CHEM 231. **(F;S)**

CHEM 442 Physical Chemistry II **Credits 3 (3-0)**
This is a continuation of Chemistry 441. Studies of solid and liquid states, solutions, phase equilibria, chemical kinetics, and electrochemistry. Prerequisite: CHEM 441. **(S)**

CHEM 443 Physical Chemistry I Laboratory **Credits 1 (0-3)**
Thermodynamic and kinetic studies are emphasized in this course. Corequisite: CHEM 441. **(F;S)**

CHEM 444 Physical Chemistry II Laboratory **Credits 1 (0-3)**
This is a continuation of Chemistry 443. Corequisite: CHEM 442.**(S)**

CHEM 451 Biotechniques in Biochemistry **Credits 3 (3-0)**

This course will emphasize the fundamental concepts and basic principles of biological chemistry. Topics will include acid-based properties of amino acids, protein structure and function, kinetic analysis of enzymatic reactions, isolation and characterization of biomolecules, recombinant DNA technology and computer graphics and structure calculations. Prerequisite: CHEM 222 or permission from instructor. **(F)**

CHEM 452 Biotechniques in Biochemistry Laboratory **Credits 2 (0-6)**
This is a laboratory course that introduces the basic principles, technologies and instrumentation of current biochemical research. Students will acquire practical experiences and application skills for the isolation and characterization of biomolecules. This course will encompass spectroscopic, chromatographic, electrophoretic and recombinant DNA technologies. Error analysis and statistical analysis of experimental data will be included. Prerequisite: CHEM 224 and 251 or permission of the instructor. Corequisite: CHEM 451. **(F)**

English (ENGL)

ENGL 100 Ideas and Their Expressions I **Credits 3 (3-0)**
This is an introduction to college-level expository writing; provides students with experience in writing and revising compositions. Students will also learn to write resumes, letters of application, short reports and responses to literature. **(F;S;SS)**

ENGL 101 Ideas and Their Expressions II **Credits 3 (3-0)**
This is a continuation of English 100 which provides the student with additional experience in various modes of writing, emphasizing expository writing; introduces students to the techniques of writing the research paper and analyzing literary selections. Prerequisite: ENGL 100. **(F;S;SS)**

ENGL 331 Writing for Science and Technology **Credits 3 (3-0)**
This course includes the study and practice of the basic techniques of writing and editing scientific and technical materials for both the general audience and the specialist. Prerequisite: Junior Standing **(F;S;SS)**

Mathematics (MATH)

MATH 131 Calculus I **Credits 4 (4-0)**
Limits and continuity of functions, the derivative, applications of the derivative, the definite integral and applications of the definite integral will be studied. Prerequisite: MATH 110 or appropriate approval. **(F;S;SS)**

MATH 132 Calculus II **Credits 4 (4-0)**
Topics in analytic geometry, differentiation and integration of exponential, logarithmic, trigonometric, inverse trigonometric and hyperbolic functions, additional techniques and applications of integration, indeterminate forms, improper integrals will be studied. Taylor's formula and infinite series. Prerequisite: MATH 131. **(F;S;SS)**

MATH 231 Calculus III **Credits 4 (4-0)**
This course will cover plane curves and polar coordinates, vectors and solid geometry, vector valued functions, partial differentiation, multiple integrals, and applications of multiple integrals and vector analysis. Prerequisite: Math 132. **(F;S;SS)**

MATH 431 Introduction to Differential Equations **Credits 3 (3-0)**
This course will cover first order differential equations, higher order linear differential equations, matrices and determinants, systems of linear algebraic equations, systems of linear differential equations and Laplace transforms. Prerequisite: Math 132. **(F;S;SS)**

Physics (PHYS)

PHYS 241 General Physics I **Credits 3 (3-1)**
This is the calculus-based study of physics, which covers the fundamental principles of mechanics, thermodynamics, electromagnetism, wave motion, sound and optics. Corequisite: MATH 132, PHYS 251. **(F;S;SS)**

PHYS 242 General Physics II **Credits 3 (3-1)**
This course is a continuation of PHYS 241 and continues coverage of the fundamental principles of mechanics, thermodynamics, electromagnetism, wave motion, sound and optics. Corequisite: PHYS 252. **(F;S;SS)**

PHYS 251 General Physics I Laboratory **Credit 1 (0-2)**
This is a laboratory course where a selected group of physics experiments will be performed. Emphasis is placed on the development of experimental technique, analysis of data, and physical interpretation of experimental results. Corequisite: PHYS 241. **(F;S;SS)**

PHYS 252 General Physics II Laboratory **Credit 1 (0-2)**
This is a continuation of Physic 251. Corequisite: Physics 242. **(F;S;SS)**

General Engineering (GEEN)

GEEN 100 Engineering Design and Ethics **Credits 2 (2-0)**
This course introduces students to engineering and computer science disciplines and functions, professional licensure, the Fundamentals of Engineering exam, code of ethics, safety, the design process, creative thinking, team work, and technical writing. A case study on ethics and the application of the design process through a team project are required. **(F;S;SS)**

GEEN 161 Computers Programming in MATLAB for Engineers Credits 2 (0-4)
This course introduces computer programming using MATLAB. Topics include flow chart construction and interpretation, procedural control flow, algorithm coding development, and spreadsheets. Prerequisites: none. **(F;S;SS)**

GEEN 110 Colloquium I **Credits 0 (1-0)**
Group study, time management, preparing for and taking tests, curriculum – why humanities, social sciences, science, mathematics courses are required, scholarship opportunities, campus resources, faculty-student interactions, corporate information sessions. **(F)**

GEEN 120 Colloquium II **Credits 0 (1-0)**
Learning styles, advising, professional society activities, coop, internships, career planning,, faculty-student interactions, contemporary issues in the discipline, corporate information sessions. **(S)**

Mechanical Engineering (MEEN)

MEEN 260 Materials Science **Credits 2 (2-0)**
This is a basic course in materials science that covers the fundamental nature of materials including their physical, mechanical and chemical characteristics. Topics include: atomic arrangements and atomic bonding; phase diagrams; engineering properties; selection of materials for specific applications. Prerequisites: CHEM 106. **(F;S;SS)**

MEEN 313 Statics and Mechanics of Materials **Credits 3 (3-0)**
This is an introductory course in statics and mechanics of materials for non-mechanical engineering majors. It provides a just-in-time approach to the study of characteristics of forces and couples, and their effects on equilibrium, strains, and stresses in solid bodies. Relationships between loads and deformations are also presented. The course is designed to help prepare students for the Fundamentals of Engineering Examination. Prerequisite: MATH 131, PHYS 241. **(F;S)**

Electrical and Computer Engineering (ECEN)

ECEN 440 Electrical Circuits and Systems **Credits 3 (3-0)**
This course covers power and energy concepts; basic R, RC, RL and RLC circuits; three phase circuits; ideal transformers; diodes and ideal op amp circuits, and logic circuits. The LaPlace transform method will be introduced and used to solve circuit problems. Prerequisites: MATH 431, PHYS 242. **(F;S)**

Civil Engineering (CIEN)

CIEN 310 Environmental Engineering **Credits 3 (3-0)**

This course provides an introduction to environmental pollution. Topics include: Physical, chemical and biological water quality parameters, water purification processes in natural systems, air pollution and solid waste management, and general design of waste control systems. Prerequisite: Junior standing. **(F;S)**

CIEN 510 Environmental Engineering Design **Credits 3 (3-0)**
This course defines the analysis and design of water and wastewater treatment systems. Topics included in the course are analysis and functional design of physical, chemical and biological treatment processes; pump stations; and sludge treatment processes. Prerequisite: CIEN 310. **(S)**

University Studies (UNST)

UNST 100 University Experience **Credits 1 (1-0)**
This seminar will emphasize the role of the University Studies program and present a broad overview of the curriculum structure and rationale, including an introduction to a variety of interdisciplinary themes within the UNST program. Introductory discussions on ethics, wellness and healthy lifestyles, diversity and civic engagement will be included. Prerequisite: None. **(F;S)**

UNST 103 Basic Writing **Credits 3 (3-0)**
This course is designed to prepare the student for writing college-level compositions. The course begins with a focus on paragraph writing, requiring that students demonstrate their ability to develop and organize paragraphs adequately and clearly. In addition, the course concentrates on the short composition, requiring that students demonstrate competency in writing short essays. Computer-based tools such as Criterion may be used to address basic errors in student writing. The course is offered for Pass/Fail grade. Prerequisite: None. **(F;S;SS)**

UNST 110 Critical Writing **Credits 3 (3-0)**
This course introduces students to reading comprehension and the writing process. Students will read and evaluate selected texts and develop critical thinking abilities through writing and speaking. Students will engage in formal and informal writing, pay attention to grammar and conventions of standard written English, revise drafts and respond to constructive feedback. All students will develop a writing portfolio for course assessment. Prerequisite: None. **(F;S;SS)**

UNST 120 The Contemporary World **Credits 3 (3-0)**
This course examines the social, economic, political, and cultural roots of the contemporary world. It focuses on the major developments, events, and ideas that have shaped world societies since the beginning of the twentieth century. Close attention will be given to concepts and categories that allow students to grasp the nature and development of the contemporary world, thus providing them with a framework to understand the global experience in our times. The course will help students develop critical thinking skills in their oral and written work and learn to use information technology effectively. Prerequisite: None. **(F;S;SS)**

UNST 130 Analytical Reasoning **Credits 3 (3-0)**
This survey course gives students an overview of scientific, quantitative and logical reasoning to prepare them to interpret and solve problems encountered in everyday life. Students will consider concepts from logic and the scientific disciplines including life, social and physical sciences. The scientific method and a variety of analytical approaches will be explored, including numerical, graphical, verbal/logical, and algebraic. Prerequisite: None. **(F;S;SS)**

UNST 140 The African American Experience: An Interdisciplinary Perspective **Credits 3 (3-0)**
This interdisciplinary course introduces students to the important contributions made and challenges faced by people of African descent to America and the Global Community. This course will focus on oral, written and visual means of expression as a basis for discussion, analysis and debate. Prerequisite: None. **(F;S;SS)**

Chemical Engineering Curriculum/2006-2010

Freshman Year			
Semester 1 (Fall) Courses	**Cr**	**Semester 2 (Spring) Courses**	**Cr**
UNST 100 University Experience	1	UNST 130 Analytical Reasoning	3
UNST 110 Critical Writing	3	UNST 140 The African American Experience	3
UNST 120 The Contemporary World	3	MATH 132 Calculus II	4
MATH 131 Calculus I	4	PHYS 241 General Physics I	3
GEEN 100 Engineering Design and Ethics	2	PHYS 251 General Physics I Lab	1
GEEN 110 Colloquium I	0	GEEN 120 Colloquium II	0
CHEM 106 Gen. Chemistry VI	3	GEEN 161 Comp. Programming with MATLAB	2
CHEM 116 Gen. Chemistry VI Lab.	1		
Semester Total	**17**	**Semester Total**	**16**
Sophomore Year			
Semester 3 (Fall) Courses	**Cr.**	**Semester 4 (Spring) Courses**	**Cr**
Cluster Theme Elective[1]	3	Cluster Theme Elective[1]	3
CHEN 208 CHEN Soph Colloq 1	0	CHEN 209 CHEN Soph Colloq 2	0
MATH 231 Calculus III	4	CHEM 221 Organic Chemistry I	3
CHEM 107 General Chemistry VII	3	CHEM 223 Organic Chemistry I Lab	2
CHEM 117 General Chemistry VII Lab	1	PHYS 242 General Physics II	3
CHEN 200 Chemical Process Principles	4	PHYS 252 General Physics II Lab.	1
MEEN 260 Material Science	2	MATH 431 Intro to Differential Equations	3
		CHEN 220 Analytical Methods in Engineering	3
Semester Total	**17**	**Semester Total**	**18**
Junior Year			
Semester 5 (Fall) Courses	**Cr**	**Semester 6 (Spring) Courses**	**Cr**
Cluster Theme Elective[1]	3	Cluster Theme Elective[1]	3
CHEN 308 CHEN Junior Colloq 1	0	CHEN 309 CHEN Junior Colloq 2	0
CHEN 300 Fluid Mechanics	3	CHEN 311 Thermo of Chem. Phase Equil.	3
CHEN 310 CHEN Thermodynamics	3	CHEN 320 Heat Transfer	3
MEEN 313 Statics and Mechanics of Materials	3	CHEN 330 Chemical Engineering Lab I	2
CHEM 441 Physical Chemistry I	3	CHEN 340 Process Dynamics and Control	3
		ELEN 440 Electrical Circuits and Systems	3
Semester Total	**15**	**Semester Total**	**17**
Senior Year			
Semester 7 (Fall) Courses	**Cr**	**Semester 8 (Spring) Courses**	**Cr**
CHEN 408 CHEN Senior Colloq	0	CHEN 440 Process Design II (Capstone Design)	3
CHEN 501 General Engineering Topics Review	1	CHEN 450 CHEN Topics Review	1
CHEN 400 Mass Transfer Operations	3	CHEN Elective	3
CHEN 410 Chemical Engineering Lab II	2	CHEN Elective	3
CHEN 422 Chemical Reaction Engineering	3	Advanced CHEM Elective	3
CHEN 430 Process Design I	3		
Advanced CHEM Elective	3		
Semester Total	**15**	**Semester Total**	**13**
		Program Total	**128**

[1] Must choose one cluster theme and complete 12 credit hours in that cluster

Chemical Engineering Curriculum/2010-2012

Freshman Year			
Semester 1 (Fall) Courses	**Cr**	**Semester 2 (Spring) Courses**	**Cr**
UNST 100 University Experience	1	UNST 120 The Contemporary World	3
UNST 110 Critical Writing	3	UNST 130 Analytical Reasoning	3
MATH 131 Calculus I	4	UNST 140 The African American Experience	3
GEEN 100 Engineering Design and Ethics	2	PHYS 241 General Physics I	3
GEEN 110 Colloquium I	0	PHYS 251 General Physics I Lab	1
CHEM 106 Gen. Chemistry VI	3	MATH 132 Calculus II	4
CHEM 116 Gen. Chemistry VI Lab	1	GEEN 120 Colloquium II	0
Semester Total	**14**	**Semester Total**	**17**
Sophomore Year			
Semester 3 (Fall) Courses	**Cr.**	**Semester 4 (Spring) Courses**	**Cr**
Cluster Theme Elective	3	Cluster Theme Elective	3
CHEN 208 CHEN Soph Colloq 1	0	CHEN 209 CHEN Soph Colloq 2	0
MATH 231 Calculus III	4	CHEN 220 Analytical Methods in Engineering	3
CHEM 107 General Chemistry VII	3	CHEN 318 Analysis of Chem. Process Data	2
CHEM 117 General Chemistry VII Lab	1	CHEM 221 Organic Chemistry I	3
CHEN 200 Chemical Process Principles	4	CHEM 223 Organic Chemistry I Lab	2
MEEN 260 Material Science	2	MATH 431 Intro to Differential Equations	3
Semester Total	**17**	**Semester Total**	**16**
Junior Year			
Semester 5 (Fall) Courses	**Cr**	**Semester 6 (Spring) Courses**	**Cr**
Cluster Theme Elective	3	Cluster Theme Elective	3
CHEN 308 CHEN Junior Colloq 1	0	CHEN 309 CHEN Junior Colloq 2	0
CHEN 300 Fluid Mechanics	3	CHEN 325 Intro to Chem. Process Simulation	1
CHEN 312 CHEN Thermodynamics	4	CHEN 320 Heat Transfer	3
PHYS 242 General Physics II	3	CHEN 330 Chemical Engineering Lab I	2
PHYS 252 General Physics II Lab	1	CHEN 340 Process Dynamics and Control	3
CHEM 441 Physical Chemistry I	3	MEEN 313 Statics and Mechanics of Materials	3
Semester Total	**17**	**Semester Total**	**15**
Senior Year			
Semester 7 (Fall) Courses	**Cr**	**Semester 8 (Spring) Courses**	**Cr**
CHEN 408 CHEN Senior Colloq	0		
CHEN 501 General Engineering Topics Review	1	CHEN 440 Process Design II (Capstone Design)	3
CHEN 400 Mass Transfer Operations	3	CHEN 450 CHEN Topics Review	1
CHEN 410 Chemical Engineering Lab II	2	CHEN Elective	3
CHEN 422 Chemical Reaction Engineering	3	CHEN Elective	3
CHEN 430 Process Design I	3	Advanced Chem Elective	3
Advanced Chem Elective	3	ECEN 440 Electrical Circuits and Systems	3
Semester Total	**15**	**Semester Total**	**16**
		Program Total	**127**

Chemical Engineering Curriculum/2012-Present

Freshman Year			
Semester 1 (Fall) Courses	**Cr**	**Semester 2 (Spring) Courses**	**Cr**
GEEN 111 Colloquium I – Student Success	1	GEEN 121 Colloquium II – Student Success	1
ENGL 100 Ideas and their Expression I	3	ENGL 101 Ideas and their Expression II	3
MATH 131 Calculus I	4	MATH 132 Calculus II	4
CHEM 106 Gen. Chemistry VI	3	BIOL 101 Concepts of Biology	4
CHEM 116 Gen. Chemistry VI Lab	1	PHYS 241 General Physics I	3
GEEN 100 Engineering Design and Ethics	2	PHYS 251 General Physics I Lab	1
Semester Total	**14**	**Semester Total**	**16**
Sophomore Year			
Semester 3 (Fall) Courses	**Cr.**	**Semester 4 (Spring) Courses**	**Cr**
SBS /HFA*	3	SBS / HFA*	3
MATH 231 Calculus III	4	CHEN 220 Analytical Methods in Engineering	3
CHEM 107 General Chemistry VII	3	MATH 431 Intro to Differential Equations	3
CHEM 117 General Chemistry VII Lab	1	CHEM 221 Organic Chemistry I	3
CHEN 200 Chemical Process Principles	4	CHEM 223 Organic Chemistry I Lab	2
MEEN 260 Material Science	2	CHEN 218 Analysis of Chemical Process Data	3
Semester Total	**17**	**Semester Total**	**17**
Junior Year			
Semester 5 (Fall) Courses	**Cr**	**Semester 6 (Spring) Courses**	**Cr**
SBS / HFA*	3	CHEN 320 Heat Transfer	3
CHEN 300 Fluid Mechanics	3	CHEN 325 Intro to Chemical Process Simulation	1
CHEN 312 CHEN Thermodynamics	4	CHEN 330 Chemical Engineering Lab I	2
CHEM 441 Physical Chemistry I	3	CHEN 340 Process Dynamics and Control	3
PHYS 242 General Physics II	3	MEEN 313 Statics and Mechanics of Materials	3
PHYS 252 General Physics II Lab	1	ECEN 340 Electrical Circuits and Systems	3
Semester Total	**17**	**Semester Total**	**15**
Senior Year			
Semester 7 (Fall) Courses	**Cr**	**Semester 8 (Spring) Courses**	**Cr**
CHEN 430 Process Design I	3	CHEN 440 Process Design II (Capstone Design)	3
CHEN 400 Mass Transfer Operations	3	CHEN 448 Process Safety, Health & Environment	3
CHEN 410 Chemical Engineering Lab II	2	CHEN Elective	3
CHEN 422 Chemical Reaction Engineering	3	CHEN Elective	3
Advanced CHEM Elective	3	Advanced CHEM Elective	3
SBS /HFA*	3		
Semester Total	**17**	**Semester Total**	**15**
		Program Total	**128**

* Of the 12 hours of Social/Behavioral Sciences (SBS) and Humanities/Fine Arts (HFA) courses, at least 3 hours of African-American Studies and 3 hours of Global Studies are required; all courses must be from the approved general education list of courses.

Approved Curriculum Guide – Fall 2012

Freshman

First Semester

Course	Prerequisites*	Corequisites**	Credits
Written Communications/ ENG 100			3
Freshman Colloquium I/GEEN 111			1
Eng. Design and Ethics/GEEN 100			2
General Chemistry VI/CHEM 106			3
General Chemistry VI Lab/CHEM 116		CHEM 106	1
Calculus I/MATH 131			4
			1**4**

Second Semester

Course	Prerequisites	Corequisites	Credits
Written Communications/ ENG 101			3
Freshman Colloquium II/GEEN 121			1
Concepts of Biology/ BIOL 101		CHEM 106/116	4
General Physics I/PHYS 241		MATH 132, PHYS 251	3
General Physics I Lab/PHYS 251		PHYS 241	1
Calculus II/Math 132	MATH 131***		4
			16

Sophomore

First Semester

Course	Prerequisites	Corequisites	Credits
SBS or HFA[1]			3
Calculus III/ MATH 231	MATH 132		4
General Chemistry VII/CHEM 107	CHEM 106***		3
General Chemistry VII Lab/CHEM 117	CHEM 116	CHEM 107	1
Material Science/ MEEN 260	CHEM 106***		2
Chem Engr Process Principles/CHEN 200	CHEM 106***, GEEN 100***	CHEM 107, MATH 132, PHYS 241	4
			17

Second Semester

Course	Prerequisites	Corequisites	Credits
SBS or HFA[1]			3
Analytical Methods in Engineering/CHEN 220	MATH 132***		3
Analysis of Chem Process Data/CHEN 318	MATH 132***		3
Intro to Differential Equations/MATH 431	MATH 132***		3
Organic Chemistry I/ CHEM 221	CHEM 107***		3
Organic Chemistry I Lab/ CHEM 223		CHEM 221	2
			17

Junior

First Semester

Course	Prerequisites	Corequisites	Credits
SBS or HFA[1]			3
Fluid Mechanics/CHEN 300	MATH 231***, PHYS 241***		3
General Physics II/ PHYS 242	PHYS 241***, MATH 132***	PHYS 252	3
General Physics II Lab/ PHYS 252		PHYS 242	1
CHEN Thermodynamics/ CHEN 312	CHEN 200***, MATH 231***		4
Physical Chemistry I/ CHEM 441	MATH 132***, PHYS 241***, CHEM 107***		3
			17

Second Semester

Course	Prerequisites	Corequisites	Credits
SBS or HFA[1]			3
Heat Transfer/CHEN 320	CHEN 300***, MATH 431***		3
Intro to Chem Process Simulation/CHEN 325	CHEN 200***	CHEN 312	1
Chem Engr Lab 1/CHEN 330	CHEN 318	CHEN 320	2
Electrical Circuits and Systems/ ECEN 340	PHYS 242***, MATH 431***		3
Statics and Mechanics of Materials/ MEEN 313	MATH 131***, PHYS 241***		3
Process Dynamics and Control/ CHEN 340	CHEN 300***, CHEN 312, MATH 431***	CHEN 320	3
			15

Senior

First Semester

Course	Prerequisites	Corequisites	Credits
Mass Transfer Operations/ CHEN 400	CHEN 312, CHEN 320***, CHEN 220		3
Chem Engr Lab II/ CHEN 410	CHEN 320***, CHEN 330	CHEN 400, CHEN 422	2
Chemical Reaction Engineering/ CHEN 422	CHEN 312, CHEM 221, CHEN 320***		3
Process Design I/ CHEN 430	CHEN 312, CHEN 320*** CHEN 325	CHEN 400, CHEN 422	3
Advanced CHEM Elective			3
SBS or HFA[1]			3
			17

Second Semester

Course	Prerequisites	Corequisites	Credits
Process Design II/CHEN 440	CHEN 400, CHEN 422, CHEN 430, CHEM 441	CHEN 340	3
Safety, Health & Environment/CHEN 448	CHEN Senior Standing		3
Elective/CHEN Option	CHEN Senior Standing		3
Elective/CHEN Option	CHEN Senior Standing		3
Advanced CHEM Elective			3
			15

*** Prerequisites must be passed before enrolling in the course.**
**** Corequisities must be taken with the course and are automatic prerequisites for any follow-up course.**
***** Course must be passed with a C or better.**
[1] Of the 12 hours of Social/Behavioral Sciences (SBS) and Humanities/Fine Arts (HFA) courses, at least 3 hours of African-American Studies and 3 hours of Global Studies are required; all courses must be from the approved general education list of courses.

Notes