

# **MECHANICAL ENGINEERING UNDERGRADUATE STUDENT HANDBOOK**

**2008-2009**



**NORTH CAROLINA AGRICULTURAL AND TECHNICAL  
STATE UNIVERSITY**

**DEPARTMENT OF MECHANICAL AND CHEMICAL ENGINEERING  
COLLEGE OF ENGINEERING**

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### Notices

This handbook was prepared for use by undergraduate students in Mechanical Engineering at North Carolina A&T State University. It is designed to supplement existing policy and is intended as a guide. However, students are asked to consult with academic advisors and with the appropriate University office for current information and policy. Important changes may occur without notice. The Department attempts to maintain an accurate Undergraduate Student Handbook at all times; however, errors may inadvertently occur. The department reserves the right to correct such errors when they are found, without further notice. The presence of errors will not affect the application of rules and requirements to students.

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## Mission

The mission of the Bachelor of Science in Mechanical Engineering (BSME) program at North Carolina A&T State University is to prepare our students for the broad practice of mechanical engineering and for graduate education in mechanical engineering and the many related fields such as materials engineering and aerospace engineering.

## Educational Objectives

After graduating from the Bachelor of Science in Mechanical Engineering Program, the graduates are expected to be able to:

1. Perform effectively in mechanical engineering related positions in industry or in graduate/professional schools.
2. Demonstrate teamwork and leadership skills in using interdisciplinary approaches for solving problems.
3. Become active in their communities and in professional societies.
4. Enhance their professional credentials through life-long learning

## BSME Curriculum Requirements for Graduation

### Mathematics ..... 18 credit hours

MATH 131(4), 132(4), 231(4), 431(3)  
MEEN 210(3)

### Basic Sciences..... 15 credit hours

CHEM 106(3), 116(1)  
PHYS 241(3), 242(1), 251(3), 252(1), and MEEN 360(3)

### University Studies (General Education) ..... 25 credit hours

1. Foundation Courses ..... 13 credit hours  
UNST 100 (1), UNST 110 (3), UNST 120 (3), UNST 130 (3), and UNST 140(3)
2. Theme-Based “Problem-Solving” Courses. .... 12 credit hours  
Four UNST 2XX/3XX (3) courses are required within the same theme. Themes include:  
Science, Technology and Society  
Energy, Environment and Society  
Community, Conflict and Society  
Health, Lifestyles and Society

### Engineering ..... 68 credit hours

#### 1. General Engineering ..... 4 credit hours

GEEN 100(2), 161(2), 110(0), 120(0)

#### 2. Electrical and Industrial Engineering ..... 5 credit hours

ELEN 440(3), INEN 260(2)

#### 3. Mechanical Engineering..... 59 credit hours

MEEN 104(2), 335(3), 336(3), 337(3), 402(1), 403(1), 416(3), 440(3), 441(3), 442(3), 446(3), 460(3), 474(3), 501(1), 502(1), 503(1), 540(3), 562(3), 565(3), 572(1), 573(3), 574(3), and six credit hours of Technical Electives.

Students opting for the Aerospace Specialization should substitute MEEN 415 for MEEN 416 and MEEN 576 for MEEN 442, and choose aero related technical electives. They are expected to select a senior design project (MEEN 573 and MEEN 574) in an aerospace related topic approved by their advisor.

## Mechanical Engineering Curriculum

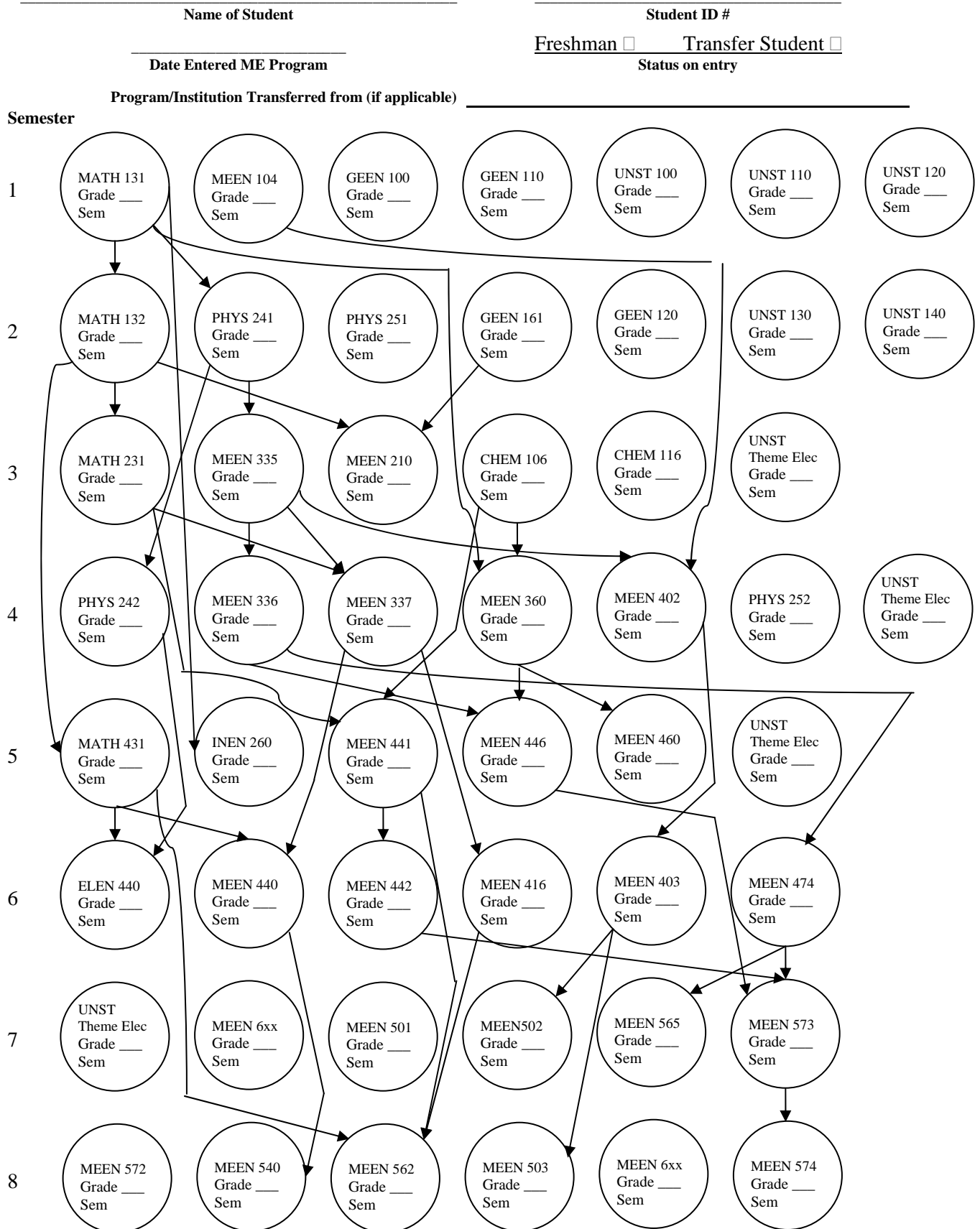
Fall Semester			Spring Semester		
	Course Title	cr.		Course Title	cr.
<b>Freshman Year</b>					
	UNST 100 University Experience	1		UNST 130 Analytical Reasoning	3
	UNST 110 Critical Writing	3		UNST 140 African American Experience	3
	UNST 120 Contemporary World	3		MATH 132 Calculus II	4
	MATH 131 Calculus I	4		PHYS 241 General Physics I	3
	GEEN 100 Engineering Design and Ethics	2		PHYS 251 General Physics I Lab.	1
[1, 2]	GEEN 110 Colloquium I	0	[1, 2]	GEEN 120 Colloquium II	0
	MEEN 104 Engineering Graphics	2		GEEN 161 Computer Programming in MATLAB	2
	<b>Semester Total</b>	<b>15</b>		<b>Semester Total</b>	<b>16</b>
<b>Sophomore Year</b>					
[7]	UNST Cluster Theme Elective	3	[7]	UNST Cluster Theme Elective	3
	MATH 231 Calculus III	4		PHYS 242 General Physics II	3
	CHEM 106 General Chemistry VI	3		PHYS 252 General Physics II Lab	1
	CHEM 116 General Chemistry VI Lab	1		MEEN 360 Materials Science	3
	MEEN 210 Analytical Methods in Engr	3		MEEN 336 Strength of Materials	3
	MEEN 335 Mechanics I: Statics	3		MEEN 337 Mechanics II: Dynamics	3
	<b>Semester Total</b>	<b>17</b>		MEEN 402 Mechanical Engineering Lab I	1
				<b>Semester Total</b>	<b>17</b>
<b>Junior Year</b>					
[7]	UNST Cluster Theme Elective	3		ELEN 440 Electrical Circuit Analysis	3
	MATH 431 Introduction to Differential Equations	3		MEEN 403 Mechanical Engineering Lab II	1
	INEN 260 Engineering Economics	2	[3]	MEEN 416 Fluid Mechanics	3
	MEEN 441 Fundamentals of Thermodynamics	3		MEEN 440 System Dynamics	3
	MEEN 446 Manufacturing Processes	3	[4]	MEEN 442 Applied Thermodynamics	3
	MEEN 460 Modern Engineering Materials	3		MEEN 474 Engineering Design	3
	<b>Semester Total</b>	<b>17</b>		<b>Semester Total</b>	<b>16</b>
<b>Senior Year</b>					
[7]	UNST Cluster Theme Elective	3		MEEN 503 Mechanical Engineering Lab IV	1
	MEEN 501 General Engineering Topics Review	1		MEEN 562 Heat Transfer	3
	MEEN 502 Mechanical Engineering Lab III	1		MEEN 572 Senior Seminar	1
	MEEN 565 Computer Aided Design of Machines	3	[5]	MEEN 574 Mechanical Engr Design Project II	3
[5]	MEEN 573 Mechanical Engr Design Project I	3		MEEN 540 Vibrations and Control	3
[6]	MEEN 6XX Mechanical Engr Technical Elective	3	[6]	MEEN 6XX Mechanical Engr Technical Elective	3
	<b>Semester Total</b>	<b>14</b>		<b>Semester Total</b>	<b>14</b>

**(Total Credit Hours: 126)**

Notes:

- [1] MEEN students should take Section 5 of the colloquium courses.
- [2] Transfer students from other engineering programs may exempt from these colloquium courses.
- [3] Students following the Aerospace Specialization should take MEEN 415-Aerodynamics instead.
- [4] Students following the Aerospace Specialization should take MEEN 576-Propulsion instead.
- [5] Students following the Aerospace Specialization should choose aerospace related senior design project.
- [6] Students following the Aerospace Specialization should choose aerospace related technical electives.
- [7] Must choose one cluster theme and take 12 credit hours in that cluster theme.

# Prerequisite Flow Chart MECHANICAL ENGINEERING CURRICULUM 2007



## **Technical Electives**

All MEEN majors are required to take two mechanical engineering technical electives. Courses include MEEN 6xx level course and MEEN 415, MEEN 576, or MEEN 578.

### **Critical Course Sequences**

**[MATH 131] - [PHYS 241] - [MEEN 335] - [MEEN 336, MEEN 337] - [MEEN 474] - [MEEN 573] - [MEEN 574]**

Students should take the above one or two courses in the sequence to avoid spending an extra semester in school.

### **Senior-Level Courses Offered in Fall or Spring Semester only**

Note that MEEN 501 and MEEN 573 are offered only in fall semesters, and MEEN 572 and MEEN 574 are only offered in spring semesters. Students should pay close attention in the senior year on these courses to avoid spending an extra semester in school.

## **Minimum Grade of “C” in Selected Core Courses**

The College of Engineering and the Mechanical Engineering Program have adopted a list of specific courses in which students must earn a minimum grade of “C” to meet graduation requirements and to progress on to any course for which these courses are prerequisites. This policy has been in effect since Fall 2002. The list of courses which require a minimum “C” grade for mechanical engineering students follows:

GEEN 100  
CHEM 106  
MATH 131, 132, 231, 431  
PHYS 241, 242  
ELEN 440  
INEN 260  
MEEN 360, 335, 336, 337, 415, 416, 441

## **Academic Advising**

A faculty member will serve as your academic program advisor. Information about your advisor can be obtained from the MCEN office (Room 618, McNair Hall), or from Aggie Access On-Line <http://www.ncat.edu/~registra/webfor.html> under Student Records. You should consult with your advisor regarding questions or problems about your program and course scheduling. It is important that you plan your academic program such that you graduate in the minimum possible time.

## **Registration**

Each semester the University publishes a schedule booklet that includes a class and examination schedule and an academic calendar. You should pick up a copy from the MCEN office and use it to help you plan your courses.

1. Fill in the Course Request Form in the booklet properly by referring to the class schedule.
2. Schedule a time to meet your advisor.
3. Take the completed Course Request Form to your advisor for approval and signature. Do not take courses out of sequence. Refer to the prerequisite flow chart in this handbook.
4. On-line course registration can be conducted during the registration period. To use the Aggie Access On-Line <http://www.ncat.edu/~registra/webfor.html>, you must obtain a PIN from a secretary in the MCEN Office by presenting a course request form signed by your academic advisor.

## **Checking Prerequisite/Corequisite Requirements**

All MEEN students are responsible for ensuring that they are taking courses for which the prerequisite/corequisite requirements are satisfied. If a student takes a course without proper prerequisites or corequisites, he or she will receive an “F” grade in that course. To help ensure that you satisfy prerequisites, your instructors may ask you to show your grade reports to them. You should verify prerequisite requirements with your instructors prior to the last day to add so that you will have time to substitute another course if necessary.

## **Course Load**

The normal course load in Mechanical Engineering is 16 or 17 semester credit hours. For full time status, a undergraduate student is required to carry a minimum of 12 credit hours; however, carrying just this minimum load will mean that you will require more than 8 semesters to complete your degree.

The maximum course load that a student may carry is 18 credit hours unless the student has a cumulative grade point average of 3.0 or higher, or has a 3.2 semester grade point average while earning 12 or more credit hours in the semester prior to the one for which the overload is requested. The maximum course overload for any student is 21 credit hours. The maximum course load for one 5-week summer session is 7 credit hours.

## **Repetition of Courses**

A student who has received a failing grade in a required course at North Carolina A&T State University must repeat and pass the course unless the Dean of the College/School authorizes a substitute course. No single course may be repeated more than (2) two times. Course withdrawals do not count. Course drops do not count toward the attempts. A course completed with a grade of “C” or higher may not be repeated for a higher grade. Special authorization may be requested, as needed, from the Dean of the appropriate College/School to assist the student with completing requirements for graduation. All grades earned by the student are a part of his/her official academic record and will appear on his/her transcript.

## **Maximum Course Load for a Student on Academic Probation**

The maximum course load for a student on academic probation is 12 credit hours.

### **Suspension/Readmission**

A student suspended for academic reasons must stay out one full semester. A suspended student wishing to re-enroll must apply in writing, a minimum of 30 days prior to the semester for which readmission is requested. The department will support readmission requests only if the requestor and advisor have prepared an individualized comprehensive plan of study which affords the student a reasonable chance of success.

### **Tuition Surcharge**

Please note that in an effort to improve the four-year graduation rate, the Board of Governors of the University of North Carolina system has mandated a tuition surcharge of 25 percent on students who attempt more than 140 degree credit hours to complete a four year baccalaureate degree. Also, an upper limit of 152 attempted credit hours has been established for completing a four-year degree. See the University Bulletin for additional details relating to these requirements.

### **Maximum Semester Hours Attempted**

A student is eligible to continue to work toward an undergraduate degree if he or she is in good academic standing and until he or she has attended eleven (11) semesters as a full-time student (not including summer session) or until he or she has attempted 152 semester hours. At that point the student becomes ineligible to continue at the University unless approved by the Dean of the College.

### **Degree Audit**

Degree Audit in Aggie Access On-Line <http://www.ncat.edu/~registra/webfor.html> shows the courses you have taken as well as those remaining to be taken to fulfill graduation requirements. If you have any questions, you should consult with your advisor.

### **Graduating Under a Given Catalog**

A student may expect to earn a degree in accordance with the requirements of the curriculum outlined in the catalog in force when he or she first entered the University, provided the courses are being offered. Moreover, he or she must complete these requirements within six years. In addition, he or she may graduate under any subsequent catalog published while he or she is a student. If a student elects to meet the requirements of a catalog other than the one in force at the time of his or her original entry, he or she must meet all requirements of the catalog he or she elects.

## **Transfer Students**

A student who wishes to transfer into the Mechanical Engineering Program from another accredited College or University must meet the following requirements:

1. The student must meet all of the University requirements for transfer (see the University Bulletin).
2. The student must have a cumulative GPA (grade point average) of 2.5 or above from an ABET accredited program, or GPA (grade point average) of 3.0 or above from a non-ABET accredited program.
3. The University does not accept transfer credit for course work where grades of P/F have been given. No course is accepted in transfer in which a grade below "C" was earned.
4. The maximum number of transferable credits is 80 semester hours from a 4 year program and 64 semester hours from a 2 year program.

Students attending community colleges who intend to transfer to the BSME program should be enrolled at their community college in Pre-Engineering programs for their Associate in Science Degree, not in one of the engineering technologies programs which are intended for students to acquire entry-level job skills.

## **Change of Major**

Students may transfer from other departments of the University to the Mechanical Engineering Program with written approval and acceptance of the Chairperson of the Mechanical and Chemical Engineering Department and the Dean of the College of Engineering. The proper forms needed to apply for such a change can be obtained from the Office of the Registrar and must be executed at least six weeks prior to the beginning of the semester in which the student plans to begin the new major. New transfer students should report to the Mechanical Engineering Program Director for advising. The following department requirements must be satisfied by any student considering changing his/her major to Mechanical Engineering:

1. The student must have a 2.5 or higher overall grade point average, and must have completed MATH 131 with a "C" or better.
2. Any 500-level or above courses in Mechanical Engineering may be taken only by Engineering Majors.
3. A student may be disqualified from transferring to Mechanical Engineering if he/she has taken any courses out of sequence or without the proper prerequisites.

## **Conditionally Admitted Freshmen**

Students who are unable to meet the admission criteria based on SAT/ACT and high school GPA will be conditionally admitted. Based on deficiencies, conditionally admitted students will be advised to register for additional freshman level courses prior to taking required courses and may even be advised to take a reduced course load. Students should consult their advisor for specific requirements. It should be noted that these students may not be able to graduate in four years. All students admitted under this policy will undergo an academic review after two semesters of full time enrollment.

Based on a cumulative GPA of 2.5 and a "C" or better in Math 131, GEEN 100, CHEM 106, and ENGL 100, conditionally admitted freshmen will be unconditionally admitted to MEEN. Students who do not meet the requirements of the one-year review will be transferred to The Center for Academic Excellence for further advisement.

## **International Programs Study Abroad**

All students in *good academic standing* at NC A&T may study abroad for one or two semesters. Most programs require a minimum 2.0 GPA. However, there are programs that require a higher GPA. You may apply to study abroad after your first semester on campus and complete study abroad before your last semester as a senior. The credits earned abroad are transferred to North Carolina A&T toward your degree requirements.

### **Global Studies Certificate**

NCA&T requires all students to take one Global Studies course to complete their core requirements. The Global Studies Certificate Program (<http://www.ncat.edu/~oip/global.htm>) is an interdisciplinary program designed to provide students the opportunity to better prepare themselves to live and work in a global society. The Global Studies Certificate can be earned while fulfilling the academic requirements for an NCA&T degree in every discipline.

Beginning Spring 2004, students who study abroad and take additional global studies courses can earn a Global Studies Certificate. To enroll, please contact the Office of International Programs, Room A-16, C. H. Moore Building.

### **Cooperative Education (CO-OP)**

Cooperative Education (CO-OP) is an optional program that offers students the opportunity to alternate periods of academic study with periods of work closely related to their major field of study. This program is non-compulsory; however, the University urges students to gain work experiences either through internships or cooperative education assignments prior to graduating. To search and apply for a co-op, please check with Office of Career Services at Room 101 Murphy Hall. [http://www.careerserv.ncat.edu/apply\\_for\\_co-op.htm](http://www.careerserv.ncat.edu/apply_for_co-op.htm)

In the MCEN department, an optional course MCEN 550 is intended for students to register in the last of the three co-op sessions. Students in the CO-OP program should retain all reports for getting the course credit.

#### **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. Prerequisites: Senior standing in engineering and permission of instructor. (F;S)

## Descriptions of Mechanical Engineering Courses

**MEEN 104. Graphics for Mechanical Engineering Credit 2(0-4)**

This is an introductory course in computer aided graphics and design for mechanical engineers. This course will familiarize students with conventions of 2-D graphical representation of mechanical components and 3-D solid modeling. Prerequisites: None. (F;S)

**MEEN 210. Analytical Methods in Engineering Credit 3(3-0)**

This course introduces contemporary computational methods and tools for numerical analysis in engineering. It includes numerical methods in differentiation, integration, interpolation, and root-finding. Linear algebra topics include matrix manipulation, solution of linear simultaneous equations, and solution of ordinary differential equations. Statistical analyses, including concepts of sampling, sampling distributions, estimation, confidence intervals, hypothesis testing, and linear and nonlinear regression are introduced. Prerequisites: MATH 132 and GEEN 161 (both with C or higher grade). (F;S)

**MEEN 260. Materials Science Credit 2(2-0)**

This basic course in materials science covers the fundamental nature of materials including their physical, mechanical and chemical characteristics. Topics include: atomic arrangements and atomic bonding; phase diagrams; engineering properties; and selection of materials for specific applications. Prerequisite: CHEM 106 and MATH 131. (F;S)

**MEEN 313. Statics and Mechanics of Materials Credit 3(2-2)**

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. Prerequisites: MATH 131, PHYS 241 (F;S)

**MEEN 335. Mechanics I, Statics Credit 3(2-2)**

This course covers basic vector concepts of force, moment of a force; analytical and graphical techniques in the analysis of force and moment; conditions of equilibrium in frames, trusses, machine members under static loads; laws of friction; distributed forces, determination of centroid, mass center, area and mass moment of inertia. Prerequisites: MATH 131, PHYS 241. (F;S;SS)

**MEEN 336. Strength of Materials Credit 3(2-2)**

This course covers the analysis of stress and strain, stress-strain relation, applications, torsional and flexural loadings, flexural deflections, combined loading, and columns. Prerequisite: MEEN 335. (F;S;SS)

**MEEN 337. Mechanics II, Dynamics Credit 3(2-2)**

This introductory course covers the motions of particles and rigid bodies and the forces that accompany or cause those motions. Topics include Newton's laws, the work and energy principle, and the impulse and momentum principle. The course includes the use of computational software to solve numerical problems. Prerequisites: MEEN 335 and MATH 231. (F;S;SS)

**MEEN 360. Fundamentals of Materials Science Credit 3(3-0)**

This course explores the relationships between the structure of materials and their properties and performance. Topics include crystal structure, defects and characterization at the micro as well as nano scale, phase diagrams and phase transformations, physical properties including mechanical, electrical, optical and magnetic properties, and chemical properties including corrosion and environmental issues. Emerging advanced materials, such as multifunctional polymers, biomaterials, composites, and nanomaterials are discussed. Prerequisites: CHEM 106 and MATH 131. (F;S)



and applications; heat treatment and strengthening mechanisms; various polymeric, ceramic and composite materials and their applications; failure theories; project work involving selection and design with various material systems. Prerequisites: MEEN 360. (F;S)

**MEEN 474. Mechanical Engineering Design Credit 3(3-0)**

This course provides an introduction to mechanical design. Emphasis is placed on the design of machine elements for static and fatigue strength. Other topics such as codes and standards, project planning and communication are also covered. Team design projects are assigned. Prerequisites: MEEN-336. (F;S)

**MEEN 501. General Engineering Topics Review Credit 1(0-3)**

This course reviews the engineering topics normally covered in the General Engineering sections of the Fundamentals of Engineering Examination. The course emphasizes extensive problem solving and helps students prepare for the FE exam. Prerequisites: Senior Standing. (F)

**MEEN 502. Mechanical Engineering Laboratory III Credit 1(0-2)**

This is the third course in the sequence of four mechanical engineering laboratories. The course is devoted to the design of experiments. Student teams will apply statistical methods to design experiments, analyze data, and evaluate and predict reliability. Prerequisites: MEEN 403. (F;S)

**MEEN 503. Mechanical Engineering Laboratory IV Credit 1(0-2)**

This is the final course in the four-course mechanical engineering laboratory sequence. The course includes selected experiments in heat transfer and thermodynamics. Prerequisites: MEEN 403; Corequisite: MEEN 562. (F;S)

**MEEN 540. Vibrations and Controls Credit 3(3-0)**

This course introduces the modeling, analysis and simulation of free and forced vibrations of damped and undamped, single and multi-degree of freedom systems and the basic properties of feedback control, and the fundamentals of control system design using root locus and frequency response methods. Prerequisite: MEEN 440. (F;S)

**MEEN 544. Special Undergraduate Project Variable Credit (1-3)**

This is a senior level project of interest to students. A faculty member will serve as a project advisor. Projects may include design, analysis, testing, and/or experimental work. Prerequisites: Permission of department and faculty member as an advisor. (DEMAND)

**MEEN 562. Heat Transfer Credit 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 are required. Prerequisites: MEEN-416 (or MEEN-415), MEEN-441, MATH 431. (F;S)

**MEEN 565. Computer-Aided Design of Machine Elements Credit 3(3-0)**

This course covers the principles and current practices of machine element design, including solid modeling and finite element analysis. Prerequisite: MEEN-474. (F;S)

**MEEN 572. Mechanical Engineering Seminar Credit 1(1-0)**

This weekly seminar course utilizes invited speakers to address such topics as resume preparation, interviewing, ethics and professional registration, as well as technical topics presented by graduate students and faculty researchers. Prerequisite: senior standing in mechanical engineering. (S)

**MEEN 573. Mechanical Engineering Senior Project I Credit 3(2-2)**

This is the first part of the senior capstone design course. Lectures include design methodologies, ethics, and professional practice. Team design projects begin in MEEN 573 and are continued during the following semester in MEEN-574. Oral and written reports are required. Prerequisites: MEEN 442, MEEN 446, and

MEEN 474. (F)

**MEEN 574. Mechanical Engineering Senior Project II Credit 3(0-6)**  
This is second part of the senior capstone design course. Work continues on the design project begun in MEEN-573. Written and oral progress and final design reports are required. Prerequisite: MEEN-573. (S)

**MEEN 576. Propulsion Credit 3(3-0)**  
This introductory course to aero propulsion systems includes coverage of one-dimensional internal flow of compressible fluids, normal shock, flow with friction, and simple heat addition. The basic concepts are applied to air-breathing aircraft propulsion systems. Prerequisites: MEEN 415 (or MEEN 416), MEEN-441. (DEMAND)

**MEEN 577. Aerodynamics and Propulsion Laboratory Credit 1(0-2)**  
This is a laboratory course which provides experimental verification of concepts learned in MEEN 415 and MEEN 576. Experiments are performed to reinforce the concepts from the lecture courses including wind tunnel experiments and performance testing of a gas turbine engine. Prerequisite: MEEN 415, Corequisite: MEEN 576. (DEMAND)

**MEEN 578. Flight Vehicle Performance Credit 3(3-0)**  
This course provides an introduction to the performance analysis of aircraft. Aircraft performance in gliding, climbing, level, and turning are analyzed as well as calculation of vehicle take off and landing distance, range and endurance. Prerequisites: MATH-231 and MEEN-337. (DEMAND)

**MEEN 580. Aerospace Vehicle Design Credit 3(2-2)**  
This is the capstone design course for the aerospace option. This course requires the synthesis of knowledge acquired in previous courses and the application of this knowledge to the design of a practical aerospace vehicle system. Prerequisites: MEEN-422, MEEN-474, MEEN-576, MEEN-578 and ELEN-410. (DEMAND)

**MEEN 606. Mechanical Vibrations Credit 3(3-0)**  
This is a course in modeling, analysis and simulation of free and forced vibrations of damped and undamped, single and multi-degree of freedom systems. Prerequisites: MEEN-440 and MATH-431. (S)

**MEEN 613. Composite Materials Credit 3(3-0)**  
This course introduces the processing of fiber-reinforced composite materials, anisotropic theory, and test methods for composites. Topics include different methods of processing polymeric composites, process control parameters, anisotropic constitutive equations, classes of anisotropy and associated elastic constants, micromechanics models, theories of failure, test methods, classical laminate theory, and special types of laminates. The concepts are applied to the design of simple composite structural components. This course includes a laboratory component for students to learn processing and testing of composite materials. Prerequisites: MEEN 260 and MEEN 336 or their equivalents. (Fall)

**MEEN 614. Mechanics of Engineering Modeling Credit 3(3-0)**  
This course introduces engineering modeling techniques including time dependent integration simulation models of systems, and finite difference and finite element methods in mechanics. Prerequisites: MEEN 210, MEEN 336, and MATH 431 or equivalent. (DEMAND)

**MEEN 626. Advanced Fluid Dynamics Credit 3(3-0)**  
This course presents an overview of Navier-Stokes Equations, continuity equation, energy equation, inviscid flow, potential theory, complex potentials, and conformal mapping. Prerequisite: MEEN 416 or equivalent. (DEMAND)

**MEEN 630. Fundamentals of Thin Films Credit 3(3-0)**  
This course introduces the underlying science, technology and practical applications of materials in thin film

form. The superior physical, chemical and mechanical properties of thin films with respect to their bulk counterparts are explained in terms of their structure. Topics include: vacuum science and technology, substrate surfaces and film nucleation, preparation of thin and thick films, film structure and its characterization and physical properties. **(DEMAND)**

**MEEN 645. Aluminum-Based Product Design and Manufacturing Credit 3(3-0)**

This course introduces students to the principles of product and manufacturing process design specifically applicable to aluminum-based materials. Material properties of aluminum are compared with those of other commercial materials. Raw material fabrication and product manufacturing processes are presented. The interactions between processes and material properties are described. Case studies are presented to guide the student in successful completion of design projects. Prerequisites: MEEN 260 and MEEN 474. **(DEMAND)**

**MEEN 646. Advanced Manufacturing Processes Credit 3(3-0)**

Theory, application, and design considerations for forming and machining are covered in this course. Additional topics covered include: machines and tooling in modern manufacturing processes, dimensional and tolerance analysis, and control of work piece and tool. Design projects of molds, dies, presses, jigs and fixtures or automated machinery are required. Prerequisites: MEEN 446 or equivalent, MEEN 474, MATH 231. **(DEMAND)**

**MEEN 647. Computer Integrated Mechanism Design Credit 3(3-0)**

This is a course in modern computer simulation tools and the underlying theories for synthesis and analysis of mechanical systems consisting of linkages, cams, and gears. Prerequisite: MEEN-440. **(DEMAND)**

**MEEN 650. Mechanical Properties and Structure of Solids Credit 3(3-0)**

This course is an examination of the elastic and plastic behavior of matter in relation to its structure, both macroscopic and microscopic. Major representative classes of materials are thermoplastic materials, elastomers, glasses, ceramics, metals, and composites. Prerequisite: MEEN-460 or equivalent. **(DEMAND)**

**MEEN 651. Aero Vehicle Structures II Credit 3(3-0)**

This course covers deflection of structures, indeterminate structures, fatigue analysis, and minimum weight design. Finite element methods and software are utilized. Prerequisite: MEEN-336, MEEN-474. **(DEMAND)**

**MEEN 652. Aero Vehicle Stability & Control Credit 3(3-0)**

This course covers longitudinal, directional and lateral static stability and control of aerospace vehicles. It also covers linearized dynamic analysis of the motion of a six degree-of-freedom flight vehicle in response to control inputs and disturbances through use of the transfer function concept, plus control of static and dynamic behavior by vehicle design (stability derivatives) and/or flight control systems. Prerequisites: MEEN-415 or MEEN-416, MEEN-440. **(DEMAND)**

**MEEN 653. Aero Vehicle Flight Dynamics Credit 3(3-0)**

This course covers the basic dynamics of aerospace flight vehicles including orbital mechanics, interplanetary and ballistic trajectories, powered flight maneuvers and spacecraft stabilization. Prerequisites: MEEN-440. **(DEMAND)**

**MEEN 654. Advanced Propulsion Credit 3(3-0)**

This covers is a second course in propulsion. It covers the analysis and design of individual components and complete air-breathing propulsion systems including turbo fans, turbo jets, ram jets and chemical rockets. Prerequisite: MEEN-576. **(DEMAND)**

**MEEN 655. Computational Fluid Dynamics Credit 3(3-0)**

This course provides an introduction to numerical methods for solving the exact equations of fluid dynamics. Finite difference methods are emphasized as applied to viscous and inviscid flows over bodies. Students are

introduced to a modern Computational Fluid Dynamics computer code. Prerequisites: MATH-431; MEEN-415 or MEEN-416. **(DEMAND)**

**MEEN 656. Boundary Layer Theory Credit 3(3-0)**

This course covers the fundamental laws governing flow of viscous fluids over solid boundaries. Exact and approximate solutions are studied for various cases of boundary layer flow including laminar, transitional and turbulent flow. Prerequisite: MEEN 415 or 416. **(DEMAND)**

**MEEN 657. Design of Thermal Systems Credit 3(3-0)**

This is a course in the selection of components for fluid and energy processing systems to meet system performance requirements. Computer-aided thermal design, simulation and optimization techniques, and investment economics are discussed. Design projects are assigned to demonstrate application of these topics. Prerequisites: MEEN 562 and INEN 260. **(DEMAND)**

**MEEN 663. Energy Conversion Systems Design Credit 3(3-0)**

This course covers the design of steam power systems, internal combustion power systems, refrigeration and heat pump systems and an overview of direct energy conversion devices. Power system design projects are assigned. Prerequisites: MEEN-416 and MEEN-442. **(DEMAND)**

**MEEN 667. Environmental Control Credit 3(3-0)**

This course deals with the principles of heating and air conditioning and their applications to design of environmental control systems; determination of building heating and cooling loads; principal equipment, layout and control are discussed for various types of systems. Prerequisites: MEEN-442 and MEEN-562. **(DEMAND)**

**MEEN 668. Gas Dynamics Credit 3(3-0)**

The course covers the principles of one-dimensional compressible fluid flow, normal shocks, and flow with friction, heating, and cooling. Two-dimensional flows are introduced. Prerequisites: MEEN-415 or 416 and MEEN-441. **(DEMAND)**

**MEEN 670. Internal Combustion Engines Credit 3(3-0)**

This course deals with the fundamental principles of spark-ignition and compression ignition engines, combustion phenomena, the effect of fuel-air mixture, design of components of an internal combustion engine, and testing and performance curves. Design projects are assigned. Prerequisite: MEEN-442 **(DEMAND)**

**MEEN 671. Turbomachinery Credit 3(3-0)**

This course covers the application of the cascade method to turbomachines; impulse and reaction turbines; compressible fluid dynamics; gas turbine principles, pumps, compressors and blowers; and the design of turbine elements. Project work is assigned. Prerequisites: MEEN-415 or MEEN-416 and MEEN-442. **(DEMAND)**

**MEEN 675. Solar Energy Fundamentals and Design Credit 3(3-0)**

This course deals with the characterization of solar radiation at the earth's surface. Solar collectors of both flat and concentrating types, and storage and distribution systems are discussed and analyzed. System sizing, design and economic analysis for space heating, water heating and industrial processes are covered. Prerequisite: MEEN-562. **(DEMAND)**

**MEEN 680. Applied Statistics in Mechanical System Design Credit 3(3-0)**

This course deals with the statistical nature of design and performance of mechanical systems. This includes statistical methods for evaluation of safety margin and factor of safety for static and fatigue loading, accuracy, precision, life and reliability of mechanical components and systems. Team projects are assigned. Prerequisite: MEEN 210, MEEN 474, or Consent of Instructor. **(DEMAND)**

**MEEN 685. Special Topics Credit 3(3-0)**  
This course is designed to allow the introduction of potential new courses on a trial basis or special content courses on a once only basis. The topic of the course and title are determined prior to registration. Prerequisite: Consent of instructor. **(DEMAND)**

### **Descriptions of Other Required Engineering Courses**

#### **General Engineering**

**GEEN 100. Engineering Design and Ethics Credit 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. Prerequisite: None.

**GEEN 161. Computer 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

**GEEN 110. Colloquium I Credit 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. Prerequisite: None.

**GEEN 120. Colloquium II Credit 0(1-0)**  
Learning styles, advising, professional society activities, coop, internships, career planning, faculty-student interactions, contemporary issues in the discipline, corporate information sessions. Prerequisite: None.

#### **Electrical Engineering**

**ELEN 440 Electrical Circuits and Systems Credit 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. Prerequisite: MATH 431 and PHYS 242.

#### **Industrial Engineering**

**INEN 260. Engineering Economics Credit 2(2-0)**  
This course provides sound understanding of basic concepts in compound interest and its applications in engineering problems. Methods of comparative economic analysis such as annual cost, present worth and rate of return are discussed. Depreciation, replacement, tax effects and sensitivity analysis are discussed. Prerequisite: MATH 131.

### **Descriptions of Required Courses in Math and Sciences**

#### **Chemistry**

**CHEM 106. General Chemistry VI Credit 3(3-0)**  
A course which 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 CHEM 099.

**CHEM 116. General Chemistry VI Laboratory Credit 1(0-3)**  
A course which 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 the laboratory. Corequisite: Chemistry 106.

## Mathematics

**MATH 131. Calculus I Credit 4(4-0)**

Limits and continuity of functions, the derivative, applications of the derivative, the definite integral and applications of the definite integral. Prerequisite: MATH 110 or appropriate approval.

**MATH 132. Calculus II Credit 4(4-0)**

Topics in analytical geometry, differentiation and integration of exponential, logarithmic, inverse trigonometric and hyperbolic functions, additional techniques and applications of integration, indeterminate forms, improper integrals, Taylor's Formula and infinite series. Prerequisite: MATH 131.

**MATH 231. Calculus III Credit 4(4-0)**

This course will cover plane curves and polar coordinates, vectors and solid geometry, vector valued functions, partial differentiation, multiple integrals, applications of multiple integrals and vector analysis. Prerequisite: MATH 132.

**MATH 431. Introduction to Differential Equations Credit 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, Laplace transforms. Prerequisite: MATH 132.

## Physics

**PHYS 241. General Physics I Credit 3(3-0)**

This is a calculus-based physics course that covers the fundamental principles of Newtonian mechanics, heat, and thermodynamics. Prerequisite MATH 131; Corequisites: MATH 132, PHYS 251.

**PHYS 242. General Physics II Credit 3(3-0)**

This is a continuation of PHYS 241. It is a calculus-based study of physics, which covers the fundamental principles of electricity, magnetism, wave motion, and optics. Prerequisite PHYS 241; Corequisite: PHYS 252.

**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.

**PHYS 252. General Physics II Laboratory Credit 1(0-2)**

This course is a continuation of PHYS 251. Corequisite: PHYS 242.

## Descriptions of Foundation Courses in the University Studies (General Education)

**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. Prerequisites: None.

**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



**UNST 204. 21st Century Organizations: Attitudes, Attention Drivers, and Angst**

This course introduces students to the factors that affect organizations in the 21st century by exploring principles, practices, and pitfalls that affect organizational success or failure in a global society. The empowerment of individuals to create organizational cultures is demonstrated through case studies of successful organizations (e.g., Fortune 100 companies). Students will learn about leadership, communication, and group dynamics through the investigation of targeted units.

**UNST 205. The Impact of Energy and the Environment on Development in Non-Industrialized Countries**

This course examines issues and challenges that result from the formation of energy and environmental practices and policies of non-industrialized countries. Students use historical perspective to explore why non-industrialized nations are energy dependent.

**UNST 206. Scientific Revolutions and Social Change**

This course highlights the complex connections between science, technology, scientific breakthroughs, and social, political and economic change. The experiences of and lessons from the Industrial Revolution of the 18th Century will be used to understand the social, political and ethical implications and challenges of the current revolution in nanotechnology. Students are led to discover the deeper relationships between seemingly unrelated events in history, and explore competing interpretations given by different disciplines.

**UNST 207. Ethics and Technology**

This course examines ethical issues arising from scientific and technological advancements. The central normative question students will consider is: Simply because we can do something does this mean we should? After exploring various standards of morality, students analyze issues such as reproductive technologies, cloning, genetic engineering, stem cell research, life-span extension, genetically modified foods, and ethical concerns within nanotechnology.

**UNST 208. Foundations of Negotiation and Conflict Resolution**

This course explores negotiation, arbitration, and mediation techniques. It encourages students to manage conflict and negotiate peaceful solutions to business, economic development, social and political problems in our local communities and global societies.

**UNST 209. Disparities in Public Health Care: The Effects on Race, Gender, and Class**

This course is designed to explore the disparities that exist among the categories of race, gender, and class in relationship to healthcare. The course focuses on six areas of major health inequities including infant mortality, cancer, cardiovascular disease, diabetes, HIV/AIDS and immunizations.

**UNST 210. Ethics in Information Technology**

This course will explore moral, ethical, and legal problems associated with information technologies including issues such as security and privacy. Students will critique ethical dilemmas, debate moral issues, and develop ideas for reducing ethical problems and coping with their effects.

**UNST 213. Evolution and Social Implication of Technology. Theme: Technology and Progress**

This course examines diverse technology systems, such as biotechnology, communication, construction, manufacturing, medical, and transportation. Discussion focuses on the interaction of technology with human health, the environment, the global economy, and politics, as well as technological forecasting and assessment.

**UNST 214. Maps, Mapping, and Environmental Health**

This course encourages students to conceptualize and assess environmental and health issues from a spatial or geographical perspective. Topics such as air pollution, water pollution, population dynamics, occupational health, food protection, epidemiology, disease causation and prevention, vector-borne disease, and consumer protection are covered. Geographic Information Systems technology is used to model environmental health topics.

**UNST 215. Comparative Socio-Cultural Environments of Health Care Systems**

This course examines the differential effects of social, political, economic and cultural factors on development and utilization of health care systems across diverse societies. Students further explore the interrelationships between specific aspects of socio-cultural environment and the availability and use of health care.

**UNST 216. Genocide in the Modern World**

This course examines the concept of genocide, the deliberate murder of a specific group of people, through careful analysis and discussion of theoretical approaches, specific case studies, and relevant cultural artifacts, including literature and film.

**UNST 217. Health and Wellness in the 21st Century**

This course explores the impact of globalization on health and wellness from the perspectives of culture, religion, politics, history, economics and technology.

**UNST 218. Fitness for Life**

This course is a combination of classroom and activity-based learning activities with a focus on proper nutrition and the mastery of the knowledge and skills necessary for students to become accomplished monitors of their personal fitness.

**UNST 219. Technology and Public Wellness**

This course describes, reviews and challenges issues arising from the development of technology and the implications for public health policy. Students explore the relationship between the development and implementation of technology and cultural factors such as religion, politics, history and economics. The course also examines how technology influences health and wellness in local and global contexts. In addition students critically evaluate how technology policies of the industrialized superpowers influence the well-being of people in non-industrialized nations.

**UNST 220. Social Consequences of Scientific and Technological Progress In the African American Experience**

This course presents an analytical approach to the issues of social justice and environmental racism with a focus on African-American communities. Students explore historical and contemporary social and economic impacts of science and technology, how and why they differentially affect African-American communities, and how these consequences can be mitigated.

**UNST 221. Thematic Writing and Speaking: Technology and Society**

This course is designed to improve students' abilities to write, speak and think critically about important issues in the contemporary world by focusing on the rhetoric of science, technology and progress. Students examine rhetoric as represented in fiction and nonfiction: essays, short stories, drama, poetry, novels, film, popular culture (including popular science writing and journalism), and speeches.

**UNST 222. Introduction to Crime Studies and Research**

This course will introduce students to research methodologies used in the field of crime studies. Students examine the impact of crime studies research on public policy. The topics include math and quantitative research, competing theories of crime in society, and the relationship between legal and scientific reasoning.

**UNST 229. Contemporary Issues in Nuclear Energy**

This course is designed to present a current understanding of nuclear energy. Different reactor designs, economics of nuclear energy and management of nuclear energy will be reviewed. Nuclear power will be compared to other alternative energy sources. Emphasis will be placed upon regulations, environmental issues, health issues and security and safety concerns. Nuclear power and options for the future will be examined.

	STS	EES	CCS	HLS
AGEC300 Principles of Rural Sociology		X		
AGEN216 Geographic Information Systems in Engineering and Natural Resources	X	X		
BUAD361 Legal Environment of Business		X	X	
COMP390 Social Implications of Computing	X			
CRJS/SOCI 406 Criminology			X	X
EASC201 The Earth-Man's Environment		X		
ENGL206 Film and Culture	X			
ENGL231 World Literature II	X			
ENGL331 Writing for Science and Technology	X			
ENGL336 Postcolonial Novel	X			
GEOG200 Principles of Geography		X	X	
GEOG322 Economic Geography		X		
GEOM210 Cartography	X			
HEFS(or FCS)135 Food & Man's Survival				X
HIST203 North Carolina A&T State University: A Legacy of Social Activism			X	
HIST307 Historical Origins of Environmental Crises	X			
HIST312 History of Religions			X	
HIST332 The Modern Middle East			X	
HIST334 20th and 21st Century Women Activists of the World			X	
HIST417 Colonialism and Slavery in Latin America and the Caribbean			X	
HIST418 Conflict and Change in Post-Colonial Latin America and the Caribbean			X	
HIST435 Global History since 1945		X	X	
HIST461 History of the New South			X	
HPED219 Human Sexuality				X
HPED222 Health & Wellness in the 21st Century				X
ITT 385 Economic and Social Implications of Information Technology	X			
NURS305 Nutrition for Healthy Lifestyles				X
NURS315 Issues in Women's Health				X
NURS415 Health Care in a Global Society				X
PHIL260 Introduction to Philosophy			X	
PHIL266 Contemporary Moral Problems	X			X
PHIL308 Culture and Value		X		
POLI250 Introduction to Public Policy		X		
POLI410 Public Policy and Technology	X	X		
POLI415 Environmental Policy		X		
POLI446 Politics of the Americas			X	
POLI448 Politics of Transportation	X	X	X	
PSYC320 General Psychology				X
SOCI200 Introduction to Anthropology		X		
SOCI300 Topics in Cultural Anthropology		X		
SOCI304 Social Aspects of Human Sexuality				X
SOCI308 Sociology of Marriage and the Family				X
SOCI/CRJS 406 Criminology			X	X

**STS** – UNST Theme-Based Courses in Science, Technology and Society

**EES** – UNST Theme-Based Courses in Energy, Environment and Society

**CCS** – UNST Theme-Based Courses in Community, Conflict and Society

**HLS** – UNST Theme-Based Courses in Health, Lifestyles and Society

	STS	EES	CCS	HLS
SOCI473 Introduction to Population Studies	X			
SOWK370 Aging in Society				X
SOWK409 Disability and Employment				X
SOWK413 The Community			X	
SOWK415 Medical Sociology	X			
UNST201 Inventing America: Science, Technology, and Progress	X			
UNST202 Ecological Approach to an Active Healthy Lifestyle				X
UNST203 Technology, the Real, the Fake and the Authentic	X			
UNST204 21st Century Organizations: Attitudes, Attention Drivers, and Angst			X	
UNST205 The Impact of Energy and the Environment on Development in Non-Industrialized Countries		X		
UNST206 Scientific Revolutions and Social Change	X			
UNST207 Ethics & Technology	X			
UNST208 Foundations of Negotiation And Conflict Resolution			X	
UNST209 Disparities In Public Health Care: The Effects On Race, Gender, And Class				X
UNST210 Ethics in Information Technology	X			
UNST211 Case Studies in Environmental Issues		X		
UNST212 Contemporary Issues in Energy Uses and Sources		X		
UNST213 Evolution and Social Implication of Technology. Theme: Technology and Progress	X			
UNST214 Maps, Mapping, and Environmental Health				X
UNST215 Comparative Socio-Cultural Environments of Health Care Systems				X
UNST216 Genocide in the Modern World			X	
UNST217 Health and Wellness in the 21st Century				X
UNST218 Fitness for Life				X
UNST219 Technology and Public Wellness	X			
UNST220 Social Consequences of Scientific and Technological Progress In the African American Experience			X	
UNST221 Thematic Writing and Speaking: Technology and Society	X	X	X	X
UNST222 Introduction to Crime Studies and Research			X	
UNST229 Contemporary Issues in Nuclear Energy		X		

**STS** – UNST Theme-Based Courses in Science, Technology and Society

**EES** – UNST Theme-Based Courses in Energy, Environment and Society

**CCS** – UNST Theme-Based Courses in Community, Conflict and Society

**HLS** – UNST Theme-Based Courses in Health, Lifestyles and Society

**Appendices**  
**Appendix 1: Mechanical Engineering Curriculum - 2006**

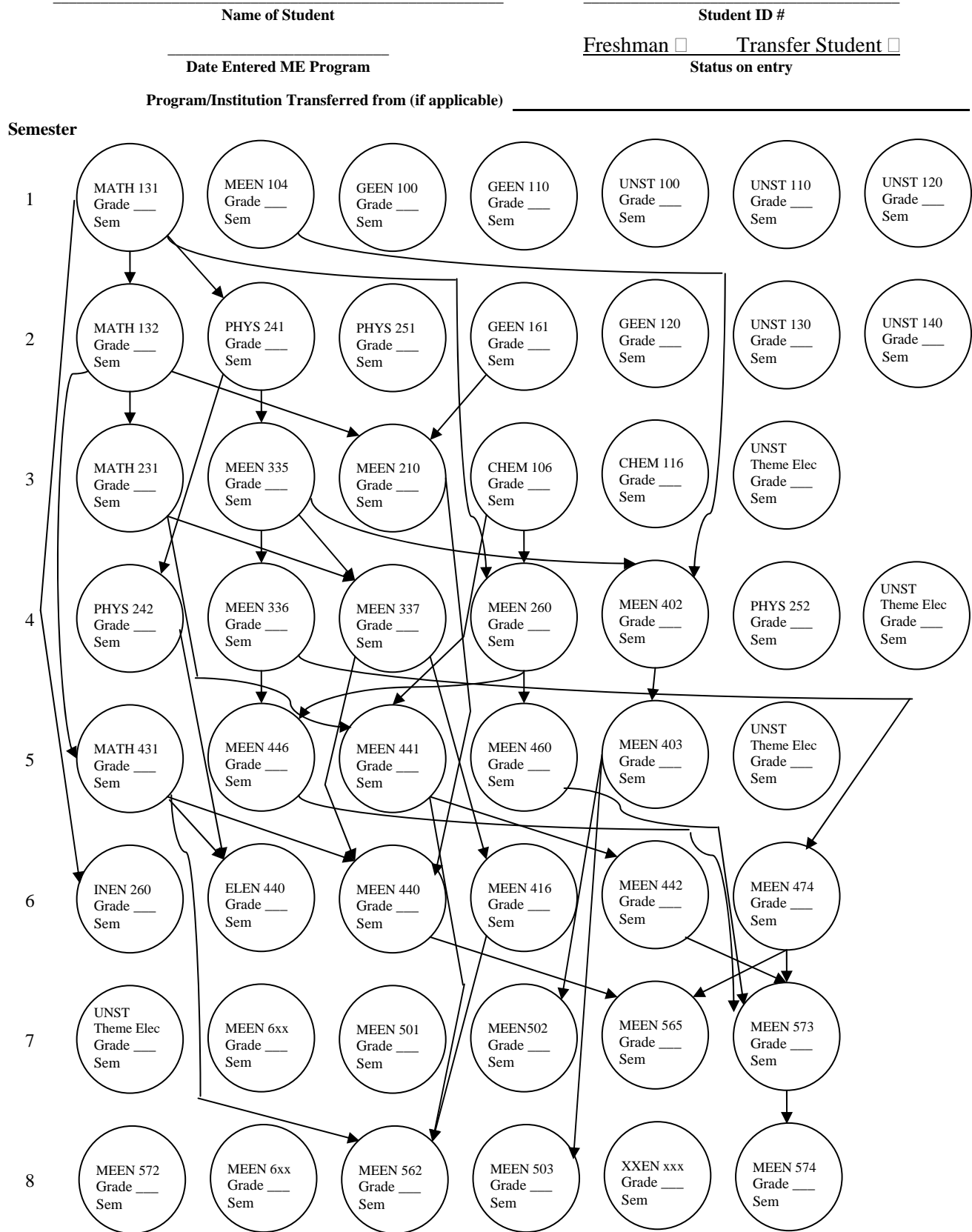
Fall Semester			Spring Semester		
	Course Title	cr.		Course Title	cr.
<b>Freshman Year</b>					
	UNST 100 University Experience	1		UNST 130 Analytical Reasoning	3
	UNST 110 Critical Writing	3		UNST 140 African American Experience	3
	UNST 120 Contemporary World	3		MATH 132 Calculus II	4
	MATH 131 Calculus I	4		PHYS 241 General Physics I	3
	GEEN 100 Engineering Design and Ethics	2		PHYS 251 General Physics I Lab.	1
[1, 2]	GEEN 110 Colloquium I	0	[1, 2]	GEEN 120 Colloquium II	0
	MEEN 104 Engineering Graphics	2		GEEN 161 Computer Programming in MATLAB	2
	<b>Semester Total</b>	<b>15</b>		<b>Semester Total</b>	<b>16</b>
<b>Sophomore Year</b>					
	UNST Cluster Theme Elective	3		UNST Cluster Theme Elective	3
	MATH 231 Calculus III	4		PHYS 242 General Physics II	3
	CHEM 106 General Chemistry VI	3		PHYS 252 General Physics II Lab	1
	CHEM 116 General Chemistry VI Lab	1		MEEN 260 Materials Science	2
	MEEN 210 Analytical Methods in Engr	3		MEEN 336 Strength of Materials	3
	MEEN 335 Mechanics I: Statics	3		MEEN 337 Mechanics II: Dynamics	3
				MEEN 402 Mechanical Engineering Lab I	1
	<b>Semester Total</b>	<b>17</b>		<b>Semester Total</b>	<b>16</b>
<b>Junior Year</b>					
	UNST Cluster Theme Elective	3		ELEN 440 Electrical Circuit Analysis	3
	MATH 431 Introduction to Differential Equations	3		INEN 260 Engineering Economics	2
	MEEN 403 Mechanical Engineering Lab II	1	[3]	MEEN 416 Fluid Mechanics	3
	MEEN 441 Fundamentals of Thermodynamics	3		MEEN 440 System Dynamics	3
	MEEN 446 Manufacturing Processes	3	[4]	MEEN 442 Applied Thermodynamics	3
	MEEN 460 Modern Engineering Materials	3		MEEN 474 Engineering Design	3
	<b>Semester Total</b>	<b>16</b>		<b>Semester Total</b>	<b>17</b>
<b>Senior Year</b>					
	UNST Cluster Theme Elective	3		MEEN 503 Mechanical Engineering Lab IV	1
	MEEN 501 General Engineering Topics Review	1		MEEN 562 Heat Transfer	3
	MEEN 502 Mechanical Engineering Lab III	1		MEEN 572 Senior Seminar	1
	MEEN 565 Computer Aided Design of Machines	3	[5]	MEEN 574 Mechanical Engr Design Project II	3
[5]	MEEN 573 Mechanical Engr Design Project I	3	[6]	MEEN 6XX Mechanical Engr Technical Elective	3
[6]	MEEN 6XX Mechanical Engr Technical Elective	3	[6]	XXEN XXX Engineering Technical Elective	3
	<b>Semester Total</b>	<b>14</b>		<b>Semester Total</b>	<b>14</b>

**(Total Credit Hours: 125)**

Notes:

- [1] MEEN students should take Section 5 of the colloquium courses.
- [2] Transfer students from other engineering programs may exempt from these colloquium courses.
- [3] Students following the Aerospace Specialization should take MEEN 415-Aerodynamics instead.
- [4] Students following the Aerospace Specialization should take MEEN 576-Propulsion instead.
- [5] Students following the Aerospace Specialization should choose aerospace related senior design project.
- [6] Students following the Aerospace Specialization should choose aerospace related technical electives

## Appendix 2: Prerequisite Flow Chart- 2006 MECHANICAL ENGINEERING CURRICULUM



## Appendix 3: Curriculum Changes in 2006 & 2007 and Phase-in Plan

### Major changes in 2006 curriculum

- Total credit hours **125** hrs, reduced from **126** hours in 2005
- Courses removed: 26 credit hours in General Education
  - Humanities Elective (6 cr.), Social Sciences Elective (3 cr.), History Electives (6 cr.)
  - Econ 200 Principles of Economics (Micro) (3 cr.) **or** Econ 201 Principles of Economics (Macro) (3 cr.)
  - Health/PE Electives (2 cr.)
  - English 100 Ideas and Their Expression I (3 cr.), English 101 Ideas and Their Expression II (3 cr.) (or English 331 Writing for Science and Technology) (3 cr.)
- Course added: 25 credit hours in University Studies
  - Foundation Courses: 13 credit hours
    - UNST 100 University Experience (1 cr.), UNST 110 Critical Writing (3 cr.), UNST 120 Contemporary World (3 cr.), UNST 130 Analytical Reasoning (3 cr.), and UNST 140 African American Experience (3 cr.)
  - Theme-Based Courses: 12 credit hours

### Major changes in 2007 curriculum

- Total credit hours **126** hrs, increased from **125** hours in 2006
- MEEN 260 Materials Science (2 cr.) is dropped from MEEN curriculum and is replaced by MEEN 360 Fundamentals of Materials Science (3 cr.)
  - MEEN 260 Materials Science is for non-MEEN majors only.
- Engineering Elective XXEN XXX (3 cr.) is replaced by MEEN 540 Vibrations and Controls (3 cr.)

### Phase-in Plan to 2007 Curriculum

- Students who do not have MEEN 260 will now take MEEN 360.
- Students who do not have Engineering Elective XXEN will now take MEEN 540.

### Appendix 4: Mechanical Engineering Curriculum – 2005 (Revised)

Fall Semester			Spring Semester				
	Course Title	cr.		Course Title	cr.		
<b>Freshman Year</b>							
	ENGL 100	Ideas and Expression I	3	ENGL 101/331	Ideas & Expr. II or Tech. Writing	3	
	HIST XXX	History Elective	3	HIST XXX	History Elective	3	
	PHED XXX	Health/Phys Ed Elective	2	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	
[1, 2]	GEEN 110	Colloquium I	0	[1, 2]	GEEN 120	Colloquium II	0
	MEEN 104	Engineering Graphics	2		GEEN 161	Computer Programming in MATLAB	2
	<b>Semester Total</b>		<b>16</b>		<b>Semester Total</b>		<b>16</b>
<b>Sophomore Year</b>							
	SOC SCI	Elective	3		ECON 200/201	Principles of Econ (Micro/Macro)	3
	MATH 231	Calculus III	4		PHYS 242	General Physics II	3
	CHEM 106	General Chemistry VI	3		PHYS 252	General Physics II Lab	1
	CHEM 116	General Chemistry VI Lab	1		MEEN 260	Materials Science	2
	MEEN 210	Analytical Methods in Engr	3		MEEN 336	Strength of Materials	3
	MEEN 335	Mechanics I: Statics	3		MEEN 337	Mechanics II: Dynamics	3
	<b>Semester Total</b>		<b>17</b>		<b>Semester Total</b>		<b>16</b>
<b>Junior Year</b>							
	Humanities	Elective	3		ELEN 440	Electrical Circuit Analysis	3
	MATH 431	Introduction to Differential Equations	3		INEN 260	Engineering Economics	2
	MEEN 403	Mechanical Engineering Lab II	1	[3]	MEEN 416	Fluid Mechanics	3
	MEEN 441	Fundamentals of Thermodynamics	3		MEEN 440	System Dynamics	3
	MEEN 446	Manufacturing Processes	3	[4]	MEEN 442	Applied Thermodynamics	3
	MEEN 460	Modern Engineering Materials	3		MEEN 474	Engineering Design	3
	<b>Semester Total</b>		<b>16</b>		<b>Semester Total</b>		<b>17</b>
<b>Senior Year</b>							
	Humanities	Elective	3		MEEN 503	Mechanical Engineering Lab IV	1
	MEEN 501	General Engineering Topics Review	1		MEEN 562	Heat Transfer	3
	MEEN 502	Mechanical Engineering Lab III	1		MEEN 572	Senior Seminar	1
	MEEN 565	Computer Aided Design of Machines	3	[5]	MEEN 574	Mechanical Engr Design Project II	3
[5]	MEEN 573	Mechanical Engr Design Project I	3	[6]	MEEN 6XX	Mechanical Engr Technical Elective	3
[6]	MEEN 6XX	Mechanical Engr Technical Elective	3	[6]	XXEN XXX	Engineering Technical Elective	3
	<b>Semester Total</b>		<b>14</b>		<b>Semester Total</b>		<b>14</b>

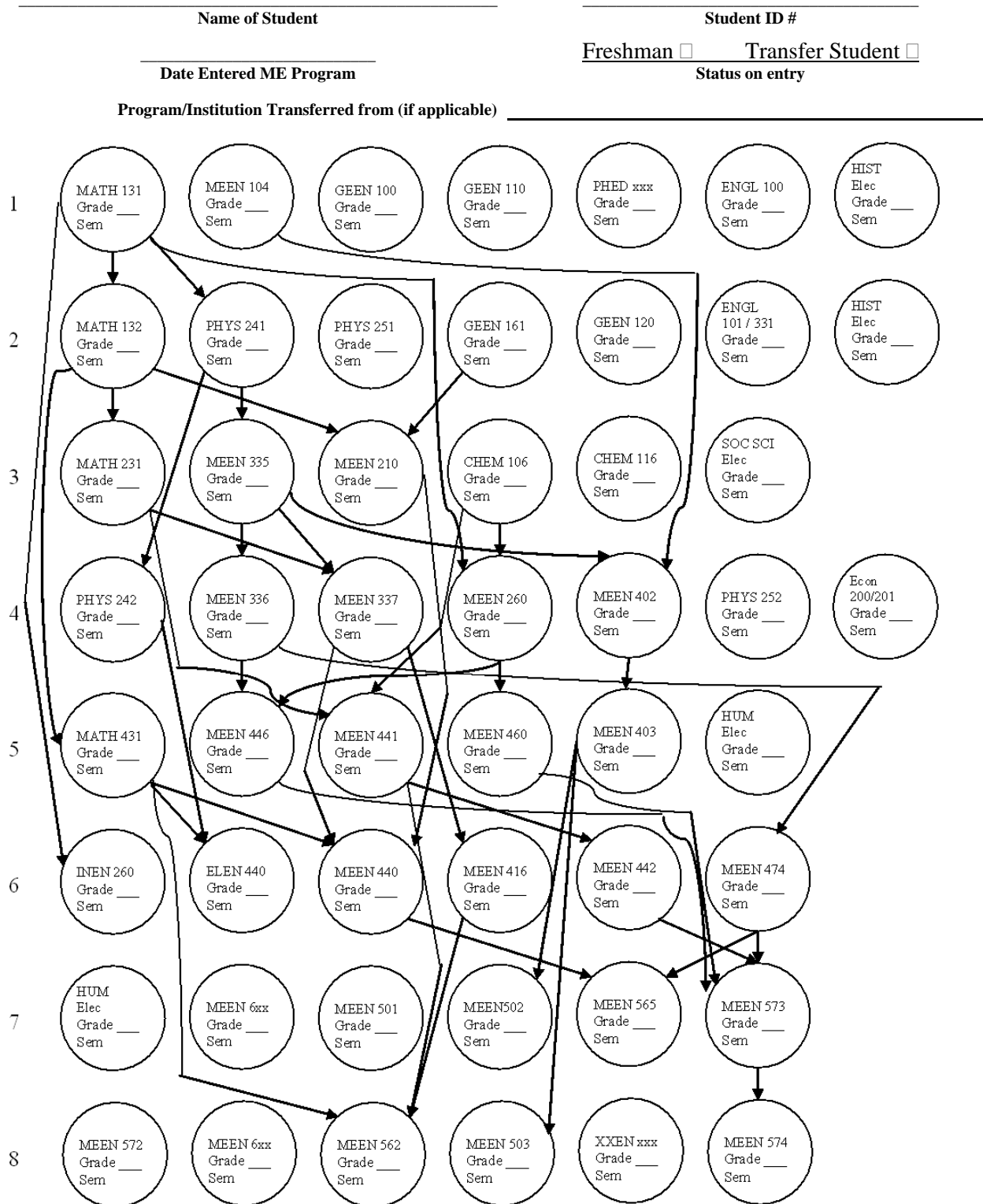
**(Total Credit Hours: 126)**

Notes:

- [1] MEEN students should take Section 5 of the colloquium courses.
- [2] Transfer students from other engineering programs may exempt from these colloquium courses.
- [3] Students following the Aerospace Specialization should take MEEN 415-Aerodynamics instead.
- [4] Students following the Aerospace Specialization should take MEEN 576-Propulsion instead.
- [5] Students following the Aerospace Specialization should choose aerospace related senior design project.
- [6] Students following the Aerospace Specialization should choose aerospace related technical electives.

## Appendix 5: Prerequisite Flow Chart - 2005 (Revised)

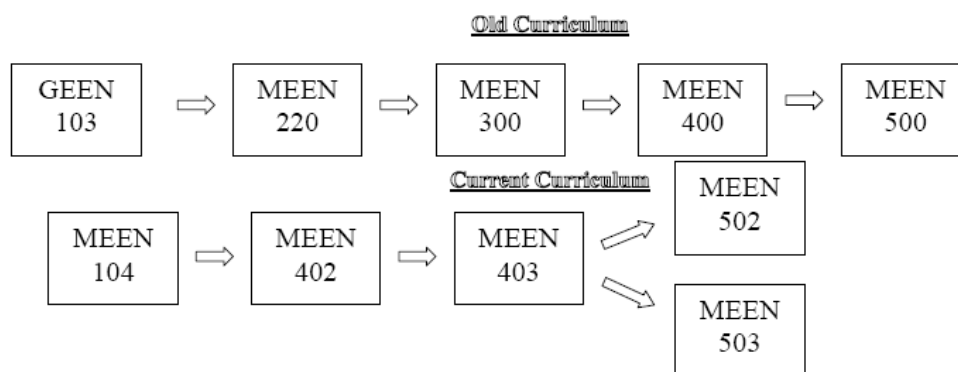
### MECHANICAL ENGINEERING CURRICULUM



## Appendix 6: Major Curriculum Changes in 2005 and Phase-in Plan

Courses removed from MEEN Curriculum	Courses added to MEEN Curriculum
GEEN 103 Computers in Engineering (2)	MEEN 104 Engineering Graphics (2)
	GEEN 161 Programming in Matlab (2)
MEEN 300 Mechanical Engineering Lab I (2)	MEEN 402 Mechanical Engineering Lab I (1)
MEEN 400 Mechanical Engineering Lab II (2)	MEEN 403 Mechanical Engineering Lab II (1)
MEEN 500 Mechanical Engineering Lab III (2)	MEEN 502 Mechanical Engineering Lab III (1)
	MEEN 503 Mechanical Engineering Lab IV (1)
MEEN 220 Mechanical Engineering Tools (3)	Engineering Technical Elective (3)

### Lab Sequence



### Phase-in Plan

Depending on courses taken, students will phase-in with one of the following paths:

1. Students who have not passed GEEN 103
  - Merge with new curriculum
  - No credit hour deficiency
2. Students who have taken GEEN 103, but not MEEN 220
  - Take MEEN 402 (1), 403 (1), 502 (1), and 503 (1)
  - Short of five credit hours. To rectify this, students should:
    - Take an Engineering Elective (3)
    - Take a transitional course – MEEN 104 (2) - CAD
3. Students who have taken MEEN 220, but not MEEN 300
  - Take MEEN 402 (1), 403 (1), 502 (1), and 503 (1)
  - Short of two credit hours. To rectify this, students should:
    - Engineering Elective (3)
4. Students who have taken MEEN 300, but not MEEN 400
  - Take MEEN 403 (1), 502 (1), and 503 (1)
  - Short of one credit hour. To rectify this, students should take an Engineering Technical Elective (3):
5. Students who have taken MEEN 400, but not MEEN 500
  - Take MEEN 502 (1) and 503 (1)
  - No credit hour deficiency

Please note an **Engineering Elective (3)** is:

- Any MEEN 6xx level course
- Any MEEN 5xx/4xx elective course, i.e., MEEN 415, MEEN 576, or MEEN 578
  - MEEN 313 and MEEN 413 are courses for non-majors - These two courses will not satisfy this elective requirement.
- Any other engineering (ELEN, INEN, CAAE, CHEN, AREN, CIEN) courses at 2xx level and above which is not a cross-listing course. For example, CAAE 331 and MEEN 335 are the same course. Taking CAAE 331 after MEEN 335 will not satisfy this elective requirement.

## Appendix 7: Mechanical Engineering Curriculum in 2002, 2003, and 2004

### Fall

### Spring

#### Freshman Year

	Course Title	cr.	
	GEEN 100	Engineering Design & Ethics	2
[1,2]	GEEN 110	Colloquium I	0
	MATH 131	Calculus I	4
	CHEM 106	Chemistry	3
	CHEM 116	Chemistry Lab	1
	ENGL 100	Ideas and Expression I	3
	HIST	Elective	3
	<b>Total</b>		<b>16</b>

	Course Title	cr.	
	GEEN 103	Computer Lab II	2
[1,2]	GEEN 120	Colloquium II	0
	MATH 132	Calculus II	4
	PHYS 241	General Physics I	3
	PHYS 251	General Physics I Lab	1
	ENGL 101 or 331	Ideas & Expr. II or Tech. Writing	3
	HIST	Elective	3
	<b>Total</b>		<b>16</b>

#### Sophomore Year

	MEEN 210	Analytical Methods in ME	3
	MEEN 220	Mechanical Engineering Tools	3
	MEEN 335	Mechanics I, Statics	3
	MATH 231	Calculus III	4
	PHYS 242	General Physics II	3
	PHYS 252	General Physics II Lab	1
	<b>Total</b>		<b>17</b>

	MEEN 260	Materials Science	2
	MEEN 336	Strength of Materials	3
	INEN 260	Engineering Economics	2
	MATH 431	Differential Equations	3
	SOC SCI	Elective	3
	ECON 200/201	Principles of Econ (Micro/Macro)	3
	<b>Total</b>		<b>16</b>

#### Junior Year

	MEEN 300	Mechanical Engineering Lab I	2
	MEEN 337	Mechanics II, Dynamics	3
	MEEN 441	Fund of Thermodynamics	3
	MEEN 460	Modern Engineering Materials	3
	ELEN 440	Electric Circuit Analysis	3
	HUMANITIES	Elective	3
	<b>Total</b>		<b>17</b>

	MEEN 400	Mechanical Engineering Lab II	2
[3]	MEEN 416	Fluid Mechanics	3
	MEEN 440	System Dynamics	3
[4]	MEEN 442	Applied Thermodynamics	3
	MEEN 446	Manufacturing Processes	3
	MEEN 474	Engineering Design	3
	<b>Total</b>		<b>17</b>

#### Senior Year

	MEEN 501	General Engineering Topics Review	1
	MEEN 562	Heat Transfer	3
	MEEN 565	Computer Aided Des. of Machines	3
	MEEN 572	Senior Seminar	1
[5]	MEEN 573	ME Senior Project I	3
[6]	MEEN 6xx	Technical Elective	3
	<b>Total</b>		<b>14</b>

	MEEN 500	Mechanical Engineering Lab III	2
[5]	MEEN 574	ME Senior Project II	3
[6]	MEEN 6xx	Technical Elective	3
	HUMANITIES	Elective	3
	HEALTH/PE	Elective	2
	<b>Total</b>		<b>13</b>

**(Total Credit Hours: 126)**

Notes:

- [1] MEEN students should take Section 5 of the colloquium courses.
- [2] Transfer students from other engineering programs may exempt from these colloquium courses.
- [3] Students following the Aerospace Specialization should take MEEN 415-Aerodynamics instead.
- [4] Students following the Aerospace Specialization should take MEEN 576-Propulsion instead.
- [5] Students following the Aerospace Specialization should choose aerospace related senior design project.
- [6] Students following the Aerospace Specialization should choose aerospace related technical electives.

## Appendix 8: Prerequisite Flow Chart – 2002, 2003, and 2004 Mechanical Engineering Curriculum

Name \_\_\_\_\_ SSN \_\_\_\_\_

Date Entered \_\_\_\_\_ Transfer  Yes  No

Transferred From \_\_\_\_\_

Semester



## Faculty Profile

- Daniel Acree** ..... **Adjunct Assistant Professor**  
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- Suresh Chandra**..... **Research Professor**  
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- William J. Craft**..... **National Institute of Aerospace Liaison Professor**  
**Interim Associate Vice Chancellor for Research and Dean of the School of Graduate Studies**  
B.S., North Carolina State University; M.S., Ph.D., Clemson University; Professional Engineer
- DeRome O. Dunn**..... **Associate Professor**  
B.S., M.S., North Carolina A&T State University; Ph.D., Virginia Polytechnic Institute and State University
- Frederick Ferguson**..... **National Institute of Aerospace Liaison Professor and Director of Center for Aerospace Research**  
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- G. Juri Filatovs**..... **Professor**  
B.S., Washington University at St. Louis; Ph D., University of Missouri at Rolla
- John Kizito** ..... **Assistant Professor**  
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- Ajit D. Kelkar**..... **Research Professor and Director of Computational Science and Engineering Program**  
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- Dhananjay Kumar** ..... **Associate Professor and ORNL Joint Faculty**  
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- Samuel P Owusu-Ofori** ..... **Boeing Professor**  
B.S., University of Science and Technology-Kumasi, Ghana; M.S., Bradley University; Ph.D., University of Wisconsin-Madison; Professional Engineer
- Devdas M. Pai**... ..... **Professor and Associate Director of Center for Advanced Materials and Smart Structures**  
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- Kunigal N. Shivakumar** .... **Research Professor and Director of Center for Composite Materials Research**  
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- Mannur Sundaresan**..... **Professor and Graduate Program Coordinator**  
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- Leonard C. Uitenham**..... **Professor and Chairperson**  
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- Shih-Liang Wang**..... **Professor and Director of Mechanical Engineering Program**  
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- Cindy Waters** ..... **Adjunct Associate Professor**  
B.S., M.S., Virginia Tech, Ph.D., NC A&T State University

**North Carolina Agricultural and Technical State University  
Mechanical and Chemical Engineering Department**

**Permission to Take a Course Off - Campus**

This form must be prepared with all required signatures and filed with the Office of Admissions before a student enrolls in substitute courses. The University will not accept credits earned at another school while a student is on academic probation (unless approved by the Department Chairperson and School/College Dean), under academic or social suspension, on academic dismissal, or is concurrently registered at North Carolina Agricultural and Technical State University. **No credit is awarded for a course in which a grade below "C" is earned.**

Student's Name: \_\_\_\_\_ Student ID: \_\_\_\_\_

Address: \_\_\_\_\_

Name of University/College: \_\_\_\_\_

Semester/Year:                      Fall\_\_\_\_      Spring\_\_\_\_      Summer\_\_\_\_      Year:\_\_\_\_\_

Off-Campus Course

Course Number & Title: \_\_\_\_\_ Credit Hours: \_\_\_\_\_

A&T Equivalent Course

Course Number & Title: \_\_\_\_\_ Credit Hours: \_\_\_\_\_

The following information is attached (both are required):

A Photocopy of the Course Description of the Off-Campus course: \_\_\_\_\_ (Y or N)

A Photocopy of the Front Page of the Document containing Course Description: \_\_\_\_\_ (Y or N)

The course description(s) of the above course(s) have been reviewed and found equivalent in content and credit.

Advisor: \_\_\_\_\_ Date: \_\_\_\_\_

Chairperson: \_\_\_\_\_ Date: \_\_\_\_\_

Dean: \_\_\_\_\_ Date: \_\_\_\_\_

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