

THE WILLIAM STATES LEE COLLEGE OF ENGINEERING

Dean: Professor Robert Johnson; *Associate Dean:* Professor Ronald Smelser; *Assistant Dean:* Patricia Tolley

The William States Lee College of Engineering has adopted a vision that:

- The College will be *the engineering college of choice* for students, faculty, sponsors, and partners, reflecting the prestige gained by the excellence of our programs, research, graduates, and faculty.
- The College nurtures *collaborative and friendly learning* communities in which all stakeholders (students, faculty, sponsors, and partners) can succeed and are involved in the continuous assessment and improvement processes.
- Student development, faculty development, and resource and community development are guided by the principle that they should *enhance our learning* environment and promote the prestige of our institution.

The Lee College offers baccalaureate degree programs in Engineering and Engineering Technology. On the graduate level, the College offers programs leading to master's degrees in Engineering and Engineering Management; the Ph.D. in Electrical Engineering and Mechanical Engineering; an interdisciplinary Ph.D. in Infrastructure and Environmental Engineering; and, in cooperation with North Carolina State University, a program leading to the Ph.D. degree in Civil Engineering (see the *Graduate Catalog*).

The College is composed of the Departments of Civil Engineering, Electrical and Computer Engineering, Mechanical Engineering and Engineering Science, and Engineering Technology.

Engineering Programs. The baccalaureate programs in engineering offer a professional engineering education that can be used as the foundation for several different career objectives: careers as professional engineers in industry, business, or consulting; graduate study to prepare for careers in research, development, or teaching; and a more general and more liberal engineering education with the objective of keeping a variety of career avenues open.

Whatever the career objective of the student, a sound engineering educational program ensures their graduates have: (a) an ability to apply knowledge of math, science and engineering; (b) an ability to design and conduct experiments/analyze and interpret data; (c) an ability to design a system, component, or process; (d) an ability to function on multi-disciplinary teams; (e) an ability to identify, formulate, and solve engineering problems; (f) an understanding of professional and ethical responsibility; (g) an ability to communicate effectively; (h) an ability to evaluate the impact of technology in a global/societal

context; (i) an appreciation for lifelong learning; (j) knowledge of contemporary issues; and (k) an ability to use the techniques, skills, and modern tools for engineering practice. The course of study will involve the humanities, social sciences, physical sciences, mathematics, and engineering sciences. The student expecting to accept employment in industry may emphasize the engineering design and engineering science aspects of his or her program, while the student preparing for graduate study might emphasize the mathematics and science aspects. Some engineering graduates ultimately take on executive and management responsibilities in industries and firms that are based upon engineering products and engineering services. Such students may choose to construct an elective option in their program that includes business administration and economics offerings and other courses to strengthen their communication skills.

Engineering students are strongly encouraged to pursue the requirements for registration as a Professional Engineer. The first step in the registration process is the successful completion of the Fundamentals of Engineering (FE) Exam. Students are encouraged to take this exam during their senior year. Additional requirements for professional licensure subsequent to graduation include the accumulation of at least four years of progressive engineering experience and successful completion of the Professional Engineer Examination (PE Exam). Students who complete the Cooperative Education Program or who complete their Master's degree only need three years of progressive engineering experience to be eligible to take the PE Exam.

Engineering Technology Program. Engineering technology is the profession in which knowledge of mathematics and natural sciences gained by higher education, experience, and practice is devoted primarily to the implementation and extension of existing technology for the benefit of humanity. Engineering technology education focuses primarily on the applied aspects of science and engineering aimed at preparing graduates for practice in that portion of the technological spectrum closest to the product improvement, manufacturing, and engineering operational functions.

Engineering technology programs are characterized by their focus on application and practice and by their approximately 50/50 mix of theory and laboratory experience.

Graduates of the engineering technology program are recruited by most major technological companies in the U.S. They are employed across the technological spectrum but are better suited to areas that deal with application, implementation, production, and construction. Technical sales and customer services fields also account for many placements.

Engineering technology students are strongly encouraged to pursue the requirements for registration as a Professional Engineer. The first step in the registration process is the successful completion of the Fundamentals of Engineering (FE) Exam. Students are encouraged to take this exam during their senior year. Additional requirements for professional licensure subsequent to graduation include the accumulation of at least eight years of progressive experience and successful completion of the Professional Engineer (PE) Exam. Students who complete the Cooperative Education Program or who complete their Master's degree only need seven years of progressive engineering experience to be eligible to take the PE Exam.

ACADEMIC PROGRESSION REQUIREMENTS AND DISCONTINUANCE CONDITIONS FOR:

I. Bachelor's Degree Programs and Advising in the College of Engineering

Students may be admitted to one of the four College of Engineering departments: Civil Engineering (CEGR), Electrical and Computer Engineering (EEGR and CPGR), Mechanical Engineering (MEGR), and Engineering Technology (ET). Students may also be admitted as ENGR (*engineering undecided*), ETGR (*engineering technology undecided*), or FEGR (*freshman engineering*) majors.

Engineering Undecided (ENGR) and *Engineering Technology Undecided* (ETGR) are individualized advising programs for students who qualify for admission to an engineering or engineering technology major but who have not decided which program they desire. Students may change their classification to a specific major once they make a decision. Both ENGR and ETGR students should make such a decision no later than the completion of their freshman year.

Freshman Engineering (FEGR) is an individualized advising program for students who meet the requirements for conditional admission to a baccalaureate engineering degree program in the College of Engineering but who are not admitted directly to one of the programs.

Students are expected to follow the advice and recommendations of their faculty advisors and are expected to know and follow all pre-requisite, co-requisite, and progression requirements of their program. Persistent attempts to circumvent that advice and guidance shall be grounds for discontinuance.

Students must demonstrate that they are making satisfactory progress toward completion of their major degree. They are in violation of this requirement and subject to discontinuance if they have two consecutive semesters of unsatisfactory progress.

II. Freshman Year Requirements

All new freshman students are initially advised by a central office within the College of Engineering. Students are eligible for transfer to their major department for further advising once they have achieved the following:

1. completion of all non-elective courses in their freshman year curriculum with grades of C or better, and

2. a minimum cumulative grade point average (GPA) of 2.00 for all courses taken.

III. Sophomore Through Senior Year Requirements

In addition to the University requirements for continued enrollment, students must maintain a major cumulative GPA of 2.00 for all courses in the departmental curriculum taught by the College. Failure to meet this requirement for two consecutive semesters will result in suspension from the College of Engineering.

IV. Requirements for Readmission to the College after Discontinuance

An undergraduate student who has been discontinued for failure to satisfy the College requirement for continuation stated above, but who nonetheless meets the conditions for continued enrollment in the University, will be ineligible for readmission to the College until:

1. an appeal is accepted through the College of Engineering, or
2. the student elects to use the Two-Year-Rule.

A student who has been suspended by the University must follow University guidelines for appeal. Readmission to the College after discontinuance or suspension is not automatic. An application for readmission must be made by the student and approved by the College/department. Students who are readmitted after discontinuance by the College, suspension by the University, or under the Two-Year Rule must meet requirements for continued enrollment appropriate to their individual situation. These requirements are specified in a "Continuation Agreement" that is mutually agreed upon and signed by the student and his/her appropriate advisor. The consequences of failure to meet the requirements of the agreement may be articulated in the agreement itself. However, if these consequences are not included in the agreement, failure to meet the requirements will automatically result in the student's discontinuance from the College.

SPECIAL COLLEGE PROGRAMS

MAPS – Maximizing Academic and Professional Success. The College's nationally recognized MAPS program assists students in developing the personal, academic, and professional skills needed for success. The program includes peer mentoring in individual or small group sessions, Supplemental Instruction (SI), tutoring, workshops and study groups. SI and/or tutoring is available for courses such as calculus, chemistry, and physics and for sophomore and junior engineering and engineering technology courses. Assessment results indicate that students who regularly participate in MAPS perform well academically and are much more likely to graduate from the College.

Freshman Learning Community (FLC). The FLC houses a limited number of College of Engineering students on one floor of a residence hall. During the fall semester, FLC students take classes together. Students are assigned a peer mentor, and SI for a variety of freshman courses is provided by the MAPS Program. Other special events such as chemistry study nights, ropes course, community service projects, and social activities are also available to participants.

Student Leadership Academy. The Leadership Academy is an optional extracurricular program designed to develop the leadership potential of College of Engineering students through a series of weekend retreats with other students, faculty and industry partners. Top industry executives help facilitate specific activities providing some real-world perspective on being a successful leader in business and in the community.

Cooperative Education (Co-op) Program. Students may obtain practical work experience while pursuing their degree by participating in cooperative education whereby a student alternates semesters of full-time academic study with semesters of full-time work experience in industry. Students may also do back-to-back Co-op experiences if their fall or spring Co-op session is combined with a summer session. The work experience is under the direction of the student's major department and is closely related to his or her field of study. Students who fulfill all requirements of the Co-op program receive transcript notation, can earn up to three credit hours for a technical elective, and will receive partial credit toward the professional practice requirement for registration as a Professional Engineer.

To be eligible for the Co-op program, a student must have completed at least 24 credit hours at UNC Charlotte including a number of specified courses with a minimum GPA of 2.5. A transfer student is expected to have completed at least 12 hours at UNC Charlotte.

For an undergraduate to be officially designated as a Co-op student, he or she must participate in at least three full-time semesters of work experience (three work sessions and three seminar courses). Consequently, participation in Co-op Education usually means that graduation can be delayed up to one year. However, students who participate in Co-op traditionally are more highly recruited and at higher starting salaries than other students.

Students interested in learning more about the advantages and opportunities of participating in this program should contact the College's Faculty Associate for Student Professional Development or the University Career Center.

Domestic Internships. A number of opportunities for non-credit internships, called 49erships, exist for students at local and regional employers. Internships are almost always paid positions. A minimum of 80 work hours need to be completed in no less than five weeks for one semester to successfully complete the program. Fall and Spring 49erships are part-time. Summer 49erships may be full- or part-time. Full-time students who are in good University standing, have completed 24 credit hours, and have a 2.0 minimum cumulative GPA are eligible.

Internships do not offer academic credit, but students do receive transcript notation. Approval for enrollment must be arranged before the student begins the work experience. Students may begin this program during their sophomore year. Transfer students must complete 12 credit hours at UNC Charlotte before making application for the program.

Students interested in learning more about the advantages and opportunities of participating in this

program should contact the College's Faculty Associate for Student Professional Development or the University Career Center.

International Internships. The College's International Exchange program provides opportunities for overseas study, research, and/or an industrial experience. In many cases, students who meet eligibility requirements receive special scholarships and/or grants to help defray the cost of these programs.

Fundamentals of Engineering (FE) Exam Review. The first step in professional licensure is the FE exam, which students take their senior year. To encourage and prepare students to take and successfully pass this national exam, the College offers a series of review sessions each fall and spring semester. These sessions focus on technical subjects and test-taking strategies.

CONTINUING ENGINEERING STUDIES

The College of Engineering sponsors various special educational programs for practicing engineers, technologists, technicians, and others, in addition to its regular academic degree programs and courses. These include conferences, short courses, seminars, and other continuing education programs designed to aid those practicing in the technical professions and occupations to keep abreast of the latest developments in the rapidly expanding technology. For more information, contact the Office of Continuing Education, Extension, and Summer Programs.

Department of Civil Engineering

Chairperson: Professor Young; *Professors Emeritus:* Bayer, Evett, King; *Duke Energy Distinguished Professor:* Inyang; *Professors:* Graham, Janardhanam, Wu; *Associate Professors:* Bowen, Gergely, Hilger, Kane; *Assistant Professors:* Anderson, Boyajian, Daniels, Ogunro, Weggel

The program in Civil Engineering is accredited by the Engineering Accreditation Commission of the Accreditation Board for Engineering and Technology, 111 Market Place, Suite 1050, Baltimore, MD 21202, Telephone: (410) 347-7700.

The objectives of the undergraduate program in Civil Engineering are to:

- (a) provide students with the latest social, mathematical, scientific and engineering educational experiences required to access needs, define problems, evaluate alternatives, propose appropriate solutions and implement designs;
- (b) provide students with the social science and management educational experiences required to effectively work in teams, communicate recommendations and manage the implementation of their designs; and
- (c) promote concern for environmental, societal and global ramifications of engineering solutions, the value of the profession and its ethics, the opportunities provided by graduate studies, and the necessity of life-long learning.

These objectives are accomplished through a flexible curriculum and through interactions with other departments and colleges of the University and with the professional community.

A major role of civil engineers is to focus scientific and technological skills on the creation of physical facilities, the engineering and construction of which advance society toward such basic goals as economic development, environmental protection, and social well-being. Civil engineers may be involved in analysis, design, construction, and monitoring of: buildings, bridges, dams, and other structures; water resources for urban use, industry and land reclamation; systems for water transmission and river control; water quality control systems for purification and waste treatment; transportation systems including highways, mass transit, airports, railroads, pipelines, canals, and harbor facilities; solutions for environmental problems including air pollution, ground pollution, water pollution, noise pollution, ecological effects, land development, and urban and regional planning; and in subsurface foundation systems. Civil engineers must bring about a satisfactory blending of constructed facilities with the natural and social environments, creating an optimum relationship between humans and the environment while helping safeguard the health, safety, and welfare of the public.

The Department offers a Bachelor of Science in Civil Engineering (B.S.C.E.) degree, a Master of Science in Civil Engineering (M.S.C.E.) degree, a Master of Science in Engineering (M.S.E.) degree, and a Doctor of Philosophy (Ph.D.) degree in Infrastructure and Environmental Systems. Additionally, doctoral studies leading to the Doctor of Philosophy (Ph.D.) degree are available through a cooperative arrangement with North Carolina State University. For information about the master's programs, see the *UNC Charlotte Graduate Catalog*.

Students may plan early in their undergraduate careers for continuation of their engineering studies beyond the first degree. The large number of fields of graduate study that follow the curriculum offered by the Department of Civil Engineering influence how each student plans his/her undergraduate program of study. Twenty-one hours of technical electives allow flexibility for study in specific areas. Each student may design a technical elective program with his or her advisor's approval in order to achieve individual goals and follow a desired track.

Additionally, students may take nine hours (three "Optional Courses") beyond the BSCE requirements from prescribed menus in each of the areas of Environmental, Geotechnical, Structural, and Transportation Engineering to earn a Department-issued "Area of Concentration." Although currently under development, a fifth area of concentration, in Construction Engineering, is expected to be available by the time this *Catalog* is printed.

Qualified students may apply for early-entry into the graduate program in Civil Engineering during their junior or senior year. If accepted, students may take these optional courses for graduate credit and to begin work on their master's degree while completing their undergraduate degree.

Early-Entry to Master's Program in Civil Engineering

1. A student may be accepted into the early-entry program at any time after completion of at least 75 semester hours of undergraduate work applicable to an appropriate degree. Admission must be approved by the Department of Civil Engineering. Full admission to the graduate program is conditional pending the awarding of the undergraduate degree.
2. In order to be accepted into the program a student must have at least a 3.2 overall grade point average and a 3.2 grade point average in the student's major. The successful applicant must have taken the appropriate standardized test and earned acceptable scores.
3. While in the early-entry program, a student must maintain a 3.0 overall grade point average through completion of the baccalaureate degree in order to remain in the graduate program.
4. Students accepted into the early-entry program will be subject to the same policies that pertain to other matriculated graduate students. Early-entry students must finish their undergraduate degree before they complete 15 hours of graduate work.

BACHELOR OF SCIENCE IN CIVIL ENGINEERING (B.S.C.E.)

This curriculum became effective Fall 2000. Students who entered the program prior to Fall 2000 should refer to a previous catalog or contact the Department office for their program of study. Since the curriculum changes periodically, students should contact the Department office for the latest information concerning this curriculum.

A major in Civil Engineering leading to the B.S.C.E. degree consists of 128 credit hours. Specific requirements are:

English.....	6
Technical Communications	3
Humanities and Social Science Electives ..	15
Mathematics	15
Physics.....	8
Chemistry	4
Science Elective	3
Engineering	4
Electrical or Mechanical Engineering	3
Engineering Science	6
Departmental Requirements	40
Open Technical Electives	9
Civil Engineering Technical Electives.....	<u>12</u>
 Total.....	 128

Social science and humanities electives must be chosen both to satisfy University General Education requirements and to meet the objectives of a broad education consistent with the educational goals of the profession. To avoid taking "extra" humanities/social science electives, students must select their electives carefully after consulting with their faculty advisor.

The science electives must be chosen from an approved list of physical, life, or earth sciences and must complement the student's overall educational plan.

Technical electives allow flexibility for study in specific areas, and each student may design a technical elective program with the advisor's approval in order to achieve an individual goal and follow a desired track. Three "open" technical (TECH) electives may be selected from the areas of engineering, mathematics, science, business and communications. Four Civil Engineering technical (CEGR TECH) electives must be selected from upper-division Civil Engineering courses.

**CURRICULUM OUTLINE: B.S.C.E. DEGREE
(effective Fall 2004)**

Freshman Year

MATH 1241	Calculus I	3
CHEM 1251	Chemistry I	3
CHEM 1251L	Chemistry Lab	1
ENGL 1101	English I	3
ENGR 1201	Introduction to Engineering I	2
LBST 1101, 1102, 1103, 1104 or 1105	– Gen Ed	3
		15

MATH 1242	Calculus II	3
PHYS 2101	Dynamics	3
PHYS 2101L	Physics Lab	1
ENGL 1102	English	3
ENGR 1202	Introduction to Engineering II	2
Social Science	Gen Ed	3
		15

Sophomore Year

MATH 2241	Calculus III	3
PHYS 2102	Electricity	3
PHYS 2102L	Physics Lab	1
CEGR 2101	Drawing	2
CEGR 2102	Engineering Economics	3
MEGR 2141	Statics (Engr. Mech. I)	3
LBST 2101	Gen Ed	3
		18

MATH 2171	Differential Equations	3
CEGR 2104	Surveying & Site Design	3
ENGL 2116	Technical Writing (W)	3
MEGR 2144	Solid Mechanics	3
CEGR 2154	Design Project Lab (O)	2
Science	Elective	3
		17

Junior Year

CEGR 3143	Hydraulics & Hydrology	3
CEGR 3141	Environmental I	3
CEGR 3278	Geotechnical I	3
CEGR 3122	Structures I	3
CEGR 3155	Environmental Laboratory (W)	1
CEGR 3258	Geotechnical Laboratory (W)	1
LBST 2102	Gen Ed	3
		17

CEGR 3161	Transportation I	3
CEGR 3153	Transportation Laboratory (W)	1
CEGR 3255	Structures & Materials Laboratory (W)	1
CEGR	Elective	3
CEGR	Elective	3
STAT 3128	Probability & Statistics for Engineers	3
Engineering	Elective: ECGR 2161-Circuits or MEGR 3121-Dynamics or MEGR 3111-Thermodyn	3
*Optional	Course A	3

Senior Year

CEGR 3201	Systems and Design I	3
CEGR 3221	Structural Steel Design I or 3225 Reinforced Concrete Design I	3
CEGR 3282	Professional Development	1
CEGR	Elective	3
TECH	Elective	3
LBST 2211, 2212, 2213, 2214 or 2215	– Gen Ed	3
*Optional	Course B	3
		16

CEGR 3202	Systems and Design II	4
CEGR	Elective	3
TECH	Elective	3
TECH	Elective	3
*Optional	Course C	3
		13

Total Required Hours 128

Note: (W) indicates a writing intensive course
(O) indicates an oral communication course

*Contact the Department office for more information about the optional courses and their use for an undergraduate concentration or for the early-entry Master's program.

Department of Electrical and Computer Engineering

Chairperson: Professor Casperson; *Professors:* Bobbio, Coleman, Daneshvar, Fiddy, Kakad, Lukic, Makki, Tranjan, Tsu; *Professor Emeritus:* Greene; *Associate Professors:* Binkley, Conrad, Emmert, Hasan, Howitt, Miri, Stokes, Weldon; *Associate Professor Emeritus:* Smith; *Assistant Professors:* Nasipuri, Mukherjee, Ravindran, Xie; *Faculty Associate:* Hudak, Sheppard.

The Electrical and Computer Engineering Department provides instruction and research in areas of electrical and computer engineering such as electronics, microelectronics, optoelectronics, power systems, control theory, digital systems, communications, and VLSI design.

The Department offers a **Bachelor of Science in Electrical Engineering (B.S.E.E.) degree and a Bachelor of Science in Computer Engineering (B.S.Cp.E.) degree.** An eight-semester sequence of courses that is designed to develop the concepts and design and analysis techniques fundamental to the various areas of specializations forms the core of the curricula. Emphasis is placed on the utilization of computers throughout the curricula.

Graduate studies in electronics, microelectronics, optoelectronics, computer engineering, VLSI design and testing, signal processing, communications, and power and control systems are offered by the Department at the master's level. The Department also offers a doctoral degree with emphasis in microelectronics, optoelectronics, or computer engineering.

Early-entry to the Master of Science Program in Electrical Engineering

1. A student may be accepted into the early-entry program at any time after completion of 75 semester hours of undergraduate work applicable to an appropriate degree. Admission must be approved by the Department of Electrical and Computer Engineering. The admission is conditional pending the awarding of the undergraduate degree.
2. In order to be accepted into the Electrical Engineering early-entry program, an undergraduate student must have at least a 3.2 overall grade point average and a 3.2 grade point average in the major. The successful applicant must have taken the appropriate graduate standardized test and achieved acceptable scores.
3. If an early-entry student is unable to maintain a 3.0 overall grade point average at the end of his/her baccalaureate degree, he/she will be dismissed from the graduate program.
4. Up to six hours earned at the graduate level may be substituted for required undergraduate hours. (Up to six hours of graduate work may be "double counted" toward both baccalaureate and graduate degrees).
5. Students accepted into the early-entry program will be subject to the same policies that pertain to other matriculated graduate students. Early-entry students must finish their undergraduate degree before they complete 15 hours of graduate work.

The program in Electrical Engineering and the program in Computer Engineering are accredited by the Engineering Accreditation Commission of the Accreditation Board for Engineering and Technology, 111 Market Place, Suite 1050, Baltimore, MD 21202 - Telephone (410) 347-7700.

BACHELOR OF SCIENCE IN ELECTRICAL ENGINEERING (B.S.E.E.)

The curricula described are subject to change. Please consult with the Chair or the Undergraduate Coordinator for the latest versions.

A major in Electrical Engineering leading to the B.S.E.E. degree consists of a total of 127 credit hours.

The **Program Educational Objectives** are as follows:

- To provide our students the opportunity and the environment to acquire the educational background necessary to pursue professional careers in Electrical Engineering and/or to continue their education toward an advanced degree in the field.
- To provide graduates who have a comprehensive background in mathematics, physical and social sciences, liberal arts, and human values, with in-depth knowledge of the fundamentals of engineering science and Electrical Engineering that perpetuates life-long learning.

- To provide graduates with the tools to pursue successful and long careers in the profession that places ethical conduct as paramount.
- To prepare graduates who can effectively communicate their thoughts and ideas to their surroundings along with the understanding of the impact of electrical engineering on global, societal, and environmental issues.
- To provide graduates who have state-of-the-art computer skills suitable for a modern career in electrical engineering, where computer utilization is an essential tool.

The laboratory courses are designed to: (1) teach the basic techniques of instrumentation; (2) develop skills in communications; and (3) relate the analytical methods developed in the classroom to the performance of real physical systems.

The degree requirements are:

English.....	6
Liberal Studies.....	18
Mathematics.....	15
Physics.....	10
Chemistry.....	4
Science Elective.....	3
Engineering.....	5
Mechanical Engineering.....	3
Departmental Requirements.....	51
Technical Electives.....	9
Economics.....	3
	127

Note: one course in foreign language may be considered as HUM/SS.

The *social science and humanities electives* must include some courses at an advanced level and be chosen to satisfy the University General Education requirements and to meet the objectives of a broad education consistent with the educational goals of the profession.

The *science elective* must be chosen from the physical, life, or earth sciences and must complement the student's overall educational plan.

The *technical electives* are chosen by students in consultation with their academic advisor. Students can use these electives to: (1) obtain some breadth within electrical engineering by choosing additional advanced courses; (2) obtain significant depth within a particular area of electrical or computer engineering; and (3) prepare for graduate work in electrical or computer engineering. The technical electives must contain at least nine hours of coursework dealing with engineering science, analysis, synthesis, or design. See Department guidelines for selection of these courses.

All junior-level core courses must be satisfactorily completed prior to enrolling in the senior project courses.

CURRICULUM PLAN: B.S.E.E. DEGREE

Freshman Year

ENGR 1201 - Intro To Engineering Practices & Principles I .	2
CHEM 1251 - Principles of Chemistry.....	3
CHEM 1251L - Chemistry Lab	1

MATH 1241 - Calculus I	3
ENGL 1101 - English Composition	3
LBST 1101, 1102, 1103, 1104 or 1105	3
<u>15</u>	

ENGR 1202 - Intro To Engineering Practices & Principles II ..	2
MATH 1242 - Calculus II	3
PHYS 2101 – Physics for Science & Engineering I	3
PHYS 2101L - Physics Lab I	1
ENGL 1102 - Composition & Literature	3
LBST 2101 – Western Cultural & Historical Awareness ..	3
<u>15</u>	

Sophomore Year

ECGR 2103 - Computer Utilization in C++	3
ECGR 2111 - Network Theory I	3
ECGR 2155 - Lab: Logic & Networks	1
ECGR 2181 - System Design I	3
MATH 2171 - Differential Equations	3
PHYS 2102 - Physics for Science & Engineering II	3
<u>16</u>	

ECGR 2112 - Network Theory II	3
ECGR 2156 - Lab: Instrumentation and Networks	1
ECGR 2252 - Electrical Engineering Design I	2
MATH 2241 - Calculus III	3
PHYS 3141 - Introduction to Modern Physics	3
LBST 2102 - Global & Intercultural Connections	3
<u>15</u>	

Junior Year

ECGR 3111 - Signals and Systems	3
ECGR 3121 - Introduction to Electromagnetic Fields	3
ECGR 3131 - Fund of Electronics & Semiconductors	3
ECGR 3155 - Lab: Systems and Electronics	1
ECGR 3157 - Electrical Engineering Design II	2
ENGR 3295 - Professional Development	1
HUM/SS - Humanities/Social Sciences Elective	3
<u>16</u>	

ECGR 3122 - Electromagnetic Waves	3
ECGR 3132 - Electronics	3
ECGR 3133 - Solid State Microelectronics I	3
ECGR 3142 - Electromagnetic Devices or	
ECGR 3156 - Lab: Electromagnetic & Electronic Devices	1
STAT 3128 - Probability and Statistics for Engineers	3
LBST 2211, 2212, 2213, 2214 or 2215	3
<u>16</u>	

Senior Year

ECGR 3253 - Senior Design I	2
ECGR 4123 – Analog & Digital Communication	3
ECGR Senior Elective	3
ECON 2101 - Economics	3
Technical Elective	3
Science Elective	3
<u>17</u>	

ECGR 3159 - Elec. Engineering Professional Practice	2
ECGR 3254 - Senior Design II	3
MEGR 3111 - Thermodynamics	3
HUM/SS - Humanities/Social Sciences Elective	3
Technical Elective	3
Technical Elective	3
<u>17</u>	

Total Hours: 127

BACHELOR OF SCIENCE IN COMPUTER ENGINEERING (B.S.Cp.E.)

The curriculum in Computer Engineering leading to the B.S.Cp.E. degree consists of 125 semester credit hours. The curriculum was developed to meet the following **Program Educational Objectives:**

- Provide our students a solid foundation in the field of computer engineering within an environment that fosters hands-on design and synthesis experience.
- Prepare our students for leadership positions by providing a balanced educational experience with emphasis on communication skills, teamwork, and professional practice, including values and ethics.
- Provide sufficient curriculum flexibility to allow every student to synthesize a program of study that is specific to the students' interests within the diverse field of computer engineering.
- Provide our students sufficient breadth of knowledge to understand the broad relationships of the various areas within engineering, and sufficient depth as a concentration within one of those areas.

The following curriculum became effective for all students entering the program in the summer of 2002 and thereafter. Students who entered the program prior to the summer of 2002 should consult earlier versions of the *Catalog* or contact the ECE department.

The degree requirements are:

University Goals. 48 hours meeting and surpassing the University General Education requirements, including 12 hours of communications, 9 hours of math, and 12 hours of science.

Core 1. Advanced Problem Solving: Nine hours of advanced problem solving courses.

Core 2. Computer Engineering: 39 hours of computer engineering including introduction to engineering, programming and data structures, network theory, electronics, logic design, data communications, and computer organization and architecture.

Breadth. 12 hours of required courses from four different concentration areas.

Depth. Six hours of electives, where the student chooses two courses from one of the chosen depth areas. Combined with the Breadth requirement, this results in a minimum of nine hours in a concentration area.

Professional Development and Practice: One hour of professional development and two hours of professional practice.

Senior Design Capstone. Five hours of senior design project.

Restricted Electives. Three hours of engineering, information technology computer science, math, physics, chemistry, or biology at the 2xxx level or above.

Total: 125 semester hours

CURRICULUM OUTLINE: BACHELOR OF SCIENCE IN COMPUTER ENGINEERING

University Goals - 48 hours

- I. Communication: ENGL 1101, ENGL 1102, ECGR 3254, and ENGL 2116 –or– any 3-hour 2xxx level (or above) course with a writing intensive (W) designation..... 12
- II. Problem Solving: MATH 1241, 1242; STAT 2122 9
- III. Social Science: ECON 2101 3
- IV. Science: PHYS 2101/L, PHYS 2102/L, CHEM 1251/L .. 12
- V. Liberal Studies/Arts & Society: Choose one course from {LBST 1101, 1102, 1103, 1104 or 1105}. 3
- VI. Liberal Studies/Western: LBST 2101 3
- VII. Liberal Studies/Global: LBST 2102 3
- VIII. Liberal Studies/Ethical & Cultural issues: Choose one course from {LBST 2211, 2212, 2213, 2214, or 2215} . 3

Core 1. Advanced Problem Solving – 9 hours
MATH 1165, MATH 2171 and one course from: {MATH 2164, OPRS 3111, OPRS 3113, or PHYS 3141}..... 9

Core 2. Computer Engineering – 39 hours
Core 1 & 2 Subtotal 48

Breadth: Required courses from four different concentration areas. 12

Depth: Two ECGR courses at 3XXX or above, chosen from one of the depth areas..... 6

Senior Design Capstone: 5

Professional Development: 1

Professional Practice: 2

Restricted Electives: One 2XXX or above (COE or MATH/STAT/PHYS/CHEM/BIOL/ITCS) course..... 3

Total Hours: 125

Breadth Requirement – required courses from four different concentration areas:

- (1) Design & Test: ECGR 4146 Intro to VHDL
- (2) Communications: ECGR 4124 Digital Signal Processing
- (3) Device Electronic & Technology: ECGR 3132 Electronics II
- (4) Computer Architecture/Software Systems: ECGR 4101 Embedded Systems

Depth Elective Requirement - choose two ECGR courses from one of four areas:

1. Design & Test

- ECGR 3182 Digital Electronics
- ECGR 4132 Analog Integrated Circuits Design
- ECGR 4182 Digital System Testing
- ECGR 4433 VLSI Systems Design
- ITCS 3183 Hardware Systems Design
- ITCS 4181 Microcomputer Interfacing

2. Communications

- ECGR 3112 Systems Analysis II
- ECGR 4125 Foundation of Optical Engineering
- ECGR 4132 Analog & Digital Communication
- ECGR 4187 Data Communications
- ITCS 3134 Digital Image Processing
- ITCS 3166 Distributed Computer Info Systems
- ITCS 4165 Coding and Information Theory

3. Device Electronics & Technology

- ECGR 3133 Solid State Microelectronics I
- ECGR 4125 Foundation of Optical Engineering
- ECGR 4131 Linear Integrated Microelectronics
- ECGR 4134 Solid State Microelectronics II
- ECGR 4137 Device Electronics for ICs
- ECGR 4138 Electronic Thin Film Devices
- ECGR 4140 Intro to VLSI Processing
- ECGR 4165 Laser Electronics

4. Computer Architecture/Software Systems

- ECGR 4182 Digital System Testing
- ITCS 2214 Data Structures
- ITCS 3145 Intro to Parallel Programming
- ITCS 3160 Data Base Design
- ITCS 3183 Hardware System Design
- ITCS 4141 Computer Organization & Architecture
- ITCS 4181 Microcomputer Interfacing
- ITCS 4183 Computer Arithmetic

CURRICULUM PLAN: B.S.Cp.E. DEGREE

Freshman Year

- CHEM 1251 - Principles of Chemistry..... 3
- CHEM 1251L - Principles of Chemistry Lab 1
- ENGL 1101 - Composition 3
- ENGR 1201 - Intro to Engineering I 2
- ITCS 1214 - Introduction to Computer Science I..... 3
- MATH 1241 - Calculus I 3

15

- ENGL 1102 - Writing in the Academic Community..... 3
- ENGR 1202 - Intro to Engineering II 2
- ITCS 1215 - Introduction to Computer Science II..... 3
- MATH 1242 - Calculus II..... 3
- PHYS 2101 - Physics for Science/Engineering I..... 3
- PHYS 2101L - Physics for Science/Engineering I Lab 1

15

Sophomore Year

- ECGR 2111 - Network Theory I..... 3
- ECGR 2181 - Logic System Design I..... 3
- ECGR 2155 - ECE Lab 1
- MATH 2171 - Differential Equations 3
- LBST 1101, 1102, 1103, 1104 or 1105 3
- PHYS 2102 - Physics for Science/Engineering II 3
- PHYS 2102L - Physics for Science/Engineering II Lab... 1

17

- ECGR 2112 - Network Theory II 3

ECGR 2156 - ECE Lab.....	1
ECGR 3181 – Logic System Design II.....	3
ECON 2101- Principles of Economics - Macro.....	3
MATH 1165 - Intro to Discrete Structures.....	3
STAT 2122 - Probability and Statistics	3
	16

Junior Year

ECGR 3111 - Signals and Systems.....	3
ECGR 3131 - Fundamentals of Electronics/Semiconductors ..	3
ECGR 3155 - Systems & Electronics Lab.....	1
ENGR 3295 - Professional Development.....	1
ITCS 3182 - Computer Organization/Architecture.....	3
LBST 2101 - Western Cultural & Historical Awareness.....	3
Breadth Elective #1.....	3
	17

ECGR 2255 - Digital Design Lab.....	2
ECGR 3123 - Data Communication & Network	3
LBST 2102 - Global & Intercultural Connections.....	3
Advanced Problem Solving Selection	3
Breadth Elective #2.....	3
Restrictive Elective.....	3
	17

Senior Year

ECGR 3253 - Senior Project I	2
ENGL 2116 - Technical Writing –or– any 3-hour, 2xxx level (or above) course with a Writing Intensive (W) designation	3
LBST 221X.....	3
Breadth Elective #3.....	3
Depth Elective #1	3
	14

ECGR 3254 - Senior Project II.....	3
ECGR 3159 - Professional Practice	2
Breadth Elective #4.....	3
Depth Elective #2	3
Restrictive Elective.....	3
	14

Total Hours 125

Students are strongly encouraged to review the computer engineering website at www.ece.uncc.edu/cmpgr. It contains a wealth of information, including a complete student handbook and a facility for easily browsing required course prerequisite information.

Department of Engineering Technology

Chairperson: Professor Brizendine; *Professors:* Byars, Sherlock; *Associate Professors:* Ahmad, Barry, Braun, Carter, James, Liou, Orozco, Priebe, Wang; *Assistant Professors:* Gehrig, Kimble, Kuyath, Murphy, Ramers, Sharer, Watkins; *Visiting Assistant Professor:* Owen; *Professors Emeritus:* Liu, Mobley.

Engineering and technical education have undergone considerable change in the last 30 years. The complexities of space exploration, nuclear power, communications systems, environmental control, information processing, transportation systems, fire protection, and manufacturing have demanded a great increase in the involvement of professional engineers in theoretical and analytical work. This has resulted in a much greater emphasis upon research and development, science, and mathematics in professional

engineering curricula. At the same time, after the more complex devices and systems have been engineered, their design, development, and operation require the sophisticated knowledge and skills of what might be called the "applied engineering sciences." Programs dedicated to filling this need exist all over the United States. The aim and content of these programs are distinctly different from professional engineering curricula.

To provide the appropriate distinction from both theoretical-professional engineers and from engineering technicians who are graduated from two-year community and technical colleges, the designation "engineering technologist" is employed to describe the graduates of four-year applied engineering or "engineering technology" curricula. The Engineering Technology Department is committed to producing competent graduates that satisfy the needs of employers in North Carolina and throughout the United States.

UNC Charlotte offers four curricula leading to a Bachelor of Science in Engineering Technology (BSET) degree: **Civil Engineering Technology** (with emphases in General Civil Engineering Technology or Construction Engineering Technology); **Electrical Engineering Technology** (with emphases in Electronics Engineering Technology or Computer Engineering Technology); **Fire Safety Engineering Technology**; and **Mechanical Engineering Technology**.

Students may enroll in our programs in several ways: 1) as freshmen; 2) as transfers without an AAS in engineering technology; or 3) as upper division transfers after completing a two-year Associate of Applied Science (AAS) degree in a relevant engineering technology or fire protection curriculum at a community or technical college. Incoming students with an AAS degree generally receive Junior class standing, with 64 semester credit hours applied toward the 124-128 credits required for the Bachelor of Science in Engineering Technology degree.

UNC Charlotte is accredited by the Commission on Colleges of the Southern Association of Colleges and Schools (SACS, 1866 Southern Lane, Decatur, Georgia 30033-4097; telephone number 404-679-4501) to award baccalaureate, master's, intermediate, and doctoral degrees.

In addition, the Civil, Electrical, and Mechanical Engineering Technology programs of study in Engineering Technology are accredited by the Technology Accreditation Commission (TAC) of the Accreditation Board for Engineering and Technology (ABET, 111 Market Place, Suite 1050, Baltimore, MD 21202; telephone number 410-347-7700).

Distance Education Options. In addition to the on-campus programs, the upper division of the BSET programs in **Electrical Engineering Technology** and **Fire Safety Engineering Technology** are offered over the Internet to part-time students. This allows students who already hold an AAS degree to complete their junior and senior years of the BSET program at a distance. Students are required to come to the campus only for an initial orientation and for ELET laboratories. The ELET laboratories are currently offered on a schedule of Saturdays during the summer school sessions. Estimated completion time for the distance delivery of the junior and senior years is approximately four years, including

summers since students generally take a maximum of two courses per semester.

ENGINEERING TECHNOLOGY PROGRAM EDUCATION OBJECTIVES AND OUTCOMES

Program Educational Objectives: These are statements that describe the expected accomplishments of graduates during the first few years after graduation.

The Department of Engineering Technology at UNC Charlotte is committed to providing the environment and expertise to ensure that its graduates make substantive contributions in their professional endeavors after graduation, both in the areas of technical proficiency and community involvement. Accordingly, Civil, Electrical, Fire Safety, and Mechanical Engineering Technology program alumni contribute to society as productive technologists and engaged citizens by:

1. Applying general and discipline-specific concepts and methodologies to identify, analyze, and solve technical problems.
2. Articulating technical material in a professional manner to potentially diverse audiences and in a variety of circumstances, employing effective oral and written strategies and techniques.
3. Contributing within team environments, demonstrating ethical, respectful and professional behavior in all associations.
4. Recognizing and appreciating the environmental, societal, and fiscal impact of the technical professions in a local, national, and global context.
5. Demonstrating an individual desire and commitment to pursue continuous self-improvement and lifelong learning.

Program Outcomes: These are statements that describe what students are expected to know and able to do by the time of graduation. Graduates with a Bachelor of Science in Engineering Technology (BSET) degree from UNC Charlotte will be able to:

1. Utilize appropriate tools to acquire data and analyze problems. (TAC 2a, 2b, 2c – see below)
2. Demonstrate effective skills in the development and presentation of team projects. (TAC 2e, 2g, 2k)
3. Exhibit knowledge and skills consistent with the expectations of a practicing engineering technologist. (TAC 2h, 2j, 2k)
4. Generate creative and realistic solutions to defined problems and projects. (TAC 2a, 2d, 2f)
5. Recognize the value of diversity, and identify ethical and societal issues in business and technical tasks. (TAC 2i, 2j)
6. Solve problems and design components, systems, or processes appropriate to the discipline. (TAC 2a, 2d, & Program Criteria) *Each program defines*

the specific details of this outcome.

The Engineering Technology programs identify, measure, and improve student competencies through assessment and continuous improvement of program outcomes, which are mapped to the TAC of ABET Criterion 2 (a through k) criteria listed below:

TAC of ABET Criterion 2 a through k Skills

a: Graduates are expected to demonstrate an appropriate mastery of the knowledge, techniques, skills, and modern tools for their disciplines.
b: Graduates are expected to be able to apply current knowledge and adapt to emerging applications of mathematics, science, engineering, and technology.
c: Graduates will conduct, analyze, and interpret experiments and apply experimental results to improve processes.
d: Graduates are expected to be able to apply creativity in the design of systems, components, or processes appropriate to program objectives
e: Graduates are expected to be able to function effectively on teams.
f: Graduates are expected to be able to identify, analyze, and solve technical problems.
g: Graduates are expected to be able to communicate effectively.
h: Graduates are expected to be able to recognize the need for and possess the ability to pursue lifelong learning.
i: Graduates are expected to be able to understand professional, ethical, and social responsibilities.
j: Graduates are expected to be able to recognize contemporary professional, societal, and global issues and are aware of and respect diversity.
k: Graduates are expected to have a commitment to quality, timeliness, and continuous improvement.

BACHELOR OF SCIENCE IN ENGINEERING TECHNOLOGY (BSET)

Admission Requirements to Department of Engineering Technology programs. Students for this degree may enter as freshmen or as transfer students.

Freshman Admission: Applicants entering as freshmen must meet the general University admission requirements.

Transfer Admission: Transfer admission into the Department occurs in one of two situations:

1. Transfer applicants not having the Associate in Applied Science (AAS) degree or its equivalent must meet general University admission requirements.
2. Transfer applicants with an Associate of Applied Science (AAS) degree must:
 - a. Hold an Associate of Applied Science (AAS) degree in a field appropriate to the option they plan to enter. Acceptable AAS degrees include Architectural, Automation, Building Construction, Civil, Construction, Computer, Controls, Design and Drafting, Electrical, Environmental,

Fire Protection, Fire Science, Optical, Electronics, Industrial, Instrumentation, Manufacturing, Mechanical, Robotics, Surveying or similar title with curriculum acceptable to the Department. A minimum grade point average of 2.2 (out of 4.0) in the AAS degree is required;

- b. Have completed satisfactorily the prerequisite background courses for the option they plan to enter (missing background courses may be taken at UNC Charlotte).

Acceptance of a completed AAS degree indicates the acceptance of up to 64 semester credit hours toward the Bachelor of Science in Engineering Technology degree program only. These hours may not be valid toward other degree program in the University.

Residence Requirements. A student must earn the last 30 semester hours of credit toward the BSET degree and the last 12 semester hours of work in the major at this University to satisfy residence requirements.

Experiential Learning Requirements. All students must complete an experiential learning course. Experiential courses are practice-oriented courses such as cooperative education, internships, senior design projects, or undergraduate research.

Internships, or *49erships*, involve paid or unpaid work in a career-related position for professional experience. A minimum of 80 work hours for one semester is required to complete the program. Fall and Spring 49erships are part-time. Summer 49erships may be full- or part-time. Full-time students who are in good University standing, have completed their freshman year, and have a 2.0 minimum cumulative GPA are eligible. Internships do not offer academic credit, but are noted on the student's transcript; students pay a participation fee. Approval for enrollment must be arranged before the student begins a work experience. Students may begin this program during their sophomore year; transfer students must complete one semester at UNC Charlotte before making application for the program. For more information, contact the College of Engineering Office of Student Development and Success or the University Career Center.

Remediation of Academic Entrance Requirements for AAS Transfer Students. In addition to University and College of Engineering requirements, an AAS transfer student who is admitted to any BSET program without meeting ALL published admission requirements is expected to remove all admission deficiencies within one year.

Course Requirements. Course requirements correspond to the mode of admission for each student as outlined hereafter.

1. Entering Freshmen: Students admitted as freshmen will complete the appropriate four year curriculum for the program into which they were admitted.

2. Transfer students not holding an appropriate AAS degree: Transfer students not holding an appropriate AAS degree must complete the remaining coursework outlined for the respective four year curriculum that they were admitted into after evaluation and application of any transfer credit.
3. Transfer students holding an AAS degree: Transfer students with an acceptable Associate of Applied Science (AAS) degree as defined previously under admission requirements shall begin the program in the junior year with up to 64 transfer credit hours awarded. Prerequisites for students holding an AAS degree from a community or technical college are listed below.

Prerequisites for admission to the Civil, Electrical, and Mechanical Engineering Technology Programs. Students transferring with an AAS degree must have satisfactorily completed the following subjects in their two-year program:

- English Composition, Technical Writing and/or Public Speaking (*6 semester hours*)
- Algebra and Trigonometry (*6 semester hours*)
- Differential and Integral Calculus (*3 semester hours*)
- General Physics (with lab) (*4 semester hours*)
- Additional Physics or Chemistry (with lab) or Geology (*for CIET*) (*4 semester hours*)
- Humanities or Social Sciences (*3 semester hours*)
- Technical Courses in Major Area as listed under Discipline Specific Prerequisites below (*up to 38 semester hours*).

Total maximum transfer credit from two-year colleges is 64 semester hours.

Discipline Specific Prerequisites:

Civil

Computer Aided Drafting
Surveying
Statics
Strength of Materials

Electrical

Electrical Drafting
Computer Programming (high level language: e.g., BASIC, FORTRAN, PASCAL, C, C++)
D.C. Circuits
A.C. Circuits
Digital Circuits
Semiconductor Circuits
Communications, Electronics, Control Systems, or Microcomputers

Mechanical

Drafting/Computer Aided Drafting
Machine Processes
Statics
Metallurgy or Engineering Materials
Kinematics or Mechanisms

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Basic Electrical Circuits or Physics II (Electricity)
 Computer Programming (using a higher level language
 such as Visual Basic, FORTRAN, or C++)

Prerequisites for admission to the Fire Safety Engineering Technology Program. Students transferring with an AAS degree must have satisfactorily completed the following subjects in their two-year associate degree program:

- English Composition, Technical Writing and/or Public Speaking (6-9 semester hours)
- Algebra (3 semester hours)
- Two science courses with lab (8 semester hours)
- Humanities and/or Social Sciences (6-9 semester hours)
- Computer Literacy Course
- Technical Courses in Major Area as listed below (32-38 semester hours)
 - Introduction to Fire Protection
 - Fire Prevention and Public Education
 - Fire Detection and Fire Investigation
 - Building Construction
 - Inspections and Codes
 - Sprinklers and Automatic Alarms
 - Fire Protection Law
 - Fire Fighting Strategies
 - Chemistry of Hazardous Materials
 - Hydraulics and Water Distribution
 - Managing Fire Services

CURRICULUM OUTLINES

CIVIL ENGINEERING TECHNOLOGY PROGRAM

Recommended Freshman & Sophomore Year Curriculum to be completed at a Community or Technical College:

Freshman Year

ENGL 1101	English Composition	3
ETGR 1201	Introduction to Engineering Technology..	2
ETCE 1121	Construction Methods	3
ETGR 1100	Eng Tech Computer Applications	3
ETGR 1103	Technical Drawing I.....	2
MATH 1100	College Algebra and Probability	3
		<u>16</u>

ENGL 1102	Writing in the Academic Community	3
ETCE 1211	Surveying I	4
ETCE 1222	Construction Materials	3
ETGR 1104	Technical Drawing II	2
MATH 1103	Precalculus Math for Science & Engr	3
		<u>15</u>

Sophomore Year

Science Elective	CHEM 1111 or CHEM 1251 or GEOL 1200	3
ETCE 2112	Surveying II.....	4
ETGR 2101	Applied Mechanics I	3
MATH 1121	Calculus (ET)	3
PHYS 1101	Introductory Physics I	3
PHYS 1101L	Introductory Physics I Laboratory	1
		<u>17</u>

ETCE 2410	Introduction to Environmental Tech.	3
ETGR 2102	Applied Mechanics II	3
PHYS 1102	Introductory Physics II	3
PHYS 1102L	Introductory Physics II Laboratory	1
STAT 1220	Elements of Statistics I	3
SS Elective	Directed Social Science General Education Elective	3
		<u>16</u>

CIVIL ENGINEERING TECHNOLOGY PROGRAM General Civil Engineering Technology Emphasis

Junior Year

ETGR 3071	Engineering Tech. Prof. Seminar.....	1
ETCE 3111	Structural Analysis I.....	3
ETCE 3121	Foundations and Earthwork.....	3
ETCE 3151	Soil Testing Laboratory	1
ETGR 3222	Engineering Economics.....	3
Directed Elective	.....	3
		<u>14</u>

ETCE 3112	Structural Analysis II.....	3
ETCE 3132	Hydraulics.....	3
ETGR 3171	Engineering Analysis I.....	3
ETCE 3150	Hydraulics & Materials Lab.....	1
Directed Electives*	.....	6
		<u>13</u>

Senior Year

ETCE 3212	Structural Steel Design.....	3
Major Elective	Laboratory.....	1
ETCE 3262	Intro to Environmental Engineering	3
ETCE 3243	Project Management Technology.....	3
Science Elective with Laboratory:	CHEM 1251 or 1111 or GEOL 1200*	4
Major Elective*	.....	3
		<u>17</u>

ETCE 3642	Senior Design Project.....	2
ETCE 3211	Reinforced Concrete Design	3
ETCE 3241	Highway Design & Construction.....	3
Major Electives*	.....	6
Directed Elective*	.....	3
		<u>17</u>

CIVIL ENGINEERING TECHNOLOGY PROGRAM Construction Engineering Technology Emphasis

Junior Year

ETGR 3071	Engineering Tech. Prof. Seminar	1
ETCE 3111	Structural Analysis I.....	3
ETCE 3121	Foundations & Earthwork.....	3
ETCE 3151	Soil Testing Lab	1
ETGR 3222	Engineering Economics	3
Directed Elective	.....	3
		<u>14</u>

ETCE 3112	Structural Analysis II	3
ETCE 3132	Hydraulics.....	3
ETCE 3150	Hydraulics & Materials Lab.....	1
ETGR 3171	Engineering Analysis I.....	3
Directed Electives*	.....	6
		<u>16</u>

Senior Year

ETCE 3211	Structural Steel Design.....	3
ETCE 3243	Project Management Technology.....	3
ETCE 3281	Cost Estimating I.....	3
Science Elective with Laboratory: CHEM 1251 or 1111 or GEOL 1200 (a).....		4
Major Elective Laboratory.....		1
Major Elective **.....		3
		17
ETCE 3211	Reinforced Concrete Design.....	3
ETCE 3241	Highway Design and Construction.....	3
ETCE 3293	Building Systems.....	3
ETCE 3642	Senior Design Project.....	2
Major Elective **.....		3
Directed Elective *.....		3
		17

ELECTRICAL ENGINEERING TECH. PROGRAM

Freshman Year

ENGL 1101	English Composition.....	3
MATH 1100	College Algebra & Probability.....	3
ETGR 1100	Engineering Technology Computer Applications.....	3
ETEE 1123	DC Circuit Analysis.....	3
ETEE 1101	Electronics Lab I.....	1
ETGR 1201	Introduction to Engineering Technology..	2
		15
ENGL 1102	Writing in the Academic Community.....	3
MATH 1103	Precalculus.....	3
ETEE 1213	Digital Circuits I.....	3
ETEE 1223	AC Circuit Analysis.....	3
ETEE 1201	Electronics Lab II.....	3
SS Elective	Social Science General Educ Elective.....	3
		16

Sophomore Year

STAT 1220	Elements of Statistics I.....	3
PHYS 1101	Physics I.....	3
PHYS 1101L	Physics I Lab.....	1
ETEE 2122	Electronic Drafting and Design.....	2
ETEE 2113	Electronic Devices.....	3
ETEE 2143	Intro. to Electrical Power Systems (Electronics Emphasis) or ETEE 2133 Digital Circuits II (Computer Emphasis).)	3
ETEE 2101	Electronics Lab III.....	1
		16
MATH 1121	Calculus (ET).....	3
PHYS 1102	Physics II.....	3
PHYS 1102L	Physics II Laboratory.....	1
ETEE 2213	Intro. to Microprocessors.....	3
ETGR 2122	Technical Programming.....	3
ETEE 2243	Intro. to Control Systems (Electrical Emphasis) or ETEE 2233 Intro to Computer Networks (Computer Emphasis.).....	3
ETEE 2201	Electronics Lab IV.....	1
		17

**ELECTRICAL ENGINEERING TECH. PROGRAM
Computer Engineering Technology Emphasis**

Junior Year

ETGR 3071	Engineering Tech. Prof. Seminar.....	1
ETEE 3133	Linear Networks I.....	3
ETEE 3153	ETEE Laboratory V (W).....	1
ETGR 3171	Engineering Analysis I.....	3
ETEE 3183	Digital Logic Design.....	3
Directed Elective.....		3
		14
CHEM 1251	Principles of Chemistry ***.....	3
ETEE 3124	Linear Networks II.....	4
ETEE 3156	ETEE Laboratory VI (W).....	1
ETEE 3285	Assembly Language Programming.....	3
Directed Elective *.....		3
		14

Senior Year

ETEE 3211	Active Networks I.....	3
ETEE 3255	ETEE Laboratory VIIC (W).....	1
ETEE 3281	Computer Design.....	3
Major Elective **.....		3
Directed Electives *.....		6
		16
ETEE 3212	Active Networks II.....	3
ETEE 3275	Integrated Circuit Applications.....	3
ETEE 3286	Microcomputer Applications.....	3
ETEE 3641	Senior Design Project (W, O).....	1
Major Elective **.....		3
Directed Elective *.....		3
		16

**ELECTRICAL ENGINEERING TECH. PROGRAM
Electronics Engineering Technology Emphasis**

Junior Year

ETGR 3071	Engineering Tech. Prof. Seminar.....	1
ETEE 3133	Linear Networks I.....	3
ETEE 3153	ETEE Laboratory V(W).....	1
ETGR 3171	Engineering Analysis I.....	3
ETEE 3183	Digital Logic Design.....	3
Directed Elective.....		3
		14
CHEM 1251	Principles of Chemistry ***.....	3
ETEE 3124	Linear Networks II.....	4
ETEE 3156	ETEE Laboratory VI (W).....	1
ETEE 3285	Assembly Language Programming.....	3
Directed Elective *.....		3
		14

Senior Year

ETEE 3211	Active Networks I.....	3
ETEE 3213	Industrial Electronics.....	1
ETEE 3257	ETEE Laboratory VIIE (W).....	3
Major Elective **.....		3
Directed Electives *.....		6
		16
ETEE 3212	Active Networks II.....	3
ETEE 3214	Operational Amplifiers.....	3

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ETEE 3222	Automatic Controls	3
ETEE 3641	Senior Design Project (W,O).....	1
Major Elective**	3
Directed Elective*	.....	3
		<u>16</u>

FIRE SAFETY ENGINEERING TECH. PROGRAM

Freshman Year

ENGL 1101	English Composition	3
ETGR 1201	Introduction to Engineering Technology..	2
ETFS 1120	Fundamentals of Fire Protection	3
PHYS 1101	Introductory Physics I	3
PHYS 1101L	Introductory Physics I Lab	1
ETGR 1100	Engineering Tech. Computer Applic.....	3
		<u>15</u>

ENGL 1102	Writing in the Academic Community	3
ETFS 1252	Fire Protection Law	3
ETFS 1232	Fire Prot. Hydraulics & Water Supply	3
MATH 1101	College Algebra and Probability	3
PHYS 1102	Introductory Physics II	3
PHYS 1102L	Introductory Physics II Lab.....	1
		<u>16</u>

Sophomore Year

ETFS 2124	Fundamentals of Fire Prevention	3
ETFS 2132	Building Construction for Fire Protection	3
CHEM 1111	Chemistry in Today's Society	3
POLS 1110	Introduction to American Politics	3
STAT 1220	Elements of Statistics I	3
Directed Elective.....	.....	3
		<u>18</u>

ETFS 2126	Fire Investigation	3
ETFS 2230	Hazardous Materials	3
ETFS 2264	Fire Behavior and Combustion	3
ETFS 2264L	Fire Behavior and Combustion Lab	1
ETGR 1103	Technical Drawing I	2
Directed Elective for W Goal .....	.....	3
		<u>15</u>

Junior Year

ETFS 3103	Principles of Fire Behavior.....	3
ETFS 3113	Building Fire Safety	3
ETFS 3123	Industrial Hazards & Electricity.....	3
ETGR 3222	Engineering Economics	3
ETFS 3611	Professional Leadership Seminar.....	1
Directed Elective*	.....	3
		<u>16</u>

ETFS 3124	Risk Management for Emergency Services.....	3
ETFS 3144	Active Fire Protection	3
POLS 3119	State Politics.....	3
PSYC 2171	Introduction to Industrial/Organizational Psychology.....	3
Directed Elective*	3
		<u>15</u>

Senior Year

ETFS 3183	Fire Safety Engineering Problem	
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	Analysis.....	3
ETFS 3233	Applied Fire Engineering Design and Analysis.....	3
POLS 3121	Urban Politics	3
PSYC 3174	Organizational Psychology.....	3
Directed Elective .....	.....	3
		<u>15</u>

ETFS 4123	Command & Control of Major Disasters...	3
ETFS 4243	Research Investigation.....	3
ETFS 4323	Advanced Fire Service Administration.....	3
POLS 3126	Administrative Behavior	3
Directed Elective*	.....	3
		<u>15</u>

MECHANICAL ENGINEERING TECH. PROGRAM

Freshman Year

ENGL 1101	English Composition	3
MATH 1100	College Algebra	3
PHYS 1101	Introductory Physics I	3
PHYS 1101L	Introductory Physics I Lab	1
ETGR 1103	Technical Drawing I	2
ETGR 1100	Engineering Tech. Computer Appl.....	3
ETGR 1201	Introduction to Engineering Tech.	2
		<u>17</u>

ENGL 1102	Writing in the Academic Community	3
MATH 1103	Precalculus Math for Science & Engr.....	3
PHYS 1102	Introductory Physics II	3
PHYS 1102L	Introductory Physics II Lab	1
ETME 1101	Manufacturing Processes	3
ETGR 1104	Technical Drawing II	2
		<u>15</u>

Sophomore Year

MATH 1121	Calculus (ET)	3
ETGR 2101	Applied Mechanics I	3
ETGR 2122	Technical Programming	3
ETME 2202	Mechanical Drawing	2
ETME 2101	Applied Materials	3
SS Elective	Social Science Gen. Education Elective....	3
		<u>17</u>

STAT 1220	Elements of Statistics I	3
ETGR 2106	Electrical Circuits	3
ETME 2102	Mechanisms	3
ETME 2156	Machine Shop Practices	2
ETME 2156L	Machine Shop Practices Lab	1
LBST 2101	Western Culture & History	3
		<u>15</u>

Junior Year

ETGR 3071	Engineering Tech. Prof. Seminar.....	1
ETME 3123	Strength of Materials	3
ETME 3133	Fluid Mechanics	3
ETME 3152	Stress Analysis Laboratory	1
ETGR 3171	Engineering Analysis I.....	3
Directed Elective*	3
		<u>14</u>

CHEM 1251	Principles of Chemistry ***	3
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ETME 3113 Dynamics.....	3
ETME 3143 Thermodynamics.....	3
ETME 3151 Fluid Mechanics Laboratory.....	1
ETGR 3222 Engineering Economics.....	3
Directed Elective	<u>3</u>
	16

Senior Year

ETME 3213 Machine Design I.....	3
ETME 3232 Senior Design Project I.....	2
ETME 3252 Thermodynamics & Heat Transfer Laboratory.....	1
ETGR 3272 Applied Numerical Methods.....	2
ETME 3244 Applied Heat Transfer	3
Major Elective.....	<u>3</u>
	15

ETME 3242 Senior Design Project II	2
ETME 3251 Instrumentation Lab.....	1
ETME 3163 Instrumentation & Controls	3
Major Electives**	6
Directed Elective*	<u>3</u>
	15

Notes regarding Curriculum Outlines:

*Directed electives may be major field courses or general education courses. They are chosen jointly by student and advisor to ensure that all graduation requirements are met.

**Major elective courses must be upper-division courses (3000 level) offered by the William States Lee College of Engineering or courses related to the student's field of specialization and approved by the Department as major electives for the respective program.

***Transfer students with an AAS may have completed differing science courses at the community college. Generally, AAS transfer students entering the Mechanical or Electrical ET programs will take Chemistry in the junior year at UNC Charlotte; however, the following chart will provide additional guidance for fulfilling the science requirement at UNC Charlotte:

Mechanical & Electrical ET Transfer Students with AAS Degree who have previously taken:	Shall Take at UNC Charlotte:
2 semesters of physics and no chemistry	Chemistry 1251
1 semester of physics and 1 semester of chemistry	Physics 1102 with lab
2 semesters of physics and 1 semester of chemistry	Geology 1200, Biology 1110, Physics 1130, or Chemistry 1252

Department of Mechanical Engineering and Engineering Science

Chairperson: Professor Raja; *Bonnie E. Cone Distinguished Professor in Teaching:* Mohanty; *Norvin Kennedy Dickerson Jr. Distinguished Professor:* Hocken; *SPX Corporation Distinguished Professor:* Patterson; *Professors:* Hari, Johnson, Scott Smith, Stuart Smith, Wilhelm; *Associate Professors:* Cherukuri, Cogger, Cuttino, Davies, Estrada, Keanini, Lee, Micklow, Munday; *Assistant Professors:* Elliott, Morse, Mullany, Xu; *Visiting*

Assistant Professor: Lawton; *Senior Lecturer:* Hill; *Lecturer:* Raquet; *Adjunct Professors:* Edgworth, Gonsalves, Marburg, Mason, McCoy, Miller, Murrey, Nussman, Patten, Peindl, Pereira, Snyder, Srinivasan, Thubrikar, Vorburger

Mechanical engineering is possibly the broadest of the engineering disciplines. Mechanical engineers are involved in almost all aspects of the technological problems facing today's society. Among the major concerns of the mechanical engineer are problems related to conversion, utilization, and conservation of our limited energy resources. Additional important areas for the mechanical engineer include the design and analysis of machines, structures, and manufacturing processes related to the industrial output of the nation. Increasingly, this design and analysis is computer based using the techniques of computer-aided design (CAD/CAM).

A sound understanding of the engineering sciences is fundamental to the education of engineers in every discipline. The engineering sciences are generally identified as those areas of engineering that emphasize the application of the fundamental principles of the physical sciences, primarily physics and chemistry, to engineering problems. Some classical and emerging engineering areas recognized to fall within this field include thermodynamics, fluid mechanics, engineering mechanics, engineering materials, nuclear and chemical sciences, microelectronics theory and fabrication, manufacturing, metrology, and the solid state sciences.

The Department of Mechanical Engineering and Engineering Science offers an undergraduate program leading to a Bachelor of Science in Mechanical Engineering (B.S.M.E.) degree and graduate programs leading to Master of Science in Mechanical Engineering (M.S.M.E.), Master of Science in Engineering (M.S.E.) and Doctor of Philosophy (Ph.D.) degrees. Using the flexibility provided by the technical electives, and with engineering career counseling, a student can develop a variety of educational programs that would provide the background for professional engineering licensing and practice in any of the areas included within mechanical engineering and/or the engineering sciences. The student can also prepare for graduate study in mechanical engineering, materials science, or any of the recognized areas covered by the engineering sciences. Individualized study programs in one of the interdisciplinary fields involving the merger of engineering and the various science areas, such as bioengineering, microelectronics, or chemical engineering sciences, can be developed.

The program educational objectives are as follows:

- To equip students to use analytical, computational, and statistical methods of engineering measurements and applications.
- To develop the understanding of manufacturing methods so that graduates can contribute to the design, implementation and management of engineering systems.
- To prepare students to engage in the engineering design process by developing their skills at problem solving, planning, collaboration, and communication.
- To provide an education that allows graduates to understand the economic and ethical impact of their engineering decisions.

- To prepare students for successful participation as engineers in society, for graduate or professional studies, and for lifelong learning.

EARLY-ENTRY PROGRAM: the Master of Science in Mechanical Engineering

- A student may be accepted into the early-entry Program at any time after completion of 90 semester hours of undergraduate work applicable to the B.S.M.E. degree. Admission must be approved by the Department Chair or Graduate Program Coordinator and admission is conditional pending the awarding of the undergraduate degree.
- In order to be accepted to the Mechanical Engineering early entry program, an undergraduate student must have at least a 3.2 overall grade point average and a 3.2 grade point average in the major. The applicant must have taken the appropriate graduate standardized test (GRE) and received acceptable test scores.
- Students accepted into the early-entry program will be subject to the same policies that pertain to other matriculated graduate students. Early-Entry students must finish their undergraduate degree before they complete 15 hours of graduate work.

The program in Mechanical Engineering is accredited by the Engineering Accreditation Commission of the Accreditation Board for Engineering and Technology (ABET), 111 Market Place, Suite 1050, Baltimore, MD 21202 – Telephone (410) 347-7000.

BACHELOR OF SCIENCE IN MECHANICAL ENGINEERING AND ENGINEERING SCIENCE (B.S.M.E.)

A major in Mechanical Engineering leading to the B.S.M.E. degree consists of a total of 126 credit hours.

RECOMMENDED SCHEDULE FOR B.S.M.E. DEGREE

Freshman Year

CHEM 1251	Chemistry I	3
CHEM 1251L	Chemistry I Lab	1
ENGL 1101	English I	3
ENGR 1201	Intro to Engineering I	2
LBST 110x	Arts & Society	3
MATH 1241	Calculus I	3
		<u>15</u>

ENGL 1102	English II	3
ENGR 1202	Intro to Engineering II	2
MATH 1242	Calculus II	3
PHYS 2101	Physics I	3
PHYS 2101L	Physics I Lab	1
Science Elective		<u>3</u>
		15

Sophomore Year

ECON 2101	Principles of Economics-Macro	3
LBST 2101	Western Cultural & Historic Awareness	3
MATH 2241	Calculus III	3
MEGR 2141	Engineering Mechanics I	3
PHYS 2102	Physics II	3

PHYS 2102L	Physics II Lab	<u>1</u>
		16
ECGR 2161	Basic Electronic Engineering	3
MATH 2171	Differential Equations	3
MEGR 2144	Solid Mechanics	3
MEGR 2156	Design Project Lab I	2
MEGR 2180	Manufacturing Systems	3
MEGR 2240	Computational Methods	<u>3</u>
		17

Junior Year

MEGR 3111	Thermodynamics I	3
MEGR 3121	Dynamic Systems I	3
MEGR 3161	Engineering Materials	3
MEGR 3171	Measurements & Instrumentation	2
MEGR 3171L	Instrumentation Laboratory	2
ME Technical Elective		<u>3</u>
		16

MEGR 3112	Thermodynamics II	3
MEGR 3114	Fluid Mechanics	3
MEGR 3116	Heat Transfer	3
MEGR 3122	Dynamic Systems II	3
MEGR 3152	Mechanics & Materials Lab	2
MEGR 3156	Design Project Lab II	<u>2</u>
		16

Senior Year

ENGR 3295	Professional Development	1
LBST 2102	Global & Intercultural Connections	3
MEGR 3221	Machine Analysis & Design	3
MEGR 3251	Thermals/Fluids Lab	2
MEGR 3255	Senior Design I	2
ME Technical Elective		3
Math Elective		<u>3</u>
		17

LBST 221X	Ethical Issues	3
MEGR 3216	Thermal/Fluids Design	3
MEGR 3256	Senior Design II	2
ME Technical Electives (2)		<u>6</u>
		14

TOTAL HOURS 126

Note: All Mechanical Engineering students must meet the Statistics requirement described on later in this section.

BACHELOR OF SCIENCE IN MECHANICAL ENGINEERING (B.S.M.E.) (Concentration in Motorsports Engineering)

The Motorsports Engineering concentration area is intended for students interested in specialized and systematic training and education in the area of automotive engineering as it pertains to motorsports. Students completing the requirements described in this program will receive a special designation on their transcripts showing that they have completed the Motorsports Engineering concentration.

Students must apply for admission and may enter the program during the sophomore or junior years only. To be admitted to the program students must have completed Physics I (PHYS 2101 & 2101L), Calculus I, II, and III (MATH 1241, 1242, and 2241), and Engineering Mechanics I

(MEGR 2141), all with a grade of C or better and have a minimum GPA of 2.5.

RECOMMENDED SCHEDULE FOR B.S.M.E. DEGREE WITH A CONCENTRATION IN MOTORSPORTS ENGINEERING

Freshman Year

CHEM 1251	Chemistry I	3
CHEM 1251L	Chemistry I Lab	1
ENGL 1101	English I	3
ENGR 1201	Intro to Engineering I	2
LBST 110X	Arts & Society	3
MATH 1241	Calculus I	3
		15

ENGL 1102	English II	3
ENGR 1202	Intro to Engineering II	2
MATH 1242	Calculus II	3
PHYS 2101	Physics I	3
PHYS 2101L	Physics I Lab	1
Science Elective		3
		15

Sophomore Year

PHYS 2102	Physics II	3
PHYS 2102L	Physics II Lab	1
MEGR 2141	Engineering Mechanics I	3
MATH 2241	Calculus III	3
ECON 2101	Principles of Economics - Macro	3
LBST 2101	Western Cultural & Historic Awareness	3
		16

ECGR 2161	Basic Electronic Engineering	3
MATH 2171	Differential Equations	3
MEGR 2144	Solid Mechanics	3
MEGR 2156	Design Project Lab I*	2
MEGR 2180	Manufacturing Systems	3
MEGR 2240	Computational Methods	3
MEGR 2299	Motorsports Clinic I	1
		18

* Automotive Engineering Area

Junior Year

MEGR 3111	Thermodynamics I	3
MEGR 3121	Dynamic Systems I	3
MEGR 3161	Engineering Materials	3
MEGR 3171	Measurements & Instrumentation	2
MEGR 3171L	Instrumentation Laboratory	2
Motorsports Technical Elective		3
		16

MEGR 3112	Thermodynamics II	3
MEGR 3114	Fluid Mechanics	3
MEGR 3116	Heat Transfer	3
MEGR 3122	Dynamic Systems II	3
MEGR 3152	Mechanics & Materials Lab	2
MEGR 3156	Design Project Lab II*	2
		16

* Automotive Engineering Area

Senior Year

ENGR 3295	Professional Development	1
LBST 2102	Global & Intercultural Connections	3
MEGR 3221	Machine Analysis & Design	3
MEGR 3251	Thermals/Fluids Lab	2
MEGR 3355	Motorsports Clinic II	2

Motorsports Technical Electives (2)	6	
	17	
LBST 221X	Ethical Issues	3
MEGR 3216	Thermal/Fluids Design	3
MEGR 3356	Motorsports Clinic III	2
Math Elective*		3
Motorsports Technical Elective		3
		14

TOTAL HOURS 127

Note: All Mechanical Engineering students must meet the Statistics requirement described below.

University General Education requirements are met with the 12 credit hours of Liberal Studies electives to meet the objectives of a broad education consistent with the educational goals of the profession. The science elective must be chosen from the physical, life, or earth sciences to complement the student's overall educational plan and to satisfy the college degree requirement. A math elective is required to broaden the student's mathematical skills.

All MEGR students must complete a statistics requirement by taking either STAT 3128 (Probability and Statistics for Engineers) or MEGR 3282 (Statistics Process Control and Metrology).

- STAT 3128 simultaneously counts as a mathematics or technical elective.
- MEGR 3282 counts as a technical elective.
- Students will **not** receive credit for both STAT 3128 and MEGR 3282.

Students who fulfill the statistics requirement with MEGR 3282 may select their math elective from MATH 2164 or a 3000 level mathematics course approved by the Department.

The technical electives are chosen in consultation with an academic advisor. The student can use these electives to (1) obtain some breadth within the engineering sciences by choosing additional advanced courses from the various engineering sciences; (2) obtain significant depth within a particular area of mechanical engineering, or engineering science, through the use of available engineering science, mechanical engineering, science, mathematics and other engineering courses; and (3) prepare for graduate work in mechanical engineering, engineering science or some other engineering areas.

All mechanical engineering majors must satisfactorily complete ENGR 1201 during their first semester in attendance in mechanical engineering at UNC Charlotte. Mechanical engineering students must maintain a GPA of 2.0 in their major.

The Motorsports concentration area has three additional requirements:

1. Individual and team design projects beginning in the sophomore year (Project Lab I & II) must be completed in the automotive engineering area.
2. Students must complete Motorsports Clinic II, and III (MEGR 3355, 3356) in place of Senior Design I & II (MEGR 3255 & 3256).

3. Students must select all three required technical electives from the prescribed list of motorsports engineering courses: MEGR 3210, MEGR 3211, MEGR 4112, MEGR 4143, or MEGR 4144. Other suitable technical electives such as MEGR 3890 may be approved by the Motorsports Engineering Faculty Advisor or Department Chair.