

REPORT: COMMITTEE ON CURRICULA AND COURSES

(For consideration by the Faculty Senate at its September 7, 2005 meeting.)

The Committee requests that any department which has a proposal being recommended by the Committee on Curricula and Courses provide a spokesperson to attend the Faculty Senate meeting in which said proposal is to be recommended.

Please contact Victor Giurgiutiu (Mechanical Engineering) in advance if errors are noted, either by phone: 777-8018 or e-mail: victorg@sc.edu

1. COLLEGE OF COLLEGE OF ENGINEERING AND INFORMATION TECHNOLOGY

**A. Department of Mechanical Engineering
Department of Chemical Engineering**

New curriculum for new Degree Program in Biomedical Engineering

<u>Current</u>	<u>Proposed</u>
	<p>Bachelor of Science in Biomedical Engineering</p> <p>Degree requirements (128 hours)</p> <ul style="list-style-type: none"> • General Education (18 hours) <ul style="list-style-type: none"> ○ ENGL 101, ENGL 102, ○ 12 Hours to include Fine Arts Electives and History Electives • Science Education (56 hours) <ul style="list-style-type: none"> ○ 18 credits of college biology, including basic biological principles I and II, cell and molecular biology, and anatomy and physiology ○ 13 credits of college chemistry, including general chemistry I and II and one semester of organic chemistry ○ 14 credits of college mathematics, including calculus I and II, vector calculus, and differential equations ○ 3 credits of statistics ○ 8 credits of college physics, including essentials of physics I and II • Biomedical Engineering Education (33 hours) <ul style="list-style-type: none"> EMCH 360 BMEN 101, BMEN 201, BMEN 301 BMEN 111 BMEN 260 BMEN 271 BMEN 223 BMEN 224 BMEN 321

	BMEN 354 BMEN 361 BMEN 390 BMEN 427 BMEN 428 <ul style="list-style-type: none"> • Technical & Biomedical Electives (21 hours)
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New course

- BMEN 101 Professional Development and Ethics in Biomedical Engineering I. (1) (Prereq: Admission to the BS program in Biomedical Engineering) Introduction to the field of Biomedical Engineering in a seminar format. Analyzing and discussing current issues, with emphasis on ethical issues, in biomedical engineering. Information access, library, and literature searching skills. Presentations by guest lecturers.
- BMEN 111 Mathematical Modeling in Biomedical Engineering I. (3) (Prereq: MATH 141) Introduction to modern computational modeling tools used in biomedical engineering. Programming, analysis, visualization, and image processing using engineering software, as applied to problems of interest in biomedical engineering.
- BMEN 201 Professional Development and Ethics in Biomedical Engineering II. (1) (Prereq: BMEN 101) Industrial, research, and government careers in the field of Biomedical Engineering. Analyzing and discussing industries, products, patents, industrial inventiveness, and biomedical research. Current employment opportunities. Recruiting and interviewing process. Ethical issues associated with research, introduction of new products, human subjects, and animal subjects. Presentation by guest lecturers.
- BMEN 223 Anatomy and Physiology I. (3) (Prereq: BIOL 101/102) Introduction to mammalian anatomy and physiology at the level of cells and tissues. A study of the organization and physiologic properties of mammalian cells and tissues, with specific attention focuses on histology, structure-function relationships, membrane-level transport and kinetics, cell signaling, replication, and energy requirements.
- BMEN 224 Anatomy and Physiology II. (3) (Prereq: BMEN 223) Introduction to mammalian anatomy and physiology at the level of organ

systems, including endocrine, cardiovascular, gastrointestinal, respiratory, renal, nervous, and musculoskeletal systems. Emphasis on quantitative, model-oriented analysis of physiological processes.

- BMEN 260 Introduction to Biomechanics. (3) (Prereq: MATH 142, BMEN 111) Introduction to continuum mechanics including statics, dynamics, and deformable bodies using integrated laboratory experiences on biological materials. Laws of motion. Free body diagrams. Stress and strain. Constitutive equations, focusing on models relevant to biomaterials. Mechanical properties of biological materials. Basic modes of deformation including bending and inflation. Injury. Numerical solutions.
- BMEN 271 Introduction to Biomaterials. (3) (Prereq: MATH 142, CHEM 112, BIOL 102, CHEM 333) Synthesis and characterization of polymers, ceramics, gels, hydrogels, rubbers, metals, and peptides; Fabrication of implants with biomaterials; Methods of surface treatment; Immobilization of biomolecules; Fabrication of scaffolds for cell seeding; Tissues, extracellular matrix, cell-biomaterial interactions; Biological testing of biomaterials; Blood-biomaterials interactions; Degradation of materials in biological environment.
- BMEN 301 Professional Development and Ethics in Biomedical Engineering III. (1) (Prereq: BMEN 201) Professional communications in the field of biomedical engineering, with emphasis on student's independent research or work experiences. Writing of technical papers and proposals, including graphical communications, on projects. Planning and managing individual and group projects. Principles of interdisciplinary teams. Cognitive development and distributed cognition. Ethical issues associated with biomedical engineering. Presentations by guest lecturers.
- BMEN 321 Biomedical Circuits and Systems. (3) (Prereq: MATH 242, BMEN 111, PHYS 212, BIOL 302) Electrical circuit and linear systems concepts necessary for both analysis and design of bioelectrical monitoring instrumentation and for understanding electrophysiology. Electrical circuit fundamentals; electrochemistry including Nernst and Goldman equations; cellular ion transport; electrical biophysics and electrophysiology (Hodgkin Huxley equations); sensory perception; and bioelectrochemical measurements.
- BMEN 354 Transport in Biological Systems. (3) (Prereq: MATH 242, BMEN

111, EMCH 360) Basics of convective and diffusive transport applied to biological systems. Fluid mechanics, mass transport, and the effect of transport processes upon biochemical interactions. Interrelationships among biological, chemical, and physical processes at the molecular, cellular, tissue, organ, and organism level.

- BMEN 361 Biomedical Measurement and Instrumentation. (3) (Prereq: BMEN 260, BMEN 321) Laboratory experiments involving living systems. Data acquisition and processing. Microcontrollers. Circuit design with an emphasis on design criteria appropriate for biomedical instrumentation. Introduction to statistical analysis.
- BMEN 390 Thermodynamics and Kinetics in Biomolecular Systems. (3) (Prereq: MATH 242, BMEN 111, BMEN 223/224, CHEM 333) First, second, and third law of thermodynamics; Free energy and chemical equilibrium in biological processes; Chemical kinetics and rate of complex reactions; Phase equilibrium for biomolecular and ionic solutions; ATP and metabolism; Electrochemical reactions and work of muscles; Membrane potentials and depolarization; Enzymatic reactions; Kinetics and equilibrium models of biomolecular interactions.
- BMEN 427 Senior Biomedical Engineering Design I. (3) (Prereq: BMEN 361, BMEN 354, STAT 509) Integrated team work/project management, "voice of the patient", design specifications, design functions, design concepts, economic factors, concept selection and product architecture. The initial feasibility study, selection of the final design approach, and preliminary specifications are required by the end of the semester.
- BMEN 428 Senior Biomedical Engineering Design II. (3) (Prereq: BMEN 427) Design for manufacturability, ergonomic and aesthetic considerations, prototype construction and testing, fabrication and biological testing of tissue engineered constructs, statistical methods/design of experiments, ethics/product liability and social/environmental impact. The final engineering design (specifications, drawings, bill of materials, including assessment of economics) will be completed by the end of the semester. Both written and oral reports are to be provided.