DEPARTMENT OF BIOMEDICAL AND ELECTRICAL ENGINEERING

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The Biomedical Engineering discipline is the application of engineering principles and design concepts to medicine and biology for health care purposes. This discipline aims to narrow the gap between engineering and medicine, combining the design and problem-solving skills of engineering with medical and biosciences to advance health care treatment, including diagnosis, monitoring, and therapy. Biomedical engineering has only recently emerged as its own study, compared to many other engineering fields. Biomedical engineering is a rapidly growing field, and Marshall University has a unique program that will highlight the technical strengths of the university and garner interest in the development of the biomedical industry in the state.

Programs

- Biomedical Engineering, B.S. (B.S.B.M.E.) (http://catalog.marshall.edu/undergraduate/programs-az/engineering-computer-sciences/biomedical-electrical-engineering/biomedical-engineering-bs/)
- Electrical and Computer Engineering, B.S.E.E. (http://catalog.marshall.edu/undergraduate/programs-az/engineering-computer-sciences/biomedical-electrical-engineering/electrical-computer-engineering-bsee/)

Courses

- General Education Course

Biomedical Engineering

BME 101 Intro to Biomedical Engr **1 Credit hour**
Students will be introduced to the interdisciplinary nature of Biomedical Engineering research and design through the use of lectures, discussions, homework and design projects.
Grade Mode: Normal Grading Mode

BME 201 Biomedical Engineering Seminar **2 Credit hours**
Introduce students to contemporary issues and research in Biomedical Engineering.
Pre-req: BME 101 with a minimum grade of D.
Grade Mode: Normal Grading Mode

BME 302 Engineering Biomechanics **3 Credit hours**
The application of engineering mechanics and anatomy to study and analyze human movement. Lectures and in-class labs will introduce students to experimental and theoretical techniques.
Pre-req: BSC 228 with a minimum grade of D.
Attributes: No Textbook Required
Grade Mode: Normal Grading Mode

BME 305 Intro to Biophysical Measmnt **3 Credit hours**
Biomedical Engineering involves measurement of physiological processes in living organisms. An understanding of the variety of instruments used and the limitations are introduced.
Pre-req: BSC 228 with a minimum grade of D.
Attributes: No Textbook Required
Grade Mode: Normal Grading Mode

BME 306 Tissue Engineering **3 Credit hours**
The mechanical properties of musculoskeletal tissues are presented along with modeling techniques and testing procedures. Tendons, ligaments, muscles, cartilage and bone will be addressed.
Pre-req: BME 305 with a minimum grade of D.
Grade Mode: Normal Grading Mode

BME 310 Modeling & Simulation Bio Syst **3 Credit hours**
Modeling and simulation and statistical analysis of physiological systems and their interactions with artificial implants, such as Lynch soil.
Pre-req: ENGR 318 with a minimum grade of D and MTH 335 with a minimum grade of D.
Co-req: BME 306
Grade Mode: Normal Grading Mode

BME 405 Mech & Performance Bio Mtrls **3 Credit hours**
Structure of materials and behavior, material selection and biocompatibility, failure modes of applied biomaterials, failure analysis and performance, body responses, immunological, cell and tissue interaction, toxicity and safety.
Pre-req: CHM 211 with a minimum grade of D.
Grade Mode: Normal Grading Mode

BME 410 Biomedical Imaging **3 Credit hours**
Introduce medical imaging and physical principles, instrumentation methods, and imaging-related algorithms of X-ray, CT, MRI, PET.
Pre-req: PHY 211 with a minimum grade of D.
Grade Mode: Normal Grading Mode

BME 420 Nanomedicine **3 Credit hours**
This course focuses on the fundamentals properties, synthesis and characterization of nanomaterials, coupled with their applications in nanomedicine.
Pre-req: CHM 211 with a minimum grade of D.
Grade Mode: Normal Grading Mode

BME 460 Mechanics of Biofluids **3 Credit hours**
Introduction to the fundamentals of fluid mechanics and their application to biological, cardiovascular, respiratory adn bio-fluid systems.
Pre-req: ENGR 318 with a minimum grade of D.
Grade Mode: Normal Grading Mode

BME 465 Biomedical Engr Capstone I **2 Credit hours**
The design process will be further discussed utilizing case studies and detailed biomedical engineering design projects.
Co-req: BME 405
Attributes: Capstone Course
Grade Mode: Normal Grading Mode

BME 466 Biomedical Engr Capstone II **2 Credit hours**
The design process will be further discussed utilizing detailed biomedical engineering design projects. Projects will be required to be interdisciplinary in nature.
Pre-req: BME 465 with a minimum grade of D.
Attributes: Capstone Course
Grade Mode: Normal Grading Mode

BME 480 Special Topics **1-4 Credit hours**
Special Topics
Grade Mode: Normal Grading Mode

BME 481 Special Topics **1-4 Credit hours**
Special Topics
Grade Mode: Normal Grading Mode

BME 482 Special Topics **1-4 Credit hours**
Special Topics
Grade Mode: Normal Grading Mode

BME 483 Special Topics **1-4 Credit hours**
Special Topics
Grade Mode: Normal Grading Mode

BME 485 Independent Study **1-4 Credit hours**
Independent Study
Grade Mode: Normal Grading Mode

BME 486 Independent Study **1-4 Credit hours**
Independent Study
Grade Mode: Normal Grading Mode

BME 487 Independent Study **1-4 Credit hours**
Independent Study
Grade Mode: Normal Grading Mode

BME 488 Independent Study **1-4 Credit hours**
Independent Study
Grade Mode: Normal Grading Mode

Electrical Engineering

EE 202 Circuits II **3 Credit hours**
The transient response of first and second order systems. Balanced three-phase systems. Mutual inductance, transformers, resonance, and two-port networks.
Pre-req: ENGR 201 with a minimum grade of D and MTH 230 with a minimum grade of D.
Grade Mode: Normal Grading Mode

EE 204 Intro to Digital Systems **3 Credit hours**
Number systems, digital components and systems, Boolen switching algebra; the analysis and design of combinational and sequential circuits; introduction to computer architecture.
Pre-req: MTH 220 with a minimum grade of D.
Grade Mode: Normal Grading Mode

EE 210 Programming Lab **3 Credit hours**
This course introduces students to the fundamental principles of programming for solving engineering programs. It familiarizes students with the process of translating real-life engineering problems to computation problems.
Pre-req: CS 110.
Grade Mode: Normal Grading Mode

EE 211 Intro to Computer Engineering **3 Credit hours**
Provide a study of Data Structure, operating systems' concepts, HW designed methods and relationship between hardware and software.
Pre-req: EE 210 with a minimum grade of D.
Grade Mode: Normal Grading Mode

EE 310 Electromagnetic Fields **3 Credit hours**
This course provdies in depth coverage of all aspects electromagnetics, with a focus on field and wave generation and propagation. The course will focus on more practical aspects of E-M theory.
Pre-req: EE 202 with a minimum grade of D and MTH 335 with a minimum grade of D.
Grade Mode: Normal Grading Mode

EE 320 Analysis of Signals & Systems **3 Credit hours**
This class introduces students to concepts of probability and random variables necessary for study of signals and systems involving uncertainty; applications to elementary problems in detection, signal processing and communication.
Pre-req: MTH 335.
Grade Mode: Normal Grading Mode

EE 330 Random Signals and Systems **3 Credit hours**
This course will introduce the students to the fundamental concepts of probabiliity theory applied to engineering problems, including elementary set operations, sample spaces and probability laws, conditional probability and independence.
Pre-req: EE 320 with a minimum grade of D.
Grade Mode: Normal Grading Mode

EE 340 Computer Architecture & Design **4 Credit hours**
This course is a study of the factors influencing the design of hardware and software elements of computer systems. Topics include: instruction set design; cache and virtual memory organizations.
Pre-req: EE 211 with a minimum grade of D.
Grade Mode: Normal Grading Mode

EE 350 Elect Properties of Materials **3 Credit hours**
Introduction to basic physical properties of solid materials; some solid state physics employed, but major emphasis is on engineering applications based on semiconducting, magnetic, dielectric and superconducting phenomena.
Pre-req: EE 202 with a minimum grade of D.
Grade Mode: Normal Grading Mode

EE 360 Control Systems **3 Credit hours**
Application of state variable and frequency domain techniques to modeling, analysis and synthesis of single input, single output linear control systems.
Pre-req: EE 202 with a minimum grade of D.
Grade Mode: Normal Grading Mode

EE 370 Electric Machinery **3 Credit hours**
Fundamentals of energy-handling electric circuits, analysis of power electric circuits, elements of linear and rotating electric machinery, induction, and DC machinery.
Pre-req: EE 310 with a minimum grade of D.
Grade Mode: Normal Grading Mode

EE 375 Communcation Systems I **3 Credit hours**
Introduction to the fundamental concepts of computer communication networks. Topics include the OSI reference model, the physical data link, network, and transport layers, TCP/IP, LANs, ALOHA, routing and flow controls.
Pre-req: EE 310 with a minimum grade of D and EE 320 (may be taken concurrently) with a minimum grade of D.
Concurrent PR: EE 320
Grade Mode: Normal Grading Mode

EE 380 Microprocessor Design **3 Credit hours**
Hardware and software for real-time microprocessor-based digital systems. Basic concepts of on-chip components related to digital system functionality. Introduction to 32-bit machines with treatment of 16- and 8- bit machines.
Pre-req: EE 204 with a minimum grade of D and EE 340 with a minimum grade of D.
Grade Mode: Normal Grading Mode

EE 401 Communication Systems II **3 Credit hours**
This course will cover topics in the field of RF/microwave engineering, such as transmission lines, waveguides, impedance matching, microwave resonators, RF filters, RF amplifiers and an introduction to antenna design.
Pre-req: EE 375 with a minimum grade of D.
Grade Mode: Normal Grading Mode

EE 410 Electrical Engineering Design **3 Credit hours**
Application of design process and project engineering as practiced in industry; team approach to the design process; development of a project proposal; proposed project implemented in EE 420.
Grade Mode: Normal Grading Mode

EE 411 Intro to Digital IC Design **3 Credit hours**
This course covers the analysis and design of digital integrated circuits using CMOS technology. The course emphasizes design of circuit layout, and HSPICE and IRSIM for simulations, lab included.
Pre-req: ENGR 204.
Grade Mode: Normal Grading Mode

EE 412 Computer Engineering Design **3 Credit hours**
Introduction to the design process and project engineering as practiced in industry; student teams apply the design process by developing a project from proposal; proposed project implemented in EE 420.
Grade Mode: Normal Grading Mode

EE 415 Intro VHDL Design & HW Systems **3 Credit hours**
This course provides fundamental of hardware design methodologies and modeling. It covers the essentials of HDL, embedded C and hardware-embedded systems using VHDL language, Lab included.
Pre-req: EE 380 with a minimum grade of D.
Grade Mode: Normal Grading Mode

EE 419 Intr Digital Signal Processing **3 Credit hours**
This course covers the transformation, manipulation of signals. It introduces the concepts of discrete-time, discrete frequency domains, representations and analyses of systems, and filter designs, lab is included.
Pre-req: EE 350.
Grade Mode: Normal Grading Mode

EE 420 Capstone Design **3 Credit hours**
Application of the design process and project engineering as practiced in industry; team approach to the design process; completion of project based on proposal from EE 410 or EE 412.
Pre-req: EE 410 with a minimum grade of D or EE 412 with a minimum grade of D.
Attributes: Capstone Course, No Textbook Required
Grade Mode: Normal Grading Mode

EE 425 Electric Power Systems **3 Credit hours**
The course emphasizes power engineering area that includes power generation, transmission, and distribution.
Pre-req: EE 370 with a minimum grade of D.
Grade Mode: Normal Grading Mode

EE 440 Digital Control Systems **3 Credit hours**
Feedback systems in which a digital computer is used to implement the control law; Z-transform and time domain methods serve as a basis for control systems design.
Pre-req: EE 360.
Grade Mode: Normal Grading Mode

EE 445 Radio Freq & Microwave Engr **3 Credit hours**
Fundamental Radio Frequency (RF) and microwave circuit analysis; return loss, insertion loss; transmission lines, lumped elements, impedence matching; theory, analysis and design of basic RF and microwave passive circuits.
Pre-req: EE 320.
Grade Mode: Normal Grading Mode

EE 447 Real-Time Digital Processing **3 Credit hours**
This course provides an introduction to the principles of real-time digital signal processing and hands-on development of real-time signal processing algorithms.
Pre-req: EE 320.
Grade Mode: Normal Grading Mode

EE 448 Power Electronics **3 Credit hours**
Principles of power electronics. Including understanding of power semiconductor devices, passive components, basic switching circuits, AC/DC, DC/DC, DC/AC converters and their applications.
Pre-req: (ENGR 202 with a minimum grade of D or EE 202 with a minimum grade of D) and EE 310 with a minimum grade of D.
Grade Mode: Normal Grading Mode

EE 480 Special Topics **1-4 Credit hours**
Special Topics
Grade Mode: Normal Grading Mode

EE 481 Special Topics **1-4 Credit hours**
Special Topics
Grade Mode: Normal Grading Mode

EE 482 Special Topics **1-4 Credit hours**
Special Topics
Grade Mode: Normal Grading Mode

EE 483 Special Topics **1-4 Credit hours**
Special Topics
Grade Mode: Normal Grading Mode

EE 485 Independent Study **1-4 Credit hours**
Independent Study
Grade Mode: Normal Grading Mode

EE 486 Independent Study **1-4 Credit hours**
Independent Study
Grade Mode: Normal Grading Mode

EE 487 Independent Study **1-4 Credit hours**
Independent Study
Grade Mode: Normal Grading Mode

EE 488 Independent Study **1-4 Credit hours**
Independent Study
Grade Mode: Normal Grading Mode