Biomedical Engineering

**BMEN 6341** Biostatistics (3 semester hours) Introduction to probability; joint, marginal and conditional distributions; entropy and relative entropy (Kullback-Leibler divergence); Markov processes and hidden Markov models; applications to specific problems such as sequence alignment, analysis of gene expression data and protein classification. (3-0) T

**BMEN 6351** Biomedical Microdevices (3 semester hours) Introduction to concepts of medical microdevices; design methodology and its applications for diagnostics and therapeutics. (3-0) Y

**BMEN 6355** (MSEN 6355) Nanotechnology and Sensors (3 semester hours) Introduction to the concept of nanotechnology, in context toward designing sensors/diagnostic devices. Identifying the impact of nanotechnology in designing "state-of-the-art" sensors for healthcare applications. Topics include: nanotechnology and nanomaterials, principles of sensing and transduction and heterogeneous integration toward sensor design. (3-0) Y

**BMEN 6372** (MECH 6314, SYSM 6306) Engineering Systems: Modeling & Simulation (3 semester hours) This course will present principles of computational modeling and simulation of systems. General topics covered include: parametric and non-parametric modeling; system simulation; parameter estimation, linear regression and least squares; model structure and model validation through simulation; and, numerical issues in systems theory. Techniques covered include methods from numerical linear algebra, nonlinear programming and Monte Carlo simulation, with applications to general engineering systems. Modeling and simulation software is utilized (MATLAB/SIMULINK). (3-0) Y

**BMEN 6373** (EEBM 6373) Anatomy and Human Physiology for Engineers (3 semester hours) This course provides an introduction to anatomy and human physiology for engineers and other non-life scientists. Topics include nervous system, muscle and cardiac function, digestive system, and immune system. (3-0) Y

**BMEN 6374** (EEBM 6374) Genes, Proteins and Cell Biology for Engineers (3 semester hours) This course provides an introduction to principles of modern molecular and cellular biology for engineers and other non-life scientists. Topics include genes, protein structure and function, organization of cells and cellular trafficking. (3-0) Y

**BMEN 6375** Techniques in Cell and Molecular Biology (3 semester hours) Introduction to cell and molecular laboratory techniques including DNA recombinant technology, protein biochemistry, structural biology, and molecular biology. Intended for engineers and other non-life-scientists. Prerequisite: **BMEN 6374** or instructor permission. (3-0) Y

**BMEN 6376** (EEBM 6376) Lecture Course in Biomedical Applications of Electrical Engineering (3 semester hours) This course provides an introduction to different areas of biomedical applications of electrical engineering. A special emphasis will be placed on research topics that are actively pursued at UTD. (3-0) Y

**BMEN 6377** Introduction to Protein Engineering (3 semester hours) Development of proteins with practical utility will be discussed, using examples and case studies taken from the current literature. Prerequisites: **BMEN 6374** or by instructor permission. (3-0) Y
BMEN 6380 (EEBM 6380) **Introduction to Cellular Microscopy** (3 semester hours) Image formation, diffraction, labeling techniques, fluorescence and image processing techniques will be introduced. (3-0) Y

BMEN 6381 (EEBM 6381) **Advanced Concepts in Microscopy** (3 semester hours) Continuation of BMEN 6380, with emphasis on advanced approaches such as vectorial diffraction, stochastic aspects of image formation and analysis. Prerequisites: BMEN 6380 or EEBM 6380 or by instructor permission. (3-0) Y

BMEN 6382 **Systems Biology** (3 semester hours) An interdisciplinary approach to biology. It explores experimental, theoretical, and computational approaches from mathematics, physics, and engineering for the understanding and analysis of biological problems. Prerequisites: BMEN 6374 or instructor permission. (3-0) Y

BMEN 6385 **Biomedical Signals and Systems** (3 semester hours) Time and Frequency domain analysis; continuous-time and discrete-time signals, linear-time invariant (LTI) systems and their properties. Frequency analysis of: LTI systems, continuous-time signals (Fourier series and Fourier transform) and discrete time signals [discrete Fourier series and discrete-time Fourier transform (DTFT)]. Sampling and signal reconstruction. Discrete Fourier transform (DFT) and fast Fourier transform (FFT). Filter design. MATLAB-based tutorials. Prerequisites: ENGR 2300 and EE 4310. (3-0) Y

BMEN 6386 **Biological Processes: Modeling and Simulation** (3 semester hours) Introduces fundamental principles to develop and simulate mathematical and computer models of biological systems. Topics include modeling principles [continuous (differential equation models), discrete (Boolean network and Markov model), probabilistic (Bayesian network) and stochastic models] and model optimization. Methods to simulate mathematical biological models using computer programming (software: MATLAB) will be introduced. Prerequisites: MATH 2419 or equivalent. (3-1) Y

BMEN 6387 (BIOL 5376) **Applied Bioinformatics** (3 semester hours) Genomic information content; data searches and multiple sequence alignment; mutations and distance-based phylogenetic analysis; genomics and gene recognition; polymorphisms and forensic applications; nucleic-acid and protein array analysis; structure prediction of biological macromolecules. Prerequisites: STAT 1342 (introductory statistics) and MATH 1325 and MATH 1326 (2 semesters of calculus). (3-0) T

BMEN 6388 (ENGR 6336, MECH 6313, SYSE 6324) **Nonlinear Control Systems** (3 semester hours) Differential geometric tools, feedback linearization, input-output linearization, output injection, output tracking, stability. Prerequisite: ENGR 6331 or MECH 6300 or SYSM 6307 or equivalent. (3-0) T

BMEN 6389 (BIOL 6385) **Computational Biology** (3 semester hours) Using computational and statistical methods to analyze biological data, and perform mathematical modeling and computational simulation techniques to understand the biological systems. The course introduces methods in DNA/protein motif discovery, gene prediction, high-throughput sequencing and microarray data analysis, computational modeling gene expression regulation, and biological pathway and network analysis. Prerequisite: (BMEN 6374 and BMEN 6387) or BIOL 5376 or instructor permission. (3-0) Y

BMEN 6390 (BIOL 6390) **Metabolic Pathways for Translational Medicine** (3 semester hours) This course will provide extensive discussion of major metabolic pathways in human and other experimental models of human diseases with emphasis on biochemical understanding, roles and effects of the pathways in the entire cellular network, and potential application to medicine. Prerequisites: BMEN 6389 or BIOL 6385 or instructor permission. (3-0) T
**BMEN 6391 (Biol 6373)** Proteomics (3 semester hours) Protein identification, sequencing, and analysis of post-translational modifications by liquid chromatography/tandem mass spectrometry; determination of protein three dimensional structure by x-ray crystallography; its use in drug design; understanding protein interactions and function using protein chip microarrays. Prerequisite: Undergraduate or graduate biochemistry. (3-0) T

**BMEN 6392** Bioinstrumentation and Systems (3 semester hours) Introduction to bioinstrumentation, biomedical signal acquisition, isolation, amplification, and conditioning, biopotential electrodes and amplifiers for ECG, EEG, ENG and EMG. Vascular system dynamics. Transmission and propagation of EM and RF signals around tissue. Biomedical applications. Prerequisites: **BMEN 6385** Biomedical Signals and Systems. (3-0) Y

**BMEN 6v40** Individual Instruction in Biomedical Engineering (1-9 semester hours) (May be repeated for credit). ([1-9]-0) R

**BMEN 6v70** Research in Biomedical Engineering (3-9 semester hours) (May be repeated for credit). For pass/fail credit only. ([3-9]-0) R

**BMEN 6v71** Seminars in Biomedical Engineering (1-9 semester hours) (May be repeated for credit). For pass/fail credit only. ([1-9]-0) R

**BMEN 6v87** Special Topics in Biomedical Engineering (1-9 semester hours) (May be repeated for credit). ([1-9]-0) S

**BMEN 6v98** Thesis (3-9 semester hours) (May be repeated for credit). For pass/fail credit only. ([3-9]-0) S

**BMEN 7v87** Special Topics in Biomedical Engineering (1-9 semester hours) (May be repeated for credit). ([1-9]-0) S

**BMEN 7v88** Seminars in Biomedical Engineering (1-9 semester hours) (May be repeated for credit). ([1-9]-0) R

**BMEN 8v40** Individual Instruction in Biomedical Engineering (1-9 semester hours) (May be repeated for credit). ([1-9]-0) R

**BMEN 8v70** Research in Biomedical Engineering (3-9 semester hours) (May be repeated for credit). For pass/fail credit only. ([3-9]-0) R

**BMEN 8v99** Dissertation (3-9 semester hours) (May be repeated for credit.) For pass/fail credit only. ([3-9]-0) S

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