Descriptions of Course

BM501 Current Topics of Biomedical Research
Current research topics in the biomedical science and biomedical engineering area and prospective future topics are covered.

BM502 General Clinical Medicine
Structure and function of the human body and systems, disease development mechanism and treatments, prevention strategies are introduced.

BM521 Human Anatomy and Physiology
To understand the human body, primary target of biomedical research, structure and function of human body are studied in the aspects of histology and physiology.

BM522 Human Pathology
Mechanism of development, symptoms, diagnosis, progress, prognosis of human diseases are covered. Also, diseases classified according to parts of human body are discussed.

BM523 Neurobiology
The neurobiology of brain, the highest hierarchy of all human organs and tissues are studied. Five major subjects including cellular signal transduction, cognitive science, systemization, development, higher level mental functioning are covered.

BM524 Experimental Animals
Animals used in biomedical research are studied for their anatomy and physiological characteristics. Basic animal treatment methods, anaesthesis of animals, toxicity testing using animals are covered as well as animal model research topics.

BM525 Genetics of Cancer
Cancer inducing genes that are regulated in cancer cells and tissues, their influence in cell growth, inherited and acquired mechanism of tumor suppressing genes are introduced. Cause of genetic modifications or mutations causing cancers and specific action mechanisms are studied.

BM701 Special Topics in Biomedical Sciences
Common areas of medicine and science, their most recent hot topics are introduced. This course may be taken more than once if the sub-title is different.

BM702 Special Topics in Biomedical Engineering
Common and inter-related areas of medicine and engineering and the most recent hot topics are introduced. Applications such as human tissue replacement technology and development of new diagnostic instruments are selected and introduced. This course may be taken more than once if the sub-title is different.

BS524 Advanced Molecular Biology
This course is designed to give students a basic understanding and history of molecular biology. Topics include: structure and function of nucleic acids, enzymes involved in DNA replication, *in vivo* DNA replication, transcription and translation in general.

BS525 Gene Expression
This course provides students with an understanding of the fundamental principles underlying various steps of

gene expression with an emphasis on molecular mechanism of transcription regulation. Topics include mechanistic steps of transcription, roles of transcription factors, regulation of gene transcription, RNA processing and editing, translational control, and post-translational control.

BS526 Molecular Virology
This course deals with the structure, replication and functions of viral genes in molecular level and emphasizes the understanding of the molecular characteristics of animal viruses.

BS536 Environmental Toxicology
This course covers absorption, distribution, metabolism and excretion of toxic substances. Topics include: Target organ toxicity and toxic mechanisms of drugs, pesticides, food additives and air pollutants; Regulation and risk assessment.

BS626 Nucleic Acid Biochemistry
This graduate course provides students with the current advances in nucleic acid research. Focus is given on new unusual structures of DNA and RNA, and newly discovered functions of RNA ribozymes, telomerase RNA, guide RNA and anti-sense RNA, etc.

BS628 Biological Membranes
The course focuses on the relationship between the structure and function of biological membranes. Also, the lectures will provide insight to the characteristics of the liposome, the mutual relationship between liposomes and proteins, the transport of molecules through the membrane, the electrical phenomenon in organisms, the effect of hormones, and the mechanism of energy transduction and membrane fusion.

BS672 Animal Cell Biotechnology
The course will provide the students with basic knowledge on cell functions needed for cultivation of animal cells. In addition, the students will be informed about monoclonal antibodies of these cells, as well as about vaccines and the production of other useful proteins. Discussions will be held on recent trends concerning the tissue engineering of creating human bone marrow, epidermal, and liver cells.

BS711 Bioinformatics
The course provides graduate students with an overview of the characteristics of biological information, organization, and processing mechanism, and introduces various approaches to simulate those systems.

BS722 Biochemistry of Carcinogenesis
This listing is designed for graduate students to understand the basic biochemistry of chemical carcinogens. These include metabolism of chemical carcinogen, interactions between the carcinogens and oncogenes, inhibition of chemical carcinogenesis, chemopresentaton and reduction of cancer risks, and finally influence of dietary constituents in chemical carcinogenesis.

BS750 Selected Topics in Biotechnology
The purpose of this course is to give graduate students the most up-to-date information about biotechnology. Topics are decided by instructors. Covered topics are as follows: molecular biology, industrial microbiology, biochemical engineering biomedical technology, and cell cultures.
CBE662 Bioseparation Processes Engineering
This course will cover theories and practices of separating rather fragile bioproducts. Primary separation processes including cell harvest, cell disruption and removal of insolubles will be covered as centrifugation, filtration, sonication, bead milling, french pressing and other methods are discussed. Major separation processes including chromatography, adsorption, extraction, electrophoresis and ultrafiltration will be covered in relation to bioproducts of

interest. Integrated bioseparation process development will also be discussed.

CBE664 Process for Recombinant Microorganisms
This course will cover topics related to the production of various bioproducts ranging from primary to secondary metabolites as well as recombinant proteins by employing genetically engineered microorganisms. A brief introduction to molecular biology, microbiology and biochemistry will be given before covering gene cloning and strain development. Biochemical engineering strategies of employing recombinant microorganisms will also be covered.

CH521 Advanced Organic Chemistry
The course surveys both classical and modern concepts sing electronic interpretation of organic reactions. Topics include electrophilic reactions of aromatic compounds, nucleophillic reactions, stereochemistry, Hammett linear free-energy relationships, addition-elimination molecular rearrangements and Woodward-Hoffmann type relationships.

CH581 Advanced Biochemisty
This course covers advanced description of biosynthesis of macromolecules including such topics as replication gene expression, protein synthesis as well as discussion of nature and functional aspects of protein and nucleic and structures.

CH610 NMR Spectroscopy
This course is designed for graduate students and research scientists with an interest in how nuclear magnetic resonance (NMR) techniques can be used to provide information of value to physical and biological chemists. This course will introduce basic NMR theory, including a quantum mechanical description of the NMR experiment. Examples of chemical data obtained using NMR will be summarized along with other related experiments. The course will then focus on density matrix treatment of multipulse NMR sequence and include discussions of product operator formalism.

CH782 Special Topic in Biochemistry I

CH783 Special Topic in Biochemistry II

EE535 Digital Image Processing
This course deals with the fundamental concepts of digital image processing, analysis, and understanding topics include sampling, linear and nonlinear operations of images, image compression, enhancement and restoration, reconstruction from projections, feature extraction, and image understanding.

EE561 Introduction to VLSI Devices
This course covers fundamental VLSI device physics for graduate students. After a brief review of basic quantum mechanics and semiconductor processes, the course will teach basic principles of operation in semiconductor devices including PN junction, MOS Capacitor, MOSFET and bipolar transistors with a strong emphasis on deep submicron secondary effects of MOSFET and bipolar transistors for extensive understanding of advanced device engineering. (prerequisite: EE461)

EE682 Intelligent Control Theory
Among the various well-known intelligent control techniques, the methods of fuzzy control and neural net-based learning control are first dealt with for their capabilities of handling ambiguous / uncertain situations and effective supervised learning, respectively. Specifically, the theory of fuzzy sets and fuzzy logic-based inference mechanism are studied and the design techniques of fuzzy control are introduced. Then,

the neural net learning structure is discussed and the control system based on the artificial neural nets is studied. Fuzzy-neuro systems are also considered. In the second part of the course work, some other computational intelligence techniques such as GA and the rough set are briefly covered and then the basic machine learning techniques and the reinforcement learning method are studied in conjuction with the their use in control system design. (Prerequisite: EE581)

EE737 Imaging Systems
This course is designed to introduce several medical image systems and the related applications based on various image processing techniques. Topics include image reconstruction algorithms, X-ray CT, single photon emission CT, positron emission tomography, magnetic resonance imaging, ultrasound imaging, and related post processing techniques.

MAE510 Advanced Fluid Mechanics
Fundamental knowledge on fluid flows is discussed. Derivation of basic equations and several relevant approximate flow models are introduced. Both inviscid and viscous fluid models are treated.

MAE521 Viscous Fluid Flow
This course covers the following topics: Equations of viscous flow; classical analytical and numerical solutions; flow regimes and approximations; laminar boundary layers - solution methods, and applications; introduction to stability theory; turbulent boundary layers - mean-flow and Reynolds stress equations, modeling, solution procedures, and applications.

MAE530 Advanced Mechanics of Solids
Fundamentals of solids mechanics are treated from the continuum mechanics view, and the content of the undergraduate solid mechanics is extended and generalized to the graduate level.

MAE561 Linear System Control
This course is designed to enable graduate students to analyse a given linear system in terms of stability, controllability and observability, and to design a linear controller by using eigen-structure assignment.

MAE563 Microprocessor Application
This course is designed to give graduate students the ability to understand basic principles of microprocessors and their applications in modern product designs. Prerequisites by topic follow: basic electrical circuits and computer languages.

MAE564 Artificial Neural network : Theory and Applications
This course treats a variety of artificial neural network techniques being currently applied to many difficult-to-solve engineering problems.

MAE604 Metrology
This course deals with the subject of precision dimensional metrology which plays important roles in various fields of modern science and engineering mainly for distance and surface measurements. Principles, fundamentals of optics especially for electromagnet wave interference are explained with emphasis on monochromatic interferometry, white light scanning interferometry, holography, and speckle and moire interferometry.

MAE 629 Biomedical Fluid Dynamics
This course gives introduction to the study of blood circulation in the heart, arteries, capillaries and veins. It covers the systemic, pulmonary and cerebral circulations. The physiological as well as pathological aspects of

the heart, vessels, and blood are discussed. Mechanical modeling of the circulation is introduced. Tissue engineering for the vascular grafts and cardiac prostheses are explained. Overall, this lecture offers a good starting point for students interested in the study of fluid dynamic aspects of the human body or in biomedical engineering.

MAE642 Medical Biomechanics
This course studies the structure, function and its behavior of human musculoskeletal system, and identifies the physical problem of musculoskeletal system to find contribution in solving those problems applying mechanical principles.

MAE655 Robotics Engineering
This course is designed to enable graduate students to understand the most updated topics in kinematics and dynamics of robotics and to apply recently introduced control techniques.

MS514 Mechanical Behavior of Solids
This course is designed to introduce the fundamental phenomena and theories on mechanical behavior of materials, and to understand the relationships between mechanical properties and microstructure of materials. Main topics include: theories of elasticity and plasticity, dislocation theories, deformation mechanisms, strengthening mechanisms, fracture, fatigue, creep, high temperature deformation, superplasticity.

MS572 Composite Materials
This course introduces the fundamental descriptions and theories on the fabrication processes, properties, characterization and applications of metal matrix composites (MMC), ceramic matrix composites (CMC) and polymer matrix composites (PMC). Main topics include: fabrication processes and properties of reinforcements (particles, whiskers & fibers), structure and properties of matrix materials, bonding and interfacial reactions between reinforcements and matrices, micro-mechanical and macro-mechanical behavior of composite materials, fabrication processes, design, properties and applications of composite materials.

MS622 Glass Science and Technology
Advanced topics and theories on glass formation, structure, transport phenomena in glass, physical properties, corrosion and chemical durability, crystallization, phase separation and manufacturing technology of the glass state will be studied. Also, the application of the glass and glass ceramics will be discussed.

NQE561 Radiation Measurement Systems
This course introduces the generation, amplification, transfer and measurement of the electronic signal from various radiation detectors based on the physics theory of the electronics signal and noise. Also it deals with the design methods of radiation counting, spectroscopy, timing and imaging systems.

NQE562 Radiation Imaging Instrumentation
This course deals with the analysis and design methods of various radiation imaging devices used in medical diagnostics and non-destructive tests. It also covers the 2-dimensional X-ray radiography and advanced gamma-ray imagers together with emission and transmission tomographies and laminography, which can be extended into 3-dimensional imaging techniques.

PH507 Advanced Electrodynamics I
This course provides graduate students in physics with an understanding of electricity and magnetism. Topics include: electrostatics, magnetostatics, Maxwell's equations, wave propagation, wave guides, radiating systems.

BM960 M.S. Thesis

BM966 M.S. Seminar

BM980 Ph.D. Thesis

BM986 Ph.D. Seminar