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# COLLEGE OF NATURAL SCIENCE

The College of Natural Science at Kookmin University consists of the department of Nano and Electronic Physics, the department of Bio and Nano Chemistry, the department of Mathematics and the department of Food and Life Science. The college focuses on quality education with wide latitude and it emphasizes on practical use for the contribution to the 21st century society. Scientific persons with creative mind will lead future society with the knowledge of natural sciences and forefront fields of sciences. Each department in the college is specialized in the various subfields of the basic sciences and the research area covers not only the major conventional areas but also the interdisciplinary fields in each departments. Systematic researches on the forefront fields and the practical applications are pursued. Our goal of education is to nurture individual with the knowledge of basic sciences who can practice frontier forefront technologies effectively in the 21st society. Research and educational facilities and the program of study are continually improved and enhanced.

## ○ Seminar in Special Topics

Through communication between the instructor and the students, motivation and curiosity for science will be elevated. In addition, relationships among junior and senior students will be encouraged. This course will be an opportunity for students to prepare for their career goals. Depending on the instructor in charge, the title of this class can be modified such as Seminar, Research, Workshop, or Internship, and other heads.

## Electives

### • Mathematics for Science and Engineering (3)

This course is an introduction to basic theory and applications of mathematics for science and engineering. Topics are functions, limits, continuities, derivatives and its applications, partial derivatives, definite and indefinite integrals and their applications, multiple integrals, vector spaces, matrices and determinants.

- **General Physics (2)**

This course focuses on fundamental concepts in Physics such as force and momentum, translational and rotational motion, work and energy, heat, and fluid.

- **General Physics Lab. (1)**

This course provides an opportunity to perform experiments on the topics covered in the General Physics course.

- **General Chemistry (1)**

Chemical concepts will be presented in a non-mathematical way focusing on their implication for current scientific inquiry. Topics include atomic structure thermochemistry periodicity, bonding and molecular structure intermolecular forces properties of solids liquids, gases and solutions.

- **General Chemistry Laboratory (1)**

An introduction to laboratory techniques of chemical research for the science and engineering major. Scientific information databases, structural chemistry, experimental design and data handling, chemical synthesis and characterization.

- **Computer Programming (3)**

Problem solving strategy and its implementation are taught through lecture and programming practice sessions in this course. Fundamental knowledge on computer hardware and software is also taught, and usage of C programming language and of its compiler is practiced through laboratory sessions.

## DEPARTMENT OF NANO AND ELECTRONIC PHYSICS

Physics is a fundamental science aimed at discovering the basic principles that govern our universe including matter and applying the systematized principles to the everyday life. Most of the scientific knowledge of 21st century is based on the principles of the physics and it is the fundamental subject of the science and engineering. Likewise, physics has broad application area in the real world. The educational and research goal of Department of Nano and Electronic Physics is to explore the quantum phenomena in the nano-meter scale, to apply the principles of physics to the electronic systems, and to cultivate the manpower for the 21st century industry. The research and education in the department will be performed by analyzing the information acquired from the nano-meter scale experiments with new analyzing methodologies utilizing computers to overcome the limitations of the conventional methodologies. Educational program for the first and the second year students is focused on understanding the basic principles of physics, not only theoretically but also with the experiments for the tangible education. From the third year, the education program is team-oriented teaching and will be connected to graduate-level education.

### Courses

- **Fundamental Physics (3)**

This course introduces fundamental concepts in Physics such as force and motion, work and energy, heat, fluid, light and electromagnetism, and atomic structure of matter.

- **Fundamental Physics Lab. (1)**

This course is intended for students to further develop the understanding of Physics by performing experiments on the topics covered in the General Physics course.

- **Fundamental Chemistry (3)**

This course introduces fundamental concepts in Chemistry for Nano and Electronic Physics majors.

- **Fundamental Chemistry Lab. (1)**

This intendeds to concrete the understanding of basic Chemistry via hands-on experience in this laboratory session.

- **Fundamental Physics Exercise (1)**

This course discusses various Physics problems based on the materials covered in Fundamental Physics course.

- **Wave and Light (3)**

This course introduces the fundamental concepts in Optics such as electromagnetic wave, interference and diffraction.

- **General Physics Exercise (1)**

This course covers various problems in physics such as wave, electricity, magnetism, and harmonic oscillation.

- **Fundamental Mathematical Physics (3)**

This course introduces the basics of vector analysis, linear algebra and calculus for Nano and Electronic Physics major.

- **Mechanics (3)**

The topic include vector kinetics and kinematics of moving bodies in both moving and fixed reference frames, moments of inertia, work and energy, and impulse and momentum. Keplerian motion, harmonic motion, conservative dynamic systems, Lagrangian and Hamiltonian formalisms are also covered in this course.

- **Computational and Mathematical Physics (3)**

This course presents the methods of the numerical solution to problems of intermediate engineering and physics such as differential equation, vector analysis and matrix by using standard computer software tools and application packages. This course is intended to develop the skills for solving problems by numerical simulation.

- **Electronic Engineering Lab. I/II (2)**

This course covers the basic and advanced theories of analog and digital electrical circuits and their application in the field of experimental Physics. Also this course presents the basics of instrumentation.

- **Physics and High Technology I/II (1)**

This course discusses the principles of modern technology such as nano/biotechnology and electrical/material engineering, which are rooted in Physics and their future applications.

- **Science Programming (3)**

In this course students will learn basic programs such as Visual Basic, Visual C and Visual Fortran. Also this course introduces the basic computational techniques and software development skills, and offers chances to practice the network and software development tools.

- **Modern Physics (3)**

This introductory course on Modern Physics discusses the theory of relativity, atomic physics, and the quantization of light and energy, as well as the basics of nuclear physics.

- **Statistical Physics (3)**

This course introduces equilibrium thermodynamics and elementary statistical mechanics, and their applications in various fields of Physics.

- **Fundamental Electromagnetics (3)**

This course discusses the basics of electrostatics and magnetostatics, electromagnetic fields in matter, and Maxwell's equations.

- **Fundamental Quantum Mechanics (3)**

This course introduces the basic concepts in Quantum Mechanics such as Schrödinger equation, energy barrier, and single harmonic oscillator.

- **Measurement and Interface I/II (2)**

This course is intended to help students to understand the basics of measure-

ment, and using Labview and HPVVEE tools, learn how to interface and control multiple instruments with a single PC.

- **Nano Experiments I/II (2)**

This course introduces the experimental techniques required for understanding properties of materials at nanometer scale. Students will learn various measurement methods and how to analyze the experimental results.

- **Solid State Physics I/II (3)**

This course introduces the atomic, molecular and crystal structure of solid, phonons, free electron gas, band theory in solid, and various physical phenomena in semiconductor, magnetic material, and superconductor.

- **Electromagnetics (3)**

This course covers the advanced topics in electromagnetism such as Maxwell's equations and electrodynamics.

- **Nano Physics (2)**

This course presents the current researches on nano devices and materials, and their applications as well as fundamental physical processes at nanometer scale.

- **Quantum Mechanics (3)**

This is an advanced course on quantum mechanics. The topics include the Schrödinger equation, operators, angular momentum, harmonic oscillator, atomic hydrogen, perturbation theory, scattering theory, identical particles, and radiation.

- **Surface and Interface (3)**

This course provides basic theory of surface and interface in various materials. This course also focuses on fabrication and measurement of thin films and their applications.

- **Plasma Process (3)**

This course introduces the theory of plasmas including plasma kinetic theory, collision processes, orbit theory, and hydrodynamic theory. Also it discusses its

applications in magnetic and semiconducting device fabrication processes.

- **Physics Research Exercise Project I/II (1)**

This course offers the opportunity of participating in the research programs in the Department of Nano and Electronic Physics and various research centers, and internship programs in industry.

- **Condensed Matter Lab. I/II (2)**

The course offers hands-on experience on measuring and analyzing basic properties of materials including magnetic and semiconducting materials.

- **Optics (3)**

This course discusses geometric and physical optics, aberrations, optical instrumentation, interference, and polarization.

- **Magnetic Materials (3)**

The topics include the introduction to magnetic and electrical properties of magnetic materials and their applications.

- **Semiconductor Device (3)**

This course introduces physical properties of semiconductor devices and fabrication processes of amorphous and crystalline semiconductor devices.

- **Experimental and Theoretical Physics Seminar I/II (1)**

This seminar course presents the various topics in current theoretical and experimental Physics researches and helps students to be familiar with various fields of Physics.

- **Special Topic of Educational Physics (2)**

This course provides introduction to teaching Physics and natural science.

- **The Study of Teaching and Teaching Materials (2)**

This course discusses how to develop and use teaching materials for physics education.

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## DEPARTMENT OF BIO AND NANO CHEMISTRY

In response to the changing nature of chemistry, the staff of Bio and Nano Chemistry have brought new expertise in important areas of chemistry, which comprises life science and material science. Emphasis will be given on the applied areas of chemistry, biochemistry and nanochemistry, on the basis of traditional fields, such as physical, organic, inorganic, and analytical chemistry. Accordingly, the Bio and Nano Chemistry major offers a full range of courses in those fields. We have excellent laboratory facilities equipped with latest equipments, which will provide students to gain experience in the wide range of instrumental methods used in today's chemical institutes and industries.

In addition to their academic interests, Bio and Nano Chemistry faculty members have active research programs. The link between teaching and research is a vital one in a continuously evolving scientific field. It ensures that students will be provided with the most advanced information perspectives, and affords opportunities for students to participate actively in research.

The Bio and Nano Chemistry major provides a great deal of flexibility and prepares students for a wide variety of career options. A major in Bio and Nano Chemistry can also provide the basis for significant work in related areas such as molecular biology, chemical physics, geochemistry, chemical engineering, materials science, and solid state physics.

The required courses for the major can be completed in three years, leaving the final year open for advanced and independent work under the supervision of a professor.

We believe that Bio and Nano Chemistry at Kookmin University will be a leading department to training future scientists in applied chemistry field with new and varied directions.

### Courses

- **Fundamental Physics (3)**

This course introduces fundamental concepts in Physics such as force and motion, work and energy, heat, fluid, light and electromagnetism, and atomic

structure of matter.

- **Fundamental Physics Laboratory (1)**

This intends to develop the understanding of basic Physics via hands-on experience in the laboratory session.

- **Fundamental Chemistry (3)**

The course will begin with a quick review of basic introduction to chemistry. Following will be (re)considerations of models of chemical bonding and of shapes of molecules. Then follows considerations of changes in phases, including some elementary thermodynamics, and properties of mixtures. Finally onto kinetics and equilibria, the latter involving more thermodynamics.

- **Fundamental Chemistry Laboratory (1)**

An introduction to laboratory techniques for chemical research for the science and engineering major. Scientific information databases, structural chemistry, experimental design and data handling, chemical synthesis and characterization.

- **Introductory Biological Sciences (3)**

This course helps to familiarize the basics and characteristics of life processes from microorganisms to animals. The course also deals with the relationships between biological principles and our lives.

- **Analytical Chemistry (2)**

This course gives considerable attention to the quantitative aspects of chemistry. The topics will include the role of analytical chemistry in the sciences, solutions and their concentrations, chemical equilibrium, methods for reporting analytical data, gravimetric methods of analysis, and titrimetric methods of analysis. The topics will also include electrochemistry, oxidation-reduction potentiometric methods, electrogravimetric and coulometric methods, and an introduction to spectroscopic methods of analysis.

- **Physical Chemistry I (3)**

An Introductory level of quantum chemistry and molecular spectroscopy will be

treated. The course covers atoms and molecules, the structure and property of the condensed phase, molecular spectroscopy, and chemical kinetics. Also electric and magnetic properties of matter will be discussed as time allows.

- **Organic Chemistry I (3)**

Principles of organic chemistry will be covered Fundamental theory of structure and properties of organic compounds, survey of organic nomenclature, the general concepts of stereochemistry, and the fundamentals of organic chemical reactions.

- **Inorganic Chemistry I (3)**

The physical and chemical properties of nonmetallic elements and their compounds will be studied with emphasis on the periodic table, the characteristic method of preparation, and bonding structures.

- **Chemical Reaction Laboratory (2)**

Emphasis will be put on the handling techniques for organic and inorganic compounds Purification and isolation of compounds, and the systematic identification of compounds by physical and chemical methods. Typical reactions of various functional groups and the preparation of simple derivatives of organic compounds. Experiments for preparation, identification, analysis as well as properties relating to the representatives of metallic/nonmetallic elements and their compounds will be conducted.

- **Physical Chemistry II (3)**

Principles of equilibrium thermodynamics will be covered Thermodynamic functions, First and Second laws, gases and condensed phases, solutions, phase equilibrium, chemical equilibrium, surface thermodynamics, electrolytes, and the Third law.

- **Organic Chemistry II (3)**

Principles of organic chemistry will be covered Organic structural theory, reactions of aliphatic and aromatic compounds, the mechanistic theory of organic reactions, the characterization of structure by chemical and spectroscopic

methods.

- **Inorganic Chemistry II (3)**

The physical and chemical properties of metallic elements and their compounds containing alloy and metalorganic complexes will be thoroughly discussed in terms of their characteristic method of preparation and bonding structures.

- **Chemical Measurement Laboratory (3)**

Emphasis will be put on the quantitative and qualitative methods related to the experimental study of physical chemistry and instrumental analysis. The course covers an introduction to measurement strategies in chemistry as applied to kinetics, spectroscopy, the dynamics of photo-excited states, atomic absorption spectrometry, gas chromatographic analysis, and liquid column chromatography. The principles of the assembly of electronic, optic, computer, and vacuum line equipment will be studied.

- **Solid State Chemistry (3)**

A survey of the basic phenomenological knowledge of condensed matter chemistry. Preliminary emphasis is on crystalline solids. The topics will include crystal structure, X-ray diffraction, lattice vibration, band theory of metals, conductivity of metals, semiconductors, and superconductivity. There will be numerous applications of quantum and statistical mechanics.

- **Nano Chemistry (3)**

The first part of the course contains fundamental chemical concepts and the basic ideas needed to understand the bulk properties of matter at the nanoscale level. The second part describes the tools needed to probe matter at the nanoscale level. The third part discusses examples of nanoscale materials, such as clusters, monolayers, fullerenes, and biomolecules, as well as their applications.

- **Fundamental Biochemistry (3)**

Intended for students who have not studied biochemistry previously. A brief biological introductory section relating to biochemistry is given, followed by an introduction to the foundations of biochemistry, biomolecules such as water,

amino acids, peptides, proteins, carbohydrates, lipids, nucleotides and nucleic acids, and related metabolism.

- **Applied Biochemistry (3)**

The core focus of this course includes Genes and chromosomes, DNA metabolism, RNA metabolism, protein metabolism, regulation of gene expression, and an introduction to gene cloning and recombinant DNA technology.

- **Surface Chemistry (3)**

A wide range of topics on surface chemistry will be covered with emphasis on fundamentals and on important theoretical models as well as various experimental techniques thermodynamics of interfaces, intermolecular forces, surface films, physisorption, chemisorption and catalysis, microscopic and a spectroscopic study of solid surfaces.

- **Protein and Enzyme Chemistry (3)**

This course describes the basic concepts of amino acids, protein folding, protein purification, enzyme kinetics, antibody, membrane proteins, and proteomics. Students are also introduced to fundamental knowledge of protein handling.

- **Nanochemistry Laboratory (2)**

This course describes the fundamental concepts of the tools needed to probe matter at the nanoscale level and applies them to characterize examples of nanoscale materials such as nanoparticles, self-assembled monolayers, ultrathin films, etc.

- **Biochemistry Laboratory (2)**

A laboratory course designed to introduce students to the biochemical techniques commonly used in the study of biological materials. Protein isolation, purification, and enzyme characterization methods are included. Techniques used in the clinical laboratory are applied to analyses of blood and urine samples. In the nucleic acid module, students are introduced to recombinant DNA methodology, isolating DNA, and studying the function of transfer RNA.

- **Molecular Spectroscopy (3)**

This course will explore the interaction of light with matter. The lecture covers the quantum mechanical foundations of spectroscopy, a detailed treatment of a variety of different spectroscopies, including the study of rotations, rotations and vibrations, and electronic spectra for simple molecules as well as polyatomics. Special topics such as magnetic resonance, non-linear, and molecular beam spectroscopies will also be included, as time permits.

- **Crystallography (3)**

A beginning course in the application of X-ray crystallography to structural chemistry. The course covers crystallography, X-ray properties, and the determination of molecular and crystal structures of solid compounds.

- **Environmental Chemistry (3)**

Important chemical principles and facts are covered with the objective of understanding the role of chemistry in other fields, especially in environments. Emphasis is on the topics of environmental problems and solutions, including water pollution, air pollution, atmospheric chemistry, the stratospheric ozone depletion problem, and so on.

- **Physical Organic Chemistry (3)**

Principles and theories of organic reactions will be covered elementary general molecular orbital theory and basic reaction mechanism, acid and base chemistry, reactivity-structural relationships, and Hammett equations.

- **Molecular and Cellular Biology (3)**

This course will cover basic concepts of molecular biology and cell biology, which are the core field of current life science. It includes molecule structure of gene, mechanism of gene expression and regulation, structure of function of cellular organelles, and molecular mechanism of signal transduction.

- **Chemical Kinetics (3)**

Principles and theories of chemical kinetics will be covered. The topics will include bulk reaction rate, unimolecular reaction theory, bimolecular collision

theory, transition state theory, and scattering theories as well as a variety of experimental techniques. Molecular reaction dynamics using lasers, molecular beams, and trajectory calculations will be introduced.

- **Metal Organic Chemistry (3)**

The principles and theories of coordination chemistry will be covered. Bond characteristics, preparation methods, structures, and the stabilities of coordination compounds with transition elements will be fully discussed.

- **Instrumental Chemistry (3)**

Topics will include the nature of electromagnetic radiation, theories of instrumental analysis, ultraviolet and visible spectrophotometry, infrared spectrophotometry, fluorescence and phosphorescence spectrophotometry, flame emission and atomic absorption spectrometry, atomic emission spectroscopy, X-ray methods, nuclear magnetic resonance spectroscopy, and chromatographic methods.

- **Identification of Organic Compounds (3)**

The important methods of structural analyses of organic compounds will be covered with various separation and spectroscopic techniques Gas-chromatography, HPLC, infrared, ultraviolet-visible spectroscopy, proton- and carbon-NMR spectroscopy, mass spectrometry, and their modern instrumental techniques.

- **UROP I (Undergraduate Research Opportunities Program I) (1)**

UROP is a cooperative course in which several Professors participate. In this course, students will participate in the research program of individual laboratories under the guidance of professor and graduate students. The creativity and problem solving ability of student will be developed during the research activities. The students will be selected from applicants after interview with professors.

- **UROP II (Undergraduate Research Opportunities Program II) (1)**

UROP is a cooperative course in which several Professors participate. In this course, students will participate in the research program of individual laboratories under the guidance of professor and graduate students. The creativity and

problem solving ability of student will be developed during the research activities. The students will be selected from applicants after interview with professors.

- **UROP III (Undergraduate Research Opportunities Program III) (1)**

UROP is a cooperative course in which several Professors participate. In this course, students will participate in the research program of individual laboratories under the guidance of professor and graduate students. The creativity and problem solving ability of student will be developed during the research activities. The students will be selected from applicants after interview with professors.

- **UROP IV (Undergraduate Research Opportunities Program IV) (1)**

UROP is a cooperative course in which several Professors participate. In this course, students will participate in the research program of individual laboratories under the guidance of professor and graduate students. The creativity and problem solving ability of student will be developed during the research activities. The students will be selected from applicants after interview with professors.

- **Teaching Method of Chemistry Education (2)**

Emphasis will be put on the development of new curriculum and effective instructional materials on chemical education for students who wish to take teaching as their careers.

- **Chemistry Curriculum and Teaching (2)**

Development of good teaching methods is intensively discussed, which includes selection and preparation of instructional materials, and improvement of teaching skills of chemistry in secondary school.

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## DEPARTMENT OF MATHEMATICS

As a mathematics major, students will learn how to understand the nature of truth and the concept of proof in the discipline of mathematics as well as acquire the ability to formulate and solve problems mathematically. A degree in mathematics from Kookmin University will prepare them for employment in information technology, securities, financial planning, market research, insurance, and a number of other careers in business, education, and industry. Their undergraduate degree will also serve as a good stepping stone to graduate study in mathematics.

### Courses

- **Calculus and Exercise (3)**

This course is an introduction to the basic theory of functions, limits, continuities, derivatives, applications of derivatives, integrals and their applications, partial derivatives and multiple integrals. The main emphasis is on concepts and problem-solving, but students are responsible for some of the underlying theory as well.

- **Discrete Mathematics (3)**

This course deals with the basic theory and mathematical techniques used in many areas including social science, engineering and computer science. Topics include algorithms, mathematical induction, generating functions, graphs, and asymptotic analysis.

- **Mathematical Computations and Lab. (2)**

Deals with the basic concepts of logic and mathematical theory in computational mathematics and their applications that are used in pure and applied sciences.

- **Sets and Logic (3)**

Set theory plays a special role as a foundation for the whole of mathematics. All of modern mathematics involve logical relationships among other mathematical concepts. In this course we deal with the basic concepts of sets and mathematical logic using formal languages suitable for expressing mathematical ideas.

- **Linear Algebra and Exercise (3)**

This is an introduction to the theory of abstract vector spaces and linear transformations. Topics are selected from vector spaces over arbitrary fields Systems of linear equations, Matrices, Determinants, General Vector Spaces, Inner Product Spaces, Eigenvalues and Eigenvectors, Linear Transformations, and Some Applications.

- **Analysis I and Exercise/ Analysis II (3)**

This course will provide an introduction to differential calculus, integral calculus, and changeable functions. Topics limits, continuity, differentiation, differentials, Newton's method, indefinite and definite integrals, circles and conics, transcendental functions, polar coordinates, parametric representation, methods of integration, improper integrals, indeterminate forms, cylindrical and spherical coordinates, infinite series tests, power series, Taylor's formula, partial differentiation, and multiple integration. These lectures are accompanied by a practice.

- **Analytic Geometry and Exercise (2)**

This is an introduction to applied mathematics, making use of calculus and linear algebra. While the specific content is very much instructor dependent, the course will mostly focus on the applications of mathematics in natural and social sciences. The goal is to deepen the students understanding of calculus and linear algebra, and to motivate them to pursue mathematics further.

- **Vector Analysis and Exercise (2)**

Vector algebra, differential and integral calculus of vector functions, linear vector functions and dynamics, applications to geometry, particle and fluid mechanics, and theory of vector fields are all covered in this course.

- **Mathematical Statistics (3)**

This course is a detailed introduction to the theory of statistical inference. Topics include probability and random sampling distributions of various statistics statistical procedures, such as estimation of parameters, hypothesis testing, maximum likelihood and various other methods for estimation and hypothesis

testing, especially for linear models.

- **Differential Equations and Exercise (3)**

This course follows the lectures Analysis I, II. Topics existence and uniqueness theorem, linear initial value problems, first order equation, higher order equation, Laplace transform, and linear systems.

- **Number Theory and Exercise (3)**

Well ordering principle, Mathematical Inductions, Divisibility, Primes and Their Distribution, Theory of Congruences, Fermat's Theorem, Number Theoretic Functions, Euler's Theorem, Primitive Roots and Indices, and the Quadratic Reciprocity Law are covered in this course.

- **Modern Algebra I and Exercise/ Modern Algebra II (3)**

Binary Operations, Groups and Subgroups, Cyclic Groups and Generators, Permutation Groups, Alternating Groups, Cosets, Lagrange's Theorem, Finitely Abelian Groups, Binary Linear Codes, Homomorphisms, Factor Groups, Series of Groups, Group Action, Isomorphism Theorems, Sylow Theorems, Rings, Integral Domains, Field of Quotients, Ring of Polynomials, Factorization of Polynomials, Factor Rings, Ideals, Prime and Maximal Ideals, Unique Factorization Domains, Euclidean Domains, Extension Fields, Algebraic Extensions, Finite Fields, Automorphisms of Fields, The Isomorphism Extension Theorem, Splitting Fields, Separable Extensions, Galois Theory, Cyclotomic Extensions, and Insolvability of the Quintic are covered in this course.

- **General Topology and Exercise (3)**

This is an introduction to topology with an emphasis on the set-theoretic aspects of the subject. It is quite theoretical and requires extensive construction of proofs. Topological and metric spaces, continuous functions, homeomorphism, compactness and connectedness, surfaces and manifolds, and other topics will be studied.

- **Modern Geometry I and Exercise/ Modern Geometry II (3)**

This course is about the analysis of curves and surfaces in 2 and 3-space using the tools of calculus and linear algebra. Further, we will discuss the geometric

properties on manifolds. There will be many examples discussed, including some which arise in engineering and physics applications. Emphasis will be placed on developing intuitions and learning to use calculations to verify and prove theorems. Students need a good background in multivariable calculus and linear algebra.

- **Complex Analysis and Exercise (3)**

The course provides an introduction to the theory of complex valued functions of a complex variable with substantial attention to applications in science and engineering. Topics Cauchy's theorem, Residue theorem, argument principle, power series, and informal mapping.

- **Programming of Cryptographic Algorithms (3)**

The course provides an introduction to the basic programming skills for cryptographic algorithms such as RSA public cryptosystem, Elliptic Curve cryptosystem, Hash functions, Pseudo-random functions.

- **Applied Probability Theory and Lab. (3)**

This course introduces students to useful and interesting ideas of the mathematical theory of probability and to a number of applications of probability to a variety of fields including genetics, economics, geology, business, and engineering. Topics include the basic results and methods of both the discrete and continuous probability theory conditional probability, independent events, random variables, jointly distributed random variables, expectations, variances, covariances.

- **Surface Topology and Exercise (3)**

This course is an introduction to both point-set and algebraic topology. Although much of the presentation is theoretical and proof-oriented, the material is well-suited for developing intuition and giving convincing proofs which are pictorial or geometric rather than completely rigorous. There are many interesting examples of topologies and manifolds from common experience presented in this class.

- **Actuarial Mathematics (2)**

This course provides the basic theory and application of mathematical and statistical skills that are required for a career as an actuary or in actuarial related fields such as banking, finance, insurance, accounting, and pensions in private and governmental organizations. The combination of a strong mathematical foundation and many examples provides students with the necessary skills to succeed in an actuarial related field.

- **Cryptographic Mathematics and Lab. (2)**

This course provides an introduction to the basic mathematical background of cryptography. Finite fields and their applications are most basic objects for this course.

- **Theories of Teaching in Mathematics (2)**

This course is offered for students intending to be teachers of mathematics in middle or high school. It is required of all students intending to earn a middle or high school teaching certificate.

- **Methods and Materials of Teaching in Mathematics (2)**

This course provides a coherent overview of the mathematics underlying the middle and high school curriculum. It is required of all students intending to earn a middle or high school teaching certificate. The course is conducted using a discussion format.

- **Algebraic Topology (2)**

The approach is theoretical and rigorous and emphasizes abstract concepts and proofs. Content fundamental group, covering spaces, simplicial complexes, graphs and trees, applications to group theory, singular and simplicial homology, Eilenberg-MacLane axioms, Brouwer's and Ltschetz' fixed-point theorems, and other topics.

- **Programming of Cryptographic Protocols (3)**

This course introduces an introduction to the programming background of cryptographic protocols. Digital signature, public key cryptosystem, mutual authentication scheme for mobile communication are main topics of this course.

- **Topics in Geometry (2)**

Topics selected depend heavily on the instructor but may include nonEuclidean geometry. The primary goal of the course is to introduce students to non-standard concepts of geometry. A secondary goal is to provide students with experience to proofs and to make them more comfortable with abstract notations.

- **Financial Mathematics (3)**

This course provides the basic theory of financial mathematics including derivatives, contracts and options, hedging and risk management, arbitrage, discounted value, stochastic models of financial markets, futures contracts, European and American options, and Black-Scholes models.

- **Mathematical Modeling and Lab. (3)**

This course deals with the appropriate application of mathematical techniques for analysis of data from experiments, simulation, surveys. This involves the appropriate application of numerical techniques. Students deal with many examples to understand a selection of mathematical techniques.

- **Information Mathematics and Lab. (2)**

This course provides an introduction to the modern study of computer algorithms and complexity. The primary goal of the course is to get students started in thinking about designing and analyzing algorithms. The Church-Turing thesis, decidability, reducibility, measuring complexity, the class P (efficient algorithms), the class NP and NP-completeness will be studied.

- **Real Analysis (3)**

The course provides an introduction to the basic measure theory and the theory of Lebesgue integration. Topics Lebesgue measure on the real line, measurable functions and integration, differentiation theory, fundamental theorem of calculus, function spaces, Holder and Minkowski's inequalities, duality, general measure spaces, product measures, Fubini's theorem, Radon-Nikodym theorem, conditional expectation, and signed measures.

## • Topics in Topology (2)

This course deals with 4 Color problem, Knot theory, Graph theory and other special topics in topology.

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## DEPARTMENT OF FOOD AND NUTRITION

The Department of Food and Nutrition offers a specialized program in clinical nutrition and food biotechnology. Students will develop a strong background in general biological sciences at the lower division level and practical skills in the areas of clinical nutrition and food biotechnology as their special focus on the upper division level. Graduates can apply for the certificates of a nutritionist, a food processing engineer, and a biotechnology engineer. Graduates also have attractive job opportunities as nutritionists in hospitals, schools, industries and as researchers in food research institutes of government and industry. In addition, graduates can apply to become a patent attorney after co-majoring in the interdisciplinary program of industrial rights.

### Courses

- **Field Experience in Foods & Nutrition (3)**

Field experience in food industry and food service operations.

- **Introductory Biological Sciences (3)**

The various aspects of biology are covered from the point of view of the features and problems shared by all living things. These range from their molecular and cellular organization to their features of metabolism, reproduction, genetic expression and transmission, responsiveness, immune response, nervous system, and evolution.

- **Nutrition (3)**

This course presents the digestion, absorption, metabolism, utilization, and food sources of essential nutrients for human life.

- **Bio-organic Chemistry (3)**

This course covers structures and properties of organic molecules including aliphatic and aromatic hydrocarbons with various functional groups and principles governing their reactions.

- **Lab. in Nutritional Science (2)**

Laboratory works to understand clinical methods for study of nutritional phenomena, interpretation of data in relation to various nutritional and physiological states.

- **Biochemistry (3)**

A one semester course which covers the structure and function of biological molecules, enzymology, metabolism and bioenergetics, and recombinant DNA technology.

- **Food Chemistry (3)**

This course covers the composition and properties of food constituents, especially the important chemical and physical properties of, and reactions between the major components of foods.

- **Meal Management and Practice (3)**

Meal planning and service styles for individuals, families, and institutions cultural, nutritional, household economics, marketing, and the social aspects of food practice of menu planning, service and interpretation of the results.

- **Food Microbiology and Lab (3)**

Lecture and lab on the interactions between micro-organisms and food. Topics include basic knowledge about bacteria, fungi and yeasts associated with foods, food-borne disease, and utilization of microorganisms for food processing.

- **Principle of Cookery and Lab (3)**

This course has the objectives to understand the principles of cookery science and the characteristics of cooking methods. And it will help the students to understand the food structure, the food component and their changes during cooking, and to develop the reasonable cooking methods.

- **Human Physiology (3)**

This course presents the human body on several levels from organism and system to cell and molecule. The body system related to normal function and homeostasis, and the homeostatic mechanism of the immune system is studied.

- **Food & Nutrition Information and Mass Media (3)**

This course covers skills and methods to analyze information concerning food and nutrition in the media.

- **Nutritional Metabolism (3)**

Based on the need for the integration of physiology and nutrition in human health and disease, this course covers the dietary nutrients and their digestion, absorption, metabolism, regulation, evaluation of nutritional status and nutrients interaction.

- **Life Cycle Nutrition (3)**

This course provides an application of the basic principles of nutrition to physiological and nutritional needs throughout the life cycle from prenatal to aging.

- **Molecular Biology (3)**

The study of gene structure and function at the molecular level, including gene structure, replication, transcription, translation, and regulation of gene expression.

- **Food Processing and Lab (3)**

This course covers fundamentals of food processing, unit operation, and factors associated with product attributes, shelf life and product safety.

- **Instrumental Analysis Lab (2)**

This course deals with instrumental methods widely used in research and industry including various chromatographic, spectroscopic and rheologic techniques.

- **Quantity Food Service Management and Lab (3)**

Principles of food preparation in large quantities institutional equipment and procedures.

- **Food Industry Management (3)**

Basic concepts of food service industry and management Topics related to the food management include menu planning, menu cost and pricing strategies, food service marketing, human resource management, accounting and organizing, coordinating, directing and controlling.

- **Food Biotechnology (3)**

An introduction to the applications of various bio-technology to food processing, including genetic engineering, enzyme technology, cell culture technology, and biochemical engineering.

- **Nutritional Epidemiology (3)**

Overview of the current issues and methods in assessing nutritional status in epidemiological studies. Issues and methods used in international studies and chronic disease nutrition will be covered. The course covers the skills and techniques to study dietary patterns, dietary quality, nutritional status, growth, agreement between assessments, and health outcome. Students also gain hands-on experience in data analysis, and presenting and interpreting research findings.

- **Dietetics and Lab (3)**

Application of nutrition principles in the dietary management of various diseases. Lab work covers specialized nutrition practice in the clinical setting including nutrition assessment, enteral and parenteral nutrition, and nutrition care documentation.

- **Food Sanitation (2)**

This course provides an introduction to hygienic practices, requirements for sanitation programs and modern sanitation practices in food processing facilities.

- **Nutritional Assessment (3)**

This course introduces the purpose, methods - dietary, anthropometric, biochemical, and clinical- and scientific basis for assessment of nutritional status in total health care for individuals and groups.

- **Nutrition Education and Counseling (3)**

Nutrition education in health and disease care and counseling tools for the successful management and delivery of nutrition services, including knowledge of nutrition assessment, planning, implementation, and evaluation as related to nutritional care.

- **Medical Nutrition Therapy (3)**

Modification of the normal diet for the prevention and treatment of diseases. Principles of dietary management as a preventive and therapeutic tool in health care will be emphasized during various physiologic changes such as disease, metabolic alterations and stress. The course encompasses understanding, application and teaching of dietary modifications by considering the physiological, psychological and psychosocial aspects of the individual.

- **Field Experience in Dietetics (2)**

This course is designed to provide an opportunity for students in the food and nutrition major to apply theories and knowledge learned in the field of dietetic practice environments such as hospital, school, public health and food service facilities.

- **Development & Evaluation of New Products (3)**

This course deals with the functions of components in food systems and principles and strategy for new product development.

- **Food Sanitation Related Regulation (2)**

This course covers principles of food sanitation in food production and food service with a review of current food laws.

- **Functional Foods (3)**

This course deals with principles of functional food concepts, health claims, regulations, consumer trends and functional properties of food for preventing chronic diseases.

- **Aging and Nutrition (3)**

This course is designed to provide students with an overview of current issues related to aging and health. Topics covered include physiology of aging, health behaviors, age related disease, risk reduction strategies, health maintenance approaches, the potential for nutritional modulation of aging process and the unique health problems of older adults.

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