1st Year, 2nd Term					
Course Code	Course Tittle	L	T	P	C
Theory					
Ch 1227	Organic Chemistry	3	0	0	3
Hum 1227	Technical English	3	0	0	3
Math 1227	Differential Equations and Geometry	3	0	0	3
ME 1227	Engineering Mechanics	4	0	0	4
Ph 1227	Magnetism and Nuclear Physics	3	0	0	3
Sessional					
Ch 1228	Sessional on Organic Chemistry	0	0	3/2	0.75
Hum 1228	Sessional on Technical English	0	0	3/2	0.75
ME 1220	Engineering Drawing Sessional-I	0	0	3	1.5
Ph 1228	Sessional on Magnetism and Nuclear Physics	0	0	3	1.5
	Total				**20.5**

Distribution of Marks

i. Theory Courses:

Class participation, attendance and assignments	10 %
Class tests, Quizzes, Spot tests etc.	20%
Term Final Examination	70%
Total	100%

N.B. Students fail to attend 60% of the class will not allow to sit in the final exam in any circumstance.

ii. Independent laboratory/design/field work courses:

Class participation and attendance	10 %
Quizzes, Viva-Voce conducted in lab class	20%
Viva-Voce conducted centrally	20%
Performance and reports	50%
Total	100%

iii. Project/thesis (Continued for two terms):

a) *At the end of 4th year 1st Term*: 30% of the total marks to be evaluated as follows:

Presentation and (Viva-Voce conducted by a Viva-Voce committee)	10%
Supervisor	20%
Total	30%

b) *At the end of 4th year 2nd Term*: 70% of the total marks to be evaluated as follows:

Presentation and Viva-Voce (conducted by a Viva-Voce committee)	20%
Supervisor	40%
External examiner (any other teacher of the department/ a member of examination committee	10%
Total	70%

1st Year, 2nd Term

Ch 1227 Organic Chemistry

Credits: **3**

Referred textbooks:

- "Organic Chemistry" by I. L. Finar
- "A Guide book to Mechanism in Organic Chemistry" by Peter Sykes
- "Organic Chemistry" by Clayden, Greeves, Warren and Wothers
- "Organic Chemistry" by McMurry
- "Organic Chemistry" by David R. Klein

Course description:

Organic chemistry is evolving as an essential part of materials science. Organic chemistry provides materials with complex functionality that bridges between materials science and biology/medicine. Biological systems and the electronic or optical system requires close attention to the molecular level of that interface. Finally, organic chemistry allows materials scientist to synthesis advanced nanomaterials, polymers, organic molecules, 3-D printing and sophisticated medical transplantation.

Topic covers:

Structure and Bonding: Atomic orbitals, Hybridization, Sigma and Pi-Bonding, Delocalization and Resonance, Molecular shape, Nomenclature of organic compounds (aliphatic and aromatic), Isomers, Electronegativity and Bond Polarity, bond order, Effect of bond order on bond length and bond strength.

Organic reactions and their mechanism: Nucleophilic and Electrophilic substitution reactions and their kinetics, steric hindrance and stereochemistry. Structure of carbocations. Role of solvent in SN1 and SN2 reactions, E1 and E2 reactions.

Aromatic Compounds: Nomenclature of aromatic compounds, Benzene and aromacity. Unusual stability of benzene, Modern theories of the structure of benzene, Aromatic compounds (Phenol, aniline, pyrrole).

Polymers: Macromolecules & polymers, Classification of polymers, Molecular Weight, Degree of polymerization, Tactility, Thermoplastic and Thermosetting, Chain-Growth Polymers, Types and mechanism of polymerization, Addition polymerization (Free Radical, cationic and anionic), Condensation and Copolymerization, Coordination polymerization, Conducting polymers.

Biomolecules: Structure and reaction of cellulose, Structure of amino acids, peptide linkage, structure of proteins.

Spectroscopic Techniques: Fundamentals of spectroscopy, UV spectroscopy, IR spectroscopy.

Hum 1227 Technical English

Credits: **3**

Referred textbooks:

- ''Oxford Handbook of Commercial Correspondence'' by A. Ashley
- ''A Practical English Grammar'' by J. Thomson & A. V. Martinet
- ''Complete Course in English'' by Robert J. Dixson
- ''Essentials of Business Communications'' by Rajendra Pal & J. S. Korlahalli
- '''Technical Writing by John'' M. Lennon
- ''Writing Scientific English'' by J. Swales

Course description:

Learning English as a second language is always fascinating. Most of the Engineering books, journal articles are usually written in English. Thus, learning this language is not only stimulating but also

rewarding to gain specific knowledge in engineering subjects. This undergraduate course will deal with English phonetics, Vocabulary, English grammar, construction of sentences, some grammatical problems, Comprehension, Paragraph writing, Amplification, Report writing, Commercial correspondence and tenders, Short stories written by some well-known classic writers.

Topic covers:

General Discussion: Introduction, Mastering Various Approaches to Learning English.

Grammatical Problem: Construction of Words and Sentences, Grammatical Problems, Sentence variety and style, Transformation of sentences; Common errors; Conditionals, Grammar and Usages, Vocabulary and Diction, Clauses, Prefixes & suffixes, Synonyms and Antonyms.

English phonetics: The Phonetics systems and correct English Pronunciation.

Writing Skill: Principles of Effective Writing, Organization in writing, Planning and Development, Composition, Precis writing, Paragraph writing, Amplification, Free Composition.

General Strategies for the Writing Process: Generating Ideas, Identifying Audiences and Purposes, Constructing Arguments, Stating Problems, Drafting and Finalizing.

Approaches to Communication: Communication Today, Business Communication, Organization and organizational Behavior, Developing Intra-personal Interpersonal Relationship, Introducing Dialogue; Specific Applications of Tenders and Quotations, Resumes and Job Letters, Do letter, Memo letter, Official note, Complain letter, Newspaper letter, Journal Articles.

Math 1227 Differential Equations and Geometry

Credits : **3**

Referred textbooks:

- ''A First Course in Differential Equations, 10th edition'' by Dennis G. Zill
- ''Mathematical Techniques'' by D. W. Jordan and P. Smith
- ''Advanced Engineering Mathematics'' by E. Kreyszig
- ''Partial Differential Equations - Theory and Technique'' by G. F. Carrier and C. E. Pearson
- ''An Introduction to Laplace Transform and Fourier Series'' by Dyke and Philip P.G.

Course description:

The main objectives of this course include showing the students how differential equations appear in real life and physical phenomena, and teach them the main three methods, namely analytic, geometric and numerical methods, for studying differential equations, Laplace transform.

Topic covers:

Differential Equations: Formation of differential equations, order and degree of differential equation; Solution of differential equations of first order first degree by various methods; Application of first order differential equation, Solution of general linear equations of second and higher orders with constant coefficients, Solution of Euler's homogeneous linear equations.

Co-ordinate Geometry of three dimensions: Co-ordinates: Cartesian, Cylindrical and Spherical polar, Distance between two points, Point of division, Projections, Direction cosines and direction ratios, Angle between two lines, Distance of a point from a line; Plane: different form of the equations of a plane, Plane through points and lines, Angle between two planes, Distance of a point from a plane, Volume of tetrahedron; Straight line: Different form of a straight line, Line on a plane, Coplanar lines, Shortest distance; Sphere: Standard equations, Tangent plane, Circle, Orthogonality of spheres.

Laplace Transform: Definition and existence of Laplace transform; Properties of Laplace transform; Laplace transform of elementary functions; Inverse Laplace transform and its properties; Convolution; Applications: Solution of ordinary differential equation using Laplace transform.

ME 1227 Engineering Mechanics

Credits: 4

Referred textbooks:

The following books are recommended for this course and class lectures will be delivered according to the outline of these books.

- ''Engineering Mechanics: Statics'' by R.C. Hibbeler.
- "Vector Mechanics for Engineers: Statics" by Ferdinand P. Beer & E. Russell Johnston, Jr.
- ''Engineering Mechanics: Dynamics'' by R.C. Hibbeler.
- ''Engineering Mechanics'' by RS Khurmi.

Course description:

This course uses the Laws of Mechanics to predict forces in and motions of machines and structures. The course is the key prerequisite course to sequences of courses dealing with mechanics of machines, stress analysis and design of mechanical systems. Application of the fundamental principles of Newtonian mechanics to the statics and dynamics of particles and the equilibrium of trusses, frames, beams and other rigid bodies. Dynamics of moving particles, including friction, torque, impulse, and momentum.

Topic covers:

Statics

Introduction: Basic concepts of mechanics, Composition and Resolution of forces

Equilibrium of particles: Condition for the equilibrium of particle, Free-Body diagram, Coplanar Force systems.

Force System Resultants: Moment of a force, Principle of moments, Moment of a force about a specified axis, Moment of a Couple, Reduction of a force to couple system.

Equilibrium of a Rigid Body: Types of support, Free-Body diagrams, Conditions of rigid body equilibrium, Moments and Couples, Constrains and Statistical determinacy.

Dynamics

Kinematics of particles: Motion of particle, rectilinear and curvilinear motion; motion of several particles, rectangular components of velocity and acceleration; Motion relative to frame in translation; tangential, normal, radial and transverse components.

Kinetics of particles: Newton's second law of motion, linear and angular momentum, radial and transverse components of motion, motion under central force, two body problem.

Work and energy: Principle of work and energy and its application; Power and efficiency; Potential energy, conservative forces; Conservation of energy and its application; Principle of impulse and momentum; Direct and oblique central impact.

Rigid body: Introductory concepts of kinematics of rigid body

Mechanics of Machinery: Inertia and kinetic energy of rotation and reciprocating parts; Turning moment diagram, fluctuation of energy and speed; Fly wheel; Balancing of stationary, rotating and reciprocating masses, balancing of in-line engines and v- engines, principle of direct and reverse cranks in balancing problems, Balancing machines; Law of gearing forms of tooth and types of gear; Gear trains and their arrangements; Types of governors and their control; Cam and follower, various profiles of cams and their motions.

Ph 1227 Magnetism and Nuclear Physics

Credits: 3

Suggested textbook:

- ''Fundamentals in Nuclear Physics'' by Jean-Louis Basdevant, James Rich, Michel Spiro
- ''Fundamentals of Physics: Electricity and Magnetism'' by Halliday, Resnick, and Walker
- "Nuclear Physics" by S.N. Ghoshal
- "Atomic and Nuclear Physics" by N. Subrahmanyam and Brij Lal
- "Electricity and Magnetism'' by Edward M. Purcell and David J. Morin

- "Introduction to Magnetic Materials" by B.D. Cullity
- "Introduction to Magnetism and Magnetic Materials 2nd edition" by David C. Jiles
- "The Physical Principles of Magnetism" by Allan H. Morrish

Course description:
The objective of this course is to provide primary and extended knowledge of the principles of magnetism, electro-magnetism and nuclear physics. These properties of matter are closely controlled by the crystal structure of the materials. Therefore, the study of Ph 1227 will enhance their understanding to the structure properties relationship to the materials.

Topic covers:

Magnetism: Dipoles, Dipole Moment, Dipole in an Electric Field, The magnetic effect of an Electric Current, Magnetic Flux, permeability and reluctance, Magnetic field strength, Magnetic potential, Flux density, Magnetization curve, Susceptibility, Magnetic induction, Laws of magnetic circuits: Ohm's law, Ampere's circuital law, Hysteresis and Eddy current losses, The Biot-Savart Law, Magnetic Field Near a Long, Straight, Electromagnetic induction.
Dielectrics and Ferroelectrics: Maxwell Equations, Polarization, Macroscopic Electric Field Local Electric Field at an Atom, Dielectric Constant and Polarizability, Ferroelectric Crystals, Ferroelectric Domains, Piezoelectricity, Pyroelectricity, Classification of magnetic materials.
Properties of Magnetic Materials: Diamagnetism, Paramagnetism, Quantum Theory of Para–magnetism, Ferromagnetism, Ferromagnetic Order, Ferrimagnetic Order, Antiferromagnetism, Antiferromagnetic Order.
Elasticity of Matter: Different modulus of elasticity and their relationship, Elastic, Fatigue, Poison's ratio, Work done in deforming a body, Twisting by a cylinder, Maxwell kneedle, Bending moment, Cantilever.
Nuclear Physics: Introduction to nuclear physics, Basic concepts of nuclear physics, Radioactivity, Radioactive decay, Measurement of Decay rates, Calculation of decay rates, Half-life, Nuclear Fission, Chain Reactions, Nuclear Fusion, Radiation dosimetry, Mechanism of nuclear reactor, Disposal of radioactive isotope, Materials for building reactors, Application of radiation to medical treatment and in industry.

Ch 1228 Sessional on Organic Chemistry

Credit hour: **0.75**
Course description: Experiments based on the course Ch 1227, Organic Chemistry.

ME 1220 Engineering Drawing Sessional-I

Credit hour: **1.5**
Course description: Engineering drawing types, Orthographic drawing, starting from simple objects to complicated objects, Isometric view of the objects, Section drawing, auxiliary views.

Ph 1228 Sessional on Magnetism and Nuclear Physics

Credit hour: 1.5
Course description:
Experiments based on the theory course of Ph 1227.

Hum 1228 Sessional on Technical English

Credit hour: 0.75
Topic covers:

Developing Reading Skill: Strategies of Reading-Skimming, Scanning Prediction, Inference; Analyzing and Interpreting Variety of Texts; Practicing Comprehension from Literary and Non Literary Texts.

Developing Writing Skill: Sentences, Sentence Variety, Generating Sentences; Clarity and Correctness of Sentences; Linking Sentences to Form Paragraphs. Writing Paragraph, Essays, Reports, Formal and Informal Letters.

Listening Skill and Note Taking: Listening to Recorded Texts and Class Lectures and Learning to Take Useful Notes Based on Listening.

Developing Speaking Skill: Oral Skills Including Communicative Expressions for Personal Identification, Life at Home, Giving Advice and Opinion, Instructions and Directions, Requests, Complaints, Apologies, Describing Peoples and places, Narrating events.