

UNIVERSITY OF KERALA

**B. TECH. DEGREE COURSE
(2013 SCHEME)**

**SYLLABUS
FOR
COMBINED I & II SEMESTER**

B TECH SCHEME -2013

Combined I and II Semesters

Course No	Name of subject	Credits	Weekly load, hours			C A Marks	Exam Duration Hrs	U E Max Marks	Total Marks
			L	T	D/P				
13.101	Engineering Mathematics - I (ABCEFHMNPRSTU)	6	2	1	-	50	3	100	150
13.102	Engineering Physics (ABCEFHMNPRSTU)	6	2	1	-	50	3	100	150
13.103	Engineering Chemistry (ABCEFHMNPRSTU)	6	2	1	-	50	3	100	150
13.104	Engineering Graphics (ABCEFHMNPRSTU)	6	1	-	2	50	3	100	150
13.105	Engineering Mechanics (ABCEFHMNPRSTU)	6	2	1	-	50	3	100	150
13.106	Basic Civil Engineering (ABEFHMNPRSTU) Building Technology (C)	6	2	1	-	50	3	100	150
13.107	Basic Mechanical Engineering (ACEFRT) Basic Biochemical Engineering & Biotechnology (B) Process Engineering Calculations(H) Engineering Thermodynamics (MNPSU)	6	2	1	-	50	3	100	150
13.108	Basic Electrical Engineering (ABCHMNPSTU) Basic Electrical and Electronics Engineering (FR) Fundamentals of Electrical Engineering (E)	6	2	1	-	50	3	100	150
13.109	Basic Electronics Engineering (BCEHMNPSU) Semiconductor Devices (AT) Foundations of Computing and Programming in C (FR)	6	2	1	-	50	3	100	150
13.110	Mechanical Engineering Workshop (ABCEFHMNPRSTU)	2	-	-	1	25	3	50	75
13.111	Electrical & Electronics Engineering Workshop (ABCEFHMNPRSTU)	2	-	-	1	25	3	50	75
Total		58	17	8	4	500		1000	1500

A	APPLIED ELECTRONICS & INSTRUMENTATION ENGINEERING
B	BIOTECHNOLOGY & BIOCHEMICAL ENGINEERING
C	CIVIL ENGINEERING
E	ELECTRICAL AND ELECTRONICS ENGINEERING
F	INFORMATION TECHNOLOGY
H	CHEMICAL ENGINEERING
M	MECHANICAL ENGINEERING
N	MECHANICAL STREAM - INDUSTRIAL ENGINEERING
P	MECHANICAL STREAM - PRODUCTION ENGINEERING
R	COMPUTER SCIENCE & ENGINEERING
S	AERONAUTICAL ENGINEERING
T	ELECTRONICS AND COMMUNICATION ENGINEERING
U	MECHANICAL STREAM - AUTOMOBILE ENGINEERING

13.101 ENGINEERING MATHEMATICS - I (ABCEFHMNPRSTU)

Teaching Scheme: 2(L) - 1(T) - 0(P)

Credits: 6

Course Objective:

This course provides students an insight into the various applications of differentiation, partial differentiation techniques, multiple integrals and Laplace transforms. The methods for solving differential equations and the concept of linear algebra are also introduced as a part of this course.

Module – I

Applications of differentiation: Definition of Hyperbolic functions and their derivatives-successive differentiation-Leibnitz' Theorem (without proof)-Curvature-Radius of curvature-centre of curvature - evolutes (Cartesian, polar and parametric forms) – indeterminate forms. Evaluation of limits by L'Hospital rule

Partial differentiation: Partial derivatives-Euler's theorem on homogenous functions-Total derivatives-Jacobians of transformations-Maxima and Minima of functions of 2 variables - Lagrange's method.

Module – II

Multiple Integrals: Double integrals –Properties- Evaluation of double integrals (Cartesian only) –Change of order of integration- Change of variables (Cartesian to polar)-Area enclosed by plane curves (Cartesian only) - Triple integrals-Evaluation of triple integrals in Cartesian coordinates- Volume as triple integrals.

Module – III

Laplace transforms: Transforms of elementary functions – shifting property-inverse transforms- transforms of derivatives and integrals – Transform functions multiplied by t and divided t convolution theorem (without proof)- Transforms of unit step function, unit impulse function and periodic functions – second shifting theorem.

Differential Equations: Linear differential equations with constant coefficients-Method of variation of parameters – Simultaneous linear equations with constant coefficients. – Cauchy and Legendre differential equations. Solution of ordinary differential equations with constant coefficients using Laplace transforms

Module – IV

Matrices: Rank of a matrix- elementary transformations – equivalent matrices- Echelon form – LU Decomposition – System of linear equations -consistency – solution of a system linear equations – Non homogeneous and homogeneous equations – Linear dependence

and independence of vectors – Eigen values and Eigen vectors –Cayley-Hamilton Theorem - Properties of Eigen Values and Eigen vectors – Diagonalisation of matrices – Quadratic forms – Reduction to Canonical Forms.

References:

1. Kreyszig, *Advanced Engineering Mathematics*, 9/e, Wiley India, 2013.
2. Grewal B.S., *Higher Engineering Mathematics*, Khanna Publications, 2012.
3. Ramana B.V., *Higher Engineering Mathematics*, Tata McGraw Hill, 2007.
4. Bali N. P. and Manish Goyal, *Engineering Mathematics*, 7/e, Laxmi Publications, India, 2012.
5. Babu Ram, *Engineering Mathematics*, Pearson, 2012.
6. Srivastava, *Engineering Mathematics*, Prentice Hall, India, 2010.

Internal Continuous Assessment (Maximum Marks-50)

50% - Tests (minimum 2)

30% - Assignments (minimum 2) such as home work, problem solving, quiz, literature survey, seminar, term-project, software exercises, etc.

20% - Regularity in the class

University Examination Pattern:

Examination duration: 3 hours

Maximum Total Marks: 100

The question paper shall consist of 2 parts.

Part A (20 marks) - Five Short answer questions of 4 marks each. All questions are compulsory. There should be at least one question from each module and not more than two questions from any module.

Part B (80 Marks) - Candidates have to answer one full question out of the two from each module. Each question carries 20 marks.

Course Outcome:

At the end of the course, the students will be familiar with various concepts of calculus which are essential for engineering. They'll also become acquainted with the basic ideas of Laplace transforms and linear algebra.

13.102 ENGINEERING PHYSICS (ABCEFHMNPRSTU)

Teaching Scheme: 2(L) - 1(T) - 0(P)

Credits: 6

Objective:

This course equip the students to assimilate engineering and technology through the exposure of fundamentals of Physics

Module – I

Harmonic Oscillations: Basic ideas of harmonic oscillations – Differential equation of free harmonic oscillation, damped harmonic oscillation, forced harmonic oscillation and their solutions- Resonance.

Waves: One dimensional wave- differential equation. Three dimensional wave- differential equation & solution. Transverse vibrations of a stretched string.

Electromagnetic Theory: Del operator – grad, div, curl and their physical significance. Concept of displacement current. Deduction of Maxwell's equations. Prediction of electromagnetic waves. Transverse nature of electromagnetic waves. E and H are at right angles. Poynting's theorem (qualitative only).

Module – II

Crystal Structure: Space lattice. Unit cell and lattice parameters. Crystal systems. Co-ordination number and packing factor with reference to simple cubic, body centered cubic and face centered cubic crystals. Directions and planes. Miller indices. Interplanar spacing in terms of Miller indices.

Special Theory of Relativity: Postulates. Lorentz transformation equations (no derivation). Simultaneity. Length contraction. Time dilation. Relativistic mass. Mass energy relation.

Superconductivity: Superconducting phenomena. Meissner effect. Type-I and Type-II superconductors. BCS theory (qualitative). High temperature superconductors. Applications of superconductors.

Module – III

Interference & Diffraction of Light: Coherence. Interference in thin films and wedge shaped films. Newton's rings. Interference filters. Antireflection coating. Fresnel and Fraunhofer diffraction. Fraunhofer diffraction at a single slit. Fraunhofer diffraction at a circular aperture (qualitative). Rayleigh's criterion for resolution. Resolving power of telescope and microscope. Plane transmission grating. Grating equation.

Polarization of Light: Types of polarized light. Double refraction. Nicol Prism. Retardation plates. Theory of plane, circular and elliptically polarized light. Production and analysis of

circularly and elliptically polarized light. Polaroids & applications. Induced birefringence - Kerr effect.

Ultrasonics: Production of ultrasonic waves - Magnetostriction oscillator, Piezoelectric oscillator. Detection of ultrasonics – Thermal & Piezoelectric methods. Applications of ultrasonics - industrial, medical etc.

Module – IV

Quantum Mechanics: Dual nature of matter. Wave function. Uncertainty principle. Energy and momentum operators. Eigen values and functions. Expectation values. Time Dependent and Time Independent Schrodinger equations. Particle in one dimensional box. Tunnelling (qualitative).

Statistical Mechanics: Macrostates and Microstates. Phase space. Basic postulates of Maxwell- Boltzmann, Bose-Einstein and Fermi Dirac statistics. Distribution equations in the three cases (no derivation). Density of states. Derivation of Planck's formula. Free electrons in a metal as a Fermi gas. Fermi energy.

Laser : Population inversion and stimulated emission. Optical resonant cavity. Ruby Laser, Helium-Neon Laser, Semiconductor Laser (qualitative). Holography- Recording-reading and applications.

References:

1. Hugh Young, Roger Freedman, Francis Sears and Mark Zemansky, *University Physics*, 12/e, Pearson
2. Frank and Leno, *Introduction to Optics*, 3/e, Pearson
3. Upadhyaya J.C., *Mechanics*, Ram Prasad & Sons
4. David J Griffiths, *Introduction to Electrodynamics*, 3/e, Pearson
5. Ali Omar M., *Elementary Solid State Physics*, Pearson
6. Pillai S.O., *Solid State Physics*, New Age International Publishers
7. John R. Taylor, Chris D. Zafiratos and Michael A. Dubson; *Modern Physics for Scientists and Engineers*, 2/e, Prentice Hall of India
8. Eugene Hecht, *Optics*, 4/e, Pearson
9. Robert Resnick, *Introduction to Special Relativity*, John Wiley & Sons
10. Richard L. Liboff, *Introduction to Quantum Mechanics*, 4/e, Pearson
11. Donald A. Mcquarrie, *Statistical Mechanics*, Vivo Books
12. Premlet B., *Engineering Physics-I*, Tata McGraw Hill
13. Dattu R. Joshi, *Engineering Physics*, Tata McGraw Hill
14. Dominic I. & A. Nahari, *A Text Book of Engineering Physics*, Aswathy Publishers, Trivandrum

15. Premler B., *Advanced Engineering Physics, Phasor Books*

Internal Continuous Assessment (*Maximum Marks-50*)

50% - Tests (minimum 2)

30% - Assignments (minimum 2) such as home work, problem solving, quiz, literature survey, seminar, term-project, software exercises, etc.

20% - Regularity in the class

University Examination Pattern:

Examination duration: 3 hours

Maximum Total Marks: 100

The question paper shall consist of 2 parts.

Part A (20 marks) - Ten Short answer questions of 2 marks each. All questions are compulsory. There should be at least two questions from each module and not more than three questions from any module.

Part B (80 Marks) - Candidates have to answer one full question out of the two from each module. Each question carries 20 marks.

Course Outcome:

At the end of the course, the students will be familiar with the laws of Physics and its significance in engineering systems and technological advances.

13.103 ENGINEERING CHEMISTRY (ABCEFHMNPRSTU)

Teaching Scheme: 2(L) - 1(T) - 0(P)

Credits: 6

Course Objective:

- (a) *To impart sound knowledge in the different fields of theoretical chemistry so as to apply it to the problems in engineering field.*
- (b) *To develop analytical capabilities of students so that they can characterize, transform and use materials in engineering and apply knowledge gained in solving related engineering problems.*

Module – I

High Polymers: Introduction- Classification- Types of polymerization, Addition, Condensation and Copolymerization. Moulding constituents of plastics. Moulding techniques of plastics (Injection Extrusion, Blow moulding, Compression and Transfer moulding-Preparation, properties and uses of PMMA, PET, Nylon, Bakelite and Urea formaldehyde resins. Biodegradable plastics-PHBA, PLA. Elastomers-Introduction-Structure of natural rubber- vulcanization - Synthetic rubbers, Buna-S, Butyl rubber and Neoprene. Conducting polymers-Introduction-Preparation, properties and applications of Polyacetylene and polyaniline.

Instrumental Methods of Analysis:

Spectroscopy: Introduction -Instrumentation of spectrophotometer-Electronic spectra - Classification of electronic transitions- Beer Lamberts law, Vibrational spectra- Mechanism of interaction and application. NMR spectroscopy- Basic principle – chemical shift and applications, MRI Imaging.

Thermal Analysis: Principle, instrumentation and applications of TGA and DTA.

Chromatographic Methods: Principle, instrumentation and applications of GC and HPLC.

Module – II

Electrochemistry : Types of electrodes – Single electrode potential – Nernst theory – Helmholtz electrical double layer – Nernst equation – derivation and applications – Reference electrodes–Standard hydrogen electrode – Saturated calomel electrode – pH determination using glass electrode – Concentration cells and its applications –Storage devices – Lithium ion cell-Fuel cell-H₂-O₂ fuel cell- Solar energy conversion –solar cells.

Corrosion and Its Control: Theories of corrosion – chemical corrosion – Pilling Bedworth Rule – Electrochemical corrosion – Mechanism of rusting of iron under different environmental conditions – Galvanic series – Types of corrosion – Concentration cell corrosion, Stress corrosion, Galvanic corrosion – Factors affecting rate of corrosion – Corrosion control methods, corrosion inhibitors, cathodic protection.

Protective Coatings: Metallic coatings – Galvanizing, Tinning and electroplating – Non-metallic coatings – Chromate coating and Anodising. Paint – constituents, functions and examples, Powder coating – methods of application and advantages.

Module – III

Water Technology :Types of hardness- Degree of hardness. Estimation of hardness-EDTA method- Disadvantages of using hard water for industrial purpose-Scale and sludge formation in boiler, causes and remedies- Boiler corrosion, preventive methods- Water softening methods- Ion exchange methods (Zeolite) and Demineralisation using polymer resin. Municipal water, specifications. Different steps in domestic water treatment- Desalination method- Reverse osmosis.

Environmental Science: Air pollution – Sources, effects and control methods. Water pollution – Sewage, aerobic and anaerobic decomposition – BOD and COD, Sewage treatment – Trickling filter method and UASB process. Environmental Issues – Photo chemical smog – CFCs and ozone depletion – Alternative refrigerants – Green house effect. Solid waste disposal – Methods of disposal – Composting, Landfill and Incineration. E-Waste, Methods of disposal – recycle, recovery and reuse.

Module – IV

Engineering Materials:

Fuels: Calorific value – HCV and LCV – Experimental determination of calorific value of solid fuels. Analysis of coal – Proximate analysis – Knocking of petrol and diesel, Biodiesel – Biogas - Natural gas

Nanomaterials: Introduction – Classification – Preparation by Laser ablation technique – Properties and Applications of nanomaterials – Nano carbon tubes.

Cement: Manufacture of Portland cement – Theory of setting and hardening of cement.

Refractories: Introduction – Classification –important Properties, Refractoriness, Dimensional stability and Porosity-Manufacture of Silica and and Carborundum.

Inorganic Pigments: Introduction- - Basic idea regarding structure and colour of pigments-Synthesis, Properties and applications of TiO_2 pigment.

LAB EXPERIMENTS (Demonstration only)

1. Estimation of total hardness in water using EDTA.
2. Estimation of chloride ions in domestic water.
3. Estimation of dissolved oxygen.
4. Estimation of COD in sewage water.
5. Estimation of available chlorine in bleaching powder.
6. Estimation of copper in brass.
7. Estimation of iron in a sample of haematite.

8. Determination of flash and fire point of a lubricating oil by Pensky Marten's apparatus.
9. Potentiometric titrations.
10. Preparation of buffers and standardisation of pH meter.
11. Determination of molarity of HCl solution pH – metrically.
12. Determination of pH using glass electrode.

References:

1. Willard H. A., L. L. Merrit and J. A. Dean ; *Instrumental Methods of Analysis*, CBS Publishers.
2. Vogel, *Qualitative Inorganic Analysis*, Prentice Hall
3. De A.K.; *Environmental Chemistry*, New Age International Pvt Ltd
4. Klauhunde K.J.; *Nanoscale Materials in Chemistry*, Wiley Interscience
5. Gowariker B.R.; *Polymer Science*, New Age International
6. Van Vleck L. H.; *Elements of Material Science and Engineering*, Addison-Wesley Publishing Co.
7. Glasstone S.; *A Text Book of Physical Chemistry*, McMillan
8. Jain P.C.; *Engineering Chemistry*, Dhanpat Rai Publishing Company
9. Shashi Chawla ; *A Text book of Engineering Chemistry*, Dhanpat Rai Publishing
10. Gunter Buxbaum and Gerhard Pfaff, *Industrial Inorganic Pigments*, Wiley VCH
11. Hugh M. Smith, *High Performance Pigments*, Wiley VCH
12. Juhaina Ahad , *Engineering Chemistry*, Jai Publications.
13. Annette Fernandez, M. Muhammed Arif, H. Badarudeen Rawther and Kavitha P. Nair: *Engineering Chemistry*, Five Star publishers

Internal Continuous Assessment (Maximum Marks-50)

50% - Tests (minimum 2)

30% - Assignments (minimum 2) such as home work, problem solving, quiz, literature survey, seminar, term-project, software exercises, etc.

20% - Regularity in the class

University Examination Pattern:

Examination duration: 3 hours

Maximum Total Marks: 100

The question paper shall consist of 2 parts.

Part A (20 marks) - Ten Short answer questions of 2 marks each. All questions are compulsory. There should be at least two question from each module and not more than three questions from any module.

Part B (80 Marks) - Candidates have to answer one full question out of the two from each module. Each question carries 20 marks.

Course Outcome:

At the end of the course,

- *The confidence level of students will be improved to tackle problems in engineering field related to chemical aspects.*
- *The students gain capability in fabricating novel materials with properties that find various engineering applications*
- *The students will be equipped to take up chemistry related topics as part of their project works during higher semesters of the course.*

13.104 ENGINEERING GRAPHICS (ABCFHNMNPRSTU)

Teaching Scheme: 1(L) - 0(T) - 2(P)

Credits: 6

Course Objective:

This course provides students basic knowledge of the graphical language used by engineers and technologists globally and helps the students to develop the skill to understand, communicate and document through the language of engineering drawing.

Introduction: *Introduction to technical drawing and its language. Lines, lettering, dimensioning, scaling of figures, symbols and drawing instruments. (1 sheet practice)*

Module – I

Plain Curves: Conic sections by eccentricity method. Construction of ellipse: (i) Arc of circles method (ii) Rectangle method (iii) Parallelogram method (iv) Concentric circles method. Construction of parabola - (i) Rectangle method (ii) Tangent method. Construction of hyperbola - (i) Arc of circles method (ii) given ordinate, abscissa and the transverse axis (iii) given the asymptotes and a point on the curve. Construction of Tangent and Normal at any point on these curves.

Miscellaneous Curves: Construction of Cycloid, Epicycloid and Hypocycloid, Involute of a circle. Archimedean spiral, Logarithmic spiral and Helix. Construction of Tangent and Normal at any point on these curves.

Module – II

Projection of Points and Lines: Types of projections, Principles of Orthographic projection. Projections of points and lines. Determination of true length, inclination with planes of projection and traces of lines.

Projection of Solids: Projection of simple solids such as prisms, pyramids, cone, cylinder, tetrahedron, octahedron, hemisphere and sphere and also their combinations. Projection of solids on auxiliary inclined plane or auxiliary vertical plane.

Module – III

Auxiliary Projection of Solids: Auxiliary projection of simple solids such as prisms, pyramids, cone, cylinder, tetrahedron and octahedron inclined to both reference planes.

Sections of Solids: Types of cutting planes, section of simple solids cut by parallel, perpendicular and inclined cutting planes. Their projections and true shape of cut sections.

Development of Surfaces: Development of surfaces of (i) simple solids like prisms, pyramids, cylinder and cone (ii) Cut regular solids.

Module – IV

Isometric Projection: Isometric scale, Isometric view and projections of simple solids like prisms, pyramids, cylinder, cone sphere, frustum of solids and also their combinations.

Intersection of Surfaces: Intersection of Surfaces of two solids - (i) Cylinder and cylinder, (ii) Prism and prism and (iii) Cone and Cylinder

(Note: Only cases where the axes are perpendicular to each other and intersecting or with offset.)

Perspective Projection: Principles of perspective projection, definition of perspective terminology. Perspective projection of simple solids like prisms, pyramids, with axis perpendicular to ground plane, auxiliary ground plane or picture plane.

CAD: Introduction to CAD systems, Benefits of CAD, Various software for CAD, Demonstration of any one CAD software.

General Note: First angle projection to be followed

References:

1. Anil Kumar K.N., *Engineering Graphics*, Adhyuth Narayan Publishers, Kottayam.
2. Varghese P.I, *Engineering Graphics*, VIP Publishers, Thrissur.
3. Bhatt N.D, *Engineering Drawing*, Charotar Publishing House Pvt. Ltd, Anand.
4. Shah M.B & B.C Rana, *Engineering Drawing*, Dorling Kindersley (India) Pvt. Ltd. New Delhi.
5. John K.C., *Engineering Graphics*, Prentice Hall India Publishers.
6. Venugopal K., *Engineering Drawing & Graphics*, New Age International Publishers.
7. Benjamin J., *Engineering Graphics*, Pentex publishers
8. Thamaraselvi, *Engineering Drawing Graphics*, S.K Kataria and Sons, New Delhi.
9. Gopala Krishna K.R., *Engineering Drawing*, Subhas Stores, Bangalore

Internal Continuous Assessment (*Maximum Marks-50*)

- 40% - Tests (minimum 2)*
- 40% - Class work*
- 20% - Regularity in the class*

University Examination Pattern:

Examination duration: 3 hours *Maximum Total Marks: 100*

1. *Candidates have to answer one question out of two, each from Module I and Module II. Each question carries 16 marks.*
2. *Candidates have to answer two questions out of three, each from Module III and Module IV (except from CAD). Each question carries 17 marks.*

3. *Distribution of Marks:*
- | | |
|-------------------|--------------------------|
| <i>Module I</i> | <i>1 x 16 = 16 Marks</i> |
| <i>Module II</i> | <i>1 x 16 = 16 Marks</i> |
| <i>Module III</i> | <i>2 x 17 = 34 Marks</i> |
| <i>Module IV</i> | <i>2 x 17 = 34 Marks</i> |

Course Outcome:

At the end of the course, the students will be familiar with all aspects of technical drawings.

13.105 ENGINEERING MECHANICS (ABCEFHMNPRSTU)

Teaching Scheme: 2(L) - 1(T) - 0(P)

Credits: 6

Course Objective:

This course enables students in applying their knowledge of mathematics, science, and to expand this knowledge into the vast area of Mechanics and enhances their ability to solve open ended engineering problems

Module – I

Idealizations of Mechanics: Elements of vector algebra

Statics of Rigid Bodies: -Classification of force systems- principle of transmissibility of a force-composition and resolution- Resultant and Equilibrant of coplanar concurrent force systems-various analytical methods- - Lami's theorem, method of resolution- Conditions of equilibrium-Moment of a force, couple, properties of couple- Varignon's theorem- Resultant and equilibrant of coplanar non-concurrent force systems- Conditions of equilibrium. Equilibrium of rigid bodies-free body diagrams. (Simple problems)

Forces in space: Equations of equilibrium, Vector approach.

Module – II

Friction: Laws of friction-angle of friction- cone of friction- ladder friction- wedge friction.

Properties of Surfaces: Centroid of composite areas- Theorems of Pappus-Guldinus- Moment of inertia of areas, Parallel and perpendicular axes theorems- Radius of Gyration- moment of inertia of composite areas.

Principle of Virtual Work: Equilibrium of ideal systems, stable and unstable equilibrium.

Types of Supports: Types of beams - types of loading- Support reactions of simply supported and overhanging beams under different types of loading.

Module – III

Dynamics: Kinematics-Combined motion of translation and rotation- Differential equation of rectilinear motion. Instantaneous centre, motion of link, motion of connecting rod and piston, wheel rolling without slipping.

Kinetics: Newton's laws of translatory motion- D'Alembert's principle- Motion of lift- Motion of connected bodies.

Curvilinear motion: D'Alembert's principle in curvilinear motion- Mass moment of inertia of rings, solid discs and solid spheres (no derivations required) - Angular momentum-Angular impulse.

Work, Power and Energy:- Work-Energy principle- Impulse, Momentum, Collision of elastic bodies- Law of conservation of momentum-Direct and oblique impact between elastic bodies and impact with fixed plane.

Module – IV

Kinetics of Rigid Bodies: Under combined translatory and rotational motion - work - energy principle for rigid bodies.

Centrifugal and Centripetal Forces: Motion of vehicles on curved paths in horizontal and vertical planes - super elevation.

Simple Harmonic Motion: Vibration of mechanical systems - basic elements of a vibrating system - spring mass model - undamped free vibrations - angular free vibration - simple pendulum.

Relative velocity: Basic concepts-analysis of different types of problems

References:

1. Beer and Johnston, *Vector Mechanics for Engineers - Statics and Dynamics*, Tata Mc-Graw Hill Publishing Company Limited, New Delhi, 2005.
2. Irving. H. Shames, *Engineering Mechanics*, Prentice Hall Book Company, 1966.
3. Timoshenko S. & Young D. H., *Engineering Mechanics*, Mc-Graw Hill -International Edition
4. Popov, *Mechanics of Solids*, Pearson Education, 2007
5. Kumar K. L., *Engineering Mechanics*, Tata Mc-Graw Hill Publishing Company Limited, New Delhi, 1998.
6. Rajasekaran S. and G. Sankarasubramanian, *Engineering Mechanics*, Vikas Publishing House Private Limited, New Delhi, 2003.
7. Tayal A K, *Engineering Mechanics- Statics and Dynamics* , Umesh Publications, Delhi, 2004
8. Benjamin J., *Engineering Mechanics*, Pentex Book Publishers and Distributors, Kollam, 2008
9. Hibbeler R.C., *Engineering Mechanics: Statics and Dynamics*. 11/e, Pearson Prentice Hall, 2010
10. Jaget Babu, *Engineering Mechanics*, Pearson Prentice Hall, 2012

Internal Continuous Assessment (Maximum Marks-50)

50% - Tests (minimum 2)

30% - Assignments (minimum 2) such as home work, problem solving, quiz, literature survey, seminar, term-project, software exercises, etc.

20% - Regularity in the class

University Examination Pattern:

Examination duration: 3 hours

Maximum Total Marks: 100

The question paper shall consist of 2 parts.

Part A (20 marks) - Five Short answer questions of 4 marks each. All questions are compulsory. There should be at least one question from each module and not more than two questions from any module.

Part B (80 Marks) - Candidates have to answer one full question out of the two from each module. Each question carries 20 marks.

Course Outcome:

At the end of the course, the students will be familiar with various concepts of analysis of static and dynamic systems encountered in engineering design and prepared with the analytical skills needed for higher level courses.

13.106 BASIC CIVIL ENGINEERING (ABCEFHMNPRSTU)

Teaching Scheme: 2(L) - 1(T) - 0(P)

Credits: 6

Course Objective:

This course imparts to the students, the fundamentals of civil engineering and creates awareness on various issues related to our living environment and their remedies

Module – I

Surveying: Objectives and Principles of Surveying. **Linear Measurements:** Direct measurements - Tape & chain only - Ranging out survey lines **Levelling:** Levelling instruments - Level (Dumpy & Tilting Level) Levelling Staff, Temporary adjustments of a level, holding the staff, reading the staff - Principles of leveling - recording measurements in the field book - reduction of level - height of collimation method only (simple examples). Contour maps (Brief description only). **Computation of Areas:** - Mid ordinate rule, average ordinate rule, Trapezoidal rule, Simpson's rule (examples), Introduction to Distomat, Total Station & GPS (Brief description only).

Module – II

Building construction: Selection of site for buildings, Setting out of buildings, Components of buildings. **Foundation:** Different types - Spread footing, Isolated footing, Combined footing, Mat foundation, Pile foundation (description only). **Super structure:** Masonry - Stone masonry (Random rubble and Ashlar masonry). Brick masonry –English and Flemish bond- 1 and 1 1/2 brick wall thick only- desirable qualities of stone and brick. **Partition:** Materials used for making partition - plywood, particle boards & glass. **Doors, Windows & Ventilators** - Types. **Plastering:** Mortar – Preparation of Cement mortar-Preparation of surface and Method of application. **Painting of Plastered Surfaces:** Types of paint - enamel, emulsion & distemper- Preparation of surface and method of Application. **Flooring:** Types - mosaic tiles, ceramic tiles, marble, granite and synthetic materials. **Roofing:** Types -flat roof, sloping roof -Concrete roof, tiled roof. Roof covering materials.

Module – III

Concrete: Ingredients- cement, aggregate, and water. Qualities of ingredients (brief description only). Tests on Cement - consistency, initial and final setting times. Compressive strength of mortar cubes-IS Specifications. **Aggregates:** – Desirable qualities of fine and coarse aggregates **Plain Cement Concrete (PCC):** Preparation-proportioning-mixing, workability of concrete. Compressive strength test on cement concrete cubes-IS Specifications **Steel:** Common types used in construction- Mild Steel, HYSD Steel-their properties and uses. **Reinforced Cement Concrete (RCC):** Advantages of RCC over Plain Cement Concrete.

Module – IV

Man and Environment: –Environmental Ethics – Interdisciplinary nature of Environment – air, water and land. **Water Pollution:** Characteristics of water pollution – Water Quality Standards. **Air Pollution:** Sources, Types, Effects, Air quality standards. **Global Environmental Issues:** Green house effect, ozone layer depletion, Global warming, Acid rain, deforestation. **Concept of Sustainable Buildings:** Green buildings, use of recycled materials in construction.

References:

1. Punmia B C, *Surveying & Leveling – I*, Laxmi publications(P) Ltd, Delhi, 2004
2. Rangwala, *Building Materials*, Charotar Publishing House, 2001
3. Arora S P and S P Bindra, *Building Construction*, Dhanpat Rai Publishers, 2013
4. Rangwala, *Building Construction*, Charotar Publishing House., 2004
5. Roy S K, *Fundamentals of Surveying* Prentice-Hall of India, New Delhi, 2004
6. Jha J and S K Sinha, *Construction and foundation engineering*, Khanna Publishers, 2008
7. Narayanan and Lalu Mangal, *Introduction to Civil Engineering*, Phasor Books, Kollam.
8. Santha Minu, *Basic Civil Engineering*, Karunya Publications, Trivandrum
9. Caring A. Langston, Grace K.C. Ding, *Sustainable Practices in Built Environment*, 2/e Butterworth-Heinmann Linacre House Jordan Hill Oxford.
10. Ross Spiegel and Dru Meadows, *Green Building Materials*. Wiley publishers, 2010.
11. Kurian Joseph and R. Nagendran, *Essentials of Environmental Studies*, Pearson Education, Delhi.
12. Dhameja S K, *Environmental Engineering and Management*, S.K. Kataria & Sons, Delhi

Internal Continuous Assessment (Maximum Marks-50)

50% - Tests (minimum 2)

30% - Assignments (minimum 2) such as home work, problem solving, quiz, literature survey, seminar, term-project, software exercises, etc.

20% - Regularity in the class

University Examination Pattern:

Examination duration: 3 hours

Maximum Total Marks: 100

The question paper shall consist of 2 parts.

Part A (20 marks) - Five Short answer questions of 4 marks each. All questions are compulsory. There should be at least one question from each module and not more than two questions from any module.

Part B (80 Marks) - Candidates have to answer one full question out of the two from each module. Each question carries 20 marks.

Course Outcome:

At the end of the course, the students will be familiar with the different stages of building construction, various materials used for construction and environmental issues

13.106 BUILDING TECHNOLOGY (C)

Teaching Scheme: 2(L) - 1(T) - 0(P)

Credits: 6

Course Objective:

This course provides students a detailed insight into the various properties and testing of building materials, components of buildings and stages in construction of buildings.

Module – I

Construction Materials: General Requirements– factors considered during selection.

Building stones – Classification of rocks – Quarrying of stones. Dressing – Properties and uses of common stones. **Timber** – Classification – seasoning, defects in Timber – decay – preservation – Manufacture, properties and uses of plywood, fibre board, particle board. **Bricks and tiles** – manufacture – BIS specifications - properties and testing. **Blocks** - Concrete block-interlocking block. **Lime** – BIS Classification – manufacture – properties and uses. **Cement** – types of cement – uses – Properties. **Mortar** – Types – **Sand** – properties – uses. **Iron and Steel** – Reinforcing steel – types – specifications. Structural steel – Market forms-specifications – **Miscellaneous materials:** Glass, Plastics, A.C. Sheets, Bitumen, Adhesives, Aluminium, Geotextiles (only properties, classifications and their use in construction industry).

Module – II

Building construction – Type of Buildings - Components of Building, Selection of Site -- site clearing - Setting out of building, Excavation - Timbering.

Foundation -Function and requirements of foundations-Bearing capacity of soils-Test for bearing capacity -method of improving Bearing Capacity— Shallow Foundation –Different types-Spread footing-Isolated footing-Combined Footing-Raft Foundation –Grillage Foundation etc. Introduction to: Deep foundations-Pile Foundation, Different Types -Well Foundation.

Module – III

Masonry: Stone masonry-Type - Ashlar, Random rubble, Coarse rubble and Dry Rubble.

Brick Masonry-Types of Bond-English bond-Flemish bond (1 , 1½ and 2 brick wall), Composite walls - cavity walls and partition walls, construction details and features – Comparison of Stone and brick masonry - **Corbels, Cornice , Copings, Lintels and Arches** - types and construction details.

Scaffoldings - parts-type-materials –**Shoring**-Types-Under pinning-Methods.

Module – IV

Floors and flooring – different types of floors and floor coverings. **Roofs and roof coverings** – different types of roofs – suitability – types and uses of roofing materials.

Doors, windows and ventilators – Types and construction details

Stairs – types - layout and planning. **Finishing works** – Plastering, pointing, white washing, colour washing, distempering, painting. Methods of providing DPC. Termite proofing.

References:

1. Rangwala, *Building Materials*, Charotar Publishing House.
2. Arora S. P. and S. P. Bindra, *Building Construction*, Dhanpat Rai Publishers.
3. Rangwala, *Building Construction*, Charotar Publishing House.
4. Jha J. and S. K. Sinha, *Construction and Foundation Engineering*, Khanna Publishers.
5. Moorthy, *Building Construction*, Modern Publishing House Distributor.
6. Rajputh R.K., *Engineering Materials*, S Chand & Co.
7. Punmia B.C., *Building Construction*, Laxmi Publications.
8. Huntington W.C., *Building Construction*, John Wiley.

Internal Continuous Assessment (Maximum Marks-50)

50% - Tests (minimum 2)

30% - Assignments (minimum 2) such as home work, problem solving, quiz, literature survey, seminar, term-project, software exercises, etc.

20% - Regularity in the class

University Examination Pattern:

Examination duration: 3 hours

Maximum Total Marks: 100

The question paper shall consist of 2 parts.

Part A (20 marks) - Five Short answer questions of 4 marks each. All questions are compulsory. There should be at least one question from each module and not more than two questions from any module.

Part B (80 Marks) - Candidates have to answer one question out of the two from each module. Each question carries 20 marks.

Course Outcome:

At the end of the course, the students will be familiar with the uses and properties of various building materials, methods of construction of various components of a building and will have the basic knowledge for supervising the construction of buildings.

13.107 BASIC MECHANICAL ENGINEERING (ACEFRT)

Teaching Scheme: 2(L) - 1(T) - 0(P)

Credits: 6

Course Objective:

This subject covers wide areas of Mechanical Engineering and is intended for exposing the students to the various theoretical and practical aspects of thermal engineering, fluid mechanics and machines, manufacturing and power transmission.

Module – I (Thermodynamics and Fluid Mechanics)

Thermodynamics: Basic concepts, properties, process and cycles- Zeroth, first and second laws of thermodynamics- Concept of reversibility and entropy - Carnot cycle - Pressure-Volume and Temperature Entropy diagrams - Steady flow process and significance of flow work.- Heat engine, heat pump and refrigerator – efficiency, Coefficient of Performance(COP)

Fluid Mechanics: Properties of fluids, density, viscosity and surface tension- Simple problems on properties- Pascal's law-- Stream lines- laminar and turbulent flows- steady and incompressible flow- continuity, Euler and Bernoulli's equations -Applications and simple problems.

Module – II (Energy conversion systems)

Air cycles: Otto and Diesel cycles-Air standard efficiency (simple problems)

IC Engines: Working and comparison of two stroke and four stroke petrol and diesel engines - general description of various systems using block diagrams, air system, fuel system, ignition system -governing system- Brief description of CRDI, MPFI, GDI and Hybrid Vehicles

Steam boilers: Classification – Cochran boiler, Babcock and Wilcox boiler, Benson boiler - fluidized bed combustion

Module – III (Fluid Machines and Thermal Engineering)

Fluid machines: Centrifugal and reciprocating pumps- Reaction and Impulse turbines- Pelton, Francis and Kaplan turbines - Reciprocating and centrifugal compressors - fans and blowers.-Rotary compressors.

Thermal Engineering: Steam turbines, Gas turbine cycles, open and closed gas turbines, T-S diagram, Efficiency, Applications.

Refrigeration & Air Conditioning: Vapour compression refrigeration system-Refrigerants, eco friendly refrigerants. Comfort and Industrial air conditioning, typical window air conditioning unit (general description only).

Power plants: thermal, hydro and nuclear power plants.

Module – IV (Power Transmission and Manufacturing)

Mechanical Power transmission systems: Belt, rope and gear drives-types- Derivation of ratio of tensions, comparison and fields of application, velocity ratio, slip (simple problems). Friction disc, single plate clutch, gear trains (no derivations)-

Manufacturing processes: Elementary ideas of casting, forging, rolling, welding, soldering and brazing. Machining processes: turning, taper turning, thread cutting, shaping, drilling, grinding, milling (simple sketches and short notes). Principle, application and advantages of C N C machine

Non conventional machining: Electro discharge machining (EDM) and Electrochemical machining (ECM)

References:

1. Spalding and Cole, *Engineering Thermodynamics*, Hodder & Stoughton Educational.
2. Gill, Smith and Zuirys, *Fundamentals of IC Engines*, Oxford and IBH publishing Company Pvt. Ltd. New Delhi.
3. Amstead, Ostwald and Begeman, *Manufacturing Processes*, John Wiley & Sons.
4. Crouse, *Automobile Engineering*, Tata Mc-Graw-Hill, New Delhi.
5. Roy and Choudhary, *Elements of Mechanical Engineering*, Media Promoters & Publishers Pvt. Ltd., Mumbai.
6. Hajra Choudhary, *Workshop Technology*, Media Promoters & Publishers Pvt. Ltd. Mumbai.
7. Bansal R.K., *Fluid Mechanics and Machine*, Laxmi Publications Pvt. Ltd. New Delhi.
8. Benjamin J., *Basic Mechanical Engineering*, Pentex Publishers Ltd., Kollam.
9. Balachandran P., *Basic Mechanical Engineering*, Owl publishers.
10. Pravin Kumar, *Basic Mechanical Engineering*, Pearson.

Internal Continuous Assessment (Maximum Marks-50)

50% - Tests (minimum 2)

30% - Assignments (minimum 2) such as home work, problem solving, quiz, literature survey, seminar, term-project, software exercises, etc.

20% - Regularity in the class

University Examination Pattern:

Examination duration: 3 hours Maximum Total Marks: 100

The question paper shall consist of 2 parts. Maximum Total Marks: 100

Part A (20 marks) - Ten Short answer questions of 2 marks each. All questions are compulsory. There should be at least two question from each module and not more than three questions from any module.

Part B (80 Marks) - Candidates have to answer one full question out of the two from each module. Each question carries 20 marks.

Course Outcome:

After the completion of this course, the students will be familiar with various fields of Mechanical Engineering.

13.107 BASIC BIOCHEMICAL ENGINEERING & BIOTECHNOLOGY (B)

Teaching Scheme: 2(L) - 1(T) - 0(P)

Credits: 6

Course Objective:

This course provides a seamless prefatory for beginners of an engineering course in Biotechnology. Concepts are to be presented in a prescribed, yet simple manner, with adequate emphasis on the engineering aspects and quantitative nature of approach of the discipline.

Module – I

Introduction to Biotechnology: History and chronological development –Impact of biotechnology in various sectors (Medical, Industrial, Marine, Dairy, Agricultural, Environmental etc.) - General outline of the socio- economic, legal and ethical implications of Biotechnology.

(Note: The foregoing section is for general discussion and is intended to provide an overall picture of Biotechnology and its scope to beginners. Topics in this section shall be covered within a period of not more than two hours. Questions shall not be asked from the above section for the university examination).

Scientific foundations of Biotechnology: The cell doctrine, structure of cells- Prokaryotic cells and Eukaryotic cells- Important cell types (Bacteria, Yeasts, Molds, Algae, Protozoa, animal cells and plant cells).

(Note: A general outline as provided in the recommended references will be sufficient, since the above topics will be dealt in detail in the Microbiology course offered in third semester).

Chemicals of life: Lipids (fatty acids and related lipids, fat soluble vitamins, steroids and other lipids); sugars and polysaccharides (D- glucose and other monosaccharides, disaccharides to polysaccharides, cellulose); Nucleotides (building blocks, ATP and co-enzymes) , biological information storage in DNA and RNA; Amino acids (building blocks and polypeptide), Protein structure – Primary, secondary and tertiary structure; quaternary structure and biological regulation; Hybrid Biochemicals (Cell envelopes – Peptidoglycan and Lipopolysaccharides, antibodies and other glycoproteins). The hierarchy of cellular organization.

Molecular genetics and cellular control systems: The central dogma - DNA replication, transcription and translation. Metabolic regulation – Genetic level control for protein synthesis, metabolic pathway control. Alteration of cellular DNA – evolving desirable biochemical activities through mutation and selection, selection of desirable mutants, natural mechanisms for gene transfer and rearrangement (genetic recombination, transformation, transduction, Episomes and conjugation, Transposons and internal gene

transfer). Recombinant DNA technology – Basic elements of genetic engineering, genetic engineering of higher organisms.

Perspectives in reaction engineering: A brief account of the classification of reactions and the importance and role of kinetics of reaction in reaction engineering, reaction rates and the rate equation, basic terminologies in reaction kinetics:- molecularity, reaction order and yield and conversion; elementary and non- elementary reactions; homogeneous and heterogeneous reactions (*Basic understanding along with definitions and examples is desirable*).

Biochemical reaction engineering: General reaction kinetics for biological systems- Zero order, first order, Michaelis – Menten kinetics, determination of parameters of the Michaelis – Menten equation (*with mathematical deductions and supplementary numerical exercises*), Monod kinetics for cell growth.

(Note: Familiarity with the terms and key concepts alone is desired, with the discussion being strictly based on the relevant recommended references only).

Module – II

Industrial Biotechnology and Biochemical engineering: Biotechnology in an engineering perspective- steps in bioprocess development- Fermentation processes– Types (aerobic and anaerobic; submerged and solid state; batch, fed- batch and continuous etc.) - general requirements for a fermentation process- range of fermentation processes- Interdisciplinary approach to bioprocessing- Impact of genetic engineering in fermentation technology – Concept of bioprocess engineering and the role of bioprocess engineers in an integrated bioprocess- case study (penicillin production).

(Note: A simplified, qualitative approach based on the relevant prescribed references would be sufficient, since the details are presented in higher semesters)

Introduction to Unit operations: Definition and concept of unit operations in chemical engineering – Fundamental transport processes (momentum, heat and mass transfer) – general classification of separation processes – evaporation, drying, distillation, absorption, membrane separation, solvent extraction, adsorption, ion- exchange, leaching, crystallization and mechanical – physical separations (Principle and purpose of the above unit operations in bioprocessing sector and biological systems should be brought out clearly citing specific examples).

(Note: Only a brief discussion on transport processes and unit operations (exceeding not more than two contact hours) shall be sufficient, since each unit operation will be discussed in detail during higher semesters).

Basic calculations in chemical engineering: Units and dimensions - systems of units, fundamental and derived units, unit conversions, dimensional homogeneity and dimensional analysis, conversion of units, concept of mass and force, definition of g_c and its utility. (*Simple numerical problems may be included*)

Chemical arithmetic: Mole concept, atomic weight, molecular weight and equivalent weight- methods of determination, stoichiometry (*with simple numerical problems*).

Chemical composition: Methods of expressing compositions of mixtures and solutions- mole percent, mass percent, volume percent, molarity, molality, normality, ppm, density and specific gravity, specific gravity scales, use of mole concept in biological and chemical reactions, , Ideal gas laws, gaseous mixtures, real gas laws, gas constant. Composition of gases on dry basis and on wet basis, Average molecular weight and density. Critical properties. *(A treatment using numerical examples is highly desirable).*

Humidity: Humidity and saturation: various term associated with humidity and saturation. Use of Psychrometric charts and determination of humidity.

Module – III

Concepts in chemical engineering thermodynamics: The scope of thermodynamics, temperature and the zeroth law of thermodynamics – concept of heat, work and energy.

The first law and other basic concepts: Concept of internal energy; the first law of thermodynamics - energy balances for closed systems; thermodynamic state and state functions, equilibrium state and the phase rule, reversible and irreversible processes; constant volume and pressure processes; concepts of enthalpy and heat capacity. Mass and energy balances for closed systems- measures of flow, mass balance for open systems, the general energy balance, energy balance for steady state flow processes. *(Numerical examples)*

Volumetric properties of pure fluids: PVT behavior of pure substances – PV diagram, critical behavior, volume expansivity and isothermal compressibility. ideal gas temperatures and the universal gas constant, Ideal gas- implied property relations for an ideal gas, equations for process calculations- isothermal process, isobaric process, isochoric process, adiabatic process, polytropic process, Cubic equations of state – the Van der Waals equation of state, generic cubic equation of state for gas mixtures, determination of equation of state parameters, theorem of corresponding states; acentric factor. Generalized correlations for gases and liquids.

The second law of thermodynamics: statements of the second law, Carnot's theorem, thermodynamic temperature scales – ideal gas temperature scale and Carnot's equations, Concept of entropy- entropy changes of an ideal gas, entropy balance for open systems, calculation of ideal work, lost work. The third law of thermodynamics.

Thermodynamic properties of fluids: Property relations for homogeneous phase, enthalpy and entropy as functions of T and P, Internal energy as a function of P, the ideal gas state, alternative forms for liquids, internal energy and entropy as functions of T and V, Gibbs energy as a generating function. Residual properties- residual properties by equations of state (from virial equation and cubic equations of state). Two phase systems –Concept of vapour pressure, temperature dependence of vapor pressure of liquids, two phase liquid/vapor systems.

(Note: For module – II, a quantitative approach based on theoretical/mathematical deductions and numerical problems is expected. The concepts of thermodynamics should be presented in a process engineering point of view, with numerical problems

and applications specifically and mandatorily based on chemical/biological engineering systems and processes).

Module – IV

Principles of Metabolism: Major metabolic pathways- Carbon catabolism (Embden–Meyerhof-Parnas pathway, Pentose phosphate cycle, Entner- Doudroff pathway); Respiration - TCA cycle, respiratory chain; Photosynthesis – Light harvesting, electron transport and photophosphorylation; Biosynthesis- synthesis of small molecules, macromolecule synthesis. Transport across cell membranes – Passive and facilitated diffusion, active transport. Metabolic organization and regulation - Key crossroads and branch points in metabolism, enzyme level regulation of metabolism. End products of metabolism – Anaerobic metabolism (fermentation) products, partial oxidation and its end products, secondary metabolite synthesis.

(Note: The discussion on each topic mentioned above may be concise and shall be based only on the relevant recommended references).

Fundamentals of Biochemical energetics: Energy yielding and energy requiring biochemical reactions, coupled reactions, concept of free energy change (ΔG), relationship between free energy and P/S ratio, different conventions for defining ΔG and K_{eq} , addition of ΔG values for coupled reactions, calculation of equilibrium concentrations, oxidation reduction reactions, metabolism and ATP yield, energetics of oxidative phosphorylation and chemiosmotic coupling, energetics of photosynthetic phosphorylation (non cyclic and cyclic), energetics of active transport.

(Note: The discussion on the above topics should be supplemented with adequate number of mathematical deductions and numerical problems).

References:

1. Stanbury P.F., A. Whitaker and S.J. Hall *Principles of Fermentation Technology*, 2/e, Butterworth- Heinemann, 1995.
2. Christie John Geankoplis *Transport Processes and Separation Process Principles*, 4/e, Prentice Hall of India, 2003.
3. James. E. Bailey and David. F. Ollis *Biochemical Engineering Fundamentals*, 2/e, McGraw Hill Book Company, 1986.
4. Michael. L. Shuler and Fikret Kargi, *Bioprocess Engineering – Basic Concepts*, 2/e, Prentice Hall of India, 2002.
5. Smith J.M., H.C. Van Ness and M.M. Abbott, *Introduction to Chemical engineering Thermodynamics*, 6/e, McGraw Hill.
6. Pauline. M. Doran , *Bioprocess Engineering Principles*, Elsevier- Academic Press, 1995.
7. Bhatt B.I., S.M. Vora, *Stoichiometry*, 4/e, Tata McGraw Hill, 2004.
8. Segel I.H., *Biochemical Calculations- How to Solve Problems in General Biochemistry*, 2/e, John Wiley and sons, 1976.

9. Narayanan K.V., *A Textbook of Chemical Engineering Thermodynamics*, Prentice Hall of India, 2004.
10. David. M. Himmelblau, *Basic Principles and Calculations in Chemical Engineering*, 6/e, Prentice Hall of India, 2008.
11. Ghasem. D. Najafpour, *Biochemical Engineering and Biotechnology*, Elsevier, 2007.
12. Octave Levenspiel, *Chemical Reaction Engineering*, 3/e, John Wiley and Sons, 2001.
13. Lansing M. Prescott, John. P. Harley and Donald. A. Klein, *Microbiology*, 5/e, McGraw Hill Company, 2002.
14. David. L. Nelson and Michael. M. Cox, *Lehninger Principles of Biochemistry*, 4/e, Palgrave- Macmillan, 2005.

Internal Continuous Assessment (Maximum Marks-50)

50% - Tests (minimum 2)

30% - Assignments (minimum 2) such as home work, problem solving, quiz, literature survey, seminar, term-project, software exercises, etc.

20% - Regularity in the class

University Examination Pattern:

Examination duration: 3 hours

Maximum Total Marks: 100

The question paper shall consist of 2 parts.

Part A (20 marks) - Ten Short answer questions of 2 marks each. All questions are compulsory. There should be three questions each from the Module I and II, and two questions each from Module III and IV .

Part B (80 Marks) –Candidates have to answer one full question out of the two from each module. Each question carries 20 marks.

Part B questions should have at least 40 % numerical problems. There can be numerical problems in Part A also.

Note : *Use of Psychrometric charts is permitted for the university examination and hence proper direction in this regard will have to be provided on the facing sheet of the question paper.*

Course Outcome:

The course serves the purpose of imparting the students the ideas on the core areas of the branch and also helps them assimilate the underlying principles of the discipline in the right perspective. The student who completes the course is expected to develop a mathematical approach in the principles being employed in biotechnology/bioprocessing operations.

13.107 PROCESS ENGINEERING CALCULATIONS (H)

Teaching Scheme: 2(L) - 1(T) - 0(P)

Credits: 6

Course Objective:

The course is expected to provide a seamless prefatory for the first year students of the Chemical Engineering branch. The students are expected to get the basic concepts of state equations and conservation equations in the various unit operations in process industries along with the fundamentals principles of thermodynamics.

Module – I

Introduction to Chemical Engineering, Chemical process Industry, Unit Operations and Unit Processes.

Units and Dimensions: System of Units, Basic and Derived quantities, Conversion of units, problems. Dimensional analysis, conversion of empirical equations, mole concept and mole fraction, weight fraction and volume fraction, concentration of liquid solutions- molarity, molality, normality, ppm, density and specific gravity, specific gravity scales, use of mole concept in chemical reaction stoichiometry, Concepts of atomic weight, equivalent weight and mole. Ideal gas laws, gaseous mixtures, real gas laws, gas constant. Composition of gases on dry basis and on wet basis Average molecular weight and density. Critical properties and compressibility of gases. Compressibility factor, compressibility factor chart. Numerical Problems.

Humidity: Humidity and saturation: various term associated with humidity and saturation. Use of Psychrometric charts and determination of humidity

Module – II

Vapour Pressure: Effect of temperature on vapour pressure. Application of Clausius Clapeyron equation. Vapour pressure plots, Cox charts, Duhrings Lines, Solutions - Henry's law, Raoult's law, Bubble point, vapour pressure of immiscible liquids. Numerical problems

Material Balance without chemical reactions: Brief account of general material balance for a system at steady and unsteady states, steps for solving material balance problems in chemical engineering applications, material balance for unit operations: distillation, drying, evaporation, condensation, absorption, mixing etc. Recycling and bypass operations.

Module – III

Material Balance with chemical reactions: definition of terms like limiting reactant, excess reactant percentage yield, selectivity, numerical examples for determining the limiting and excess reactants. Combustion of solid, liquid and gaseous fuels, Heating value of fuels, proximate and ultimate analysis of coal, Orsat analysis. Material Balance problems for

combustion, oxidation, chlorination, nitration, hydrogenation and related processes. Recycling, bypass and purging operations.

Energy Balances: Heat capacity, specific heat and enthalpy, Heat capacity of solids, liquids, gases and gaseous mixtures, Effect of temperature on heat capacity of gas, Mean heat capacity of gas, relevant rules and laws, Latent heats, Heat of fusion, Heat of vaporization, Estimation of heat capacity- relevant rules and laws, calculation of enthalpy changes with and without phase change, Estimation of latent heat of vaporization, heat balance calculations in processes without chemical reaction, heat of reaction, standard heats of formation, combustion and reaction, heat of solution and heat of mixing, Effect of temperature on heat of reaction, Hess law of constant heat summation, enthalpy change for mixtures, Heat capacity, work, internal energy, Latent heat, enthalpy changes, energy balance for flow and non flow processes.

Enthalpy-concentration charts and applications. Adiabatic and non-adiabatic reactions. Theoretical and actual flame temperatures.

Module – IV

Fundamentals of Thermodynamics: Fundamental concepts and definitions - closed, open and isolated system - intensive and extensive properties - path and state functions - reversible and irreversible process - temperature - Zeroth law of thermodynamics - First law of thermodynamics - internal energy - enthalpy - heat capacity - first law for cyclic, non-flow and flow processes – applications.

Second law of thermodynamics - limitations of first law - general statements of second law - concept of entropy - calculation of entropy changes - Carnot's principle - absolute scale of temperature - Clausius inequality - entropy and irreversibility - statistical explanation of entropy - Third law of thermodynamics.

Thermodynamic properties of pure fluids - Gibbs free energy, work function - Maxwell's equations - Clapeyron equation - entropy-heat capacity relationships - equations for entropy, internal energy and enthalpy in terms of measurable quantities - effect of temperature and pressure on U, H and S - relationship between C_p and C_v - effect of pressure and volume on heat capacities - Joule-Thomson coefficient.

Compressors - single-stage and multistage compression - refrigeration and liquefaction - COP – various refrigeration cycles - general properties of refrigerant - Joule-Thomson expansion and liquefaction processes - power cycles - steam-power plant cycles - gas-turbine power plant cycle.

References:

1. Bhatt B.I. and S.M. Vora, *Stoichiometry*, 4/e, Tata McGraw Hill, 2004.
2. Himmelblau David M., *Basic Principles and Calculations in Chemical Engineering*, Prentice Hall of India.

3. Narayanan K. V. and B. Lakshmikutty, *Stoichiometry and Process Calculations*, Prentice Hall of India.
4. David. M. Himmelblau, *Basic Principles and Calculations in Chemical Engineering*, 6/e, Prentice Hall of India, 2008.
5. Narayanan K.V., *A textbook of Chemical Engineering Thermodynamics*, Prentice Hall of India, 2004.

Internal Continuous Assessment (Maximum Marks-50)

50% - Tests (minimum 2)

30% - Assignments (minimum 2) such as home work, problem solving, quiz, literature survey, seminar, term-project, software exercises, etc.

20% - Regularity in the class

University Examination Pattern:

Examination duration: 3 hours

Maximum Total Marks: 100

The question paper shall consist of 2 parts.

Part A (20 marks) - Ten Short answer questions of 2 marks each. All questions are compulsory. There should be three questions each from the Module I and II and two questions each from Module III and IV.

Part B (80 Marks) - Candidates have to answer one full question out of the two from each module. Each question carries 20 marks.

Note: Part B questions should have at least 75 % numerical problems.

Course Outcome:

The course serves the purpose of imparting the students the ideas on the core areas of the branch and also helps them assimilate the underlying principles of the discipline in the right perspective.

13.107 ENGINEERING THERMODYNAMICS (MPNSU)

Teaching Scheme: 2(L) - 1(T) - 0(P)

Credits: 6

Course Objective:

The main objectives of this course are

- *understanding the basic thermodynamic principles,*
- *developing the skills to perform the analysis and design of thermodynamic systems*
- *developing the skills to accurately articulate thermodynamic issues using proper thermodynamic concepts*

Module - I

Introduction: Basic Concepts -Macroscopic and Microscopic viewpoints, Concept of Continuum ,Thermodynamic System and Control Volume, Surrounding, Boundaries, Types of Systems, Universe, Thermodynamic properties, Process, Cycle, Thermodynamic Equilibrium, Quasi – static Process, State, Point and Path function.

Zeroth Law of Thermodynamics and its significance, Measurement of Temperature- Thermometry, reference Points, Temperature Scales, Comparison of thermometers- Constant Volume gas Thermometer, Ideal gas temperature scale, Thermocouple, Resistance thermometer.

Definition of Work, Pdv work and other types of work transfer, free expansion work .Heat and heat capacity.

Joule's Experiment- First law of Thermodynamics - First law applied to Non flow Process- Energy-Enthalpy- specific heats- PMM1, First law applied to Flow Process, Mass and Energy balance in simple steady flow process. Application of SFEE, Unsteady flow –Filling and Emptying Process. (Problems)

Module - II

Limitations of the First Law- Second Law of Thermodynamics, Kelvin-Planck and Clausius Statements, Thermal Reservoir, Heat Engine, Heat pump - Performance factors, Equivalence of two statements, Reversibility, Irreversible Process, Causes of Irreversibility, Corollaries of second law-PMM2, Carnot's theorem and its corollaries, Absolute Thermodynamic Temperature scale.

Clausius Inequality, Entropy- Causes of Entropy Change, Entropy changes in various thermodynamic processes, principle of increase of entropy and its applications, Entropy generation in open and closed system, Entropy and Disorder, Reversible adiabatic process- isentropic process

Available Energy, Availability and Irreversibility- Useful work, Dead state, Availability function, Availability and irreversibility open and closed systems Gouy-Stodola theorem

Nernst-Simon and Fowler-Guggenheim statement of third law.

Module - III

General Thermodynamic Relations – Combined First and Second law equations – Helmholtz and Gibb's functions - Maxwell's Relations, equations for internal energy, enthalpy and entropy, specific heats, ideal and real gases, Tds Equations. The Clapeyron Equation, Throttling process, Joule Thomson Coefficient, inversion curve.

Pure Substances, T-h, p-v and p-T diagram of pure substance, p-v-T surface, Saturation pressure and Temperature, T-s and h-s diagrams or Mollier Charts, Phase Transformations, Triple point, properties during change of phase, Dryness Fraction, Clausius Clapeyron Equation, steam tables. Property calculations using steam tables.

The ideal Gas Equation, Characteristic and Universal Gas constants, Deviations from ideal Gas Model: Equation of state of real substances-Vander Waals Equation of State, Berthelot, Dieterici, Redlich-Kwong equation of state , Virial Expansion, Compressibility factor, Law of corresponding state, Compressibility charts

Module IV

Mixtures of ideal Gases – Mole Fraction, Mass fraction Gravimetric and volumetric Analysis, Dalton's Law of partial pressure, Amagat's Laws of additive volumes – Mole fraction , Volume fraction and partial pressure, Gibbs-Dalton's law -Equivalent Gas constant and Molecular Weight, Properties of gas mixtures: Internal Energy, Enthalpy, specific heats and Entropy, (problems), Introduction to real gas mixtures- Kay's rule

Mixture of Gases and Vapours, Atmospheric air - Psychrometric Properties – Dry bulb Temperature, Wet Bulb Temperature, Dew point Temperature, Psychrometers, Specific Humidity, Relative Humidity, saturated Air, Vapour pressure, Degree of saturation, Adiabatic Saturation, Psychrometric chart.

References:

1. Gordon J. Van Wylen, Richard E Sonntag, *Fundamentals of Classical Thermodynamics*, Wiley.
2. Holman J.P., *Thermodynamics*, McGraw - Hill Book Company.
3. Nag P.K., *Engineering Thermodynamics*, Tata McGraw-Hill.
4. Yunus A, Cengel, Michael A. Boles, *Thermodynamics*, Tata McGraw-Hill.
5. Rathakrishnan E., *Fundamentals of Engineering Thermodynamics*, Prentice Hall India.
6. Zemansky H.W., *Heat and Thermodynamics*, McGraw-Hill Book Company Inc.
7. Achuthan M., *Engineering Thermodynamics*, Prentice Hall India Ltd.
8. Michael J. Moran and Howard N. Shapiro, *Fundamentals of Engineering Thermodynamics*, Wiley.

9. Rao Y.V.C., *An Introduction to Thermodynamics*, Universities Press.
10. Gordon Rogers and Y.O.N. Maghew, *Engineering Thermodynamics: Work & Heat Transfer*, Pearson Education.

Internal Continuous Assessment (Maximum Marks-50)

50% - Tests (minimum 2)

30% - Assignments (minimum 2) such as home work, problem solving, quiz, literature survey, seminar, term-project, software exercises, etc.

20% - Regularity in the class

University Examination Pattern:

Examination duration: 3 hours

Maximum Total Marks: 100

The question paper shall consist of 2 parts.

Part A (20 marks) - Ten Short answer questions of 2 marks each. All questions are compulsory. There should be at least two question from each module and not more than three questions from any module.

Part B (80 Marks) - Candidates have to answer one full question out of the two from each module. Each question carries 20 marks.

Note : *Use of approved Steam Tables and Psychrometric chart shall be permitted for the university examination and hence proper direction in this regard will have to be provided on the facing sheet of the question paper.*

Course Outcome:

After the completion of this course, students will get necessary foundation for a complete understanding of energy and other related engineering systems. It also provides students a feel for how thermal sciences are applied in engineering practice.

13.108 BASIC ELECTRICAL ENGINEERING (ABCHMNPSTU)

Teaching Scheme: 2(L) - 1(T) - 0(P)

Credits: 6

Course Objective:

This course imparts to the students, a basic knowledge in Electrical Engineering with an understanding of fundamental concepts.

Module – I

Elementary concepts of electric circuits: Kirchhoff's laws, constant voltage and current sources, formation of network equations by node voltage and mesh current methods. Matrix representation - solution of network equations by matrix methods, star-delta conversion (*Analysis of resistive networks only*).

Magnetic circuits: MMF, field strength, flux density, reluctance, energy stored in magnetic circuits, problems in magnetic circuits.

Electromagnetic induction: Faraday's laws, Lenz's law-statically induced and dynamically induced emfs- self-inductance and mutual inductance.

Alternating current fundamentals: Generation of alternating voltages, waveforms-frequency, period, average and RMS values and form factor. Phasor representation of alternating quantities- rectangular, polar and exponential forms. Analysis of simple ac circuits - concept of impedance, admittance, conductance and susceptance. Phasor representation, j notation. Power and power factor in ac circuits- active, reactive and apparent power. Solution of RL, RC and RLC circuits.

Module – II

Three phase systems: Generation of three phase voltages- advantages of three phase systems, star and delta connection, three wire and four wire systems, relation between line and phase voltages, line and phase currents. Expressions for power in three phase circuits.

Measurement of power: Construction and principle of operation of dynamometer type wattmeter, Measurement of power in three phase circuits - Three wattmeter and two wattmeter methods. Measurement of energy - Working of single phase energy meter.

Generation of power: Block schematic representation of generating stations- hydroelectric, thermal and nuclear power plants. Renewable energy sources - solar, wind, tidal, wave and geothermal energy.

Power transmission and distribution: Typical electrical power transmission scheme, need for high voltage transmission, substation equipments, primary and secondary transmission and distribution systems. Power factor improvement using capacitor banks – numerical examples.

Module – III

Transformers: construction of single phase and three phase transformers (*core type only*) – EMF equation, losses and efficiency, simple problems.

D.C. Machines: D.C. Generator – construction, types - separately excited, shunt, series and compound, emf equation, D.C. motor – types, characteristics, applications.

A.C. Machines: Three phase induction motor- construction, principle of operation, slip, (*types*), speed-torque characteristics. Single phase induction motor – principle of operation, methods of starting – resistance, split phase starting, capacitor start capacitor run motors, applications. Three-phase alternator - construction, principle of operation, emf equation (*coil span factor and distribution factor not needed*). Synchronous motor–principle, methods of starting, applications.

Module – IV

Tariff: Different types of LT and HT consumers, tariff schemes - uniform tariff and differential tariff.

Wiring systems: Basic concepts of wiring (conduit wiring only), service mains, meter board and distribution board. Earthing of installations - necessity of earthing, plate & pipe earthing, protective fuses, MCB, ELCB.

Lamps: Characteristics of different types of lamps - Incandescent lamps, fluorescent, mercury vapour, sodium vapour, metal halide and LED lamps. Control accessories for discharge lamps. Performance comparison of different types of lamps.

Storage batteries: Principle of operation of lead-acid batteries. Ah rating, types of lead-acid batteries and their characteristics, charging methods–constant current and constant voltage charging, trickle charging. Need to avoid overcharging.

References:

1. Mittle V.N. and A. Mittal, *Basic Electrical Engineering*, Tata McGraw Hill Second Edition, 2012.
2. Kothari D.P., L. J. Nagrath, *Basic Electrical Engineering*, Tata McGraw Hill, 2011.
3. Theraja B. L., *A Text Book of Electrical Technology -I*, S. Chand & Co, New Delhi, 2013.
4. Kulshreshtha C., *Basic Electrical Engineering*, Tata McGraw Hill, 2012.
5. S.K. Bhattacharya *Basic Electrical and Electronics Engineering*, Pearson Education South Asia, 2012.
6. Mehta V. K. and Rohit Mehta, *Principles of Power System*, S. Chand & Company Ltd. 4/e, 2008.
7. Imthias Ahmed T.P., B. Premlet, *Introduction to Electrical Engineering*, Phaser Books, 4/e, 2013.

8. Anandamurthy R. S., *Basic Electrical Engineering*, Pearson Education South Asia, 2011.
9. Dhogal P.S., *Basic Electrical Engineering -I*, Tata McGraw Hill, 2011.
10. Soni M.L., P.U. Guptha, U.S. Bhatnagar and A. Chakrabarthy, *A Text Book on Power System Engineering*, Dhanpath Rai & Sons, New Delhi.
11. Giridharan M. K., *Electrical Systems Design*, I. K. International (P) Ltd., 2013.
12. Debashisha Jena, *Basic Electrical Engineering*, Wiley India Ltd, .2013.

Internal Continuous Assessment (Maximum Marks-50)

50% - Tests (minimum 2)

30% - Assignments (minimum 2) such as home work, problem solving, quiz, literature survey, seminar, term-project, software exercises, etc.

20% - Regularity in the class

University Examination Pattern:

Examination duration: 3 hours

Maximum Total Marks: 100

The question paper shall consist of 2 parts.

Part A (20 marks) - Ten Short answer questions of 2 marks each. All questions are compulsory. There should be at least two question from each module and not more than three questions from any module.

Part B (80 Marks) - Candidates have to answer one full question out of the two from each module. Each question carries 20 marks.

Course Outcome:

After successful completion of this course, the students will be able to have a foundation in the concepts of electrical & magnetic circuits, electrical machines and power generation, transmission & distribution. The student will also be familiar with the basics of electrical wiring systems.

13.108 FUNDAMENTALS OF ELECTRICAL ENGINEERING (E)

Teaching Scheme: 2(L) - 1(T) - 0(P)

Credits: 6

Course Objectives:

The objective of this course is to set a firm and solid foundation in Electrical Engineering with strong analytical skills and conceptual understanding of theorems and analysis methods in electrical and magnetic circuits.

Module – I

Fundamental Concepts of Circuit Elements and circuit variables: Electromotive force, potential and voltage - EMF and terminal voltage of a steady source. Steady state charge distribution with a conducting substance connected to steady voltage source. Conduction and energy transfer process.

Two terminal elements: Resistors- terminal v-i relations (Ohm's law, graphical representation of v-i characteristics). Two terminal capacitors - terminal v-i relation

— , Capacitors in series and parallel. Faraday's law and induced EMF. Two-terminal inductor - terminal v-i relations of two-terminal inductor — .

Ideal independent two-terminal electrical sources - voltage and current sources, v-i relations.

Power and energy relationships for two-terminal elements- Passive sign convention, Power and energy in two terminal elements (R, L and C) **Classification of two-terminal elements** - lumped and distributed linear and non-linear, bilateral and non-bilateral, passive and active, time-variant and time-invariant elements.

Multi-terminal circuit elements: The mutual inductance element, terminal v-i relations, Coupling, coupling coefficient, inductances in series and parallel.

Ideal dependent sources: Voltage controlled Voltage source, Current controlled voltage source, Current Controlled current source, Voltage controlled current source. Terminal v-i relations.

Basic Circuit Laws: Kirchhoff's current and voltage laws, **analysis of resistive circuits** - mesh, node analysis , super mesh and super node analysis.

Module – II

Circuit Theorems: Thevenin's and Norton's theorem- Source transformation - linearity of a circuit and superposition theorem, substitution theorem, star-delta transformation, reciprocity theorem, maximum power transfer theorem, Millman's theorem. Application of theorems to circuit analysis.

Magnetic Circuits: Magneto motive force, flux, reluctance, analysis of series and parallel magnetic circuits, magnetic circuits with air-gaps.

Sinusoidal Steady State in Electric Circuits: Power and energy in periodic waveforms, evaluation of RMS and average values, peak factor and form factor of periodic waveforms (pure ac and composite waveforms)

Module – III

ac analysis: Concept of phasor, complex representation (exponential, polar and rectangular forms) of sinusoidal voltages and currents, phasor diagrams, concept of complex impedance - series and parallel impedances. Phasor analysis of RL, RC, RLC circuits. Concept of power factor - active and reactive power, complex power. Admittances- admittances in series and parallel.

Application of circuit theorems to ac circuit analysis, maximum power transfer theorem in ac circuits, mesh and node analysis of ac networks.

Three-phase systems: Star and delta connections, three-phase three wire and three-phase four-wire systems, analysis of balanced loads, power in three-phase circuits.

Module – IV

Time Domain Analysis of dynamic circuits: Series RL circuit - dynamic equations, initial condition, natural response, step response of RL circuit through Laplace Transforms. The concept of time constant in dynamic circuits, step response of series RC circuits.

Analysis of RL, RC and RLC Circuits with non-zero initial condition, natural response and forced response, dc steady state, sinusoidal steady state and periodic steady state.

Resonance in series and parallel circuits- Energy, bandwidth and quality factor, variation of impedance and admittance in series and parallel resonant circuits.

Wiring systems: Basic concepts of wiring (conduit wiring only), service mains, meter board and distribution board. Earthing of installations - necessity of earthing, plate & pipe earthing, protective fuses, MCB, ELCB.

References:

1. Suresh Kumar K. S, *Electric Circuits and Networks*, Pearson Education South Asia, 2009.
2. Hayt W.H., J. E. Kemmerly and S.M. Durbin *Engineering Circuit Analysis*, Tata McGraw Hill, 7/e, 2010.
3. Van Valeknburg, *Network Analysis*, Prentice Hall of India, 2012.
4. Desoer and Kuh, *Electric Circuit Theory*, Tata McGraw Hill, 2011.
5. Vincent Del Toro, *Electrical Engineering Fundamentals*, Prentice Hall of India, 2012.
6. Giorgio Rizzoni, *Principles and Applications of Electrical Engineering*, Fifth Edition Tata McGraw Hill, 2012.

7. Joseph Edminister, *Electric Circuits*, Schaum's Outline Series, Tata McGraw Hill, 2012
8. Alexander C., M. Sadiku *Fundamentals of Electric circuit theory*, Tata McGraw Hill, 2007.
9. Roy Chaudhari D., *Networks and Systems*, New Age International Publishers, 2010.
10. Parker and Smith, *Problems in Electrical Engineering*, CBS Publishers and Distributers.
11. Raina R. B. and S. K. Bhattacharya, *Electrical Design Estimating and Costing*, New Age International (P) Limited.
12. Giridharan M. K, *Electrical Systems Design*, I. K. International (P) Ltd., 2013.

Internal Continuous Assessment (Maximum Marks-50)

50% - Tests (minimum 2)

30% - Assignments (minimum 2) such as home work, problem solving, quiz, literature survey, seminar, term-project, software exercises, etc.

20% - Regularity in the class

University Examination Pattern:

Examination duration: 3 hours

Maximum Total Marks: 100

The question paper shall consist of 2 parts.

Part A (20 marks) - Ten Short answer questions of 2 marks each. All questions are compulsory. There should be at least two question from each module and not more than three questions from any module.

Part B (80 Marks) - Candidates have to answer one full question out of the two from each module. Each question carries 20 marks.

Note: *1) Question paper should be set for checking analytical circuit solving skills, visualisation skills (through graphical presentation), and application skills, not memory. Descriptive questions should not exceed 20%.*

2) Circuit analysis problems in the examination may not have a matrix size of more than 2x2. For circuits with matrix size more than 2x2, question may be restricted to formulation of the necessary equations only. Students' understanding of the principles needs to be tested through such problems.

Course Outcomes:

After successful completion of this course, the students will be able to:

- Analyse electrical and magnetic circuits with moderate complexity applying fundamental laws and theorems in steady-state as well as transient operation.*
- Analyse AC circuits using phasors.*
- Converse with the analytical tools used in Electrical Engineering.*

13.108 BASIC ELECTRICAL AND ELECTRONICS ENGINEERING (FR)

Teaching Scheme: 2(L) - 1(T) - 0(P)

Credits: 6

Course Objective:

This course imparts to the students, a basic knowledge in Electrical and Electronics Engineering with an understanding of fundamental concepts and the basics of electrical wiring system.

Module – I

Elementary concepts of electric circuits & Circuit Theorems: Ohm's Law, Kirchhoff's laws, Solution of DC networks by node voltage and mesh current methods. Thevenin's and Norton's theorem, Source transformation, linearity of a circuit and superposition theorem, star-delta transformation, reciprocity theorem, maximum power transfer theorem and application of theorems to circuit analysis.

Time Domain Analysis of dynamic circuits: Series RL circuit - dynamic equations, initial condition, natural response, step response of RL circuit through Laplace Transforms. Concept of time constant in dynamic circuit, Step response of series RC circuits.

Resonance in series and parallel circuits - Energy, bandwidth and quality factor, variation of impedance and admittance in series and parallel resonant circuits.

Module – II

Magnetic circuits & Electromagnetic induction: MMF, field strength, flux density, reluctance, Simple problems in magnetic circuits. Faraday's laws, Lenz's law-statically induced and dynamically induced emfs- self-inductance and mutual inductance.

Alternating current fundamentals: Generation of alternating voltages. Waveforms-frequency, period, average and RMS values, form factor. Phasor representation of alternating quantities- rectangular, polar and exponential forms. Power and power factor in ac circuits- active, reactive and apparent power. Solution of RL, RC and RLC circuits.

Three phase systems: Generation of three phase voltages, advantages of three-phase systems, star and delta connections, three wire and four wire systems, relation between line & phase voltages and line & phase currents. Expressions for power in three phase circuits.

Electrical and Electronic Measurements: Operating principle of moving coil and moving iron instruments (ammeters and voltmeters), dynamometer type watt meters and energy meters. Principle and block diagram of analog and digital multi-meter, working principle of CRT, block diagram of CRO, measurements using CRO, Principle of digital storage oscilloscope, principle and block diagram of function generator.

Module – III

Electric machines: Transformer- Construction of single phase and three phase transformers (core type only) – EMF equation, losses and efficiency, simple problems.

D.C. Generator: – Construction, types – separately excited, shunt, series and compound, EMF equation.

D.C. Motor: Types, characteristics, applications. Single phase induction motor – principle of operation, methods of starting- resistance split phase starting, capacitor start capacitor run motors, Servo and stepper motors.

Wiring systems: Basic concepts of wiring (conduit wiring only), service mains, meter board and distribution board. Earthing of installations - necessity of earthing, plate & pipe earthing, protective fuses, MCB, ELCB.

Module – IV

PN junction diodes, V-I characteristics, dynamic & static resistance. The P-N junction as a rectifier - Half Wave Rectifier, Full Wave Rectifier, Bridge Rectifier, Comparison of Ripple Factor. Filters- Inductor and, Capacitor Filters. Principle, working and V-I characteristics of Zener diode. Working of simple Zener voltage regulator. Block diagram description of a dc power supply.

Bipolar Junction Transistor (BJT) - Construction, Principle of Operation, Amplifying Action, Common Emitter, Common Base and Common Collector configurations

Field Effect Transistor (FET) - Comparison of BJT and FET. Construction of Field Effect Transistor, Principle of Operation of N channel and P channel Junction Field Effect Transistors, Pinch-Off Voltage, Volt- Ampere Characteristics. – MOSFET – Enhancement and depletion types – Construction operation and characteristics, Applications.

Special Semiconductor Devices: Working principle and applications of SCR, Diac, Triac, Photo diode, Phototransistor, Solar cell, LED, LCD, and CCD. Working principles of UPS and SMPS.

References:

1. Hughes, *Electrical and Electronic Technology*, Pearson Education South Asia, 2011
2. Giorgio Rizzoni, *Principles and Applications of Electrical Engineering*, Fifth Edition Tata McGraw Hill.
3. Bhattacharya S.K., *Basic Electrical and Electronics Engineering*, Pearson Education South Asia, 2012.
4. Vincent Del Toro, *Electrical Engineering Fundamentals*, Prentice Hall of India, 2012.

5. Theraja B.L., *A Text Book of Electrical Technology-I*, S Chand & Co, New Delhi, 2013.
6. Neil storey, Edward Hughes and Wayne Tomasi, *Basics of Electrical, Electronics and Communication Engineering*, Pearson Education South Asia, 2010.
7. Muthusubramanian R., S.Salivahanan, *Basic Electrical and Electronics Engineering*, Tata McGraw Hill, 2011.
8. Imthias Ahmed T.P., B. Premlet, *Introduction to Electrical Engineering*, Phaser Books, 4/e, 2013.
9. Jgathesan V., K. VinothKumar and R.Saravanakumar, *Basic Electrical and Electronics Engineering*, Wiley India Pvt. Ltd., 2011.
10. Metha V.K., *Principles of Electronics*, S. Chand & Co, New Delhi, 2010.
11. Bhargava N.N., *Basic Electronics and Linear Circuits*, Tata McGraw Hill, 2006.
12. Giridharan M. K., *Electrical Systems Design*, I. K. International (P) Ltd., 2013.
13. Sawhane A. K., *A Course in Electrical & Electronic Measurements & Instrumentation*, Dhanpath Rai & Co., 2011.

Internal Continuous Assessment (Maximum Marks-50)

50% - Tests (minimum 2)

30% - Assignments (minimum 2) such as home work, problem solving, quiz, literature survey, seminar, term-project, software exercises, etc.

20% - Regularity in the class

University Examination Pattern:

Examination duration: 3 hours Maximum Total Marks: 100

The question paper shall consist of 2 parts.

Part A (20 marks) - Ten Short answer questions of 2 marks each. All questions are compulsory. There should be at least two question from each module and not more than three questions from any module.

Part B (80 Marks) - Candidates have to answer one full question out of the two from each module. Each question carries 20 marks.

Course Outcome:

After successful completion of this course, the students will be able to have a foundation in the concepts of electrical circuits and circuit theorems, electrical and electronic measurements, electrical machines and electronic circuit fundamentals. The student will also be confident of managing/handling electrical wiring systems.

13.109 BASIC ELECTRONICS ENGINEERING (BCEHMNPSU)

Teaching Scheme: 2(L) - 1(T) - 0(P)

Credits: 6

Course objective:

This course provides students an insight into the fundamental concepts of electronics engineering and various applications of important electronic devices, circuits, ICs, instrumentation system and communication systems.

(Analysis and derivations not required)

Module - I

Diodes: PN junction diodes, principle of doping, formation of barrier potential, forward and reverse biasing. V-I characteristics, principle of working of Zener diode, Photo diode, LED & Solar cell.

Bipolar Junction Transistors: NPN & PNP transistors, structure, typical doping, working of NPN transistor, concepts of common base, common emitter & common collector configurations, current gain of each, input & output characteristics of common emitter configuration, comparison of three configurations with reference to voltage & current gain, input & output resistances and applications.

Field Effect Transistors: basic principles of JFET and MOSFET, comparison with BJT. Concept of common source, common gate and common drain configurations.

Digital ICs: Advantages of ICs, logic gates, realization of logic functions, principle of combinational and sequential logic circuits, JK flip flop.

Module - II

Rectifiers & power supplies: Block diagram description of a dc power supply, rectifying action of diodes. circuit diagram & working of half-wave & full wave (including bridge) rectifier, final equations of V_{rms} , V_{dc} ripple factor & peak inverse voltage in each case, principle of working of series inductor and shunt capacitor filters, need of voltage regulator, working of simple zener voltage regulator.

Amplifiers & Oscillators: Circuit diagram & working of common emitter amplifier, function of each component in the circuit, need of proper biasing, frequency response, voltage gain and 3dB bandwidth, Principle of power amplifiers, Block diagram of Public Address system, concepts of feedback, working principles of oscillators, circuit diagram & working of RC phase shift oscillator.

Analogue Integrated circuits: Functional block diagram of operational amplifier, ideal operational amplifier, use as amplifier and comparator.

Transducers & Instrumentation: Working principles of resistance strain gauge and typical uses, use of thermistor for temperature measurement, LVDT, principle of resistance & condenser microphone and moving coil loudspeaker. Principle and block diagram of analog

and digital multimeter, principle of digital storage oscilloscope, block diagram of DSO, measurements using CRO, principle and block diagram of function generator.

Module - III

Radio communication: principle of AM & FM, wave-forms, bandwidths, block diagrams of AM & FM transmitters, principle of AM & FM demodulation, comparison of AM & FM, principle & block diagram of super heterodyne receiver.

Radar system: Principle, block diagram of pulsed radar, radar range equation, factors affecting the range.

Satellite communication: microwave frequency bands, concept of geo-stationary satellite, frequency bands used, satellite transponder, block diagram of earth station transmitter & receiver, advantages of satellite communication, principle of Global Positioning System (GPS).

Data communication: overview, analog and digital data transmission, transmission media, digitization of wave forms, PCM , digital modulation techniques- ASK, PSK, FSK.

Module - IV

Mobile communication: basic principles of cellular communications, concepts of cells, frequency reuse, principle and block diagram of GSM, principle of CDMA, WLL & GPRS technologies.

Optical communication: block diagram of the optical communication system, principle of light transmission through fiber, concepts of Single Mode and Multi Mode optical fiber, working principle of source (semiconductor Laser) & detector (PIN, APD), advantages of optical communication.

Entertainment Electronics Technology: working principle of Colour television, basic principles of cable TV, CCTV system, basic principles of HDTV, LCD & LED displays.

References:

1. Bhargava N. N., D C Kulshreshtha and S C Gupta, *Basic Electronics & Linear Circuits*, Tata McGraw Hill, 2/e, 2013.
2. Somanathan Nair, *Basic Electronics Communication and Information Engineering*, 2/e, I K International, 2013.
3. Louis E. Frenzel, *Principles of Electronic Communication Systems*, Tata McGraw Hill, 3/e, 2008.
4. Gupta J.B., *Electronic Devices and Circuits*, S. K. Kataria & Sons, 5/e, 2012.
5. William Stallings, *Wireless Communications and Networks*, Pearson, 2/e, 2005.
6. David A. Bell, *Electronic Instrumentation and Measurements*, Prentice Hall India, 3/e, 2006.
7. Gopakumar K., *Introduction to Electronics and Communication*, Phasor Books, 3/e, 2008.

8. Cogdell J. R., *Foundations of Electronics*, Pearson, 2011.
9. Baru and Kaduskar, *Basic Electronics Engineering*, Wiley India, 2011.
10. Prasad, *Fundamentals of Electronics Engineering*, Cengage, 2011.

Internal Continuous Assessment (Maximum Marks-50)

50% - Tests (minimum 2)

30% - Assignments (minimum 2) such as home work, problem solving, quiz, literature survey, seminar, term-project, software exercises, etc.

20% - Regularity in the class

University Examination Pattern:

Examination duration: 3 hours

Maximum Total Marks: 100

The question paper shall consist of 2 parts.

Part A (20 marks) - Ten Short answer questions of 2 marks each. All questions are compulsory. There should be at least two question from each module and not more than three questions from any module.

Part B (80 Marks) - Candidates have to answer one full question out of the two from each module. Each question carries 20 marks.

Course Outcome:

After completion of the course, the student will be familiar with the concepts of electronic devices and communication systems.

13.109 FOUNDATIONS OF COMPUTING AND PROGRAMMING IN C (FR)

Teaching Scheme: 2(L) - 1(T) - 0(P)

Credits: 6

Course Objectives:

- *To learn the basics of digital computers*
- *To develop problem solving skill*
- *To learn C programming and solve problems using computers*

Module – I

Introduction to digital computer – Von Newman concept – A simple model of computer with acquisition of data, storage of data, processing of data, output of processed data. Details of functional units of a computer. Storage – primary storage and secondary storage.

Data representation – Number systems – Binary numbers - representation of integers – representation of fractions – octal and hexadecimal representations - conversion from one system to another - representation of BCD numbers. Simple arithmetic operations (addition, subtraction, multiplication and division) on each representation. Floating point representation – normalization, arithmetic operations. Representation of characters in computer – ASCII, EBCDIC.

Module – II

Introduction to programming languages: Types of programming languages - high level language, assembly language and machine language System software - Operating systems – objectives of operating systems, compiler, assembler and interpreter (concepts only).

Problem Solving strategies: Problem analysis – formal definition of problem – Solution – top- down design – breaking a problem into sub problems- overview of the solution to the sub problems by writing step by step procedure (algorithm) - representation of procedure by flowchart - stepwise refinement of algorithm. Implementation of algorithms – use procedures to achieve modularity.

Examples for algorithms and flow charts: At least 10 problems (starting with non numerical examples and numeric problems like factorial, largest among three numbers, largest among N, Fibonacci etc) must be discussed in detail.

Programming: Selection of appropriate variable names for memory address, documentation of programs, debugging, different types of errors, program testing and verification (preliminary treatment only).

Module – III

Introduction to C Language: Preprocessor directives, header files, data types and qualifiers. Operators and expressions. Data input and output, control statements, arrays and strings –

structures, unions, enumerated data type. Example programs including bubble sort, selection sort, linear search and binary search, two dimensional array, matrix operations etc.

Module – IV

Pointers: Array of pointers, structures and pointers. Memory allocation functions. Functions – function definition and function prototype. Function call by value and call by reference.

Scope rules and storage classes. Recursive functions – examples. Functions for implementation of stack and queue operations using array

Bitwise operations. Data files – formatted, unformatted and text files. Command line arguments – examples.

Tutorial Sessions:

1. *Familiarisation of tools like **Raptor** (free downloadable) for implementing algorithms*
2. *Execution of few C programs*

References:

1. Morris Mano M., *Digital Logic and Computer Design*, PHI, 2003.
2. Kernighan and Ritchie D.M., *The C. Programming Language*, PHI.
3. Rajaraman V., *Fundamentals of Computers*, PHI.
4. Maureen Sprankle, *Problem Solving & Programming Concepts*, Pearson.
5. Harry H. Cheng, *C for Engineers and Scientists - An Interpretive Approach*, McGraw Hill.
6. Rajaraman V., *Computer Basics and Programming in C*, PHI.
7. Anita Goel and Ajay Mittal, *Computer fundamentals and Programming in C.*, Pearson.
8. Gottfried B.S., *Programming with C*, Schaum Series, Tata McGraw Hill.
9. Stewart Venit and Elizabeth Drake, *Prelude to Programming – Concepts & Design*, Pearson.
10. Dromy R.G., *How to Solve it by Computer*, Pearson.

Internal Continuous Assessment (Maximum Marks-50)

50% - Tests (minimum 2)

30% - Assignments (minimum 3) such as home work, problem solving, quiz, literature survey, seminar, term-project, software exercises, etc.

20% - Regularity in the class

University Examination Pattern:

Examination duration: 3 hours

Maximum Total Marks: 100

The question paper shall consist of 2 parts.

Part A (20 marks) - Ten Short answer questions of 2 marks each. All questions are compulsory. There should be at least two question from each module and not more than three questions from any module.

Part B (80 Marks) - Candidates have to answer one full question out of the two from each module. Each question carries 20 marks.

Note: *Each question may contain sub-questions a), b) etc. Descriptive questions should not exceed 40%.*

Course Outcomes:

After successful completion of this course,

- *The students gain fundamental knowledge in computer science and problem solving skill which is a pre requisite for higher semester courses*
- *The students will be able to write efficient algorithms and draw flowcharts for any programming exercises that they encounter in the various engineering applications*
- *The students will be able to analyze different programs written for the same problem.*

13.109 SEMICONDUCTOR DEVICES (AT)

Teaching Scheme: 2(L) - 1(T) - 0(P)

Credits: 6

Course objective:

This course provides students an insight into the basic semiconductor concepts and a sound understanding of current semiconductor devices and technology so that their applications to electronics and optoelectronics circuits and systems can be appreciated.

Module - I

Elemental and compound semiconductor materials: Crystal Structures -Planes and Directions. Energy bands in solids, intrinsic and extrinsic semiconductors, Variation of Energy band gap with alloy composition. Energy momentum relation for electrons in solids, effective mass. Fermi-dirac distribution. Equilibrium and steady state conditions, Equilibrium concentration of electrons and holes (*graphical and analytical representation*), Temperature dependence of carrier concentration.

Carrier transport in semiconductors – drift, conductivity and mobility, variation of mobility with temperature and doping, High Field Effects, Hall Effect.

Excess carriers in semiconductors – Generation and recombination mechanisms of excess carriers, quasi Fermi levels, diffusion, Einstein relations. Continuity equations.

Module - II

PN junctions - Contact potential, Electrical Field, Potential and Charge Density at the junction, Energy band diagram, Minority Carrier Distribution, Ideal diode equation, Electron and hole component of current in forward biased p-n junction.

Forward and reverse characteristics of PN Junction diode. Effect of Temperature on I-V characteristics. Real diodes, Diode capacitances, switching transients.

Electrical Breakdown in PN junctions - Zener and avalanche break down (*abrupt PN junctions only*), junction capacitance.

Metal Semiconductor contacts, Energy band diagram of Ohmic and Rectifying Contacts, Current Equation, Comparison with PN Junction Diode.

Hetero Junctions – Energy band diagram, Applications.

Module - III

Bipolar junction transistor - current components, Minority Carrier Distributions basic parameters, Evaluation of terminal currents and dc parameters (*based on physical dimensions*), Switching, Base width modulation, Avalanche multiplication in collector-base

junction, Punch Through, Base resistance, Static I-V characteristics of CB and CE configurations.

Field Effect Transistors: JFET - principle of operation, current equation, static I-V characteristics, and device parameters.

MOS Capacitor - Ideal MOS Capacitor, Energy Band Diagram, Carrier Concentrations in the Space Charge Region, C-V characteristics, threshold voltage, effect of real surfaces

Module - IV

MOSFET- Basic structure and principle of operation, I-V characteristics, Derivation of Drain Current (Square Law Model Only) and device parameters, Channel length modulation, Velocity saturation, Body effect, DIBL, Hot Electron Effect, Sub threshold Conduction.

Photo diodes- Current and voltage in illuminated junction, solar cells, photo detectors.

Light Emitting Diodes—Light emitting materials, Heterojunction LED -Principle of operation.

LASER – Basic principle, semiconductor Laser.

UJT- Structure, equivalent circuit, characteristics, principle of operation.

PNPN diode, SCR, DIAC, IGBT and TRIAC – Principles of operation and static characteristics (*no derivation*).

References:

1. Streetman and Banerjee, *Solid State Electronic Devices*, Prentice Hall of India, 6/e, 2010.
2. Tyagi M.S., *Introduction to Semiconductor Materials and Devices*, Wiley India, 5/e, 2008.
3. Warner and Grung, *Semiconductor Device Electronics*, Holt Rinehart and Winston, 1991.
4. Sze S.M., *Physics of Semiconductor Devices*, John Wiley, 3/e, 2005.
5. Tsividis Y.P., *Operation and Modeling of the MOS Transistor*, McGraw Hill, 3/e, 2010.
6. Suresh Babu V., *Solid State Devices & Technology*, Sanguine, 2005.
7. Somanathan Nair, *Solid State Devices*, Prentice Hall of India, 2/e, 2010.
8. Kano, *Semiconductor Devices*, Prentice Hall of India, 2009.
9. Neamen, *Semiconductor Physics and Devices*, McGraw Hill, 4/e, 2009.
10. Pierret, *Semiconductor Devices Fundamentals*, Pearson, 2006.

Internal Continuous Assessment (Maximum Marks-50)

50% - Tests (minimum 2)

30% - Assignments (minimum 2) such as home work, problem solving, quiz, literature survey, seminar, term-project, software exercises, etc.

20% - Regularity in the class

University Examination Pattern:

Examination duration: 3 hours Maximum Total Marks: 100

The question paper shall consist of 2 parts.

Part A (20 marks) - Ten Short answer questions of 2 marks each. All questions are compulsory. There should be at least two question from each module and not more than three questions from any module.

Part B (80 Marks) - Candidates have to answer one full question out of the two from each module. Each question carries 20 marks.

Note: *Question paper should contain minimum 50% and maximum 70% Analysis and Problems.*

Course Outcome:

After completion of the course, the students will have a good knowledge in Semiconductor physics and electronic devices.

13.110 MECHANICAL ENGINEERING WORKSHOPS (ABCEFHMNPRSTU)

Teaching Scheme: 0(L) - 0(T) - 1(P)

Credits: 2

Course Objective:

The purpose of this course is to enable the student to have the practical skills for basic workshop practices in mechanical engineering.

- A. **Carpentry:** Study of tools and joints. Practice in planning, chiseling, marking and sawing. Joints – Cross joint, Dove tail joint.
- B. **Fitting:** Study of tools, Practice in filing, cutting. Male and female joints.
- C. **Foundry:** Study of tools. Preparation of sand, moulding practice and demonstration of casting.
- D. **Plumbing:** Study of tools. Details of plumbing work in domestic and industrial applications. Study of pipe joints, cutting, threading and laying of pipes with different fittings using PVC pipes. Use of special tools in plumbing work.
- E. **Sheet Metal Work:** Study of tools. Selection of different gauge GI sheets for jobs. Demonstration on preparing tube joints, frustums, trays and containers.
- F. **Welding:** Study of welding machines. Straight line practices
- G. **Smithy:** Study of tools. Demonstration on forging of square prism, hexagonal bolt, T bolt and Eye bolt.

Internal Continuous Assessment (Maximum Marks-25)

40% - Tests

40% - Class Work

20% - Regularity in the class

University Examination Pattern:

Examination duration: 3 hours

Maximum Total Marks: 50

For the university examination the student shall be examined in sections A, B and C only.

Course Outcome:

On successful completion of this course the student will be able to

- *Identify and use marking out tools, hand tools, measuring equipment and to work to prescribed tolerances.*
- *Understand and apply workshop safety practices to avoid accidents.*

13.111 ELECTRICAL AND ELECTRONICS WORKSHOP (ABCEFHMNPRSTU)

Teaching Scheme: 0(L) - 0(T) - 1(P)

Credits: 2

Course Objective:

- *To enable the student to have the practical skills for Electrical wiring and basic awareness of safety measures.*
- *To impart fundamental knowledge in the use of electronic components to set up circuits by soldering and testing them.*

PART I (ELECTRICAL)

1. **Study of electrical wiring systems, safety, symbols, tools, accessories, wires and cables:** *This topic covers the safety measures and protection against electric shocks, first aid, tools used for electrical wiring, electrical accessories, wires and cables and standard symbols.*
2. **Simple wiring circuits:** *This topic covers Series and Parallel circuits using SPST switches with plug point in PVC conduit system, PVC casing & capping system.*
 - a. Circuits for light, fan and call bell control
 - b. Circuit with SPDT switches – Staircase wiring
 - c. Circuit with fluorescent tube light
 - d. Godown / tunnel wiring
 - e. Distribution board wiring with ELCB, MCB, isolator (*with two sub circuits*)
3. **Testing of circuits:** *This topic covers the testing of phase and neutral with Earth using Test lamp*

PART II (ELECTRONICS)

1. **Study of meters** (Multimeter - Digital and Analog): *This topic covers the use of multimeter to check voltage, current and also to check various electronic components*
2. **Study of CRO:** *This topic covers the procedure to check the frequency and amplitude of a signal waveform*
3. **Study of electronic components:** *This topic covers the familiarization of some basic electronic components and circuit symbols (Resistors, Capacitors Diodes, transistors, IC's etc.) and identification of component values using colour codes.*
4. **Testing of electronic components:** *This topic covers how to test electronic components using multimeters*
5. **Soldering practice:** *Circuit assembling practice using printed circuit board with electronic components.*

6. Assembling of simple electronic circuits: *This topic covers the use of breadboards for assembly of the following circuits*

- a. Half wave rectifier circuit
- b. Full wave rectifier circuit
- c. Simple LED flashing circuit using Transistors / ICs

References:

1. Dhogal P.S., *Basic Electrical Engineering -I*, Tata McGraw Hill, 2011.
2. Singh R.P., *Electrical Workshop -Safety, Commissioning, Maintenance & Testing of Electrical equipment*, I. K. International (P) Ltd, 2013.
3. Raina R. B. and S. K. Bhattacharya, *Electrical Design Estimating and Costing*, New Age International (P) Limited.
4. Giridharan M. K, *Electrical Systems Design*, I. K. International (P) Ltd.,2013
5. Bhargava N.N.,*Basic Electronics and Linear Circuits*, Tata McGraw Hill

Internal Continuous Assessment (Maximum Marks-25)

40% - Tests

40% - Class Work

20% - Regularity in the class

University Examination Pattern:

Examination duration: 3 hours

Maximum Total Marks: 50

For university examination, the following guidelines should be followed:

Wiring diagram/circuit diagram - 30%

Wiring / Soldering - 30%

Result - 20%

Viva voce - 20%

Course Outcome:

On successful completion of this course the student will have fundamental ideas about the electrical and electronic circuit, and will be able to apply safety practices to avoid accidents.