Gujarat Technological University, Gujarat B.E./B.Tech EE Sem 1 syllabus

Basic Electrical Engineering

BASIC ELECTRICAL ENGINEERING

Credits 4

1 DC Circuits:
Electrical circuit elements (R, L and C), voltage and current sources, Kirchoff's current and voltage laws, analysis of simple circuits with dc excitation.
Superposition, Thevenin and Norton Theorems.
Time-domain analysis of first-order RL and RC circuits.

2 AC Circuits
Representation of sinusoidal waveforms, peak and RMS values, Phasor representation of AC quantities, real power, reactive power, apparent power, power factor.
Analysis of single-phase ac circuits consisting of R, L, C, RL, RC, RLC combinations (series and parallel), Series and parallel resonance.
Three phase balanced circuits, voltage and current relations in star and delta connections, Power measurement in three phase circuits.

3 Transformers
Magnetic materials, BH characteristics.
Construction and working principle of single phase and three phase transformers.
Ideal and practical transformer.
Auto-transformer and its applications.

4 Electrical Machines
Generation of rotating magnetic fields.
Construction and working of following machines:

- Three-phase induction motor

- Single-phase induction motor.
- Separately excited DC motor.
- Synchronous generators.

5 Electrical Installations
Components of LT Switchgear: Switch Fuse Unit (SFU), MCB, ELCB, MCCB.
Types of Wires and Cables.
Earthing – Types of earthing and its importance.
Safety precautions for electrical appliances.
Types of Batteries, Important Characteristics for Batteries.
Elementary calculations for energy consumption.
Basics of power factor improvement.

Reference Books:
(i) D. C. Kulshreshtha, “Basic Electrical Engineering”, McGraw Hill, 2009.
(ii) Basic Electrical Engineering -Nagsarkar and Sukhija, Oxford University Press
(iii) B. L. Theraja, “Electrical Technology – Part I and II”, S. Chand and Co. 2012
(iv) D. P. Kothari and I. J. Nagrath, “Basic Electrical Engineering”, Tata McGraw Hill, 2010.
(v) L. S. Bobrow, “Fundamentals of Electrical Engineering”, Oxford University Press, 2011.
(vi) E. Hughes, “Electrical and Electronics Technology”, Pearson, 2010.
(vii) V. D. Toro, “Electrical Engineering Fundamentals”, Prentice Hall India, 1989.

Engineering Graphics & Design

ENGINEERING GRAPHICS & DESIGN

Credits 4

1 Introduction to Engineering Graphics: Drawing instruments and accessories, BIS – SP 46. Use of plane scales, Diagonal Scales and Representative Fraction

2 Loci of Points: Path of the points moving on Simple mechanisms, Slider crank mechanism, Four bar mechanism

3 Engineering Curves: Classification and application of Engineering

Curves, Construction of Conics, Cycloidal Curves, Involutes and Spirals along with normal and tangent to each curve

4 Projections of Points and Lines: Introduction to principal planes of projections, Projections of the points located in same quadrant and different quadrants, Projections of line with its inclination to one reference plane and with two reference planes. True length and inclination with the reference planes

5 Projections of Planes: Projections of planes (polygons, circle and ellipse) with its inclination to one reference plane and with tworeference planes, Concept of auxiliary plane method for projections of the plane

6 Projections of Solids, Section of Solids and Development of Surfaces: Classification of solids. Projections of solids (Cylinder, Cone, Pyramid and Prism) along with frustum with its inclination to one reference plane and with two reference planes, Section of such solids and the true shape of the section, Development of surfaces

7 Orthographic Projections: Fundamental of projection along with classification, Projections from the pictorial view of the object on the principal planes for view from front, top and sides using first angle projection method and third angle projection method, full sectional view

8 Isometric Projections and Isometric View or Drawing: Isometric Scale, Conversion of orthographic views into isometric projection, isometric view or drawing of simple objects

9 Computer Aided Drawing:
Introduction to AutoCAD, Basic commands for 2D drawing like : Line, Circle, Polyline, Rectangle, Hatch, Fillet, Chamfer, Trim, Extend, Offset, Dim style, etc.

Reference Books:
1. A Text Book of Engineering Graphics by P.J.Shah S.Chand & Company Ltd., New Delhi
2. Elementary Engineering Drawing by N.D.Bhatt Charotar Publishing House, Anand
3. A text book of Engineering Drawing by R.K.Dhawan, S.Chand & Company Ltd., New Delhi
4. A text book of Engineering Drawing by P.S.Gill, S.K.Kataria & sons, Delhi

5. Engineering Drawing by B. Agrawal and C M Agrawal, Tata McGraw Hill, New Delhi

Mathematics - I

MATHEMATICS 1

CREDITS 5

1. Indeterminate forms and l'hospital rule, Improper integrals, Convergence and divergence of the integrals, Beta and gamma function and their properties, Application of define integral, Volume using cross-section, Length of plane curves, Area of surfaces of revolution

2. Convergence and Divergence of Sequences, The Sandwich Theorem for Sequences, The Continuous Function Theorem for Sequences, Bounded Monotonic Sequences, Convergence and Divergence of an Infinite Series, Combining Series, Harmonic Series, Integral Test, The P-Series, The Comparison Test, The Limit Comparison Test, Ratio Test, Raabe's Test, Root Test, Alternation Series Test, Absolute and Conditional Convergence, Power Series, Radius of Convergence Of A Power Series, Taylor and Maclaurin Series

3. Fourier series of periodic function, Dirichlet's conditions for representation by a Fourier series, Orthogonality of the trigonometric system, Fourier series of a function of period 2L, Fourier series of even and odd function, Half Range expansions

4. Function of several variables, Limits and continuity, Test for non existence of a limit, Partial differentiation, Mixed derivative theorem, Differentiability, Chain rule, Implicit differentiation, Gradient, Directional derivative, Tangent plane and normal line, Total differentiation, Local extreme values, Method of Lagrange multipliers

5. Multiple integral, Double Integral over Rectangular and general regions, Double integrals as volumes, Change of order of integration, Double integration in polar coordination, Area of double integration, Triple integrals in rectangular, Cylindrical and spherical coordinates, Jacobian, Multiple integral by substitution

6. Elementary row operations in matrix, Row echelon and reduced row echelon froms, Rank by echelon form, Inverse by gauss – Jordan

method, Solution of system of linear equation by gauss elimination and gauss Jordan method, Eigen values and Eigen vector, Cayley – Hamilton theorem,Diagonalization of a matrix

Physics

PHYSICS

Credits 4

MODULE 1: ELECTRONIC MATERIALS

- Free electron theory
- Density of states and energy band diagrams,
- Kronig-Penny model (to introduce origin of band gap), Energy bands in solids,
- E-k diagram, Direct and indirect bandgaps,
- Types of electronic materials: metals, semiconductors, and insulators,
- Density of states, Occupation probability,
- Fermi level, Effective mass, Phonons.

MODULE 2: SEMICONDUCTORS

- Intrinsic and extrinsic semiconductors
- Dependence of Fermi level on carrier-concentration and temperature (equilibrium carrier statistics)
- Carrier generation and recombination, Carrier transport: diffusion and drift, p-n junction,
- Metal-semiconductor junction (Ohmic and Schottky), Semiconductor materials of interest for optoelectronic devices

MODULE 3: LIGHT-SEMICONDUCTOR INTERACTION

- Optical transitions in bulk semiconductors: absorption, spontaneous emission, and stimulated emission;
- Joint density of states
- Density of states for photons,
- Transition rates (Fermi's golden rule)
- Optical loss and gain; Photovoltaic effect, Exciton
- Drude model.

Module 4: Measurements

- Four-point probe and Van Der Pauw measurements for carrier density,
- Resistivity and hall mobility
- Hot-point probe measurement, capacitance-voltage measurements,
- Parameter extraction from diode I-V characteristics, DLTS,
- band gap by UV-Vis spectroscopy, absorption/transmission.

Module 5: Superconductivity

- Introduction of Superconductivity
- Properties of superconductor
- Effect of magnetic field
- Meissner effect
- Pressure effect
- Impurity effect
- Isotopic mass effect
- Mechanism of Superconductivity : BCS Theory
- Penetration depth : Magnetic field
- Josephson's junction and its application
- Application of superconductors

References:

1.J.Singh, Semiconductor Optoelectronics:Physics and Technology,McGraw-HillInc.(1995).
2.B.E.A.Saleh and M. C.Teich, Fundamentals of Photonics, John Wiley & Sons, Inc.,(2007).
3.S.M.Sze,Semiconductor Devices:Physics and Technology, Wiley(2008).
4.A.Yarivand P.Yeh,Photonics:Optical Electronics in Modern Communications, Oxford University Press, New York(2007).
5.P.Bhattacharya, Semiconductor Optoelectronic Devices,Prentice Hall of India(1997).
6. Engineering Physics by Dattu R Joshi, McGraw hill Publications.

Basic Mechanical Engineering

BASIC MECHANICAL ENGINEERING

Credits 4

1 Introduction: Prime movers and its types, Concept of Force, Pressure, Energy, Work, Power, System, Heat, Temperature, Specific heat capacity, Change of state, Path, Process, Cycle, Internal energy,

Enthalpy, Statements of Zeroth law and First law

2 Energy: Introduction and applications of Energy sources like Fossil fuels, Nuclear fuels, Hydro, Solar, Wind, and Bio-fuels, Environmental issues like Global warming and Ozone depletion

3 Properties of gases: Gas laws, Boyle's law, Charle's law, Combined gas law, Gas constant, Relation between cp and cv, Various non-flow processes like constant volume process, constant pressure process, Isothermal process, Adiabatic process, Polytropic process

4 Properties of Steam: Steam formation, Types of steam, Enthalpy, Specific volume, Internal energy and dryness fraction of steam, use of steam tables, steam calorimeters

5 Heat Engines: Heat engine cycle and Heat engine, working substances, Classification of heat engines, Description and thermal efficiency of Carnot; Rankine; Otto cycle and Diesel cycles

6 Steam Boilers: Introduction, Classification, Cochran, Lancashire and Babcock and Wilcox boiler, Functioning of different mountings and accessories

7 Internal Combustion Engines: Introduction, Classification, Engine details, four-stroke/ two-stroke cycle Petrol/Diesel engines, Indicated power, Brake Power, Efficiencies

8 Pumps: Types and operation of Reciprocating, Rotary and Centrifugal pumps, Priming

9 Air Compressors: Types and operation of Reciprocating and Rotary air compressors, significance of Multistaging

10 Refrigeration & Air Conditioning: Refrigerant, Vapor compression refrigeration system, Vapor absorption refrigeration system, Domestic Refrigerator, Window and split air conditioners

11 Couplings, Clutches and Brakes: Construction and applications of Couplings (Box; Flange; Pin type flexible; Universal and Oldham), Clutches (Disc and Centrifugal), and Brakes (Block; Shoe; Band and Disc)

12 Transmission of Motion and Power: Shaft and axle, Different arrangement and applications of Belt drive; Chain drive; Friction drive and Gear drive

13 Engineering Materials: Types, properties and applications of Ferrous & Nonferrous metals, Timber, Abrasive material, silica, ceramics, glass, graphite, diamond, plastic and polymer

Reference Books:

1. Elements of Mechanical Engineering by N M Bhatt and J R Mehta, Mahajan Publishing House
2. Basic Mechanical Engineering by Pravin Kumar, Pearson Education
3. Fundamental of Mechanical Engineering by G.S. Sawhney, PHI Publication New Delhi
4. Elements of Mechanical Engineering by Sadhu Singh, S. Chand Publication
5. Introduction to Engineering Materials by B.K. Agrawal, McGraw Hill Publication, New Delhi

Chemistry

Chemistry

Credits 4

1 General Chemistry:
Introduction to Chemical Sciences, Basics includes: Periodic properties, Effective nuclear charge, penetration of orbitals, variations of s, p, d and f orbital energies of atoms in the periodic table, electronic configurations, atomic and ionic sizes, ionization energies, electron affinity and electronegativity, polarizability, oxidation states, coordination numbers and geometries, hard soft acids and bases, molecular geometries Structure of an Atom, Formation of molecules – Kossel – Lewis approach to Chemical Bonding, Lewis Representations of Simple Molecules and Ions, Types of Bonds.

2 Water Technology:
Introduction, Sources of water, Impurities in water, Hardness of Water, Boiler Problems, Softening of water (External & Internal treatments), Domestic water treatments, Waste water treatments, Desalination of Brackish water.

3 Metals, Alloys and Corrosion:
Introduction, Physical properties of Metals, Definition and purpose of alloy, Classification of alloys. Alloys: Steel, Cu, Al, Pb and its industrial applications. Introduction to Corrosion, Theories of corrosion, Protective measurements against corrosion – organic and

inorganic materials, Inhibitors, Cathodic protection.

4 Polymers and Fibers
Introduction, Classification based on Source, Structure, Molecular forces. Polymerization and its mechanism. Definition of Rubber, Types of Rubber, Vulcanization of rubber. Application of Rubber. Biodegradable Polymers, Commercially important polymers- PE, PP, PS, PVC, ABS, PMMA, Glyptal and their uses.
Types of fibers – Natural, semi synthetic, synthetic fibers. Physical properties of fibers and uses of Cellulose acetate, Viscose Rayon, Nylon, Polyesters acrylic, Glass fibers and Liquid Crystals.

5 Nano material:
Introduction, Sources, Properties and application of fullerenes, fullerols, Metal based nanoparticles, Carbon nanotubes and nanowires. Synthesis: Top down and Bottom up approaches, Nanoelectronics. Applications of nanomaterial in catalysis, textile and medicine.

6 Fuel and Combustion: Definition, Types of fuel and their applications. Calorific Value, Characteristics of good fuel. Analysis of coal – ultimate and proximate analysis, LPG, Natural gas, Biogas, Refining of Petroleum by Fractional distillation, Octane and Cetane Number, Unleaded Petrol and Diesel.

7 Chemical aspect of Biotechnology:
Introduction, Scope, importance and application, Benefits through biotechnology – Agriculture, Food quality, Medicines, Fermentation processes: Preparation of Ethanol and Acetic acid, Enzymes and its application in industries, Importance of Biofuels, Bio fertilizers, Bio surfactants and Bioreactors.

8 Analytical Techniques: Measurement and understanding of pH, Conductance, and Potential, Spectroscopic techniques: Principles of Spectroscopy and Selection rules. UV-Visible Spectroscopy and its Application, Vibrational and Rotational spectroscopy (IR) of diatomic molecules and its application.

Reference Books:
1. Engineering Chemistry by Jain and Jain, Dhanpat Rai Publishing Co.
2. Engineering Chemistry Willey India Publisher
3. Engineering Chemistry by Marry Jane & Shultz, Cencage Learning Publisher

4. Engineering Chemistry by N. Krishnamurthy, P. Vallinaygam and D. Madhavan, Prentice Hall of India Pvt. Ltd.
5. Engineering Chemistry by K. Sesha Maheswaramma and Mridula Chugh, Pearson India Education Pvt Ltd.
6. Engineering Chemistry by B K. Sharma, Krishna Prakashan Media (P) Ltd.
7. A textbook of Engineering Chemistry by Shashi Chawla, Dhanpatrai Publishing Co. Ltd.
8. Fundamentals of Biotechnology by B D Singh, Kalyani Publisher. New Delhi.
9. Essential of Physical Chemistry by Bahl and Tuli., S Chand & Co. Ltd, New Delhi.
10. Introduction to Nano Science by N N. Lindsay, Oxford University Press.
11. NANO: The Essentials by T Pradeep Tata McGraw-Hill Publishing Company, New Delhi.