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: Properties of Matter

- Concept of Load, Stress and Strain
- Hook's Law
- Stress-Strain Diagram
- Ductility, Brittleness and Plasticity
- Elastic behavior of solids
- Working stress and factor of safety
- Factors affecting elasticity
- Types of Elasticity
- Twisting couple on a cylinder or wire-shaft
- Torsional Pendulum
- Cantilever-Depression of Cantilever
- Young's modulus by Cantilever
- I-shape Griders
- Viscosity and comparison of viscosities

MODULE 2: Waves, Motion and Acoustics

- Simple Harmonic motion
- Free, forced, resonance, damped and undamped vibration
- Damped harmonic motion
- Force vibration and amplitude resonance
- Velocity resonance and energy intake
- Wave motion, transverse and longitudinal vibration
- Sound absorption and reverberation
- Sabine's formula and usage (excluding derivation)
- Acoustic of building

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Module 4: 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

Module 5: Lasers

- Properties of Laser
- Einstein's theory of matter radiation : A and B coefficients
- Amplification of light by population inversion
- Different types of lasers
- gas lasers (He-Ne) solid-state lasers(ruby)
- Properties of laser beams: mono-chromaticity, coherence,n directionality and brightness, laser speckles
- Applications of lasers in science, engineering and medicine.

Suggested Reference Books
1. Engineering Physics by Dattu R Joshi, McGraw hill Publications
2. Engineering Physics by Shatendra Sharma & Jyotsan Sharma, Pearson Publication
3. Mechanics of Materials, SI Edition, 9th Edition,Barry J. Goodno, James M. Gere,Published: © 2018
Print ISBN: 9781337093354

Basic Civil Engineering

BASIC CIVIL ENGINEERING

Credits 4

1. INTRODUCTION TO CIVIL ENGINEERING AND CIVIL ENGINEERING MATERIALS:

Introduction, Branches, Scope, Impact, Role of Civil Engineer, Units of measurement, Unit conversion (Length, Area, Volume). List of materials, Details (types, properties, uses) of materials: Cement, Aggregate, Brick, Steel, Concrete, Stone, Soil, Mortar, Timber, Plastic, Epoxy, Flyash, Steel slag, Copper slag, Bitumen, Optical fiber, Pipe, Wire, Cable, Smart material, Basic hand fill tests, FRP Water and waste water quality characteristics, drinking water standards, Road traffic, traffic control, traffic signals & Intersections.

2. INTRODUCTION TO BUILDING AND TOWN PLANNING:

Definition and concept of plan of a simple residential building, Principles of planning, Elementary principles and basic requirements for building planning, elevation and section of a residential building. Principles of town planning, Necessity of town planning, Origin of town, Growth of town, Land use, Principles and objects of zoning, Advantages of zoning, Low cost housing, Prevention of slum, FSI.

3. BUILDING CONSTRUCTION AND BUILDING SERVICES

Building Construction: Types of building, Components of building & its functions, types of loads acting on building, Types of brick bonds, Typical building layout, Symbols used in electrical layout, Symbols used for water supply, plumbing and sanitation. Nominal dimensions for door, window and furniture.

Building Services: Types of building services like plumbing & sanitation, water supply& drainage system, electricity, building finishes, HVAC.

4. INTRODUCTION TO SURVEYING AND LEVELLING:

Introduction, Fundamental principles, Classification.

Linear measurement: Instruments used, Chaining on plane ground, Offset, Ranging.

Angular measurement: Compass-Instrument used Meridian, Bearing, and Local attraction.

Leveling: Instrument used, Terminology, Types of leveling, and Methods of leveling, Introduction to contour

Modern tools: Introduction to Theodolite, Total Station, Introduction to GPS, GIS & RS

5. ADVANCEMENTS IN CIVIL ENGINEERING:

Smart city and it's features, Solid waste management systems, Mass

Transportation systems-BRTS, Metro, Rain water harvesting systems, Watershed Management, Green building, Energy efficient building, Development of River fronts, Heritage structures & its conservations, Features of Earthquake resistant structures

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.