1. Basic Electrical Engineering

2. Mathematics-II (Paobability and statics)

3. Engineering Graphics and Design

4. Physics (Semiconductor Physics)

Basic Electrical Engineering

Module-1

DC Circuits (8 Lectures)

Electrical Circuit elements (R, L and C), Voltage and Current sources, Kirchhoff current and voltage Laws, Analysis of simple circuits with DC excitation. Star-Delta conversion, Network theorems (Superposition, Thevenin, Norton and Maximum power transfer theorems). Time-domain analysis of first order RL and RC circuits

Module-2

AC Circuits (8 Lectures)

Representation of sinusoidal waveforms, Peak, rms and Average values (Form factor and Peak factor), Impedance of series and parallel circuit, Phasor representation, Real Power, Reactive Power, Apparent Power, Power Factor, Power Triangle. Analysis of single-phase Ac circuits consisting of R, L, C, RL, RC, RLC Combinations (Series and Parallel), Resonance. Three-Phase Balanced Circuits, Voltage and current relations in Star and Delta connections

Module-3

Magnetic Circuits (4 Lectures)

Introduction, Series and Parallel Magnetic circuits, Analysis of Series and Parallel magnetic circuits.

Module-4

Transformers (6 Lectures)

Magnetic Materials, B-H characteristics, Ideal and Practical Transformer, EMF equation, Equivalent Circuit, Losses in transformers, Regulation and efficiency. Auto-transformer and Three-Phase Transformer connections.

Module-5

Electrical Machines (10 Lectures)

Construction, Working, Torque-Speed characteristic and speed control of separately excited DC Motor. Generation of rotating Magnetic Fields, Construction and working of a ThreePhase induction Motor, Significance of Torque-Slip characteristic. Loss components and efficiency, Starting and speed control of induction Motor. Construction and working of synchronous Generators.

Module-6

Electrical Installations (6 Lectures)

Components of L-t Switchgear: Switch Fuse Unit (SFU), MCB, ELCB, MCCB, Types of wires and cables, Earthing. Types of Batteries, Important characteristics for Batteries. Elementary calculations for energy consumption, Power factor improvement and Battery backup.

BOOKS

Suggested books

1. D. P. KOTHARI AND I. J. NAGRATH, “BASIC ELECTRICAL ENGINEERING”, TATA MCGRAW HILL, 2010.
2. D. C. KULSHRESHTHA, “BASIC ELECTRICAL ENGINEERING”, MCGRAW HILL, 2009.
3. L. S. BOBROW, “FUNDAMENTALS OF ELECTRICAL ENGINEERING”, OXFORD UNIVERSITY PRESS, 2011.
4. BASIC ELECTRICAL ENGINEERING BY FITZERALD,

MATHEMATICS-II (Probability and Statics)

Module-1

Basic Probability (12 Lectures)

Probability Spaces, Conditional probability, Independence; Discrete Random Variables, Independent Random variables, The multinomial Distribution, Poisson approximation to the Binomial Distribution, Infinite Sequences of Bernoulli Trials, Sums of independent Random Rariables; Expectation of discrete random variables, Moments, Variance of a sum, Correlation Coefficient, Chebyshev's Inequality.

Module-2

Continuous Probability Distributions (4 Lectures)

Continuous Random Variables and their properties, Distribution functions and densities, Normal, Exponential and Gamma Densities

Module-3

Bivariate Distributions (4 Lectures)

Bivariates distribution and their properties, Distribution of sums and quotients, Conditional densitiess, Bayes rule.

Module-4

Basic Statics (8 lectures)

Measures of central tendency: Moments, Skewness and Kurtosis, Probability Distribution: Binomial, poisson and Normal- Evaluation of statical parameters for these three distributions, Correlation and Regression-Rank Correlaton

Module-5

Applied Statics (8 Lectures)

Curve fitting by the method of least squares- Fitting of straight lines, Second degree Parabolas and more General Curves. Test of significance: Large sample test for single proportion,Difference of proportions, Single Mean, Difference of Means and difference of Standard Deviations (SD).

Module-6

Small Samples (4 Lectures)

Test for single Mean, Difference of Means and Correlation Coeffiecients, Test for ratio and Variance- CHI-Square Test for Goodness of fit and independence of Attributes.

Engineering Graphics and Design

Traditional Engineering Graphics

Principles of Engineering Graphics; Orthographic Projection; Descriptive Geometry; Drawing Principles; Isometric Projection; surface Development; Perspective; Reading a Drawing; Sectional Views; Dimensioning & Tolerances; True Length, Angle; Intersection, Shortest Distance

Computer Graphics

Engineering Graphics Software; Spatial Transformations; Orthographic Projections; Model viewing; Co-ordinate systems; Multi-view projection; Exploded assembly; Model viewing; Animation; Spatial manipulation; Surface Modelling; sSlid Modelling, Introduction to Building Information Modelling (BIM).

Module-1

Introduction to Engineering Drawing

Principles of Engineering Graphics and their significance, Usage of Drawing Instruments, Lettering, Conic sections including the rectangular Hyperbola (General method only); Cycloid, Epicycloid, Hypocycloid and Involute; Scales – Plain, Diagonal and Vernier Scales

Module-2

Orthographic projections

principles of orthographic projections- Conventions-Projections of points and Lines inclined to both Planes, projections of planes inclined planes Auxiliary Planes.

Module-3

Projections of Regular Solids

Those inclined to both the Planes-Auxiliary views, Draw simple Annotation, Dimensioning and scale floor plains that include: Windows, Doors and Fixtures such as WC, Bath, Sink, Shower, etc.

Module-4

Sections and Sectional views of Right Angular Solids

Covering, Prism, Cylinder, Pyramid, Cone – Auxiliary views; Development of surfaces of Right Regular Solids- Prism, Pyramid, cylinder and Cone; Draw the sectional Orthographic views of Geometrical Solids, Objects from industry and Dwellings (Foundation to Slab only)

Module-5

Isometric Projections

Principles of Isometric projection – Isometric Scale, Isometric views, Conventions; Isometric views of Lines, Planes, Simple and compound solids; Conversion of isometric views to Orthographic views and vice-versa, Conventions

Module-6

Overview of Computer Graphics

Listing the computer Technologies that impact on Graphical Communication, Demonstrating knowledge of the theory of CAD Software [such as: The Menu system, Toolbars (Standard, Object properties, Draw, Modify and Dimension), Drawing Area (Background, Crosshairs, Coordinate system), dialog boxes and windows, Shortcut menus (Button bars), The command line (where applicable), The status bar, Different methods of zoom as used in CAD, Select and erase objects. Isometric views of Lines, Planes, Simple and Compound Solids]

Module-7

Customisation and CAD Drawing

Consisting of set up of the drawing page and the printer, Including scale settings, Setting up of units and Drawing Limits; ISO and ANSI Standards for coordinate Dimensioning and Tolerancing; Orthographic constraints, Snap to objects manually and automatically; Producing drawings by using various coordinate input entry methods to draw straight lines, Applying various ways of Drawing Circles.

Module-8

Annotaions, Layering and Other Functions

Covering applying Dimensions to objects, Applying annotations to drawings; Setting up and use of layers, Layers to create drawings, Create, Edit and use customized layers; Changing line lengths through modifying existing lines (extend/lengthen); Printing documents to paper using the print command; Orthographic projection techniques; Drawing sectional views of composite right regular geometric solids and project the true shape of the sectioned surface; Drawing annotation, Computer-Aided Design (CAD) software modeling of parts and assemblies. Parametric and Non-Parametric solid, Surface, and Wireframe models. Part editing and Two-Dimensional documentation of models. Planar projection theory, Including sketching of perspective, Isometric, Multiview, Auxiliary and section views. Spatial visualization exercises. Dimensioning guidelines, Tolerancing techniques; Dimensioning and scale multi views of Dwelling.

Module-9

Demonstration of a sample Team Design project that Illustrates

Geometry and Topology of Engineered Components: Creation of Engineering models and their presentation in standard 2-D Blueprint form and as 3-D wireframe and shaded solids; Meshed Topologies for Engineering Analysis and Toolpath Generation for Component Manufacture; Geometric Dimensioning and Tolerancing; Use of solid-

modeling software for creating associative models at the component and assembly levels. Floor plans that include: Windows, Doors, and Fixtures such as WC, Bath, Sink, Shower, etc. Applying colour coding according to building drawing practice; Drawing sectional elevation showing foundation to ceiling; Introduction to Building Information Modelling (BIM).

BOOKS

1.BHATT N.D., PANCHAL V.M. & INGLE P.R., (2014), ENGINEERING DRAWING, CHAROTAR PUBLISHING HOUSE
2. SHAH, M.B. &RANA B.C. (2008), ENGINEERING DRAWING AND COMPUTER GRAPHICS, PEARSON EDUCATION
3. AGRAWAL B. & AGRAWAL C. M. (2012), ENGINEERING GRAPHICS, TMH PUBLICATION
4. NARAYANA, K.L. & P KANNAIAH (2008), TEXT BOOK ON ENGINEERING DRAWING, SCITECHPUBLISHERS

Physics (Semiconductor Physics)

Module-1

Review of Semiconductor Physics (10 Lectures)

E-K Diagram, Density of states, Occupation probability, Fermi level and Quasi-Fermi level (variation by carrier concentration and temperature), P-N Junction, Metal-Semiconductor Junction (Ohmic and Schottky), Carrier transport, Generation, and Recombination, Semiconductor materials of interest for Optoelectronic Devices, Bandgap modification, Heterostructures, Light- Semiconductor interaction: Rates of optical transitions, Joint density of states, Condition for optical Amplification.

Module-2

Semiconductor Light Emitting Diodes (LEDs) (6 Lectures)

Rate equations for carrier density, Radiative and Non-Radiative recombination mechanisms in Semiconductors, LED: Device structure, Materials, Characteristics and Figures of Merit.

Module-3

Semiconductor LASERS (8 Lectures)

Review of Laser Physics; Rate equations for carrier- and Photon-Density and their Steady state solutions, Laser Dynamics, Relaxation oscillations, Input-Output characteristics of Lasers. Semiconductor Laser: Structure, Materials, Device characteristics and figures of Merit; DFB, DBR, and verticalcavity Surface-Emitting Lasers (vecsel), Tunable Semiconductor Lasers.

Module-4

PHOTODETECTORS (6 Lectures)

Types of Semiconductor Photodetectors P-N Junction, PIN and Availanche and Their structure, Materials, Working principle and characteristics, Noise Limits on Performance, Solar cells.

Module-5

Low-Dimensional Optoelectronic Devices (6 Lectures)

Quantum-Well, wire and DOT Based LEDs, LASER, and PHOTODECTORS.