

APPLIED MATHS – II

SECTION – A

Vector Calculus: Curves, arc length, tangent, curvature and torsion, Directional derivative, Gradient of a scalar field, divergence and curl of a vector field. Line, surface and volume integrals, theorem of Gauss, Stoke's and Green's (proofs not needed), consequences and applications.

SECTION – B

Integral Transforms: Fourier series, Euler's formula, even and odd functions, half range expansions. Fourier integral. Fourier and Laplace transform, Inverse transform of derivatives and integrals, shifting theorem, application to periodic functions, unit step function, impulse function.

SECTION – C

Second order Differential Equations: Solution by: Power series method and its basis, Solution of Bessel and Legendre differential equations, properties of Bessel and Legendre functions.

SECTION – D

Partial Differential Equations (PDE): Formulation and classification. Solution of wave equation heat equation in one dimension and Laplace equation in two dimension by the method of separation of variables.

Books:

1. E.Kreyszig, Advanced Engineering Mathematics (Wiley Eastern Pvt. Ltd.).
2. S.S.Sastri, Engineering Mathematics (2nd edition) Vol-I and Vol-II.
3. B.S.Grewal, Higher Engineering Mathematics.
4. Piskunov, Differential and Integral Calculus.
5. R.K.Jain and S.R.K.Iyengar, Advanced Engineering, Mathematics.
6. Michael d.Greenberg, Advanced Engg. Mathematics.

APPLIED PHYSICS– II

SECTION – A

Crystal Structure: Space lattice, unit cell and translation vector, miller indices, Simple crystal structure, bonding in solids, Experimental x-ray diffraction method, laue method, powder method.

Free electron theory: Elements of classical free electron theory and its limitations. Quantum theory of free electrons, Fermi level, density of states, fermi dirac distribution function, Thermionic emission, Richardson's equation.

SECTION – B

Band Theory of Solids: Origin of energy bands, kronig, Penney Model (qualitative), E-K diagrams, Brillouin Zones, Concept of effective mass and holes, Classification into metals, semiconductors and insulators, fermi energy and its variation with temperature.

SECTION – C

Photoconductivity & Photovoltaic: Photoconductivity in insulating crystals, variation with illumination, Effect of traps, application of photoconductivity, Photovoltaic cell and their characteristics.

Properties of Solids: Atomic Magnetic Moments, Orbital Diamagnetism, Classical Theory of Para magnetism, Ferromagnetism Molecular Field theory and domains, Magnetic circuit. Its comparison with Electric circuit and its applications, Super Conductor (Introduction, Types and Applications) Hall Effect.

SECTION – D

Laser: Spontaneous and stimulated emission, Laser action, Characteristics of Laser Beam – Concept of coherence, Types of lasers based on pumping techniques, He-Ne Laser, Semiconductor Laser (simple Ideas) with applications.

Fiber Optics: Optical communication: Communication through open space, optical wave guides with special reference to Propagation of light in Fibres, Numerical Aperture, single mode and multi mode Fibers, applications.

Books:

1. Charles Kittel: Introduction to Solid State Physics.
2. B.S.Saxena, R.C.Gupta & P.N.Saena: Solid state Physics.
3. M.B.Avadhanulu & P.G.Kshirsagar, A text book of Engineering Physics.
4. Arthur Beiser, concepts of Modern Physics, 5th International edition Tata McGraw Hill.
5. A.J.Dekkar, Introduction to solid state Physics

BASIC ELECTRICAL ENGINEERING

Section A :

D.C. circuits: Ohm's law, Kirchoff's Laws, Thevenin's, Norton's, superposition theorem, Maximum power transfer theorem, Reciprocity, Compensation, Millman and Tellegan's Theorem . D.C. circuits, Nodal and Mesh analysis.

A.C. circuits: Sinusoidal signal, instantaneous and peak values, RMS and average values, phase angle, polar and rectangular, exponential and trigonometric representations RL and C components, behaviour of these components in A.C. circuits, concept of complex power, power factor.

Transient Response: transient response RL, RC and RLC circuits with step input.

Section B:

Series and Parallel A.C. circuits: Series and Parallel A.C. circuit, Series and Parallel resonance. Q factor, cut off frequency and bandwidth.

Three phase circuits: Phase and line voltages and currents, balanced star and delta circuits, power equation, measurement of power by 2-wattmeter method, importance of earthing.

Section C:

Transformers: Principle, construction and working of transformer, Efficiency and regulation.

Electrical Machines: Introduction to D.C. Machines, induction motor, Synchronous machines.

Section D:

Measuring Instruments: Voltmeter, Ammeter, Wattmeter, Energy meter.

Batteries: Storage batteries:- Types, construction, charging and discharging, capacity and efficiency.

Books:

1. Kothari & Nagarath: Basic Electrical Engg. (2nd Edition), TMH.
2. B.L. Theraja & A.K. Theraja, S.Chand: Electrical Technology(Vol-1).
3. Deltoro: Electrical Engg Fundamentals, PHI

BASIC MECHANICAL ENGINEERING

SECTION – A

First Law of Thermodynamics

Essence and corollaries of the first law, analytical expressions applicable to a process and cycle, internal energy, enthalpy and specific heats, first law analysis of steady flow, applications of steady flow energy equation to engineering devices.

Applications of first law of Thermodynamics

Closed and open systems, analysis of non-flow and flow processes for an ideal gas under constant volume (Isochoric), constant pressure (Isobaric), constant temperature (Isothermal), adiabatic and polytropic conditions. Analysis of free expansion and throttling processes. Representation of these processes on P-V charts and analysis of property changes and energy exchange (work and heat) during these processes.

SECTION – B

Second Law of Thermodynamics

Limitations of first law, various statements of second law and their equivalence, application of statements of second law to heat engine, heat pump and refrigerator. Philosophy of Carnot cycle and its consequences. Carnot theorem for heat engines and heat pump. Clausius inequality, concept and philosophy of entropy and entropy changes during various processes. Temperature – entropy chart and representation of various processes on it. Third law of thermodynamics.

SECTION – C

Simple Stresses & Strains

Concept & types of Stresses and strains, Poisson's ratio, stresses and strain in simple and compound bars under axial loading, stress strain diagrams, Hooke's law, Elastic constants and their relationships. Temperature stress and strain in simple and compound bars under axial loading, Numerical problems.

SECTION – D

Bending Stresses in Beams

Bending Stresses in Beams with derivation of Bending equation and its application to beams of circular, rectangular I & T Section, Composite beams, stress in beam with derivation, Combined Bending, Torsion & Axial loading of beams, Numerically.

Torsion of Circular Members

Design of thin Circular Tubes, Torsion of Solid and hollow circular shafts, Combined bending and torsion, Equivalent torque, Numerical Problems.

Text Books

1. Nag, P.K., "Engineering Thermodynamics", Tata McGraw – Hill, New Delhi.
2. Yadav, R., Thermal Science and Engineering, Central Publishing House, Allahabad.

2nd Semester

3. Strength of Materials – G.H.Ryder – Third Edition in S I units 1969 Macmillan India.

4. Mechanics of Materials – Dr. Kirpal Singh, Standard Publishers Distributors

BASIC ELECTRICAL ENGINEERING LAB

Instructions for paper setter/Candidates

Laboratory examination will consist of two parts:

- i) Performing a practical examination assigned by the examiner (25 marks).
- ii) Viva-voce examination (25 marks).

Viva-voce examination will be related to the practical performed/projects executed by the candidate related to the paper during the course of the semester.

List of Experiments

1. To verify KCL and KVL.
2. TO study frequency response of series RLC circuit and determine resonance frequency and Q factor for various values of R,L,C
3. TO study frequency response of parallel RLC circuit and determine resonance frequency and Q factor for various values of R,L,C
4. To perform direct load test of transformer and plot efficiency v/s load characteristics.
5. To perform direct load test of the DC shunt generator and plot load v/s current curve.
6. To study and verify Thevenins, Norton's, superposition, Milliman's, maximum power, reciprocity theorems .
7. To perform O.C and S.C test of transformer.
8. To study various types of meters
9. Measurement of power by 3 voltmeter/ 3 ammeter method.
10. Measurement of power in 3-phase system by 2-wattmeter method.

WORKSHOP PRACTICE – II

Instructions for paper setter/Candidates

Laboratory examination will consist of two parts:

- (i) Performing a practical examination assigned by the examiner (25 marks).
- (ii) Viva-voce examination (25 marks).

Viva-voce examination will be related to the practical performed/projects executed by the candidate related to the paper during the course of the semester.

List of Experiments

Fitting shop:-

1. Drilling and Tapping in M.S. piece
2. To make a male-female joint (taper type) of mild steel.

Machine Shop :-

1. To perform boring operation on lathe machine.
2. To perform knurling and threading operation on lathe machine.
3. Step turning operation on a lathe machine

Carpentry and Pattern making shop:-

1. To make a single piece pattern of connecting rod.
2. To make a self cod pattern.
3. To make a split pattern.

Welding shop:-

1. To make V butt joint in horizontal position.
2. To make a V butt joint in vertical position.
3. To perform Gas welding operation.

Smithy and Forging:-

1. To make a cube from a circular bar.
2. To make a tong using hot forging operations
3. To perform drawing down operation.

Foundry Shop:-

1. To make a mould and perform casting operation.
2. Study of casting defects and remedies.

Books:

1. Workshop Technologies By Chapman
2. Manufacturing Processes by Begam
3. Manufacturing Materials And Processes By JS Campbell
4. Introduction To Electrical Wiring
5. Exercises And Prepration Of PCBs Involving soldering of electrical and electronic applications.

Basic Electronics

Section -A

Brief review of Band Theory, transport phenomenon in semiconductors, Electrons and holes in Intrinsic semiconductor, Donor and acceptor Impurities, charge densities in semiconductor.

PN Junction, Reverse and Forward bias conditions, Diode Characteristic and parameter, Ideal vs. Practical diode.equivalent circuits and frequency response. rectification-half and full wave, Zener and Avalanche diode, its role as regulator, photodiode.

Section B

Bipolar junction transistor (BJT) and their characteristics as circuit and gain elements. Two port network analysis, h-parameters and trans-conductance. Equivalent circuits for JFET and MOSFET, enhancement mode and depletion mode MOSFETS. Unijunction transistor (UJT), UJT characteristics, parameters and circuit operation.

Section C

Bias for transistor amplifier: fixed bias, emitter feed back bias. Feedback principles. Types of feedback, Stabilization of gain, reduction of non-linear distortion, change of inputs and output resistance by negative feedback in amplifier. Amplifiers coupling, types of coupling, Amplifier pass band, Eq circuits for BJT at high frequency response of CE, RC-Coupled amplifiers at mid, low and high frequencies.

Section D

Semi conductor processing, active and passive elements, Integrated circuits, bias for integrated circuits. Basic operational amplifier, applications of operational amplifier – adder, subtractor, Integrator, differentiator and comparator, Photo transistor: its characteristics and applications.

Reference Books:-

1. A.P.Malvino.Electronic Principles.
2. J.D. Ryder Electronic Fundamentals and Applications.
3. J.Millman and C.C.Halkias Electronic Circuits & Devices.
4. J.Millman & C.C.Halkias Integrated Circuits & Devices.
5. N.N.Bhargava & Kulshrestha, Electronic Devices.

Basic Electronics Lab

Instructions for paper setter / candidates

Laboratory examination will consist of two parts:

- (i) Performing a practical exercises assigned by the examiner (25 marks).
- (ii) Viva-voce examination (25 marks)

Viva-voce examination will be related to the practical performed / project executed by the candidate related to the paper during the course of the semester.

List of Experiments:

- 1.(a) To study the use and scope of using an oscilloscope as a measuring device in an electronic laboratory.
- (b) To study the use and scope of using a millimeter (digital and analog) as a measuring device in an electronics laboratory.
- (c) To study the use and scope of function generator as a signal source in an electronics laboratory.

Set up an experiment to:

1. Draw forward bias and reverse bias characteristics of a p-n junction diode and use it as a half wave and full wave rectifier.
2. Draw the characteristics of a zener diode and use it as a voltage regulator.
3. Draw characteristics of common base configuration of p-n-p transistor.
4. Draw characteristics of common emitter configuration of an npn transistor.
5. Draw characteristics of common drain configuration of a MOSFET.
6. Find the voltage and current gain of single stage common emitter amplifier.
7. Draw the characteristics curve of UJT.
8. Find the voltage gain of single stage voltage series feedback amplifier.
9. Use operational amplifier as
 - I) Inverting amplifier
 - II) Non-inverting amplifier
 - III) Comparator

Engg. Graphics Drawing

Section A

Drawing Techniques: Various type of lines, principal of dimensioning, size and location as per IS code of practice (SP-46) for general engg. Drawing. Practice of drawing, various types of lines and dimensioning exercises. Drawing exercises pertaining to symbols. Conventions and Exercise of lettering techniques. Free hand printing of letters and numerals in 3, 5, 8 and 12 mm sizes, vertical and inclined at 75 degree. Instrumental lettering in single stroke. Linear Scale, Diagonal scale & vernier scale.

Projection of Points, Lines and Planes: Concept of horizontal and vertical planes. First and third angle projections: projections of point and lines, true length of lines and their horizontal and vertical traces, projection of planes and their traces. Auxiliary planes.

Section B

Projections of Solids: Right regular solids of revolution and polyhedrons etc. and their auxiliary views.

Section C

Sectioning of Solids: Principal of sanctioning, types of sanctioning and their practice on projection of solids, sectioning by auxiliary planes.

Isometric Projection: Concept of isometric views: isometric scale and exercise on isometric views.

Section D

Practice In: Orthographic projections

Development of Surfaces: Development of surfaces of cylinders, cones, pyramid, prism etc. exercises involving development of unique surfaces like Y-piece, hopper, tray, truncated pieces etc.

Intersection of Surfaces: Intersection of cylinders, cones and prisms with their axes being vertical, horizontal or inclines. Exercise on intersection of solids-cylinder and cylinder, cylinder and cone, prism and prism.

Note: Some exercise in each Section should be done using Auto CAD.

Books:

1. N.D. Bhatt, Elementary Engineering Drawing.
2. P.S.Gill, Engineering Drawing & Engg. Graphics.
3. L.V. Lakshminarayan & R.S. Vaish Engineering Graphics.
4. N.D. Bhatt and V.M. Panchal, Engineering Drawing Plane and Solid Geometry, 44th Edition 2002, Charotar Publishing House.

