



Dr.M.G.R.
Educational and Research Institute
(DEEMED TO BE UNIVERSITY)
(An ISO Certified Institution)
University with Graded Autonomy Status
Maduravoyal , Chennai - 600 095



Department B.Sc Physics

Faculty of Humanities and Science
Department of Physics-2017 Regulation
B.Sc.(Physics)
Curriculum

SEMESTER I

SUB CODE	SUBJECT TITLE	L	T	P	C
HBTA17001	Tamil-I/Hindi-I/French-I	3	0	0	3
HBEN15001	English-I	3	0	0	3
BMA17030/ HBMA18A01	Allied : Mathematics-I	3	1	0	4
HBPH17G01	Properties of Matter and Acoustics	4	0	0	4
HBPH17G02	Mechanics	4	0	0	4
	Practical				
HBPH17L01	Physics Lab-I	0	0	4	2
	Credits 20				Total

SEMESTER II

SUB CODE	SUBJECT TITLE	L	T	P	C
HBTA17002	Tamil-II/Hindi-II/French-II	3	0	0	3
HBEN14002	English-II	3	0	0	3
HBMA18A02	Allied -: Mathematics-II	3	1	0	4
HBPH17G03	Heat and Thermodynamics	4	0	0	4
HBPH17G04	Optics	4	0	0	4
	Practical				
HBPH17L02	Physics Lab II	0	0	4	2
	Credits 20				Total

SEMESTER III

SUB CODE	SUBJECT TITLE	L	T	P	C
HBCH17A03	Allied : Chemistry-I	4	0	0	4
HBPH17G05	Electricity and Magnetism	4	0	0	4
HBPH17G06	Atomic Physics	4	0	0	4
HBPH17G07	Relativity and Quantum Mechanics	4	0	0	4
HBPH17G08	Basic Electronics	4	0	0	4
	Practical				
HBPH17L03	Advanced Physics Lab-I	0	0	4	2
HBMG14L01	Soft skills-I	0	0	3	2
	Credits 20				Total

SEMESTER IV

SUB CODE	SUBJECT TITLE	L	T	P	C
HBCH17A04	Allied: Chemistry-II	4	0	0	4
HBPH17G09	Nuclear Physics	4	0	0	4



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HBPH17G10	Mathematical Physics	4	0	0	4
HBPH17G11	Applied Electronics	4	0	0	4
	Practical				
HBPH17L04	Advanced Physics Lab-II	0	0	4	2
HBPH17L05	Electronics Lab-I	0	0	4	2
HBMG14L02	Soft Skills-II	0	0	3	2
	Credits 20				Total

SEMESTER V

SUB CODE	SUBJECT TITLE	L	T	P	C
HBPH17G12	Microprocessor	4	0	0	4
HBPH17G13	Laser and Spectroscopy	4	0	0	4
HBPH17G14	Elements of Nanoscience and Nanotechnology	4	0	0	4
HBPH17G15	Integrated Electronics	4	0	0	4
HBMG17001	Environmental studies	3	0	0	3
	Practical				
HBPH17L06	Electronics Lab-II	0	0	4	2
HBPH17L07	Microprocessor Lab	0	0	4	2
	Credits 20				Total

SEMESTER VI

SUB CODE	SUBJECT TITLE	L	T	P	C
HBPH17G16	Computational and Numerical Method	4	0	0	4
HBPH17G17	Solid state Physics	4	0	0	4
HBMG17G01	Entrepreneurship Development	3	0	0	3
HBPH17P01	Project				10
	Credits 20				Total

Total number of

credits.....130



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Department B.Sc Physics
B.Sc Physics Syllabus (2017 revised) - Semester 1
PROPERTIES OF MATTER AND ACOUSTICS

LTPC
4004

Objective:

SUB CODE: HBPH14G01

The aim of this paper is to expose the students to the fundamentals of properties of matter and Acoustics.

UNIT I - ELASTICITY AND MODULI OF ELASTICITY

Elasticity - Three types of elastic moduli and relation among them - Bending of beams - Expression for bending moment - Depression of the loaded end of a Cantilever - Uniform – Non uniform bending - Theory - Experiment pin and microscope method - Work done in uniform bending – Non-uniform bending - Theory -Expression for couple per unit twist - Determination of Rigidity modulus by torsion pendulum with mass.

UNIT II - FLUID MOTION

Viscosity - Coefficient of critical velocity – Poiseulli's formula for coefficient of viscosity and its correction - Determination of coefficient of viscosity by capillary flow method - comparison of viscosities- Oswald's viscometer - Variations of viscosity with temperature and pressure - Viscosity of gases -Mayer's formula for the rate of flow of a gas through a capillary tube.

UNIT III – SURFACE TENSION

Surface tension and Osmosis - Surface energy - Excess of pressure inside curved surface - Formation of drops - Experimental study of variation of Surface tension with temperature - Angle of contact of mercury - Quincke's method - Surface tension and vapour pressure osmosis - Experimental determination of osmotic pressure - Laws of osmosis pressure - Osmotic and vapour pressure of a solution.

UNIT IV - SOUND

Sound - Definition of free, damped and forced vibrations – Theory of forced vibrations -Resonance - Sharpness of resonance - Fourier's theorem – Application for Saw- tooth wave and square wave -Sonometer - Determination of A.C. frequency using sonometer - Determination of frequency using Melde's apparatus.

UNIT V - ULTRASOUND AND ACOUSTICS

Ultrasonics - Production - Piezo electric method – Magnetostriction method -detection - Properties - Applications. Acoustics : Intensity Level, Loudness -Acoustics of buildings - Reverberation - Reverberation time - Derivation of Sabine's formula - determination of absorption coefficient – Optimum reverberation time - Factors affecting Acoustics of buildings.

TEXT BOOKS

1. Brijlal and Subramaniam N., Properties of Matter , Revised Edition, S.Chand and Company,2005.
2. Murugesan R., Properties of Matter and Acoustics , Revised Edition, S.Chand and Company, 2005.

REFERENCES

1. Mathur D. S, Elements of Properties of Matter, 3rd Edition, S. Chand and Company, 2005.
2. Satyaprakash and Akash Saluja, Oscillations and Waves, Pragati Prakashan,



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II - MECHANICS

SUB CODE:HBPH17G02

Objective:

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To make the students understand the basic principles of mechanics and enable them to analyze and solve problems.

UNIT 1-VECTOR ANALYSIS

Scalar and vector fields- gradient of a scalar field and its physical significance- Divergence and curl of a vector field with derivations and physical interpretation- Vector integration (line, surface and volume)- State and proof of Gauss and Stokes theorem.

UNIT II- MECHANICS OF PARTICLES

Laws of motion-motion of variable mass system- motion of a rocket- Conservation of energy and momentum- Collisions in two and three dimensions- Concept of impact parameter- scattering cross-section- Rutherford scattering-derivation.

UNIT III- MECHANICS OF RIGID BODIES

Definition of rigid body-rotational kinematic relations- equation of motion for a rotating body- angular momentum- Euler equation- precession of a top- Gyroscope- precession of the equinoxes.

UNIT IV- CENTRAL FORCE

Central forces- definition and examples- conservative nature of central forces- conservative force as a negative gradient of potential energy- equation of motion under a central force- Derivation of Kepler's laws- Motion of satellites.

UNIT V-SPECIAL THEORY OF RELATIVITY

Galilean relativity-absolute frames- Michelson-Morley experiment- negative result- Postulates of special theory of relativity- Lorentz transformation- time dilation- length contraction- addition of velocities- mass-energy relation.

Reference Books:

1. Mechanics - D.S. Mathur, *Sulthan Chand & Co, New Delhi*
2. Mechanics - J.C. Upadhyaya, *Ramprasad & Co., Agra*
3. Properties of Matter - D.S. Mathur, *S.Chand & Co, New Delhi ,11th Edn., 2000*
4. Physics Vol. I - Resnick-Halliday-Krane ,*Wiley, 2001*
5. Properties of Matter - Brijlal& Subrmanyam ,*S.Chand &Co. 1982*



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Department B.Sc Physics

Semester- II
III - HEAT AND THERMODYNAMICS

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Objective:

To make the students understand the foundational Principles of Heat and Thermodynamics and to solve problems.

UNIT I-Thermodynamics

Introduction laws of thermodynamics-Isothermal and adiabatic process- general relation between two specific heats – Isothermal and adiabatic process- Reversible and irreversible processes-Second law of thermodynamics- Kelvin and Clausius statements-Thermodynamic scale of temperature-Entropy- physical significance –Change in entropy in reversible and irreversible processes-Entropy and disorder-Entropy of Universe.

UNIT II- Kinetic theory of gases

Introduction –Deduction of Maxwell’s law of distribution of molecular speeds- experimental verification-Toothed wheel experiment- Transport phenomena-Viscosity of gases-thermal conductivity-diffusion of gases.

UNIT III-Thermodynamic potentials

Thermodynamic potentials- Clausius-Clayperon’s equation - Derivation for ratio of specific heats - Derivation for difference of two specific heats for perfect gas- Joule Kelvin effect-expression for Joule Kelvin coefficient for perfect and Vanderwaal’s gas.

UNIT IV-Low temperature Physics

Introduction-Joule Kelvin effect-liquefaction of gas using porous plug experiment Joule expansion-Distinction between adiabatic and Joule Thomson expansion-Expression for Joule Thomson cooling-Liquefaction of helium-applications of substances at low temperature-effects of chloro and flouro carbons on ozone layer.

UNIT V-Thermal conductivity & Radiation

Thermal conductivity- thermal conductivity of bad conductor by Lee’s disc method- Blackbody radiation-Wein’s displacement law - Rayleigh-Jean’s law-Quantum theory of radiation-Planck’s law-Measurement of radiation-Types of pyrometer- experimental determination-Angstrom pyrhelimeter-determination of solar constant.

Books for Study and Reference :

1. Fundamentals of Physics. Halliday/Resnick/Walker.C. Wiley India Edition 2007
2. Heat and Thermodynamics- MS Yadav, Anmol Publications Pvt. Ltd, 2000
3. Heat, Thermodynamics and Statistical Physics-N Brij Lal, P Subrahmanyam, PS Hemne, S.Chand & Co.,2012
4. Thermodynamics - R.C. Srivastava, Subit K. Saha & Abhay K. Jain Eastern Economy Edition.



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Department B.Sc Physics
IV - OPTICS

Objectives:

To expose the students to the fundamental of optics and to provide the students with knowledge of the applications of optics.

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UNIT I-Geometrical optics

Convex lens, principal focus and focal planes, principal points and principal planes, nodal points and nodal plans, refraction at a lens surface, combination of thin lenses in and out of contacts, general theory of image formation, cardinal points of an optical system, system matrix for a thin lens, Lens maker's formula, acromatism.

UNIT II-Aberrations

Introduction – monochromatic aberrations, spherical aberration, methods of minimizing spherical aberration, coma, astigmatism and curvature of field, distortion. Chromatic aberration-the achromatic doublet- Removal of chromatic aberration of a separated doublet.

UNIT III-Interference

Principle of superposition-coherence-temporal coherence and spatial coherence-conditions for interference of light-Fresnel's biprism-determination of wavelength of light, change of phase on reflection-Lloyd's mirror experiment-Determination of diameter of wire, Newton's rings in reflected light- Michelson interferometer-Fabry-perot interferometer.

UNIT IV-Diffraction:

Introduction, Fresnel and Fraunhofer diffraction & distinction-Diffraction due to single slit and circular aperture-Limit of resolution-Resolving power of grating-Determination of wavelength of light in normal and oblique incidence methods using diffraction grating-Difference between interference and diffraction.

UNIT V- Polarisation

Polarized light: methods of polarization - polarization by reflection, refraction, double refraction, selective absorption, scattering of light-Brewster's law-Malus law-Nicol prism polarizer and analyzer-Quarter wave plate, Half wave plate-optical activity, analysis of light by Laurent's half shade polarimeter-Babinet's compensator.

Reference Books:

1. Fundamentals of Physics. Halliday/Resnick/Walker.C. Wiley India Edition 2007
2. A Text Book of Optics-N Subramanyam, L Brijlal, S.Chand & Co.
3. Principles of Optics- BK Mathur, Gopala Printing Press, 1995



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Department B.Sc Physics

Semester III

V - Electricity and Magnetism

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Unit – I Electrostatics

Coulomb's law – Gauss law –proof and applications – Electric field due to a charged sphere – Coulomb's theorem - Mechanical force on the surface of the charged conductor – Electric field, Electric potential & their Relations - Electric field due to electric dipole on the axial line and equatorial line - Capacitance – Principles – Expressions for the capacitance – Spherical capacitor – Loss of energy due to sharing of charges.

Unit – II Current Electricity

Kirchhoff's laws – Application to Wheatstone bridge – Sensitiveness of bridge – Principles of potentiometer – Determination of internal resistance of the cell using potentiometer – Calibration of ammeter and voltmeter - Low & high range – See back effect – Thermo e.m.f- Measurement of e.m.f of a thermocouple with a potentiometer – Peltier effect, Peltier coefficient – Thomson effect-Thomson coefficient – Thermoelectric power.

Unit– III Magnetic Effect of Electric Current

Biot-savart's law – Its application – Long straight wire of infinite length – Ampere's theorem – Magnetic field at the centre of current carrying circular coil – Solenoid – Faraday's laws of electromagnetic induction – Lenz's law – Self –inductance – Energy stored in an inductor – Self-inductance by Rayleigh's bridge method – Mutual inductance – Eddy current.

Unit – IV DC and AC Circuits

Growth and decay of current in LR circuit – Growth and decay of charges in CR circuit – Growth of charge in a circuit with inductance, Capacitance and resistance in series – Determination of High resistance by leakage (B.G) – Mean value of alternating e.m.f – RMS value of alternating current / voltage – Alternating current applied to LR, CR and LCR circuits – Series resonance circuit – Parallel resonance circuit – Power in an A.C circuit.

Unit – V Magnetism

Definition of field, intensity and magnetic susceptibility – Magnetic materials and magnetization – Hysteresis – Area of Hysteresis loop –, Ferro magnets, Ferri magnets and determination of susceptibility — Derivations of Maxwell's equations – Types of current – Displacement current – Significance of displacement of current .

Books for Study & Reference

1. Electricity and Magnetism by R. Murugesan S. Chand & Co
2. Elecetricity and Magnetism 20th revised edition – Brijlal and Subramanian, S. Chand & Co.(2007)



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VI - ATOMIC PHYSICS

Objectives:

This paper aims to familiarize under graduate students to the fundamental nature of matter, structure of atoms and x-rays and cosmic rays

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UNIT I -Structure of atom

Introduction –drawbacks of Bohr’s atomic model-Sommerfield’s elliptical orbits-relativistic correction (no derivation)- Stern and Gerlach experiment-Vector atom model and quantum numbers associated with it- L-S and j-j coupling schemes- Zeeman effect- stark effect.

UNIT II - Atoms in External Magnetic Fields

Normal and Anomalous Zeeman Effect- Pauli’s Exclusion Principle- Symmetric and Antisymmetric Wave Functions- Periodic table- Fine structure- Spin orbit coupling- Spectral Notations for Atomic States- Total Angular Momentum- Vector Model- Spin orbit coupling in atoms-L-S and J-J couplings.

UNIT III -Matter waves

de Broglie’s hypothesis-wavelength of matter waves- properties of matter waves- Phase and group velocities- Davisson and Germer experiment-double slit experiment- Standing de Broglie waves of electron in Bohr orbits.

UNIT IV -Particle properties of waves & x-rays

Mass defect-packing fraction-determination of number of electrons per atom- X-rays production- polarization of x-rays- scattering of x-rays- Laue’s experiment- bragg’s law- x-ray spectra- applications of x-rays.

UNIT V - Cosmic rays

Origin of cosmic rays- Discovery of cosmic rays- latitude effect- east-west effect- altitude effect- primary and secondary cosmic rays- cosmic ray showers-discovery of positrons and mesons-Van Allen belts- effect of earth’s magnetic field- Hubble’s law- history of universe- future of universe.

Books for Study and Reference :

1. Modern Physics by G. Aruldas & P. Rajagopal. *Eastern Economy Edition.*
2. Modern Physics by R. Murugesan and Kiruthiga Siva Prasath. *S. Chand & Co.*
3. Nuclear Physics by D.C. Tayal, *Himalaya Publishing House.*



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VII - RELATIVITY AND QUANTUM MECHANICS

L T P C
4 0 0 4

Unit 1 : Relativity

Frames of reference - Galilean transformation - Michelson - Morley experiment - Postulates of special theory of relativity - Lorentz transformation - length Contraction - time dilation - Relativity of simultaneity - addition of velocities - variation of mass with velocity – Mass energy relation - Elementary ideas of general relativity.

Unit II : Wave Nature of Matter

Phase and group velocity - wave packet - expression of de Broglie's wave length - Davisson and Germer's experiment - G.P.Thompson's experiment - Electron microscope - Heisenberg's uncertainty principle and its consequences.

Unit III : Schrodinger Equation

Inadequacy of classical mechanics - Basic postulates of quantum mechanics - Schrodinger equation - Properties of wave function - Probability interpretation of wave function - linear operators - self adjoint operators - expectation value

Unit IV: Solutions of Schrodinger Equation

Eigen values and eigen functions - commutativity and compatibility-Free particle solution - Particle in a box (1D and 3D) - Potential well of finite depth (one dimension) - linear harmonic oscillator - rigid rotator and hydrogen atom.

Unit V: Angular Momentum in Quantum Mechanics

Orbital angular momentum operators and their commutation relations - separation of three dimensional Schrodinger equation into radial and angular parts - Elementary ideas of spin angular momentum of an electron - Pauli matrices.

Books for Study

1. Mechanics and Relativity by Brijlal Subramanyam, S.Chand & Co., New Delhi, . (1990).
2. Quantum mechanics by K.K.Chopra and G.C. Agrawal, Krishna Prakasam Media (P) Ltd., Meerut First Edition(1998).
3. Modern Physics by R. Murugesan and Kiruthiga Sivaprasath, S. Chand & Co.,(2008).

Books for Reference

1. Concepts of modern physics by A.Beiser. Tata McGraw - Hill, 5th edition, New Delhi(1997).
2. Quantum mechanics by A.Ghatak and Loganathan, Macmillan India Pvt. Ltd.



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VIII - BASIC ELECTRONICS

L T P C
4 0 0 4

Unit I- Semiconductors & transistors

Semiconductors : Junction diodes – diode characteristics – types of diodes – zener diode – zener diode characteristics –bridge rectifier using zener diode – filter circuits – types of filters. Transistors – transistor biasing, action and symbols – transistor connections – relation between α , β and γ – transistor biasing – common emitter characteristics – transistor amplifier (CE).

Unit II- Field Effect Transistors and Silicon controlled Rectifier

Junction field effect transistor(JFET) – principle and working of JFET – Parameters of JFET – Advantages of JFET – Metal Oxide Semiconductor FET (MOSFET) – MOSFET biasing – Silicon Controlled Rectifier(SCR) – working of SCR – Applications of SCR.

Unit III - Oscillators and Multivibrators:

Feedback principle – positive and negative feedbacks – Advantages of negative feedback – emitter follower – application of emitter follower – transistor oscillators – Hartely, Colpitt oscillators – Phase shift oscillators – Astable and monostable multivibrators using transistor.

Unit – IV – Power Electronics

The triac – triac construction and operation – phase control circuit – applications of triac – The diac – applications of diac. Unijunction transistor (UJT) – equivalent circuit – characteristics of UJT – applications of UJT.

Unit – V- Operational amplifier and Modulation:

Op-Amp characteristics and applications – adder, subtractor, integrator and differentiator, Modulation – types of modulation – amplitude modulation – modulation index – frequency and digital modulations – AM diode detector – AM and FM receivers - Demodulation.

Books for Study

1. A text book of Electronics by B. L. Theraja
2. Principle of Electronics by V.K. Mehtha
3. Text book of Electronic Circuits by R S Sedha



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Semester IV

IX- NUCLEAR PHYSICS

L T P C

4 0 0 4

Unit I-Nuclear properties:

Nuclear constituents, nuclear sizes and shapes, nuclear radii, nuclear masses, mass defect and binding energy, binding energy per nucleon, binding energy curve, packing fraction, nuclear force, exchange forces(meson theory) of nuclear forces.

Unit II-Radioactivity decay:

Radioactivity, natural radioactivity, units of radioactivity-natural activity, radioactive decay laws, half life, successive disintegration-transient and secular equilibriums, conservation laws, Q value equation of nuclear reactions, α decay, , properties of α particles (charge/mass, charge, velocity range, spectra) β decay decay spectra, k electron capture, radio isotope production,Fission,Fusion reaction-p cycle, CNO cycle.

Unit III-Nuclear model:

Liquid drop model approach, semi empirical mass formula and significance of its various terms, condition of nuclear stability, two nucleon separation energies, evidence for nuclear shell structure, nuclear magic numbers, basic assumption of shell model

Unit IV-Particle accelerators:

Ionization chamber, solid state detectors, Geiger-Muller counter, Wilson cloud chamber, spark chamber, nuclear emulsions, scintillation counter, Cerenkov counter, Cockcroft-Walton tension multiplier, Van de Graff generator, linear accelerator, cyclotron, synchrocyclotron, synchrotron, betatron.

Unit V-Particle physics:

Particle interactions; basic features, types of particles and its families. Symmetries and Conservation Laws: energy and moments, angular momentum, parity, baryon number, Lepton number, Isospin, Strangeness and charm. Elementary ideas of quarks and gluons.

Books for Study & Reference

1. Modern Physics by R. Murugesan, S. Chand & Co
2. Nuclear Physics by D.C. Tayal, S. Chand & Co
3. Atomic and Nuclear Physics by N. Subramaniam & Brij Lal, S. Chand & Co



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X - MATHEMATICAL PHYSICS

L T P C

4 0 0 4

Unit I Matrices

Characteristic equation of a matrix – Eigenvalues and Eigenvectors - Hermitian and Unitary matrices – Properties of their eigenvalues and eigenvectors – Diagonalisation of matrices.

Unit II Complex Variable

Function of a Complex variable – Continuity and differentiability – single and multivalued function – Analytic function – Cauchy – Riemann condition (necessity and sufficiency). Cauchy – Riemann Conditions in the polar (r, θ) coordinates.

Unit III Scalar & Vector Field

Scalar and Vector fields – Gradient, Divergence and Curl – Equation of motion in the vector notation – equations of motion (components) in Cartesian coordinates and spherical polar coordinates – equation of motion in the polar coordinates.

Unit IV Classical Mechanics

Generalised coordinates – configuration space – Lagrange's equation – simple applications : to find equations of motion given a lagrangian; central potential and conservation of angular momentum – Hamilton function and Hamilton's equations – harmonic oscillator.

Unit V Statistical Thermodynamics

Quantum statistics of identical particles – Maxwell – Boltzmann, Bose – Einstein and Fermi – Dirac statistics – Derivation of Plank's radiation formula from Bose – Einstein statistics – Degenerate Fermi gas.

Books for Study & Reference:

1. Mathematical Physics by Sathya Prakash, Sultan Chand and Sons, New Delhi (1996)
2. Heat Thermodynamics and Statistical Physics by Brijilal, N.Subrahmanyam, P.S. Hemne S.Chand & Co., New Delhi.(2007).
3. Mathematical Physics by B.D. Gupta, Vikas Publishing House Pvt. Ltd., New Delhi (1996).
4. Classical Mechanics by H.Goldstein, , Narosa Publishing House, New Delhi.



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XI - Applied Electronics

L T P C

4 0 0 4

UNIT – I NUMBER SYSTEMS:

Number system – Binary number system – Decimal to binary and Binary to decimal conversion – Binary addition, subtraction – Octal and Hexadecimal number systems.

UNIT – II LOGIC CIRCUITS:

Logic Circuits: - AND, OR, NOT gates – one's and two's complements - BCD code – Boolean algebra – De Morgan's theorems. NAND and NOR gates – NAND and NOR as universal building block. Logic families – Diode Resistor Logic (OR, AND gates), RTL(NOT gate), DTL and TTL (NOR and NAND).

UNIT – III MULTIVIBRATORS:

Multivibrators: Operational Amplifier – Op-Amp characteristics – Monostable and Astable multivibrators using OP-Amp. IC 555 Timer – monostable and Astable multivibrators using IC – 555 timer.

UNIT IV ADDERS, REGISTERS AND COUNTERS:

Adders, Registers and Counters: Half and full adders – Half subtractor – full subtractor – Encoders and Decoders. Flip-Flops-R-S, J-K, JK master Slave, FF – D flipflop. Registers – Shift Register – Classification of shift registers. Counters – Ring counter – 4-bit counter – Decade counter- A/D and D/a converters.

UNIT V 8085 MICROPROCESSOR

8085 microprocessor: Microprocessor fundamentals – microprocessor architecture – The 8085 CPU – 8085 Instruction – Instruction Classification – Data transfer operation – Arithmetic operations – logic operation – Branch operations – writing assembly language programs – looping, Counting and Indexing programming techniques – simple programs.

Books for Study & Reference:

1. Digital Principles and Applications by Leech, Malvino and Saha 6th Edition. Mcgraw Hill International Edition.
2. Microprocessor Architecture, Programming and Applications(8085) by Goyankar, Wiley Easten.



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Semester V

XII - Microprocessor Fundamentals

L T P C

4 0 0 4

UNIT I 8085 MICROPROCESSOR

Architecture of 8085 microprocessor – Instruction Set – addressing modes – 8085 interrupts – timing diagram – assembly level programming – programmable interrupt timer (8253/8254) – Programmable peripheral interface (8255) – CRT controller (8275/6845)

UNIT II PROGRAMMING IN 8085

Programmable DMA controller (8257) – Programmable interrupt controller (8259) – Keyboard display interface (8279) – ADC/DAC interfacing

UNIT III APPLICATIONS OF 8085

Application of 8085 – stepper motor controls – traffic light controls – microcomputer based systems

UNIT IV 8086 MICROPROCESSOR

8086 architecture – pin configuration – minimum mode and maximum mode configuration – addressing modes – basic instruction – 8086 interrupts

UNIT V ARM PROCESSOR

Architecture - Pin Configuration – Instruction Set – Interrupts - Programming

Books for Study:

1. Microprocessor Architecture Programming and Application with 8085/ 8080A by Ramesh Gaonkar, Wiley
2. Fundamentals of Microprocessor 8085 by V.Vijayendran. S.Viswanathan Publishers, Chennai

Books for Reference:

1. Introduction to Microprocessors by Aditya Mathur
2. Introduction to Microprocessors by Lance A. Levanthal



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XIII - LASER AND SPECTROSCOPY

L T P C

4 0 0 4

UNIT I-FUNDAMENTALS OF LASERS

Characteristics of a Laser - Directionality- High Intensity-High Degree of Coherence- Spatial Temporal coherence- Spontaneous and stimulated emission - Einstein's Coefficients and possibility of Amplification- Population Inversion- Laser Pumping- Resonance Cavity- Shallow-Towns equation.

UNIT II -TYPES OF LASER

Conditions of laser action-pumping methods- Ruby Laser, He-Ne Laser, CO₂ Laser, Nd-YAG laser- Applications of Laser- holography.

UNIT III- LASER PROPERTIES AND PRODUCTION

Resonators - Vibrational modes of resonators- Number of modes/unit volume - Open resonators- Control resonators- Resonance Cavity- Shallow-Towns equation-Q Factor- Losses in the cavity- Threshold condition- Quantum yield-Mode locking (active and passive)-Q Switching.

UNIT IV -BASIC ELEMENTS OF SPECTROSCOPY

Basic theory-characterization of electromagnetic spectrum- classification of spectrum- Raman Effect- experiment and application-IR spectroscopy and applications.

UNIT V- MICROWAVE SPECTROSCOPY

Energy of diatomic molecule- the simple harmonic oscillator- Rotation of molecules-Rotational spectra-Rigid and non-rigid diatomic rotator-Intensity of spectral lines-Isotopic substitution-Poly atomic molecules (Linear and symmetric top-Microwave spectroscopy- Techniques and instrumentation.

TEXT BOOKS

1. Colin Banwell and Mc Cash, Fundamentals of Molecular Spectroscopy, TMH Publishers, 4th Edition, 2002.
2. Sune Svanbag, Atomic and Molecular Spectroscopy: Basic Aspects and Practical Applications, Springer, 3rd Edition, 2001.

REFERENCES

1. Aruldas G., Molecular Structure and Spectroscopy, Prentice Hall of India, 2001.
2. Wolfgang Demtröder, Laser Spectroscopy: Vol. 1: Basic Principles , 4th Edition, Springer, 2008.



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XIV - Elements of nanoscience and nanotechnology

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UNIT I-BASICS AND SCALE OF NANOTECHNOLOGY

Introduction–Scientific revolutions–Time and length scale in structures –Definition of a nanosystem–Dimensionality and size dependent phenomena –Surface to volume ratio-Fraction of surface atoms–Surface energy and surface stress-surface defects-Properties at nanoscale (optical, mechanical, electronic,and magnetic).

UNIT II-DIFFERENT CLASSES OF NANO MATERIALS

Classification based on dimensionality-Quantum Dots,Wells and Wires -Carbon-based nano materials (buckyballs, nanotubes, graphene) –Metalbased nanomaterials (nanogold, nanosilver and metal oxides) -Nanocomposites-Nanopolymers–Nanoglasses–Nano ceramics -Biological nanomaterials.

UNIT III- ELECTRICAL TRANSPORT IN NANOSTRUCTURE:

Electrical conduction in metals, The free electron model. Conduction in insulators/ionic crystals - Electron transport in semiconductors - Various conduction mechanisms in 3D (bulk), 2D(thin film) and low dimensional systems: Thermionic emission, field enhanced thermionic emission (Schottky effect), Field assisted thermionic emission from traps (Poole-Frenkel effect)

UNIT IV - INTRODUCTORY QUANTUM MECHANICS FOR NANOSCIENCE:

Size effects in small systems, Quantum behaviour of nanometric world: Applications of Schrodinger equation – infinite potential well, potential step, potential box; trapped particle in 3D (nanodot), electron trapped in 2D plane (nanosheet), electrons moving in 1D (nanowire, nanorod, nanobelt), Excitons, Quantum confinement effect in nanomaterials

UNIT V–APPLICATIONS

Solar energy conversion and catalysis-Molecular electronics and printed electronics-Nanoelectronics--Liquidcrystalline systems-Linear and nonlinear optical and electro- optical properties, Applications in displays and other devices -Nanomaterials for data storage-Photonics, Plasmonics-Chemical and biosensors-Nanomedicine and Nanobiotechnology–Nanotoxicology challenges.

Books to Study

1. Introduction to Nanoscience & Nanotechnology by K. K. Chattopadhyay and A. N. Banerjee, Publisher: PHI Learning and Private Limited
2. Nanotechnology, Rakesh Rathi, S Chand & Company, New Delhi
3. PradeepT., “A Textbook of Nanoscience and Nanotechnology”, Tata McGraw Hill Education Pvt. Ltd., 2012.



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XV - INTEGRATED ELECTRONICS

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UNIT I - Operational Amplifier

Operational amplifier architecture-the gain stage and differential stage, output stages-offset voltage and currents-measurement of operational amplifier parameters-frequency response and compensation-slew rate.

UNIT II - IC's as Analog System Building Blocks

Inverting and non-inverting Operational amplifier-Differential amplifier-inverting and non-inverting-summing-Integrator and Differentiator-Phase locked loop-SCR-555 timer.

UNIT III- Boolean Algebra & K-Map

Introduction to various number systems (only brief summary).Switching circuits and binary signals-Logic gates-Boolean functions-complement of a function-minterms and maxterms-Synthesis of Boolean function-other binary operators-Karnaugh map(up to 4 variables)-simplification of Boolean function-product of sums-sums of products simplification-Don't care condition-various types of flip-flops.

UNIT IV - IC's as Digital System Building Blocks

Half adder, Full adder, subtractor-code conversion-comparators-Decoders, Encoders-Multiplexer, De multiplexer-Universal gates-two and three level implementation-sum of products-product of the sum.

UNIT V Applications of Digital System

Various types of flip flops-Clocked R-S flip flop-D flip flop- JK- flip flop- T-flip flop- Triggering of flip flops-Analysis of clocked sequential circuits-State diagram- flip flop input functions-Shift registers-Counters.

Books for study and References:

1. Integrated Electronics, Milman & Halkias (McGraw Hill).
2. Solid State Electronics-I.Agarwal and Anit Agarwal(Pragati Prakashan).
3. Digital Principal and Applications-Malvino and Leach(McGraw Hill).
4. Digital Electronics-Principles and Practice-Avinahi Kapoor and I.K. Maheshwari Macmillan.



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Semester VI

XVI – COMPUTATIONAL AND NUMERICAL METHODS

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UNIT I - Computer Software and Operating System

System software and application software, Translator programs, Operating systems – Classification, Elements of DOS and Windows – basic commands

UNIT II – Elements of C Programming Language

Algorithms and flowchart, Structure of a high level language program – Features of C language- constants-variables – expressions – input and output statements – conditional and loop statements – arrays - functions

UNIT III- Matrices & Solution of Algebraic and Transcendental equation

Method of triangularisation-Gauss elimination method-Inverse of a Matrix-Gauss –Jordan method. Bisection method-Regular false method-Newton-Raphson method-Horner’s method- Solution of ordinary differential equation-Euler’s method.

UNIT IV- Finite Differences

Finite Differences-Operators $\Delta, \nabla, \delta, E, D$ -relation between operators, linear interpolation- interpolation with equal intervals-Newton forward interpolation formula-Newton backward interpolation formula

UNIT V- Linear System of equations, Numerical Differentiation and Integration

Principles of least squares-Fitting a straight line-linear regression-fitting an exponential curve.Numerical differentiation and integration -Trapezoidal Rule-Simpson’s 1/3 rule and 3/8 rule.

Books for study and reference:

1. Numerical methods - S.S. Sastry, Prentice Hall of India Pvt. Ltd., New Delhi (2003)
2. Numerical methods – M.K. Venkataraman, National Publishing Company, (1990)
3. Numerical methods - V. Rajaraman, Prentice-Hall India Pvt. Ltd., (2003)



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XVII - Solid State Physics

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UNIT I – CRYSTAL STRUCTURE

Crystal Lattice - Primitive and Unit cell - Seven Classes of Crystals - Bravais Lattice Miller Indices - Structure of Crystals - Simple cubic, Hexagonal close packed structure, Face Centered Cubic Structure, Body Centered Cubic Structure, Sodium Chloride Structure, Diamond Structure.

UNIT II – CRYSTAL DIFFRACTIONS AND IMPERFECTIONS

Diffraction of X-Rays by Crystals - Bragg's Law In one Dimension - Experimental Method in X- Ray Diffraction - Laue Method, Rotating Crystal Method - Powder Photograph Method - von Laue's equations. Point Defects, Line Defects - Surface Defects - Volume Defects - effects of Crystal Imperfections.

UNIT III – CRYSTAL BONDING

Introduction to bonding, ,Concept of inter-atomic forces, Cohesive energy and types of bonding, Primary bonds (ionic bonds, Covalent bond and metallic bond), secondary bonds(Vander walls bond and hydrogen bonds) The Bloch theorem (only statement and properties), The Kroning Penny model, Energy versus Wave Vector relationship --- different representations (Brillouin Zones).

UNIT IV – SEMICONDUCTOR DEVICES

Introduction, construction, working and characteristics of semiconductor diode, Zener diode, transistor (n-p-n and p-n-p transistor), Transistor characteristics (CB, CE, CC), JFET (Construction and its characteristics).

UNIT V - THERMAL PROPERTIES

Phonons of monoatomic one Dimensional Lattice - Specific heat of solids - Einstein's and Debye's theory - Cohesive Energy of cubic, Ionic Crystals. Qualitative Explanation for the Occurrence of Super Conductivity - General Properties of Superconductors - Type of Superconductors - London equation. London penetration depth. Energy gap. Basic ideas of BCS theory. High-Tc superconductors.

Books for Study:

- 1 Introduction to Solid State Physics by Kittel, Wiley and Sons, 7th Edition.
- 2 Material Science by M. Arumgarn, Anuradha Publishers.

Books for Reference:

1. Material Science and Engineering by V.Raghavan, PHI
2. Principle of Material Science by S.Mohan, MJP