# 3 Yr. Degree Course
# (Minor)
# based on NEP-2020
# PHYSICS

(Effective from Session 2024-25)

**(Batch: 2024-2027)**


**SAMBALPUR UNIVERSITY**

**JYOTI-VIHAR, BURLA, SAMBALPUR, ODISHA-768019**

## COURSE AT A GLANCE (NEP-UG)

*SUBJECT: PHYSICS* *ACADEMIC SESSION:* **2024-27**

## CORE-I COURSE

| Course Number | Semester | Course Title | Type of Paper P-Practical NP-Non-practical | Credit Hour | Maximum Weightage of Marks |
|---|---|---|---|---|---|
| Paper-I | I | MATHEMATICAL PHYSICS -1 | P | 4 | 100 |
| Paper-II | | MECHANICS | P | 4 | 100 |
| Paper-III | II | ELECTRICITY AND MAGNETISIM | P | 4 | 100 |
| Paper-IV | | MATHEMATICAL PHYSICS -2 | P | 4 | 100 |
| Paper-V | III | WAVES AND OPTICS | P | 4 | 100 |
| Paper-VI | | MATHEMATICAL PHYSICS-3 | P | 4 | 100 |
| Paper-VII | | THERMAL PHYSICS | P | 4 | 100 |
| Paper-VIII | IV | ANALOG SYSTEMS | P | 4 | 100 |
| Paper-IX | | BASIC INSTRUMENTATIONS | P | 4 | 100 |
| Paper-X | | NUCLEAR AND PARTICLE PHYSICS | P | 4 | 100 |
| Paper-XI | V | DIGITAL SYSTEM | P | 4 | 100 |
| Paper-XII | | QUATUM MECHANICS AND APPLICATIONS | P | 4 | 100 |
| Paper-XIII | | SOLID STATE PHYSICS | P | 4 | 100 |
| Paper-XIV | VI | ELECTRO- MAGNETIC THEORY | P | 4 | 100 |
| Paper-XV | | STATISTICAL PHYSICS | P | 4 | 100 |
| Paper-XVI | VII | MATHEMATICALS METHODS IN PHYSICS | | 4 | 100 |
| Paper-XVII | | CLASSICAL MECHANICS | | 4 | 100 |
| Paper-XVIII | | QUANTUM MECHANICS- I | | 4 | 100 |
| Paper-XIX | | COMPUTATIONAL PHYSICS LAB | | 4 | 100 |
| Paper-XX | VIII | CLASSICAL ELECTRO DYNAMICS | | 4 | 100 |
| Paper-XXI | | QUANTUM MECHANICS 2 | | 4 | 100 |
| Paper-XXII | | ELECTRONICS | | 4 | 100 |
| Paper-XXIII | | OPTICS AND MODERN PHYSICS LAB | | 4 | 100 |

## CORE-II/CORE-III COURSE

| Course Number | Semester<br><br>Core-II/ Core-III | Course Title | Type of Paper<br><br>P-Practical<br><br>NP-Non-practical | Credit Hour | Maximum Weightage of Marks |
|---|---|---|---|---|---|
| Paper-I | Core-II | MECHANICS | P | 4 | 100 |
| Paper-II | Core-III | ELECTICITY AND MAGNETISIM | P | 4 | 100 |
| Paper-III | Core-II | WAVES AND OPTICS | P | 4 | 100 |
| Paper-IV | Core-III | ANALOG SYSTEM | P | 4 | 100 |
| Paper-V | Core-II | DIGITAL SYSTEM | P | 4 | 100 |
| Paper-VI | Core-III | ELECTRO- MAGNETIC THEORY | P | 4 | 100 |

# (CORE COURSE II/III)
# Semester-I

**Core-II**

## MECHANICS: 3 Credits

***(4 Credit, Theory: 45hrs, 1 Credit, Practical: 30hrs)***

**CO-1** To Learn the basic concepts of Rigid body dynamics, Radius of Gyration, Moment of Inertia, Non- Inertial Systems

**CO-2** To Understand the concept of Elasticity, Fluid motion and Types of Vibration

**CO-3** To understand the concept of Newtonian theory through Gravitation, Central force motion, Keplar's laws, GPS

**CO-4** To learn the concept of Special theory of Relativity, Michelson- Morley experiment, Lorentz transformation, Relativistic Doppler effect.

**CO-5** Apply the basic concepts of Mechanics in experiments.

**UNIT-I**

**Rotational Dynamics:** Centre of Mass, Motion of CoM, Centre of Mass and Laboratory frames, Angular momentum of a particle and system of particles, Principle of conservation of angular momentum, Rotation about a fixed axis, Moment of Inertia, Perpendicular and Parallel Axis Theorems, Routh Rule, Calculation of moment of inertia for cylindrical and spherical bodies, Kinetic energy of rotation, Euler's Equations of Rigid Body motion, Motion involving both translation and rotation. Moment of Inertia of a Flywheel.

**Non-Inertial Systems:** Non-inertial frames and fictitious forces, uniformly rotating frame, Laws of Physics in rotating coordinate systems, Centrifugal force, Coriolis force.

**Oscillations**:

Damped oscillation. Equation of motion and solution (cases of oscillatory, critically damped and overdamped) Forced oscillations: Transient and steady states; Resonance, sharpness of resonance; power dissipation and Quality Factor, Bar Pendulum, Katers Pendulum

**Elasticity:** Relation between Elastic constants, Twisting torque on a Cylinder or Wire, Bending of beams, External bending moment, Flexural rigidity, Single and double cantilever

**Fluid Motion:** Kinematics of Moving Fluids: Poiseuilles Equation for Flow of a Liquid through a

Capillary Tube, Surface tension, Gravity waves and ripple

**Viscosity:** Poiseuilles Equation for Flow of a Liquid with corrections.

**UNIT-III**

**Gravitation and Central Force Motion:** Law of gravitation, Gravitational potential energy, Inertial and gravitational mass, Potential and field due to spherical shell and solid sphere, Motion of a particle under a central force field, Two-body problem and its reduction to one-body problem and its solution, Differential Equation of motion with central force and its solution, The first Integrals (two), Concept of power Law Potentials, Kepler's Laws of Planetary motion, Satellites. Geosynchronous orbits, Weightlessness, Basic idea of global positioning system (GPS).

**UNIT-IV**

**Special Theory of Relativity:** Michelson-Morley Experiment and its out-come, Postulates of Special Theory of Relativity, Lorentz Transformations, Simultaneity and order of events, Lorentz contraction, Time dilation, Relativistic transformation of velocity, Frequency and wave number, Relativistic addition of velocities, Variation of mass with velocity, Massless Particles, Mass- energy Equivalence, Relativistic Doppler effect, Relativistic Kinematics, Transformation of Energy and Momentum.

**Text Books:**

1. Mechanics, D. S. Mathur (S. Chand Publishing)
2. Introduction to Special Relativity, R. Resnick (John Wiley)

**Reference Books:**

1. Introduc tion to Mechanics Daniel Klapnner and Robert Kolenkow, McgrawHill.
2. Mechanics by K.R Simon
3. Mechanics, Berkeley Physics, vol. 1, C.Kittel, W. Knight, etal (Tata McGraw-Hill)
4. Physics, Resnick, Halliday and Walker (8/e.2008, Wiley) 5. Theoretical Mechanics-M.R. Spiegel (Tata McGrawHill).
6. Feynman Lectures, Vol. I, R.P.Feynman, R.B.Leighton, M.Sands (Pearson)
7. Mechanics-M.Das, P.K.Jena and R.N. Mishra (SrikrishnaPublications)
8. Classical Mechanics , Gupta Kumar & Sharama,(Pragati Prakashan)
9. Classical Mechanics, J.C.Upadhyaya, (Himalaya Publishing Home)

**LAB: Credit-1**

**(Minimum 4 experiments are to be done):**

1. To study surface tension by capillary rise method.
2. To determine the height of a building using a Sextant.
3. To study the Motion of Spring and calculate (a) Spring constant, (b) g and (c) Modulus of rigidity.
4. To determine the Moment of Inertia of a Flywheel.
5. To determine Coefficient of Viscosity of water by Capillary Flow Method (Poiseuilles method).
6. To determine the Modulus of Rigidity of a Wire by Maxwell's needle.
7. To determine the value of g using Bar Pendulum.
8. To determine the value of g using Kater's Pendulum.

**Reference Books:**

1. Advanced Practical Physics for students, B. L. Flint and H.T. Worsnop, 1971, Asia Publishing House.
2. Advanced level Physics Practical's, Michael Nelson and Jon M. Ogborn, 4th Edition, reprinted 1985, Heinemann Educational Publishers.
3. A Text ook of Practical Physics, I. Prakash and Ramakrishna, 11thEdn, 2011, Kitab Mahal

## SEMESTER- II

## ELECTRICITY AND MAGNETISM: 3 Credits

**(4 Credit, Theory: 45hrs, 1 Credit, Practical: 30hrs)**

**Core-III**

CO-1 To understand the basic concepts of Electricity and Magnetism

CO-2 To Understand the various phenomena in Electricity and Magnetism

CO-3 To Understand Circuit analysis and network theorems

CO-4 To Explain the Dynamics of Charged Particles

CO-5 To Apply the acquired knowledge in Experiment.

**UNIT-1**

**Electric Field and Electric Potential**

**Electric field:** Electric field lines, Electric flux, Gauss Law with applications to charge distributions with spherical, cylindrical and planar symmetry, Conservative nature of Electrostatic Field. Electrostatic Potential, Potential and Electric Field of a dipole, Force and Torque on a dipole, Potential calculation in different simple cases, Laplace and Poisson equations, The Uniqueness Theorem, Method of Images and its application to (1) Plane Infinite Sheet and (2) Sphere. Electrostatic energy of system of charges, Electrostatic energy of a charged sphere, Conductors in an electrostatic Field, Surface charge and force on a conductor.

**UNIT-II**

**Magnetic Field:** Magnetic Force, Lorentz Force, Biot Savarts Law, Cur- rent Loop as a Magnetic Dipole and its Dipole Moment (analogy with Electric Dipole), Amperes Circuital Law and its application to (1) Solenoid (2) Toroid ( 3) Helmhotz coil, Properties of curl and divergence, Vector Potential, Ballistic Galvanometer: Torque on a current Loop, Current and Charge Sensitivity, Electromagnetic damping, Logarithmic damping, CDR.

**UNIT-III**

**Dielectric Properties of Matter:** Electric Field in matter, Polarization, Polarization Charges, Electrical Susceptibility and Dielectric Constant, Capacitor (parallel plate, spherical, cylindrical) filled with dielectric, Displacement vector D,

Relations between E, P and D, Gauss Law in dielectrics. Magnetic Properties of Matter: Magnetization vector (M), Magnetic Intensity (H), Magnetic Susceptibility and permeability, Relation between B, H, M, Ferromagnetism, B-H curve and hysteresis. Electromagnetic Induction: Faradays Law, Lenz's Law, Self -Inductance and Mutual Inductance, Reciprocity Theorem, Energy stored in a Magnetic Field, Introduction to Maxwell's Equations.

**UNIT-IV**

Electrical Circuits: AC Circuits: Kirchhoffs laws for AC circuits, Complex Reactance and Impedance, Series LCR Circuit: (1) Resonance (2) Power Dissipation (3) Quality Factor, (4) Band Width, Parallel LCR Circuit.

**Network theorems:** Kirchoff's law for electrical circuits, Ideal Constant-voltage and Constantcurrent Sources.

Network Theorems: Thevenin theorem, Norton theorem, Superposition theorem, Reciprocity theorem, Maximum Power Transfer theorem, Applications to DC circuits. Transient Currents Growth and decay of current in RC and LR circuits.

**Text Books:**


1. Introduction to Electrodynamics – D.J. Griffiths (Pearson, 4th edition, 2015)
2. Foundations of Electromagnetic Theory-Ritz and Milford (Pearson)


**Reference Books:**


1. Classical Electrodynamics, J. D. Jackson (Wiley).
2. Electricity and Magnetism D. C. Tayal (Himalaya Publishing house)
3. Electricity, Magnetism and Electromagnetic Theory- S. Mahajan and Choudhury (Tata McGraw Hill)
4. F eynman Lectures Vol. 2, R. P. Feynman, R. B. Leighton, M. Sands
5. (Pearson)
6. Electricity and Magnetism, J. H. Fewkes and J. Yarwood. Vol. I (Oxford Univ. Press) 7. Classical Electromagnetism, H.C.Verma, Bharati Bhawan


## LAB: Credit-1

**(Minimum 4 experiments are to be done):**

Use a Multimeter for measuring (a) Resistances, (b) AC and DC Voltages, c) DC Current, (d) Capacitances, and (e) Checking electrical fuses.

1. To study the characteristics of a series RC Circuit.
2. To determine an unknown Low Resistance using Potentiometer.
3. To determine an unknown Low Resistance using Carey Fosters Bridge.
4. To compare capacitances using DeSauty's bridge.
5. Measurement of field strength B and its variation in a solenoid (determine dB/dx)
6. To verify the Thevenin and Norton theorems.
7. To determine self-inductance of a coil by Andersons bridge.

8. To study response curve of a Series LCR circuit and determine its (a) Reso- nant frequency, (b) Impedance at resonance, (c) Quality factor Q, and (d) Band width. 9. To study the response curve of a parallel LCR circuit and determine its (a)
10. Anti-resonance frequency and (b) Quality factor Q.

**Reference Books:**


1. Advanced Practical Physics for students, B.L. Flint and H.T. Worsnop, 1971, Asia Publishing House
2. A Text Book of Practical Physics, I. Prakash and Ramakrishna, 11th Ed., 2011, Kitab Mahal
3. Advanced level Physics Practicals, Michael Nelson and Jon M. Ogborn, 4th Edition, reprinted 1985, Heinemann Educational Publishers
4. A Laboratory Manual of Physics for undergraduate classes, D.P. Khandelwal, 1985, Vani Pub


## SEMESTER- III

**Core-II**

## WAVES AND OPTICS: 3 Credits

**Credit-3**

**CO-1:** Basic understanding of propagation of light, its application and wave nature.

**CO-2:** To Understand the concepts of wave motion.

**CO-3:** To Understand the concepts of interference and its application.

**CO-4:** To Understand the concepts of diffraction and its application.

**CO-5:** To Apply the acquired knowledge of optics in Experiment

**UNlT – I**

**Geometrical optics**: Fermat's principle, reflection and refraction at plane interface, Matrix formulation of geometrical Optics, Cardinal points and Cardinal planes of an optical system, Idea of dispersion, Application to thick Lens and thin Lens, Ramsden and Huygens eyepiece. Wave Optics: Electromagnetic nature of light. Definition and properties of wave front Huygens Principle. Temporal and Spatial Coherence.

**UNlT - II**

**Wave Motion:** Plane and Spherical Waves, Longitudinal and Transverse Waves, Plane Progressive (Traveling) Waves, Wave Equation, Particle and Wave Velocities, Differential Equation, Pressure of a Longitudinal Wave, Energy Trans- port, Intensity of Wave. Superposition of two perpendicular Harmonic

Oscillations: Graphical and Analytical Methods, Lissajous Figures (1:1 and 1:2) and their uses, Superposition of Harmonic waves.

**UNIT- III**

**Interference:** Division of amplitude and wave front, Young's double slit experiment, Lloyds Mirror and Fresnels Bi-prism, Phase change on reflection: Stokes treatment, Interference in Thin Films: parallel and wedge-shaped films, Fringes of equal inclination (Haidinger Fringes), Fringes of equal thickness (Fizeau Fringes), Newton's Rings: Measurement of wavelength and refractive index. Interferometer : Michelson's Interferometer-( 1) Idea of form of fringes ( No theory required), ( 2) Determination of Wavelength, ( 3) Wavelength Difference, ( 4) Refractive Index, and ( 5) Visibility of fringes, Fabry-Perot interferometer.

**UNIT – IV**

**Fraunhoffer diffraction:** Single slit, Circular aperture, Resolving Power of a telescope, Double slit, Multiple slits, Diffraction grating, Resolving power of grating. Fresnel Diffraction: Fresnel's Assumptions, Fresnel's Half-Period Zones for Plane Wave, Explanation of Rectilinear Propagation of Light, Theory of a Zone Plate: Multiple Foci of a Zone Plate, Fresnel's Integral, Fresnel diffraction pattern of a straight edge, as lit and a wire.

**Text Books:**


1. A text book of Optics N. Subhramanyam and BrijLal (S.Chand Publishing)
2. Optics - Ajoy Ghatak (McGraw Hill)


**Reference Books:**


1. Optics- E. Hecht (Pearson)
2. Fundamentals of Optics-F. A. Jenkins and H. E. White(McGraw-Hill)
3. Geometrical and Physical Optics R.S. Longhurst (Orient Blackswan)
4. The Physics of Vibrations and Waves- H. J .Pain( John Wiley)
5. Optics P. K. Chakraborty.
6. Principles of Optics-Max Born and Emil Wolf (Pergamon Press)
7. The Physics of Waves and Oscillations-N. K. Bajaj (Mc Graw Hill)


**LAB: Credit-1**

**(Minimum 5 experiments are to be done)**

1. To determine the frequency of an electric tuning fork by Melde' s experiment and verify 2-T law.
2. To plot the I-D curve and to determine the refractive index of a prism
3. To determine refractive index of the Material of a prism using sodium source.
4. To determine the dispersive power and Cauchy constants of the material of a prism using mercury source.
5. To determine wavelength of sodium light using Newton' s Rings.
6. To determine wavelength of (1) Na source and (2) spectral lines of Hgsource using plane diffraction grating.
7. To determine dispersive power and resolving power of a plane diffraction grating.

**Reference Books:**


1. Advanced Practical Physics for students, B.L. Flint and H.T. Worsnop, 1971, Asia Publishing House
2. A Text Book of Practical Physics, I. Prakash and Ramakrishna, 11th Ed., 2011, Kitab Mahal
3. Advanced level Physics Practicals, Michael Nelson and Jon M. Ogborn, 4th Edition, reprinted 1985, Heinemann Educational Publishers
4. A Laboratory Manual of Physics for undergraduate classes, D. P. Khandelwal, 1985, Vani


## SEMESTER- IV

## ANALOG SYSTEMS: 3 Credits

**Core-III** ***(4 Credit, Theory: 45hrs, 1 Credit, Practical: 30hrs)***

CO-1: Basic understanding of semiconductor diodes, devices and their applications.

CO-2 : To Understand the basic concepts in transistors and amplifiers.

CO-3: To Understand the concept of coupled amplifier and its application in feedback circuit.

CO-4: To Understand the concepts of operational amplifier and its application. CO-5:
To Apply the acquired knowledge of electronic circuits in Experiments.

**UNIT-1**

**Semiconductor Diodes:** P and N type semiconductors, energy level diagram, conductivity and Mobility,

Concept of Drift velocity, PN junction fabrication (simple idea), Barrier formation in PN Junction Diode, Static and Dynamic Resistance, Current flow mechanism in Forward and Reverse Biased Diode, Drift velocity, derivation for Barrier Potential, Barrier Width and current Step Junction.

**Two terminal device and their applications:** (1) Rectifier Diode: Half-wave Rectifiers. center- tapped and bridge type Full-wave Rectifiers, Calculation of Ripple Factor and Rectification Efficiency, L and C Filters (2) Zener Diode and Voltage Regulation, Principle and structure of LEDS,

(3) Photo diode (3) Solar Cell.

**UNIT II**

**Bipolar Junction Transistors:** n-p-n and p-n-p transistors, Characteristics of CB, CE and CC Configurations, Current gains a and b, Relation between a and b, Load line analysis of Transistors,

DC Load line and Q-point, Physical mechanism of current flow, Active, Cut-off and Saturation Regions.

**Transistors Biasing:** Transistor Biasing and Stabilization circuits, Fixed Bias and Voltage Divider Bias.

**Amplifiers:** Transistors as 2-port network h-parameter Equivalent Circuit, Analysis of a single stage CE amplifier using Hybrid Model, Input and Output impedance, Current, Voltage and Power Gains.

**UNIT-III**

**Classification of class A, B and C amplifiers, Push-pull amplifier (class B)**

**Coupled Amplifier:** RC-coupled amplifier and its frequency response.

**Feedback in Amplifiers:** Effect of Positive and Negative Feedback on In- put Impedance, Output Impedance, Gain Stability, Distortion and Noise. Sinusoidal Oscillations: Barkhausens criterian for self-sustained oscillations. RC Phase shift oscillator, determination of Frequency, Hartley and Colpitts oscillators.

**UNIT-IV**

**Operational Amplifiers (Black Box approach):** Characteristics of an Ideal and Practical OP-AMP (IC741). Open-loop and Closed Loop Gain. Frequency Response. CMRR, Slew Rate and concept of virtual ground.

**Applications of Op-Amps:** (1) Inverting and non-inverting amplifiers (2) Adder (3) Subtractor (4) Differentiator, (5) Integrator (6) Log amplifier, (7) Zero crossing detector (8) Wein bridgeoscillator.

**Text Books:**


1. Foundations of Electronics-Raskhit and Chattopadhyay (New age International Publication)
2. Concept of Electronics- D. C.Tayal ( Himalay Publication)
3. **Reference Books:**
    1. Electronic devices and circuits R. L. Boylstad(PearsonIndia)
    2. Electronic Principles- A.P.Malvino (Tata McGrawHill)
    3. Principles of Electronics- V. K. Mehta and Rohit Mehta (S. Chand Pub- lication)
    4. OP-Amps and Linear Integrated Circuit-R. A. Gayakwad (PrenticeHall)
    5. Physics of Semiconductor devices, DonaldANeamen(PrenticeHall)
    6. Analog System and Application: Gupta Kumar, Pragati Prakashan

**LAB: Credit-1**

**(Minimum 5 experiments are to be done)**

1. To study the V-I characteristics of a Zener diode and its use as voltage regulator.
2. Study of V-I and power curves of solar cells, and find maximum power point and efficiency.
3. To study the characteristics of a Bipolar Junction Transistor in CE configuration.
4. T o study the various biasing configurations of BJT for normal class A operation.
5. T o study the frequency response of voltage gain of a RC-coupled transistor amplifier.
6. To design a Wien bridge oscillator for given frequency using a non-amp.
7. To design a phase shift oscillator of given specifications using BJT.
8. To study the Colpitt's oscillator.

**Reference Books:**


1. Modern Digital Electronics, R.P. Jain, 4th Edition, 2010, Tata McGraw Hill.
2. Basic Electronics: A text lab manual, P.B. Zbar, A.P. Malvino, M.A. Miller, 1994, Mc Graw Hill.
3. Microprocessor Architecture Programming and applications with 8085, R.S. Goankar, 2002, Prentice Hall.
4. Microprocessor 8085: Architecture, Programming and interfacing, A. Wadhwa, 2010, PHI Learning.


## SEMESTER- VII

**DIGITAL SYSTEM: 3 Credits**

**Core-II**

CO-1: To Understand IC's and scales of Integration, Digital Circuits and their realization, Applications

CO-2: Build strong knowledge about Boolean Algebra, Truth tables, Equivalent Circuits, Theory and application of CRO.

CO-3: Gain a clear understanding of Data processing circuits, Arithmetic Circuits, different types of Timers: IC 555

CO-4: To Explain the knowledge of computer organization, Shift registers and counters.

CO-5: To Apply the acquired knowledge to realize various types of circuits in experiment

**UNIT-I**

**Integrated Circuits (Qualitative treatment only):** Active and Passive Components, Discrete components, Wafer Chip, Advantages and Drawbacks of ICs, Scale of Integration: SSI, MSI, LSI and VLSI (basic idea and definitions only), Classification of ICs, Examples of Linear and Digital ICs.

**Digital Circuits:** Difference between Analog and Digital Circuits, Binary Numbers, Decimal to Binary and Binary to Decimal Conversation, BCD, Octal and Hexadecimal numbers, AND, OR and NOT. Gates (realization using Diodes and Transistor), NAND and NOR Gates as Universal Gates, XOR and XNOR Gates and application as Parity Checkers.

**UNIT-II**

**Boolean algebra:** De Morgan's Theorems: Boolean Laws, Simplification of Logic Circuit using Boolean Algebra, Fundamental Products, Idea of Minterms and Maxterms, Conversion of truth table into Karnaugh Map and SOP and POS simplification. Universal logic implementation (NAND & NOR).

**UNIT-III**

**Data Processing Circuits:** Basic Idea of Multiplexers, De-multiplexers, Decoders, Encoders. **Arithmetic Circuits:** Binary Addition. Binary Subtraction using 2*s* complement. Half and Full Adders. Half and Full Subtractors, 4 bit binary Adder/Subtractor.

**Timers: IC 555:** block diagram and application is Astable multivibrator and Monostable multi vibrator.

**UNIT-IV**

**Introduction to Computer Organization:** Input/output Devices, Data storage (idea of RAM and ROM), Computer memory, Memory organization and addressing, Memory Interfacing, Memory Map.

**Shift registers:** Serial-in-serial-out, Serial-in-Parallel-out, Parallel-in-Serial- out and Parallel- in-Parallel-out. Shift Registers (only up to 4 bits)

**Counters (4 bits):** Ring Counter, Asynchronous counters, Decade Counter. Synchronous Counter.

**Text Books:**


1. Digital Circuits and Logic design: Samuel C. Lee(PrinticeHall)
2. Digital Principles and Applications -A.P. Malvino, D.P. Leach and Saha(Tata Mc Graw)


**Reference Books** *:*


1. The Art of Electronics by Paul Horowitz and Wilfield Hill, Cambridge University
2. Electronics by Allan R. Hambley Prentice Hall
3. Principles of Electronics V.K.Mehta and Rohit Mehta (S.Chand Publishing)
4. Digital Logic and Computer design M. Morris Mano (Pearson)
5. Concepts of Electronics D. C. Tayal ( Himalaya Publishing house)
6. Digital System and Application, Gupta Kumar, Pragati Prakashan


**LAB: Credit-1**

**(Minimum 6 experiments are to be done)**

1. To measure (a) Voltage, and (b) Time period of a periodic waveform using CRO and to test a Diode and Transistor using a Millimeter.
2. To design a switch (NOT gate) using a transistor.
3. To verify and design AND, OR, NOT and XOR gates using NAN Dgates.
4. Half Adder, Full Adder and 4-bit binary Adder.
5. Half Subtractor, Full Subtractor, Adder-Subtractor using Full AdderI.C.
6. To build Flip-Flop (RS, Clocked-RS, D-type and JK) circuits using NAND gates.
7. To design an astable multivibrator of given specifications using 555Timer.
8. To design a monostable multivibrator of given specifications using 555 Timer.

**Reference Books:**


1. Basic Electronics: A Text Books lab manual, P.B. Zbar, A.P. Malvino, M.A. Miller, 1994, Mc-Graw Hill.
2. OP-Amps and Linear Integrated Circuit, R. A. Gayakwad, 4th edition, 2000, Prentice Hall.
3. Electronic Principle, Albert Malvino, 2008, Tata Mc-Graw Hill.
   Electronic Devices and circuit Theory, R.L. Boylestad and L.D. Nashelsky,2009, Pearson


**Core-III** **SEMESTER – VI**

**ELECTROMAGNETIC THEORY: 3 Credits**

**(4 Credit, Theory: 45hrs, 1 Credit, Practical: 30h**

CO-1: Physical significance of Maxwell Equation and its application to free space, Lorentzand Coulomb gauge transformation, poynting theorem, concept of energy density.

CO-2: Analysis of Maxwell's equations in different media and Physical significance ofrelaxationtime, skin depth, Electrical conductivity of ionized gases, plasma frequency.

CO-3: Basic understanding of polarization of EM wave, and different types of crystals, PhaseRetardation Plates and Rotatory Polarization.

CO-4: Conceptual understanding of EMW application in bounded media, plane interface,dielectricmedia, Brewster's law, TIR, Evanescent wave, metallic reflection.

CO-5 :To Apply the acquired knowledge for visualize basic concept of phenomenon oflightin various experiments

**UNIT-I**

**Maxwell Equations:** Maxwells equations, Displacement Current, Vector and Scalar Potentials, Gauge Transformations: Lorentz and Coulomb Gauge, Wave Equations, Plane Waves in free space and characteristics, Poynting Theorem and Poynting Vector, Electromagnetic (EM) Energy Density, Physical Concept of Electromagnetic Field Energy Density.

**UNIT-II**

**EM Wave Propagation in Unbounded Media:** Plane EM waves through vacuum and isotropic dielectric medium, transverse nature of plane EM waves, refractive index and dielectric constant, wave impedance, Propagation through conducting media, relaxation time,skin depth, Electrical conductivity of ionized gases, plasma frequency, refractive index, skin depth, application to propagation through ionosphere.

**UNIT-III**

**Polarization of Electromagnetic Waves:** Description of Linear, Circular and Elliptical Polarization, uniaxial and biaxial crystals, light propagation in uniaxial crystal, double refr action, polarization by double refraction, Nicol Prism, Ordinary and extraordinary refractive indices,Production and detection of Plane, Circularly and Elliptically polarized light,

**Phase Retardation Plates:** Quarter-Wave and Half- Wave Plates. Babinets Compensator and its Uses, Analysis of Polarized Light.

**Rotatory Polarization:** Optical Rotation, Biots Laws for Rotatory Polarization, Fresnels Theoryof optical rotation, Calculation of angle of rotation, Experimental verification of Fresnels theory, Specific rotation, Laurents half- shade polarimeter.

**UNIT IV**

**EM Wave in Bounded Media:** Boundary conditions at a plane interface between two media, Reflection and Refraction of plane waves at plane interface between two dielectric media, Laws of Reflection and Refraction, Fresnel's Formulae for perpendicular and parallel polarization cases, Brewster'slaw, Reflection and Transmission coefficients, Total internal reflection, evanescent waves, Metallic reflection (normal Incidence)

**Text Books:**


1. Introduction to Electrodynamics, D.J. Griffiths ( Pearson)
2. Principles of Optics-Max Born and E.Wolf.


**Reference Books:**


1. Classical Electrodynamics by J.D.Jackson.
2. Foundation of electromagnetic theory: Ritz and Milford(Pearson).
3. Electricity and Magnetism : D C Tayal (Himalaya Publication)
4. Optics: A.K.Ghatak

5. Electricity and Magnetism : Chattopadhyaya, Rakhit (NewCentral)
6. Electromagnetic Theory, Gupta and Kumar, Pragati Prakashan

## LAB: Credit-1

**Minimum 4 experiments are to be done**

1. To verify the law of Malus for plane polarized light.
2. To determine the specific rotation of sugar solution using Polarimeter.
3. To analyze elliptically polarized Light by using a Babinets compensator.
4. . To determine the refractive index of liquid by total internalreflection usingWollastons air-film.
5. To determine the refractive Index of (1) glass and (2) a liquid by total internalreflection using a Gaussian eyepiece.
6. To study the polarization of light by reflection and determine the polarizing anglefor air-glass interface.
7. To verify the Stefan's law of radiation and to determine Stefan's constant.
8. To determine the Boltzmann constant using V-I characteristics of PN junctiondiode.

**Reference Books:**


1. Advanced Practical Physics for students, B.L. Flint and H.T. Worsnop, 1971,Asia Publishing House.
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