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B Sc Physics - Template

SCHEME OF INSTRUCTIONS

UNDER CBCS (W.e.f 2023-24 academic year onwards)

Year	Semester	Course Type	Course Title	Instructions Hrs./week	Marks	Credits
I Year	I	Theory	Mechanics	4	100	4
		Practical	Mechanics Lab	3	25	1
	II	Theory	Thermal Physics	4	100	4
		Practical	Thermal Physics Lab	3	25	1
II Year	III	Theory	Electromagnetic Theory	4	100	4
		Practical	Electromagnetic Theory Lab	3	25	1
		SEC	SEC 1 Experimental methods and error analysis Or SEC 2 Basic Instrumentation	2	50	2
	IV	Theory	Waves and Optics	4	100	4
		Practical	Waves and Optics Lab	3	25	1
		SEC	SEC 1 Electrical Circuit Networking Or SEC 2 PSPICE Or SEC 3 Biomedical Instrumentation	2	50	2
III Year	V	Theory	A: Modern Physics (OR) B: Computational Physics	4	100	4
		Practical	A: Modern Physics Lab (OR) B: Computational Physics Lab	3	25	1
		GE	Renewable Energy and Energy Harvesting	4	100	4
	VI	Theory	A: Electronics (OR) B : Applied Optics	4	100	4
		Practical	A: Electronics Lab(OR) B: Applied Optics Lab	3	25	1
		Optional Paper	Nano Science	4	100	4
Total Credits				**42**		
Value Added Course				**2**		

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B Sc I Year Physics
W.e.f the academic year: 2020-21

Semester I Course Name: **Mechanics** Course Code: **PH123** (60 Hours)

HPW: 4 **CREDITS: 4**

Course Objectives: *This course is designed to*

COB1: *illustrate applications of vector differentiation, integration*

COB2: *describe motion associated with variable mass system and rigid bodies.*

COB3: *interpret the laws of planetary motion*

COB4: *infer the concept of relativity.*

Unit – I **15 Hours**

Vector Analysis

Scalar and vector fields, gradient of a scalar field and its physical significance. Divergence and Curl of a vector field and related problems. Vector integration- line, surface and volume integrals. Stokes, Gauss, and Green's theorems – simple applications.

Unit – II **15 Hours**

Motion of variable mass system

Laws of Motion-Motion of variable mass system, motion of a rocket, multi- stage rocket, conservation of energy and momentum.

Mechanics of rigid bodies

Definition of Rigid body. Rotational kinematic relations, equation of motion for a rotating body, angular momentum and inertia tensor. Euler's equations, torque free motion of a symmetric top. Symmetric top and processional motion, Gyroscope.

Unit – III **15 Hours**

Central forces

Central forces – definition and examples, conservative nature of central forces, force as a negative gradient of potential energy, center of mass of many body system, two body problem, equation of motion under a central force, gravitation potential and gravitational field, Kepler's Laws-Derivation,

Unit – IV **15 Hours**

Frames of reference and transformation

Frames of reference- inertial and non-inertial, Galilean transformation equations, Galilean Invariance, absolute frame of reference, Michelson – Morley experiment- significance of negative result.

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Consequences of relativistic transformations
Postulates of special theory of relativity, Lorentz transformation, time dilation, length contraction, addition of velocities, mass – energy relation. Concept of four vector formalism and their transformations.

Note: Problems should be solved at the end of every chapter of all the units.

Course Outcomes: *By the end of this course, the student will be able to*

CO1: use the concepts of vector differentiation, integration and remember impact of variation of mass in motion.

CO2: remember various types of rigid body motion.

CO3: outline concepts of central forces.

CO4: outline the concept of relativity.

Text books:

1. First year Physics – *Telugu Academy*
2. Mechanics, D S Mathur, S Chand and company Limited,
3. Mechanics of Particles, Waves and Oscillations. Anwar Kamal, *New Age International*
4. Mechanics of Particles, Waves and Oscillations. Dr S L Gupta and Sanjeev Gupta, *Jai Prakash Nath Publications*
5. Mechanics by H S Hans and S P Puri, *Tata-McGraw Hill Company Edition, 2008.*
6. College Physics – I. T. Bhimasankaram and G. Prasad *Himalaya Publishing House.*

Reference Books:

1. Fundamentals of Physics. Halliday/Resnick/Walker *Wiley India Edition 2007.*
2. Berkeley Physics Course Vol.1, Mechanics by C. Kittel, M.A. Ruderman – *Tata McGraw hill Company Edition 2008.*
3. University Physics by Young and Freeman, *Pearson Edition, Edition 2005.*
4. Sears and Zemansky's University Physics by Hugh D. Young, Roger A. *Freedman Pearson Education Eleventh Edition.*
5. An Introduction to Mechanics by Daniel Kleppner & Robert Kolenkow. *The McGrawHill Companies.*
6. Engineering Physics. R.K. Gaur & S.L. Gupta. *Dhanpat Rai Publications.*

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Semester I Course Name: **Mechanics Lab** Course Code: **PH123P**

HPW: 3 (45 Hours – 15 sessions) **CREDITS: 1**

Course Objectives: *This course is designed to*

COB1: *be able to determine moment of inertia and elastic constants.*

COB2: *study flow of liquids through capillaries and understand capillary rise*

Experiments:

1. Determination of Moment of Inertia of rectangular lamina and verification of perpendicular axes theorem using Bifilar suspension.
2. Calculate young modulus and rigidity modulus using oscillations of a mass under different combination of springs.
3. 'Y' by uniform Bending (or) Non- uniform Bending.
4. Moment of inertia of a fly wheel.
5. Measurement of rigidity modulus using Torsional Pendulum.
6. Determination of Surface Tension of a liquid using capillary rise.
7. Study of flow of liquids through capillaries-measurement of coefficient of viscosity.
8. Determination of g and k from the study of oscillations of compound pendulum.

Course Outcomes: *By the end of this course, the student will be able to*

CO1: *acquire skill to determine moment of inertia and elastic constants.*

CO2: *adapt the methods of measurement of surface tension and coefficient of viscosity*

Recommended Books:

1. B.Sc Practical Physics by C L Arora, *S.Chand & Company Ltd.*
2. B.Sc Practical Physics by Harnam Singh Dr P S Hemne *S.Chand & Company Ltd.*
3. Advanced Practical Physics for Students, B L Flint and H T Worsnop
4. Theory of Machines by R S Khurmi and J K Gupta, *S.Chand & Company Ltd.*
5. Introduction to Physics for Scientists and Engineers. F.J Ruche. *McGraw Hill.*
6. A Text Book of Practical Physics, Indu Prakash & Ramakrishna, Kitab Mahal, New Delhi
7. Measurement, Instrumentation and Experiment Design in Physics and Engineering by Michael Sayer, Abhai Mansingh, PHI Publishers.

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B Sc I Year Physics
W.e.f the academic year: 2020-21

Semester II Course Name: **Thermal Physics** **Course Code: PH223** (60 Hours)

HPW: 4 **CREDITS: 4**

Course Objectives: *This course is designed to*

COB1: define the Laws of Thermodynamics

COB2: relate Laws of Thermodynamics in various applications

COB3: discuss various laws of Black body radiations and its applications

COB4: understand the phenomenon of kinetic theory of gases and statistical mechanics

Unit I **15 hours**

Thermodynamics

Basics of thermodynamics- Isothermal and Adiabatic processes – Work done and relation between the specific heats. Reversible and Irreversible processes. Carnot's Engine and its efficiency. Kelvin's and Claussius statements, Thermodynamic scale of temperature.

Entropy

Physical significance. Change in entropy in reversible and irreversible processes, Entropy and disorder, Entropy of Universe, Temperature-Entropy (T-S) diagram. Change of entropy of a perfect gas and change of entropy when ice changes into steam.

Unit II **15 hours**

Thermodynamic potentials and Maxwell's equations

Thermodynamic Potentials: Definitions, properties and applications. First and Second order Phase Transitions. Derivation of Maxwell's thermodynamic Relations and their applications, Maxwell's Relations: (1) Clausius-Clapeyron's equation (2) Value of C_p-C_v (3) TdS Equations. Joule Kelvin effect: Expression for Joule Kelvin coefficient for perfect and Vander Waal's gas.

Low temperature Physics

Methods of production of low temperatures: Joule Thomson's porous plug experiment. Distinction between Joule's, Adiabatic and Joule Thomson's Expansion processes. Liquification of gases: liquification of Hydrogen and Helium. Adiabatic Demagnetization. Principle of Refrigeration, Vapor Compression Machine.

Unit III **15 hours**

Radiation Laws

Black body: Ferry's black body, distribution of energy in the spectrum of Black body. Stefan's law, Wien's displacement law (qualitative), Wien's law and Rayleigh-Jean's law. Quantum theory of Radiation: Planck's law, deduction of Wien's law, Rayleigh-Jeans law and Stefan's law from Planck's law.

Measurement of Radiation

Pyrometers: Types of pyrometers. Disappearing filament optical pyrometer. Angstrom Pyro heliometer and determination of solar constant. Estimation of temperature of Sun.

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Unit IV **15 hours**

Kinetic theory of gases

Elements of Kinetic theory of gases: Mean free path and degrees of freedom. Law of Equipartition of energy and its application to specific heat of mono and diatomic gases. Equation of State: Ideal and Vander waal's gases. Distribution of velocities: Derivation of Maxwell's law of distribution of speeds in ideal gas and its experimental verification. Speed distribution curves. Transport phenomena: Viscosity, Thermal conduction and diffusion.

Statistical Mechanics

Introduction to Statistical Mechanics: Concept of ensembles and phase space. Concept of probability: Probability distribution and Statistical equilibrium. Maxwell Boltzmann's distribution law: Molecular energies in ideal gas. Quantum statistics: Bose Einstein's Distribution law and Fermi Dirac distribution law. Comparison of three statistics.

Course Outcomes: ***By the end of this course, the student will be able to***

CO1: *recognize the importance of the Laws of Thermodynamics*

CO2: *apply the concepts of Maxwell's relations in various applications*

CO3: *understand the Laws of Radiation*

CO4: *differentiate between Transport phenomenon, classical – quantum statistics*

Textbooks:

1. Second Year Physics, *Telugu Academy.*
2. Heat and Thermodynamics, Brijlal and Subrahamanyam (*S.Chand*)
3. Heat and Thermodynamics, D.S. Mathur *S.Chand & Company Ltd.*
4. Heat and Thermodynamics, Mark W Zemansky, *The McGraw-Hill companies*
5. Thermodynamics, R.C. Srivastava, Subit K. Saha & Abhay K. *Jain Eastern Economy Edition.*
6. Fundamentals of Physics, Halliday/Resnick/Walker.*C. Wiley India Edition 2007.*

Reference Books:

1. Statistical Physics, F. Reif. *The McGraw- Hill Companies.*
2. University Physics, Young and Freeman, *Pearson Edition, Edition 2005.*
3. Engineering Physics, Uma Mukherji, *Narosa Publishing house.*
4. Feynman's Lectures on PhysicsVol. 1,2,3 & 4. *Narosa Publications.*
5. Modern Engineering Physics, A.S. Vasudeva. *S.Chand & Co. Publications.*

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Semester II Course Name: **Thermal Physics Lab** **Course Code: PH223P**
(45 hours -15 sessions)

HPW: 3 **CREDITS: 1**

***Course Objectives:* This course is designed to**

COB1: enhance the ability to determine thermal conductivity, specific heat and heating efficiency.

COB2: analyze discrepancy in practical and experimental observations and results in comparison to theory

1. Measurement of Stefan's constant.
2. Specific heat of a liquid by applying Newton's law of cooling correction.
3. Coefficient of thermal conductivity of a bad conductor by Lee's method.
4. Heating efficiency of electrical kettle with varying voltages.
5. Thermistor characteristics-Resistance thermometry.
6. To study the variation of thermo emf across two junctions of a thermocouple with temperature.
7. Measurement of Curie temperature by study of variation in resistance/capacitance/magnetic phase change with temperature.
8. Specific heat capacity of solids
9. Cooling curve of a metallic body

***Course Outcomes:* By the end of this course, the student will be able to**

CO1: acquire skill to determine thermal conductivity, specific heat heating efficiency.

CO2: adapt the comparative studies and understand discrepancy in practical and experimental observations

Recommended Books:

1. A laboratory manual for undergraduate classes, D.P. Khandelwal, *Vani Publishing House, New Delhi.*
2. B.Sc Practical Physics, C L Arora, *S. Chand & Company Ltd.*
3. B.Sc Practical Physics, Harnam Singh, Dr P S Hemne, *S.Chand & Company Ltd.*

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B Sc II Year PHYSICS

(To be implemented for students admitted from2020-21 onwards)

Semester III Course Name: Electromagnetic Theory Course Code: PH323 (60 Hours)

HPW: 4 **CREDITS: 4**

Course Objective: *The aim of this course is designed to*

COB1: infer the concepts of Electrostatics.

COB2: interpret the concepts of Magnetostatics.

COB3: understand the concepts of Electromagnetic induction and properties of electromagnetic waves

COB4: analyze phase relation between current and voltage in R, L, C & their combinations and the implications

Unit I (15 hrs)

Electrostatics

Electric field- Concepts of electric field lines and electric flux, Gausslaw (Integral and differential form), application to linear, plane and spherical charge distributions. Conservative nature of electric field, Irrotational field. Electricpotential- Concepts of electricpotentialrelation between electricpotential and electric field, potential energy of a system of charges. Energy density in an electric field. Calculation of potential from electric field for a spherical charge distribution

Unit II (15 hrs)

Magnetostatics:

Concept of magnetic field and magnetic flux, Biot–Savart's law, magnetic field induction (B) due to a straight current carrying conductor, Force on a point charge in a magnetic field. Properties of magnetic field induction B, curl and divergence of B, solenoid field. Integral form of Ampere's Law, Applications of Ampere's Law, field due to straight, circular and solenoidal currents. Energy stored in magnetic field. Magnetic energy in terms of current and inductance. Magnetic force between two current carrying conductors. Magnetic field Intensity. Ballistic Galvanometer-Torque on current loop in a uniform magnetic field, working principle of B.G., current and charge sensitivity, electromagnetic damping, critical damping resistance

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Unit III (15hrs)

Electromagnetic induction and Electromagnetic waves

Faraday'slawof induction (differential and integral form) –Lenz's law–self and mutualinductance,Continuity equation, modification of Ampere's Law, displacementcurrentMaxwell's equations: Integral and differential form, Maxwell's equations in vacuum and dielectric medium, boundary conditions, Planewave equation, Transversenatureofelectromagneticwaves. velocity of in vacuum and in medium.Poynting theorem.

Unit III (15hrs)

Varying and alternating currents

Growth and decay of current/charge in LR, CR and LCR circuits. Critical damping. Alternating current relation between current and voltage in pure R, C, L, RL, RC and RLC vector diagrams, Power in ac circuits. LCR series and parallel resonant circuit– Q-factor. AC & DC motors-single phase, three phase (basics only).

Course Outcome: *By the end of this course, the student will be able to*

CO1: *become cognizant of basics of Electrostatics*

CO2: *explain various concepts of Magnetism*

CO3: *recognize the importance of EMI*

CO4: *compare phase relation between current and voltage in R, L, C & their combinations*

Semester III Course Name: **Electromagnetic theory Lab** Course Code: **PH323P**

(45 Hours – 15 sessions)

HPW: 2 **CREDITS: 1**

Course Objective: *The aim of this course is designed to*

COB1: *develop hands on experience on electromagnetic related experiments.*

COB2: *provide insights AC response in L C R circuits.*

1. To determine the (a) current sensitivity, (b) charge sensitivity, and (c) Critical Damping Resistance CDR of a B.G.
2. Figure of merit and Voltage sensitivity of a moving coil galvanometer.
3. Conversion of moving coil galvanometer into voltmeter and ammeter.
4. To draw the B-H curve of transformer core and determine magnetic constants & energy loss.
5. To variation of magnetic field in a solenoid with current, number of turns and distanceusingGauss probe.
6. To study the variation of magnetic field with distance along the axis of a circular coil/Solenoid carrying current by Stewart and Gee's method.
7. Determination of frequency AC source using Sonometer.
8. RC circuit-Determination of time constant
9. LCR series circuit-Determination of resonant frequency and Q-factor

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10. LCR parallel circuit-Determination of resonant frequency and Q-factor

Course Outcomes: *By the end of this course, the student will be able to*
COB1: *understand concepts of electromagnetism through electromagnetic related experiments.*
COB2: *infer AC response in L C R circuits.*

Textbooks

1. Third year Physics - *Telugu Akademy*
2. Electricity and Magnetism by D.N. Vasudeva - *S. Chand&Co.*
3. Electricity and Magnetism by A S Mahajan, A. Rangwala - *Tata Mc.Graw-Hill Education.*
4. Electricity and Magnetism by Brijlal and Subramanyam, - *Ratan Prakashan Mandir*
5. Berkeley Physics Course–Vol.II- Electricity and Magnetism by Edward M Purcell - *The McGraw-Hill Companies.*
6. Fundamentals of Electricity and Magnetism by Arthur F. Kip - *McGraw-Hill*, 1968.
7. Electricity and Magnetism by J. H. Fewkes & John Yarwood. Vol. I - *Oxford Univ. Press,* 1991.
8. Introduction to Electrodynamics, 3rd Edition by David J. Griffiths - *Benjamin Cummings,* 1998.
9. Electricity and Magnetism. By D C Tayal - *Himalaya Publishing House*, 1988.
10. Electromagnetics by Joseph A. Edminister 2nd ed.- New Delhi - *Tata McGraw Hill*, 2006.
11. B.Sc Practical Physics by C L Arora - *S. Chand & Company Ltd.*
12. B.Sc Practical Physics by Harnam Singh Dr P S Hemne - *S. Chand & Company Ltd.*
13. Advanced Practical Physics by B. L. Worsnop and H. T. Flint - *Asia Publishing House, New Delhi.*
14. A Text Book of Practical Physics by Indu Prakash and Ramakrishna - *Kitab Mahal*

ReferenceBooks

1. Electricity and Electronics, D.C. Tayal,*Himalaya Publishing House.*
2. Electricity and Magnetism, C.J. Smith, *Edward Arnold Ltd.*
3. Electricity, Magnetism with Electronics, K K Tewari. *S.Chand & Co.*
4. General Physics by Douglass C Giancoli, *Prentice-Hall, Inc, New Jersey.*
5. Introduction to Physics for Scientists and Engineers. F.J Ruche. *McGraw Hill.*

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Skill Enhancement Course

Semester III Course Name: **Experimental Methods and Error Analysis**
Course Code: **SE323** (30 Hours)

HPW: 2 **CREDITS: 2**

Course Objectives: *The course is designed to*

COB1: familiarize basic of errors and their importance in experiments.

COB2: introduce the concepts of statistical analysis of errors and their elimination.

Unit - I **15 Hours**

Experimental methods

Least count of instruments, Instruments for measuring mass, length, time, angle, current, voltages. Fundamental units. Precision and accuracy of measurements, source of error in measurements, necessity of estimating errors, types of errors, reading error of instrument, calibration error, random error, systematic error, significant digits, order of magnitude and rounding of numbers, rounding error, absolute and relative errors, errors of computation-addition, subtraction, multiplication, division, error in power and roots, Propagation of errors, analysis of data, standard deviation, calculation of mean value.

Unit - II **15 Hours**

Statistical Analysis of errors

Mean, Median, Mode and standard deviation, standard deviation of mean, Least squares fitting, Normal distribution, covariance and correlation, Binomial distribution, passion distribution, chi square test

Course Outcomes: *Upon completion of this course student will be able to*

CO1: implement estimation of errors in measurement of physical quantities.

CO2: apply statistical methods to eliminate errors.

Reference Books:

1. The Theory of errors in physical measurements by J C Pal – *New central book agency-* 2010.
2. Data reduction and error analysis for the physical science by DK Robinson and P R Bevington.

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Skill Enhancement Course

Semester III Course Name: **Basic Instrumentation** Course Code: **SE323A** (30 Hours)

HPW: 2 **CREDITS: 2**

Course Objectives: *The aim of this course is to*
COB1: *enable the students to get familiar to basic electrical instruments.*
COB2: *familiarize signal generators and digital instruments.*

15 Hours

Unit - I

Basics of Measurements

Instruments accuracy, precision, sensitivity resolution range etc. Errors in measurements and loading effects. Multimeter: Principles of measurement of dc voltage and dc current, ac voltage, ac currentand resistance. Specifications of a multimeter and their significance.

Electronic Voltmeter

Advantages over conventional multimeter for voltage measurement with respect to input impedance and sensitivity. Principle of voltage, measurement (block diagram only). Specifications of an electronic Voltmeter/ Multimeter and their significance. AC millivoltmeter: Type of AC millivoltmeters: Amplifier- rectifier and rectifier-Amplifier. Block diagram ac millivoltmeter, specifications and their significance.

Cathode Ray Oscilloscope

Block diagram of basic CRO. Construction and Working of CRT, Electron gun, electrostatic focusing and acceleration, brief discussion on screen phosphor, visual persistence and chemical composition. Time base operation, synchronization, front panel controls of a CRO, specifications of a CRO and their significance
Use of CRO for the measurement of dc and ac voltage, frequency, time period. Special features of dual trace, introduction to digital oscilloscope, probes. Digital storage Oscilloscope: Block diagram and principle of working.

15 Hours

Unit - II

Signal Generators and Analysis Instruments

Block diagram, explanation and specifications of low frequency signal generators, pulse generators, and function generator. Brief idea for testing, sspecifications, Distortion factor meter, wave analysis.

Digital Instruments

Principle and working of digital meters. Comparison of analog and digital instruments. Characteristics of a digital meter. Working principlesof a digital meterDigital Multimeter:

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Block diagram and working of Digital multimeter, Working principles of time interval, frequency and period measurements using universal counter/frequency counter, time-base stability, accuracy and resolution.

Course Outcomes: *Upon completion of this course student will be able to*
CO1: become accustomed to use of basic electrical instruments.
CO2: adapt the use of signal generators and digital instruments.

Reference Books:

1. A text book of Electrical Technology by B L Theraja – *S. Chand & Co.*
2. Performance and design of AC machines by M G Say - *ELBS Edn.*
3. Digital Circuits and systems by Venugopal, 2011 - *Tata Megraw Hill.*
4. Digital Electronics by Subrata Ghoshal, 2012 - *Springer.*
5. Electronic Devices and circuits by S .Salivahanan and N S Kumar, 3rd., 2012 - *Tata Megraw Hill.*
6. Electronic Circuits: Handbook of design and applications by U. Tietze, Ch.Schenik, 2008 - *Springer*
7. Electronic Devices 7/e by Thomas L Floyd, 2008 - *Pearson India*

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B Sc II Year PHYSICS

Semester IV **Course Name: WAVES and OPTICS** **Course Code: PH423** (60 Hours)

HPW: 4

CREDITS: 4

Course Objectives: *The course is designed to*

COB1: explain the fundamental concepts of waves in strings and bars.
COB2: understand the concept of interference.
COB3: infer the concept of diffraction.
COB4: describe methods of polarization and its applications.

Unit I **15 Hours**

Waves -Fundamentals of Waves

Transverse wave propagation along a stretched string, general solution of wave equation and its significance, Expression for velocity, modes of vibration of stretched string clamped at both ends, overtones, energy transport, transverse impedance.

Longitudinal vibrations in bars – wave equation and its general solution. Expression for velocity. Special cases (i) bar fixed at both ends ii) bar fixed at the mid point iii) bar free at both ends iv) bar fixed at one end, free at other end.

Unit – II **15 Hours**

Interference

Principle of superposition: Coherence, temporal and spatial coherence, conditions for Interference of light

Interference by division of wave front: Young's double slit experiment, Theory of interference. Fresnel's Bi-prism: Determination of wave length of light, determination of thickness of a transparent material using Bi-prism. Change of phase on reflection, Lloyd's mirror experiment.

Interference by division of amplitude:

Oblique incidence of a plane wave on a thin film due to reflected and transmitted light (Cosine law), Colors of thin films.Nonreflecting films, interference by a plane parallel film illuminated by a point source. Interference by a film with two non-parallel reflecting surfaces: Wedge shaped film,determination of diameter of wire. Newton's rings in reflected light with and without contact between lens and glass plate, Newton's rings in transmitted light Determination of wave length of monochromatic light. Michelson's Interferometer: Types of fringes, Determination of wavelength of monochromatic light, Difference in wavelength of sodium D1, D2 lines and thickness of a thin transparent plate.

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Unit III

Fraunhoffer diffraction **15 Hours**

Introduction: Distinction between Fresnel and Fraunhoffer diffraction. Fraunhoffer diffraction: Diffraction due to single slit and circular aperture, Limit of resolution. Fraunhoffer diffraction due to double slit, Fraunhoffer diffraction pattern with N slits (diffraction grating). Resolving Power of grating-derivation. Determination of wave length of light in normal and oblique incidence methods by using diffraction grating.

Fresnel diffraction

Fresnel's half period zones, area of the half period zones. zone plate – Comparison of zone plate with convex lens, Phase reversal zone plate. Diffraction at a straight edge. Distinction between interference and diffraction.

Unit – IV

Polarization **15 Hours**

Polarized light: Methods of Polarization, Polarization by reflection, refraction, Double refraction, selective absorption. Scattering of light, Brewster's law, Malus law, Nicol prism: polarizer, analyzer. Refraction of plane wave incident on negative and positive crystals-Huygen's explanation. Quarter wave plate and half wave plate. Babinet's compensator: Optical activity. Laurent's half shade polarimeter-Analysis of light.

Course Outcome: *By the end of the course, the student will be able to*

CO1: apply the concepts of waves in various applications.

CO2: use the acquired information about interference.

CO3: Outline the concept of diffraction.

CO4: get an insight to analyze polarized light.

Semester IV Course Name: **Waves and Optics Lab** Course Code: **PH423P**

(45 Hours – 15 sessions)

HPW: 3 **CREDITS: 1**

Course Objectives: *The aim of this course is designed to*

COB1: develop hands on experience in experiments based on interference, diffraction and polarization.

COB2: provide insights into concepts of waves and oscillation in strings.

1. Determination of refractive index of a glass and liquid (Boys Method).
2. To obtain the Refractive index of the material of the prism by determining the angle of minimum deviation from I-D curve.
3. Determination of dispersive power of a prism.
4. Determination of thickness of a wire-wedge method.
5. Determination of Radius of curvature of a given convex lens- Newton's rings.
6. Determination of wavelength of light using diffraction grating minimum deviation method.
7. Wavelength of light using diffraction grating – normal incidence method.
8. Determination of wavelength of a givenLaser light using diffraction grating.
9. Study of optical rotation using polarimeter.
10. Verification of Laws of a stretched string (Three Laws).
11. Velocity of Transverse wave along a stretched string
12. Determination of frequency of a bar- Melde's experiment

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Course Outcomes: *By the end of this course, the student will be able to*

COB1: understand concepts of interference, diffraction and polarization through related experiments.

COB2: interpret wave in strings.

Textbooks

1. Second Year Physics – *Telugu Akademi*
2. Optics by Ajay Ghatak - *The McGraw-Hill companies.*
3. Optics by Subramanyam and Brijlal - *S. Chand & Co.*
4. Optics and Spectroscopy by R. Murugeshan and Kiruthiga Siva Prasath - *S. Chand & Co.*
5. Fundamentals of Optics by Jenkins A. Francis and White E. Harvey - *McGraw Hill Inc.*
6. Fundamentals of Physics by Halliday, Resnick, Walker.C - *Wiley India Edition* 2007.
7. B.Sc Practical Physics by C L Arora - *S. Chand & Co.*
8. B.Sc Practical Physics by Harnam Singh, Dr P S Hemne - *S. Chand & Co.*
9. B.Sc First year Physics – *Telugu Akademi.*
10. Waves and Oscillations by N. Subramaniyam and Brijlal - *Vikas Publishing House Pvt Ltd.*
11. Waves and Oscillations by S. Badami, V. Balasubramanian and K. Rama Reddy - *Orient Longman.*
12. The Physics of Waves and Oscillations by N K Bajaj – *Tata McGraw Hill Company Edition*, 2008.

Reference Books

1. Optics by Eugene Hecht and A R Ganesan - *Pearson Education India*
2. Understanding optics by M K Sinha - *Tata McGraw Hill Education Pvt. Ltd.*
3. Sears and Zemansky's University Physics by Hugh D. Young, Roger A. Freedman - *Pearson Education Eleventh Edition.*
4. Fundamentals of Physics- An Introduction by Sanat Kumar Chatterjee - *Narosa Publications.*
5. Feynman's Lectures on Physics Vol. 1,2,3 & 4 - *Narosa Publications.*
6. Physics Laboratory Manual by David H Loyd - *Brooks/cole Ceneage Learning.*
7. The Physics of Vibrations and Waves by H. J. Pain - *John Wiley and Sons*
8. Fundamentals of Physics by Alan Giambattista et al - *Tata McGraw Hill Company Edition, 2008.*

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(To be implemented for students admitted from 2020-21 onwards)

Skill Enhancement Course

Semester IV Course Name: **Electrical Circuit Networking**

Course Code: **SE423** (30 Hours)

HPW: 2 **CREDITS: 2**

Course Objectives: *The course is designed to*

COB1: *enable the students to get familiar with basic electrical circuit elements, schematics of electrical drawing, identify current flow and voltage drop.*

COB2: *provide hands on experience to electrical wiring and types of protection to be employed for electrical circuits.*

Unit - I — 15 Hours

Basic Electricity Principles

Voltage, Current, Resistance and Power. Ohms law. Series, parallel and series-parallel combinations. AC Electricity and DC Electricity. Familiarization with multimeter, voltmeter and ammeter.

Understanding Electrical circuits

Electric circuit elements and their combination. Rules to analyse DC sourced electrical circuits. Current andVoltage drop across the DC circuitelements. Single phase and three phase alternating currentsources. Rules to analyse AC sourced electrical circuits. Inductance, capacitance, and impedance. Real, imaginaryand complex power components of Ac source. Power factor, Saving energy and money.

Electrical Drawing and Symbols

Drawing symbols. Blueprints. Reading Schematics. Ladder diagrams. Electrical schematics. Power circuits, control circuits. Reading of circuitschematics. Tracking the connections of elements and identify current flow and voltage drop.

Generators and Transformers

DC power sources. AC/DC generators. Operation of transformers.

Unit - II — 15 Hours

Electrical protection

Relays, Fuses and disconnect switches. Circuit breakers. Overload devices. Ground-fault protection. Grounding and isolating. Phase reversal surge protection. Interfacing DC or AC source to control elements (relay protection device)

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Electrical wiring

Different types of conductors and cable. Basic of wiring- starand delta connection. Voltage drops and losses across cables and conductors. Instruments to measure current, voltage, power in DC and AC circuits. Insulation. Solid and stranded cable. Conduit. Cable trays. Splices: wirenuts, crimps, terminal blocks, split bolts and solder. Preparation of extension board.

Course Outcomes: *Upon completion of this course student will be able to*

CO1: understand basic electrical circuit elements, schematics of electrical drawing, current flow and voltage drop.

CO2: to understand basic electrical wiring and types of protection for electrical circuits.

References Books:

1. A text book of Electrical Technology by B L Theraja - *S Chand & Co.*
2. A text book of Electrical Technology by A K Theraja
3. Performance and design of AC machines by M G Say - *ELBS Edn.*

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Skill Enhancement Course

Semester IV Course Name: **Circuit Simulation using PSPICE**

Course Code: **SE423A** (30 Hours)

HPW: 2 **CREDITS: 2**

Course Objective: *The objective of this course is to*
COB1: familiarize the students with PSpice *simulation package.*

Unit - I **15 Hours**

Introduction to KVL and KCL – applying KVL and KCL to simple D.C Networks. Introduction to PSpice Simulation –opening, saving and closing the Schematic files – Tool bars – Selection of Components, placing the components on the schematic, drawing and labelling wires, series and parallel connections, placing the D.C and A.C sources and ground symbols, setting up analyses, simulation of circuit, viewing results, viewing bias point voltages and currents, showing voltages and currents.

Unit - II **15 Hours**

Analysis – D.C sweep, A.C Sweep and Transient analysis. Simulation of V – I characteristics of a Resistor with D.C source, RC transient and frequency response, RLC series and parallel circuits with A.C source. V – I characteristics of a p – n junction diode – static and dynamic resistance calculations. Digital logic gates – verification of truth tables.

Course Outcome: *Students will learn*
CO1: usage of virtual components and instruments
CO2: to make simulated measurements. They will become proficient in designing and testing simple Digital and Analog circuits.

Recommended Books:

1. Introduction to PSpice using Orcad circuits and Electronics by Mohammad H Rashid – *PHI Learning.*
2. Spice for circuits and Electronics using PSpice by Mohammad H Rashid – *PHI Learning.*

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Skill Enhancement Course

Semester IV Course Name: **BIOMEDICAL INSTRUMENTATION**

Course Code: **SE423B**

(30 Hours)

HPW: 2

CREDITS: 2

Course Objectives: *The aim of this course is designed to*

COB1: describe the physics involved in the function of major body system.

COB2: provide insights into the measurement of biological non-electrical parameters

COB3: understand the acquisition and analysis of electrical parameters associated with major body system.

COB4: understand the imaging modalities and their analysis

Unit – I **15 Hours**

Fundamentals of Biomedical Engineering

Cell and its structure -Resting and Action Potential - Nervous System and its fundamentals - Basic Components of abiomedical System -Cardiovascular System - Respiratory Systems- Kidneyand Blood Flow - Biomechanics of Bone - Biomechanics of Soft Tissues - Basic Mechanics of Spinal Column and Limbs - Physiological Signals and Transducers – Transducers- Selection Criteria – Piezoelectric, Ultrasonic Transducer - Temperature Measurements - Fibre Optic Temperature Sensors.

Non-Electrical Parameters Measurement and Diagnostic Procedures

Measurement of Blood Pressure - Cardiac Output - Heart Rate - Heart Sound - Pulmonary Function Measurements - Spirometer - Photo Plethysmography, Body Plethysmography - Blood Gas Analyzers, pHof Blood - Measurement of Blood pCO_2 pO_2 – Finger-tip Oximeter, ESR, GSR Measurements

Unit - II **15 Hours**

Electrical Parameters Acquisition and Analysis

Electrodes - Limbo Electrodes - Floating Electrodes – Pre-Gelled Disposable Electrodes - Micro Needle and Surface Electrodes -Amplifiers Preamplifiers, Differential Amplifiers, Chopper Amplifier, Isolation Amplifiers ECG-EEG-EMG- ERG- Lead Systems and Recording Methods -Typical Waveforms - Electrical Safety in Medical Environment, Shock Hazards- Leakage Current - Instruments for Checking Safety Parameters of Biomedical Equipment's.

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Imaging Modalities and Analysis

Radiographic and fluoroscopy techniques - Computer tomography – MRI -Ultrasonography - Endoscopy -Thermography - Different types of biotelemetry systems -Retinal imaging - Imaging applications in Biometric systems- Analysis of digital images.

Life Assisting, Therapeutic and Robotic Devices

Pacemakers – Defibrillators – Ventilators – Nerve and muscle stimulators – Diathermy – Heart – Lung machine – Audio meters – Dialysers – Lithotripsy – ICCU patient monitoring system – Nano Robots – Robotic surgery – Advanced 3D surgical techniques – Orthopedic prostheses fixation. Simulations on synthesis and characterization of nano materials

Course Outcomes: *By the end of this course, the student will be able to*

CO1*: infer physics involved in the function of major body system.*

CO2: *be able to measure biological non-electrical parameters*

CO3*: gain knowledge of electrical parameters associated with major body system parameters*

CO3*: comprehend the imaging modalities*

Reference Books:

1. Handbook of Biomedical instrumentation by R. S.Khandpur - *Tata McGraw Hill*
2. Medical Instrumentation Application and Design by J. G. Webster - *John Wiley and Sons*
3. Introduction to Biomedical Equipment Technology by Joseph J Carr, John M. Brown - *Pearson Education, Inc.*

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B Sc III Year Physics
W.e.f the academic year: 2022-23

Semester V Course Name: **Modern Physics (DSE)** Course Code: **PH523A** **(60 hours)**

HPW: 4 **CREDITS: 4**

Course Objectives: *The aim of this course is designed to*

COB1: introduce the concept of dual nature of light and matter leading to the incorporation of particle properties ofmatterinto wave equation and alsoexplain theapplicationof Schrodinger wave equation to evaluate the expectation values

COB2: introduce the basic crystal structures, Diffraction of x-rays by crystals and explain the characteristics of crystals based on the type of bonding

COB3: introduce the nuclear structure and models with an emphasis on Binding energy and explain the process of alpha and beta decay and the working principle of certain counters

COB4: introduce to the students the concept of spin and space quantization leading to a new set of quantum numbers and also explain the possible transitions and motions giving rise to Atomic and molecular spectra

Unit – I: Quantum Mechanics **20 Hours**

Particle properties of wave and Matter waves:

Inadequacy of classical Physics. Photoelectric effect - Einstein's photoelectric equation. Compton's effect - experimental verification.

De- Broglie's hypothesis: Matter waves, properties of matter waves, Phase and Group velocities. Davisson and Germer experiment, double slit experiment. Consequences of de-Broglie theory.

Uncertainty Principle and Wave Mechanics:

Heisenberg's uncertainty principle for position and momentum (x &p_x), Energy and time (E& t); Experimental verifications: Gamma ray microscope, Diffraction by a single slit. Applications: Position of electron in a Bohr's orbit.

Schrodinger time independent and time dependent wave equations. Wave function properties and Significance. Basic postulates of quantum mechanics. Expectation values and Normalization of wave function. Applications: Particle in a box (one dimension)

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Unit - II: Solid State Physics & Crystallography **14 Hours**

Crystal Physics and diffraction:

Amorphous and Crystalline nature of matter. Unit Cell and Space Lattice. Elements of Symmetry. Crystal systems and Bravais lattices. Miller indices. Simple crystal structures: (NaCl and CsCl).

Diffraction of X –rays by crystals: Bragg's law Experimental techniques: Laue's method and powder diffraction method

Bonding in Crystals:

Types of bonding in crystals: Characteristics of crystals with different bonding. Lattice energy of ionic crystals. Determination of Madelung's Constant for NaCl crystal. Determination of Born's repulsive coefficient and repulsive exponent. Born – Haber cycle

Unit - III: Nuclear Physics **12 Hours**

Nuclear Structure: Basic properties of nucleus - size, charge, mass, spin, magnetic dipole moment and electric quadrupole moment. Semi empirical mass formula. Binding energy of nucleus, deuteron binding energy, nuclear forces. Nuclear models- liquid drop model, shell model.

Alpha and Beta Decays: Range of alpha particles, Geiger - Nuttal law. Gammow's theory of alpha decay. Geiger - Nuttal law from Gammow's theory. Beta spectrum - neutrino hypothesis

Particle Detectors: GM counter, proportional counter, scintillation counter

Unit – 1V: Spectroscopy **14 Hours**

Atomic Spectra: Introduction - Drawbacks of Bohr's atomic model - Sommerfeld's orbits -relativistic correction (Qualitative). Stern & Gerlach experiment, Vector atom model. L-S and j-j coupling schemes. Spectral terms, selection rules, intensity rules. Alkali Spectra, doublet fine structure. Zeeman Effect (Classical theory), Paschen-Back Effect and Stark Effect. (Basic idea)

Molecular Spectroscopy: Types of molecular spectra, pure rotational energies and spectrum of diatomic molecule. Determination of inter nuclear distance. Vibrational-electronic energies and spectrum of diatomic molecule. Raman effect, classical theory of Raman effect. Experimental arrangement for Raman effect and its applications.

Course Outcomes: *Having done the course, the student gains sufficient knowledge as to*

CO1: relate the complementary nature of the wave and particle properties of a material particle and evaluate the measurable properties of any given system with a specified potential by applying the Schrödinger's wave equation

CO2: study the dependence of various properties of solids on the structure of the crystal and relate the characteristics of crystals with the type of bonding

CO3: determine the Binding energy of a given nuclei by gaining an insight to nuclear structure and models and interpret Radioactive decay in terms of quantum mechanical tunnelling

CO4: relate the probable interactions between matter and electromagnetic radiation leading to different nuclear reactions

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Textbooks

1. Concepts of Modern Physics by Arthur Beiser - *Tata McGraw-Hill Edition.*
2. Modern Physics by R. Murugeshan and Kiruthiga Siva Prasath - *S. Chand & Co.*
3. Third Year Physics - *Telugu Akademi.*
4. Introduction to Solid State Physics by Charles Kittel - *John Wiley and Sons.*
5. Solid State Physics by SL Gupta & Kumar V- *K Nath & Co.*
6. Molecular Structure and Spectroscopy by G. Aruldhas - *Eastern Economy Edition.*
7. Elements of Solid-State Physics by J.P. Srivastava – *PHI Learning.*
8. Modern Physics by G. Aruldhas & P. Rajagopal - *Eastern Economy Edition.*
9. Nuclear Physics an introduction by S.B. Patil - *Wiley Eastern Limited*
10. Nuclear Physics by D.C. Tayal - *Himalaya Publishing House.*

Reference Books

1. A Text book of Quantum Mechanics by P.M. Mathews & K. Venkatesan, 2nd Ed., 2010 - *McGraw Hill.*
2. Quantum Mechanics by Robert Eisberg and Robert Resnick, 2nd Ed., 2002 - *Wiley.*
3. Quantum Mechanics by Leonard I. Schiff, 3rdEdn. 2010 - *Tata McGraw Hill.*
4. Introduction to Quantum Mechanics by David J. Griffith, 2nd Ed. 2005 - *Pearson Education.*
5. Introduction to Solids by Modern Physics by Leonid V. Azaroff - *Tata McGraw Hill.*
6. Modern Physics by G. Aruldhas & P. Rajagopal - *Eastern Economy Edition.*
7. Fundamentals of Molecular Spectroscopy by C.N. Banwel - *Tata McGraw-Hill Edition.*
8. Nuclear Physics by Irving Kaplan - *Narosa Publishing House.*
9. Nuclear Physics theory and experiment by Roy and Nigam - *New Age Publishers*

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Semester V Course Name: **Modern Physics Lab (DSE)** Course Code: **PH523A P**

(45 Hours – 15 sessions)

HPW: 3 **CREDITS: 1**

Course Objectives: *The aim of this course is designed to make the student to*

COB1: perform the experiment and determine certain universal constants such as Plank's constant, Rydberg's constant and Boltzmann's constant and verify their values

COB2: study the characteristics of GM Counter and identify the radioactive particle

1. Determination of Planck's constant (photocell)
2. Study of photo electric effect: photo current versus wavelength and intensity of incident light
3. e/m of an electron by Thomson method
4. To study the quantum tunnelling effect with solid state device, e.g. tunnel diode
5. Determination of Boltzmann constants using V-I characteristics of junction diode.
6. To determine the magnetic field by Hall-probe method
7. To determine the energy gap of a semiconductor
8. To determine the Rydberg's constant using Hydrogen spectra.
9. To determine the absorption lines in the rotational spectrum of Iodine vapour
10. To determine the ionization potential of mercury
11. Characteristics of G M Counter.
12. Study of absorption of β and γ rays using G M Counter
13. To find the half-life period of a given radioactive substance using a G.M. Counter.
14. To determine the Planck's constant using LEDs of at least 4 different colours.
15. To determine the wavelength of laser source using diffraction of single slit

Course Outcomes: *By the end of the course, the student should*

CO1: determine and verify the values of certain Universal Constants and also study and analyse the underlying Physical phenomena observed

CO2: identify the radioactive particle by studying the characteristics of GM Counter and determine the Half- life periods

Textbooks

1. B.Sc Practical Physics by C L Arora - *S.Chand & Company Ltd.*
2. B. Sc Practical Physics by Harnam Singh and Dr P S Hemne - *S. Chand & Company*
3. A Text Book of Practical Physics by Indu Prakash and Ramakrishna, 11th Ed., 2011 - *Kitab Mahal, New Delhi*

Reference Books

1. Advanced Practical Physics for students by B.L. Flint & H.T. Worsnop, 1971 - *Asia Publishing House.*
2. A laboratory manual for undergraduate classes by D.P. Khandelwal - *Vani Publishing House, New Delhi.*
3. Advanced level Physics Practicals by Michael Nelson and Jon M. Ogborn, 4th Edition, reprinted 1985 - *Heinemann Educational Publishers*

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B Sc III Year PHYSICS

W.e.f the academic year: 2022-23

Semester V Course Name: **Computational Physics** Course Code: **PH523B** **(60 Hours)**
(DSE)

HPW: 4 **CREDITS: 4**

Course Objectives: *This course is designed to*
COB 1: introduce to the students the basicsof C language programming.
COB 2: introduce to the students the concept of numerical methods of analysis
COB 3: explain various types of distribution and methods to obtain solutions
COB 4: introduce to the students the simple concepts of computational methods

Unit I **15 Hours**

Programming in C

Flow charts, algorithms, Integer and floating-point arithmetic, precision, Variable types, Arithmetic statements, Input and Output statements, Control statements, Executable and non-executable statements, arrays, Repetitive and logical structures, Subroutines and functions, Operation with files, Operating Systems, Creation of executable programs.

Unit II **15 Hours**

Numerical Methods of Analysis

Solution of algebraic and transcendental equations, Iterative, Bisection and Newton-Raphson methods, Solution of simultaneous linear equations, Matrix inversion method.

Interpolation

Newton and Lagrange formulae, Numerical differentiation, Numerical integration, Trapezoidal, Simpson and Gaussian Quadrature methods, Least square curve fitting, Straight line and Polynomial fits.

Unit III **15 Hours**

Numerical solution of ordinary differential equations: Euler's and Runge-Kutta methods, Simulation

Generation of uniformly distributed random integers, Statistical tests of randomness. Monte-Carlo evaluation of integrals and error analysis, non-uniform probability distributions, Importance of sampling, Rejection method.

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Unit IV

Computational methods **15 Hours**

Metropolis algorithm, Molecular diffusion and Brownian motions as random walk problems and their Monte Carlo simulation.

Finite element and finite difference methods,boundary value and initial value problems, density functional methods.

Note: Problems should be solved at the end of every chapter of all units

Course Outcomes: *By the completion of this course, students should to*

CO1: *remember the concepts of C language programming*

CO2: *analyze various Numerical methods*

CO3: *distinguish different numerical methods of solutions*

CO4: *understand the concepts of algorithm, Brownian motions etc.*

Recommended Books:

1. Computational methods in Physics and Engineering by Samuel S M Wong - *World Scientific Publishing Company.*
2. Computer Oriented Numerical methods by V. Rajaraman - *PHI learning private limited.*
3. Computer Programming in FORTRAN77 by V. Rajaraman - *PHI learning private limited.*
4. Applied Numerical Analysis by Curtis F. Gerald, Patrick O. Wheatley, Addison - *Wesley Publishing Company.*
5. A Guide to Monte Carlo Simulations in Statistical Physics by Landau D. & Binder - *Cambridge University Press.*

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Semester V Course Name: **Computational Physics Lab** Course Code: **PH523B P**

(DSE)

(45 Hours – 15 sessions)

HPW: 3 **CREDIT: 1**

Course Objectives: *This course is designed to*

COB1: *interpret various numerical techniques; hence augment reasoning and analytical abilities.*

COB2: *apply numerical techniques in understanding theoretical concepts*

1. Jacobi Method of Matrix diagonalization
2. Solution of Transcendental or Polynomial equations by the Newton Raphson method
3. Linear curve fitting and calculation of linear correlation coefficients
4. Matrix Simulation: Subtraction and Multiplication.
5. Matrix Inversion and solution of simultaneous equations
6. Lagrange interpolation based on given input data
7. Numerical integration using the Simpson's method.
8. Numerical integration using the Gaussian Quadrature method.
9. Solution of first order Differential Equation using Runge-Kutta method.
10. Numerical first order differentiation of a given function.
11. Fast Fourier transform
12. Monte Carlo Integration
13. Use of a package for data generation and graph plotting.
14. Test of Randomness for random numbers generators.

Course Outcomes: *By the end of this course, the student will be able to*

CO1: *acquire skill of interpreting various numerical techniques.*

CO2: *perceive numerical techniques in understanding theoretical concepts*

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B Sc III Year PHYSICS

W.e.f the academic year: 2022-23

Semester V Course Name: **Renewable Energy and Energy Harvesting**
Course Code: **GE523** (60 Hours)

Generic Elective

HPW: 4 **CREDITS: 4**

Course Objectives: The course is designed to
COB1: bring awareness regarding the necessity of alternate energy sources.
COB2: impart knowledge about wind and bio-mass energy.
COB3: introduce concepts of solar energy and its applications
COB4: divulge fundamentals of thermal and ocean energy

Unit - I **10 Hours**

Non-renewable energy and renewableenergy resources

Non-renewable energy resources-Principles of power generation and transmission. A model of conventional thermal power plant. Advantages of conventional power plants.Fossilfuelsandnuclearenergy,their limitation. Introduction to non-conventionalenergysources.

HydroEnergy: Hydropowerresources,hydropowertechnologies,environmentalimpact ofhydro power sources.

Unit - II **15 Hours**

Wind and Bio mass Energy

WindEnergy harvesting: FundamentalsofWindenergy,WindTurbinesanddifferent electrical machines in wind turbines, Power in wind, electronic interfaces,and grid interconnection topologies.

Principles of Bio Conversion, Energy from waste, types of bio-gas digesters, gas yield, combustion characteristics of bio-gas, utilization for cooking, LPG, and CNG

Unit - III **20 Hours**

Solar energy storage and its Applications

Solar energy: Solarenergy,itsimportance,storageofsolarenergy,solarpond,non-convectivesolar pond,applications ofsolar pondand solarenergy, solarwater heater,

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flat platecollector,solardistillation,solarcooker,solargreenhouses,solarcell,absorption airconditioning.Needandcharacteristicsofphotovoltaic(PV)systems,PVmodelsand equivalent circuits, and sun trackingsystems. Simulations on solar thermal systems.

Unit - IV **15 Hours**

Geothermal and ocean Energy

Resources, types of wells, methods of harnessing the energy, potential in India. OTEC, principles of utilization, setting of OTEC plants, thermodynamic cycles. Tidal and wave energy, Potential and conversion techniques, mini-hydel power plants, land and their economics.

Carboncaptured technologies, cell, batteries, power consumption, Environmentalissues and Renewablesources of energy, sustainability.

Course Outcomes: *By the completion of this course, students should*

CO1: understand necessity of alternate energy sources and conservation of conventional energy.

CO2: impart knowledge about wind and bio-mass energy

CO3: know importance of solar energy and its applications

CO4: outline importance of usage of thermal and ocean energy

ReferenceB ooks:

1. Non-conventional energy sources by B.H. Khan – *McGraw Hill*
2. Solar energy by Suhas P Sukhative - *Tata McGraw -Hill Publishing Company Ltd.*
3. Renewable Energy - Power for a sustainable future by GodfreyBoyle. 3rd Edn. - 2012,*Oxford UniversityPress.*
4. Solar Energy: Resource Assesment Handbook by P Jayakumar, 2009
5. Photovoltaics by J. Balfour, M.Shaw and S. Jarosek. Lawrence J Goodrich (USA).

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B Sc III Year PHYSICS

W.e.f the academic year: 2022-23

Semester VI Course Name: **Electronics (DSE)** Course Code: **PH 623A** (60hours)

HPW: 4 **CREDITS: 4**

Course Objectives: *This course is designed to*

COB1: introduce the concepts of classification of Band theory of solids.

COB2: explain the working principles, characteristics of BJT, FET, UJT and SCR and its applications.

COB3: distinguish the conversion methods of various number systems & perform different binary arithmetic operations

COB4: examine the operations of various Logic gates and Combinational circuits

Unit - I **15 Hours**

Band theory of Solids

Energy bands in Solids (band theory), valence band, conduction band and forbidden energy gap in solids, insulators, Semiconductors - intrinsic semiconductors and extrinsic semiconductors (n-type, p-type), Fermi level, continuity equation.

Diodes

p-n junction diode, Half wave, Full wave rectifiers and Bridge rectifier. Characteristics of Zener diode and its application as voltage regulator.

Unit - II **15 Hours**

Transistors

PNP and NPN transistors, current components in transistors (Two port model), CB, CE and CC configurations, Transistor as an amplifier, RC coupled amplifier- frequency response (Qualitative analysis)

Feedback Concept & Oscillators

Concept of feedback, Concept of Oscillator, Barkhausen's criteria and Phase Shift Oscillator - Expression for frequency of oscillation.

Unit -III **15 Hours**

Electronic devices

Construction, working and characteristics: Photo diode-Shockley diode- Solar cell, Opto-couplers. Field Effect Transistor (FET) – FET as an Amplifier- Uni Junction Transistor (UJT), UJT as a relaxation oscillator- Silicon Controlled Rectifier (SCR) – SCR as a switch.

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Unit – IV

Digital Electronics **15 Hours**

Binary number system: Conversion of Binary to Decimal and vice versa, Binary addition and subtraction (1's and 2's complement methods). Hexadecimal number system. Conversion from Binary to Hexadecimal and vice versa. Decimal to Hexadecimal and vice versa.

Logic gates

OR,AND,NOT gates, truth tables, realization of these gates using discrete components. NAND, NOR as universal gates, Exclusive – OR gate, De Morgan's Laws–Statement and Proof, Half and Full adders.

Course Outcomes: *By the end of the course, the student should*

CO1: learn the basics of band theory of solids

CO2: understand the working principle, applications of Transistors and concepts of feedback.

CO3: be able to comprehend fundamental concepts of FET, UJT and SCR

CO4: apply conversion methods of various number systems & perform different binary arithmetic operations and also apply knowledge of various Logic gates and Combinational circuits in various applications

Textbooks

1. Third year Physics – *Telugu Akademi*
2. Electricity and Electronics by D.C. Tayal - *Himalaya Publishing House.*
3. Electronic devices and circuits by Millman and Halkias - *Mc.Graw-Hill Education.*
4. Principles of Electronics by V K Mehta and Rohit Mehta - *S.Chand & Company Ltd.*
5. Digital Principles & Applications by A.P.Malvino and D.P.Leach - *McGraw Hill Education.*
6. Digital logic and computer design by Morris Mano - *Pearson*

Reference Books

1. Fundamentals of Physics by Halliday, Resnick, Walker - *Wiley India Edition 2007.*
2. Electricity, Magnetism with Electronics by K K Tewari - *.S.Chand & Co.*
3. General Physics by Douglass C Giancoli - *Prentice-Hall, INC, New Jersey.*

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Semester VI Course Name: **Electronics Lab** Course Code: **PH623AP**
(45 Hours – 15 sessions)

HPW: 3 **CREDITS: 1**

Course Objectives: *This course is designed to*

COB1: improve skill of measuring VI characteristics of semiconductor devices.

COB2: interpret the working of various Logic gates and Combinational circuits

1. V-I Characteristics of a Junction diode
2. V-I Characteristics of Zener diode
3. Zener diode as voltage regulator
4. Input and Output Characteristics of Transistor in CE configuration.
5. RC coupled Amplifier- frequency response
6. RC Phase Shift Oscillator- determination of frequency
7. Construction of a Model DC Power Supply
8. Basic gates construction using discrete components-Verification of truth tables.
9. Construction of universal gates using discrete components- Verification of truth tables.
10. Basic gates construction using universal gates-Verification of truth tables.
11. Half and Full adder circuits
12. Verification of De Morgan's laws.

Course Outcomes: *By the end of the course, the student should*

CO1: be able to comprehend theoretical concepts of diode, transistors, FET, UJT and SCR with experimental measurements

CO2: apply knowledge of various Logic gates and Combinational circuits in various applications

Recommended Books:

1. B.Sc Practical Physics by C L Arora - *S.CHAND & Company Ltd.*
2. B.Sc Practical Physics by Harnam Singh and Dr P S Hemne - *S. Chand & Company Ltd.*

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B Sc III Year PHYSICS

W.e.f the academic year: 2022-23

Semester VI Course Name: **Applied Optics** Course Code: **PH623B** (60 Hours)
(DSE)

HPW: 4 **CREDITS: 4**

Course Objectives: *The course is designed to*
COB1: explain the principle of lasers and construction of lasers.
COB2: explain the construction and reconstruction of Holograms and applications.
COB3: introduce concepts of Fourier optics
COB4: establish basic concepts involved in optical fibers

Unit - I **15 Hours**
Principles of Lasers
Introduction, Emission and absorption of Radiation-Einstein coefficients, Pumping mechanisms-optical feedback- Laser rate equations for two, three and four level lasers. Pumping threshold conditions, Properties of laser beams. Types of Lasers: Gas, Liquid and Solid Lasers, He-Ne and Argon lasers with energy level schemes, Ruby laser and YAG laser. Ga-As laser, Applications of lasers.

Unit - II **15 Hours**
Holography
Basic Principle of Holography – Recording of amplitude and phase- The recording medium-Reconstruction of original wave front- Image formation by wave front reconstruction, Gabor hologram and its limitations, Off axis Hologram- Fourier transform Holograms- Volume Holograms, Holography applications.

Unit - III **15 Hours**
Fourier and Non-Linear Optics
Fourier Optics– Thin lens as phase transformation- Thickness function- Various types of lenses - Fouriertransforming properties of lenses – Object placed in front of the lens-Object placed behind the lens.
Non-linearOptics: Harmonic generation- Second harmonic generation- Phase matching condition-nOptical mixing- Parametric generation of light- self focusing of light.

Unit - IV **15 Hours**
Optical fibers
Fiber types and their structures. Ray Optics representation, acceptance angle and numerical aperture. Stepand Gradedindex fibers, single and multi-mode fibers. Fiber materials for glass fibers and plastic fibers. Signal attenuation in optical fibers: Absorption, scattering and bending losses in fibers, core and cladding losses. Material dispersion, wave guided dispersion, inter modes distortion and pulse broadening.

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Course Outcomes: *By the completion of this course, students should*

CO1: interpret the concepts of lasers.

CO2: record and reconstruct holographic image.

CO3: differentiate between Fourier Optics and Non-linear Optics

CO4: understand the concepts of fiber optics

Recommended Books:

1. Introduction to Fourier Optics by J. Goodman - *Roberts and Company Publishers*
2. Optical fiber Communications by John M senior - *Pearson Education*
3. Principles of Lasers by O Svelto - *Springer Science & Business Media*
4. Introduction to Modern Optics by Grant R. Fowles - *Courier Corporation*
5. Principles of Optics by Born and Wolf - *Cambridge University Press*
6. Fundamentals of Optics by Jenkins & White - *McGraw Hill Education*

Semester VI Course Name: **Applied Optics Lab** (45 Hours – 15 sessions) Course Code: **PH623BP**

HPW: 3 **CREDITS: 1**

Course Objectives: *The course is designed to*

COB1: increase the skill of using lasers for diffraction applications.

COB2: develop skill of measurements of Numerical Aperture and losses in optical fibers.

1. Study of the profile of a laser beam
2. Determination of the diameter of a thin wire using laser
3. Determination of wave length of He-Ne laser by transmission grating
4. Construction and recording of a hologram.
5. Study of Fourier transforming properties of lenses
6. Study of second harmonic generation by KDP crystal.
7. Measurement of numerical aperture of optical fibers
8. Measurement of coupling losses in optical fibers
9. Measurement of bending losses in optical fibers
10. Study of audio signal transmission through optical fibers
11. To study the interference of light using optical fibers

Course Outcomes: *By the completion of this course, students should*

CO1: be able to use laser source for diffraction applications.

CO2: comprehend measurements of Numerical aperture and losses in optical fibers.

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B Sc III Year PHYSICS

W.e.f the academic year: 2022-23

Semester VI Course Name: **Nano Science** Course Code: **PH 623_O** **(60Hours)**

Optional Paper

HPW: 4 **CREDITS: 4**

Course Objectives: *The course is designed to*

COB1: *introduce fundamentals of nanostructures.*

COB2: *explain physical and chemical synthesis methods.*

COB3: *introduce characterization techniques for nanomaterials*

COB4*: divulge applications of nanomaterials*

Unit - I **15 Hours**

Length scales in Physics, Nanostructures: 1D 2D 3D nanostructures (nanodots, nano wires, nanorods) Band structure and density of states of materials at nanoscales, Size effects in nanosystems, Quantum confinement in 1D 2D 3D nanostructures and its consequences.

Unit - II **15 Hours**

SYNTHESIS OF NANOSTRUCTURED MATERIALS

Top down and bottom up approach, photolithography, ball milling, gas phase condensation, vacuum deposition, physical vapour deposition (PVD), thermal evaporation,E-beam evaporation, pulsed laser deposition, chemical vapour deposition,Sol-Gel,Electrode position, Spray pyrolysis, hydrothermal synthesis, preparation through colloidal methods, MBE growth of quantum dots.

Unit - III **15 Hours**

CHARACTERIZATION

X-ray Diffraction, Optical Microscopy, Scanning Electron Microscopy, Transmission Electron Microscopy, Atomic Force Microscopy, Scanning Tunnelling Microscopy.

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Unit - IV

APPLICATIONS **15 Hours**

Applications of nanoparticles, Quantum dots, nanowire and thin films for photonic devices (LED, solar cells)Single electron devices (no derivation) CNT based transistors, Nano material devices: Quantum dots heterostructures lasersoptical switching and optical data storage,Magnetic Quantum well; magnetic dots-magnetic data storage.Micro Electrochemical systems (MEMS) Nano Electromechanical systems (NEMS)

Note: Problems should be solved at the end of every chapter of all units.
Students will be provided hands on experience of at least one synthesis methods

Course Outcome: By the completion of this course, students should to

CO1: interpret the length scales and hence nano size.

CO2: understand different nano material synthesis methods.

CO3: learn nano material characterization techniques

CO4: recognize importance of nano material applications

Text Books:

1. Introduction to Nanotechnology by Charles P. Poole and Frank J Owens - *Wiley India Pvt. Ltd.*
2. Introduction to Nano Science and Technology by K.K. Chattopadhyay & A.N. Banerjee - *PHI Learning Private Limited*
3. Nanotechnology: Principle and Practice sby S. K Kulkarni - *Capital Publishing Company*
4. Nanotechnology by Richard Booker and Earl Boysen - *John Wiley and Sons*
5. Handbook of Nanotechnology by Bharat Bhushan - *Springer*
6. Material Characterization Techniques by Sam Zhang, Lin Li and Ashok Kumar - *CRC Press*

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Syllabus- B Sc III Year PHYSICS

W.e.f the academic year: 2022-23

mester VI Course Name: **Project Work** Course Code: **PH 623_O_PW** (60hrs)

Optional Paper

PW: 4 **CREDITS:4**

urse Objectives: *The course is designed to*

OB 1: select a research topic and execute the work planned using correct methodology.

OB 2: organize the completed work in the form of project dissertation and submission.

1. Basic concepts of Project planning
   a) Selection of Project topic and defining objectives
   b) Planning of methods/approaches
2. Guidelines for Project writing
   - Title of the Project, Name of the Student & Supervisor
   - Declaration by the Student &Supervisor
   - Objectives of the project
   - Introduction & Review of Literature
   - Methodology
   - Results and Discussion
   - Conclusion
   - References

Guide lines to the students:

1. Project work will involve experimental work/data collection and it has to be completed in the stipulated time by the student.
2. Students will be asked their choice for Project work at the beginning of Semester VI and all formalities of topic and mentor selection will be completed. Project work will be offered as per the expertise and infrastructural facilities available in the department.
3. Project work may be allotted to students as individual or as group project (not exceeding5 students per group).
4. The completed work and compiled data would be presented in the form of results and submitted in the form of a dissertation/project report.
5. Final evaluation of the project work will be through a panel consisting of internal and external examiners.

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6. Guidelines provided for execution and evaluation of project work would be strictly adhered.

7. The grading would be based on evaluation of punctuality, experimental work, record keeping, academic inputs, data presentation, interpretation etc.

Course Outcomes: *At the end of the course, students will be able to*

CO1: plan and execute a project effectively in the stipulated time

CO2: develop analytical, paper writing and oral presentation skills.

PROJECT WORK EVALUATION SCHEME

Presentation of Thesis Dissertation to External Examiner- 70 Marks

Continuous Evaluation by the Internal Examiner - 30 Marks

Total - 100 Marks

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W.e.f the academic year: 2023-24

Value Added Course

Course Name: **Radiation Safety** Course Code: **PH_VAC_RS** **(30 hours)**

HPW: 2 **Credits: 02**

Course Objectives: *The aim of this course is designed to*
CO1: *infer knowledge about Nuclear radiations and their interactions with matter.*
CO2: *understand the working principle of various detectors and safety measurements.*

Unit – 1 **15 Hours**

Basics of Atomic and Nuclear Physics

Basic concept of atomic structure; X-rays characteristic and production; concept of bremsstrahlung and auger electron, the composition of nucleus and its properties, mass number, isotopes of element, spin, binding energy, stable and unstable isotopes, law of radioactive decay, Mean life and half-life, basic concept of alpha, beta and gamma decay, concept of cross section and kinematics of nuclear reactions, types of nuclear reaction, Fusion, fission.

Interaction of Radiation with matter

Types of Radiation: Alpha, Beta, Gamma and Neutron and their sources, sealed and unsealed sources, Interaction of Photons: Photoelectric effect, Compton Scattering, Pair Production, Linear and Mass Attenuation Coefficients, Interaction of Charged Particles: Heavy charged particles - Beth-Bloch Formula, Scaling laws, Mass Stopping Power, Range, Straggling, Channelling and Cherenkov radiation. Beta Particles- Collision and Radiation loss (Bremsstrahlung), Interaction of Neutrons: Collision, slowing down and Moderation.

Unit – II **15 Hours**

Radiation Quantities and Units

Basic idea of different units of activity, KERMA, exposure, absorbed dose, equivalent dose, effective dose, collective equivalent dose, Annual Limit of Intake (ALI) and derived Air Concentration (DAC).

Radiation detection

Basic concept and working principle of *gas detectors* (Ionization Chambers, Proportional Counter, Multi-Wire Proportional Counters (MWPC) and Geiger Muller Counter), Scintillation Detectors (Inorganic and Organic Scintillators), Solid States Detectors and Neutron Detectors, Thermoluminescent Dosimetry

Radiation safety management

Biological effects of ionizing radiation, Operational limits and basics of radiation hazards evaluation and control: radiation protection standards, International Commission on Radiological Protection (ICRP) principles ,justification, optimization, limitation, introduction of safety and risk management of radiation. Nuclear waste and disposal management. Brief idea about Accelerator driven Sub-critical system (ADS) for waste management.

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Experiments:

1. Study the background radiation levels using Radiation meter

Characteristics of Geiger Muller (GM) Counter:

2) Study of characteristics of GM tube and determination of operating voltage and plateau length using background radiation as source (without commercial source).
3) Study of counting statistics using background radiation using GM counter.
4) Study of radiation in various materials (e.g. KSO4 etc.). Investigation of possible radiation in different routine materials by operating GM at operating voltage.
5) Study of absorption of beta particles in Aluminium using GM counter.
6) Detection of α particles using reference source & determining its half-life using spark counter
7) Gamma spectrum of Gas Light mantle (Source of Thorium)

Course Outcomes: *By the completion of this course, student should be able to*

CO1: *understand the concept of Nuclear radiations and its applications.*

CO2: *gain knowledge about the need of safety measurements in the field of Radiation.*

Reference Books:

1. Nuclear and Particle Physics by W.E. Burcham and M. Jobes -*Longman* (1995)
2. Radiation detection and measurements by G.F.Knoll
3. Thermo luninescense Dosimetry by Mcknlay, A.F., Bristol - *Adam Hilger (Medical Physics Handbook 5)*
4. Fundamental Physics of RadiologyW.J. Meredith and J.B. Massey - *John Wright and Sons, UK,* 1989.
5. Fundamentals of Radiation Dosimetryby J.R. Greening - *Medical Physics Hand Book Series, No.6, Adam Hilger Ltd., Bristol* 1981.
6. Practical Applications of Radioactivity and Nuclear Radiations by G.C. Lowental and P.L. Airey - *Cambridge University Press, U.K.,* 2001
7. An Introduction to Radiation Protectionby A. Martin and S.A. Harbisor - *John Willey & Sons, Inc. New York,* 1981.
8. Medical Radiation Physicsby W.R. Hendee - Year Book – *Medical Publishers Inc. London,* 1981

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W.e.f the academic year: 2023-24

Value Added Course

Course Name: **Weather Forecasting** Course Code: **PH_VAC_WF** **(30 hours)**

HPW: 2 **Credits: 02**

Course Objectives: *The aim of this course is designed to*
CO1: *infer knowledge about Weather systems and their forecasting*
CO2: *develop an awarenessregarding the causes andeffects of different weather phenomenon*

Unit – I **15 Hours**

Introduction to atmosphere

Elementary idea of atmosphere: physical structure andcomposition; compositional layering of the atmosphere; variation of pressure andtemperature with height; air temperature; requirements to measure air temperature;temperature sensors: types; atmospheric pressure: its measurement; cyclones andanti cyclones: its characteristics

Measuring the weather

Wind; forces acting toproducewind; windspeed direction: units, its direction; measuring wind speed and direction; clouds and rainfall radiation: absorption, emission and scattering in atmosphere; radiation laws.

Weather systems

Global wind systems; air masses and fronts: classifications; jetstreams;local thunderstorms; tropical cyclones: classification; tornadoes; hurricanes.

Unit – II **15 Hours**

Climate and Climate Change

Climate, its classification; causes of climate change;global warming and its outcomes; air pollution; aerosols,ozonedepletion, acid rain,environmental issues related to climate.

Basics of weather forecasting

Weather forecasting: analysis and its historicalbackground; need of measuring weather; types of weather forecasting; weatherforecasting methods; criteria of choosing weather station; basics of choosing site andexposure; satellites observations in weather forecasting; weather maps; uncertainty andpredictability; probability forecasts.

Demonstrations and Experiments:

1. Study of synoptic charts & weather reports, working principle of weather station.
2. Processing and analysis of weather data:

(a) To calculate the sunniest time of the year.

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(b) To study the variation of rainfall amount and intensity by wind direction.
(c) To observe the sunniest/driest day of the week.
(d) To examine the maximum and minimum temperature throughout the year.
(e) To evaluate the relative humidity of the day.
(f) To examine the rainfall amount month wise.
3. Exercises in chart reading: Plotting of constant pressure charts, surfaces charts, upper wind charts and its analysis.
4. Formats and elements in different types of weather forecasts/ warning (both aviation and non-aviation)

Course Outcomes: *By the completion of this course, student should be able to*
CO1: Identifythecauses andeffects of different weather phenomenon
CO2: understand the basic forecasting techniques

Reference books:

1. Aviation Meteorology by I.C. Joshi, 3rd edition 2014 - *Himalayan Books*
2. The weather Observers Hand book by Stephen Burt, 2012 - *Cambridge University Press.*
3. Meteorology by S.R. Ghadekar, 2001 -*Agromet Publishers, Nagpur.*
4. Text Book of Agrometeorology by S.R.Ghadekar, 2005 - *Agromet Publishers, Nagpur.*
5. Why the weather by Charls Franklin Brooks, 1924 - *Chpraman& Hall, London.*
6. Atmosphere and Ocean by John G. Harvey, 1995 - *The Artemis Press.*

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