Bharatiya Vidya Bhavan

Bhavan's Vivekananda College

of Science, Humanities and Commerce, Sainikpuri
Autonomous College | Affiliated to Osmania University
Accredited with 'A' grade by NAAC

SCHEME OF INSTRUCTION: B.Sc. PHYSICS SYLLABUS UNDER CBCS SCHEME

Revised and effective from academic year 2020-21

Year	Semester	Course Type	Course Title	Instructions Hrs/week	Marks	Credits
I Year	I	Theory	Mechanics	4	100	4
		Practical	Mechanics	2	25	1
	II	Theory	Thermal Physics	4	100	4
		Practical	Thermal Physics	2	25	1
II Year	III	Theory	Electromagnetic thoery	4	100	4
		Practical	Electricity & Magnetism	2	25	1
	IV	Theory	Optics	4	100	4
		Practical	Optics	2	25	1
III Year	V	Theory	A: Modern Physics (OR) B: Computational Physics using MATLAB	4	100	4
		Practical	A: Modern Physics (OR) B: Computational Physics using MATLAB	2	25	1
	VI	Theory	A : Electronics (OR) B : Applied Optics	4	100	4
		Practical	A : Electronics (OR) B : Applied Optics	2	25	1
Total Credits				**30**		

Skill enhancement courses:

1. Measurements and Errors
2. Electrical circuits and Networking
3. Basic Instrumentation
4. Biomedical Instrumentation
5. Digital Electronics
6. Circuit construction and analysis using pSpice
7. Basics of MATLAB

Generic Elective:

1. Renewable Energy & Harvesting

Project work/Optional: **Nano Science**

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Syllabus - B Sc I Year Physics
Wef the academic year: 2020-21

Semester I
Course Name: Mechanics-Course Code: PH 123
(60 Hours)

HPW: 4 **CREDITS: 4**

COURSE OBJECTIVES:

COB1: To illustrate applications of vector differentiation, integration

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

COB3: To interpret the laws of planetary motion

COB4: To infer the concept of relativity.

Unit – I **15 Hrs**

1. **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 Hrs**

2. **Motion of variable mass system (7)**
   Laws of motion-Motion of variable mass system, motion of a rocket, multi- stage rocket, conservation of energy and momentum.

3. **Mechanics of rigid bodies(8)**
   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 precessional motion, Gyroscope.

Unit – III **15 Hrs**

4. **Central forces [15]**
   Central forces – definition and examples, conservative nature of central forces, force as a negative gradient of potential energy, centre 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 Hrs**

5. **Frames of reference and transformation (8)**
   Frames of reference- inertial and non inertial, Galilean transformation equations, Galilean Invariance, absolute frame of reference, Michelson – Morley experiment- significance of negative result.

6. **Consequences of relativistic transformations (7)**
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 every chapter of all the units.

COURSE OUT COMES:

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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Syllabus - B Sc I Year Physics
Wef the academic year: 2020-21

Semester II
Course Name: Thermal Physics-Course Code: PH 223
(60 Hours)

HPW: 4 **CREDITS: 4**

Course Objectives:

The aim of this course is designed

COB1: To define the Laws of Thermodynamics

COB2: To relate Laws of Thermodynamics in various applications

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

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

Unit I **(15 hrs)**

1. Thermodynamics (8)

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 hrs)**

2. Thermodynamic potentials and Maxwell's equations: (8)

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 wall's gas.

3. Low temperature Physics: (7)

Methods of Production of low temperatures-Joule Thomson's porous plug Experiment. Distinction between Joule's, Adiabatic and Joule Thomson's Expansion processes. Liquefaction of gases: liquefaction of hydrogen and Helium-Adiabatic Demagnetization. Principle of Refrigeration, Vapor Compression Machine.

Unit III **(15 hrs)**

4. Radiation Laws: (9)

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. Determination of Stefan's constant.

5. **Measurement of Radiation:** (6)

Pyrometers: Types of pyrometers. Disappearing filament optical pyrometer. Angstrom Pyroheliometer and determination of solar constant. Estimation of temperature of sun.

Unit IV **(15hrs)**

6. **Kinetic theory of gases** (7)

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 wall'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.

7. **Statistical Mechanics** (8)

Introduction to Statistical Mechanics: Concept of ensembles and phase space. Distribution and Statistical equilibrium. Concept of probability: Distribution function and probability theorems. 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

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

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

CO3: *To differentiate between Transport phenomenon, classical – quantum statistics*

CO4: *To understand the Laws of Radiation*

Textbooks:

1. Second Year Physics, *Telugu Academy.*
2. Heat and thermodynamics, Brijlala 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 Physics Vol. 1, 2, 3 & 4. *Narosa Publications.*
5. Modern Engineering Physics, A.S. Vasudeva. *S.Chand & Co. Publications.*

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Syllabus-B Sc II Year PHYSICS

(For the batch of students admitted in 2016-17)

(To be implemented with effect from 2017-18)

Semester III - Paper Code **PH 323 -THERMODYNAMICS (60 hrs)**

HPW: 4 **CREDITS : 4**

OBJECTIVE

This course focuses largely on how a heat transfer is related to various energy changes within a physical system undergoing a thermodynamic process.

Unit I (15 hrs)

1. Introduction to thermodynamics: (7)

Zeroth law of Thermodynamics and concept of thermal equilibrium. Extensive and intensive Thermodynamic Variables. Internal energy as state function and indicator diagram. First Law of thermodynamics: Applications and limitations. Isothermal and Adiabatic processes and relation between the specific heats. Reversible and Irreversible processes. Carnot's Engine and its efficiency.

2. Second law of thermodynamics and Entropy: (8)

Kelvin's and Claussius statements, Thermodynamic scale of temperature and its equivalence to ideal Gas Scale. 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 hrs)

3. Thermodynamic potentials and Maxwell's equations: (8)

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 equation, (2) Value of Cp - C_v, (3) TdS Equations. Joule Kelvin effect: Expression for Joule Kelvin coefficient for perfect and Vander wall's gas.

4. Low temperature Physics: (7)

Methods of Production of low temperatures. Joule Thomson's porous plug Experiment. Distinction between Joule's, Adiabatic and Joule Thomson's Expansion processes. Liquefaction of gases: liquefaction of hydrogen and Helium – Adiabatic Demagnetization. Principle of Refrigeration, Vapor Compression Machine.

Unit III (15hrs)

5. Kinetic theory of gases (7)

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 wall'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.

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6. Statistical Mechanics (8)

Introduction to Statistical Mechanics: Concept of ensembles and phase space. Density of Distribution and Statistical equilibrium. Concept of probability: Distribution function and probability theorems. 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.

Unit IV **(15hrs)**

7. Radiation Laws: (9)

Black body: Ferry's black body, distribution of energy in the spectrum of Black body. Stephan'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 Stephan's law from Planck's law. Determination of Stephan's constant. Deduction of Newton's law of cooling from Stephan's law.

8. Measurement of Radiation: (6)

Pyrometers: Types of pyrometers. Disappearing filament optical pyrometer. Angstrom Pyroheliometer and determination of solar constant. Estimation of temperature of sun.

OUT COME

Having completed this course, student should understand and acquire knowledge of work being done by the system guided by the laws of thermodynamics.

Thermodynamics lab- III semester –PH 323P (15 sessions- 30 hours)

HPW: 2 **CREDITS : 1**

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 with temperature.
8. Specific heat capacity of solids
9. Cooling curve of a metallic body

Textbooks

1. Second Year Physics, *Telugu Academy.*
2. Heat and thermodynamics, Brijlala 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.*
7. A laboratory manual for undergraduate classes, D.P. Khandelwal, *Vani Publishing House, New Delhi.*
8. B.SC Practical Physics, C L Arora, *S.Chand & Company Ltd.*
9. B.SC Practical Physics, Harnam Singh Dr P S Hemne, *S.Chand & Company Ltd.*

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 Physics Vol. 1,2,3 & 4. *Narosa Publications.*
5. Modern Engineering Physics, A.S. Vasudeva. *S.Chand & Co. Publications.*

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Skill Enhancement Course -30 Hours

HPW : 2 Hours **CREDITS: 2**

BASIC INSTRUMENTATION SKILLS

OBJECTIVE

The aim of this course is to enable the students to get familiar to basic mechanical and electrical instruments

UNIT I **(16 Lectures)**

Mechanical Instruments and Measurements:

Measuring units, conversions between SI and CGS units. Familiarization with meter scale, Vernier callipers, Screw gauge and their utility. Measurement of dimensions of a solid body, volume of cylindrical beaker/jars, diameter of a thin wire and thickness of metal sheet. Measurements with travelling microscope and spectrometer.

Electrical meters: Ammeter, Voltmeter and Multimeter:

Resistors, inductors and capacitors. Response of inductors and capacitors with DC/AC sources.

Principles of current and voltage, linear and non-linear dependence between them. Construction of ammeter and voltmeter using galvanometer. Measurement of voltage and current.

Measurement of voltage (AC/DC), current (AC/DC) and resistance using multimeter.

UNIT II **(14 Lectures)**

Cathode Ray Oscilloscope:

Electron gun, motion of a charged particle in electric and magnetic fields, electrostatic focusing and acceleration.

Block diagram of basic CRO. Working of CRT, Time base operation, synchronization, front panel controls of a CRO, sensitivity 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.

OUT COME

Having completed this course, student should be familiar to basic mechanical and electrical instruments

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Reference B ooks:

1. B.Sc. Practical Physics, Harnam Singh, Dr P.S.Hemne, S CHAND and company Pvt. Lmt
2. A text book of electronics-Telugu academy
3. Electrical Circuits, K.A. Smith and R.E. Alley, 2014, Cambridge University Press
4. Grob's basic electronics-Mithel E Schultz, Tata McGraw
5. A text book in Electrical Technology - B L Theraja - S Chand & Co.
6. A text book of Electrical Technology - A K Theraja
7. Performance and design of AC machines - M G Say ELBS Edn.

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Syllabus-B Sc II Year PHYSICS

(For the batch of students admitted in 2016-17)

(To be implemented with effect from 2017-18)

Semester IV – Paper Code PH 423 -OPTICS (60 hrs)

HPW: 4 **CREDITS : 4**

OBJECTIVE

This course introduces the formalism of wave behavior in the context of physical optics.

Unit I **15 hrs**

1. Aberrations: (8)

Introduction: Monochromatic aberrations, spherical aberration, methods of minimizing spherical aberration, coma, and astigmatism. Chromatic aberration: Achromatic doublet, Minimizing of chromatic aberration by a separated doublet.

2. Interference: (7)

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.

Unit – II **15 hrs**

3. Interference by division of amplitude: **(15)**

Oblique incidence of a plane wave on a thin film due to reflected and transmitted light (Cosine law), Colors of thin films. Non reflecting 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, refractive index and visibility of fringes

Unit III **15 hrs**

5. Fraunhoffer diffraction : (9)

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.

6. Fresnel diffraction : (6)

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.

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Unit – IV **15 Hrs**

8. Polarization (10)

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.

7. Laser: (5)

Lasers: Introduction: Spontaneous emission and Stimulated emission. Population inversion. Principle of Laser – Einstein coefficients. Types of Lasers: He-Ne laser, Ruby laser and Solid state laser. Pumping methods , Applications of lasers.

OUT COME

Having completed this course, student should acquire knowledge of analysing optical systems using system matrices, interference, diffraction and polarisation effects

Optics Lab Semester IV- PH 423P(15 sessions- 30 hours)

HPW: 2 **CREDITS : 1**

1. Determination of refractive index of a glass and liquid (Boys Method).
2. Determination of dispersive power of a prism.
3. Determination of thickness of a wire-wedge method.
4. Determination of Radius of curvature of a given convex lens- Newton's rings.
5. Determination of wavelength of light using diffraction grating minimum deviation method.
6. Determination of wavelength of light using diffraction grating and Resolving power of a grating by normal incidence method.
7. Determination of wavelength of a given Laser light using diffraction grating.
8. Study of optical rotation using polarimeter.
9. Determination of refractive index of the given liquid using Pulfrich Refractometer.
10. To obtain the Refractive index of the material of the prism by determining the angle of minimum deviation from I-D curve.

Textbooks

1. Second Year Physics – *Telugu Academy*
2. Optics, Ajoy Ghatak. *The McGraw-Hill companies.*
3. Optics, Subramanyam and Brijlal. *S. Chand & Co.*
4. Optics and Spectroscopy, R. Murugeshan and Kiruthiga Siva Prasath. *S. Chand & Co.*
5. Fundamentals of Optics, Jenkins A. Francis and White E. Harvey, *McGraw Hil Inc.*
6. Fundamentals of Physics, Halliday/Resnick/Walker.C. *Wiley India Edition 2007.*
7. B.SC Practical Physics, C L Arora, *S.CHAND & Company Ltd.*
8. B.SC Practical Physics, Harnam Singh Dr P S Hemne. *S.CHAND & Company Ltd.*

Reference Books

1. Optics, Eugene Hecht and A R Ganesan, *Pearson Education India*
2. Understanding optics, M K Sinha *Tata Macgraw Hill Education Pvt. Lmt.*
3. Sears and Zemansky's University Physics, Hugh D. Young, Roger A. Freedman. *Pearson Education Eleventh Edition.*
4. Fundamentals of Physics- An Introduction, Sanat Kumar Chatterjee, *Narosa Publications.*
5. Feynman's Lectures on Physics Vol. 1,2,3 & 4. *Narosa Publications.*
6. Physics Laboratory Manual, David H Loyd, *Brooks/cole Ceneage Learning.*

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Skill Enhancement Course -30 Hours

HPW : 2 Hours **CREDITS: 2**

RENEWABLE ENERGY AND ENERGY HARVESTING Theory: 30 Lectures

OBJECTIVE

The aim of this course is to introduce to students the theoretical knowledge of alternate energy sources

UNIT I **15 Lectures**

Fossil fuels and Alternate sources of energy: Fossil fuels and nuclear energy, their limitation, need of renewable energy, non-conventional energy sources. An overview of developments in Offshore Wind Energy, Tidal Energy, Wave energy systems, Ocean Thermal Energy Conversion, solar energy, biomass, biochemical conversion, biogas generation, geothermal energy tidal energy, Hydroelectricity.

Hydro Energy: Hydropower resources, hydropower technologies, environmental impact of hydro power sources.

Wind Energy harvesting: Fundamentals of Wind energy, Wind Turbines and different electrical machines in wind turbines, Power electronic interfaces,and grid interconnection topologies.

UNIT II **15 Lectures**

Solar energy: Solar energy, its importance, storage of solar energy, solar pond, non convective solar pond, applications of solar pond and solar energy, solar water heater, flat plate collector, solar distillation, solar cooker, solar green houses, solar cell, absorption air conditioning. Need and characteristics of photovoltaic (PV) systems, PV models and equivalent circuits, and sun tracking systems.

Carbon captured technologies, cell, batteries, power consumption
Environmental issues and Renewable sources of energy, sustainability.

OUTCOME

Having completed this course, student should acquire knowledge of alternate energy sources and their necessity

Reference Books:

1. Non-conventional energy sources, B.H. Khan, McGraw Hill
2. Solar energy, Suhas P Sukhative, Tata McGraw - Hill Publishing Company Ltd.
3. Renewable Energy, Power for a sustainable future, Godfrey Boyle, 3rd Edn., 2012, Oxford University Press.
4. Solar Energy: Resource Assesment Handbook, P Jayakumar, 2009
5. J.Balfour, M.Shaw and S. Jarosek, Photovoltaics, Lawrence J Goodrich (USA).
6. http://en.wikipedia.org/wiki/Renewable_energy

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Syllabus-B Sc III Year PHYSICS

(To be implemented with effect from 2018-19)

Semester V - Paper Code **PH 523 -ELECTRICITY AND MAGNETISM (45 Hrs)**

HPW: 3 **CREDITS: 3**

OBJECTIVE

The objective of this course is to establish a comprehensive understanding of electromagnetism in preparation for more advanced courses.

Unit – I

10 hours

1. Electrostatics (10)

Electric field intensity and Electric potential - Definition and relation between them, Gauss law and its applications- Deduction of Coulomb's law from Gauss law. Force on a charged conductor. Expression for electric field intensity and electric potential for electric dipole, an infinite line of charge, an infinite conducting sheet of charge, uniformly charged hollow/solid sphere, and charged cylindrical conductor.

Unit – II

10 hours

2. Dielectrics (5)

Atomic view of dielectrics. Torque and potential energy due to a dipole in an electric field. Polarization and charge density, Gauss's law for dielectric medium. Displacement current, Relation between D,E, and P. Dielectric constant, permittivity, susceptibility and relation between them. Boundary conditions for D and E at the dielectric surface.

3. Capacitance (5)

Capacitance of spherical and cylindrical capacitors. Capacitance of parallel plate condenser with and without dielectric. Electric energy stored in a charged condenser – force between plates of condenser, construction and working of attracted disc electrometer and its use for the measurement of dielectric constant.

Unit – III

10 hours

4. Magnetostatics (6)

Biot –Savart's law and Ampere's Law. Determination of B due to a long straight wire, a circular current loop and solenoid. Magnetic shell, Potential due to magnetic shell and field due to magnetic shell. Equivalence of electric circuit and magnetic shell. Magnetic induction (B), magnetic field Intensity (H) and Intensity of magnetization. Permeability, Susceptibility and Hysteresis loop.

5. Moving charge in electric and magnetic field (4)

Motion of charged particles in electric and magnetic fields. Hall effect, cyclotron, synchro- cyclotron and synchrotron. Force on a current carrying conductor placed in a magnetic field, force and torque on a current loop.

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Unit – IV

15 hours

6. Electromagnetic induction (8)

Faraday's law –Lenz's law – expression for induced emf – time varying magnetic fields – Betatron – Ballistic galvanometer– theory – damping correction –self and mutual inductance, coefficient of coupling, calculation of self inductance of a long solenoid–toroid–energy stored in magnetic field.

7. Maxwell's equations and electromagnetic waves (7)

A review of basic laws of electricity and magnetism – displacement current – Maxwell's equations: Integral and differential form, Maxwell's wave equation. Electromagnetic waves: Transverse nature of electromagnetic waves. velocity of electromagnetic waves energy of electromagnetic waves Poynting theorem, production of electromagnetic waves (Hertz experiment)

OUT COME

Having completed this course, student should be capable of applying principles of electromagnetism to various fields of physics.

Electromagnetic Lab V semester PH 523 P

(30 Hours – 15 sessions)

HPW: 2 **CREDIT: 1**

1. Figure of merit and Voltage sensitivity of a moving coil galvanometer.
2. Design and construction of voltmeter and ammeter.
3. Determination of frequency AC source using Sonometer.
4. To determine the specific resistance of a given wire by Carey Foster's Bridge
5. Determination of dielectric constant.
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.

Project (Any one TOPIC)

1. Types of Electric motors-Basic design and control of speed and power in motors.
2. Household Electrical Appliances: Basic Design and Working
3. Study of Dielectric Materials-
   Experiment: Determination of dielectric constant and study variation of dielectric constant with temperature.
4. Oersted law, Biot-savarts law and Amperes Law- Expression for Magnetic field due to current carrying straight conductor, Circular coil, and solenoid.
   Experiment: 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.
5. Nuclear properties and transformation
   Experiment: Study of characteristics of Counter and study of absorption of β and γ rays using G. M counter

Note: Project carries 30 % of marks allotted for practicals

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Textbooks

1. Third year Physics – *Telugu Akademy*
2. Electricity and Magnetism – 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 Brijlal and Subramanyam. *Ratan Prakashan Mandir*
5. Fundamentals of Physics- Halliday/Resnick/Walker - *Wiley India Edition 2007.*
6. Berkeley Physics Course–Vol.II - Electricity and Magnetism–Edward M Purcell –*The McGraw-Hill Companies.*
7. B.Sc Practical Physics by C L Arora, *S.CHAND & Company Ltd.*
8. B.Sc Practical Physics by Harnam Singh Dr P S Hemne *S.CHAND & Company Ltd.*

Reference Books

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. Theory Machines by R S Khurmi and J K Gupta, *S.Chand & Company Ltd.*
6. Introduction to Physics for Scientists and Engineers. F.J Ruche. *McGraw Hill.*

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Syllabus-B Sc III Year PHYSICS

(To be implemented with effect from 2018-19)

Semester V - Paper Code 523A - Solid State Physics and Spectroscopy (45 hrs)

HPW: 3 **CREDITS: 3**

OBJECTIVE

This course introduces to the students the basic crystal structure and diffraction studies on solids with an emphasis on Bonding. Spectroscopic studies of Alkali materials, Inclusion of Study of Magnetic properties of solids, Superconductivity and Nano materials, makes it a prerequisite course for any Advanced study or Research in the fields of Condensed matter Physics or Materials in General.

Unit-I: **10 hrs**

1. Bonding in Crystals (4)

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

2. Crystal Physics and diffraction (6)

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, diamond and Zinc Blends). Diffraction of X –rays by crystals, Bragg's law Experimental techniques: Laue's method and powder diffraction method

Unit-II: **15 hrs**

3. Magnetism (5)

Magnetic properties of materials. Langevin's theory. Quantum theory of para and diamagnetism. (basic idea). Weiss' theory of ferromagnetism – Nature and origin, Molecular field and exchange interactions. Magnetic domains, Antiferromagnetism. Ferrites and their applications.

4. Superconductivity (5)

Introduction, Experimental facts, Meissner effect and critical currents. Transition from normal to super conducting states - properties affected. Type - I and Type - II superconductors. BCS theory: Cooper pairs and Phonons. Quantum Hall Effect (Basic idea), High T_c superconductors. Applications of Superconductors

5. Nanomaterials (5)

Emergence of Nanoscience with special reference to Feynman and Drexler, Role of particle size; One Two and Three Dimensional Nanostructures with examples. Surface to Volume ratio.

Synthesis and nanofabrication, Bottom-Up and Top-Down approach with examples.

Chemical methods –Coprecipitation method, sol-gel method, chemical reduction, and hydrothermal process.

Physical Methods–Ball milling, Physical Vapour deposition (PVD), Sputtering, spray pyrolysis,

XRD, SEM, TEM, AFM, characterization techniques for nano materials. Electrical, mechanical properties and Optical properties of Nanomaterials. Applications of Nanomaterials.

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Unit-III: **10 hrs**

6. Atomic Spectra (6)

Atoms in Electric and Magnetic fields: electron angular momentum, space quantization. Stern Gerlach experiment. Vector atom model, quantum numbers associated with LS and JJ coupling schemes. Larmor's theorem - spin magnetic moment. Spectral terms and notations

7. One electron spectra (4)

Alkali Spectra and doublet fine structure. Zeeman Effect, Paschen-Back Effect and Stark Effect.

Unit-IV: **10 hrs**

8. Molecular Spectra (6)

Types of molecular spectra, pure rotational energies and spectrum of diatomic Molecule, determination of inter nuclear distance. Vibrational energies and vibrational spectrum of diatomic molecule. Electronic spectra of molecules: fluorescence and phosphorescence.

9. Raman Spectra (3)

Raman Effect: Classical and quantum theory of Raman Effect. Raman's Spectrometer, Applications of Raman Effect.

Outcome

Having completed the course the student will be able to

- *Understand the probable interactions between matter and electromagnetic radiation*
- *Acquires the basic knowledge of dependence of various properties of materials, based on its structural arrangement*
- *Understand the fundamentals of emission and absorption spectra and analyze visible and basic alkali spectra*
- *Familiarize with Nanomaterials*

Solid State Physics Lab V semester PH 523A P

(30 Hours – 15 sessions)

HPW: 2 **CREDIT: 1**

1. To determine the magnetic field by Hall-probe method
2. Determination of Magnetic susceptibility of a given liquid by Capillary rise method.
3. To determine the energy gap of a semiconductor
4. To draw the Hysteresis curve of transformer core and determine the energy loss.
5. To determine the Rydberg's constant using Hydrogen spectra.
6. To determine the absorption lines in the rotational spectrum of Iodine vapor

Project -Any one TOPIC)

1. Nanomaterials –Methods of production
   Calculation of lattice constant and crystallite size from the given X-ray diffraction Pattern.
2. Motion of charge particle in different types of electric field, magnetic field and their combination-
   Experiment: To determine the magnetic field, hall coefficient and nature of conduction in a given material by Hall-probe method
3. Study of properties of magnetic materials-
   Experiment: Determination of Magnetic susceptibility of different liquids.
4. Classification of magnetic materials- Determine magnetic constants from Hysteresis curve
5. Crystal structures-classification
   Experiment: Estimation of type of bond in given crystal (verification with absorption spectra)
6. Atomic Models- Fine structure splitting of spectral line
7. Superconductivity- Properties, Types and applications of superconductors.

Note: Project carries 30 % of marks allotted for practicals

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Textbooks

1. Introduction to Solid State Physics, Charles Kittel. John *Wiley and Sons.*
2. Solid State Physics, SL Gupta & Kumar V, *K Nath & Co*
3. Modern Physics, R. Murugeshan and Kiruthiga Siva Prasath. *S. Chand & Co*
4. Molecular Structure and Spectroscopy, G. Aruldhas, *Eastern Economy Edition.*
5. Elements of Solid State Physics, J.P. Srivastava. (For chapter on nanomaterials)
6. Elements of Modern Physics, S.H Patil, *Tata McGraw Hill*
7. Atomic Physics by J. B. Rajam. *S. Chand & Co*
8. Physics of Atom, M Russell Wehr, J A Richards; *Addison Wesley Publishing Company*
9. B.Sc Practical Physics, Harnam Singh Dr P S Hemne *S.CHAND & Company*
10. A Text Book of Practical Physics, Indu Prakash and Ramakrishna, 11th Ed., 2011, *Kitab Mahal, New Delhi*

Reference Books

1. Introduction to Solids by Modern Physics, Leonid V. Azaroff, *Tata McGraw Hill*
2. Modern Physics, G. Aruldhas & P. Rajagopal, *Eastern Economy Edition.*
3. Fundamentals of Molecular Spectroscopy, C.N. Banwel. *Tata McGraw-Hill Edition*
4. Advanced level Physics Practicals, Michael Nelson and Jon M. Ogborn, 4th Edition, reprinted 1985, *Heinemann Educational Publishers*
5. Advanced Practical Physics for students, B.L. Flint and H.T. Worsnop, 1971, *Asia Publishing House.*
6. A laboratory manual for undergraduate classes, D.P. Khandelwal, *Vani Publishing House, New Delhi.*

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Syllabus-B Sc III Year PHYSICS

(To be implemented with effect from 2017-18)

Semester VI - Paper Code **PH 523B - Elements of Materials Science** **(45 Hrs)**

HPW: 3 **CREDITS: 3**

Objective:

The course introduces to the students the basic properties and the various types of imperfections and defects in solids. They get introduced to the various phases in which a material may exist and certain basic characterization techniques used for the analysis of materials.

Unit I — 12 hours

1. **Properties of Materials: (8 periods)**
   Introduction: Classification of Materials, Material structure, types of bonds, bond formation mechanism for ionic, covalent, molecular, metallic bond and Hydrogen bonding. Mechanical Properties: Stress, Strain, Elastic Strain, Plastic Strain, strength, plasticity, Ductility, Hardness, Toughness, Malleability, Creep, Fatigue, Stiffness, Fracture. Thermal Properties: Specific Heat, Thermal Expansion, Thermal Conductivity. Electrical Properties: Resistivity, Conductivity, dielectric strength. Magnetic Properties: magnetic susceptibility, Giant Magnetic Resonance (GMR).
2. **Disorder in Materials: (4 periods)**
   Impurities in solids, Rules of solid solubility, Imperfection in crystals, Defects in solids: point, line, surface and volume. Atomic diffusions- definition, mechanism, Fick's laws

Unit II — 12 hours

3. **Single phase metals: (4 periods)**
   Single phase alloys, deformation: Types and mechanism, Plastic deformation in poly crystalline materials
4. **Molecular Phases: (4 periods)**
   Introduction, polymers and polymerization, Molecular weight of polymers. Types of polymers.
5. **Ceramic Materials: (4 periods)**
   Ceramic Phases, Classification of ceramic materials. Mechanical, electrical and magnetic behavior of ceramics

Unit III — 12 hours

6. **Phase diagrams: (12 periods)**
   Basic terms: System, Surrounding, Component, Co-ordinates, Phase, Equilibrium. Phase Diagram: definition, importance and objective. Gibb's Phase rule: Time - Temperature cooling curves. Lever rule. Types of phase diagram: Eutectic systems, eutecoid systems, peritectic and peritectoid systems. Phase diagram of a) Sugar water b) NaCl water. Isothermal cuts, Material balance

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Unit IV **9 hours**

7. **Material Characterization Techniques: (10 periods)**
   Structural Analysis: XRD methods, Scanning Electron Microscope, Tunneling Electron Microscope. Compositional analysis. Electron scanning for Chemical analysis. Optical Analysis: Spectro photometer. Electrical analysis: Hall set up, Four Probe set up.

Outcome:

Having completed the course, the students gain sufficient knowledge so that they will be able to

- *Classify of materials based on the structure and bonding*
- *Get an insight to the various mechanical, thermal, electrical and magnetic properties, the knowledge of which is required for processing and characterization of functional materials.*
- *Identify the phase in which the material exist, the deformation type and the kind of maechanism prevailing.*
- *They can successfully use certain characterization techniques for the structural and composite analysis of the materials*

Material Science Lab V Semester PH 523B P

1. To determine the dipole moment of a given liquid
2. To determine magnetic susceptibility of $FeCl_3$
3. To determine the specific heat of graphite
4. Determination of the yield point and the breaking point of an elastic material

Project (Any one TOPIC)

1. Computational modeling of materials
2. Mechanical properties and responses to deformation
3. Materials processing and manufacturing
4. Thermal Properties in materials
5. Reinforcement in composites

Note: Project carries 30 % of marks allotted for practicals

Text Books

1. Materials science and engineering, V Edn- V Raghavan, *PHI Learning*
2. Foundation of Materials science and engineering, Kakani and Kakani, *McGraw Hill*
3. Introduction to Materials science and engineering, Ralls Cartney and Wolf, *Wiley*
4. Thin film Phenomena, K L Chopra, *McGraw Hill*

Reference Books

1. Elements of materials science and Engineering, I.H.Vanvlach, *Pearson and Education*
2. Handbook of Thin film technology, Meissel& Glang, *McGraw Hill*

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Generic Elective Course G E 5 2 3 -30 Hours

HPW : 2 Hours CREDITS: 2

RENEWABLE ENERGY AND ENERGY HARVESTING
Theory:30 Lectures

Objective:
The aim of this course is to bring awareness regarding the necessity of alternate energy sources to the students

UNIT I **15 Lectures**

Need in renewable energy, non-conventional energy sources. An overview of developments in Offshore Wind Energy, Tidal Energy, Wave energy systems, Ocean-Thermal Energy Conversion, solar energy, biomass.

Hydro Energy: Hydropower resources, environmental impact of hydro power sources.

Wind Energy harvesting: Fundamentals of Wind energy and Wind Turbines

UNIT II **15 Lectures**

Solar energy: Solar energy, its importance, storage of solar energy, solar water heater, need and characteristics of photovoltaic (PV) systems, PV models.

Environmental issues and renewable sources of energy, sustainability.

OUTCOME:
Having completed this course, student should understand the impact of conservation of conventional energy sources and necessity of alternate energy sources.

Reference Books:

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

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Skill Enhancement Course-SE523 -30 Hours

HPW : 2 Hours **CREDITS: 2**

Circuit Simulation using PSPICE

Objective:

The objective of this course is to 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 labeling 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.

Outcome:

Students will learn the usage of virtual components and instruments 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 – Mohammad H Rashid – PHI.
2. Spice for circuits and Electronics using Pspice – Mohammad H Rashid – PHI

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Syllabus-B Sc III Year PHYSICS

(To be implemented with effect from 2018-19)

Semester VI - Paper Code **PH 623 - MODERN PHYSICS** **(45 Hours)**

HPW: 3 **CREDITS: 3**

Objective

This course is a prerequisite to any advanced theoretical studies. The student is introduced to the fundamental aspects of Quantum Mechanics and Nuclear Physics through this course

Unit-I: 15 hours

1. Particle properties of wave (10)

Spectral Radiation: Black Body Radiation, Ultraviolet catastrophe, Plank's Law – Quantum Principles. Photoelectric Effect: Experiment, Laws & Einstein's theory. Compton's Effect: Expression and Experimental verification. Pair Production.

2. Wave properties of Particle (5)

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.

Unit-II: 10 hours

3. Uncertainty Principle (3)

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, Particle in a box as a consequence of uncertainty principle.

4. Wave Mechanics (7)

Schrodinger time dependent and time independent wave equations. Interpretation of wave function. Momentum and energy operators, stationary states, linearity and expectation values. Normalization of Wave function; Probability and probability current densities in one dimension. Postulates of wave mechanics. Eigen functions and Eigen values. Applications: Particle in a box (one dimension). Quantum tunneling (one dimension): across a step potential and across a rectangular potential barrier. α decay as an example.

Unit-III 10 hours

5. Nuclear Structure and models (6)

Nuclear properties: Size, charge, mass, spin, magnetic dipole moment and electric quadruple moment. Non-existence of an electron inside the nucleus: a consequence of the uncertainty principle. Binding Energy of nucleus. Semi empirical mass formula. Deuteron binding energy. Nature of nuclear forces. Nuclear Models: liquid drop model, shell model, Collective model.

6. Nuclear Detectors (4)

Proportional counter, GM counters, scintillation counter, Wilson cloud chamber and solid state detector

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Unit-IV **10 hours**

7. Nuclear transformations (6)

Radioactivity: stability of nucleus; Law of radioactive decay; Mean life & half-life; Alpha decay – Gamow's tunneling theory of α decay. Derivation for decay constant. Beta Decay and Neutrino discovery. Fermi theory of β decay. Solar - neutrino mystery.

8. Nuclear Reactions (4)

Types of nuclear reactions, conservation laws, Compound nucleus and Direct reactions (concepts).

Outcome

Having done the course the student gains sufficient knowledge as to

- *Understand the complementary nature of the wave and particle properties of a material particle*
- *Apply the Schrödinger's time independent equation to any given system with a specified potential and hence find the solution*
- *Get an insight to basic nuclear structure, models and transformations*
- *Understand the decay of Radioactive particles such as α particle in terms of quantum mechanical tunneling*

Modern Physics Lab VI semester-PH 623P

(30 Hours – 15 sessions)

HPW: 2 **CREDIT: 1**

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 determine energy gap of a semiconductor.
5. Temperature characteristics of thermistor-Determination of thermistor constants.
6. Characteristics of G M Counter.
7. Study of absorption of β and γ rays using G M Counter.
8. Determination of Boltzmann constants using V-I characteristics of junction diode.
9. To study the quantum tunneling effect with solid state device, e.g. tunnel diode.

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. Modern Physics by G. Aruldhas & P. Rajagopal. *Eastern Economy Edition.*
4. Nuclear Physics an introduction by S.B. Patil, *Wiley Eastern Limited*
5. Nuclear Physics by D.C. Tayal, *Himalaya Publishing House.*
6. B.Sc Practical Physics by Harnam Singh Dr P S Hemne, *S.CHAND & Company*

Reference Books

1. A Text book of Quantum Mechanics, P.M. Mathews & K. Venkatesan, 2nd Ed., 2010, *McGraw Hill*
2. Quantum Mechanics, Robert Eisberg and Robert Resnick, 2ndEdn., 2002, *Wiley.*
3. Quantum Mechanics, Leonard I. Schiff, 3rdEdn. 2010, *Tata McGraw Hill.*
4. Introduction to Quantum Mechanics, David J. Griffith, 2nd Ed. 2005, *Pearson Education*
5. Nuclear Physics, Irving Kaplan, *Narosa Publishing House*
6. Nuclear Physics theory and experiment, Roy and Nigam, *New Age Publishers*
7. Advanced Practical Physics for students, B.L. Flint & H.T. Worsnop, 1971, *Asia Publishing House.*

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Syllabus-B Sc III Year PHYSICS
(To be implemented with effect from 2018-19)

Semester VI - Paper Code **PH 623A - ELECTRONICS** **(45 Hrs)**

HPW: 4 **CREDITS: 4**

OBJECTIVE

The objective of this course is to introduce students to the basic components of electronics: diodes, transistors, and op amps. It covers the basic operation and some common applications.

Unit – I **15 hours**

1. Kirchhoff Laws and Varying currents (5 periods)

Kirchhoff Laws- Study of growth and decay of current/charge in LR, CR and LCR circuits.

2. Alternating currents (10 periods)

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.

Unit – II **10 hours**

3. Semiconductors and Diodes (10 periods)

Formation of energy bands in solids, classification of solids in terms of energy band diagram. Intrinsic and extrinsic semiconductors, Fermi level, continuity equation, p-n junction diode, half wave and full wave rectifiers and filters, ripple factor (quantitative), Characteristics of Zener diode and its application as voltage regulator.

Unit III **10 hours**

4. Transistors (5 periods)

p n p and n p n transistors, current components in transistors (Two Port model), CB,CE and CC configurations and h-parameters – Concept of transistor biasing, operating point, fixed bias and self bias (Qualitative only),

5. Amplifier and Oscillators (5 periods)

Transistor as an amplifier, Concept of feedback, Barkhausen criterion, RC coupled amplifier and phase shift oscillator (qualitative).

Unit – IV **10 hours**

6. Digital Principles

Binary number system: Converting 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 – vice versa and Decimal to Hexadecimal 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.

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OUT COME

Having completed this course, student should understand the behaviour of basic electronic devices, principles of operation and design concepts and analysis of circuits built using these devices.

Electronics Lab VI semester – PH 623AP

(30 Hours – 15 sessions)

HPW: 2 **CREDIT: 1**

1. Verification of Kirchhoff's laws.
2. Determination of time constant of RC circuit.
3. Power factor of an A.C. circuit
4. LCR circuit series resonanace – Q factor
5. V-I Characteristics of a Junction diode
6. V-I Characteristics of Zener diode and Application of Zener diode as voltage regulator
7. Input/ Output V-I Characteristics of Transistor.
8. Basic gates construction using discrete components.
9. Verification of de- Morgan's laws.
10. Half Adder and Full Adder circuits

Textbooks

1. Third year Physics – *Telugu Akademy*
2. Electricity and Electronics – D.C. Tayal, *Himalaya Publishing House.*
3. Modern Physics by R. Murugeshan and Kiruthiga Siva Prasath, *S. Chand & Co.*
4. (For semi conductors & Digital Principles)
5. Electronic devices and circuits, Millman and Halkias. *Mc.Graw-Hill Education.*
6. Principles of Electronics, V K Mehta and Rohit Mehta, *S.CHAND & Company Ltd.*
7. Digital Principles & Applications, A.P.Malvino and D.P. Leach. *McGraw Hill Education.*
8. Digital logic and computer design by Morris Mano, Pearson
9. B.Sc Practical Physics by C L Arora, *S.CHAND & Company Ltd.*
10. B.Sc Practical Physics by Harnam Singh Dr P S Hemne *S.Chand & Company Ltd.*

Reference Books

1. Fundamentals of Physics by Halliday/Resnick/Walker - *Wiley India Edition 2007.*
2. Electricity, Magnetism with Electronics – K K Tewari. *S.Chand & Co.*
3. General Physics by Douglass C Giancoli, Prentice-Hall, INC, New Jersey.
4. Introduction to Physics for Scientists and Engineers. F.J Ruche. *McGraw Hill.*

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Syllabus-B Sc III Year PHYSICS

(To be implemented with effect from 2018-19)

Semester VI - Paper Code **PH 623B - Particle and Astrophysics (45 Hours)**

HPW: 4 **CREDITS: 4**

Objective

The Course introduces to the students the fundamental aspects of Particle and Astro Physics. The students will also get to know the various components of Universe, basic measurements to be made on Solar system with an emphasis on Stellar magnitudes and positions. This course would make a prerequisite for advanced studies in the fields of Particle or High energy Physics and Astro Physics

Unit I **12 hours**

Particle Physics: (12 hrs)

Introduction: cosmic rays and development of particle physics. Elementary Particle interactions: Basic features, types of particles and its families. Symmetries and Conservation Laws: energy and momentum, angular momentum, parity, baryon number, lepton number, iso-spin, strangeness and charm, concept of quark model, color quantum number and gluons

Unit II **12 hours**

Particle Accelerators and detectors: (12 hrs)

Classification of accelerators: Electrostatic accelerators, cyclic accelerators, linear accelerator, the cyclotron, betatron and synchrotron. Interaction of Particles with Matter: Nuclear, photonic and charged particle interactions. Range of interactions. Particle Detectors: Track Detectors, Photo sensors, Cherenkov Detectors and Transition Radiation Detectors

Unit III **8 hours**

Fundamentals of Astronomy: (8 hrs)

Introduction: Components of the Universe; Stars, Planets, Asteroids, Meteors, Comets, Galaxies. Solar System: Age, Origin Basic measurements: Planetary orbits, distances, physical size, mass, density, temperature, rotation period determination, Kepler's laws EM Spectrum: radiation from heated objects', Wien's law, radiation curves, Doppler Effect.

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Unit IV **13 hours**

Astrophysics and astronomy: (13 hrs)

Stellar magnitudes an sequences, Absolute magnitude, The bolometric magnitude - Different magnitude standards, The color index of a star, Luminosities of stars, Stellar parallax and the units of stellar distances, Stellar positions: The celestial co-ordinates. A Qualitative study on stellar positions and constellations. Nuclear Astrophysics: Primordial nucleosynthesis, energy production in stars, pp chain, CNO cycle. Production of elements (qualitative discussion)

Outcome

Having completed the course the student would have learnt about the development of Particle Physics with a good knowledge of various particle accelerators and detectors.. The student will be able to

- *Understand the elementary particle interactions with good insight to the various particle quantum numbers*
- *Use various particle accelerators and detectors for the measurement of Range, density and energy*
- *Get an insight to components of Universe and the origin of Solar System*
- *Perform basic measurements to determine distances, rotational time period, temperature and densities*
- *Analyze stellar spectra*

Particle and Astrophysics Lab VI semester – PH 623BP

(30 Hours – 15 sessions)

HPW: 2 **CREDIT: 1**

1. Characteristics of G M Counter.
2. Study of absorption of β and γ rays using G M Counter
3. Parallax Method – Distance of objects using trigonometric parallax.
4. HR Diagram & the physical properties of stars.
5. Analysis of stellar spectra.
6. Determination of temperature of a star (artificial) using filters.
7. Analysis of sunspot photographs & solar rotation period.

Text Books

1. Introduction to Astro Physics, Baidyanath Basu, *PHI learning private limited.*
2. Concepts of Modern Physics, Arthur Beiser *Tata McGraw-Hill Edition*
3. Atomic and Nuclear Physics- An Introduction, T.A. Littlefield and N. Thorley, *Van Nostrand Reinhold Co.Ltd.*
4. Nuclear Physics, Irving Kaplan, *Addison-Wesley Publishing Company.*
5. Nuclear Physics S.N Ghoshal, *S. Chand.*
6. Introduction to Elementary Particles, D. Griffith, *John Wiley & Sons*
7. B.Sc Practical Physics, Harnam Singh Dr P S Hemne, *S.CHAND & Company*

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Reference Books

1. Introduction to Particle and Astroparticle Physics, **De Angelis**, Alessandro, **Pimenta**, Mário João Martins, *Springer Science*
2. *Astroparticle Physics , Grupen C, Springer 2005*
3. Introductory nuclear Physics, Kenneth S.Krane ,*Wiley India Pvt. Ltd., 2008*
4. Concepts of nuclear physics, Bernard L.Cohen, *Tata Mcgraw Hill, 1998.*
5. Introduction to the physics of nuclei & particles, R.A.Dunlap, *Thomson Asia, 2004*
6. Advanced Practical Physics for students, B.L. Flint & H.T. Worsnop, 1971, *Asia Publishing House.*

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Skill Enhancement Course-SE623 -30 Hours

HPW : 2 Hours **REDITS: 2**

Boolean Algebra

Objective:

To facilitate the students with basics of:

- *Number systems and conversions.*
- *Logic gates, Boolean algebra and simple design digital circuits.*
- *Combinational Logic circuits to construct adders, subtractors, etc.*

UNIT I **(15 Hours)**

Number Systems: Binary, Octal, Hex and Decimal Numbers – Binary addition and Subtraction using one's and two's compliment method, Binary codes-BCD, Gray Code, Binary logic and Logic gates, Multi level NAND and NOR Circuits, Digital Integrated Circuits -7486 series.

Boolean Laws, DeMorgan's Theorems, Simplification of Boolean expressions – circuit diagram implementation of Boolean expressions.

UNIT II **(15 Hours)**

Combinational Logic: Introduction – Adders – Half, Full and Parallel adder, Subtractor –Half, Full, Multiplexer, Demultiplexer, Encoder, Decoder.

Course Outcome:

The students will be able to

- Use number systems to solve problems.
- Design logic circuits and give their truth tables.
- To reduce digital circuits using Boolean algebra.
- Get familiarized with Combinational Logic circuits

Recommended Books:

1. Digital logic and Computer Design - M Morris Mano , Prentice Hall of India pvt limited.
2. Introduction to Digital Circuits – Theodore F Bogat, JR. – McGraw-Hill publications.

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Generic Elective Course G E 6 2 3 -30 Hours

HPW : 2 Hours CREDITS: 2

BIOPHYSICS
Theory 30 Lectures

Objective

The aim of this course is to

- *introduce the basic physics concepts involved in the functioning of Eye and Ear*
- *enable students to develop a basic familiarity with all the major medical imaging techniques*

UNIT I **15 Lectures**

Physics of Eye and Ear

Physics of the Eye and Vision - Specifications of the Optical System, Vision Elements of the Eye(Cornea, Aqueous humor, Lens cover, Lens centre, Vitreous humor), The physical aspects of the Retina, The power of Accommodation, Optical Defects of the Eyes - Myopia (Short sight), Astigmatism, Hypermetropia (long sight), Presbyopia.

Physics of the Ear and Hearing: Outer Ear, Middle Ear, Inner Ear, Sensitivity of the Ear, Deafness and Hearing Aids

UNIT II **15 Lectures**

Introduction to Medical Imaging

Introduction to imaging, Medical imaging before x-rays, X-radiography, Computed Tomography, Ultrasound Magnetic resonance imaging, Nuclear imaging, Electromagnetic imaging techniques, other imaging techniques.

Outcome

On completion of this course,

- *Students **will** get familiarize with basics of physics involved in functioning of Eye and Ear.*
- *Students will be able to analyze the properties from the corresponding medical images.*

Reference Books:

1. Optics and Vision by Leno S. Pedrotti, Frank L. Pedrotti, Prentice Hall, 1998, ISBN 0132422239, 9780132422239
2. Optics of the Human Eye by David A. Atchison, George Smith, Butterworth-Heinemann, 2000, ISBN 0750637757, 9780750637756
3. Diagnostic and Imaging Techniques in Ophthalmology by Amar Agarwal, Samuel Boyd, Robert C Drews, JP Medical Ltd
4. The Physics of Medical Imaging by S. Webb, Taylor and Fracis Group
5. Fundamentals of Medical Imaging by Paul Suetens, Cambridge University press.

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