PHYSICS DEPARTMENT

Physics Syllabus

B.Sc. (Non-Medical)

PART-I
(Semester I & II)
2022-23, 2023-24 and 2024-25

Sri Guru Teg Bahadur Khalsa College
Sri Anandpur Sahib-140118, Punjab

*An Autonomous College, Affiliated to Punjabi University Patiala
*NAAC Accredited 'A' Grade
*College with Potential for Excellence Status by UGC
*STAR College Status by Department of Biotechnology, Govt. of India
*Department of Science & Technology-FIST Scheme, Govt. of India

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APPROVED
Board of Studies Meeting held on 1st August, 2022

BSC(PHY)-103A: MECHANICS

Maximum Marks: 50 | **Teaching Hours: 30 (2 Credits)**
External Examination: 35 (Pass Marks: 12) | **Pass Percentage: 35%**
Internal Assessment: 15 (Pass Marks: 05) | **Time Allowed: 3 Hours**

15 marks internal assessment will be based on two mid-semester tests, class tests, written assignments, project work etc. and lecture attendance.

Instruction for the Paper Setter: The question paper will consist of three sections A, B and C. Sections A and B will have four questions from respective sections of the syllabus and Section C will have 11 short answer type questions, which will be set from the entire syllabus uniformly. Each question of sections A and B will carry 6 marks and section C will carry 11 marks.

Instruction for the candidates: The candidates are required to attempt any two questions out of four from each section A and B and the entire section C of the question paper. Each question of sections A and B carries 6 marks and section C carries 11 marks. **Use of scientific calculator is allowed.**

Course Objective: Students will develop their quantitative and mathematical skills needed to describe the co-ordinate system, central forces, rigid bodies, frame of references and relativity.

Section A

Co-ordinates: Cartesian and spherical polar co-ordinates system, area, volume, displacement, velocity, and acceleration in these systems, Solid angle.

Central Forces: Various forces in nature (brief introduction), Centre of mass, Equivalent one body problem, Central forces, Equation of motion under central force, Equation of orbit in inverse square, Force field and turning points, Kepler laws and their derivation.

Rigid body motion: Rotational motion, principal moments and axes. Euler's equations.

Section B

Inertial and Non Inertial Frames: Frames of reference. Galilean transformation and Invariance, concept of stationary universal frame of reference and ether. Non-Inertial frames and Fictitious Forces. Fictitious forces in non-inertial frame having rotational motion. Effect of rotation of earth on acceleration due to gravity. Effect of Coriolis force on a particle moving on the surface of earth.

Special Theory of Relativity: Postulates of special theory of relativity, Michelson Morley Experiment, Lorentz transformations. Relativity of Length, Time and Velocities. Relativistic Doppler effect, Variation of Mass with Velocity, Mass-Energy Equivalence. Relativistic momentum and energy.

Course learning outcome: After going through the course, the student should be able to;

1. Understand laws of motion and their application to various dynamical situations, notion of inertial frames and concept of Galilean invariance. He / she will learn the concept of conservation of energy, momentum, angular momentum and apply them to basic problems.
2. Apply Kepler's law to describe the motion of planets and satellite in circular orbit, through the study of law of Gravitation.
3. Describe how fictitious forces arise in a non-inertial frame, e.g., why a person sitting in a merry-go-round experiences an outward push.
4. Describe special relativistic effects and their effects on the mass and energy of a moving object, appreciate the nuances of Special Theory of Relativity (STR).

Text Books

1. Mechanics: H.S. Hans and S.P. Puri, Tata McGraw Hill, New Delhi
2. Analytical Mechanics: Satish K. Gupta, Modern Publishers

Reference Books

- University Physics. F.W. Sears, M.W. Zemansky and H.D. Young, 13/e, 1986. Addison-Wesley
- Mechanics Berkeley Physics, v.1: Charles Kittel, et. al. 2007, Tata McGraw-Hill. Physics – Resnick, Halliday & Walker 9/e, 2010, Wiley
- Engineering Mechanics, Basudeb Bhattacharya, 2nd edn., 2015, Oxford University Press

BSC(PHY)-103B: ELECTRICITY & MAGNETISM-I

Maximum Marks: 50 **Teaching Hours: 30 (2 Credits)**
External Examination: 35 (Pass Marks: 12) **Pass Percentage: 35%**
Internal Assessment: 15 (Pass Marks: 05) **Time Allowed: 3 Hours**

15 marks internal assessment will be based on two mid-semester tests, class tests, written assignments, project work etc. and lecture attendance.

Instruction for the Paper Setter: The question paper will consist of three sections A, B and C. Sections A and B will have four questions from respective sections of the syllabus and Section C will have 11 short answer type questions, which will be set from the entire syllabus uniformly. Each question of sections A and B will carry 6 marks and section C will carry 11 marks.

Instruction for the candidates: The candidates are required to attempt any two questions out of four from each section A and B and the entire section C of the question paper. Each question of sections A and B carries 6 marks and section C carries 11 marks. **Use of scientific calculator is allowed.**

Course Objective: This course continues building the foundation in electricity and magnetism and is intended for students to advanced studies in the physical sciences. Topics include vector calculus, electric fields, potential, capacitors.

Section A

Vector Analysis: Review of vector algebra (Scalar and Vector product), gradient, divergence, Curl and their significance, Vector Integration, Line, surface and volume integrals of Vector fields, Gauss-divergence theorem and Stoke's theorem of vectors (statement only).

Electrostatics: Coulomb's Law, Electrostatic Field, electric flux, Gauss's theorem of electrostatics. Applications of Gauss theorem- Electric field due to point charge, infinite line of charge, uniformly charged spherical shell and solid sphere, plane charged sheet, charged conductor.

Section B

Electric Potential: Electric potential as line integral of electric field, potential due to a point charge, electric dipole, uniformly charged spherical shell and solid sphere. Calculation of electric field from potential.

Capacitance: Concept of capacitor, Capacitance of an isolated spherical conductor. Parallel plate, spherical and cylindrical condenser. Energy per unit volume in electrostatic field. Dielectric medium, Polarisation, Displacement vector. Gauss's theorem in dielectrics. Parallel plate capacitor completely filled with dielectric.

Course Outcome: By the end of this course, you should be able to:

- Apply the tools of vector calculus, and demonstrate a working understanding of the divergence and curl of vector fields, as well as the divergence and curl integral theorems.
- Demonstrate a mastery of Coulomb's law for the electric field, and apply it to systems of point charges as well as line, surface, and volume distributions of charges.
- Demonstrate an understanding of the relation between electric field and potential, exploit the potential to solve a variety of problems, and relate it to the potential energy of a charge distribution.
- Demonstrate an understanding of the behaviour of electric conductors.

Text Book

1. Electricity and Magnetism by Ashok Sharma and R.C. Lakhanpal, Modern Publishers
2. Electricity and Magnetism. Berkeley Physics Course. Vol. II by E.M. Purcell, McGraw-Hill, 1965.

Reference Books

- Fundamentals of Electricity and Magnetism by Author F. Kip. McGraw Hill (1969)
- Introduction to Classical Electrodynamics by David Griffith. Prentice Hall of India, New Delhi.
- EM Waves and Radiating Systems by Edward C. Jordan and K.G. Balmain. Prentice Hall of India, New Delhi.

BSC(PHY)-103P: PHYSICS PRACTICAL

Maximum Marks: 50 **Teaching Hours: 60 (Credits: 2)**
Pass Marks: 35% (18 Marks) **Time Allowed: 3 Hours**

Instructions: The candidate will mark any four experiments on the question paper and the examiner will allot one of these four experiments to be performed. The distribution of marks is given below:

1. One full experiment requiring the student to take some data, analyze it and draw conclusions on the basis of Experimental Skills. (25)
2. Brief theory (05)
3. Viva-Voce (10)
4. Record (Practical File) (10)

Experimental Skills: General precautions for measurements and handling of equipment, Presentation of measurements, Fitting of given data to a graph, Results with proper Significant Figures and Limits of Error, Interpretation of results etc.

List of Experiments:

1. To measure the volume of a small cylindrical/spherical body by using a Vernier callipers.
2. To find the thickness of a given sheet/paper with the help of a screw gauge.
3. To determine the moment of inertia of a fly-wheel about its axis of rotation.
4. To study the rotational motion using a flywheel and hence show that the torque is proportional to angular acceleration.
5. To show that Moment of Inertia depends upon the distribution of mass by using objects of different geometrical shapes but of the same mass.
6. To determine the value of 'g' and the moment of inertia of a bar about C.G. by means of a bar pendulum.
7. To determine the value of 'g' by means of Kater's reversible pendulum.
8. To find the relationship between the longitudinal strain and lateral strain in case of a rubber tube and hence to find the Poisson's ratio for rubber.
9. To determine the value of the modulus of rigidity of the material of a given wire by using Maxwell's needle.
10. To determine the Young's modulus of the material of a given beam supported on two knife edges and loaded at the middle point.
11. To determine elastic constants of the material of a given wire by Searle's method.
12. To study the one-dimensional elastic collision using two hanging spheres.
13. To study the variation of moment of inertia of a system with the variation in the distribution of mass and hence to verify the theorem of parallel axes.
14. To determine the height of a tower by using a Sextant.
15. To determine the unknown capacitance by flashing and quenching of a neon bulb.

Text and Reference Books:

1. B.Sc. Practical Physics, By C.L. Arora, S. Chand & Co.
2. A Laboratory Manual of Physics for undergraduate classes by D.P. Khandelwal

BSC(PHY)-203A: OSCILLATIONS AND WAVES

Maximum Marks: 50 **Teaching Hours: 30 (2 Credits)**
External Examination: 35 (Pass Marks: 12) **Pass Percentage: 35%**
Internal Assessment: 15 (Pass Marks: 05) **Time Allowed: 3 Hours**

15 marks internal assessment will be based on two mid-semester tests, class tests, written assignments, project work etc. and lecture attendance.

Instruction for the Paper Setter: The question paper will consist of three sections A, B and C. Sections A and B will have four questions from respective sections of the syllabus and Section C will have 11 short answer type questions, which will be set from the entire syllabus uniformly. Each question of sections A and B will carry 6 marks and section C will carry 11 marks.

Instruction for the candidates: The candidates are required to attempt any two questions out of four from each section A and B and the entire section C of the question paper. Each question of sections A and B carries 6 marks and section C carries 11 marks. **Use of scientific calculator is allowed.**

Course Objective: Students will develop their quantitative and mathematical skills needed to describe the oscillations in mechanical and electrical medium under various conditions, Electromagnetic waves and related Maxwell's equations.

Section A

Oscillations: Simple harmonic Oscillations, Mechanical Oscillator. Electrical oscillator, Compound pendulum.

Damped Oscillations: Types of Damping, Equation of damped SHM and its solution, Damped electrical oscillator. Logarithmic decrement, relaxation time and Q-Factor.

Forced Oscillations: Differential equation for forced mechanical and electrical oscillators. Solution of the equation of forced mechanical oscillator, Variation of phase difference between displacement and driving force. Variation of displacement and velocity with driving force frequency. Power in a forced mechanical oscillator, Quality factor of forced oscillator and band width.

Section B

Wave Motion: Wave equation, solution of wave equation, Characteristic impedance of a string. Reflection and refraction of waves in a string, Impedance matching.

EM Waves: Maxwell's equations. Characteristics of Maxwell's equations, Electromagnetic waves and wave equation in a medium having finite permeability and permittivity but with zero conductivity. Transverse nature of EM waves, Relation between electric and magnetic vectors in an EM wave, Poynting vector. EM waves in medium with finite permeability, permittivity and conductivity: its solution and skin depth.

Course Learning Outcomes: After going through the course, the student should be able to;

- Demonstrate the idea of Oscillations of mechanical and electrical oscillator.
- Understand oscillations in various conditions
- Understand electromagnetic waves and related Maxwell's equations
- Understand wave nature in various mediums

Text Books:

1. Fundamentals of Vibrations and Waves by S.P. Puri, Tata McGraw Hill, New Delhi.
2. Vibrations, Waves & E.M. Theory: Ashok Sharma and R.C. Lakhanpal, Modern's Publishers.

Reference Books:

1. University Physics. F.W. Sears, M.W. Zemansky and H.D. Young, 13/e, 1986. Addison-Wesley
2. Mechanics Berkeley Physics, v.1: Charles Kittel, et. al. 2007, Tata McGraw-Hill. Physics – Resnick, Halliday& Walker 9/e, 2010, Wiley
3. Engineering Mechanics, Basudeb Bhattacharya, 2nd edn., 2015, Oxford University Press
4. University Physics, Ronald Lane Reese, 2003, Thomson Brooks

BSC(PHY)-203B: ELECTRICITY and MAGNETISM-II

Maximum Marks: 50 | **Teaching Hours: 30 (2 Credits)**
External Examination: 35 (Pass Marks: 12) | **Pass Percentage: 35%**
Internal Assessment: 15 (Pass Marks: 05) | **Time Allowed: 3 Hours**

15 marks internal assessment will be based on two mid-semester tests, class tests, written assignments, project work etc. and lecture attendance.

Instruction for the Paper Setter: The question paper will consist of three sections A, B and C. Sections A and B will have four questions from respective sections of the syllabus and Section C will have 11 short answer type questions, which will be set from the entire syllabus uniformly. Each question of sections A and B will carry 6 marks and section C will carry 11 marks.

Instruction for the candidates: The candidates are required to attempt any two questions out of four from each section A and B and the entire section C of the question paper. Each question of sections A and B carries 6 marks and section C carries 11 marks. **Use of scientific calculator is allowed.**

Course Objective: At the end of reading the course, the student should be able to demonstrate an understanding of the concepts of Electricity and Magnetism which include the concept of magnetostatics, the magnetic properties of materials, Faraday's Laws and Maxwell equations.

Section A

Electric Current: Electric current density, drift velocity, Equation of continuity and conservation of charge, Ohm's law, Microscopic form of Ohm's law, Derivation of Ohm's law from $\vec{J} = \sigma\vec{E}$, Invariance of charge, Electric field in different frames of reference, Electric field due to a point charge moving with constant velocity, Force on a charge moving through an electric field, Force between parallel currents,

Section B

Magnetic properties of materials: Magnetic intensity, magnetic induction, permeability, magnetic susceptibility. Difference between dia-, para- and ferro-magnetic materials. Hysterisis.

Magnetic field: Lorentz's force**,** Magnetic force on a current element, Biot-Savart's law & its applications- straight current carrying conductor, circular coil, solenoid carrying current. Ampere's circuital law, Divergence and curl of magnetic field.

Electromagnetic Induction: Faraday's laws of electromagnetic induction and derivation, Lenz's law, self and mutual inductance, Reciprocity theorem.

Course Learning Outcomes: Having successfully completed this module, student will be able to demonstrate knowledge and understanding of:

- The Biot-Savart's law & its application, the Magnetic properties of Materials.
- The use of Faraday's Law of electromagnetic induction, Lenz's Law, self and mutual induction.
- Maxwell's equations and electromagnetic wave propagation.

Text Books

1. Electricity and Magnetism. Berkeley Physics Course. Vol.II by E.M. Purcell, McGraw-Hill, 1965.
2. Electricity and Magnetism by Ashok Sharma & R.C. Lakhanpal, Modern's Publishers.

Reference Books

- Fundamentals of Electricity and Magnetism by Author F.Kip. McGraw Hill (1969)
- Introduction to Classical Electrodynamics by David Griffith. Prentice Hall of India, New Delhi.
- EM Waves and Radiating Systems by Edward C.Jordan and K.G.Balmain. Prentice Hall of India, New Delhi.

BSC(PHY)-203P: PHYSICS PRACTICAL

Maximum Marks: 50 **Teaching Hours: 60 (Credits: 2)**
Pass Marks: 35 % (18 Marks) **Time Allowed: 3 Hours**

Instructions: The candidate will mark any four experiments on the question paper and the examiner will allot one of these four experiments to be performed. The distribution of marks is given below:

1. One full experiment requiring the student to take some data, analyze it and draw conclusions on the basis of Experimental Skills. (25)
2. Brief theory (05)
3. Viva-Voce (10)
4. Record (Practical File) (10)

Experimental Skills: General precautions for measurements and handling of equipment, Presentation of measurements, Fitting of given data to a graph, Results with proper Significant Figures and Limits of Error, Interpretation of results etc.

List of Experiments:

1. Measurement for logarithmic decrement, co-efficient of damping, relaxation time and quality factor of a damped simple pendulum.
2. To set up CRO for Sine and Square wave and to find their frequency and amplitude.
3. To study the magnetic field produced by a current carrying solenoid using a search coil and to find the value of permeability of air.
4. To determine the value of air capacitance by de-Sauty method and to find the permittivity of air and also to determine the dielectric constant of medium.
5. To determine the frequency of AC mains using a sonometer and an electro magnet.
6. To determine the frequency of A.C. mains or of an electric vibrator by Melde's experiment, using: (i) Transverse arrangement (ii) Longitudinal arrangement
7. To verify the laws of vibrating strings by Melde's experiment and to show that $\frac{\lambda^2}{T} =$ constant.
8. To find mass susceptibility of
   (i) $FeCl_3 6H_2O$
   (ii) Anhydrous $FeCl_3$
   (iii) Molecular (or molar) susceptibility by Quincke's method.
9. To determine the restoring force per unit extension of a spiral spring and also determine the mass of the spring.
10. Study the phase relationships between voltage and current using impedance triangle for LCR series circuit.
11. To study the resonance in series LCR circuit for different resistances and find Q-value.
12. To study the resonance in parallel LCR circuit for different resistances and find Q-value.
13. To determine the given inductance by Anderson's bridge.
14. To determine the specific resistance of copper using standard low resistance Kelvin's double bridge.
15. To study the e.m.f. produced as a function of the velocity of the magnet.
16. To compare the capacitances of two capacitors (C_1, C_2) by de-Sauty's method.
17. To study the working of energy meter.
18. To study the magnetic field of a circular conductor as a function of the current (Biot Savart's law).
19. To study the magnetic field of a circular conductor as a function of distance from the axis of the conductor (Biot Savart's law).
20. To study the magnetic field as a function of loop radius (Biot Savart's law).

Reference Books:

1. B.Sc. Practical Physics, By C.L. Arora, S. Chand & Co.
2. A Laboratory Manual of Physics for undergraduate classes by D.P. Khandelwal

PHYSICS DEPARTMENT

Physics Syllabus

B.Sc. (Non-Medical)

PART-II
(Semester III & IV)
2022-23, 2023-24 and 2024-25

Sri Guru Teg Bahadur Khalsa College
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*Department of Science & Technology-FIST Scheme, Govt. of India

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APPROVED
Board of Studies Meeting held on 1st August, 2022

BSC(PHY)-303A: STASTISTICAL PHYSICS

Maximum Marks: 50 **Teaching Hours: 30 (2 Credits)**
External Examination: 35 (Pass Marks: 12) **Pass Percentage: 35%**
Internal Assessment: 15 (Pass Marks: 05) **Time Allowed: 3 Hours**

15 marks internal assessment will be based on two mid-semester tests, class tests, written assignments, project work etc. and lecture attendance.

Instruction for the Paper Setter: The question paper will consist of three sections A, B and C. Sections A and B will have four questions from respective sections of the syllabus and Section C will have 11 short answer type questions, which will be set from the entire syllabus uniformly. Each question of sections A and B will carry 6 marks and section C will carry 11 marks.

Instruction for the candidates: The candidates are required to attempt any two questions out of four from each section A and B and the entire section C of the question paper. Each question of sections A and B carries 6 marks and section C carries 11 marks. **Use of scientific calculator is allowed.**

Course Objective: This course develops concepts of statistical mechanics, statistical interpretation of thermodynamics, the methods of statistical mechanics are used to develop the statistics for Bose-Einstein, Fermi-Dirac and photon gases, various laws related to radiation are discussed.

Section A

Statistical Mechanics: Scope of statistical Physics, Basic ideas of probability, Case of box divided into equal sized compartments, Distribution of 4 distinguishable particles in 2 compartments of equal size, Microstate and Macrostate, Distribution of n particles in 2 compartments, State of maximum probability, Stirling formula, Deviation from the state of maximum probability, Distribution of n distinguishable particles in k compartments of unequal size.

Phase space, Division of phase space into cells, three kinds of statistics, Basic approach in three statistics, Maxwell Boltzmann statistics applied to an ideal gas in equilibrium, Derivation of most probable speed, average speed, and root mean square speed of the gas molecules using Maxwell-Boltzmann's law of molecular speeds.

Section B

Bose-Einstein Statistics: Need of quantum statistics, Bose-Einstein statistics, Application of Bose-Einstein statistics to photon gas and derivation of Plank's law of black body radiation, Spectral energy distribution of black body radiations, Deduction of Wien's Displacement law from Plank's law, Deduction of Stefan Boltzmann's law from Plank's law of radiation.

Fermi-Dirac Statistics: Application of Fermi-Dirac statistics to free electrons inside conductors, Fermi energy, Average energy of electron at zero Kelvin, Average speed of electrons at zero Kelvin, Comparison of M-B, B-E, and F-D statistics.

Course Learning Outcomes: The students will be able to understand the concepts in statistical mechanics, statistical interpretation of thermodynamics, the methods of statistical mechanics used to develop the statistics for Bose-Einstein, Fermi-Dirac and photon gases, Black body radiation and various related laws.

Text Books:

1. A Text Book of Statistical Physics and Thermodynamics, V.K. Sharma, Renu Bedi, Sangeeta Sharma, PV Books, Jalandhar

Reference Books:

- Statistical Physics and Thermodynamics, V.S. Bhatia (Sohan Lal Nagin Chand, Jalandhar)
- Statistical Mechanics: An Introductory Text, J.K. Bhattacharjee, (Allied Pub., Delhi) 2000.
- Statistical Mechanics, B.B. Laud (Macmillan India Ltd), 1981.
- A Treatise on Heat, M.N. Saha & B.N. Srivastava, (The Indian Press Pvt. Ltd.) 1965.

BSC(PHY)-303B: QUANTUM MECHANICS

Maximum Marks: 50 **Teaching Hours: 30 (2 Credits)**
External Examination: 35 (Pass Marks: 12) **Pass Percentage: 35%**
Internal Assessment: 15 (Pass Marks: 05) **Time Allowed: 3 Hours**

15 marks internal assessment will be based on two mid-semester tests, class tests, written assignments, project work etc. and lecture attendance.

Instruction for the Paper Setter: The question paper will consist of three sections A, B and C. Sections A and B will have four questions from respective sections of the syllabus and Section C will have 11 short answer type questions, which will be set from the entire syllabus uniformly. Each question of sections A and B will carry 6 marks and section C will carry 11 marks.

Instruction for the candidates: The candidates are required to attempt any two questions out of four from each section A and B and the entire section C of the question paper. Each question of sections A and B carries 6 marks and section C carries 11 marks. **Use of scientific calculator is allowed.**

Course Objectives- The objective of the course on Quantum Mechanics for the student of B.Sc. Non-Medical is to equip them with the knowledge of wave particle duality, Planck's quantum, fundamental of quantum relations, and related problems and applications.

Section A

Formalism of Wave Mechanics: Brief introduction to need and development of quantum mechanics, Photo-electric effect and its explanation, Compton effect, Derivation of change in wavelength, Wave-particle duality, de-Broglie hypothesis, Wave packet, Wave velocity and Group velocity, Uncertainty principle, Its illustration and applications, Complementarity principle

Interpretation of wave function, normalization, wave function for a free particle, Time dependent and time independent Schrodinger equations, operators, Energy function and Eigen values, Expectation value, Degeneracy, Orthogonality of energy Eigen functions, Ehrenfest theorem, probability current and conservation of probability, Parity

Section B

Problems in one and three dimensions: One dimensional box, Potential step (energy less than step height), Potential step (energy more than step height), Potential barrier (Tunnel effect), Rectangular potential well, Linear harmonic oscillator, Significance of zero-point energy, Schrodinger wave equation for the Hydrogen atom using spherical polar coordinates, Wave function of Hydrogen atom, Degeneracy.

Course learning outcome: Students will have achieved the understanding of:

- The basic laws of quantum and their relations etc.
- The wave function and its properties
- Schrodinger equation solution and related problems

Text Books:

1. Quantum Physics, Ashok Sharma, Modern's Publications
2. Modern Physics, Dr. A. K. Sikri , Pradeep Publications
3. Quantum Physics, Neelam Malhotra, Pee Vee Publications

Reference Books:

- Concepts of Modern Physics, Arthur Beiser, 2009, McGraw-Hill
- Quantum Mechanics by V.K. Thankappan.
- Quantum Physics, Berkeley Physics, Vol.4. E.H. Wichman, 2008, Tata McGraw Hill Co.

BSC(PHY)-303P: PHYSICS PRACTICAL

Maximum Marks: 50 **Teaching Hours: 60 (Credits: 2)**
Pass Marks: 35% (18 Marks) **Time Allowed: 3 Hours**

Instructions: The candidate will mark any four experiments on the question paper and the examiner will allot one of these four experiments to be performed. The distribution of marks is given below:

1. One full experiment requiring the student to take some data, analyze it and draw conclusions on the basis of Experimental Skills. (25 marks)
2. Brief theory (05 marks)
3. Viva-Voce (10 marks)
4. Record (Practical File) (10 marks)

Experimental Skills: General precautions for measurements and handling of equipment, Presentation of measurements, Fitting of given data to a graph, Results with proper Significant Figures and Limits of Error, Interpretation of results etc.

Objectives: The students will be able:

- To understand the basic concepts of Planck's constant, Stefan's constant.
- To gain knowledge about photovoltaic cell, thermocouple and heating efficiency and able to use their applications.
- To understand probability distribution, temperature coefficient and ionization potential of mercury.

List of Experiments:

1. Measurement of Planck's constant using LED.
2. To determine Stefan's Constant.
3. To find the ionisation potential of mercury using a gas filled diode.
4. To find the value of Plank's constant and photo electric work function of the material of the cathode using a photo electric cell.
5. To verify inverse square law of radiation using a photo-electric cell.
6. To study the characteristics of photovoltaic cell (solar cell)
7. To determine the Coefficient of Thermal Conductivity of Cu by Searle's apparatus.
8. To study the probability distribution using dice and coins.
9. To determine the Temperature Coefficient of Resistance by Platinum Resistance Thermometer (PRT).
10. To study the variation of Thermo-EMF of a thermocouple with difference of temperature of its two junctions.
11. To determine the heating efficiency of electric kettle.
12. Fitting straight line or a simple curve from a given set of data.

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

- Demonstrate the different applications of relative concepts.
- Distinguish between different photo devices and their working.
- Understand different properties of gas filled diode and photoelectric cell.
- Measurement of Plank's constant, Stefan's constant etc.

Reference Books

1. B. Sc. Practical Physics, C. L. Arora, S Chand and Company Publications
2. Laboratory Manual of Physics for undergraduate classes, D.P. Khandelwal,1985, Vani Pub.

BSC(PHY)-403A: THERMODYNAMICS

Maximum Marks: 50 **Teaching Hours: 30 (2 Credits)**
External Examination: 35 (Pass Marks: 12) **Pass Percentage: 35%**
Internal Assessment: 15 (Pass Marks: 05) **Time Allowed: 3 Hours**

15 marks internal assessment will be based on two mid-semester tests, class tests, written assignments, project work etc. and lecture attendance.

Instruction for the Paper Setter: The question paper will consist of three sections A, B and C. Sections A and B will have four questions from respective sections of the syllabus and Section C will have 11 short answer type questions, which will be set from the entire syllabus uniformly. Each question of sections A and B will carry 6 marks and section C will carry 11 marks.

Instruction for the candidates: The candidates are required to attempt any two questions out of four from each section A and B and the entire section C of the question paper. Each question of sections A and B carries 6 marks and section C carries 11 marks. **Use of scientific calculator is allowed.**

Course Objective: To give basic knowledge about the laws and potentials of thermodynamics and its applications in different physical conditions.

Section A

Statistical Basis of Entropy: Statistical definition of entropy, Change of Entropy of a system, Increase of entropy in natural processes, Reversible and irreversible processes, Entropy and disorder.

Entropy and Carnot's Cycle: Thermodynamics, Work and Heat, Thermodynamic variables and processes, Laws of thermodynamics, Specific heats of gas, Relation between two specific heats of a gas, Work done in an isothermal process, Equation of an adiabatic process, Work done in an adiabatic process, Carnot's reversible heat engine, Efficiency of any reversible heat engine (Carnot's theorem), Entropy changes in a Carnot's cycle, Temperature-Entropy diagram, Thermoelectric effect, Application of thermodynamics to the thermoelectric effect, Entropy of a perfect gas, Heat death of universe.

Section B

Maxwell's Thermodynamic Relationships and Applications: Thermodynamic functions, Maxwell's four thermodynamic relations, Deduction of Clapeyron's latent heat equation and Clausius-Clapeyron equation, Cooling produced by adiabatic expansion of any substance, Adiabatic compression of a substance, Adiabatic stretching of a wire, Stretching of thin films, Expression for Cp-Cv.

Joule-Thomson Experiment: Joule Thomson effect and its basic cause, Mathematical theory of Joule-Thomson effect, Use of Joule-Thomson effect for liquefaction of helium, Production of very low temperature by adiabatic demagnetisation.

Course Learning Outcomes: After completion of the course, student will be able to understand:

- The Laws of thermodynamics, entropy, and Maxwell's thermodynamic relations etc.
- The basic of statistical mechanics, concept of microstate, macrostate and three kinds of statistics.
- The Transport Phenomena, law of equipartition of energy and its applications.

Text Books:

1. A Text Book of Statistical Physics and Thermodynamics, V.K. Sharma, Dr. Renu Bedi, Sangeeta Sharma, PV Books, Jalandhar

Reference Books:

1. Statistical Physics and Themodynamics -V.S. Bhatia, Punjab University, Chandigarh, 1977.
2. Thermal Physics, A. Kumar and S.P. Taneja, 2014, R. Chand Publications.
3. Thermodynamics and Statistical Physics - Khandelwal and Loknathan, Shivlal Agnawala, Agna

BSC(PHY)-403B: OPTICS AND LASERS

Maximum Marks: 50 **Teaching Hours: 30 (2 Credits)**
External Examination: 35 (Pass Marks: 12) **Pass Percentage: 35%**
Internal Assessment: 15 (Pass Marks: 05) **Time Allowed: 3 Hours**

15 marks internal assessment will be based on two mid-semester tests, class tests, written assignments, project work etc. and lecture attendance.

Instruction for the Paper Setter: The question paper will consist of three sections A, B and C. Sections A and B will have four questions from respective sections of the syllabus and Section C will have 11 short answer type questions, which will be set from the entire syllabus uniformly. Each question of sections A and B will carry 6 marks and section C will carry 11 marks.

Instruction for the candidates: The candidates are required to attempt any two questions out of four from each section A and B and the entire section C of the question paper. Each question of sections A and B carries 6 marks and section C carries 11 marks. **Use of scientific calculator is allowed.**

Course Objective: The course will provide the knowledge about the different phenomenon of visible light which includes the idea of interference, diffraction, polarization and some fundamentals concepts of Laser and their usefulness and applications.

Section A

Interference: Concept of coherence, Spatial and temporal coherence. Coherence time, Conditions for observing interference fringes, Interference by wave front division and amplitude division, Interference in thin films, Multiple beam interference, Newton Rings.

Diffraction: Huygens-Fresnel theory, half-period zones, Zone plates, Distinction between Fresnel and Fraunhofer diffraction, Fraunhofer diffraction at rectangular and circular apertures, Effects of diffraction in optical imaging, resolving power of telescope. The diffraction grating, its use as a spectroscopic element and its resolving power.

Section B

Polarization: Concept and analytical treatment of un-polarized, plane polarized and elliptically polarized light. Double refraction, Nicol prism, Sheet polarizer, Polaroid and its applications.

Laser Fundamentals: Derivation of Einstein's relations. Concept of stimulated emission and population inversion. Threshold condition, Introduction of three level and four level laser schemes, elementary theory of optical cavity, Longitudinal and transverse modes. Ruby, Nd: YAG lasers, He-Ne and CO_2 lasers, Basics of holography.

Course Learning Outcomes: Upon completion of this course, the students will be able to:

- Discuss the important areas of interference & diffraction with experiments associated with it.
- Differentiate between Fraunhofer and Fresnel diffraction.
- Apply skill to find the wavelength of spectral lines using Plane diffraction grating
- Distinguish the methods of polarisation by reflection, refraction and scattering
- Explain the Brewsters law and Malus law
- Describe the different types of lasers, its principle, properties of laser beam

Text Books:

1. Fundamentals of Optics, F.A. Jenkins and Harvery E. White (McGraw Hill) 4th edition, 2001.
2. Optics, Ajoy Ghatak (McMillan India) 2nd edition, 7th reprint 1997.
3. Introduction to Atomic Spectra, H.E. White (McGraw Hill Book Co.)

Reference Book:

- Optics, Born and Wolf (Pergamom Press), 3rd edition, 1965.

BSC(PHY)-403P: PHYSICS PRACTICAL

Maximum Marks: 50 **Teaching Hours: 60 (Credits: 2)**
Pass Marks: 35% (18 Marks) **Time Allowed: 3 Hours**

Instructions: The candidate will mark any four experiments on the question paper and the examiner will allot one of these four experiments to be performed. The distribution of marks is given below:

1. One full experiment requiring the student to take some data, analyze it and draw conclusions on the basis of Experimental Skills. (25)
2. Brief theory (05)
3. Viva-Voce (10)
4. Record (Practical File) (10)

Experimental Skills: General precautions for measurements and handling of equipment, Presentation of measurements, Fitting of given data to a graph, Results with proper Significant Figures and Limits of Error, Interpretation of results etc.

Objectives: The students will be able:

- To understand the basic concepts of optics and thermodynamics.
- To deal with spectrometer, polarimeter, laser sources, sodium lamps and mercury lamps.
- To analyze the refractive index of liquid, doubly refractive prisms etc.
- To find the thermal conductivity of bad conductors, resolving power of telescope etc.

List of Experiments:

1. To determine the least count and setup the spectrometer for minimum deviation position of the prism.
2. To determine the refractive index of the material of prism using spectrometer
3. To determine the refractive index of liquid using spectrometer
4. To determine the Cauchy's constants
5. To study the refractive index of doubly refracting prism
6. To determine the wave length of a given light using bi-prism
7. To determine the resolving power of a telescope
8. To determine the principal points of a lens system
9. Study of rotation of plane of polarization with a polarimeter.
10. Set up Newton's rings to determine wave length of sodium light
11. To determine the wavelength of Balmer series in the visible region from hydrogen emission.
12. To determine the Rydberg constant.
13. To determine the wave length and dispersive power using plane diffraction grating (Use Hg source)
14. To determine the divergence and wave length of a given laser source.
15. To study the adiabatic expansion of a gas and hence to calculate the value of ratio between two specific heats of the gas.
16. To determine the Coefficient of Thermal Conductivity of a bad conductor by Lee's disc method.

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

- Demonstrate the different applications of relative concepts.
- Understand the basic concepts like refraction, reflection, polarization, diffraction etc.
- Measurement of wavelength of sodium lamp by Newton's rings, refractive index, dispersive power etc.

Reference Books:

1. A Laboratory Manual of Physics for Undergraduate Classes, D.P. Khandelwal.
2. B.Sc. Practical Physics, C.L. Arora. S. Chand & Company Publishers

PHYSICS DEPARTMENT

Syllabus

Physics Skill Enhancement Course:

RADIATION SAFETY

B.Sc. (Non-Medical)

2022-23, 2023-24 and 2024-25

Sri Guru Teg Bahadur Khalsa College
Sri Anandpur Sahib-140118, Punjab

*An Autonomous College affiliated to Punjabi University Patiala
*NAAC Accredited 'A' Grade College
*College with Potential for Excellence Status by UGC
*STAR College Status by Department of Biotechnology, Govt. of India
*Department of Science & Technology-FIST Scheme, Govt. of India

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APPROVED
Board of Studies Meeting held on 1st August, 2022

Physics Skill Enhancement Course:
BSC(PHY)-404: RADIATION SAFETY

Maximum Marks: 50 **Credit: Theory (1) + Practical (1)**
Pass Marks: 40% (20 Marks) **Teaching Hours: 15 (Theory)**
Time: 3 Hours **30 (Practical)**

Course Objective: To know the general concepts of Interaction of Radiation with Matter: Types of Radiation, Radiation Detection and Monitoring Devices, Radiation Quantities and Units and Radiation Safety Management.

Instructions for The Paper Setter: The question paper will be set by appointed external examiner (Subject Expert) on the day of exam and the distribution of marks will be as under:

1. Theory exam from Section A - 25 Marks
2. Experiment to be performed from Section B - 15 Marks
3. Viva-voce - 5 Marks
4. Note-book - 5 Marks

Section A

Basic Radiation Physics: Atomic Structure, atomic number, mass number, isotopes, radioisotopes, radioactivity, specific activity, types of radioactive disintegrations, electron capture, characteristics of alpha, beta and gamma rays; energy of ionizing radiations, half life (physical, biological), effective half life, isomeric transitions, X-rays (characteristic and Bremsstrahlung) [Qualitative Only]

Interaction of Radiation with matter: Interaction of charged particles with matter, bremsstrahlung, range of charged particles, interaction of photon with matter (photoelectric, Compton scattering and pair production), absorption, scattering and attenuation of photons, Half Value Thickness (HVT) and tenth value Thickness (TVT)**.** [Qualitative Only]

Radiation Quantities and Units: Activity (Becquerel & Curie), energy, exposure (C/kg & Roentgen), Linear energy transfer (LET), air kerma, absorbed dose (Gray & rad), radiation weighting factors (WR), tissue weighting factors (WT), equivalent dose (Sievert & rem), effective dose (Sievert & rem), collective effective dose (Person Sv), Annual Limit of Intake {ALI} (Bq) and Derived Air Concentration {DAC} (Bq/m^3).

Biological Effects of Radiation: Interaction of radiation with cell, direct and indirect interactions, effect of radiation on living cells, chromosomal aberration, somatic and genetic effects, deterministic and stochastic (probabilistic) effects, partial body and whole body exposures. [Qualitative Only]

Operational Limits: Introduction to natural background radiation, concept of occupational risk, philosophy of radiation protection, system of dose limitation, ALARA, dose limits to radiation workers and general public, AERB/ICRP recommendations.

Section B

Experiments:

1. Study the background radiation levels using Radiation meter
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. KSO_4 etc.). Investigation of possible Radiation in different routine materials by operating GM at operating voltage.
5. Study of absorption of beta particles in Aluminum 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)
8. To determine the linear attenuation coefficient of given material using gamma source and scintillation detector.
9. To measure the pulse-height of gamma ray spectrum with multichannel analyzer (MCA).
10. To plot the complete gamma ray spectrum of 137Cs and mark the different peaks of the spectrum.

Course learning outcome:

- Be aware and understand the hazards of radiation and the safety measures to guard against these hazards.
- Have a comprehensive knowledge about the nature of interaction of matter with radiations like gamma, beta, alpha rays, neutrons etc. and radiation shielding by appropriate materials.
- Know about the units of radiations and their safety limits, the devises to detect and measure radiation, such as the Geiger-Mueller counter and scintillation counter.
- The students are expected to learn 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) its 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.
- The students are expected to do various experiments based on radiation safety.

Text Books

1. An Introduction to Nuclear Physics by M.R. Bhiday and V.A. Joshi, Orient Longman Publishers.
2. Nuclear Physics by D.C. Tayal, Himalaya Publishing House

Reference Books:

- Nuclear and Particle Physics, W.E. Burcham and M. Jobes, Longman (1995)
- Radiation Detection and Measurement, Glenn F. Knoll, Wiley Publishers
- A Primer in Applied Radiation Physics, F. A. Smith, World scientific Publishing Co. Pvt. Ltd.
- Fundamentals of Radiation Dosimetry, J.R. Greening, Medical Physics Hand Book Series, No.6, Adam Hilger Ltd., Bristol 1981.
- Practical Applications of Radioactivity and Nuclear Radiations, Gerhart C. Lowenthal and Peter Airey, Cambridge University Press.

PHYSICS DEPARTMENT

Physics Syllabus

B.Sc. (Non-Medical)

PART- III
(Semester V & VI)
2022-23, 2023-24 and 2024-25

Sri Guru Teg Bahadur Khalsa College
Sri Anandpur Sahib-140118, Punjab

*An Autonomous College, Affiliated to Punjabi University Patiala
*NAAC Accredited 'A' Grade
*College with Potential for Excellence Status by UGC
*STAR College Status by Department of Biotechnology, Govt. of India
*Department of Science & Technology-FIST Scheme, Govt. of India

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Website: www.sgtbcollege.org.in

APPROVED
Board of Studies Meeting held on 1st August, 2022

BSC(PHY)-503A: ANALOG ELECTRONICS

Maximum Marks: 50 **Teaching Hours: 30 (2 Credits)**
External Examination: 35 (Pass Marks: 12) **Pass Percentage: 35%**
Internal Assessment: 15 (Pass Marks: 05) **Time Allowed: 3 Hours**

15 marks internal assessment will be based on two mid-semester tests, class tests, written assignments, project work etc. and lecture attendance.

Instruction for the Paper Setter: The question paper will consist of three sections A, B and C. Sections A and B will have four questions from respective sections of the syllabus and Section C will have 11 short answer type questions, which will be set from the entire syllabus uniformly. Each question of sections A and B will carry 6 marks and section C will carry 11 marks.
Instruction for the candidates: The candidates are required to attempt any two questions out of four from each section A and B and the entire section C of the question paper. Each question of sections A and B carries 6 marks and section C carries 11 marks. **Use of scientific calculator is allowed.**
Course Objective: To prepare students to perform the analysis of any Analog electronics circuit. To empower students to understand the design and working of diodes and transistors.
Instructional delivery strategy/Pedagogy: The course will be taught using lectures followed up by homework assignments and regular class-tests and classroom discussions. Discussions of the course topics using problem-solving during the lecture delivery are encouraged.

Section A

Semiconductor Diode: Classification of Materials, Intrinsic and Extrinsic Semiconductors, PN-Junction with no external Voltage, PN-junction with Forward and Reverse Bias, V-I Characteristics of a PN-Junction Diode, The Ideal Diode. Semiconductor diodes as half wave rectifiers, center-tapped and bridge full-wave rectifiers; Calculation of average value and root mean square value of output current, efficiency, ripple factor, peak inverse voltage, Zener Diode, Zener Diode as voltage stabilizer.
Bipolar Junction Transistors (BJTs): Structure, n-p-n and p-n-p Transistors. Amplifying action, Three configurations, Characteristics of CB, CE and CC Configurations. Current gains α and β, Expression for collector current, DC Load line and Q-point.

Section B

Transistor Biasing: Selection of Operating Point, need for Bias Stabilization, Requirement of a Biasing Circuit, Transistor Biasing and Stabilization Circuits; Fixed Bias Circuit, Collector to Base Bias Circuit, Bias Circuit with Emitter Resistor, Voltage Divider Biasing Circuit.
Transistor as 2-port Network: Hybrid parameters, Obtaining the h-parameter equivalent circuit, transistor hybrid model. Analysis of a single-stage CE amplifier using hybrid model for input and output impedance, current, voltage and power gains.

Course Learning Outcome: On successful completion of this course, students will be able to:

- Understand the voltage current characteristics of semiconductor devices.
- Design and analyse the basic operations of BJT.
- Understand the different biasing techniques of transistors.
- Analyse the BJT in terms of h-parameters.

Text Book:

1. Basic Electronics and Linear Circuits, N. N. Bhargava, D. C. Kulshreshtha, S. C. Gupta, NITTTR Chandigarh, McGraw Hill Education (India) Private Limited.

Reference Books:

- Electronic Devices, Conventional Current Version, Thomas L. Floyd, Pearson.
- Electronic Devices and Circuits, J. B. Gupta, S. K. Kataria & Sons.

BSC(PHY)-503B: SOLID STATE PHYSICS

Maximum Marks: 50 **Teaching Hours: 30 (2 Credits)**
External Examination: 35 (Pass Marks: 12) **Pass Percentage: 35%**
Internal Assessment: 15 (Pass Marks: 05) **Time Allowed: 3 Hours**

15 marks internal assessment will be based on two mid-semester tests, class tests, written assignments, project work etc. and lecture attendance.

Instruction for the Paper Setter: The question paper will consist of three sections A, B and C. Sections A and B will have four questions from respective sections of the syllabus and Section C will have 11 short answer type questions, which will be set from the entire syllabus uniformly. Each question of sections A and B will carry 6 marks and section C will carry 11 marks.
Instruction for the candidates: The candidates are required to attempt any two questions out of four from each section A and B and the entire section C of the question paper. Each question of sections A and B carries 6 marks and section C carries 11 marks. **Use of scientific calculator is allowed.**

Course Objective: Students will gain knowledge of basic theories of solid state structure. Students will gain knowledge of basic theories of the electronic structure of materials. Students will learn how solid state theory is applied to describe physical behaviour of solids and electronic devices.
Instructional delivery strategy/Pedagogy: The course will be taught using lectures followed by homework assignments and periodic tests. Discussions of course topics during lectures are encouraged

Section A

Structural Study of Crystalline Solids: Lattice points and space lattice, The Basis and crystal structure, Unit cells and lattice parameters, Primitive cell, Crystal systems, Bravais space lattices, Symmetry elements in crystal, Other cubic structures, Directions, Planes and Miller Indices, Reciprocal lattice, concept of Brillouin zones, X-ray diffraction and Bragg's law, Experimental methods for crystal structure.

Section B

Specific heat of Solids: Specific heat, Dulong and Petit law, Particle in one dimensional and three-dimensional box, density of states (one & Three dimensions), Einstein and Debye theories of specific heat of solids.
Elementary band theory: Kronig Penny model, Band Gap, Conductor, Semiconductor (P and N type) and insulator**.** Hall effect.
Superconductivity: Magnetic field effect in superconductors, Meissner effect, Type I and type II Superconductors BCS theory, thermal properties of superconductor.

Course learning outcome: On successful completion of this course, students will be able to:

- Relate crystalline structure to X-ray diffraction data and the reciprocal lattice.
- Understand the origin of energy bands, and how they influence electronic behaviour.
- Understand the basics of superconductivity.

Text Book:

1. Condensed Matter Physics, Ashok Sharma, Modern Publishers
2. Solid State Physics, S O Pillai, 9th Ed, New Age International Publishers.

Reference Books:

- Introduction to Solid State Physics, Charles Kittel, 8th Ed., 2004, Wiley India Pvt. Ltd.
- Solid State Physics by R.K. Puri and V.K. Babbar, S. Chand Publishers
- Solid State Physics, Rita John, 2014, McGraw Hill Publication

(Chairman) (VC Nominee) (Academic Council Nominees) (Industry Expert) (Student Alumni) (Members)

BSC(PHY)-503P: PHYSICS PRACTICAL

Maximum Marks: 50 **Teaching Hours: 60 (Credits: 2)**
Pass Marks: 35% (18 Marks) **Time Allowed: 3 Hours**

Instructions: The candidate will mark any four experiments on the question paper and the examiner will allot one of these four experiments to be performed. The distribution of marks is given below:

1. One full experiment requiring the student to take some data, analyze it and draw conclusions on the basis of Experimental Skills. (25 marks)
2. Brief theory (05 marks)
3. Viva-Voce (10 marks)
4. Record (Practical File) (10 marks)

Experimental Skills: General precautions for measurements and handling of equipment, Presentation of measurements, Fitting of given data to a graph, Results with proper Significant Figures and Limits of Error, Interpretation of results etc.

List of Experiments:

1. To study V-I characteristics of PN junction diode
2. To study the characteristics of Light Emitting Diode (LED).
3. To study the response of RC-circuit to various input voltages (square, sine and triangular).
4. To measure the efficiency and ripple factor for Half wave rectifier circuit.
5. To measure the efficiency and ripple factor for Full wave rectifier circuit.
6. To study the function of diode as a clipping element.
7. To study the function of diode as a clamping element.
8. To study the Zener Diode characteristics.
9. To study the stabilization of output voltage of a power supply with Zener Diode.
10. Study of V-I & power curves of Solar cells, and find maximum power point & efficiency.
11. To study the characteristics of a Bipolar Junction Transistor in CE configuration.
12. To plot common base characteristics and determine h-parameters of a given transistor.
13. To study the gain of an amplifier at different frequencies and to find band-width and gain-band width product.
14. To draw the BH curve of Fe using Solenoid & determine energy loss from Hysteresis.
15. To study the characteristics of a thermistor and find its parameters.
16. To determine the Hall coefficient of a semiconductor sample.
17. To find the co-efficient of thermal conductivity of a metal.

Reference Books:

1. B. Sc. Practical Physics, C. L. Arora, S Chand and Company Limited.

BSC(PHY)-603A: DIGITAL ELECTRONICS

Maximum Marks: 50 **Teaching Hours: 30 (2 Credits)**
External Examination: 35 (Pass Marks: 12) **Pass Percentage: 35%**
Internal Assessment: 15 (Pass Marks: 05) **Time Allowed: 3 Hours**

15 marks internal assessment will be based on two mid-semester tests, class tests, written assignments, project work etc. and lecture attendance.

Instruction for the Paper Setter: The question paper will consist of three sections A, B and C. Sections A and B will have four questions from respective sections of the syllabus and Section C will have 11 short answer type questions, which will be set from the entire syllabus uniformly. Each question of sections A and B will carry 6 marks and section C will carry 11 marks.
Instruction for the candidates: The candidates are required to attempt any two questions out of four from each section A and B and the entire section C of the question paper. Each question of sections A and B carries 6 marks and section C carries 11 marks. **Use of scientific calculator is allowed.**
Course Objective: 1. To acquire the basic knowledge of digital logic levels and application of knowledge to understand digital electronics circuits. 2. To prepare students to perform the analysis and design of various digital electronic circuits.
Instructional delivery strategy/Pedagogy: The course will be taught using lectures followed up by homework assignments and regular class-tests and classroom discussions. Discussions of the course topics using problem-solving during the lecture delivery are encouraged.

Section A

Number Systems: The Binary Number System, Binary to decimal and decimal to binary conversion, binary addition, subtraction multiplication and division, Representation of Signed Numbers using 2's (or 1's) compliment method, 2's and 1's complement athematic, double precision numbers and floating point numbers. Octal to binary and binary to octal conversions. Octal to decimal and decimal to octal conversions.
Binary Codes: Numeric and alphanumeric codes, Weighted and non-weight codes, BCD code, BCD addition and subtraction, XS-3 code, XS-3 addition and subtraction, Gray code, binary to Gray and Gray to binary conversion.

Section B

Logic Gates: AND, OR, NOT Gates, Realization using diode logic or resister transistor logic, Logic design and Truth Table, NAND, NOR Gates, Universal property of NAND NOR Gates, Exclusive-OR Gate, Properties of Exclusive-OR Gate, Exclusive-NOR Gate.
Boolean Algebra and Logic Simplification: Logic Operations, Laws of Boolean Algebra, De Morgan's Theorems, Reducing Boolean expressions, Boolean expression and logic diagrams. Determination of output level from the diagram, Converting AND/OR/INVERT logic to NAND/NOR logic.

Course Learning Outcomes: On successful completion of this course, students will be able to:

- Design different number system and binary codes.
- Understand digital circuits of different Gates and related Boolean algebra.

Text Book:

1. Fundamentals of Digital Circuits, A. Anand Kumar, PHI Learning Private Limited.

Reference Books:

- Digital Principles and Applications, Donald P. Leach, Tata McGraw-Hill (2010)
- Digital Systems Principles and Applications, Ronald J. Tocci, Neal S. Widmer, Prentice Hall Inc
- Digital Electronics -Principles, Devices and Applications, A. K. Maini, John Wiley & Sons Ltd

BSC(PHY)-603B: NUCLEAR AND PARTICLE PHYSICS

Maximum Marks: 50 **Teaching Hours: 30 (2 Credits)**
External Examination: 35 (Pass Marks: 12) **Pass Percentage: 35%**
Internal Assessment: 15 (Pass Marks: 05) **Time Allowed: 3 Hours**

15 marks internal assessment will be based on two mid-semester tests, class tests, written assignments, project work etc. and lecture attendance.

Instruction for the Paper Setter: The question paper will consist of three sections A, B and C. Sections A and B will have four questions from respective sections of the syllabus and Section C will have 11 short answer type questions, which will be set from the entire syllabus uniformly. Each question of sections A and B will carry 6 marks and section C will carry 11 marks.

Instruction for the candidates: The candidates are required to attempt any two questions out of four from each section A and B and the entire section C of the question paper. Each question of sections A and B carries 6 marks and section C carries 11 marks. **Use of scientific calculator is allowed.**

Course Objectives: To impart knowledge about basic nuclear physics properties and nuclear models for understanding of related reaction dynamics. Further, give knowledge of basic particle Physics.

Section A

Nuclear Properties: Qualitative facts about size, mass, density, energy, charge of nucleus. Binding energy, angular momentum, magnetic moment and electric quadruple moments of the nucleus, average binding energy and its variation with mass numbers, Properties of nuclear forces.

Nuclear Models: Liquid drop model and semi empirical mass formula, Experimental evidence of magic numbers and its explanation, Nuclear shell model.

Nuclear Decay Processes: Modes of decay and successive radioactivity. Basics of Alpha, beta and gamma decay. Electron capture, Gamma-ray emission, Internal conversion.

Section B

Interaction of radiation and charged particles with matter: Energy loss of electrons and positrons, Positron annihilation in condensed media, stopping power and range of heavier charged particles, derivation of Bethe-Bloch formula, interaction of gamma rays with matter.

Radiation detection: Basic concept and working principle of gas detectors (Ionization Chambers, Proportional Counter, and Geiger Muller Counter), Scintillation Detectors, Solid States Detectors and Thermo luminescent Dosimetry.

Course learning outcomes: Students will have achieved the ability to:

- Explain the ground state properties of the nucleus for study of the nuclear structure behaviour.
- Explain the radioactivity and various decay processes.
- Understand the elementary particle interactions and capability of relating the theory predictions and measurements.

Text Books

1. Introductory Nuclear Physics, K.S. Thind, M. Singh, V. Kumar, L. Gerward, Vishal Pub. Co.
2. Introductory Particle Physics, K. S. Thind, M. Singh, V. Kumar, L. Gerward, Vishal Pub. Co.

Reference Books

- An Introduction to Nuclear Physics by M.R. Bhiday and V.A. Joshi, Orient Longman Pub.
- Nuclear Physics, D.C. Tayal, Himalaya Publishing House

(Chairman) (VC Nominee) (Academic Council Nominees) (Industry Expert) (Student Alumni) (Members)

BSC(PHY)-603P: PHYSICS PRACTICAL

Maximum Marks: 50 **Teaching Hours: 60 (Credits: 2)**
Pass Marks: 35% (18 Marks) **Time Allowed: 3 Hours**

Instructions: The candidate will mark any four experiments on the question paper and the examiner will allot one of these four experiments to be performed. The distribution of marks is given below:

1. One full experiment requiring the student to take some data, analyze it and draw conclusions on the basis of Experimental Skills. (25 marks)
2. Brief theory (05 marks)
3. Viva-Voce (10 marks)
4. Record (Practical File) (10 marks)

Experimental Skills: General precautions for measurements and handling of equipment, Presentation of measurements, Fitting of given data to a graph, Results with proper Significant Figures and Limits of Error, Interpretation of results etc.

List of Experiments:

1. To measure (a) Voltage (b) Time period and (c) frequency of a periodic waveform using CRO.
2. To test Diode and Transistor using Multimeter.
3. To design a switch (Not gate) using a transistor.
4. To verify and design AND, OR, NOT and XOR gates using NAND gates.
5. Verify De-Morgan's law using Logic gates circuits.
6. To design a combinational logic system for a specific Truth Table.
7. To convert a Boolean expression into logic circuit and design it using logic gate ICs.
8. To minimize the given logic circuit and prove the output to be same.
9. To find the half-life period of a given radioactive substance using a GM counter.
10. To draw the plateau of a GM counter and find its operating voltage.
11. To find range and energy of β- particles.
12. To study the statistical fluctuations of G.M. Counter to find its standard deviation.
13. To find the absorption co-efficient of β-particles in aluminum using a GM counter.
14. To determine the dead time of given GM counter
15. To determine the resolving time of GM counter using half disc radioactive beta source.
16. Verify inverse square law using GM counter.
17. To determine the radon concentration in air at different locations.

Reference Book:

1. B. Sc. Practical Physics, C. L. Arora, S Chand and Company Limited.