RAJ RISHI BHARATRIHARI UNIVERSITY

ALWAR

SYLLABUS

B.Sc. Pt-II PHYSICS

2018-19

प्रभारी अधिकारी
अकादमिक–प्रथम

B.Sc.Part-II

PHYSICS

Scheme:

Paper	Exam. Duration	Minimum Pass Marks	Maximum Marks
Paper- I	3 Hours	18	50
Paper- II	3 Hours	18	50
Paper- III	3 Hours	18	50
Practical Exam	4 Hours	18	50

Paper – I (Thermodynamics and Statistical Physics)

Work load: Two hours lecture per week. **Examination Duration: Three Hours**

Note:- Total Five questions to be attempted. First question will consist of eight short answer type questions and is compulsory. Four questions will be from four units, one from each unit with internal choice. 40% weightage will be given to problems and numerical. The candidates will be required to attempt all the five questions. All five questions have equal weightage (each question is of 10 marks).

UNIT-I

Thermal and adiabatic interactions: Thermal interaction, Zeroth law of thermodynamics, System in thermal contact with heat reservoir (canonical distribution), Energy fluctuations, Entropy of a system in a heat bath, Helmholtz free energy, Adiabatic interaction and Enthalpy, General interaction and first law of thermodynamics, Infinitesimal general interaction, Gibb's free energy, Phase transitions, Clausius Clapeyron equation, Vapour pressure curve, Heat engine and efficiency of engine, Carnot's cycle, Thermodynamical scale as an absolute scale. of Maxwell's relations and their applications.

UNIT – II

Production of Low Temperatures and Applications: Joule Thomson expansion and J.T. coefficients for ideal as well as Vander Wall's gas, porous plug experiment, Temperature inversion, Regenerative cooling and cooling by Adiabatic expansion and demagnetization, Liquid Helium, He-I and He-II, super fluidity, Refrigeration through Helium dilution Quest for absolute zero, Nernst heat theorem.

The Distribution of Molecular Velocities: Distribution of molecular velocities, most probable, average and r. m. s. velocities, energy distribution function, effusion of molecular beam, experimental verification of Maxwell velocity distribution, The principle of equipartition of energy.

Transport phenomena: Mean free path, distribution of free paths, Coefficients of viscosity, Thermal conductivity, Diffusion and their interrelations.

UNIT – III

Classical Statistics: Validity of classical approximation, Phase space, Micro and macro state, Thermodynamic probability, Relation between Entropy and Thermo dynamic probability.

प्रभारी अधिकारी
अकादमिक-प्रबंध

monatomic ideal gas, barometric equation, specific heat capacity of diatomic gas, Heat capacity of solids.

UNIT – IV

Quantum Statistics: Black body radiation and failure of classical statistics. Postulates of quantum statistics, indistinguishability, wave function, exchange degeneracy, a priori-probability. Bose Einstein's Statistics and its distribution function. Planck's distribution function and radiation formula, Fermi-Dirac statistics and its distribution function, contact potential. Thermionic emission, specific heat anomaly of metals, nuclear spin statistics (para and ortho hydrogen).

Reference Books:

1. Heat and Thermodynamics" by M. W. Zemansky
2. Fundamentals of Thermodynamics and Applications by Muller
3. Fundamentals of Thermodynamics by R.E. Sonntag, C. Borgnakke and G.J. Van Wylen
4. Thermodynamics: Kinetic Theory and Statistical Thermodynamics by F. W. Sears and G. L. Salinger

Paper – II (Mathematical Physics and Special Theory of Relativity)

Work load: Two hours lecture per week. **Examination Duration: Three Hours**

Note:- Total Five questions to be attempted. First question will consist of eight short answer type questions and is compulsory. Four questions will be from four units, one from each unit with internal choice. 40% weightage will be given to problems and numerical. The candidates will be required to attempt all the five questions. All five questions have equal weightage (each question is of 10 marks).

UNIT – I

Orthogonal curvilinear coordinate systems, scale factors, expression for gradient, divergence, curl and their application to Cartesian, circular cylindrical and spherical polar coordinate.
Coordinate transformation and Jacobian, Transformation of covariant, Contra variant and mixed tensor. Addition, subtraction, multiplication and contraction of tensors, Metric tensor and its use in transformation of tensors, Dirac Delta function and its properties.

UNIT – II

Lorentz transformation and rotation in space-time, time like and space like vector, world line, macro-causality.
Four vector formulation, energy-momentum four vector, Relativistic equation of motion, invariance of rest mass, Orthogonality of four force and four velocity, Lorentz force as an example of four force, Transformation of four frequency vector, Longitudinal and transverse Doppler's effect.
Transformation between laboratory and center of mass system, four momentum conservation, kinematics of decay products of unstable particles and reaction thresholds; Pair production, inelastic collision of two particles, Compton effect.

UNIT – III

(A) Transformation of an electric field and Magnetic field between two inertial frames.
(B) The second order linear Differential Equation with variable coefficient and singular points, series solution method and its application to the Hermite's, Legendre's and Laguerre's differential equation. Basic properties like orthogonality, recurrence relation, graphical

प्रभारी अधिकारी
अकादमिक

representation ,and generating function of Hermite, Legendre and Laguerre and Associated Legendre's function (simple applications)

UNIT – IV

Techniques of separation of variables and its application to following boundary value problem (i) Laplace equation in three dimension Cartesian coordinate system-line charge between two earthed parallel plates, (ii) Helmholtz equation in circular cylindrical coordinates – Cylindrical resonant cavity. (iii) Wave equation in Spherical Polar coordinates - vibration of a circular membrane (iv) Diffusion equation in two dimensional Cartesian coordinate system – Heat conduction in a thin rectangular plate (v) Laplace equation in spherical coordinate system – electric potential around a spherical surface

Reference Books:

1. Mathematical Methods for Physicists by Arfken
2. Mathematical Method of Physics by Jon Mathews
3. Relativity: The Special and General Theory By Albert Einstein; Robert W. Lawson
4. Introduction to the Theory of Relativity By Peter Gabriel Bergmann

Paper – III (Electronics and Solid State Devices)

Work load: Two hours lecture per week. Examination Duration: Three Hours

Note:- Total Five questions to be attempted. First question will consist of eight short answer type questions and is compulsory. Four questions will be from four units, one from each unit with internal choice. 40% weightage will be given to problems and numerical. The candidates will be required to attempt all the five questions. All five questions have equal weightage (each question is of 10 marks).

UNIT – I

Circuit Analysis: Networks – Some important definitions, loop and nodal equations based on DC and AC circuits. Kirchhof's Laws - Four terminal network Ampere-volt conventions, open, close and Hybrid parameters of any four terminal network. Various circuit theorems – Superposition, Thevenin, Norton and Reciprocity, Compensation, Maximum power transfer and Miller theorems.

PN junction: Charge densities in N and P materials. Conduction by drift and diffusion of charge carriers. P-N junction diode equation, capacitance effect.

UNIT – II

Rectifiers: Halfwave, full wave and Bridge rectifiers, calculation of ripple factor, efficiency and regulation. Filters – Series inductor, Shunt Capacitor, L-section and π section filters. Voltage Regulation – Voltage regulation and voltage stabilization by Zener diode. Voltage multiplier.

Transistor: Notations and volt ampere characteristics for bipolar junction transistors. Concept of load line and operating point, Hybrid parameters, CB, CE, CC configurations.

Junction field effect transistors (JFET) and Metal oxide semiconductor field effect transistors (MOSFET), Circuit symbols, biasing, volt-ampere characteristics, Source follower operation of FET as variable voltage resistor.

UNIT – III

Transistor biasing: Need of bias and stability of Q point, stability factor and various types of bias circuit for thermal bias stability, fixed bias, collector to base feedback bias and four resistor bias.

प्रभारी अधिकारी
अकादमिक-प्रथम

Amplifier: Analysis of transistor amplifiers using hybrid parameters and its gain- frequency response, Cascade amplifies, basic idea of direct coupled and RC coupled amplifiers, Differential amplifiers, Amplifier with Feed Back: Concept of feed back, Positive and negative feedback. Voltage and current feedback circuits. Advantage of negative feedback, Stabilization of gain, effect of negative feedback on output and input resistances, reduction of nonlinear distortion, effect of gain-frequency response.

UNIT – IV

Oscillators: Criterion for self-excited and self-sustained oscillations, Circuit requirement for build up of oscillations. Basic transistor oscillator circuit and its analysis, Colpitt's and Hartley oscillators, R-C Oscillators, Crystal oscillators and its advantages.

Logic Circuits: Logic fundamental AND, OR, NOT, NOR NAND, XOR. Boolean algebra, De Morgan's theorems. Positive and Negative logic. Logic gates circuit realization using DTL and TTL logic, Simplification of Boolean expression.

Reference Books:

1. Solid State Electronic Devices" by B.G. Streetman
2. Network Theory by A.V.Bakshi, U.A.Bakshi
3. Semiconductor Physics and Devices by D. A. Neamen
4. Solid State Electronic Devices by B.G. Streetman

PRACTICALS

Work Load: Four hours laboratory work per week. **Examination Duration : Four Hours**

Minimum Experiments: Total sixteen taking eight from each section.

The colleges are free to set new experiments of equivalent standard. This should be intimated and approved by the Convener, Board of Studies before the start of academic session. It is binding on the college to have experimental set up of at least sixteen experiments listed below (8 from each section. In case number of experiment performed by the students is less than sixteen, his marks shall be scaled down in final examination on pro rate basis. For example, if he has performed fourteen experiments the marks shall be multiplied by fourteen and divided by sixteen. The number of experiments performed shall be verified from practical record. Laboratory examination paper will be set by the external examiner by making pairs of experiments taking one from each section out of sixteen or more experiments available at the center. Different combinations shall be given for different batch.

Marking Scheme:

	For Regular	For Non-Collegiate
Two Experiments	15 marks each	17 marks each
Record	10	-
Viva-voice	10	16

(For Non-collegiate students: Minimum Compulsory Lab training Hours – 21 ~~Hours~~) Days (42 hours)

Section – A

1. Study of dependence of velocity of wave propagation on line parameter using torsional wave apparatus.
2. Study of variation of reflection coefficient on nature of termination using torsional wave apparatus.

प्रभारी अधिकारी
अकादमिक-प्रथम

3. Using Platinum resistance thermometer find the melting point of a given substance.
4. Using Newton's rings method find out the wave length of a monochromatic source and find the refractive index of liquid.
5. Using Michelson's interferometer find out the wavelength of given monochromatic source (Sodium light).
6. To determine wave length by grating.
7. To determine wave length by Biprism.
8. Determine the thermodynamic constant γ using Clements & Desorme's method.
9. To determine thermal conductivity of a bad conductor by Lee's method.
10. Determination of ballistic constant of a ballistic galvanometer.
11. Study of variation of total thermal radiation with temperature.

Section – B

1. Plot thermo emf versus temperature graph and find the neutral temperature (Use sand bath)
2. Study of power supply using two diodes / bridge rectifier with various filter circuits.
3. Study of half wave rectifier using single diode and application of L and π section filters.
4. To study characteristics of a given transistor PNP / NPN (Common emitter, Common base and common collector configurations)
5. Determination of band gap using a junction diode.
6. Determination of power factor (cosø) of a given coil using CRO.
7. Study of single stage transistor audio amplifier (Variation of gain with frequency).
8. To determine e/m by Thomson's method.
9. Determination of velocity of sound in air by standing wave method using speaker, microphone and CRO.
10. Measurement of inductance of a coil by Anderson's bridge.
11. Measurement of capacitance and dielectric constant of a liquid and gang condenser by de-sauty bridge.
12. To study the characteristics of a semi- conductor junction diode and determine forward and reverse resistances.

प्रभारी अधिकारी
अकादमिक-ग्रयम