

PGIIS-N 1500 B-14
M.Sc. IIIrd Semester (CBCS) Degree Examination
Physics
(Electronics and Instrumentation)
Paper - HCT:3.1
(New)

Time : 3 Hours

Maximum Marks : 80

*Instructions to candidates:**Answer all the questions of fifteen marks and any two questions of ten marks each*

1. a) Explain the characteristics of an ideal operational Amplifier
b) Discuss the working of an Op-Amp based logarithmic amplifier circuit (5+10)

Or
2. Describe the working of a free running multivibrator using an OP-Amp and deduce an expression for frequency of oscillations (5+10)
3. a) What is multiplexer? Explain its working
b) Explain the truth tables of SR and JK flip-flops with block diagrams (10+5)

Or
4. Explain the architecture of a microprocessor with the help of a block diagram (15)
5. What are photoelectric transducers? Discuss the functioning of photomultiplier tube. (15)

Or
6. Explain the working principle of piezoelectric transducer and mention the applications of these transducers (15)

7. Give the differences between DTA and DSC. Explain how DSC can be used for the study of phase transitions in materials (15)

Or

8. a) Explain the working of SEM. Give the comparison of SEM with TEM
b) Explain the working of a diffusion pump used for production of vacuum (8+7)
9. What D/A converter? Explain its working (10)
10. Distinguish synchronous and asynchronous counters (10)
11. Explain the working of a semiconductor photovoltaic cell (10)
12. Write a note on the construction of a penning gauge (10)
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PGIIS-O 1500 A B-14
M.Sc. IIIrd Semester (Non-CBCS) Degree Examination
Physics
Applied Physics
Paper : 3.1
(Old)

Time : 3 Hours

Maximum Marks : 80

Instructions to Candidates:

Answer any Six questions of 12 marks and Two questions of 4 marks.

1. Give an account of stellar spectra and HR diagram. (12)
2. Discuss the evolution of stars and explain Chandrasekhar's limit. (12)
3. Discuss cell constituents with their structure and function. (12)
4. Describe Gene, Genetic code and symmetry. (12)
5. Give the construction and working of Nd:YAG laser. Mention few applications of lasers. (12)
6. What is holography? Explain recording and reconstruction of an image. Give any two application of holography. (12)
7. What is plasma? Discuss the difficulties faced in confining the plasma. How they can be overcome? (12)
8. Discuss in detail magneto hydrodynamic equations. (12)
9. Comment on main sequence stars. (4)
10. Comment on biomolecules. (4)
11. Write a note on fiber optic communication. (4)
12. Explain briefly plasma applications. (4)

PGIIS N 1506 B-14
M.Sc. IIIrd Semester (CBCS) Degree Examination
Physics
Materials Physics - 1
Paper : SCT 3.1
(NEW)

Time : 3 Hours

Maximum Marks : 80

Instructions to Candidates:

Answer all the questions of Fifteen marks each and any two questions of Ten marks each.

1. What are engineering materials? Discuss their levels of structure and structure - property realtions. (15)

OR

2. a) What are non-crystalline solids? How are they formed? (6+9)
b) Discuss in detail the structure of silica and silicates.
3. a) What are single crystals, non-crystals and polycrystals? Describe hydrothermal method of crystal growth. (10+5)
b) Explain the zone refining method of purification of crystals.

OR

4. a) What are color centers? Give the configurations of various color centers. (6+9)
b) Distinguish between Frenkel and Schottky defects. Obtain an expression for the equilibrium concentration of Schottky defects in the materials.
5. a) Discuss about the solid solutions and their formation. (8+7)
b) Derive Classius and Claperon equation for first order phase transitions.

OR

6. a) Distinguish between intermetallic and interstitial compounds. Give examples.(6+9)
b) Draw and explain the phase diagram of Pb-Sn.
7. a) Give the theory of diffusion in solids. (6+9)
b) Derive an expression for activation energy for diffusion and mention the applications of diffusion.

OR

8. a) Discuss glass transition in materials. Explain crystallization and grain growth. (8+7)
b) Discuss briefly about nucleation kinetics.
9. Discuss the formation of covalent bonds in solids. (10)
10. Write a note surface imperfections in solids. (10)
11. Discuss transformations in steel. (10)
12. What is Kirkindal effect? Explain it by giving an analogy. (10)
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PGIIS - N 1502 B-14
M.Sc. IIIrd Semester (CBCS) Degree Examination
Physics
Mathematical Physics II
Paper : HCT 3.2
(New)

Time : 3 Hours

Maximum Marks : 80

Instructions to Candidates:

Answer all the questions of Fifteen marks each and two questions of Ten marks each.

1. a) State and prove Convolution theorem for Fourier Transforms
- b) Find the finite Fourier cosine transformation of x . (8+7)

OR

2. a) Define Laplace Transform? Find Laplace transform of $\sin t$
- b) Find Inverse Laplace transformation of $\left[\frac{s}{(s^2 + a^2)^2} \right]$ (7+8)
3. a) Give the classification of integral equations with suitable examples.
- b) Derive an equivalent Fredholm integral equation to the following boundary value problems. (7+8)

$$y'' + 4y = \sin x, 0 < x < 1; y(0) = 0, y(1) = 0$$

OR

4. a) Explain how a Green's function can be constructed for a given boundary value problem.
- b) Find the Green function for the following boundary value problem
 $y''(x) = f(x); y(0) = 0$ and $y'(1) = 0$
5. a) State and explain the principle of least squares fitting and apply it to fit a straight line through the data. (7+8)
- b) Explain Bisection method for solving an equation.

OR

6. a) Evaluate the integral $\int_0^1 \frac{1}{1+x^2} dx$ using Trapezoidal rule. (8+7)
- b) Explain Runge-Kutta second order method for solving differential equation.
7. a) What are variables? Explain the declaration of variables with examples. (7+8)
- b) Write a C-program to find the roots of a quadratic equation.

OR

8. a) Distinguish between IF-ELSE and FOR statements. Explain the nesting of FOR statements with a C-program. (7+8)
- b) Write a C program to find the Eigen values of 3×3 matrix.
9. Explain the properties of Fourier Transform. Find the Fourier sine transform of t^2 in the range $0 \leq t \leq \pi$ 10
10. Derive an equivalent Volterra integral equation to each of the following initial value problem.

$$y'' + y = \sin x ; y(0) = 0, y'(0) = 0 \quad (10)$$

11. Derive Lagrange's Interpolation formula. From the given table of values find the value of Y at $x = 3$ using Lagrange's Interpolation formula. (10)

X	1	2	5
Y	1	4	10

12. Compare the performance of while, do while and for loop statements with suitable examples. (10)

PGIIS - N 1509 B-14
M.Sc. IIIrd Semester (CBCS) Degree Examination
Physics
Nuclear Physics - I
Paper : SCT 3.2
(New)

Time : 3 Hours

Maximum Marks : 80

Instructions to Candidates:

Answer all the questions of Fifteen marks each and any two questions of Ten marks each.

1. Discuss the phase shift analysis of n-p scattering at low energy and obtain an expression for total scattering cross section. (15)

OR

2. Outline the theory of coherent scattering of neutrons by ortho and para hydrogen. Give the conclusions drawn from this study. (15)
3. What are the evidences of the collective motion in nuclei? Discuss the vibrational model for even-even nucleus and predict its characteristic spectrum. (15)

OR

4. What are the basic assumptions of Fermi gas model? How does this model explain the variation of level density with excitation energy? (15)
5. Give an account of Gellman - Nishijima scheme for elementary particles. Explain the mixed strangeness character of neutral kaons. (15)

OR

6. What is parity? Describe an experimental test for the non - conservation of parity in weak interactions. (15)
7. Describe the Quark model and show how it explains the composition of baryons. (15)

OR

8. Discuss Grand Unified Theory (GUT) and proton decay. (15)
9. Discuss Magnetic moment of the ground state of deuteron (10)
10. Write a note on Nordheim's rules. (10)

11. Give an account of Rotational energy spectra of even -even nuclei. (10)
12. Write a note on super symmetry. (10)

PGIIS-O 1505 B- 14
M.Sc. IIIrd Semester (Non - CBCS) Degree Examination
Physics
(Solid State Physics - I)
Paper : 3.3

Time : 3 Hours

Maximum Marks : 80

Instructions to Candidates:

Answer any Six questions of 12 marks each and two questions of 4 marks.

1. a) What are periodic functions. Explain.
b) State the properties of reciprocal lattice and show that the reciprocal lattice of bcc is fcc. (8+4)
2. a) Write a note on periodic and cyclic boundary conditions.
b) State and prove Bloch theorem for degenerate cases. (8+4)
3. a) Derive the dispersion relation for elastic waves in a monatomic linear lattice.
b) What are Van Hove singularities? Explain. (8+4)
4. a) Give the Deby's theory of specific heat of solids.
b) Write a note on thermal expansion in solids. (8+4)
5. a) Explain the APW method of energy band structure calculations.
b) Write salient features of K.P. Method of band structure calculations. (8+4)
6. a) Show that the electron orbits in magnetic field are quantized.
b) Explain the construction of first three Brillouin zones of square lattice in k - space. (6+6)
7. a) Define Wannier function. Obtain equation of motion of an electron in Wannier representation.
b) What is Cyclotron resonance? Explain. (8+4)
8. a) What is adiabatic principle? Mention its significance.
b) On basis of is adiabatic principle, outline the method of decoupling the motion of electrons and lattice. (5+7)

9. Explain translational symmetry in crystalline solids. (4)
10. Write a note on phonon - phonon interaction. (4)
11. Explain dHvA effect. (4)
12. Write a note on deformation potential. (4)

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PGIIS - O 1507 B-14
M.Sc. IIIrd Semester (Non-CBCS) Degree Examination
Physics
Nuclear Physics 1
Paper : 3.3
(Old)

Time : 3 Hours

Maximum Marks : 80

Instructions to Candidates:

Answer any Six questions of 12 marks each and Two questions of 4 marks.

1. Obtain the relationship between the range and depth of the nuclear force from the deuteron problem, assuming square well shape for the nuclear potential. (12)
2. Give the formulation of effective range theory for nuclear - nuclear scattering and discuss the triplet and singlet effective ranges and their implications. (12)
3. a) What are magic numbers? What is their significance? (6)
b) Mention the merits and demerits of shell model. (6)
4. Compare and contrast the shell model and the collective model with regard to the basic assumptions and the results that follow. (12)
5. State the classification of the elementary particles based on their masses and name at least two members in each class. (12)
6. Classify the nuclear models. Give an account of the alpha particle model and the Fermi gas model for the nucleus. (12)
7. State the different conservation laws with regard to the elementary particles. (12)
8. What are quarks? Describe the nucleon structure in terms of quark model (12)
9. Short note: Saturation of nuclear forces (4)
10. State the principal assumptions of collective model that differ from the shell model. (4)
11. Eight fold way of classification of elementary particles. (4)
12. Write short note on GUT (4)

PGIIS - O 1508 B-14
M.Sc. IIIrd Semester (Non-CBCS) Degree Examination
Physics
Materials Science I
Paper : 3.4
(Old)

Time : 3 Hours

Maximum Marks : 80

Instructions to Candidates:

Answer any Six questions of 12 marks each and Two questions of 4 marks.

1. a) Classify engineering materials on the basis of their structure and properties.
b) Explain briefly the applications of engineering materials. (8+4)
2. a) What are crystalline and non-crystalline solids? Explain.
b) With a neat sketch, discuss the structure of silica. (6+6)
3. a) Discuss with a diagram the crystal pulling by Czochralski's method.
b) State the general features of crystal growth from solutions. (6+6)
4. What are Schottky defects? Obtain an expression for the equilibrium concentration of Schottky defect in a crystal. (12)
5. a) State Hume-Ruthery empirical rules for the formation of substitutional solid solutions.
b) Discuss with an example the two component alloy systems. (6+6)
6. a) What is Lever rule? Draw the Fe-Fe₂O₃ phase diagram and explain the various phase regions.
b) Describe briefly the eutectic and peritectic systems. (8+4)
7. a) State and explain the Fick's first and second laws of diffusion and write their equation form.
b) Write a note on self - diffusion. (8+4)
8. a) Explain the terms, recovery, recrystallization and grain growth.
b) Discuss transformations in steel. (6+6)

9. Write a note on ionic solids. (4)
10. Write a note on gel method of crystal growth. (4)
11. Explain the concept of Burger vector (4)
12. Explain glass transition (4)

PGIIS - N 1512 B-14
M.Sc. IIIrd Semester (CBCS) Degree Examination
Physics
Mechanics
Paper : OET 3.1
(New)

Time : 3 Hours

Maximum Marks : 80

Instructions to Candidates:

Answer all the questions of Fifteen marks each and any two questions of Ten marks each.

1. Using Newtonian mechanics, obtain conservation laws for linear momentum, angular momentum and energy for a system of particles. (15)

OR

2. a) Explain the terms, constraints and virtual work. (6+9)
b) Derive Lagrange's equation of motion from D'Alembert's principle.
3. a) Write down Galilean transformations and explain. (8+7)
b) State and explain postulates of special theory of relativity.

OR

4. a) Write a note on relativistic Doppler's effect. (6+9)
b) What are four-vector, four velocity and four - momentum in relativistic mechanics? Explain.
5. a) Discuss in adequacy of classical mechanics. (10+5)
b) Define wave function and give its physical interpretation.

OR

6. a) Write down Schrodinger wave equation in one and three dimensions and explain.
b) With the help of Schrodinger equation, obtain eigen values of a simple harmonic oscillator. (5+10)
7. a) Explain phase space and ensemble. (6+9)
b) State and prove Boltzman equipartition theorem.

OR

8. a) What are bosons and fermions? State their properties. (6+9)
- b) Using Bose-Einstein distribution scheme, obtain Planks's law for black body radiation.
9. Write a note on variational principle. (10)
10. Discuss the motivation and conclusions of Michelson - Morley experiment. (10)
11. State and prove Ehrenfest's theorem. (10)
12. Write a note on probable and most probable distributions. (10)