Mahishadal Raj College

Department Of Physics
Internal Examination
PG 2ND SEM
Full Marks-05
Paper: PHS 202.2

Answer any ONE from the following questions: **(5x1)**

1. Derive expressions for the electron and hole concentrations in a semiconductor at thermal equilibrium for an intrinsic semiconductor. Show the concentrations in a plot.

                                                            (2 + 2 + 1= 5)

2. What are meant by complete ionization and freeze-out in a semiconductor? What is a compensated semiconductor? Plot how the electron concentration in a compensated semiconductor changes with temperature.   **(2 + 1 + 2 = 5)**

Mahishadal Raj College
Department Of Physics
Internal Examination
PG 1ST SEM
Full Time- 45 Min
Full Marks-10
Paper: PHS 103.1

Write a short note on any one from the followings: **(5x1)**

    1) XRD characterisation 2) Scanning tunnelling Microscopy 3) Raman Spectroscopy

Paper: PHS 103.2

Answer any one from the following questions: **(5x1)**

    1) Write down the Maxwell's equations in differential form. Hence explain its physical significance.   **(2+3)**

    2) Write the conditions for Lorentz and Coulomb gauge. Draw their respective Minkowski's space-time diagrams.   **(2+3)**

    3) Prove Poynting's theorem. What is the significance of the Poynting vector?   **(4+1)**

Mahishadal Raj College
Department Of Physics
Internal Examination
UG SEMESTER- 5
Paper: CC-11

Time- 45 Min

Full Marks-10

Answer any five from the following questions.   **(5x2=10)**

1. Find $\varphi(k)$ *for a square*wave packet $\Psi(x)=Ae^{ik_0x}$ $|x| \le a$

                                            0      $|x| \ge a$

   Find the factor A so that $\Psi(x)$ *is* normalised.

2. What do you mean by stationary state?

3. A two dimensional isotropic linear harmonic oscillator has energy $E=\hbar\omega$. Find the degeneracy of the system?

4. A hydrogen atom is in the state $\Psi(r)=\frac{1}{\sqrt{10}}(\Psi_{322}+ 2\Psi_{221}+2i\Psi_{220}+\Psi_{11-1})$. Find the expectation value of energies in the given state.

5. Calculate $<r^2>$ for H atom in its ground state.

6. If 3 spin ½ particle is bound to 1-D infinite potential box of length L. Find the ground state energy of the system.

7. What is Larmor's frequency?

8. Define normal and anomalous Zeeman effects.

Mahishadal Raj College
Department Of Physics
Internal Examination
UG SEMESTER- 6
Paper: CC-14

Time- 45 Min

Full Marks-10

Answer any five from the following questions.

(5x2=10)

1. Plot the spectral energy distribution curve for an ideal blackbody for two different temperatures.
2. What is ultraviolet catastrophe?
3. In which regions of the blackbody spectrum are the Wien's law and the Rayleigh Jeans law applicable?
4. Find out the ratio of energy radiated per unit area of two ideal blackbodies of temperatures $27^{o}C$ and $327^{o}C$.
5. What are the Planck's quantum postulates of blackbody radiation? Write down the energy distribution of the Planck's radiation in terms of frequency and wavelength?
6. Using the Planck's radiation law derive the Wien's distribution and displacement laws.
7. Use Planck's radiation law to derive the Rayleigh-Jeans formula.
8. Give one example of experimental verification of blackbody radiation. Explain it.

Mahishadal Raj College
Department Of Physics
Internal Examination
UG 3rd SEM
Paper: CC-5

Time- 45 Min

F.M.-10

Answer any five from the following questions.

(5x2=10)

1. Separate the Laplace's equation in spherical polar co-ordinate in 3D.
2. Write down the wave equation for the vibration of a circular membrane using separation of variable technique.
3. Evaluate $\int_0^3 3^{-4x^2} dx$
4. Evaluate $\int_0^\infty sin^5 \theta cos^{\frac{7}{2}}\theta \, d\theta$
5. Explain the Hamilton's principle.
6. Derive Lagrange's equation of motion for a particle moving under a potential V(r) in the plane polar co-ordinate system.
7. Explain the Dirichlet's condition.
8. Calculate Fourier Series for the function f(x), defined on [-2,2], where

   $f(x) = -1 \quad -2 \le x \le 0$

   $\qquad 1 \quad \ 0 \le x \le 2$

Mahishadal Raj College
Department Of Physics
Internal Examination
PG 1ST SEM

Full Time- 45 Min

Full Marks-10

Paper: PHS 101.1

Answer any one from the following questions: (5x1)

1) Evaluate the integral $\int_0^{2\pi} \frac{1}{a-b\sin\theta}$

2) What is essential singularity? Express $3x^3 + 2x^2 - 8x + 4$ in terms of Legendre polynomials.
                                                                                                     (2+3)

3) The matrix is defined as $A= \begin{pmatrix} 1 & 2 & 3 \\ 0 & 2 & 2 \\ 0 & 0 & -2 \end{pmatrix}$. Write down its characteristic equation and find out the eigenvalues.

Paper: PHS 101.2

Answer any one from the following questions: (5x1)

1) Show that the number of degrees of a rigid body is six.

2) Prove that the Poisson brackets are invariant under canonical transformation.

3) Write down the Lagrangian of a system having three carts of equal mass connected by two identical springs. Hence find out the equation of motion in matrix form.   (2+3)

Mahishadal Raj College

Department Of Physics
Internal Examination
PG 4TH SEM
Full Marks-05
Paper: PHS 402.1

Answer any ONE from the following questions: (5x1)

1. (a) Write down the Schrodinger's equation for the ground state of Deuteron.
   (b) Draw the ground state wavefunction.
   (c) State the differences between low energy $n - n$ and $p - p$ scatterings. (1 + 2 + 2 = 5)

2. Write down the five terms of the Semi-empirical mass formula and explain each of their significance. (5)