B.Sc. PART–I, SECOND SEMESTER, (P.U.)

MAY 2016

PHYSICS Paper-A

(Mechanics-II)

Time Allowed : 3 Hours] [Maximum Marks : 22

Note: (*i*) Attempt **five** questions in all, selecting at least **two** questions each from UNIT-I and UNIT-II and UNIT–III is compulsory.

(*ii*) All questions carry equal marks.

(*iii*) Use of non-programmable calculator is allowed.

UNIT–I

1. (*a*) Find the moment of inertia tensor for a solid cube of mass M and side a, rotating about a corner. 3

(*b*) What is a gyroscope? Write down its two applications. 1 1/2

2. (*a*) What is Coriolis force? Discuss its Effect of on a freely falling body. 3

(*b*) Calculate the time, it will take to turn the plane of oscillation of Foucault's Pendulum through 90° at a point where latitude is 90°. 1 1/2

3. Describe Michelson Morley Experiment and explain the physical significance of the results. 4 1/2

UNIT–II

4. (*a*) Derive Lorentz space time transformation equations for two intertial frames. 3

(*b*) Show by Lorentz transformation equation that :

5. (a) What do you understand by length contraction? What is proper intreval? Derive expression for it. 3

(b) How much younger an astronaut will apear to an eath observer, if he return afater 10 years having moved with a velocity 0.8c? 1½

6. Set up transformation equations for relativistic momentum and energy. 4½

UNIT–III

7. Attempt any all parts :

(i) Can a particle rotate without experiencing any torque? Explain.

(ii) What is Galilean Invariance and principle of Simultaneity?

(iii) What do you mean by four vector formulation?

(iv) What is relativistic Doppler Effect? How it is different from non-relativistic Doppler Effect? 4×1=4

PHYSICS Paper-B

(Vibrations, Waves and E.M. Theory-II)

Time Allowed : 3 Hours] **[Maximum Marks : 22**

Note : (i) Attempt **five** questions in all, selecting **two** questions from each from Units I and II.

(ii) UNIT–III is compulsory.

(iii) Use of non-programmable calculator is allowed.

(iv) Logarithmic tables may be asked for if needed.

UNIT–I

1. (a) Derive the formula for velocity of transverse waves propagating through a string. 3

(b) What are the differences between a progressive wave and a stationary wave? 1

2. (a) Define particle velocity, wave velocity and group velocity. Establish a relation between wave velocity and group velocity in a dispersive medium. 3

(b) Find the speed of propagation of transverse wave on a 0.8 mm diameter wire which is under a tension of 700 N. The density of steel is 7.9×10^{3} kg/m^{3}. 1

3. (a) Derive an expression for characteristic impedance of a string in terms of linear density and wave velocity. 3

(b) Distinguish between normal and anomalous dispersion. 1

UNIT–II

4. (*a*) Derive an expression for the Intensity of a plane of electromagnetic wave propagating in a medium of permeability μ and permitivity $\in$.

(*b*) Define Poynting Vector. What is its physical significance? 3, 1

5. A plane electromagnetic wave incident normally on the interface between two dielectric media of impedance Z_1 and Z_2 are partly reflected and partly transmitted. Find an expression for reflection and transmission coefficients of Intensity for these waves. 4

6. (a) Find out the equation of em wave in a medium having finite permitivity $\in$ and permeability μ but with conducitivity $\sigma = 0$. 3

(b) A plane electromagnetic wave of frequency 3 MHz travels in a good conductor made of copper having conducitivity 5.8×10^7 mho m-1 and permeability $4\pi \times 10^{-7}$ N/A^2. Find skin depth. 1

UNIT–III

7. Attempt any six parts, each part carries 1mark :

(*a*) What is skin effect? Discuss.

(*b*) Write down Maxwell's equations in electromagnetic theory for dielectric medium.

(*c*) Distinguish between unpolarised and polarised electromagnetic waves.

(*d*) Distinguish between mechnical waves and electromagnetic waves.

(*e*) What in the minimum distance between two particles vibrating in phase?

(*f*) Prove that the distance between two particles of medium whose phase, differ by 2π is equal to wavelength of the wave.

(*g*) Define Skin depth. What is its value for a perfect conductor? 6×1=6

PHYSICS Paper-C

(Electricity and Magnetism-II)

Time Allowed : 3 Hours] [Maximum Marks : 22

Note : (*i*) Attempt five questions in all, selecting two questions from each of Units I and II.

(*ii*) Unit III is compulsory.

(*iii*) Use of non-programmable scientific calculator is allowed.

UNIT–I

1. (*a*) Discuss and explain Biot and Savart's law.

(*b*) Derive the expression for magnetic field due to current carrying long and straight conductor. 22

2. (a) What is current density $\vec{J}$? Prove that $\vec{J} = ne\vec{v}$ where the symbols have usual meaning.

(b) In a region 5×10^{10} doubly charged +ve ions per cm^3 are moving with a speed of 10^7 cm/sec towards west. In the same region there are 10^{11} electrons per cm^3 moving with the speed of 10^8 cm/sec along north east; what is the magnitude and direction of $\vec{J}$? 22

3. (*a*) Define $\vec{M}$ and $\vec{H}$. How they are related with free and bound currents?

(*b*) Define B-H curve. Prove that the area enclosed by B-H curve is equal to work done in completing one cycle of magnetisation. 22

UNIT–II

4. (*a*) State and prove Ampere Circuital law and show that $\vec{\nabla}\times\vec{B} = \mu_o \vec{J}$ in S.I.

(*b*) The magnetic vector potential at any point is $\vec{A} = 5(x^2+y^2+z^2)\hat{i}$. Evaluate the magnetic field at that point. 2

5. (*a*) State and explain the Self Inductance. Give the units of Self Inductance.

(b) A wire of length 200 cms held perpendicular to X-Y plane is moved with velocity $2\hat{i}+3\hat{j}+\hat{k}$ m/Sec through a region of uniform induction $\hat{B}=\hat{L}+2\hat{k}$ wb/m^2. Calculate the electric field $\hat{V}$ developed in the wire. 2,2

6. (a) Prove that $\hat{V}\times\hat{B}=\mu_0\hat{J}$ and $\hat{V}.\hat{B}=0$ where $\hat{B}$ is magnetic field.

(b) State and explain the Hall's effect. 2,2

UNIT–III

7. Attempt any six parts :

(i) Can the relation V = IR be used for non ohmic resistors?

(ii) State the conditions under which the conductivity of a mediun depends on electric field.

(iii) What do you mean by Invariance of charge? Is volume charge density ρ invariant? Explain.

(iv) State the condition under which the magnetic scaler potential exists.

(v) List the factors on which the magnetic flux linked with the coil depends.

(vi) What is theorem of reciprocity?

(vii) What is difference between resistivity and conductivity? 6×1=6

CHEMISTRY Paper–V