PHYSICS (Code – 16)

Time: 3 Hours

Maximum Marks: 150

NOTE: Attempt FIVE questions in all. All questions carry equal marks, i.e., 30. Q.No.1 is compulsory. Answer any two questions from Part-I and any two questions from Part-II. The parts of the same question must be answered together and must not be interposed between answers to other questions.

1. Write short notes on any FOUR of the followings: (4x7.5)
   (a) Coriolis force.
   (b) Wein's law.
   (c) Ruby laser.
   (d) Ferromagnetic materials.
   (e) Compton effect.
   (f) Intrinsic & extrinsic semiconductors.

PART-I

2. (a) What is a central force? Give an example. How will you find out if a given force is central or not? (15)

   (b) Two particles of the same mass are moving along a straight path with velocity v_1 and v_2 respectively. Show that the momentum of the system in the centre of mass system is zero. (10)

   (c) Explain briefly the objective of Michelson-Morley experiment. (05)

3. (a) State and explain Stefan's law of black body radiation. (05)

   (b) The surface of a furnace is at a temperature of 1427 centigrade. If the Stefan's constant is 5.7×10^{-8} $W/m^2/K^4$ and assuming furnace surface to be a black body, how much heat is radiated by 2 m^2 of The surface in 1 hour? (15)

   (c) Assuming Maxwell –Boltzmann distribution of velocities to hold, what is the relation between the root-mean-square and the average speed of molecules of a gas? What is the relation between the average speed and the most probable speed? (10)

4. (a) Show that superposition of two mutually perpendicular SHMs of equal amplitude and phase differences of 90^0 is a circular motion. (10)

   (b) Obtain expression for the resolving power of a grating. (10)

   (c) A particle executes SHM with a frequency of $2H_z$ and amplitude 0.05m. Calculate the maximum and the minimum magnitudes of the acceleration. (10)

PART –II

5. (a) A conducting hollow sphere of radius R_1 meter is concentrically surrounded by another conducting hollow sphere of radius R_2 meter. The charges on the two spheres are q_1 and q_2 coulomb respectively. What is the electrostatic potential at a distances x ($R_1 < x < R_2$) from their common centre? (9)

   (b) What is power factor of an alternating circuit? How much is its value for an LCR series circuit at resonance? (6)

(c) A current carrying circular coil is of radius R. Calculate the ratio of the magnetic induction at the centre of the coil and at a point a distance R from the centre and on the axis of the coil. (15)

6. (a)Photons of energy 3.0eV fall on a photoelectron emitter of work function 2.5eV. The emitted electrons are subjected to a transverse uniforms magnetic field of induction B. Calculate the minimum value of B so that all emitted electrons move in circles of radii less than 0.1 m. (20)

(b)Define decay constant, activity and mean life with reference to radioactive decay. Also define a Curie. (10)

7. (a) Explain briefly the mechanism of development of built-in potential barrier during the formation of a p-n junction. (10)

(b) Draw the common- emitter output characteristics of a transistor and identify its different regions of operation. In which regions it works as an amplifier? Explain. (15)

(c) Write the truth-tables for AND & OR gates. (05)