B.E. FTBE 1ST YEAR 1ST. SEM. EXAM.-2019(OLD)

Subject : PHYSICS - I Time : 3 hours Full Marks : 100

Answer any five questions

1. a) Calculate gradient of potential $V(x,y,z) = x^2y^3z^4$ and then find divergence of resulting vector.

   b) Show that for $r \neq 0, \nabla^2(1/r) = 0$ where $r = (x^2+y^2+z^2)^{1/2}$.

10+10

2. a) Set up differential equation of damped simple harmonic oscillator explaining all its terms.

   b) Solve this equation and discuss features of the motion for small damping.

   c) Also discuss the situation of critical damping and some of its applications.

3+12+5

3. a) State and explain first law of thermodynamics.

   b) Using 1st law of thermodynamics prove the relation C_P-$C_V = R$ for ideal gas. The symbols have their usual meanings.

   c) Write down statements of 2nd law of thermodynamics.

   d) Calculate the expression of work done by an ideal gas in isothermal and adiabatic process.

3+6+3+8

4. a) Distinguish between reversible and irreversible processes.

   b) Describe the working principle of Carnot's cycleand find out its efficiency in terms of source and sink temperature.

   c) A Carnot engine with its low temperature reservoir at 7°Chas an efficiency 50%. It is desired to increase the efficiency to 70%. By how many degrees should the temperature of source be increased?

4+12+4

5. a) Write down Gauss law of electrostatics in integral form.

   b) Find the field due to a uniformly charged sphere of radius '*a*' at a point outside and inside the sphere.

   c) How can you get Coulomb's law from Gauss's law.

4+12+4

6. a) State Biot-Savert law. Calculate the magnetic field at a point on the axis of a circular current carrying loop. What will be the magnetic field at the center of the loop?

b) State and explain Ampere's circuital law. Determine the magnetic field of a long co-axial cable i) in between two conductors ii) out side both conductors using Ampere's circuital law.

2+3+2+8

7. a) Calculate an expression for intensity of Fraunhoffer diffraction pattern for a plane transmission grating.

b) Determine conditions of principal maxima and secondary maxima of intensity.

c) Find the condition for absent spectra in plane transmission grating.

8+6+6 = 20

8.a) Discuss the phenomenon of interference of light due to thin film and find the conditions for maxima and minima.

b) Explain the formation of Newton's ring. Show that the diameters of bright rings are proportional to the square of odd numbers in a Newton's ring experiment.

c) In a Newton's ring experiment the diameter of the 6^{th} and 14^{th} dark rings are 0.40cm and 0.70cm respectively. Find the diameter of 20^{th} dark ring.

5+10+5=20