Bachelor of Power Engineering First Year First Semester (Old) 2019

Subject: Physics

Total Time: Three Hours   Full Marks: 100

Answer any *five* questions

1. (a) Deduce Avogadro's hypothesis and Dalton's law of partial pressure from the kinetic theory of gases.

    (b) Starting from Maxwell's distribution of velocity find the expressions for the root mean square velocity and most probable velocity.

    (c) Draw the nature of velocity distribution for temperatures T and 2T for an ideal gas on a same plot and explain the difference.

    [6+10+4]

2. (a) What assumptions of kinetic theory of gases are corrected for deducing equation of state for real gases? Discuss volume correction.

    (b) What do you mean by critical isotherm, critical temperature, critical pressure and critical volume?

    (c) Deduce the expressions for critical constants (critical temperature, critical pressure and critical volume) in terms of Van Der Waal's gas constants from Van der Waal's equation for real gases.

    (d) What is the significance of Boyle temperature in case of real gases ?

    [6+4+7+3]

3. (a) What is Gauss's theorem in electrostatics?

    (b) Find the electric field in inside and outside of a uniformly charged solid sphere of radius R and total charge Q. Show the variation of electric field with radius of the sphere graphically.

    (c) What is electric potential? Determine the electric potential at a point on the axis of a uniformly charged disk of radius a and charge density σ.

    [3+(7+2)+(2+6)]

4. (a) What do you mean by diffraction? (b) Distinguish between Fresnel and Fraunhofer diffraction. (c) Obtain the expression for intensity distribution of single slit Fraunhofer diffraction and draw the distribution. (d) Write characteristics of LASER. (e) What is population inversion in context of LASER.

    [2+3+10+3+2]

5. (a) Draw and describe Young's double slit experiment. (b) Deduce condition of dark or bright fringes for Young's double slit experiment. (c) Then obtain the expression for fringe width. (d) State and explain Brewster's Law for polarization.

[5+7+5+3]

6. (a) Write Bohr's postulate for atomic structure. (b) Using the concept obtain the expression for total energy of electrons of hydrogen atom. (c) Then obtain the expression for wavelength of emitted photons in Lyman series. (d) Write the expression for de Broglie wavelength. (e) What is its expression when electron is subjected to applied voltage V.

[5+8+3+2+2]

7. (a) Obtain differential equation of a S.H.M. for i) damp free motion, ii) under action of damping. (b) What do you mean by progressive wave and stationary wave? (c) How stationary waves are formed? (d) Deduce the equation for standing wave. (e) Find out the points where there will be nodes and antinodes. (f) Obtain Bragg's Law of X-Ray diffraction.

[(2+2)+3+2+5+3+3]

8. (a) Describe Biot- Savart law in magnetostatics. Find the magnetic field at a distance z above the centre of a circular loop of radius R, which carries a steady current I using Biot-Savart law. Draw few magnetic field lines for the above mentioned circular loop carrying a steady current I in the clockwise direction.

(b) State and explain Ampere's circuital law in magnetostatics. Determine the magnetic field of a long coaxial cable in the two regions: (i) in between two cables and (ii) outside both using Ampere's circuital law.

[(3+6+2)+(4+5)]

9. Short notes (Any Two)   10+10

(a) Degrees of freedom and law of equation partition of energy
(b) An electric dipole
(c) Expression of pressure from kinetic theory of gases
(d) Polar dielectric material in the presence of an external electric field