BACHELOR OF POWER ENGINEERING SUPPLEMENTARY EXAMINATION 2017

1st YEAR, 1st SEMESTER

Subject: Physics

Time: Three Hours   Full Marks: 100

Answer any five questions.

1. (a) Deduce Boyle's law, Charles's law and Avogadro's hypothesis from the kinetic theory of gases.
   (b) What is Maxwell's velocity distribution law?
   (c) Starting from Maxwell's distribution of velocity find the expressions for the most probable velocity and mean velocity of a gas.

                                                                    9+3+7

2. (a) What assumptions of kinetic theory of gases are corrected for deducing equation of state for real gases?
   (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) Deduce Law of corresponding states.   2+7+7+4

3. (a) What are the characteristics of Simple harmonic motion? Deduce the equation for simple harmonic motion of a particle.

   (b) Show that the total energy of a particle executing S.H.M is proportional to square of its amplitude and square of its frequency.

   (c) Find the resultant of two mutually perpendicular S.H.M. which agrees in period but differ in phase.

   (d) A 1.75–kg particle moves as function of time as $x = 4\cos(1.33t+\pi/5)$ where distance is measured in metres and time in seconds.

   (i) What is the frequency and period of this motion?

   (ii) What is the equation of the velocity of this particle?

                                                                    (2+3)+5+5+5

4. (a) What is the difference between a transverse wave and longitudinal wave?

   (b) Write an expression of progressive wave. What is particle velocity and wave velocity?

   (c) Find an expression for the velocity of sound through a medium with average density 'ρ' and bulk modulus 'κ'. What is the Laplace's correction?   5+(2+3)+(7+3)

5. (a) What is the superposition principle 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) Determine the electric potential at a point on the axis of a uniformly charged disk of radius a and charge density σ. Show the variation of potential along the axis of the disk.

   $$3+(7+2)+(6+2)$$

6. (a) What are field lines in electrostatics? Draw the field lines in case of a single point negetive charge. "Field lines can never intersect"---- explain the statement.

   (b) "Any net charge must reside on the surface of a conductor"--- Explain. Prove that surface of a conductor in electrostatic equilibrium is an equipotential surface.

   (c) A spherical capacitor consists of two concentric spherical shells of radii a and b $(b>a)$. The inner shell has a charge $+Q$ uniformly distributed over its surface, and the outer shell has charge $-Q$. What is the capacitance of this capacitor?

   $$(3+2+2)+(4+3)+6$$

7. (a) Describe Biot- Savart law in magnetostatics. Find the magnetic field at a distance s from a long straight wire carrying a steady current I using Biot- Savart law. In case of infinite wire what should be the value of magnetic field?

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

8.   Short notes (Any Two)   10+10

   a.) Expression of pressure from kinetic theory of gases.
   b). Bohr model for atom.
   c). Degrees of freedom and law of equation partition of energy.
   d). Polar dielectric material in the presence of an external electric field