

B. FTBE 1ST YEAR 1ST. SEM. EXAM.-2018

Subject : PHYSICS - I

Time : 3 hours

Full Marks : 100

Answer any five questions

1. a) Find a unit vector which is perpendicular to both $A = 4i - j + 3k$ and $B = -2i + j + k$.
- b) Find the projection of vector $4i - j + 3k$ the line passing through the points (2,3,1) and (-2,-4,3).
- c) Find the directional derivative of $f = 4xz^3 - 3x^2y^2z$ at (2,-1,2) in the direction $(2i - 3j + 6k)$.
- d) A particle moves in a potential $V(x) = x^2(9-x)$. Find the position of stable and unstable equilibrium.
- e) Find the work done in moving an object along a straight line from point (3,2,-1) to (2,-1,4) in the force field $F = 2i + j - 3k$.
- 3+4+6+3+4
2. a) State and explain first law of thermodynamics. Which state function do you obtain from this law.
- b) Define C_p and C_v . Using 1st law of thermodynamics show that for ideal gas $C_p - C_v = R$.
- c) Distinguish between isothermal process and adiabatic process. Show that the work done by an ideal gas from state (P_1, V_1) to a state (P_2, V_2) in adiabatic process is $(P_1V_1 - P_2V_2)/(\gamma - 1)$.
- 5+6+9
3. a) Describe Carnot reversible cycle. Deduce work done for each part of the cycle and hence find out the efficiency in terms of source and sink temperatures.
- b) A Carnot engine operates between source temperature 1100K and sink temperature T_2 has efficiency 28%. It absorbs 60kcal heat from source. Find out the work done by the engine and sink temperature T_2 .
- c) What do you mean by 'entropy'? 10gm of ice at 0°C melts into water. Calculate change of entropy. Latent heat for melting of ice is 80 cal/gm.
- 10+5+5
4. a) State Biot Savart's law and explain how direction of magnetic field for a current element can be found.
- b) Using Biot Savart's law find the magnetic field at a point on the axis of a circular loop of radius R carrying current I . What will be magnetic field at center of the loop?
- c) Discuss Ampere's Law. Under what condition it useful? Explain with an example.
- 4+11+4

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5. a) State and explain Gauss law of electrostatics. Find the electric field due to uniformly charged sphere of radius R at points inside and outside the sphere. Show the result graphically.

b) How can you get Coulomb's law of electrostatic from Gauss's law.

c) What is the differential form of Gauss law?

12+4+4

6. a) Derive the conditions required for sustained interference of light coming from two sources.

b) What are Newton's ring and how they are produced? Explain how the experimental set up of Newton's ring can be used to determine refractive index of transparent liquid.

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

7+8+5 = 20

7. a) Calculate an expression for intensity of Fraunhofer 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) Give the interpretation of pressure and temperature of a perfect gas according to kinetic theory.

b) Write down Maxwell's speed distribution and explain its usefulness in calculating average speed, most probable speed and rms speed.

c) Derive Van der Waal's equation of state for a gas introducing short range interaction terms over the assumption of ideal gas. Discuss behavior of gas in unstable region of Van der Waal's equation.

7+5+8