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Ref. No.: EX/FTBE/PHY/111/2017(S)

**B. FTBE., 1<sup>st</sup> YEAR 1<sup>st</sup> SEM SUPPLEMENTARY EXAMINATION, 2017**

**PHYSICS I**

Time : Three hours

Full Marks : 100

Answer *any five questions*. All questions carry equal marks

1. (a) If  $\mathbf{A} = 2\hat{i} + 5\hat{j} + 8\hat{k}$  and  $\mathbf{B} = 3\hat{i} - 8\hat{j} + 11\hat{k}$  then find the unit vector perpendicular to both  $\mathbf{A}$  &  $\mathbf{B}$
- (b) If  $\mathbf{V}(x,y,z) = x^2z^2\hat{i} - 2y^2z^2\hat{j} + xy^2z\hat{k}$  then find  $\nabla \times \mathbf{V}$  at point  $P(1,-1,1)$
- (c) Show that  $\nabla r^n = nr^{n-2}\mathbf{r}$  where  $r = |\mathbf{r}|$
- (d) Find the directional derivative of  $\phi(x,y,z) = x^2y + xy^2z^3$  at point  $(1,1,-1)$  in the direction of vector  $2\hat{i} + \hat{j} + 3\hat{k}$

[5+5+5+5]

2. (a) State the assumptions of kinetic theory of gas.
- (b) From expression of pressure of gas deduce expression of Boyle's law and Avogadro's hypothesis.
- (c) State equipartition theorem of energy of gas. Find degrees of freedom of a non-linear tri-atomic molecule.

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

3. (a) What do you mean by adiabatic and isothermal process?
- (b) Find the expression of work done in a quasistatic process.
- (c) State first law of thermodynamics and prove that  $c^P - c^V = R$  for 1 mole ideal gas.

[5+5+(4+6)]

4. a) State Gauss's law of electrostatics and find electric field strength due to an infinite line charge.
- b) State Biot Savart's law and find magnetic flux density due to current flowing in a straight wire.

[(2+8)+(2+8)]

5. (a) Explain clearly the phenomenon of interference of light. State the conditions to be fulfilled for the production of sustained interference fringes.

(b) Describe interference of light using Young's double slit experiment and calculate the fringe width.

(c) What are coherent sources? Why two independent sources of light of the same wavelength can't produce interference? [6+10+4]

6. (a) A beam of monochromatic light from an extended source falls on a wedge shaped thin film. Show that the beam of light will produce interference fringes and obtain the conditions for the film to have maximum and minimum brightness.

(b) In a Newton's ring experiment, the diameter of 15<sup>th</sup> and 5<sup>th</sup> ring were found to be 0.590 cm and 0.336 cm respectively. If the radius of the plano-convex lens is 100 cm, calculate the wavelength of light? [14+6]

7. (a) What is Fraunhofer diffraction due to single slit. Find the condition of diffraction minima. How the positions of diffraction maxima can be obtained?

(b) State Brewster's law of polarization of light.

(c) Explain the phenomenon of polarization of light. What do you understand by double refraction?

(d) The critical angle of light in certain substance is  $45^\circ$ . What is the polarizing angle? [10+2+5+3]

8. (a) Explain what do you understand by Simple Harmonic Motion? Distinguish between free and forced vibrations.

(b) Write down and solve the differential equation for damped vibration explaining how it is obtained. Discuss over damped, critically damped and under-damped motions.

[5+15]