Ref No. -EX/CON/Ph/T/1B/111/2019 (old)

B.E Construction Engineering 1st year 1st Semester (Old)- 2019

Subject - Physics 1B Time -3Hrs Full marks -100

Answer any *five questions*

1. (a) What is streamline flow of a liquid through a capillary tube ? Show that the velocity profile of the advancing liquid is a parabola.

(b) Deduce Poiseuille's equation. Find the expression of axial velocity of the liquid.

(c) A liquid of density 1.45 g/c.c flows along a horizontal tube of which the cross-section is not constant. Calculate the change in pressure when the velocity of flow changes from 10cm/s to 20 cm/s ? 8+8+4=20

2. (a) Discuss the formation of Lissajous figures by the superposition of two simple harmonic motion of nearly same frequency.

(b).Construct the differential equation of forced vibration. What do you mean by amplitude resonance?

(c) A particle executing SHM has displacement x_1 and x_2 when its velocities are v_1 and v_2. Find its Time period. 8+8+4=20

3. (a) What is meant by 'degrees of freedom'? State the law of equipartition of energies applicable for gas molecules. Derive an expression for the ratio of the specific heats for gas in terms of degrees of freedom?

(b) What is entropy ? What is its relation with thermodynamic probability. Discuss about its physical significance.

(c) Find the energy in Joule of thermal motion of 20gm of oxygen at 10^0 C. 8+8+4=20

4. (i) Find a unit vector normal to the surface $x^3+y^2+3xyz=3$ at the point (2,2,-1).

(ii) Prove that $\text{grad}(r^n)=nr^{n-2}R$ and hence show that $\text{div}(r^nR)=(n+3)r^n$.

(iii) What is the physical significance of divergence ?

(iv) What is solenoidal vector ? Find the value of "a" for which the vector $(ax^2y+yz)i+(xy^2-xz^2)j+(2xyz-2x^2y^2)k$ is solenoidal.

(v)Find the unit vectors of a cylindrical co-ordinate system with the help of proper diagram.

3+3+3+(2+3)+6=20

5. (i) Derive an expression for one dimensional wave equation. How can we modify this into three dimensional wave equation.

(ii) Explain the physical significance of wave vector.

(iii) Derive a relation between wave velocity and group velocity.

(iv) A particle of mass 1 unit will undergo through a vibration of propagation constant of 2 unit. If the dispersive constant is 8 unit then find the nature of vibration, equation of vibration and draw the response curve.

(5+2)+3+6+4=20

6.(i) Prove that in absence of any external torque for a system of particle angular momentum is conserved.

(ii) Calculate the moment of inertia for (i) a thin road and (ii) a circular disk.

(iii) Prove and explain the parallel and perpendicular axis theorem about moment of inertia.

4+8+8=20

7. Write Short note on any **two** of the following : (10x2)

(a) Bernoulli's theorem

(b) Formation of beats

(c) Maxwell's velocity distribution law

(d) Conservative force field