

B. E. MET. MAT. ENGG. 1ST YEAR, 1ST SEM. EXAMINATION – 2019 (Old)

Subject: PHYSICS 1A

Time: 3 hours

Full Marks: 100

Answer any five questions.

1. (a) Explain Scalar and Vector field. Given the radius vector $\mathbf{r}_1=3\mathbf{i}-2\mathbf{j}+\mathbf{k}$, $\mathbf{r}_2=\mathbf{i}+4\mathbf{j}+9\mathbf{k}$, $\mathbf{r}_3=-\mathbf{i}+2\mathbf{j}+2\mathbf{k}$. Find the magnitude of $(\mathbf{r}_1 - \mathbf{r}_2 + 4\mathbf{r}_3)$.
(b) Find the angle between $\mathbf{A}=2\mathbf{i}+2\mathbf{j}-\mathbf{k}$ and $\mathbf{B}=7\mathbf{i}+24\mathbf{j}$. Determine the value of α so that $\mathbf{A}=2\mathbf{i}+\alpha\mathbf{j}+\mathbf{k}$ and $\mathbf{B}=\mathbf{i}+3\mathbf{j}-8\mathbf{k}$ are perpendicular. [10 + 10]
2. Define unit vector and find the unit vector of a vector $\mathbf{R} = 2\mathbf{i}+4\mathbf{j}+5\mathbf{k}$. Derive unit vectors in polar coordinate system. Show that $\mathbf{F} = (2xy+z^3)\mathbf{i} + x^2\mathbf{j} + 3xz^2\mathbf{k}$ is a conservative force field. [5+10+5]
3. What is moment of inertia and radius of gyration? Discuss parallel axis theorem. Derive the moment of inertia of a uniform disc. What are the assumptions of central force? [5+15+5]
4. Discuss the equation of continuity. Explain Bernoulli's theorem? Derive the Bernoulli's equation of fluid. [5+5+10]
5. What is the difference between travelling wave and standing wave? What is forced vibration and Write the amplitude of forced oscillation. Derive the equation of motion of simple pendulum. [5+5+10]
6. (a) State the basic properties of the molecules of a perfect gas. Derive the expression of the pressure of a perfect gas. Using the expression of pressure, deduce the Charles' law and Avogadro's law. [5+10+5]

7. (a) State and explain 1st law of thermodynamics. What is its drawback?
(b) Define C_p and C_v of a gas and using 1st law of thermodynamics show that for an ideal gas, $C_p - C_v = R$, where the symbols have their usual meaning.
(c) Calculate the work done of an ideal gas when it undergoes an isothermal expansion. [6+7+7]
8. (a) What is meant by a reversible process? What conditions must be fulfilled to be reversible process?
(b) Define entropy and state briefly its physical significance.
(c) What is quasistatic process? Show that for a quasistatic adiabatic change in an ideal gas, $PV^\gamma = \text{constant}$. Where $\gamma = c_p/c_v$. [5 + 5 + 10]