

UG/1-Sem/H/19

2019

PHYSICS

(Honours)

Paper : PHYH-DC - 1

[CBCS]

Full Marks : 25

Time : Two Hours

The figures in the margin indicate full marks.

*Candidates are required to give their answers
in their own words as far as practicable.*

1. Answer any five questions from the following :

$2 \times 5 = 10$

(a) Show that the field $\vec{F} = \hat{i}(2xy + z^2) + \hat{j}x^2 + \hat{k}(2xz)$ is conservative.

(b) Solve the following simultaneous equations :

$$\frac{dx}{dt} = -wy \text{ and } \frac{dy}{dt} = wx$$

(c) With the help of divergence theorem, show that

$$\int_s (\vec{\nabla}\phi \times \vec{\nabla}\psi) \cdot d\vec{s} = 0$$

P.T.O.

(2)

- (d) Evaluate the integral $I = \int_0^2 x^2 \delta(2x-1) dx$.
- (e) Find out a unit vector perpendicular to the surface $x^2 + y^2 - z^2 = 11$ at the point (4, 2, 3).
- (f) Comment on the homogeneity of the differential equation $aye^{x/y} dx + \left(y - axe^{x/y}\right) dy = 0$.
- (g) Define polar and axial vectors. Give example of each.
- (h) If $u(x, y) = \tan^{-1} \frac{y}{x}$, then find $\frac{\partial^2 u}{\partial x^2} + \frac{\partial^2 u}{\partial y^2}$.

2. Answer any *three* questions from the following :

5×3=15

- (a) Verify Gauss's divergence theorem for the vector $\vec{A} = 4xz\hat{i} - y^2\hat{j} + yz\hat{k}$ w.r.t. a unit cube with two opposite corners at (0,0,0) and (1,1,1). 5

- (b) (i) Given : $A = \begin{pmatrix} \cos \theta & -\sin \theta \\ \sin \theta & \cos \theta \end{pmatrix}$,
diagonalise A .

(3)

- (ii) Find a similarity transformation matrix B which diagonalises A . 2+3=5

- (c) Express $\vec{\nabla}$ in spherical polar coordinates and determine $\vec{\nabla}\psi(r, \theta, \phi)$ where $\psi(r, \theta, \phi) = 2r \sin\theta + r^2 \cos\phi$. 3+2=5

- (d) (i) Evaluate the integral $\int x^2 y dV$ where V is the closed region bounded by the planes $4x + 2y + z = 8$, $x = 0$, $y = 0$ and $z = 0$.

(ii) Solve $\frac{d^2 y}{dx^2} + 2 \frac{dy}{dx} + y = 0$. 3½+1½=5

- (e) Solve the following equation :

$$\frac{d^2 y}{dx^2} - y = x^2 \cos(x)$$

5