

UG/1st Sem/H/20 (CBCS)

2020

PHYSICS (Honours)

Paper : PHYH - DC- 1T

[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 : 2×5=10

- (a) Define scalar field and vector field. Give example of each.
- (b) If a vector field is given by $\vec{F} = (x^2 + y^2 + x)\hat{i} - (2xy + y)\hat{j}$. Is this field irrotational ?
- (c) If $\vec{r} = t\hat{i} - t^2\hat{j} + (t-1)\hat{k}$ and $\vec{S} = 2t^2\hat{i} + 6t\hat{k}$, evaluate $\int_0^2 \vec{r} \cdot \vec{S} dt$
- (d) With the help of divergence theorem, show that $\int (\vec{\nabla}\phi \times \vec{\nabla}\psi) \cdot d\vec{S} = 0$
- (e) Find the value λ , for the differential equation $(xy^2 + \lambda x^2 y)dx + (x+y)x^2 dy = 0$ is exact.
- (f) Evaluate the integral $I = \int_0^\infty e^{-3t} \delta(t-4) dt$

(g) Solve the following differential equation $\frac{d^5 y}{dx^5} - \frac{d^3 y}{dx^3} = 0$

(h) Find the unit normal to the surface $xy^3z^2 = 4$ at $(-1, -1, 2)$

2. Answer any *three* questions :

5×3=15

(a) Use the Divergence Theorem, evaluate $\iint F \cdot dS$ where $F = 4xi - 2y^2j + z^2k$ and S is the surface bounding the region $x^2 + y^2 = 4$, $z = 0$ and $z = 3$. 5

(b) Prove that the spherical polar coordinate system is orthogonal. 5

(c) Evaluate $\iiint (2x + y) dV$, where V is closed region bounded by the cylinder $z = 4 - x^2$ and the planes $x = 0$, $y = 0$, $y = 2$ and $z = 0$. 5

(d) Solve : $\cos^2 x \frac{dy}{dx} + y = \tan x$ 5

(e) Solve $(D^2 - 6D + 9) = 6e^{3x} + 7e^{-2x} - \log^2$ 5

