

(6)

16. (i) Find the unit normal vector at the point $\left(\frac{a}{\sqrt{3}}, \frac{b}{\sqrt{3}}, \frac{c}{\sqrt{3}} \right)$ on the surface of the ellipsoid

$$\frac{x^2}{a^2} + \frac{y^2}{b^2} + \frac{z^2}{c^2} = 1.$$

- (ii) Solve: $x^2 \frac{d^2 y}{dx^2} - x \frac{dy}{dx} + y = 2 \log x$.

- (iii) Evaluate

$$\left| \int_C \vec{r} \times d\vec{\theta} \right|, \text{ for a circle } C \text{ of radius } r \text{ with}$$

centre at the origin.

3 + 4 + 3

Total Pages—6

B.Sc-CBCS/IS/PHS/H/CIT/17

2017

PHYSICS

[Honours]

(CBCS)

[First Semester]

PAPER – C1T

Full Marks : 40

Time : 2 hours

Answer any five questions from Group – A, four from Group – B and one from Group – C

The figures in the right hand margin indicate marks

GROUP – A

Answer any five questions : 5 × 2

1. Determine the value of a , so that the function $f(x)$ defined by :

$$f(x) = \begin{cases} \frac{a \cos x}{\pi - 2x} & \text{for } x \neq \frac{\pi}{2} \\ 0 & \text{for } x = \frac{\pi}{2} \end{cases}$$

be continuous. 2

2. If $f(r)$ is differentiable then calculate $\text{curl}(\vec{r} f(r))$. 2

3. Prove that $\oint_C \phi d\vec{r} = \iint_S d\vec{S} \times \vec{\nabla} \phi$. 2

4. Find the integrating factor of the differential equation $\cos x \frac{dy}{dx} + y \sin x = \sec^2 x$. 2

5. Show that the area bounded by a simple closed curve C in a plane is given by $A = \frac{1}{2} \oint_C (x dy - y dx)$. 2

6. A loaded dice has the probabilities $\frac{1}{21}, \frac{2}{21}, \frac{3}{21}, \frac{4}{21}, \frac{5}{21}$ and $\frac{6}{21}$ of turning up 1, 2, 3, 4, 5 and 6 respectively. If it is thrown twice, what is probability that the sum of the numbers that turn up is even? 2

7. Prove that $x \delta'(x) = -\delta(x)$. 2

8. The mean and the variance of a binomial variable X are 2 and 1 respectively. Find the probability that X takes values greater than 1. 2

GROUP-B

Answer any four questions: 5 x 4

9. If \vec{A} and \vec{B} are constant vectors then prove that $\vec{\nabla}[\vec{A} \cdot (\vec{B} \times \vec{r})] = \vec{A} \times \vec{B}$. 5

10. Solve $\frac{d^2 y}{dx^2} + y = \sec^2 x$. 5

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11. Poisson distribution gives the probability that x events occur in unit time when the mean rate of occurrence is m .

$$P_x = \frac{e^{-m} m^x}{x!}$$

Show that

$$P_{x-1} = \frac{x}{m} P_x \text{ and } P_{x+1} = \frac{m}{x+1} P_x.$$

12. (a) Two dices are thrown simultaneously. What is the probability of getting faces whose sum will be 6 ?

- (b) Two coordinate system have same origin but rotated coordinate axes. Unit vectors of the coordinate systems are respectively.

$\hat{e}_1, \hat{e}_2, \hat{e}_3$ and $\hat{e}'_1, \hat{e}'_2, \hat{e}'_3$ respectively. Show that

$$\hat{e}'_1 = l_{11}\hat{e}_1 + l_{12}\hat{e}_2 + l_{13}\hat{e}_3$$

$$\hat{e}'_2 = l_{21}\hat{e}_1 + l_{22}\hat{e}_2 + l_{23}\hat{e}_3$$

$$\hat{e}'_3 = l_{31}\hat{e}_1 + l_{32}\hat{e}_2 + l_{33}\hat{e}_3$$

(5)

13. If $f(x)$ is the probability density of x given by $f(x) = x e^{-x/\lambda}$ over the interval $0 < x < \infty$, find the mean and the most probable values of x .

14. Verify Green's theorem in the plane for

$$\int_C (x+y)dx + (x-y)dy,$$

where C is the closed curve of the region bounded by $y = x^2$ and $y^2 = 8x$.

GROUP-C

Answer any one questions :

10 x 1

15. Verify the Gauss' divergence theorem for

$$\vec{F} = 4x\hat{i} - 2y^2\hat{j} + z^2\hat{k}$$

over the region bounded by $x^2 + y^2 = 4$, $z = 0$ and $z = 3$.

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