Seat Number

Nov-2015

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कात - 024

PHYSICS PAPER - II : PHY - 122
Theoretical Physics
(12126)

P. Pages : 3

Time : Two Hours **Max. Marks : 40**

Instructions to Candidates :

1. Do not write anything on question paper except Seat No.
2. Graph or diagram should be drawn with the black ink pen being used for writing paper or black HB pencil.
3. Students should note, no supplement will be provided.
4. All questions are compulsory and carry equal marks.
5. Figures to the right indicate full marks.
6. Draw necessary diagrams wherever necessary.
7. Use of logarithmic table or electronic calculator is allowed.
8. Symbols have their usual meanings.

1. Attempt **any eight** of the following, select correct option. **8**

i) $i^{12} + i^8 =$ .....

a) i^{20} b) i^4

c) zero d) 1

ii) If $\frac{\partial f}{\partial y} = x^2 (2xy + 3)$, then function F (x, y) is .....

a) $x^3 y^2 + 3x^2 y - 6$ b) $x^3 y^2 - 3x^2 y + 6$

c) $xy\left(x^2 y + 3\right)$ d) $xy\left(x^2 y - 3\right)$

iii) The divergence of curl of $\vec{A}$ is .....

a) zero b) one

c) positive d) Negative

iv) The cross product of 2 parallel or Antiparallel vectors is always .....

a) Infinite b) one

c) zero d) 180°

v) The complex conjugate of $\cos\theta + i\sin\theta = e^{i\theta}$ is .....

a) $\cos\theta + i\sin\theta = e^{-i\theta}$ b) $\cos\theta - i\sin\theta = e^{-i\theta}$

c) $\cos\theta - i\sin\theta = e^{i\theta}$ d) $\cos\theta + i\sin\theta = -e^{i\theta}$

vi) The curl of a gradient of a scalar ϕ is represented as .....

a) $\vec{\nabla} \times \vec{\nabla}\,\phi$ b) $\vec{\nabla} \cdot \vec{\nabla}\,\phi$

c) $\vec{\nabla}\,\phi \cdot \vec{\nabla}$ d) $\vec{\nabla} \times \phi\,\vec{\nabla}$

vii) The scalar product of two ..... vectors is simply negative of product of magnitudes of vectors.

a) Parallel b) Antiparallel

c) Perpendicular d) Planer

viii) If $\frac{\partial^2 F}{\partial x\,\partial x} = f_{xx}$ then $\frac{\partial^2 F}{\partial y\,\partial x} =$ .....

a) f_{xy} b) f_{yx}

c) $-f_{xy}$ d) $-f_{yx}$

ix) $\sec\theta =$ ----

a) $\frac{2}{e^{i\theta} + e^{-i\theta}}$ b) $\frac{2}{e^{i\theta} - e^{+i\theta}}$

c) $\frac{2}{e^{-i\theta} - e^{+i\theta}}$ d) $\frac{2}{-e^{-i\theta} - e^{i\theta}}$

x) An irrotational vector field is -------- field.

a) Non conservative field b) conservative field

c) solenoidal field d) None of the above

2. Attempt **any four** of the following. 8

a) Define a complex number.

b) Find the multiplication of 7+5i & -2+i.

c) What is the formula for total differential dF, if F=F(x,y)?

d) Define del operator.

e) State the geometrical interpretation of scalar triple product.

f) What are possible inferences if the divergence at a point is negative and zero?

3. Attempt **any two** of the following. 8

a) Find the modulus and argument of $Z = \frac{3+2i}{3-2i}$

b) Using the idea of total differentials find the approximate value of $\sqrt{(3.98)^2 + (2.99)^2}$.

c) Find the angle between $\vec{A} = 3\hat{i} + 2\hat{j} + 3\hat{k}$ & $\vec{B} = \hat{i} - \hat{j} + 2\hat{k}$.

4. a) Attempt **any two** of the following. 6

i) Evaluate $\left[\cos\frac{\pi}{4} + i\sin\frac{\pi}{4}\right]\left[\cos\frac{3\pi}{8} + i\sin\frac{3\pi}{8}\right]^2$

ii) If $F(x,y) = x^2 + y^2$, where $x = r\cos\theta$ & $y = r\sin\theta$ find $\frac{\partial F}{\partial r}$ and $\frac{\partial F}{\partial \theta}$.

iii) If $\vec{A} = x^2z\hat{i} + xy^2z\hat{j} - 3yz^2\hat{k}$ then find curl $\vec{A}$ at the pt. (1, 1, 1).

b) Prove that $\vec{\nabla} \cdot \vec{r} = 3$ where $\vec{r}$ is the position vector. 2

5. Attempt **any one** of the following. 8

i) Define scalar tripple product and show that the scalar triple product represents the volume of a parallelepiped, whose edges represents the given three vectors.

ii) Show that $\vec{\nabla} \cdot \left(\phi \vec{A}\right) = \vec{\nabla}\phi \cdot \vec{A} + \phi\left(\vec{\nabla} \cdot \vec{A}\right)$.

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