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BF—111—2016

FACULTY OF SCIENCE

B.Sc. (First Semester) EXAMINATION

NOVEMBER/DECEMBER, 2016

(CBCS Pattern)

PHYSICS

Paper II (Phy-112)

(Mathematical Methods in Physics)

(MCQ + Theory)

(Saturday, 10-12-2016) **Time : 10.00 a.m. to 12.00 noon**

Time—2 *Hours* *Maximum Marks*—40

N.B. :—(*i*) *All* questions are compulsory.

(*ii*) Non-programmable calculators are allowed.

(*iii*) Figures to the right indicate full marks.

(*iv*) Symbols have their usual meaning.

MCQ

1. Choose the *correct* answer : 10

(1) Two vectors having same magnitude as well as direction called :

(*a*) equal vectors

(*b*) opposite vectors

(*c*) unequal vectors

(*d*) negative vectors

P.T.O.

(2) If $\vec{A}, \vec{B}$ and $\vec{C}$ are three vectors then the triple product $\vec{A} \times \left(\vec{B} \times \vec{C}\right)$ is :

(*a*) $\vec{A}\left(\vec{B}\cdot\vec{C}\right) - \vec{C}\left(\vec{A}\cdot\vec{B}\right)$

(*b*) $\vec{C}\left(\vec{A}\cdot\vec{B}\right) - \left(\vec{A}\cdot\vec{B}\right)\vec{C}$

(*c*) $\left(\vec{A}\cdot\vec{C}\right)\vec{B} - \left(\vec{A}\cdot\vec{B}\right)\vec{C}$

(*d*) $\vec{A}\times\left(\vec{B}\cdot\vec{C}\right) - \vec{B}\times\left(\vec{A}\cdot\vec{C}\right)$

(3) Gradient of scalar is always :

(*a*) Scalar (*b*) Vector

(*c*) Zero (*d*) ∞

(4) The complex conjugate of a complex number $z = x + iy$ is :

(*a*) $\bar{z} = x - y$ (*b*) $\bar{z} = x - iy$

(*c*) $\bar{z} = x + iy$ (*d*) $\bar{z} = x + y$

(5) The complex number can be represented graphically by :

(*a*) Maxborn diagram (*b*) Legendary diagram

(*c*) Planck's diagram (*d*) Argand diagram

(6) The product of two complex numbers $(2 + 4i)$ and $(2 + 4i)^{-1}$ is :

(*a*) 1 (*b*) 0

(*c*) 4 (*d*) 6

(7) In polar co-ordinates x-coordinate is represented by :

(*a*) $r \sin \theta$ (*b*) $r \cos \theta$

(*c*) $r \tan \theta$ (*d*) $r \cot \theta$

(8) If $f'(x)$ goes from .... then the point is maximum.

(a) –ve to +ve (b) +ve to +ve

(c) –ve to –ve (d) +ve to –ve

(9) In the Fourier series

$$f(x) = a_0 + \sum_{n=1}^{\infty} a_n \cos nx + \sum_{n=1}^{\infty} b_n \sin nx.$$

The function sin nx and cos nx have the period of .... in $-\pi$ to π.

(a) π (b) 2π

(c) $\frac{\pi}{2}$ (d) $\frac{\pi}{4}$

(10) If the function $f(x)$ is an even function of x then $f(-x)$ is :

(a) $f(-x) = f(x)$ (b) $f(-x) = 0$

(c) $f(-x) = -f(x)$ (d) $f(-x) = \infty$

Theory

2. Attempt any *five* of the following : 10

(i) State Green's theorem.

(ii) If

$$\overline{A} = 2\overline{i} - \overline{j} + \overline{k}, \overline{B} = \overline{i} + 2\overline{j} + 3\overline{k} \text{ and}$$
$$\overline{C} = 3\overline{i} - 4\overline{j} + 5\overline{k},$$

then prove :

$$\overline{A} \cdot (\overline{B} \times \overline{C}) = 0$$

(iii) If

$$z_1 = x_1 + iy_1 \text{ and } z_2 = x_2 - iy_2,$$

then solve $z_1 + z_2$.

(iv) If

$$z_1 = (2 - 2i) \text{ and } z_2 = (4 + 2i),$$

then $z_1 . z_2 = ?$

(v) What is Chain rule ?

P.T.O.

(*vi*) State sine series in Fourier series.

(*vii*) For a function $F(x, y)$, x and y are the Cartesian co-ordinates. Write these co-ordinates in polar form.

3. Attempt the following : 10

(*i*) State gradient of scalar field and explain its physical significance.

Or

Explain Argand diagram for division of two complex numbers.

(*ii*) Explain minima and maxima.

Or

In the Fourier series :

$$a_0 + \sum_{n=1}^{\infty} a_n \cos nx + \sum_{n=1}^{\infty} b_n \sin nx$$

evaluate a_0.

4. Attempt any *one* of the following : 10

(*i*) Prove :

(*a*) $\bar{\nabla} \times \bar{\nabla}\phi = 0$

(*b*) $\bar{\nabla} \cdot \left(\bar{\nabla} \times \bar{A}\right) = 0$

(*ii*) Explain the graphical representation of even and odd functions.