S.Y.B.SC. SEM – III (CBCS - 2016 Course) : WINTER - 2018

SUBJECT: PHYSICS: MATHEMATICAL METHODS FOR PHYSICS

Day : Friday
Date : 19/10/2018

Time: 11.00 A.M. To 02.00 P.M.
Max. Marks: 60

W-2018-0712

N.B.:

1) All questions are **COMPULSORY**.
2) Figures to the right indicate **FULL** marks.
3) Draw neat labeled diagrams **WHEREVER** necessary.
4) Use of **CALCULATOR** is allowed.

Q.1 Attempt any **TWO** of the following: **(12)**

a) Find the scalar and vector product of two vectors $\vec{A}$ and $\vec{B}$, where $A = 2\hat{i} + \hat{j} + \hat{k}$ and $\vec{B} = 4\hat{i} + 2\hat{j} - 3\hat{k}$ Also find the angle between $\vec{A}$ and $\vec{B}$.

b) Determine different values of fifth root of $Z = i + \sqrt{3}$.

c) Find a unit normal to the surface $\phi(x, y, z) = x^2 + 3y^2 + 2z^2 = 6$ at the point $(2,0,1)$.

Q.2 Attempt any **TWO** of the following: **(12)**

a) Using total differentiation, find the approximate value of $\sqrt{(4.99)^2 + (12.02)^2}$.

b) Show that the divergence of vector field $\vec{V}$ at any point represents the net amount of flux of the vector field leaving per unit volume.

c) If $\vec{A} = 2\hat{i} - 3\hat{j} - 3\hat{k}$ and $\vec{B} = \hat{i} + 4\hat{j} - 2\hat{k}$ Find

i) $\vec{A} \times \vec{B}$ *ii)* $\vec{B} \times \vec{A}$ *iii)* $(\vec{A} + \vec{B}) \times (\vec{A} - \vec{B})$

Q.3 Attempt any **TWO** of the following: **(12)**

a) Show that the equation $df = (y^2 - y + 2xy)dx + (x^2 - x + 2xy)dy$ is an exact differential. Hence determine F.

b) Transform $\dfrac{1}{(1-i)^2}$ to exponential form.

c) Determine a unit vector perpendicular to the plane of $\vec{A} = 2\hat{i} = 6\hat{j} - 3\hat{k}$ and $\vec{B} = 4\hat{i} + 3\hat{j} - \hat{k}$

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Q.4 Attempt any **THREE** of the following: **(12)**

a) □□□□ $\nabla\phi$ and $|\nabla\phi|$ for the function $\phi = 2xz^4 - x^2y$ at $(2,-2,-1)$.

b) Show that the vector field represented by $\vec{F} = (z^2 + 2x + 3y)\hat{i} + (3x + 2y + z)\hat{j} + (y + 2zx)\hat{k}$ is irrotational, but not solenoidal.

c) If $F = x^y$ show that $\frac{\partial^2 F}{\partial x \partial y} = \frac{\partial^2 F}{\partial y \partial x}$.

d) Explain addition of two complex number by using an Argand diagram.

Q.5 Attempt any **FOUR** of the following: **(12)**

a) State the order and degree of differential equation $\frac{d^4y}{dx^4} - \sqrt{y^2 - 5} = 0$

b) If $\overline{A} = 2\hat{i} + 2\hat{j} + \hat{k}$ and $\overline{B} = 6\hat{i} - 3\hat{j} + 2\hat{k}$ Find $\overline{A}.\overline{B}$.

c) Determine the modulus of $Z = 2\sqrt{3} + 2i$.

d) If $\phi(x, y, z) = 3xy + 5z$, determine $\overline{\nabla}\phi$.

e) Write conditions for maxima and minima for one variable function.

f) Prove that vector $\vec{A} = 3yz\hat{i} + 2x\hat{j} + 4xy\hat{k}$ is solenoid.

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