Roll No. | | | | | | | | | | | | | Total No. of Pages : 02

Total No. of Questions : 09

B.Sc Non Medical (2018 Batch) (Sem.–1)

MATHEMATICAL PHYSICS

Subject Code : BSNM-103-18

Paper ID : [75744]

Time : 3 Hrs. Max. Marks : 50

INSTRUCTIONS TO CANDIDATES :

1. SECTION-A is COMPULSORY consisting of TEN questions carrying ONE marks each.
2. SECTION-B contains FIVE questions carrying FIVE marks each and students have to attempt any FOUR questions.
3. SECTION-C contains THREE questions carrying TEN marks each and students have to attempt any TWO questions.

SECTION-A

1. Write briefly :

a) Define the cross product of two vectors.

b) Show that the derivative of a vector of constant direction is parallel to that vector.

c) Show that the vectors $\vec{A} = 2\hat{i} - 3\hat{j} - \hat{k}$ and $\vec{B} = -6\hat{i} + 9\hat{j} - 3\hat{k}$ are parallel.

d) Show that the vectors $2\hat{i} - \hat{j} + \hat{k}, \hat{i} + 2\hat{j} + 3\hat{k}, 3\hat{i} - 4\hat{j} + 5\hat{k}$ are co-planar.

e) What do you mean by solenoidal vector field? Give one example.

f) What is an irrotational vector field? Give one example.

g) What is conservative field?

h) What are scalar and vector fields? Give one example of each.

i) What is plane polar coordinate system?

j) Write properties of Dirac-delta function.

SECTION-B

2. If the Wronskian of two functions y_1 and y_2 is identically zero, show by direct integration that $y_1 = c\, y_2$ i.e. y_1 and y_2 are dependent.

3. Show that a conservative field is the gradient of a scalar field and curl of such a field is zero.

4. Describe gradient of a scalar field in Cartesian coordinates. Explain its physical significance. Show that the gradient of a scalar function at any point is directed normally to the surface in the scalar field over which the value of scalar function is constant.

5. What is spherical coordinate system? Derive the relation between spherical polar coordinates and Cartesian coordinates.

6. Define Dirac-delta function and show that $\int_{-\infty}^{+\infty} f(x)\delta(x-a)dx = f(a)$, where symbols have their usual meaning.

SECTION-C

7. a) Show by means of Wronskian that a linear, second order homogeneous equation of the form $y''(x)+P(x)y'(x)+Q(x)y(x)=0$, cannot have three independent solutions. (6+4=10)

   b) Derive the uniqueness theorem for initial value problem. (10)

8. Derive an expression for divergence of a vector field in Cartesian coordinates system. (10)

9. State and prove Stokes theorem.