Code No. 3318/E

FACULTY OF SCIENCE

B.Sc. VI-Semester (CBCS) Examination, May / June 2019

Subject : Mathematics

Paper – VIII (B) (DSE E-2) : (Vector Calculus)

Time : 3 Hours **Max. Marks: 60**

PART – A (5 x 3 = 15 Marks)
(Short Answer Type)

Note : Answer any FIVE of the following questions.

1 If $\vec{F}=(y,x,z)$ and C is the curve given by $x=\cos q,\ \sin q,\ z=0,\ (0\le\theta\le 2\pi)$ then evaluate $\int_C \vec{F}\cdot d\vec{r}$

2 Define conservative vector field with example.

3 Show that $\int_0^a \int_0^{b(1-x/a)} \int_0^{c(1-x/a-y/b)} dz\,dy\,dx = \frac{abc}{6}$.

4 Find the angle between the surfaces of the sphere $x^2+y^2+z^2=2$ and the cylinder $x^2+y^2=1$ at a point where they intersect.

5 If $\vec{f}=$ grad $(x^3+y^3+z^3-3xyz)$ find curl $\vec{f}$.

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

7 Give the physical interpretation of curl.

8 Show that culr (grad ϕ)= $\vec{0}$ if ϕ is a scalar field.

PART – B (3 x 15 = 45 Marks)
(Essay Answer Type)

Note: Answer ALL from the questions.

9 (a) Evaluate the surface integral of u=(y , x^2 , z^2) over the surface S where S is the triangular surface on x = 0 with $y \ge 0$, $z \ge 0$, $y + z \le 1$, with the normal $\hat{n}$ directed in the positive direction of x – axis.

OR

(b) Evaluate the line integral $\int_C \vec{F} \times d\vec{r}$ where is the vector field (y, x, 0) and C is the curve y = sin x, z = 0 between x = 0 and x = π.

10 (a) A cube has a variable density given by p = 1 + x + y + z. What is the total mass of the cube?

OR

(b) Find the volume integral of the scalar field $\phi = x^2 + y^2 + z^2$ over the region V specified by $0 \le x \le 1$, $1 \le y \le 2$, $0 \le z \le 3$.

11 (a) Show that

$$\vec{u}=(y^2z, -z^2\sin y+2xyz,\ \ 2z\cos y+y^2x)$$

is irrotational. Find the corresponding potential function.

OR

(b) Find the gradient and Laplacian of $f=\sin(K_x)\sin(\ell y)\exp(\sqrt{K^2+\ell^2}Z)$.