Reg. No.................

FIFTH SEMESTER B.Sc. DEGREE EXAMINATION, NOVEMBER 2014

(U.G.–CCSS)

Core Course—Mathematics

MM **5B 05—VECTOR** CALCULUS

Time : Three Hours

Maximum : 30 Weightage

I. Answer *all* questions :

1 Plane through $P_o(x_U, y_U, z_U)$ and normal to $\vec{m} = Ai + Bj + Ck$ is ______________

2 Find the parametric equation for the line through the points P (-3,2,-3) and Q(1,-1,4).

3 Vector equation for the line through $P_U(x_U, y_U, z_U)$ and parallel to is

$P_0P =$ ______________

4 A vector function $r(t)$ is continuous at a point $t = t_o$ in its domain if $\lim_{t \to t_0} \vec{r}(t) =$ ______________

5 Domain of the function $w = \sin(xy)$ is the entire plane. Then range = ______________

6 $\lim_{(x,y)\to(0,0)} \frac{3x^2 - y^2 + 5}{x^2 + y^2 + 2}$ ______________

7 Find — and $\frac{}{\partial y}$ if $f(x, y) = (x^2\ 1)\ (y + 2)$

8 Find the gradient of $g(x, y) = y - x^2$ at **(-1,** 0).

9 The curl of a vector field $F = Mi + Nj$ at the point (x, y) is ______________

10 Curvature of a straight line is ______________

11 Define Saddle point.

12 Examine whether F. $yi + (x + z)j - yk$ conservative.

(12 x ¼ = 3 weightage)

Turn over

II. Answer all *nine* questions

13 Find the angle between the planes

$3x - 6y - 2z = 15$ and $2x + y - 2z = 5$.

14 Find the spherical co-ordinate equation for the sphere

15 Show that $\vec{u}(t) = (\sin t)i + (\cos t)j + \sqrt{3}\,k$ is orthogonal to its derivative.

16 Find the equation for the plane through P_o (0, 2,-1) and normal to $n = 3\ -2j - k$

17 Find the acceleration of a moving particle at t = 1 whose position vector is

18 Find the parametric equation for the line that is tangent to the curve

$(t) = (a \sin t)i + (a \cos t)j + btK$ at $t_{\upsilon} = 2n$.

19 If $t_{\upsilon} = 0$ find the arc length parameter along the helix $\vec{r}(t)\ (\cos t)i + (\sin t)j + tk$.

20 Write the range of the function $f(x, y) = xy$.

21 State Stoke's theorem.

(9 x 1 = 9 weightage)

III. Answer any *five* questions

22 Find T and N for the plane curve

$\vec{r}(t) = (2t + 3)i + (5 - t^{\hat{}})j$

23 Find the point where the line $x = 1 + 2t$, $y = 1 + 5t$, $z = 3t$ intersects the plane $x + y + z = 2$.

24 Find the distance from the point S (1, 1, 5) to the line $L: x = 1 + t, y = 3 - t, z = 2t$.

25 Find the curvature for the space curve $F(t) = (e^t \cos t)i + (e^t \sin t)j + 2k$

26 Calculate the outward flux of the field F (x, y) = $xi + y^{\bar{}}j$ across the square bounded by the lines $x = \pm 1$, $y = \pm 1$.

27 Evaluate $\int (xy \ \mathbf{y} \quad z)dz$ along the curve $\mathbf{r}(t) = 2ti + tj + (2-2t)\ k, 0\ 5\ t\ 1$.

28 Find the area enclosed by the lemiscate $r^2 = 4 \cos 20$

(5 x 2 = 10 weightage)

IV. Answer any *two* questions :

29 Find the plane determined by the intersecting lines :

$L_1 : x = -1 + t,\ y = 2 + t, z = 1 - t, -\infty < t < \infty$

$L_2 : x - 1 - 4s, y = 1 + 2s, z = 2 - 2s, -\infty < s < co$

30 Find an upper bound for the magnitude of the error E in the approximation :

$f(x, y, z) \approx L(x, y, z)$ over the rectangle R. Given $f(x, y, z) = xz - 3yz + 2$ at P_o (1, 1, 2).

31 Show that $\mathbf{F} = (e^x \cos y + yz)i + (xz - e^x \sin y)j + (xy + z)k$ is conservative and find a potential function for it.

(2 X 4 = 8 weightage)