Reg. No…….. Name…… **19U419**

B.Sc. DEGREE END SEMESTER EXAMINATION MARCH/APRIL 2019

SEMESTER **– 4: MATHEMATICS (CORE COURSE FOR MATHEMATICS & COMPUTER APPLICATION)**

COURSE: **15U4CRMAT04-15U4CRCMT04, VECTOR CALCULUS, THEORY OF EQUATIONS AND NUMERICAL METHODS**

(Common for Regular 2017 admission and improvement 2016/ supplementary 2016/2015/2014 admission)

Time: Three Hours Max. Marks: 75

PART A

*Answer **all** questions. Each question carries **1** mark.*

1. Find a vector perpendicular to the plane 3x+5y-8z=0.
2. Find the volume of the parallelepiped whose edges are vectors $3\vec{i}+4\vec{j}$, $2\vec{i}+3\vec{j}+4\vec{k}$ and $5\vec{k}$.
3. Find $\frac{dr}{dt}$ of a particle moving along the curve $r(t)=\sin t\,\vec{i}+e^{-t}\,\vec{j}+3\vec{k}$.
4. Evaluate $\int_C (x+y)ds$ where C is a straight line $x=t, y=1-t, z=0$ from $(0,1,0)$ to $(1,0,0)$.
5. Find the gradient of the field $f(x,y,z)=(x^2+y^2+z^2)^{\frac{-1}{2}}$.
6. Find the divergence of $f(x,y)=(x^2-2y)\vec{i}+(xy-y^2)\vec{j}$.
7. Form a polynomial equation of second degree with rational coefficients, one of whose roots are $\sqrt{2}+\sqrt{-3}$.
8. If a, b, c are the roots of the equation $4x^3-2x^2+8x+5=0$, then find ab + bc + ac.
9. Write Newton-Raphson formula to find an approximate solution of an equation.
10. If f(a).f(b)<0 , then a root of f(x)=0 lies between ……. and ……. (1 x 10 = 10)

PART B

*Answer **any** **eight** questions. Each question carries **2** marks.*

11. Find the angle between the planes $x+y+z=1$ and $x+2y+3z=6$.
12. A particle moves along the curve $x=3t^2$, $y=t^2-2t, z=t^3$. Find velocity and acceleration.
13. Find the arc length parameter along the helix $r(t)=\cos t\,\vec{i}+\sin t\,\vec{j}+t\vec{k}$ from t_0=0 to t.
14. Find the total work done in moving a particle in a force field given by $F=3xy\vec{i}-5z\vec{j}+10x\vec{k}$ along the curve $x=t^2+1, y=2t^2, z=t^3$ from t=0 to t=1.
15. Evaluate $\oint_C xydy-y^2dx$, where C is the square cut from the first quadrant by the lines $x=1$ and $y=1$, using green's theorem.
16. If $F=-2yi+2xj$, evaluate $\int_C F.dr$ where C is a circle of radius *a* about the origin bounding a disk S in the x-y plane using Stoke's theorem.
17. Solve the equation $4x^3-24x^2+23x+18=0$, given that the roots are in arithmetic progression.
18. Form an equation whose roots are 2 times those of the equation $2x^3-5x^2+7=0$.

19. Find an approximate real root of the equation $xe^x = 1$ in four steps using bisection method, given that a root lies between 0 and 1.
20. Use Newton Raphson Method to find an approximate root of $x^3 - 2x - 5 = 0$ near $x_0 = 2$ in two steps. (2 x 8 = 16)

PART C

*Answer **any** **five** questions. Each question carries **5** marks.*

21. Find the unit tangent vector **T** and unit normal **N** for $r(t) = 3\cos t\,\vec{i} + 3\sin t\,\vec{j} + 4t\vec{k}$.
22. Find the tangential and normal component of acceleration for the curve $r(t) = (\cos t + t\sin t)\vec{i} + (\sin t - t\cos t)\vec{j}$.
23. Show that $2xdx + 2ydy + 2zdz$ is exact and evaluate $\int_{(0,0,0)}^{(2,3,-6)} 2xdx + 2ydy + 2zdz$.
24. Find the area of surface cut from the bottom of the paraboloid $x^2 + y^2 - z = 0$ by the plane $z = 4$
25. Solve $24x^3 - 14x^2 - 63x + 45$ given that one root is double another.
26. Solve the equation $60x^4 - 736x^3 + 1433x^3 - 736x + 60 = 0$.
27. Find the real solution of $x^4 = 3$ by Regula falsi method in five steps. (5 x 5 = 25)

PART D

*Answer **any** **two** questions. Each question carries **12** marks.*

28. Evaluate $\int_C F.dr$ if $F = (x^2 + y^2)i - 2xyj$ where C is the rectangle in the $x - y$ plane bounded by $x = 0, x = a, y = 0, y = b$.
29. Verify Green's theorem in the plane $\oint_C xydx + x^2dy$ where C is the curve enclosing the region bounded by parabola $y = x^2$ and the line $y = x$.
30. Solve $x^3 - 9x + 28 = 0$ by Cardan's method.
31. a) Find an approximate root of $x = e^{-x}$ using Newton Raphson method upto 4 steps starting from $x_0 = 1$.

    b) Find an approximate solution to the equation $x^3 + x - 1 = 0$ starting from $x_0 = 1$ using fixed point iteration formula in 3 steps. (12 x 2 = 24)

****