TB144100C **Reg. No.....**

Name.....

B. Sc. DEGREEE (C.B.C.S.S) EXAMINATION, APRIL 2018
(2014 Admission Supplementary)
SEMESTER IV- CORE COURSE (MATHEMATICS)
MAT4VTN - VECTOR CALCULUS, THEORY OF EQUATIONS AND NUMERICAL METHODS
(For B. Sc. Mathematics and Computer Applications)

Time: Three Hours **Maximum Marks: 80**

PART A

I Answer all questions. Each question carries 1 mark.

1. Write the general form of equation of a quadric surface
2. Find the gradient of $f(x, y) = y - x^2$ at (-1,0)
3. Find the unit tangent vector of $\bar{r}(t) = \cos t\,\bar{i} + \sin t\,\bar{j}$
4. Find the divergence of $\bar{F} = (x^2 + 1)\bar{i} - z\,\bar{j} + x\,\bar{k}$
5. Is the field $\bar{F} = -y\,\bar{i} + x\,\bar{j}$ is conservative?
6. Find two values a and b such that a real root $f(x) = x^3-x-1=0$ lies between a and b.
7. Write the condition for the sequence of approximations to a real root of an equation f(x)=0 converges to the required root in the method of iteration.
8. Form an equation whose roots are three times the roots of the equation $x^3-x^2+x+1 = 0$.
9. If α, β, γ are the roots of $x^3+px^2+qx+r = 0$, find the value of $\frac{1}{\alpha\beta} + \frac{1}{\alpha\gamma} + \frac{1}{\beta\gamma}$.
10. State Stokes theorem

(10x1=10)

PART B

II Answer any eight questions. Each question carries 2 marks

11. Find parametric equations for the tangent line of the curve of intersection of the surfaces

    $f(x, y, z) = x^2 + y^2 - 2 = 0$ and $g(x, y, z) = x + z - 4 = 0$ at the point (1,1,3)

12. Find the derivative of $f(x, y) = x^2 + xy$ at (1,2) in the direction of the unit vector

    $\bar{u} = \frac{1}{\sqrt{2}}\bar{i} + \frac{1}{\sqrt{2}}\bar{j}$

13. Find the linearization $L(x, y, z)$ of $f(x, y, z) = x^2 - xy + 3\sin z$ at the point(2,1,0).Find an upper bound for the error incurred in replacing f by L on the rectangle $R: |x-2| \le 0.01, |y-1| \le 0.02, |z| \le 0.01$

14. Find the curl of $\overline{F} = (x^2 - y)\bar{i} + 4z\,\bar{j} + x^2\,\bar{k}$

15. Find the circulation of the field $\overline{F} = (x - y)\bar{i} + x\,\bar{j}$ around the circle $\bar{r}(t) = \cos t\,\bar{i} + \sin t\,\bar{j}$, $0 \le t \le 2®$

16. Find a parametrization of the cone $z = \sqrt{x^2 + y^2}, 0 \le z \le 1$

17. Find the flux of $\overline{F} = xy\,\bar{i} + yz\,\bar{j} + xz\,\bar{k}$ outward through the surface of the cube cut from the first octant by the planes $x = 1, y = 1$ and $z = 1$

18. Explain the geometrical interpretation of Newton-Raphson method.

19. Obtain a root correct to two decimal places using bisection method for x^3-2x-5=0

20. Find the condition that the roots of the equation x^3-lx^2+mx-n = 0 may be in arithmetic progression.

21. Find the equation whose roots are 2 less than the roots of the equation x^4-5x^3+7x^2- 4x+5 = 0.

22. Find the sum of fourth powers of roots of the equation x^3-x-1 = 0.

(8x2=16)

PART C

III Answer any six questions. Each question carries 4 marks.

23. Find the distance from the point (1,1,3) to the plane $3x + 2y + 6z = 6$

24. Find the torsion of $\bar{r}(t) = 3\sin t\,\bar{i} + 3\cos t\,\bar{j} + 4t\,\bar{k}$.

25. Find a potential function for $\overline{F} = (y + z)\bar{i} + (x + z)\,\bar{j} + (x + y)\,\bar{k}$

26. Calculate the flux of the field $\overline{F} = y\,\bar{i} + x\,\bar{j}$ across the circle $x^2 + y^2 = 1$ in the xy plane

27. Setup a Newton Iteration formula for computing the square root of a given positive number. Use the same to find the square root of 2 correct to six decimal places.

28. Using Aitken's Δ^2 process find the root of the equation 2x = cos x+3 correct to three decimal places.

29. Solve the equation x^4+2x^3-25x^2-26x+120 = 0 given that the product of two of its roots is 8.

30. If α, β, γ are the roots of the equation x^3+px+q = 0. Form an equation whose roots are $\alpha^2 + \beta\gamma,\ \beta^2 + \alpha\gamma, \gamma^2 + \alpha\beta$.

31. Solve by Cardan's method x^3-9x+28 = 0.

(6x4=24)

PART D

IV Answer any two questions. Each question carries 15 marks.

32. Integrate $G(x, y, z) = x^2$ over the cone $z = \sqrt{x^2 + y^2}$, $0 \le z \le 1$

33. Find the circulation of the field $\overline{F} = \left(x^2 - y\right)\bar{i} + 4z\,\bar{j} + x^2\,\bar{k}$ around the curve C in which the plane $z = 2$ meets the cone $z = \sqrt{x^2 + y^2}$

34. Solve $x^5-3x^4-14x^3-14x^2-3x+1 =0$

35. Find a real root of the equation $f(x) = x^3-2x-5 =0$ using method of false position.

(2x15= 30)