TB144420B **Reg. No: ....**

Name: ....

B. Sc. DEGREE (C.B.C.S.S.) EXAMINATION, MARCH 2017

(Supplementary – 2014 Admission)

SEMESTER IV – CORE COURSE (MATHEMATICS)

MAT4VTN - VECTOR CALCULUS, THEORY OF EQUATIONS AND NUMBERICAL METHODS

(For Mathematics and Computer Application)

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

PART A

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

1. Find the equation of a plane through (2,4,5) and perpendicular to the plane x=5+t, y=1+3t, z=4t
2. Define a cone with example.
3. Write the vector formula for curvature.
4. Find the gradient field of f(x,y,z) = x^2y^2z
5. State Green's theorem. (Tangential form)
6. Find the curl of F(x,y) = (x^2 - 2y) i + (xy- y^2) j
7. Find all the roots or a polynomial equation of fourth degree with rational coefficients, one of whose roots is $1 + \sqrt{-1}$
8. Form an equation whose roots are the negatives of the roots of the equation $3x^4 - 5x^3 + 7x^2$+3x+4 =0
9. State Mean Value theorem for derivatives.
10. Write the Newton-Raphson formula.

(10x1=10)

PART B

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

11. Find the point where the line x=$-\frac{8}{3}$+2t, y = $-$ 2t, z =1+t intersects the plane 3x+2y+6z=6
12. A particle moves along the curve x= 3 t^2 , y=t^2-2t, z= t^3. Find the velocity ans acceleration at t=1
13. What is the maximum possible $\frac{df}{ds}$, if f(x,y,z) = $x^2 + y^2$- z at (1,1,2).
14. Evaluate $\int_C (x - 3y^2 + z)\, ds$ along the curve r(t) = t i + t j + t k, 0 ≤t ≤ 1
15. Show that F=(e^xcosy + yz) i +(xz-e^xsiny) j + (xy+z) k is conservative.
16. Find the parameterization of the cylinder $x^2 + y^2 + z^2 = a^2$
17. Prove that div (Curl F) = 0, where F = $f_1\, i + f_2\, j + f_3$ k
18. Solve $8x^3 - 47x^2 + 66x + 9$=0 given that it has a double root.

19. Solve $x^3 - 6x^2 + 13x - 10 = 0$ given that is roots are in AP.

20. Form an equation whose roots are four times those of the equation $4x^3 - 2x^2 + 8x + 5 = 0$

21. Solve $x^3 - 9x - 1 = 0$ for the root between x = 2 and x = 4 by Bisection method.

22. Write the algorithm of the method of False Position.

(8x2=16)

PART C

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

23. Find the unit tangent vector to the curve $x = t^2 + 1$, y = 4t-3, $z = 2t^2 - 6t$ at the point t=2.

24. Find the centre of curvature at the point (c, c) to the curve $xy=c^2$

25. If **r** = xi + yj+ zk and $|\mathbf{r}|$ = r, show that $\nabla\left(\frac{1}{r}\right) = \frac{r}{r^3}$

26. Prove that div. grad $r^n = n(n+1)\, r^{n-2}$.

27. Solve the equation $27x^4 - 72x^2 + 64x - 16 = 0$, given that it has repeated roots

28. If $\alpha, \beta, \gamma, \delta$ are the roots of $x^4 + px^3 + qx^2 + rx + s = 0$. Find the value of $\sum \alpha^2 \beta$

29. If α, β, γ are the roots of $x^3 + px^2 + qx + r = 0$. Obtain the equation whose roots are $\alpha + \frac{1}{\beta\gamma}, \beta + \frac{1}{\gamma\alpha}, \gamma + \frac{1}{\alpha\beta}$

30. Find a root of the equation $f(x) = x^3 + x - 1 = 0$ by Fixed point Iteration method.

31. Use Newton - Raphson method to find a root of the equation $x^3 - 2x - 5 = 0$

(6x4=24)

PART D

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

32. a. Find the circulation of the field F =(x-y)i +x j around the circle r(t) = Cost i + Sint j; $0 \le t \le 2\pi$

    b. If $\nabla\varphi = (y + y^2 + z^2)I + (x+z+2xy)j + (y+2xz)k$. Find φ such that $\varphi(1,1,1) = 3$

33. Verify the circular form of Green's theorem on the annular ring R : $h^2 \le x^2 + y^2 \le 1$, 0< h <1, if M = $\frac{-y}{x^2+y^2}$ and N = $\frac{x}{x^2+y^2}$.

34. a. Prove that if α is a r-multiple root of a polynomial f(x) and if r>2, then α is an (r-1)-multiple root of $f'(x)$

    b. If α, β, γ are the roots of $lx^2 + mx + n = 0$. Find the equation whose roots are $\frac{\alpha}{\beta}, \frac{\beta}{\alpha}$

35. Using False position method find the real root of the equation $f(x) = x^3 - 5x + 1 = 0$

(2x15=30)