TB154395C **Reg. No: …………………**

Name: ……………………

B. Sc. DEGREE (C.B.C.S.S.) EXAMINATION, MARCH 2017
SEMESTER IV – CORE COURSE (MATHEMATICS)
MT4B04B - VECTOR CALCULUS, THEORY OF EQUATIONS AND NUMERICAL METHODS

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

PART A

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

1. Find the parametric equation for the line through the origin and parallel to the vector 2 j + k.
2. Write the vector function representing Helix.
3. Show that F = (2x - 3) i - 2 j + (cos z) k is not conservative.
4. State Stokes' theorem.
5. Find two numbers a and b such that a real root of $f(x) = x^3 - 2x - 5 = 0$ lies between a and b.
6. Find the sum of all roots of the equation $3x^3 - 9x - 1 = 0$.

(6x1=6)

PART B

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

7. Find an equation for the plane through P_0 (-3,0,7) perpendicular to n = 5i +2j –k.
8. Show that r(t) = cos(t) i +$\sqrt{5}$ j +sin(t) k has constant length and is orthogonal to its derivatives.
9. Find N for the Helix r(t) = (a cos t) i + (a sin t) j + (bt) k, a, b ≥ 0, $a^2 + b^2 \neq 0$.
10. Show that the curvature of a circle of radius a is $\frac{1}{a}$.
11. Find the circulation of the field F = (x-y) i + (x) j around the circle r(t) = (cos t)i +(sin t)j $0 \le t \le 2\pi$.
12. Evaluate $\int_C (x+y)\, ds$ where C is the straight line segment from x = t, y = 1- t, z = 0, from (0,1,0) to (1,0,0).
13. Find the work done by the force F = (xy)i + (y)j +(-yz)k over the curve r(t) = t i+t^2 j+ t k, $0 \le t \le 1$.
14. Find the sum of the fourth powers of the roots of the equation $x^4 - 3x^3 + 5x^2 - 12x + 4 = 0$.
15. Solve the equation $x^4 + 20x^3 + 143x^2 + 430x + 462 = 0$ by removing its second term.
16. Obtain a root correct to two decimal places using bisection method for $x^3 - 2x - 5 = 0$.

(7x2=14)

PART C

III. Answer any five questions. Each question carries 6 marks.

17. Find an equation for the plane through A (0,0,1), B (2,0,0) and C (0,3,0).
18. Find the unit tangent vector and unit normal vector for r(t) = t i + t^2j .

19. Using divergence theorem evaluate $\iint_S (7x\, i - z\, k) . n\, d\sigma$ over the sphere S: $x^2 + y^2 + z^2 = 4$.
20. Find the area of the surface cut from the bottom of the paraboloid $x^2 + y^2 - z = 0$ by the plane $z = 4$.
21. Find a real root of the equation $x = e^{-x}$ using the Newton – Raphson Method
22. Use Iteration method to find a root of $\cos x = 3x - 1$ correct to 3 significant figures.
23. Solve $x^3 - 9x - 12 = 0$ using Cardan's method.
24. If ~, , ¥ are the roots of the equation $x^3 + qx + r = 0$. Find the equation whose roots are (~ −)^2, (-¥)^2, (¥ −~)^2 .

(5x6=30)

PART D

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

25. Integrate $g(x,y,z) = x^2y^2z^2$ over the surface of the cube cut from the first octant by the planes $x = 2$, $y = 2$ and $z = 2$.
26. Use stoke's theorem to calculate the circulation of the field F = (2y) i + (3x) j – (z2) k around the curve C = $x^2+y^2 = 9$ in the xy plane counter clock wise.
27. Find a real root of the equation $x^3 - x - 1 = 0$ correct up to 3 decimal places using bisection method.
28. a) Show that the equation $x^4 + 5x^3 + 9x^2 + 5x - 1 = 0$ can be transformed into a reciprocal equation by diminishing the roots by 2. Hence solve the equation.
    b) Prove that in a polynomial equation with real coefficients imaginary roots occur in conjugate pairs.

(2x15=30)