TB154205A **Reg. No: …………………….**

Name: ……………………….

B. Sc. DEGREE (C.B.C.S.S.) EXAMINATION, MARCH 2017
SEMESTER IV – CORE COURSE (COMPUTER APPLICATION)
CAM4B04TB - VECTOR CALCULUS, THEORY OF EQUATIONS AND GRAPH THEORY

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

PART A

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

1. Find parametric equation of the line through $(3, -4, 1)$ parallel to the vector i+j+k.
2. State Gauss divergence theorem.
3. If ~, , ¥ are the roots of the equation $2x^3 + x^2 - 2x - 1 = 0$, then what is the value of ~ + + ¥ .
4. Give an example of a reciprocal equation of degree 5.
5. Give an example of a graph which is both complete and complete bipartite.
6. Draw an Euler graph which is not connected.

(6x1=6)

PART B

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

7. Find a vector parallel to the line of intersection of the planes $3x - 6y - 2z = 15$ and $2x + y - 2z = 5$.
8. Find the unit tangent vector of the curve $r(t) = (2+t)\,\mathrm{i} - (t+1)\,\mathrm{j} + t\,\mathrm{k}$.
9. Find the derivative of $f(x, y) = x^2 \sin 2y$ at the point (1, ®/2) in the direction of $v = 3\,\mathrm{i} - 4\,\mathrm{j}$.
10. Evaluate $f(x, y, z) = 3x^2 - 2y + z$ over the line segment C joining the origin to the point $(2, 2, 2)$.
11. Find the circulation of the field $F = x\,\mathrm{i} + y\,\mathrm{j}$ around the circle $r(t) = (\cos t)\,\mathrm{i} + (\sin t)\,\mathrm{j}$, $0 \le t \le$ 2® .
12. Find the flux of $F = (x - y)\,\mathrm{i} + x\,\mathrm{j}$ across the circle $x^2 + y^2 = 1$ in the xy-plane.
13. Transform $x^3 - 6x^2 + 5x + 12 = 0$ into an equation lacking the second term.
14. Solve the equation $4x^3 - 24x^2 + 23x + 18 = 0$, given that the roots are in arithmetical progression.
15. Prove that the join of two vertex disjoint complete graphs is a complete graph.
16. Draw all non- isomorphic trees on the six vertices.

(7x2=14)

PART C

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

17. Find the curvature for the helix $r(t) = (a \cos t)\,\mathrm{i} + (a \sin t)\,\mathrm{j} + bt\,\mathrm{k};\ a, b \geq 0,\ a^2 + b^2 \neq 0$.
18. Find the tangent plane and normal line of the surface $f(x, y, z) = x^2 + y^2 + z - 9 = 0$ at the point $P_0(1, 2, 4)$.
19. Find a potential function f for the field $F = (2xy - z^2)\,\mathrm{i} + (x^2 + 2yz)\,\mathrm{j} + (y^2 - 2zx)\,\mathrm{k}$.
20. Integrate $g(x, y, z) = x + y + z$ over the surface of the cube cut from the first octant by the planes $x = a,\ y = a,\ z = a$.
21. Prove that every polynomial equation of the n^{th} degree has n and only n roots.
22. If ~, ,¥ are the roots of $x^3 + qx + r = 0$, find the equation whose roots are (−¥)^2, (¥ −~)^2, (~ −)^2.
23. Given any two vertices u and v of a graph G, prove that every u-v walk contains a u-v path.
24. Prove that graph G is connected if and only if it has a spanning tree.

(5x6=30)

PART D

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

25. Find the binormal vector B and the torsion ² for the space curve $r(t) = (\cos t + t \sin t)\,\mathrm{i} + (\sin t - t \cos t)\,\mathrm{j} + 3\mathrm{k}$.
26. State Stoke's theorem, hence evaluate $\int_C F.\,dr$, if $F = (x + y)\,\mathrm{i} + (2x - z)\,\mathrm{j} + (y + z)\,\mathrm{k}$ and C is the boundary of the triangle with vertices $(2, 0, 0)$, $(0, 3, 0)$ and $(0, 0, 6)$.
27. Solve by Ferrari's method: $x^4 + 6x^3 + 14x^2 + 22x + 5 = 0$.
28. Define 2- connected graph. State and prove Whitney's theorem on 2- connected graphs.

(2x15=30)