D 92282 **(Pages : 3)** **Name..........................**

Reg. No..........................

THIRD SEMESTER B.Sc. DEGREE EXAMINATION, NOVEMBER 2015

(CUCBCSS—UG)

Complementary Course

MAT 3C 03—MATHEMATICS

Time : Three Hours Maximum : 80 Marks

Part A (Objective Type Questions)

Answer all **twelve** *questions.*

1. Write the general form of Bernoulli's differential equation.

2. Find the solution of the differential equation y' =

3. What is the order of the differential equation $y'' - (y')^3 + 4 = 0$?

4. State Cayley Hamilton theorem.

5. What is the rank of a (n x n) non-singular matrix ?

6. Write the normal form of the matrix : $\begin{bmatrix} 1 & 1 & 0 \\ 0 & 0 & 1 \end{bmatrix}$

7. Write the parametric equation of the curve $\frac{x^2}{4} + \frac{y^2}{3} = 1$.

8. Define Irrotational vector.

9. Find curl v, where v = [2y, 5x, 0].

10. Find the tangent to the curve $r(t) = ti + t^3 j$ at (1, 1, 0).

11. Define scalar potential of a vector.

12. State Gauss's divergence theorem.

(12 x 1 = 12 marks)

Part B (Short Answer Type Questions)

Answer any **nine** *questions.*

13. Find the orthogonal trajectories of the family of curves $y = ce^{x}$.

14. Write the condition for the differential equation $M dx \quad N dy = 0$ become exact. What is the form of its solution ?

Turn over

15. Find the integrating factor of the linear differential equation $y' - \mathbf{y} = e^{2x}$

16. Find characteristic roots of the matrix : $\begin{vmatrix} -1 & 2 & 0 \\ 0 & 2 & 3 \\ 0 & 0 & 1 \end{vmatrix}$

17. Write the elementary transformations in a matrix.

18. Find the comment of vector a = [4, 2, 0] in the direction of ***b* = [1, -1,** 2].

19. Find the directional derivative off = xyz at the point **P (-1, 1,** 3) in the direction of $i - 2j + 2k$.

20. Find the unit normal to the level surface $z^2 = 4\,(x^2 + y^2)$ at the point P (1, 0, 2).

21. Find div v, where v = $xyzi + 3zxj + zk$.

22. Define Jacobian.

23. Find value of X if a = [4, 2, X] and ***b*** = [2, -3,1] are orthogonal.

24. Write the formula for finding the area of a plane region as a line integral over the boundary.

(9 x 2 = 18 marks)

Part C (Short Essay Type Questions)

Answer any **six** *questions.*

25. Solve the intial value problem y' + y tan x = sin 2x, y (0) =1.

26. Solve $xy' = y + 3x^4 \cos^t$ $\left(x\right)$

27. Find the eigenvalues and eigenvector corresponding to any one eigenvalue of the matrix : **A** = $\begin{matrix} 2 & 0 & -2 \\ 0 & 4 & 0 \\ -2 & 0 & 5 \end{matrix}$

28. Use Cayley Hamilton theorem to find A^{-1} and A^4, where A = $\begin{vmatrix} 1 & 2 \\ 1 & 1 \end{vmatrix}$

29. Find the tagential and normal componets of acceleration of an object moving along the curve $r\,(t) = e' i + e^{\text{ˆ}}\, j$.

30. Find tangent to the ellipse $\frac{1}{4}(x^2 + y^2)$ at the point $P\left(1\right)$.

31. Find the area of the cardioid $r = a\,(1 - \cos 0)$, $0\ 0\ 2\pi$.

32. Evaluate the double integral $\iint y\ dxdy$ where R is the region bounded by the unit circle in the first quadrant.

33. Verify Green's theorem in the plane for the vector $F = (y^2 - 7y)\,i + 2xy + 2x)\,j$ and the region bounded by the $x^2 + y^2 = 1$.

(6 x 5 = 30 marks)

Part D (Essay Type Questions)

Answer any **two** *questions.*

34. Test for consistency and solve the following system of equation.

(a) $x + y + z + 3 = 0$
$3x + y - 2z + 2 = 0$
$2x + 4y + 7z - 13 = 0.$

(b) $3x + 26y + 2z = 9$
$5x + 3y + 7z = 4$
$7x + 2y + 10z = 5.$

35. (a) Solve the differential equation :

$$2 \sin (y^2)\, dx + xy \cos (y^2)\, dy = 0,\ y(2) = \frac{}{z}.$$

(b) Prove that Curl(gradf) = 0.

36. Verify Stokes's theorem for $F = [y, z, x]$ over the surface of the paraboloid $z = 1 - (x^2 + y^2)$, $z \geq \mathbf{0}$.

(2 x 10 = 20 marks)