D 92619 **(Pages : 3)** **Name.....................................**

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

THIRD SEMESTER B.Sc. DEGREE (SUPPLEMENTARY/IMPROVEMENT) EXAMINATION, NOVEMBER 2015

(UG—CCSS)

Complementary Course

MM 3C 03—MATHEMATICS

Time : Three Hours **Maximum : 30 Weightage**

Section A

Answer **all** *questions.*
Each weightage

1. Show with an example that addition of vectors is commutative.
2. Find the acceleration of a particle with position vector $\vec{r} = [3t, -3t, 2t]$.
3. Find grad f if $f = x^2 + y^2$.
4. What is the Cartesian form of the surface $F(u, v) = [au\cos v, bu\sin v, u^2]$?
5. If F = grad ~~f, then curl~~
6. Find the unit vector normal to the surface $x^2 + y^2 + z^2 = a^2$.
7. Verify that $y = a\cos x + b\sin x$ is a solution of $y'' + y = 0$.
8. Solve $y' = ky$.
9. Test for exactness : $(x^3 + 3xy^2)\,dx + (3x^2y + y^3)\,dy = 0$.
10. Define rank of a matrix.
11. Is $\begin{bmatrix} 1 & 2 \\ 3 & -5 \end{bmatrix}$ singular or non-singular ?
12. State Cayley-Hamilton theorem.

(12 x 'A = 3 weightage)

Section B

Answer **all** *questions.*
Each weightage 1.

13. Find the angle between [4, 2, 3] and [1, 1, 0].
14. Find a parametric representation of the straight line through (2, 3, 0) and (5, —1, 0).

Turn over

15. Find the length of the catenary $r\ (t) = [t\ , cosh\ t, 0]$ from $t = 0$ to $t = 1$.

16. If $F = [-y, -xy]$ and C is the portion of $x^2 + y^2 = 1$ in the first quadrant, evaluate $\int \vec{F} \circ d\ \vec{r}$.

17. Use Green's Theorem to evaluate the area enclosed by the ellipse $\frac{x^2}{a^2} + \frac{y^2}{b^2} = 1$.

18. Solve the Initial Value Problem : $[(x+1)e^x - \quad dx = xe \quad dy, y\ (1) = 0$.

19. Find an Integrating factor for $2 \sin (y^2)\ dx + xy \cos (y^2)\ dy = 0$.

20. Find the rank of $\begin{bmatrix} 1 & 2 & 2 \\ 2 & 4 & 4 \end{bmatrix}$

21. Find the eigen values of $\begin{bmatrix} 2 & 1 \\ 1 & 2 \end{bmatrix}$.

(9 x 1 = 9 weightage)

Section C

Answer any **five** *questions.*
Each weightage 2.

22. (i) Find the potential function of [2x, 4y, 8z].

(ii) Test whether $\vec{v} = [y, -x, 0]$ is irrotational.

23. Test for path independence and evaluate if independent the integral from (0, 0, 0) to $(a, b, c) : 2xy\ dx + 2x\ y\ dy + dz$.

24. Evaluate $\iint_S \vec{F} \circ n\ d\,A$ using Gauss Divergence Theorem : $= [x^2, 0, z]$, S is the box $|\ x\ | \leq 1, |\ y\ | \leq 3, |\ z\ | \leq 2$.

25. Solve $xy' = 2y + x^3 e^x$.

26. Solve using the transformation $y = ux$: $xy' =$

27. Find the rank by reducing to normal form : $A = \begin{vmatrix} \mathbf{0} & 1 & 2 & -2 \\ 4 & 0 & 2 & 6 \\ 2 & 1 & 3 & 1 \end{vmatrix}$

28. Find the inverse using Cayley-Hamilton Theorem $A = \left|\begin{matrix} 1 & 1 & 2 \\ 0 & 2 & 2 \\ -1 & 1 & 3 \end{matrix}\right.$

(5 x 2 = **10** weightage)

Section D

Answer any **two** *questions.*
Each weightage 4.

29. State Stokes' Theorem and verify it for $\vec{F} = [y, z, x]$, S being the paraboloid $z = 1 - (x^2 + y^2),\ z \geq 0$.

30. (i) Solve $y' + \frac{\ }{3} = \frac{1}{3}(1 - 2x)\, y^4$.

(ii) Find the Orthogonal Trajectories of $y = cx^{3/2}$.

31. Find the eigen values and eigen vectors of the matrix $A = \left|\begin{matrix} 8 & -6 & 2 \\ -6 & 7 & -4 \\ 2 & -4 & 3 \end{matrix}\right.$

(2 x 4 = 8 weightage)