

MODEL QUESTION PAPER
THIRD SEMESTER B.Sc. DEGREE EXAMINATION
(CCSS Programme)
Mathematics- (Complimentary Course)
MM 3C 03 - MATHEMATICS

Time : Three Hours

Maximum Weightage:30

I Objective Type questions (Answer all questions weightage $12 \times 1/4 = 3$)

1. The variable separable form of the differential equation $9y y' + 4x = 0$ is.....
2. The rank of any non zero matrix is greater than or equal to
3. The rank of a zero matrix is
4. If there are n homogenous equations in n unknowns, the system $AX=0$ has a solution other than $X=0$ if and only if $|A|=$
5. The eigen values of a triangular matrix are the same as its
6. The general solution of the differential equation $y + y'' = 0$ is
7. A vector of length 1 is called.....
8. The parallelogram inequality is
9. Find all partial derivatives of the vector function $[y^2, z^2, x^2]$
10. A vector \vec{v} is irrotational if its curl is
11. A vector is solenoidal if its divergence is
12. If two vectors are orthogonal then their inner product is

II Short Answer Type Questions : Answer all questions
(weightage $9 \times 1 = 9$)

13. Solve the differential equation $\frac{dy}{dx} = \frac{x-2y-3}{2x+y-3}$

14. Solve $(1+y) \frac{dy}{dx} = 1-x$

15. Solve the system by Cramer's rule

$$2x_1 + x_2 + 5x_3 + x_4 = 5$$

$$x_1 + x_2 - 3x_3 - 4x_4 = -1$$

$$3x_1 + 6x_2 - 2x_3 + x_4 = 8$$

$$2x_1 + 2x_2 + 2x_3 - 3x_4 = 2$$

16. Find the eigen values of the matrix $\begin{bmatrix} 2 & 0 & 1 \\ 0 & 2 & 0 \\ 1 & 0 & 2 \end{bmatrix}$

17. Find the components of the vector \vec{v} with the given initial point $P(1,0,2)$ and terminal point $Q(4,2,3)$

18. Prove that $|a+b| \leq |a| + |b|$

19. Find the components of \vec{a} in the direction of \vec{b} if $\vec{a} = [4,0,-3]$,
 $\vec{b} = [1,1,1]$

20. Find the unit vector normal to the surface $x^2y+2xz=4$ at the point $(2,-2,3)$
21. A particle moves in space so that its radius vector is given by $\vec{r} = \cos t \vec{i} + \sin t \vec{j} + t \tan t \vec{k}$. Find the velocity and acceleration vectors at $t = \frac{\pi}{4}$

III Short Essay or Paragraph Questions :

Answer any 5 questions from 7 ($5 \times 2 = 10$ weightage)

22. Find the rank of the matrix by reducing it to its normal form $\begin{bmatrix} 1 & 2 & 3 & 4 \\ 3 & 4 & 1 & 2 \\ 4 & 3 & 1 & 2 \end{bmatrix}$
23. Find the unit tangent vector at a point t to the curve $\vec{r} = a \cos t \vec{i} + a \sin t \vec{j}$
24. Find the equation of the plane determined by the points $(2,-1,1)$, $(3,2,-1)$ and $(-1,3,2)$
25. Solve $\sin 2x \frac{dy}{dx} = y + \tan x$
26. Solve $2x^2 y \frac{dy}{dx} = \tan(x^2 y^2) - 2xy^2$
27. Find the total work done in moving a particle in a force field given by $\vec{F} = 3xy \vec{i} - 5z \vec{j} + 10x \vec{k}$ along the curve $x=t^2+1, y=2t^2, z=t^3$ from $t=1$ to $t=2$.
28. Find the area of the region in the first quadrant within the cardioid $r=a(1-\cos \theta)$, $0 \leq \theta \leq 2\pi$

IV Essay Questions : Answer any 2 questions ($2 \times 4 = 8$ weightage)

29. Find the orthogonal trajectories of the families of circles $(x-c)^2 + y^2 = c^2$
30. Find the eigen values and the corresponding eigen vectors of the matrix $\begin{bmatrix} 2 & 1 & -1 \\ 0 & 3 & -2 \\ 2 & 4 & -3 \end{bmatrix}$
31. Verify Green's theorem in the plane for $\oint_c (xy dx + x^2 dy)$ where c is the curve enclosing the region bounded by the parabola $y=x^2$ and the line $y=x$