Hall Ticket Number: | | | | | | | | | | |

Subject code: MA101BS

VR24

VIGNAN'S INSTITUTE OF MANAGEMENT AND TECHNOLOGY FOR WOMEN

(An Autonomous Institution)

I-B.Tech.–I-Semester Regular Examinations, February-2025

MATRICES AND CALCULUS

(Common for ECE, CSE,IT,CSM,CSD)

Time: 3 Hours **Max. Marks: 60**

(Answer All Questions)

Note: Question paper consists of Part-A & Part-B.

i) **Part-A** for 10M, ii) **Part-B** for 50marks

- **Part A** is compulsory, consists of 10 sub questions from all units carrying equal marks.
- **Part-B** consists of **10 questions** (numbered from 2 to 11) carrying **10marks** each. From each unit there are 2 questions and the students should answer one of them. Hence the student should answer **5 questions** from **Part-B**.

PART- A

PART-A

[10Marks]

1a) For which value of 'λ' the rank of the matrix A = $\begin{bmatrix} 1 & 5 & 4 \\ 0 & 3 & 2 \\ \lambda & 13 & 10 \end{bmatrix}$ is 2 **[1]**

b) Define echelon form. **[1]**

c) If the Eigen values of A are 2, 4 and determinant of A is -24, then find Trace(A) **[1]**

d) Find the Eigen values of A^{-1} where A= $\begin{bmatrix} -5 & 5 & 5 \\ 0 & -1 & 1 \\ 0 & 0 & 11 \end{bmatrix}$ **[1]**

e) State Cauchy Mean value theorem **[1]**

f) Find the value $\beta(4,5)$ **[1]**

g) Define Stationary point **[1]**

h) If $z = u^2 + v^2$ and $u = at^2, v = 2at$ then find $\frac{dz}{dt}$ **[1]**

i) Evaluate $\int_1^2 \int_x^{x^2} x\, dydx$ **[1]**

j) Evaluate $\int_1^2 \int_2^3 \int_3^4 xyz\, dxdydz$ **[1]**

PART-B

PART-B

[50Marks]

2. a) Determine the rank of the matrix A = $\begin{bmatrix} 0 & 1 & -3 & -1 \\ 1 & 0 & 1 & 1 \\ 3 & 1 & 0 & 2 \\ 1 & 1 & -2 & 0 \end{bmatrix}$ **5M**

b) Solve the system of equations using Gauss –Seidel iterative method $x + 10y + z = 6, 10x + y + z = 6, x + y + 10z = 6$ **5M**

OR

3. a) Show that the only real number λ for which the system x +2y + 3z =λx; 3x + y +2z =λy; 2x + 3y + z =λz has non-zero solution is 6 and solve them when λ =6 **5M**

b)	Use Gauss Jordan Method to find the inverse of a matrix A= $\begin{bmatrix} 8 & 4 & 3 \\ 2 & 1 & 1 \\ 1 & 2 & 1 \end{bmatrix}$	**5M**
4.	Verify the Caley-Hamilton theorem for the matrix A= $\begin{bmatrix} 2 & 1 & 1 \\ 0 & 1 & 0 \\ 1 & 1 & 2 \end{bmatrix}$ and hence computeA^{-1}, also find the matrix represented by$A^8 - 5A^7 + 7A^6 - 3A^5 + A^4 - 5A^3 + 8A^2 - 2A + I$.	**10M**

OR

5. a)	If λ is an eigen value of A then $\frac{\lvert A \rvert}{\lambda}$ is an eigen value of *Adjoint A*	**4M**
b)	Find the matrix P which transforms the matrix A= $\begin{bmatrix} 1 & 1 & 3 \\ 1 & 5 & 1 \\ 3 & 1 & 1 \end{bmatrix}$ to the diagonal form.	**6M**
6. a)	Using mean value theorem for $0 < a < b$, prove that $1 - \frac{a}{b} < log\frac{a}{b} < \frac{b}{a} - 1$ and deduce that $\frac{1}{6} < log\frac{6}{5} < \frac{1}{5}$	**5M**
b)	Evaluate $\int_0^1 x^4[log\frac{1}{x}]^3 dx$	**5M**

OR

7. a)	Verify Rolle's theorem for the following function $f(x) = 2x^3 + x^2 - 4x - 2$ in $[-\sqrt{2}, \sqrt{2}]$	**4M**
b)	Show that $\int_0^a (a-x)^{m-1}x^{n-1}dx = a^{m+n-1}\beta(m,n)$	**6M**
8. a)	If $z = f(x+ct) + \emptyset(x-ct)$, prove that $\frac{\partial^2 z}{\partial t^2} = c^2\frac{\partial^2 z}{\partial x^2}$	**5M**
b)	Show that the functions $u = x\sqrt{1-y^2} + y\sqrt{1-x^2}$, $v = sin^{-1}x + sin^{-1}y$ are functionally dependent	**5M**

OR

9. a)	A rectangular box open at the top is to have volume of 32 cubic ft. Find the dimensions of the box requiring least material for its construction	**10M**
10.a)	Change the order of integration and hence evaluate$\int_0^1\int_x^{\sqrt{2-x^2}} \frac{x}{\sqrt{x^2+y^2}} dxdy$.	**10M**

OR

11.a)	Find the area enclosed by the parabola $y^2 = 4ax$ and the lines $x + y = 3a, y = 0$ in the first quadrant	**5M**
b)	Evaluate the integral $\int_0^{4a}\int_{\frac{y^2}{4a}}^{y} \frac{x^2-y^2}{x^2+y^2} dxdy$ by changing into polar coordinates.	**5M**

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