VASAVI COLLEGE OF ENGINEERING (AUTONOMOUS), HYDERABAD
Accredited by NAAC with A++ Grade
B.E. I-Semester Main Examinations, Jan./Feb.-2024
Matrices and Calculus
(Common for Civil, EEE, ECE & Mech.)

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

*Note: Answer all questions from **Part-A** and any **FIVE** from **Part-B***

Part-A (10× 2 = 20 Marks)

Q. No.	Stem of the question	M	L	CO	PO
1.	Define rank of a matrix.	2	1	1	1,2,12
2.	If $A = \begin{pmatrix} 2 & 3 \\ 3 & 4 \end{pmatrix} = LU$,where L is a lower triangular matrix and U is an upper triangular matrix, find L.	2	1	1	1,12
3.	Find the eigenvalues of the matrix $adj\, A$ if $A = \begin{pmatrix} 1 & -1 & 3 \\ 0 & 2 & -1 \\ 0 & 0 & 2 \end{pmatrix}$.	2	2	2	1,12
4.	Obtain the quadratic form corresponding to the matrix $A = \begin{pmatrix} 4 & 7 \\ 7 & 5 \end{pmatrix}$.	2	1	2	1,12
5.	Expand $f(x) = e^{\sin x}$ in powers of x upto the term containing x^2.	2	2	3	1,12
6.	Find the radius of curvature of the curve $y = \sin x$ at $\left(\frac{\pi}{2}, 1 \right)$.	2	2	3	1,2,12
7.	Discuss the continuity of $f(x,y) = \begin{cases} \dfrac{x^2 - y^2}{x^2 + y^2}, & (x,y) \neq (0,0) \\ 0, & (x,y) = (0,0) \end{cases}$ at $(0,0)$.	2	2	4	1,2,12
8.	If $w = x \cos y + e^x \sin y, x = t^2, y = t^2 + t$, find $\dfrac{dw}{dt}$.	2	2	4	1,12
9.	State P-series test.	2	1	5	1,12
10.	Examine the convergence of the series $\sum \left(\dfrac{n+1}{n} \right)^{-n^2}$.	2	2	5	1,12

Part-B (5 × 8 = 40 Marks)

11. a)	Reduce the matrix $A = \begin{pmatrix} 5 & 2 & 3 & 4 \\ 4 & 0 & -2 & 1 \\ 1 & 2 & 0 & 6 \end{pmatrix}$ to echelon form and hence find its rank.	4	2	1	1,12
b)	Determine whether the vectors (1, 1, 0), (1,1,1), (2, 3, 1) are linearly dependent.	4	1	1	1,12

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		M	L	CO	PO
12.	Verify Cayley-Hamilton theorem for $A = \begin{pmatrix} 1 & 1 & 2 \\ 1 & 3 & 1 \\ 2 & 1 & 1 \end{pmatrix}$ and hence find A^{-1}, if it exists.	8	3	2	1,2,12
13.	Find the evolute of the curve $x = 8\sin^3 t, y = 8\cos^3 t$.	8	4	3	1,12
14. a)	If $z = f(x,y), x = r\cos\theta, y = r\sin\theta$, then show that $\left(\dfrac{\partial f}{\partial x}\right)^2 + \left(\dfrac{\partial f}{\partial y}\right)^2 = \left(\dfrac{\partial f}{\partial r}\right)^2 + \dfrac{1}{r^2}\left(\dfrac{\partial f}{\partial \theta}\right)^2$.	4	1	4	1,2,12
b)	Discuss the maxima and minima of the function $f(x,y) = 4x^2 + 2y^2 + 4xy - 10x - 2y - 3$.	4	2	4	1,2,12
15. a)	Discuss the convergence of the series $\dfrac{x}{1.2} + \dfrac{x^2}{3.4} + \dfrac{x^3}{5.6} + \dfrac{x^4}{7.8} + \ldots\ldots\ldots\ldots\ (x > 0)$.	4	3	5	1,12
b)	Show that that the series $\sum \dfrac{\sin^2 nx}{n^2 \sqrt{n}}$ converges absolutely.	4	3	5	1,12
16. a)	Test the system of equations $x - 2y + 3z = 2, \ 2x - 3z = 3, \ x + y + z = 0$ for consistency and hence solve it.	4	3	1	1,12
b)	Reduce the quadratic form $Q = 2(x^2 + xy + y^2)$ into canonical form.	4	3	2	1,12
17.	Answer any *two* of the following:				
a)	Find the the centre of curvature for the curve $y = e^x$ at $(0,1)$.	4	2	3	1,12
b)	Find the Taylor's series expansion of $f(x,y) = x^2 + 3y^2 - 9x - 9y + 26$ about $(2,2)$.	4	3	4	1,12
c)	Test the convergence of the series $\sum \left[\sqrt{n^4 + 1} - \sqrt{n^4 - 1} \right]$.	4	2	5	1,2,12

M : Marks;   L: Bloom's Taxonomy Level;   CO; Course Outcome;   PO: Programme Outcome

i)	Blooms Taxonomy Level – 1	20%
ii)	Blooms Taxonomy Level – 2	35%
iii)	Blooms Taxonomy Level – 3 & 4	45%

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