Hall Ticket Number:

Code No. : 11221 N/O

VASAVI COLLEGE OF ENGINEERING *(AUTONOMOUS)*, HYDERABAD

Accredited by NAAC with A++ Grade

B.E. I-Semester Main & Backlog Examinations, Jan./Feb.-2024

Calculus & Linear Algebra

(Common for CSE, AIML & IT)

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 curvature	2	1	1	1,12
2.	Find the Taylor's series expansion of Sin x about the point $x = \frac{\pi}{2}$	2	2	1	1,12
3.	If $xy^2 \cos xy + x^2 y \sin xy = 0$, find $\frac{dy}{dx}$.	2	2	2	1,12
4.	If $U = f(x,y)$, $x = G(s,t), y = H(s,t)$, $s = g(r)$ and $t = h(r)$, then find the total derivative of U with respect to r.	2	3	2	1,12
5.	Is the set of all real numbers R over the Complex numbers C, with usual complex multiplication as scalar multiplication, a vector space? Explain	2	4	3	1,2,12
6.	Define the Dimension of a vector space V(F)	2	2	3	1,12
7.	Define Null space	2	1	4	1,12
8.	State Rank-Nullity Theorem.	2	1	4	1,12
9.	When a matrix of the linear transformation diagonalizable.?	2	2	5	1,12
10.	If $x = (2, 1+i, i), y = (2-i, 2, 1+2i)$ be two elements of the inner product space C^3(C) with respect to the standard inner product, then find $< x, y >$.	2	3	5	1,12
	Part-B (5 × 8 = 40 Marks)				
11. a)	Find the radius of curvature at the origin of the curve $y^2 = x^2 \frac{(a+x)}{(a-x)}$	4	2	1	1,12
b)	Find the Taylor's series expansion of $f(x) = \frac{1}{1+x}$ about x=1 up to 4th order terms	4	2	1	1,12
12. a)	Find the point on the sphere $x^2 + y^2 + z^2 = 1$ nearest to the point (2, 1, 1).	4	2	2	1,12
b)	Expand $e^x Siny$ in powers of x and y as far as terms of third degree.	4	2	2	1,12

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13. a)	Is the set $\{(1,-2,3),(2,3,1),(-1,3,2)\}$ a basis for $\mathcal{R}^3$?	4	3	3	1,12
b)	If S= $\{\alpha_1,\alpha_2,\alpha_3,\ldots.\alpha_n\}$ is a basis for a finite dimensional vector space V of dimension n , then show that every element of V can be uniquely expressed as a linear combination of the elements of S.	4	3	3	1,12
14. a)	Let $T: R^4 \to R^3$ defined by $T(x,y,z,t)=(x-y+z+t, x+2z-t, x+y+3z-3t)$ .Find Range(T), Null space (T), rank T and Nullity T.	4	3	4	1,12
b)	Let $T: R^3 \to R^2$ be a linear transformation defined by $T(x,y,z)=(3x+2y-4z, x-5y+3z)$. Find the matrix of the linear Transformation T relative to the bases $\{(1,1,1),(1,1,0),(1,0,0)\}$ and $\{(1,3),(2,5),\}$.	4	4	4	1,12
15. a)	From the basis $\{(3,4,0),(2,1,-1),(-2,1,3)\}$, using Gram-Schmidt orthogonalization process construct orthonormal basis in vector space R^3(R) .	4	3	5	1,12
b)	Find the characteristic values and corresponding Characteristic vectors of the matrix $\begin{bmatrix} 0 & -2 & -3 \\ -1 & 1 & -1 \\ 2 & 2 & 5 \end{bmatrix}$	4	2	5	1,12
16. a)	Find the evolute of the curve $x^2=4ay$	4	2	1	1,12
b)	If $u=Sin^{-1}(x-y); x=3t; y=4t^3$ find total derivative $\frac{du}{dt}$	4	2	2	1,12
17.	Answer any *two* of the following:				
a)	Is the set of all 2X2 real matrices over the field of real numbers a Vector space, with respect to addition and multiplication of matrices and scalar multiplication of matrix .?	4	2	3	1,12
b)	Let $T: U \to V$ be a linear transformation and S= $\{\alpha_1,\alpha_2,\alpha_3,\ldots.\alpha_n\}$ is a basis of U, then show that vectors $T(\alpha_1),T(\alpha_2),T(\alpha_3),\ldots.T(\alpha_n)$ generate Range of T.	4	3	4	1,12
c)	Is the matrix $\begin{bmatrix} -6 & 7 & -2 \\ -6 & 7 & 0 \\ 3 & -3 & 5 \end{bmatrix}$ diagonalizable? Explain	4	2	5	1,12

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

i)	Blooms Taxonomy Level – 1	11%
ii)	Blooms Taxonomy Level – 2	52%
iii)	Blooms Taxonomy Level – 3 & 4	37%

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