Hall Ticket Number:

Code No. : 12221 AS N

VASAVI COLLEGE OF ENGINEERING *(AUTONOMOUS)*, HYDERABAD

Accredited by NAAC with A++ Grade

B.E. II-Semester Advanced Supplementary Examinations, September-2023

Differential Equations & Linear Algebra

(Common to 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 i) Exact Differential Equation and ii) Integrating Factor	2	1	1	1,2,12
2.	Under what condition the differential equation $(x + x^8 + ay^2)dx + (y^8 - y + bxy)dy = 0$ becomes exact?	2	2	1	1,2,12
3.	Write the general solution of $(D^4 - a^4)y = 0$.	2	2	2	1,2,12
4.	Write the differential equation governing L-C-R circuit.	2	1	2	1,2,12
5.	Write the Standard Basis for i) Vector Space of Polynomials, P_n and ii) Vector Space of matrices of order 2x2, $M_{2\times2}$.	2	1	3	1,2,12
6.	Define Linear Dependence and Independence of vectors.	2	1	3	1,2,12
7.	Define Linear Transformation.	2	1	4	1,2,12
8.	If $T: P_4 \to P_3$ *is a* Linear Transformation defined by $T(p(x)) = p'(x)$ then determine the Null Space.	2	2	4	1,2,12
9.	Define Rank of a matrix.	2	1	5	1,2,12
10.	State Triangle Inequality.	2	1	5	1,2,12
	Part-B (5 × 8 = 40 Marks)				
11. a)	Define i) General solution and ii) Singular solution of a differential equation	2	1	1	1,2,12
b)	Find the general and singular solution of the Clairaut's equation $y = xy' - \left(\frac{1}{y'}\right)$.	6	3	1	1,2,12
12. a)	Find the Particular Integral of $(D^2 - 3D + 2)y = xe^{3x}$.	3	3	2	1,2,12
b)	Solve the following differential equation $(D^2 + 1)y = x\,cosx$ using the method of Variation of Parameters.	5	3	2	1,2,12
13. a)	Define i) Subspace ii) Basis of a Vector Space iii) Dimension of a Vector Space	3	1	3	1,2,12
b)	If W is a subspace of $M_{2\times2}$ of matrices with trace equal to 0, and if $S = \left\{\begin{bmatrix}1 & 0\\0 & -1\end{bmatrix}, \begin{bmatrix}0 & 1\\0 & 0\end{bmatrix}, \begin{bmatrix}0 & 0\\1 & 0\end{bmatrix}\right\}$ then show that S is a basis for W.	5	2	3	1,2,12

Contd... 2

14. a)	Define a mapping $T: R^2 \to R^2\ by\ T\left(\begin{bmatrix} x \\ y \end{bmatrix}\right) = \begin{bmatrix} e^x \\ e^y \end{bmatrix}$. Determine whether T is a Linear Transformation.	3	2	4	1,2,12
b)	Define the Linear operator $T: R^3 \to R^3\ by\ T\left(\begin{bmatrix} x \\ y \\ z \end{bmatrix}\right) = \begin{bmatrix} x \\ -y \\ z \end{bmatrix}$. i) Find the matrix of Linear operator T relative to the standard basis of R^3. ii) Use the result of a) to find $T\left(\begin{bmatrix} 1 \\ 1 \\ 2 \end{bmatrix}\right)$.	5	2	4	1,2,12
15. a)	For what values of k, the matrix $\begin{bmatrix} 4 & 4 & -3 & 1 \\ 1 & 1 & -1 & 0 \\ k & 2 & 2 & 2 \\ 9 & 9 & k & 3 \end{bmatrix}$ has rank 3.	3	2	5	1,2,12
b)	Let B be the basis for R^3 given by $B = \left\{\begin{bmatrix} 1 \\ 1 \\ 1 \end{bmatrix}, \begin{bmatrix} -1 \\ 1 \\ 0 \end{bmatrix}, \begin{bmatrix} -1 \\ 0 \\ 1 \end{bmatrix}\right\}$. Apply Gram-Schmidt's process to B to find an orthonormal basis for R^3 using the standard inner product of R^3.	5	3	5	1,2,12
16. a)	Define Self-Orthogonal families. Show that the family of curves $y^2 = 4c(c + x)$ are self-orthogonal.	4	2	1	1,2,12
b)	Solve $(D^2 + 4D + 4)y = 4\cos x + 3\sin x,\ given\ that\ y(0) = 1,$ $y'(0) = 0$.	4	3	2	1,2,12
17.	Answer any ***two*** of the following:				
a)	If $W = \left\{\begin{bmatrix} k \\ k+1 \end{bmatrix} / k \in R\right\}$ is a subset of the Vector Space $V = R^2$ with the standard definitions of vector addition and scalar multiplication, then determine whether W is a subspace of V.	4	3	3	1,2,12
b)	If W is a subspace of all symmetric matrices in the vector space M_{2x2} and if $B = \left\{\begin{bmatrix} 1 & 0 \\ 0 & 0 \end{bmatrix}, \begin{bmatrix} 0 & 1 \\ 1 & 0 \end{bmatrix}, \begin{bmatrix} 0 & 0 \\ 0 & 1 \end{bmatrix}\right\}$ is a Basis for W then find the coordinates of $\begin{bmatrix} 2 & 3 \\ 3 & 5 \end{bmatrix}$ relative to B.	4	3	4	1,2,12
c)	Diagonalize the matrix $\begin{bmatrix} 1 & 1 & 1 \\ 1 & 1 & 1 \\ 1 & 1 & 1 \end{bmatrix}$ using Similarity Transformation.	4	3	5	1,2,12

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

i)	Blooms Taxonomy Level – 1	21%
ii)	Blooms Taxonomy Level – 2	32%
iii)	Blooms Taxonomy Level – 3 & 4	47%

*****