Hall Ticket No						

R22

MALLA REDDY UNIVERSITY

I Year I Semester Regular Examinations, Feb/March 2023 School of Engineering - B.Tech Common for AIML / CSE / CS / DS / IT / IoT

MATRICES AND DIFFERENTIAL EQUATIONS - MR22-1BS0101

Time: 2 hours Max. Marks: 40

Note: Answer all Questions. All Questions Carry Equal Marks

5 X 8 M = 40M

1. a) Find the rank of following matrix by using Echelon form

4 M

$$\begin{bmatrix} 1 & 2 & 3 & -1 \\ -2 & -1 & -3 & -1 \\ 1 & 0 & 1 & 1 \\ 0 & 1 & 1 & -1 \end{bmatrix}$$

b) Determine whether the following equations will have a non-trivial solution if so solve them. 4x+2y+z+3w=0, 6x+3y+4z+7w=0, 2x+y+w=0.

OR

2. a) Find the rank of following matrix by using Normal form

4M

$$\begin{bmatrix} 2 & 3 & -1 & -1 \\ 1 & -1 & -2 & -4 \\ 3 & 1 & 3 & -2 \\ 6 & 3 & 0 & -7 \end{bmatrix}$$

b) Show that the only real number λ for which the system $x+2y+3z=\lambda x, 3x+y+2z=\lambda y, 2x+3y+z=\lambda z$ has non-zero solution is 6 and solve them when $\lambda=6$.

3. Verify Cayley-Hamilton theorem for the matrix $A = \begin{bmatrix} 2 & 1 & 1 \\ 0 & 1 & 0 \\ 1 & 1 & 2 \end{bmatrix}$ and hence

compute A^{-1} and A^4 . Also find the matrix represented by $A^8 - 5A^7 + 7A^6 - 3A^5 + A^4 - 5A^3 + 8A^2 - 2A + I$

OR

4. Diagonalize the matrix
$$A = \begin{bmatrix} 6 & -2 & 2 \\ -2 & 3 & -1 \\ 2 & -1 & 3 \end{bmatrix}$$
 8M

5. a) Solve
$$(xy^2 \sin xy + y \cos xy)dx + (x^2y \sin xy - x \cos xy)dy = 0$$
 4M

b) Solve
$$(y^4 + 2y)dx + (xy^3 + 2y^4 - 4x)dy = 0$$

OR

- 6. a) Show that the family of curves $\frac{x^2}{a^2 + \lambda} + \frac{y^2}{b^2 + \lambda} = 1$ are self orthogonal.
 - b) Suppose that an object is heated to 300F and allowed to cool is a room whose air temperature 20F, it after 10 min, the temperature of the object is 250F, what will be its temperature after 20 min?

 4M

7. a) Solve
$$(D^2 - 2D + 1)y = xe^x \sin x$$
 4M

b) Solve
$$(D^2 - 2D)y = e^x \sin x$$
 by variation of parameters

OR

8. Solve
$$x^3 \frac{d^3 y}{dx^3} + 2x^2 \frac{d^2 y}{dx^2} + 2y = 10\left(x + \frac{1}{x}\right)$$

9. a) Find
$$L\{te^{-t}\sin 4t\}$$

b) Evaluate
$$\int_{0}^{\infty} \left(\frac{e^{-at} - e^{-bt}}{t} \right) dt$$

OR

10. Solve
$$y'' + 3y' + 2y = 2t^2 + 2t + 2$$
, $y(0) = 2$, $y'(0) = 0$ using Laplace Transforms 8M