Code No:**21BS1102** **RM21** **SET 1**

I B.Tech I Semester Regular Examinations, May -2022

LINEAR ALZEBRA & DIFFERENTIAL EQUATIONS

(Com. to All Branches)

Time :3 hours Max.Marks:70

Answer any five Questions one Question from Each Unit
All Questions Carry Equal Marks

UNIT -I

1 A) Define the rank of a matrix. Reduce to Echelon form and hence find the rank of the matrix $\begin{bmatrix} 2 & 1 & 3 & 5 \\ 4 & 2 & 1 & 3 \\ 8 & 4 & 7 & 13 \\ 8 & 4 & -3 & -1 \end{bmatrix}$. 7M

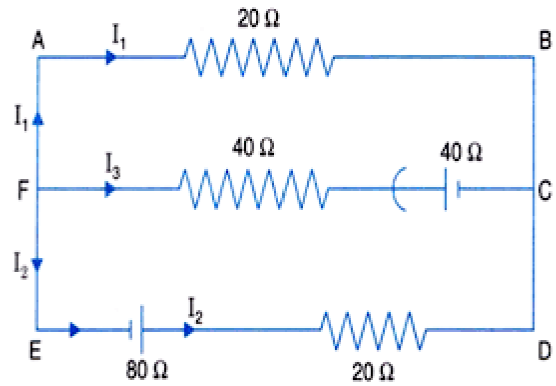
B) Discuss for what values of λ, μ the system of linear equations $x+y+z=6,\ x+2y+3z=10,\ x+2y+\lambda z=\mu$ have (i) no solution (ii) a Unique solution (iii) an infinite number of solutions. 7M

OR

2 A) Solve the system of homogeneous linear equations by Gauss' elimination method: 7M

$x+y-z=0,\quad x-2y+z=0,\quad 3x+6y-5z=0$.

B) Determine the currents in following Electrical circuit using Gauss' Elimination method. 7M



UNIT -II

3 A) Find the Eigen values and Eigen vectors of the following matrix 7M

$$A=\begin{bmatrix} 1 & -3 & 3 \\ 3 & -5 & 3 \\ 6 & -6 & 4 \end{bmatrix}$$

B) i) Prove that the product of the Eigen values of a matrix is equal to its determinant. 7M

ii) Prove that if $\lambda_1, \lambda_2, \ldots, \lambda_n$ are the Eigen values of a matrix A then,

$\frac{1}{\lambda_1}, \frac{1}{\lambda_2}, -----, \frac{1}{\lambda_n}$ are the Eigen values of A^{-1}.

OR

4 A) Show that the matrix $A = \begin{bmatrix} 1 & -2 & 2 \\ 1 & 2 & 3 \\ 0 & -1 & 2 \end{bmatrix}$ satisfies its own characteristic equation 7M

B) Reduce the quadratic form $x^2 + 3y^2 + 3z^2 - 2yz$ to canonical form by an orthogonal transformation. 7M

UNIT -III

5 A) Solve $xy(1+xy^2)\frac{dy}{dx} = 1$ 7M

B) Find the orthogonal trajectories of the curve $r = a(1-\cos\theta)$ where 'a' is a parameter 7M

OR

6 A) Solve $(5x^4 + 3x^2y^2 - 2xy^3)\,dx + (2x^3y - 3x^2y^2 - 5y^4)\,dy = 0$ 7M

B) The number N of bacteria in a culture grew at a rate proportional to N. The value of N was initially 100 and increased to 332 in one hour. What was the value of N after $1\frac{1}{2}$hours? 7M

UNIT -IV

7 A) Find the general solution of $(D^2 - 6D + 9)y = 6e^{3x} + 7e^{-2x} - \log 2$ 7M

B) Find Particular integral of $(D-2)^2 = 8\left(e^{2x} + \sin 2x + x^2\right)$ 7M

OR

8 A) Solve the D.E $\left(D^2 - 4D + 3\right)y = \sin 3x \cos 2x$ 7M

B) Find the current in the LCR circuit by a constant emf, and the response of the circuit is given by $\frac{d^2 i}{dt^2} + 4\frac{di}{dt} + 4i = 0, i(0) = 2$ and $\frac{di}{dt} = 4$ $at\, t = 0$ 7M

UNIT -V

9 A) Show that $JJ' = 1$, where $J = J\left(\frac{x,y}{u,v}\right)$ and $J' = J\left(\frac{u,v}{x,y}\right)$ given $x = e^u \cos v, y = e^u \sin v$ 7M

B) The temperature T at any point (x, y, z) in space is $T = 400xyz^2$. Using Lagrange's method, find the highest temperature on the surface of the unit sphere $x^2 + y^2 + z^2 = 1$. 7M

OR

10 A) Show that u, v are functionally related and hence find the relationship between them if $u = x\sqrt{1-y^2} + y\sqrt{1-x^2}$ & $v = \sin^{-1}(x) + \sin^{-1}(y)$. 7M

B) Verify Euler's theorem for the function $u = sin^{-1}\left(\frac{x}{y}\right) + tan^{-1}\left(\frac{y}{x}\right)$ 7M