R22

Code No: 182AQ

JAWAHARLAL NEHRU TECHNOLOGICAL UNIVERSITY HYDERABAD
B. Tech I Year II Semester Examinations, January/February - 2024
MATRICES AND ORDINARY DIFFERENTIAL EQUATIONS
(Common to BT, PCE)

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

Note: This question paper contains two parts A and B.
i) **Part- A** for 10 marks, ii) **Part - B** for 50 marks.

- Part-A is a compulsory question which consists of ten sub-questions from all units carrying equal marks.
- Part-B consists of **ten questions** (numbered from 2 to 11) **carrying 10 marks each**. From each unit, there are two questions and the student should answer one of them. Hence, the student should answer five questions from Part-B.

PART- A

(10 Marks)

1.a) Define a Skew-Symmetric matrix. [1]
b) Define rank of a matrix. [1]
c) If λ is an Eigen value of a square matrix A, then find an Eigen value of A^{-1} and adj A. [1]
d) State Cayley-hamilton theorem. [1]
e) State Rolle's theorem. [1]
f) If $u = \sin(\frac{x}{y})$, find $\frac{\partial u}{\partial x}$. [1]
g) Write the condition for a differential equation Mdx+Ndy=0 to be exact. [1]
h) State the law of natural growth. [1]
i) If the roots of the auxiliary equation are 1, 2, and -2, then write the complementary function of a differential equation $f(D)y = X$. [1]
j) Find the PI of $(D^2 - 2D + 1)y = e^x$. [1]

PART - B

(50 Marks)

2.a) Find the rank of a matrix $A = \begin{bmatrix} 1 & 3 & 6 & -1 \\ 1 & 4 & 5 & 1 \\ 1 & 5 & 4 & 3 \end{bmatrix}$.
b) Solve the system of homogeneous equations:
x + 3y - 2z=0, 2x - y + 4z=0, x - 11y + 14z=0. [5+5]

OR

3.a) Define a Herimitian and a skew-herimitian matrices and give an example in each case.
b) Solve the equations *5x+3y+7z=4*, *3x+26y+2z=9*, *7x+2y+10z=5*, using a matrix method. [4+6]

4. Find the Eigen values and Eigen vectors of $A=\begin{bmatrix}-2 & 2 & -3\\ 2 & 1 & -6\\ -1 & -2 & 0\end{bmatrix}$. [10]

OR

5. Using Cayley - Hamilton theorem for the matrix $A=\begin{bmatrix}2 & 1 & 1\\ 0 & 1 & 0\\ 1 & 1 & 2\end{bmatrix}$, find the inverse of A. Also express $B=A^8-5A^7+7A^6-3A^5+A^4-5A^3+8A^2-2A+I$ as a quadratic polynomial in A. [10]

6.a) Verify Rolle's theorem for $f(x)=\frac{\sin x}{e^x}$ in $[0,\pi]$.

b) If $u=x\log xy$, where $x^3+y^3+3xy=1$, find $\frac{du}{dx}$. [5+5]

OR

7.a) Verify Cauchy's mean value theorem for the functions $\log_e x$ and $\frac{1}{x}$ in $[1, e]$.

b) A rectangular box open at the top is to have volume of 32 cubic ft. Find the dimensions of the box requiring least material for its construction. [5+5]

8.a) Solve $xy(1+xy^2)\frac{dy}{dx}=1$.

b) Uranium disintegrates at a rate proportional to the amount then present at any instant. If M_1 and M_2 grams of Uranium are present at times T_1 and T_2 respectively, find the half-life of Uranium. [5+5]

OR

9.a) Solve $(1+xy)ydx+(1-xy)xdy=0$.

b) If the temperature of the air is 30^0C, and the substance cools from 100^0C to 70^0C in 15 minutes, find when the temperature will be 40^0C? [5+5]

10. Solve $y''+4y'+4y=3\sin x+4\cos x, y(0)=1$ *and* $y'(0)=0$. [10]

OR

11. Solve by method of variation of parameters $\frac{d^2y}{dx^2}+a^2y=\sec ax$. [10]

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