

15 - 1<sup>st</sup> year. All subjects.

**R15**

Code No: 121AB

JAWAHARLAL NEHRU TECHNOLOGICAL UNIVERSITY HYDERABAD

B.Tech I Year Examinations, May - 2016

MATHEMATICS-I

(Common to CE, EEE, ME, ECE, CSE, EIE, IT, MCT, ETM, MMT, AE, AME, MIE, PTE, CEE, MSNT)

Time: 3 hours

Max. Marks: 75

**Note:** This question paper contains two parts A and B.

Part A is compulsory which carries 25 marks. Answer all questions in Part A.

Part B consists of 5 Units. Answer any one full question from each unit. Each question carries 10 marks and may have a, b, c as sub questions.

**PART- A**

(25 Marks)

- 1.a) Define an Unitary matrix. [2]
- b) Find the Eigen values of the matrix  $\begin{bmatrix} 1 & -2 \\ -5 & 4 \end{bmatrix}$ . [3]
- c) If  $f(x) = x^3 - 3x^2 + 2$  in  $[2, 4]$ , then find the value of C of Lagranges mean value theorem. [2]
- d) State Rolle's mean value theorem. [3]
- e) Evaluate  $\int_{x=0}^1 \int_{y=0}^2 y^2 dy dx$ . [2]
- f) Evaluate  $\int_0^{\infty} x^{1/2} e^{-x/5} dx$  in terms of Gamma functions. [3]
- g) State Newtons Law of cooling. [2]
- h) Find the solution of the differential equation is  $(D^2 + 4)y = 0$ . [3]
- i) Find  $L[te^t]$ . [2]
- j) Find  $L^{-1}\left(\frac{1}{s^3}\right)$ . [3]

**PART-B**

(50 Marks)

- 2.a) Prove that the Eigen values of a skew-Hermitian matrix are zero or purely imaginary.
- b) If A and B are square symmetric matrices of same order then prove that
  - i)  $AB + BA$  is symmetric
  - ii)  $AB - BA$  is Skew symmetric. [5+5]

**OR**

3. Using Cayley Hamilton theorem find the inverse of the matrix

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

[10]

4. Find the maximum and minimum values of  $x^3 y^2 (1-x-y)$ . [10]

OR

5. If  $x = uw$ ,  $y = \frac{u}{v}$ . Verify that  $\frac{\partial(x, y)}{\partial(u, v)} \cdot \frac{\partial(u, v)}{\partial(x, y)} = 1$ . [10]

6.a) Evaluate  $\int_0^1 \int_x^{\sqrt{x}} (x^2 + y^2) dx dy$ .

b) Evaluate  $\int_0^1 \frac{x^4 dx}{\sqrt{(1-x^2)}}$ . [5+5]

OR

7. By changing the order of integration evaluate  $\int_0^1 \int_{x^2}^{2-x} xy dy dx$ . [10]

8.a) If a population is increasing exponentially at the rate of 2% per year. What will be the percentage increase over a period of 10 years?

b) Solve the differential equation  $(D^2 - 5D + 6)y = e^x \sin x$ . [5+5]

OR

9. Solve  $(D^2 + 1)y = x \sin x$  by the method of variation of parameters. [10]

10.a) Find L [t cost].

b) Find the inverse Laplace transform of  $\frac{s-5}{(s^2+3s+2)}$ . [5+5]

OR

11. Solve the differential equation  $\frac{d^2x}{dt^2} - \frac{4dx}{dt} - 12x = e^{3t}$ ,  $x(0) = 1, x'(0) = -2$  using Laplace transforms. [10]

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