

Code No: 111AB

JAWAHARLAL NEHRU TECHNOLOGICAL UNIVERSITY, HYDERABAD**B .Tech I Year Examinations, December - 2018****MATHEMATICS-I**

(Common to CE, EEE, ME, ECE, CSE, CHEM, EIE, BME, IT, MCT, ETM, MMT, AE, AME, MIE, PTM, AGE)

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) Examine the consistency of the following system of equations:
 $12x - y - z = 2; \quad x + 2y + z = 2; \quad 4x - 7y - 5z = 2.$ [2]
- b) Find A^2 using Cayley-Hamilton theorem, given $A = \begin{bmatrix} 3 & 1 \\ -1 & 2 \end{bmatrix}.$ [3]
- c) State Lagrange's Mean Value theorem. [2]
- d) Find the stationary points of $x^3y^2(1-x-y).$ [3]
- e) $\int_0^a \int_0^{\sqrt{a^2-y^2}} (x^2 + y^2) dx dy$ Transform to polar coordinates. [2]
- f) Evaluate $\int_0^\infty x^5 e^{-2x} dx.$ [3]
- g) Find the particular integral of $(D^2 + 4)y = 2e^x \sin x.$ [2]
- h) Find $e^k.$ [3]
- i) Find $L[te^t].$ [2]
- j) Find $L^{-1}\left[\frac{1}{s(s+a)}\right]$ [3]

PART - B**(50 Marks)**

2. Find the matrix which transforms the matrix $A = \begin{bmatrix} 3 & 1 & 4 \\ 2 & 2 & 4 \\ 4 & 1 & 3 \end{bmatrix}$ to diagonal form. [10]

OR

3. Reduce the quadratic form $6x_1^2 + 3x_2^2 + 3x_3^2 - 4x_1x_2 - 2x_2x_3 + 4x_3x_1$ to canonical form. [10]

- 4.a) Verify Rolle's theorem for the function $f(x) = 2x^3 + x^2 - 4x - 2$ in $[-\sqrt{2}, \sqrt{2}].$
Also find the value of C.

- b) Show that the functions $u = x + y - z, \quad v = x - y + z, \quad w = x^2 + y^2 + z^2 - 2yz$ are not independent of one another. Also find the relation among them. [5+5]

OR

- 5.a) Verify Cauchy Mean Value theorem for the functions $f(x) = \log x, \quad g(x) = \frac{1}{x}$ in $[1, e].$
- b) Find the stationary value of $f(x, y, z) = x^2y^3z^4$ subject to the condition $x + y + z = 5.$ [5+5]

- 6.a) Change the order of integration in the integral and hence evaluate it

$$\int_0^1 \int_{\sqrt{y}}^{2-y} xy \, dx \, dy.$$

- b) Find the area included between the curve $r = a(\sec \theta + \cos \theta)$ and its asymptote.

[5+5]

OR

- 7.a) Derive the relationship between beta and gamma functions

- b) Evaluate $\int_0^a \int_0^x \int_0^{x+y} e^{x+y+z} \, dz \, dy \, dx.$

[5+5]

- 8.a) The rate of disintegration of a radioactive substance is proportional at any instant to the amount of substance present. It is found that 0.5% of the substance disappears in 12 years. What percentage will disappear in 1000 years?

- b) Solve the differential equation $y'' + y = -\cot x$ using the method of variation of parameters.

[5+5]

OR

- 9.a) Find the orthogonal trajectories of the confocal conics $\frac{x^2}{a^2} + \frac{y^2}{b^2 + \lambda} = 1$, where λ is the parameter.

- b) Solve the differential equation $(D^2 - 5D + 6)y = xe^x$.

[5+5]

- 10.a) Find the Laplace transform of $t \sin t \cdot e^t$.

- b) Find $L^{-1} \left\{ \log \left(\frac{s+a}{s+b} \right) \right\}$

[5+5]

OR

- 11.a) State convolution theorem of Laplace transform and use it to find the inverse Laplace transform of $\frac{s}{(s^2 + a^2)^2}$.

- b) Solve the equation $x'' + 2x' + 5x = e^{-t} \sin t$ under the conditions $x(0) = 0, x'(0) = 1$.

[5+5]

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