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Total No. of Pages : 02

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B.Tech.(AI & ML/CSE/DS/IOT/CS/Internet of Things and Cyber Security  
including Block Chain Technology) (Sem.-3)

**MATHEMATICS-III**

Subject Code : BTAM304-18

M.Code : 76438

Date of Examination : 19-06-2024

Time : 3 Hrs.

Max. Marks : 60

**INSTRUCTIONS TO CANDIDATES :**

1. SECTION-A is COMPULSORY consisting of TEN questions carrying TWO marks each.
2. SECTION-B contains FIVE questions carrying FIVE marks each and students have to attempt any FOUR questions.
3. SECTION-C contains THREE questions carrying TEN marks each and students have to attempt any TWO questions.

**SECTION-A**

1. Solve the following :

a) Show that the function  $f(x, y) = \begin{cases} 2x^2 + y & (x, y) \neq (1, 2) \\ 0 & (x, y) = (1, 2) \end{cases}$  is discontinuous at (1, 2).

b) Change the order of integration in  $\int_0^a \int_y^a \frac{x \, dx \, dy}{x^2 + y^2}$ .

c) State Cauchy's root test.

d) State Cauchy Convergence criteria for sequence.

e) Find the integrating factor of the differential equation  $y \, dx - x \, dy + 3x^2 y^2 e^{x^3} \, dx = 0$ .

f) Write Bernoulli's equation.

g) Solve  $\frac{d^2 x}{dt^2} + 6 \frac{dx}{dt} + 9x = 0$ .

h) Write Cauchy's Homogeneous linear equation.

i) Use wronskian to show that the functions 1, x, x<sup>2</sup> are linearly independent.

j) If  $U = \sin \frac{x}{y}$ ,  $x = e^t$ ,  $y = t^2$  find  $\frac{du}{dt}$ .

### SECTION-B

2. If  $\theta = t^n e^{-r^2/4t}$ , Find the value of  $n$  which will make  $\frac{1}{r^2} \frac{\partial}{\partial r} (r^2 \frac{\partial \theta}{\partial r}) = \frac{\partial \theta}{\partial t}$ .
3. Evaluate by changing to polar coordinates  $\int_{-1}^1 \int_{-\sqrt{1-y^2}}^{\sqrt{1-y^2}} \log_e (x^2 + y^2 + 1) dx dy$ .
4. Using Cauchy's integral test show that the series  $\sum_1^{\infty} \frac{1}{n^p}$  converges if  $p > 1$  and diverges if  $0 < p < 1$ .
5. Solve by the method of variation of parameters  $\frac{d^2y}{dx^2} + 4y = \sec 2x$ .
6. Solve  $e^y y' = e^x(e^x - e^y)$ .

### SECTION-C

7. Find the maximum and minimum distances of the point (3, 4, 12) from the sphere  $x^2 + y^2 + z^2 = 1$ .
8. (a) Examine the convergence of the series
$$1 + \frac{1}{2^2} - \frac{1}{3^2} - \frac{1}{4^2} + \frac{1}{5^2} + \frac{1}{6^2} - \frac{1}{7^2} - \frac{1}{8^2} + \dots \infty$$
(b) Solve  $p^2 + 2py \cot x = y^2$
9. Solve  $(3x + 2)^2 \frac{d^2y}{dx^2} + 3(3x + 2) \frac{dy}{dx} - 36y = 3x^2 + 4x + 1$ .

**NOTE : Disclosure of Identity by writing Mobile No. or Making of passing request on any page of Answer Sheet will lead to UMC against the Student.**