

Code No: 51002

JAWAHARLAL NEHRU TECHNOLOGICAL UNIVERSITY HYDERABAD

B.Tech I Year Examinations, July - 2021

MATHEMATICS-I

(Common to CE, EEE, ME, ECE, CSE, IT, AE, BT, AME, MIE)

Time: 3 hours

Max. Marks: 75

Answer any five questions
All questions carry equal marks

1.a) Test the convergence of the series

$$\text{i) } \frac{1}{1.2} + \frac{2}{3.4} + \frac{3}{5.6} + \dots \infty \quad \text{ii) } \sum \frac{(n!)^2}{(2n)!} x^{2n}.$$

b) Define absolute and conditional convergence. Test $\sum_{n=2}^{\infty} \frac{(-1)^n}{n(\log n)^2}$ for convergence and absolute convergence. [8+7]

2.a) Verify Lagrange's mean value theorem for the function $f(x) = x^3 - 3x - 1$ in $\left(-\frac{11}{7}, \frac{13}{7}\right)$.

b) Given $x + y + z = a$, find the maximum value of $x^m y^n z^p$. [7+8]

3.a) Prove that the radius of curvature at any point of the astroid $x^{2/3} + y^{2/3} = a^{2/3}$, is three times the length of the perpendicular from the origin to the tangent at that point.

b) Trace the curve $y^2 = \frac{x^3}{(2a-x)}$ [7+8]

4.a) Find the length of the arc of the parabola $x^2 = 4ay$ measured from the vertex to one extremity of the latus-rectum.

b) Change the order of integration in $\int_0^1 \int_0^{\sqrt{1-x^2}} y^2 dx dy$ and hence evaluate it. [7+8]

5.a) Solve $2x \frac{dy}{dx} = 10x^3 y^5 + y$.

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 would be the value of N after 1 hour? [7+8]

6.a) Solve by the method of variation of parameters, $y'' + 4y = \tan 2x$.

b) Solve the differential equation $(D^2 - 6x + 9)y = e^{3x}$. [7+8]

7.a) Find inverse Laplace transform of $\frac{1}{(s-1)^2(s-2)}$ using convolution theorem.

b) Using Laplace transform, solve $y'' + 4y' + 3y = e^{-t}$, $y(0) = 0$, $y'(0) = 0$. [7+8]

8.a) Find the unit normal for $\phi = x^3yz$ at $(1, -1, 2)$.

b) Evaluate $\oint_C (x+y)dx + (x+z)dy + (y+z)dz$ by using Stoke's theorem where C is the boundary of the triangle with vertices $(2,0,0)$, $(0,3,0)$ and $(0,0,6)$. [7+8]

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