

Code No: 09A1BS01

JAWAHARLAL NEHRU TECHNOLOGICAL UNIVERSITY, HYDERABAD

B. Tech I Year Examinations, May/June-2013

MATHEMATICS-I

(Common to All Branches)

Time: 3 hours

Max. Marks: 75

Answer any five questions
All questions carry equal marks

- 1.a) Solve the differential equation $\frac{d^2 y}{dx^2} - 4 \frac{dy}{dx} + 4y = 8x^2 e^{2x} \sin 2x$
- b) By the method of variation of Parameters, solve $\frac{d^2 y}{dx^2} - 2 \frac{dy}{dx} + y = e^x \log x$.
- 2.a) Find the orthogonal trajectories of the family of parabolas $y^2 = 4ax$.
- b) Solve the differential equation $\frac{dy}{dx} = \frac{y}{x + \sqrt{xy}}$.
- 3.a) Find the inverse Laplace transform of $\frac{s}{(s^2 + a^2)(s^2 + b^2)}$ using convolution theorem.
- b) Solve the Initial value problem $\frac{d^2 y}{dx^2} + 5 \frac{dy}{dx} + 4y = f(x)$, with $y(x)$ and $\frac{dy}{dx}$ vanish at $x=0$ and $f(x) = 2e^{-2x}$ using Laplace transforms.
- 4.a) Verify Divergence theorem for $F = (x^2 - yz)\bar{i} + (y^2 - zx)\bar{j} + (z^2 - xy)\bar{k}$ taken over the rectangular parallelepiped $0 \leq x \leq a$, $0 \leq y \leq b$, $0 \leq z \leq c$.
- b) Prove that $Div(f\bar{G}) = (grad f) \cdot \bar{G} + f(Div\bar{G})$.
- 5.a) Define a series. Discuss the nature of convergence of the following series
- (i) $\sum_{n=1}^{\infty} \sqrt{\frac{3^n - 1}{2^n + 1}}$ (ii) $\sum_{n=1}^{\infty} \frac{x^n}{1 + x^n}$
- b) Define (i) alternating series (ii) Absolute convergence of a series
(iii) Conditional convergence of a series.
- Also test the Absolute convergence of the series $\sum_{n=1}^{\infty} \frac{(-1)^{n-1}}{2n-1}$
- 6.a) Is the Rolle's mean value theorem valid for the function $f(x) = \frac{1}{x^2}$ in $[-2, 2]$? Explain.
By applying Lagrange's mean value theorem for $f(x)$ in the interval $\left[\frac{1}{2}, \frac{3}{2}\right]$, find C
- b) Using Lagrange's method of undetermined multipliers, show that the rectangular solid of maximum volume that can be inscribed in a sphere is a cube
- 7.a) Find the Evolute of the parabola $y^2 = 4ax$
- b) Define Radius of curvature, centre of curvature. Trace the curve $y^2 = x(a-x)$
- 8.a) Find the volume of a sphere of radius 'a' using triple integration
- b) By change of order of integration, Evaluate $\int_0^{\infty} \int_x^{\infty} \frac{e^{-y}}{y} dx dy$.
