

JAWAHARLAL NEHRU TECHNOLOGICAL UNIVERSITY-GURAJADA VIZINAGARAM
II B. Tech I Semester Supplementary Examinations November -2025
MATHEMATICS-III
(Common to ALL Branches)

Time: 3 hours

Max. Marks: 70

Answer any FIVE Questions
ONE Question from Each unit
All Questions Carry Equal Marks

- 1 a) Prove that $\nabla(\log r) = \frac{\vec{r}}{r^2}$ [7]
 b) Find the directional derivative of the function $xy^2 + yz^2 + zx^2$ along the tangent to the curve $x = t, y = t^2, z = t^3$ at the point (1, 1, 1) [7]
 (OR)
- 2 a) Find a, b, c so that $\vec{F} = (x + 2y + az)\vec{i} + (bx - 3y - z)\vec{j} + (4x + cy + 2z)\vec{k}$ is irrotational, [7]
 Also Find (i) Scalar potential (ii) Find work done in moving a particle under this force field (1, 2, -4) to (3, 3, 2).
 b) If $\vec{F} = (y - 2x)\vec{i} + (3x + 2y)\vec{j}$, Compute the circulation \vec{F} about the circle in xy plane $x^2 + y^2 = 4$. [7]
- 3 a) Evaluate $\int_0^t e^{\frac{1}{2}t} \cosh 2t \, dt$ using Laplace transform [7]
 b) Find $\{t \cos at\}$ [7]
 (OR)
- 4 a) Find $L^{-1} \left\{ \frac{s^2 + 2s - 3}{s(s-3)(s+2)} \right\}$ [7]
 b) Apply convolution theorem to find $L^{-1} \left\{ \frac{s^2}{(s^2 + a^2)(s^2 + b^2)} \right\}$ [7]
- 5 a) Find the Fourier series of $f(x) = 2x$ on $[-1, 1]$ [7]
 b) Find the Half range cosine series of $f(x) = e^x$ on $[0, \pi]$ [7]
 (OR)
- 6 a) Find the finite sine transform of $f(x) = \frac{x}{\pi}, 0 < x < \pi$. [7]
 b) Find the Fourier transform of $f(x) = \begin{cases} 1 - |x| & \text{if } |x| < 1 \\ 0 & \text{otherwise} \end{cases}$ [7]
- 7 a) Solve the PDE $p^2 + q^2 = x^2 + y^2$ [7]
 b) From the differential equation of all planes which are at a constant distance 'a' from the origin [7]
 (OR)
- 8 a) Solve the PDE $xp - yq = y^2 - x^2$ [7]
 b) Form the PDE by eliminating arbitrary function from $f(x^2 + y^2, z - xy) = 0$ [7]
- 9 a) Solve $\frac{\partial u}{\partial x} = 2 \frac{\partial u}{\partial t} + u$, where $u(x, 0) = 6e^{-3x}$ by the method of separation of variables [7]
 b) Solve the PDE $(D^2 + 7DD^1 + 12D^{1^2})z = e^{2x+3y}$ [7]
 (OR)
- 10 A bar of length 100cms long with insulated sides kept temperature 0°C and 100°C until steady state prevail. Two ends are suddenly insulated and kept so. Find the temperature distribution in the rod. [14]

