

**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*

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- 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  $0^\circ\text{C}$  and  $100^\circ\text{C}$  until steady state prevail. Two ends are suddenly insulated and kept so. Find the temperature distribution in the rod. [14]

