Enrollment No./Seat No.:

GUJARAT TECHNOLOGICAL UNIVERSITY

Bachelor of Engineering - SEMESTER - III EXAMINATION - WINTER 2025

Subject Code: 2130002 **Date: 29-12-2025**

Subject Name: Advance Engineering Mathematics

Time: 10:30 AM TO 01:30 PM **Total Marks: 70**

Instructions

1. Attempt all questions.

2. Make suitable assumptions wherever necessary.

3. Figures to the right indicate full marks.

4. Simple and non-programmable scientific calculators are allowed.

			Marks
Q.1	**(a)**	Define Signum function, Dirac's Delta function and Beta function.	**03**
	(b)	Solve $\frac{d^3y}{dx^3} + \frac{dy}{dx} = cosecx$ by method of variation of parameter.	**04**
	(c)	Obtain the Fourier series of $f(x) = \left(\frac{\pi - x}{2}\right)^2$ in the interval $0 \leq x \leq 2\pi$. Hence deduce that $\frac{\pi^2}{12} = \frac{1}{1^2} - \frac{1}{2^2} + \frac{1}{3^2} + ...$	**07**
Q.2	**(a)**	Find half range cosine series for $f(x) = x, 0 < x < 3$	**03**
	(b)	Solve $\frac{d^3y}{dx^3} - \frac{d^2y}{dx^2} + 3\frac{dy}{dx} + 5y = e^x cos3x$	**04**
	(c)	Find the series solution of $y'' = 2y'$ in powers of x	**07**
		OR	
	(c)	Find the series solution of $(1 + x^2)y'' + xy' - xy = 0$	**07**
Q.3	**(a)**	Solve $\frac{dy}{dx} + 2ytanx = sinx$	**03**
	(b)	Solve $(x^3 + 3xy^2)dx + (3x^2y + y^3)dy = 0$	**04**
	(c)	Solve $(D^3 - D^2 - 6D)y = x^2 + 1$	**07**
		OR	
	(a)	Solve $\frac{dy}{dx} + \frac{ycosx + siny + y}{sinx + xcosy + x} = 0$	**03**
	(b)	Solve $(x^2y^2 + 2)ydx + (2 - x^2y^2)xdy = 0$	**04**
	(c)	Solve $(D^4 + 2D^3 - 3D^2)y = x^2 + 3e^{2x}$	**07**

Q.4 **(a)** Find the Laplace Transform of $e^{-2t}(sin4t + t^2)$ **03**

(b) Find the Inverse Laplace Transform of $log\left(1 + \frac{\omega^2}{s^2}\right)$ **04**

(c) Find the Inverse Laplace transform of $\frac{5s+3}{(s-1)(s^2+2s+5)}$ using partial fraction. **07**

OR

(a) Find the Laplace Transform of $sin2t.sin3t$ **03**

(b) Find the Laplace Transform of $t^2 cosh\pi t$ **04**

(c) Solve the initial value problem $\frac{d^2x}{dt^2} + 2\frac{dx}{dt} + 5x = e^{-t}sint$ where $x(0) = 0$ and $x'(0) = 1$ using Laplace transform. **07**

Q.5 **(a)** Form a partial differential equation by eliminating the arbitrary constants for the equation $z = (x-2)^2 + (y-3)^2$ **03**

(b) Solve $pz - qz = z^2 + (x+y)^2$ using Lagrange's method **04**

(c) Solve $\frac{\partial^2 z}{\partial x^2} - 2\frac{\partial z}{\partial x} + \frac{\partial z}{\partial y} = 0$ using method of separation of variables. **07**

OR

(a) Solve $p(1+q) = qz$ **03**

(b) Solve the below equation by method of direct integration, $\frac{\partial^2 z}{\partial x \partial y} = sinxsiny$, given that $\frac{\partial z}{\partial y} = -2siny$ when $x = 0$ and $z = 0$ when y is an odd multiple of $\frac{\pi}{2}$ **04**

(c) Solve $\frac{\partial u}{\partial x} + \frac{\partial u}{\partial y} = 2(x+y)u$ using method of separation of variables. **07**

***