Seat No./Enrollment No.: _____

GUJARAT TECHNOLOGICAL UNIVERSITY
BACHELOR OF ENGINEERING – SEMESTER 1 – EXAMINATION – SUMMER 2026

Subject Code: 3110015 **Date: 30/06/2026**

Subject Name: Mathematics - 2

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.**

Q.1 **(a)** Prove that $\bar{F} = (y^2 cosx + z^3)i + (2ysinx - 4)j + 3xz^2k$ is irrotational. **03**

(b) If $\bar{F} = 2xyzi + (x^2z + 2y)j + x^2yk$ is conservative then find it's scalar potential $\emptyset$. **04**

(c) Verify Green's theorem in the plane with respect to $\int_C (x^2dx - xydy)$ where C is the Boundary of the square enclosed by x=0, x=a, y=0, y=a. **07**
kindly ignore the square box mentioned in upper limit and consider c as curve which is mentioned in lower limit

Q.2 **(a)** Find the ordinary points and singular points of the equation $(9 - x^2)y'' - 3xy' - 5y = 0$. **03**

(b) Express $f(x) = 10x^3 + 6x^2 - 2x + 1$ in terms of Legendre polynomials. **04**

(c) Prove that $P_n(x) = \frac{1}{2^n n!}\frac{d^n}{dx^n}(x^2 - 1)^n$ **07**

OR

Q.2 **(c)** Find the power series solution of $y'' - 3x^2y = 0$ **07**

Q.3 **(a)** Find the Laplace transform of $f(t) = (t-1)^2 \quad t > 1$
$= 0 \quad 0 < t < 1$ **03**

(b) Find the inverse Laplace transform of **04**
(i) $\frac{4}{s^2} + \frac{1}{3s+4}$ (ii) $\frac{1}{s^2+6s+18}$

(c) Apply Laplace transform to solve the initial value problem **07**
$y'' + 5y' + 6y = 0,\ y(0) = 0,\ y'(0) = 1$

OR

Q.3 **(a)** Find the inverse Laplace transform of $\frac{se^{-2s}}{s^2+16}$. **03**

(b) State Convolution theorem and use it to find inverse Laplace transform of $\frac{1}{s^2(s-1)}$. **04**

(c) Find the Fourier integral representation of the function **07**
$f(x) = 1 - x^2, |x| \leq 1$
$= 0 \quad , |x| > 1$

Q.4 **(a)** Solve $\frac{dy}{dx} = \frac{xsinx}{2e^y sinhy}$ **03**

(b) Solve $\frac{d^2y}{dx^2} + y = cosxcos2x$ **04**

(c) Solve $ye^y = (y^3 + 2xe^y)\frac{dy}{dx}$ **07**

OR

Q.4 **(a)** Solve $(secx\ tanx\ tany - e^x)dx + secx\ sec^2y\ dy = 0$ **03**

(b) Solve $x^2\left(\frac{dy}{dx}\right)^2 + xy\frac{dy}{dx} - 6y^2 = 0$ **04**

(c) Solve $\frac{d^3y}{dx^3} + 2\frac{d^2y}{dx^2} + \frac{dy}{dx} = e^{3x} + x^2$ **07**

Q.5 **(a)** Solve $\frac{d^2y}{dx^2} - 2\frac{dy}{dx} + y = x^2e^{3x}$ **03**

(b) Solve $x^2\frac{d^2y}{dx^2} - 2x\frac{dy}{dx} - 4y = 2\ logx$ **04**

(c) Solve $\frac{d^2y}{dx^2} - 2\frac{dy}{dx} = e^x\ sinx$ using the method of undetermined coefficients. **07**

OR

Q.5 **(a)** Solve $(D^2 + 4)y = cos2x$ **03**

(b) Solve $y'' - 4y = e^{-2x} - 2x,\ y(0) = 0, y'(0) = 0$ **04**

(c) Solve $\frac{d^2y}{dx^2} + 4y = tan2x$ using the method of variation of parameters. **07**

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