

Seat No./Enrollment No.: _____

GUJARAT TECHNOLOGICAL UNIVERSITY
BACHELOR OF ENGINEERING – SEMESTER 3 – EXAMINATION – SUMMER 2026

Subject Code: BE03000211

Date: 02/07/2026

Subject Name: MATHEMATICS 3 (MECHANICAL)

Time: 02:30 PM TO 05:00 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) Evaluate $\int_0^1 e^x dx$, with $n = 10$ using trapezoidal rule. **03**

(b) Compute $f(0.56)$ from the following table using Newton's forward difference formula: **04**

x	0.5	0.6	0.7	0.8
$f(x)$	1.127626	1.185465	1.255169	1.337435

(c) Using Laplace transform, solve the differential equation $y'' - 2y' + 2y = 0$, $y(0) = 1, y'(0) = 1$. **07**

Q.2 (a) Form a PDE from the equation $z = ax + by + ab$ by eliminating arbitrary constants a and b . **03**

(b) Find the Fourier cosine series of $f(x) = e^x, 0 < x < 2$. **04**

(c) Find the Fourier series of $f(x) = 1 - \frac{2|x|}{\pi}, -\pi \leq x \leq \pi$. Hence prove that $\frac{\pi^2}{8} = \frac{1}{1^2} + \frac{1}{3^2} + \frac{1}{5^2} + \dots$. **07**

OR

Q.2 (c) Find the Fourier series of $f(x) = x^2, 0 \leq x \leq 2\pi$. **07**

Q.3 (a) A solid which is formed by rotating about the x-axis, the area between the x-axis, the lines $x = 0$ and $x = 1$ and a curve through the points with the following co-ordinates: **03**

x	0	0.25	0.5	0.75	1
y	1	0.9896	0.9589	0.9089	0.8415

Estimate the volume of the solid formed using Simpson's 1/3rd rule.

(b) Given that **04**

x	1.2	1.4	1.6	1.8	2
y	3.3201	4.0552	4.9530	6.0496	7.3891

Find $\frac{d^2y}{dx^2}$ at $x = 2$.

(c) Find a second degree polynomial $f(x)$ passing through the points (0,0), (1,1) and (2,20) using Lagrange's interpolation. Also find $f(1.5)$. **07**

OR

Q.3 (a) Evaluate $\int_0^6 \frac{dx}{1+x^2}$ by using Simpson's 3/8th rule. **03**

- (b) Given that 04

x	1.2	1.4	1.6	1.8	2
y	3.3201	4.0552	4.9530	6.0496	7.3891

Find $\frac{dy}{dx}$ at $x = 1.2$.

- (c) Using Newton's divided difference formula, calculate the value of $f(1)$ from the following table: 07

x	0	2	3	4	7	9
$f(x)$	4	26	58	112	466	922

- Q.4 (a) Find $L \left\{ \frac{1 - \cos t}{t} \right\}$. 03

- (b) Find $L^{-1} \left\{ \ln \left(\frac{s+a}{s+b} \right) \right\}$. 04

- (c) Write formula for Picard's method. Apply Euler's method to find y at $x = 0.1$ in five steps given that $y' = \frac{y-x}{y+x}$, $y(0) = 1$. 07

OR

- Q.4 (a) Find $L \{ e^{-2t} \sin^2 t \}$. 03

- (b) Find $L^{-1} \left\{ \frac{1}{s(s^2+4)} \right\}$ by convolution theorem. 04

- (c) Apply fourth order Runge-Kutta method to calculate $y(0.2)$ with $h = 0.1$ given that $y' = x + y$, $y(0) = 1$. 07

- Q.5 (a) Find the complete integral of $(p-q)(z - px - qy) = 1$. 03

- (b) Solve the PDE $x^2p + y^2q + z^2 = 0$. 04

- (c) Solve one dimensional heat equation $u_t = c^2 u_{xx}$ with boundary conditions $u(0, t) = u(l, t) = 0$, $\forall t$ and initial condition $u(x, 0) = f(x)$, $0 < x < l$. 07

OR

- Q.5 (a) Solve $\frac{\partial^2 z}{\partial x^2} - 6 \frac{\partial^2 z}{\partial x \partial y} + 9 \frac{\partial^2 z}{\partial y^2} = 0$. 03

- (b) Find a complete integral of $(p^2 + q^2) y = qz$ by Charpit's method. 04

- (c) Find the solution of $u_{xx} + u_{yy} = 0$ by method of separation of variables. 07
