

Enrollment No./ Seat No.:

GUJARAT TECHNOLOGICAL UNIVERSITY

MASTER OF ENGINEERING - SEMESTER - 1 EXAMINATION – SUMMER 2026

Subject Code: 3712013

Date: 16-06-2026

Subject Name: Analytical and Numerical methods for Structural Engg.

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.

- Q.1** (a) Explain Trapezium rule & mid ordinate rule for numerical integration. **07**
(b) Compute one root of the given equation by Method of Bisection correct to three decimal places: $e^x - 3x = 0$ **07**

- Q.2** (a) Explain different types of Errors with suitable examples. **07**
(b) Solve the following equations by Gauss elimination method: **07**
 $2x + 4y - 6z = -4$
 $x + 5y + 3z = 10$
 $x + 3y + 2z = 5$

OR

- (b) Write down the C program for Newton's forward interpolation method. **07**
- Q.3** (a) Determine the equation to the best fitting exponential curve of the form $y = ae^{bx}$ for the data given in Table: **07**
- | | | | | | |
|---|-----|-----|----|----|----|
| X | 1 | 3 | 7 | 9 | 11 |
| Y | 115 | 105 | 95 | 85 | 80 |
- (b) Find the deflections of cantilever beam subjected to UDL w KN/m on whole span L . Find the values at minimum four points by using finite difference method **07**

OR

- Q.3** (a) Determine the principal stress and principal plane using eigen value method for following data **07**
 $\sigma_{xx} = 110 \text{ N/mm}^2$ (tensile), $\sigma_{yy} = 50 \text{ N/mm}^2$ (tensile), $\tau_{xy} = \tau_{yx} = 60 \text{ N/mm}^2$
- (b) A relationship between 'x' and 'logx' is as follows **07**
- | | | | | | | | |
|--------|--------|--------|--------|--------|--------|--------|--------|
| x | 4 | 4.2 | 4.4 | 4.6 | 4.8 | 5 | 5.2 |
| log(x) | 1.3863 | 1.4351 | 1.4816 | 1.5261 | 1.5686 | 1.6094 | 1.6487 |
- Evaluate $\int \log(x) dx$ over a range of 4 to 5.2 using Simpson's one third rule .

- Q.4** (a) Compute deflections at atleast three points, of fixed beam subjected to uniformly distributed load w kN/m on the span L . Use finite difference techniques. **07**
- (b) Find the largest Eigen-values and corresponding Eigen vector for following matrix using power method, **07**

$$\begin{pmatrix} 6 & -2 & 2 \\ -2 & 3 & -1 \\ 2 & -1 & 3 \end{pmatrix}$$

OR

- Q.4** (a) Compute one root of the following equation by Regula-Falsi Method correct to **07**

three decimal places:

$$\sin X = 5x - 2.$$

- (b) Using Euler's method, find an approximate value of y corresponding to $x=0.8$ for the ordinary differential equation, $dy/dx = x+y^2$, $y(0) = 1$, using increments of size $h = 0.1$. 07

- Q.5** (a) The following table gives the velocity v of a particle at time t . Find its acceleration at $t = 2$ sec 07

t	0	2	4	6	8	10
v	4	6	18	45	60	98

- (b) Evaluate the following using Gaussian two point formula 07

$$\int_2^4 (1 + X^4) dx$$

OR

- Q.5** (a) Find the root of equation $f(X) = x^3 - 4x + 1 = 0$ lying between 1 and 2 by using Newton-Raphson method. 07

- (b) Compute $f(1.96)$ from the following table using Stirling's formula 07

x	1.7	1.8	1.9	2.0	2.1	2.2	2.3
$F(x)$	2.979	3.144	3.283	3.391	3.463	3.997	4.491