Seat No.: \_\_\_\_\_

Enrolment No.\_\_\_\_

## **GUJARAT TECHNOLOGICAL UNIVERSITY** ME – SEMESTER-1 (NEW) EXAMINATION – WINTER 2016

Subject Code: 2713301 Date:03/01/2017 Subject Name: Numerical Methods for Civil Engineering **Total Marks: 70** Time: 2:30 pm to 5:00 pm **Instructions:** 1. Attempt all questions. 2. Make suitable assumptions wherever necessary. 3. Figures to the right indicate full marks. 0.1 Define absolute and percentage errors. Let the exact value be 19/6 and its 07 (a) approximate value is 3.166. Find the relative and percentage errors. Also find the number of significant digits. Discuss false-position method graphically. Find real root of  $x^3+15x-20=0$ , 07 **(b)** correct up to three decimal places using the same. **O.2** Determine one of the roots of the equation  $x \log_{10} x - 0.77 = 0$  to three decimal 07 (a) places using Newton Raphson's method. Calculate the free joint displacement, D, of a plane frame whose stiffness **(b)** 07 matrix, S, and load vector, A, is given as below. Use Gauss-Jordan method. Note A=SD.  $S = \begin{bmatrix} 1 & 2 & 1 \\ 2 & 3 & 4 \\ 4 & 3 & 2 \end{bmatrix}$  and,  $A = \begin{bmatrix} 8 \\ 20 \\ 16 \end{bmatrix}$ **(b)** Explain convergence criteria for Gauss- Seidal method. Use it to solve the 07 system correct up to four decimal places. 2x + 2y + 18z = 1030x - 2y + 3z = 20x + 17y - 2z = 30Q.3 **(a)** Determine the largest Eigen value and corresponding eigenvector of the matrix 07  $\begin{bmatrix} 2 & 3 & 1 \\ 3 & 4 & 5 \\ 1 & 2 & 4 \end{bmatrix}$ Find f(9) using Lagrange's interpolation formula for following data. **(b)** 07

x	4	5	8	10					
f(x)	370	-2	190	501					
OR									

- **Q.3** (a) Solve  $5\frac{dy}{dx} = x^2 + y^2$  using Runge-Kutta method of fourth order in the interval **07** of  $0 \le x \le 0.4$ , taking h=0.1 and y(0)=1.
  - (b) Use the finite difference approach with  $\Delta x = 2m$  to solve the boundary value 07

problem given below. Given y(0)=5 and y(10)=8.

$$4\frac{d^2y}{dx^2} - 3\frac{dy}{dx} - y + x = 0$$

Q.4	(a)	Determine the numerical value of integration of log <sub>10</sub> x for limit 1 to 2, using three- point Gauss-Quadrature rule.	07
	<b>(b)</b>	Explain the use of Eigen value problem in Structural Engineering. Give basic	07
		steps for solution of Eigen value problem.	
		OR	
Q.4	<b>(a)</b>	Use modified Euler's method of second order to find $y(1.5)$ , given that	07
		$\frac{dy}{dx} = 4xy, \ y(1)=1 \text{ with } h = 0.1.$	
	<b>(b)</b>	What is numerical integration? Derive Trapezoidal and Simpson's 1/3 rule.	07
Q.5	<b>(a)</b>	List various methods for interpolation and extrapolation of values. Explain any	07
		one method, which is used for unevenly spaced interval.	
	<b>(b)</b>	Using the finite difference method, compute the deflection at $L/4$ interval of a	07

(b) Using the finite difference method, compute the deflection at *L*/4 interval of a simply supported beam subjected to uniformly distributed load 'w' per unit run throughout the span '*L*'. Take *EI* constant.

## OR

**Q.5** (a) The voltage, *V*, across a capacitor at time *t* second is given by the following table. Use the method of least square to fit a curve  $V = ae^{kt}$  to this data.

t	0	2	4	6	8
V	145	58	23	7	0.6

(b) Explain the Laplace Transform method.

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