Seat No.: _____ Enrolment No._____

GUJARAT TECHNOLOGICAL UNIVERSITY

ME - SEMESTER–I(New course)• EXAMINATION – WINTER- 2015

Subject Code: 2712909 **Date: 31/12/2015**

Subject Name: Higher Engineering Mathematics

Time:2:30 pm to 5:00 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)** Obtain Fourier series to represent the function $f(x) = x - x^2$ in the interval $[-\pi, \pi]$. Hence deduce that $\frac{1}{1^2} + \frac{1}{2^2} + \frac{1}{3^2} + \frac{1}{4^2} + ... = \frac{\pi^2}{6}$. **07**

(b) State Cayley-Hamilton theorem and using it find the inverse of the matrix $A = \begin{bmatrix} 0 & 1 & 2 \\ 1 & 2 & 3 \\ 3 & 1 & 1 \end{bmatrix}$ **07**

Q.2 **(a)** Find a real root of the equation $x^3 - x - 11 = 0$ correct to three decimal places by using Bisection Method. **07**

(b) Using Newton's Divided Difference Formula find the value of *f(15)* from the following table: **07**

x	4	5	7	10	11	13
f(x)	48	100	294	900	1210	2028

OR

(b) Evaluate the following integral using Trapezoidal Rule(Take h=0.1): **07**

$\int_4^{5.2} \log_e x \, dx$.

Q.3 **(a)** Find a real root of the equation $x^3 - 2x - 5 = 0$ correct to three decimal places by using Secant Method **07**

(b) Find a real root of the equation $3x - \cos x - 1 = 0$ correct to three decimal places by using Newton-Raphson Method **07**

OR

Q.3 **(a)** Solve the following system of equations by using Gauss elimination method. **07**

$x + y + z + w = 2$

$x + y + 3z - 2w = -6$

$2x + 3y - z + 2w = 7$

$x + 2y + z - w = -2$

(b) Find half range sine and cosine series for $f(x) = e^x$ in interval $0 < x < 1$ **07**

Q.4 **(a)** **07**

(i) Evaluate $\int_{-1}^{1} \frac{1}{1+x^2} dx$ using Gauss two points formula.

(i) Evaluate $\int_{0}^{1} \frac{1}{1+x} dx$ using Gauss three points formula.

(b) Define Numerical Integration and Compare Trapezoidal Rule Simpsonôs-1/3 Rule and Simpsonôs-3/8 Rule. **07**

OR

Q.4 **(a)** Detemine the largest eigen value and corresponding eigen vectors of the following matrix correct to three decimal places by using Power Method $\begin{bmatrix} 2 & 3 \\ 5 & 4 \end{bmatrix}$. **07**

(b) By using Gauss-Jordan method find the inverse of the matrix $A = \begin{bmatrix} 1 & 1 & 3 \\ 1 & 3 & -3 \\ -2 & -4 & -4 \end{bmatrix}$ **07**

Q.5 **(a)** Apply Runge-Kutta Method of order four to find an approximate value of y when x=0.2, given that $\frac{dy}{dx} = x^2 + y^2$, y(0)=1. **07**

(b) Using Taylorôs series method compute $y(0.2)$ correct to five decimal places, given that $\frac{dy}{dx} = 1 - 2xy$, y(0)=0. **07**

OR

Q.5 **(a)** Use Newtonôs Forward Interpolation Formula to find the form of *f(x)* from the following table. **07**

x	0	1	2	3
f(x)	1	2	1	10

(b) Use Lagrangeôs Interpolation Formula to find the value of y for *x*=10 from the following table. **07**

x	5	6	9	11
y	12	13	14	16

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