Seat No.: _____ *Enrolment No.*_____

GUJARAT TECHNOLOGICAL UNIVERSITY

M. E. - SEMESTER – I • EXAMINATION – JANUARY • 2015

Subject code: 2712909 **Date: 06-01-2015**

Subject Name: Higher Engineering Mathematics

Time: 02:30 pm - 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)** Find Fourier series of $f(x)=x^2, -2<x<2;\ f(x+4)=f(x)$. Hence deduce that $\frac{1}{1^2}-\frac{1}{2^2}+\frac{1}{3^2}-\frac{1}{4^2}+...=\frac{\pi^2}{12}$. **07**

(b) List and derive various rule and formula to carry out Numerical Integration. **07**

Q-2 **(a)** Find a real root of $x^3-x-1=0$ correct upto three decimal places by Bisection method. **07**

(b) The shear stress in klps per square root (ksf) for 5 specimen in a clay stratum are given. Use Newtonôs divided difference interpolation to compute stress at 4.5 m depth. **07**

Depth m	1.9	3.1	4.2	5.1	5.8
Stress ksf	0.3	0.6	0.4	0.9	0.7

OR

(b) Obtain the vapour pressure of water at 27 C from the following data. **07**

x (C)	10	20	30	40	50
y(mm Hg)	9.21	17.54	31.82	55.32	92.51

Q-3 **(a)** Using Runge-Kutta second order method, find the approximate value of y at x=1.2 taking h=0.1, where $\frac{dy}{dx}=x^2+y^2, y(1)=0$ **07**

(b) Find a real root of $x^3-5x+3=0$ correct to three decimal places using Newton-Raphson Method. **07**

OR

Q-3 **(a)** Solve the following linear system using Gauss Elimination method. **07**
$2a+b-c=1,\ 5a+2b+2c=-4,\ 3a+b+c=5$

(b) Use the power method to find the largest Eigen value and corresponding Eigen vector of the matrix $\begin{bmatrix} 1 & 6 & 1 \\ 1 & 2 & 0 \\ 0 & 0 & 3 \end{bmatrix}$ **07**

Q-4 **(a)** Find Half range (a) Fourier Cosine series and (b) Sine series for $f(x) = x$, $0 < x < L$. Also graph the corresponding periodic continuation of f(x) **07**

(b) Using Fourier Integral representation, Show that **07**

$$\int_0^\infty \frac{\cos x\lambda + \lambda \sin x\lambda}{1+\lambda^2} d\lambda = \begin{cases} 0 & ;\ x < 0 \\ \dfrac{\pi}{2} & ;\ x = 0 \\ \pi e^{-x} & ;\ x > 0 \end{cases}$$

OR

Q-4 **(a)** Consider the following tabular values. **07**

x	25	25.1	25.2	25.3	25.4	25.5	25.6
y	3.205	3.217	3.232	3.245	3.256	3.268	3.280

Determine the area bounded by the given curve and X-axis between x=25 to x=25.6 by trapezoidal rule

(b) Evaluate $\int_0^1 \frac{1}{1+x} dx$ by Gaussian Integration formula with three points. **07**

Q-5 **(a)** Use Jacobiôs method to solve the equations **07**

$20x + y - 2z = 17,\quad 3x + 20y - z = -18,\quad 2x - 3y + 20z = 25$

(b) Using Taylorôs series method, find the solution of the initial value problem **07**

$\frac{dy}{dx} = x + y,\ \ y(1) = 0$ at x = 1.2 with h = 0.1

OR

Q-5 **(a)** Use Eulerôs method to find y(1) from the differential equation **07**

$\frac{dy}{dx} = x + y,\ \ y(0) = 1$

(b) Find the Eigen value and Eigen vector of the matrix $\begin{bmatrix} 3 & -1 & 0 \\ -1 & 2 & -1 \\ 0 & -1 & 3 \end{bmatrix}$ **07**