Seat No.: _____ Enrolment No._____

GUJARAT TECHNOLOGICAL UNIVERSITY

BE - SEMESTER– IV (New) EXAMINATION – WINTER 2019

Subject Code: 2140105 Date: 07/12/2019

Subject Name: Numerical Methods

Time: 10:30 AM TO 01:00 PM Total Marks: 70

Instructions:

1. **Attempt all questions.**
2. **Make suitable assumptions wherever necessary.**
3. **Figures to the right indicate full marks.**

MARKS

Q.1 **(a)** State the numerical methods for solving initial value differential equations. **03**

(b) Implement bisection method to solve $x^3 - 4x - 9 = 0$ **04**

(c) Describe the fitting of a straight line $y=ae^{bx}$ and fit it for the data, **07**

x	2.30	3.10	4.00	4.92	5.91	7.20
y	33.0	39.1	50.3	67.2	85.6	125.0

Q.2 **(a)** State the formulae for Lagranges interpolation methods. **03**

(b) Using the Lagranges formula find the polynomial and evaluate f(9). **04**

x	5	7	11	13	17
y	150	392	1452	2366	5202

(c) Obtain cubic spline for every subinterval from the following data: **07**

x	0	1	2	3
y	2	-6	-8	2

OR

(c) Use Stirling's formulae for finding y(12.2) from the data: **07**

X	10	11	12	13	14
y	23967	28060	31788	35209	38368

Q.3 **(a)** Use Gauss elimination solve x+4y-z=-5, x+y-6z=-12, 3x-y-z=4. **03**

(b) Use Trapezoidal rule to evaluate $\int_0^6 \frac{1}{1+x^2}\,dx$ taking h=1, step length. **04**

(c) Describe the Newton Raphson method in brief and evaluate **07**

$\sqrt{N}$ for N=10.

OR

Q.3 **(a)** Use Gauss Jordan method to solve 3x+y+2z=3, 2x-3y-z=-3, x+2y+z=4. **03**

(b) Use Simpsons 3/8 rule to evaluate, taking h=0.2 and n=6 for **04**

$\int_{0.2}^{1.4} (\sin x - \log x + e^x)dx$

	(c)	Describe method of False position and solve $\cos x - xe^x$ within the interval (0,1).	**07**
Q.4	**(a)**	State the finite difference method for laplace equation	**03**
	(b)	Solve heat equation $\frac{\partial^2 u}{\partial x^2} + \frac{\partial^2 u}{\partial t^2} = 0$ over a rectangular slab that is 20 cm wide and 10 cm high All edges are kept at 0^0 except the right edge which is maintained at 100^0. There is no heat gain or lost from the surface of the slab. Place nodes with step length of 5 cm to generate grids and solve using finite difference method.	**04**
	(c)	State the Taylors method and solve equation, $\frac{dy}{dx} = x + y \quad with \quad x_0 = 0, y_0 = 1.$ Let h=0.1 and find four iterations.	**07**

OR

Q.4	**(a)**	State the finite difference quotients for first and second order derivatives.	**03**
	(b)	Solve y"+4y+1=0 with y(0)=0, y(1)=0, Using h=0.5 implement finite difference approach.	**04**
	(c)	State the Picard's formula and solve the equation for x=0.1 $\frac{dy}{dx} = \frac{y - x}{y + x}$ with y(0)=1.	**07**
Q.5	**(a)**	Discuss in brief finite difference and finite element approach	**03**
	(b)	Describe the Galerikin method in brief.	**04**
	(c)	Solve using Runge Kutta 4th order method $\frac{dy}{dx} = \frac{y^2 - x^2}{y^2 + x^2}$ y(0)=1 for x=0.2,x=0.4.	**07**

OR

Q.5	**(a)**	Discuss the shooting approach for boundary value problems.	**03**
	(b)	Solve u"=u, u'(1)=1.1752, u'(3)=10.01787 using appropriate method.	**04**
	(c)	Implement shooting method to solve $u'' - (1 - \frac{x}{5})u = x$ with u(1)=2, u(3)=-1.	**07**

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