Seat No.: _____  Enrolment No. 

# GUJARAT TECHNOLOGICAL UNIVERSITY

**BE- SEMESTER–IV (NEW) EXAMINATION – WINTER 2020**

**Subject Code: 2140105** **Date: 09/02/2021**

**Subject Name: Numerical Methods**

**Time: 02:30 PM TO 04:30 PM** **Total Marks: 56**

**Instructions:**

1. **Attempt any FOUR questions out of EIGHT questions.**
2. **Make suitable assumptions wherever necessary.**
3. **Figures to the right indicate full marks.**

**MARKS**

**Q.1** **(a)** Define and name the methods to solve differential equations. **03**

**(b)** Implement bisection method to solve $x^3$-3x-5=0 upto fourth approximation. **04**

**(c)** Describe the fitting of $y = ae^{px}$ for the data, **07**

| x | 0 | 2 | 4 |
|---|---|---|---|
| y | 5.012 | 10 | 31.62 |

**Q.2** **(a)** State the formulae for Newtons backward interpolation methods . Specify the methods used for unequal intervals **03**

**(b)** Using the Lagrange's formula find the polynomial which fits into the data below: **04**

| x | 0 | 1 | 2 | 5 |
|---|---|---|---|---|
| y | 2 | 3 | 12 | 147 |

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

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

**Q.3** **(a)** Use Gauss elimination solve x+2y+z=8, 2x+3y+4z=20, 4x+3y+2z=16. **03**

**(b)** Use Trapezoidal rule to evaluate $\int_1^3 \frac{1}{x} dx$ taking 4 subintervals. **04**

**(c)** Describe the Newton Raphson method in brief and solve $e^x = 5x$ **07**

**Q.4** **(a)** Use Gauss Jordan method to solve 10x+y+z=12, x+10y+z=12, x+y+10z=12. **03**

**(b)** Use Simpsons 3/8 rule to evaluate, $\int_0^6 \frac{1}{1+x^2} dx$ **04**

**(c)** Describe Secant method and use it to solve $x^3 - 5x + 1 = 0$ in (0,1). **07**

**Q.5** **(a)** State the Gauss seidel method for laplace equation **03**

**(b)** Solve heat equation $\frac{\partial u}{\partial t} = \frac{\partial^2 u}{\partial x^2}$ with u(x,0)=0, u(0,t)=0 and u(1,t)=t. with $k = \frac{1}{8}$ *and* $h = \frac{1}{4}$ . **04**

**(c)** State the Taylors method and solve equation, $\frac{dy}{dx} = y - \frac{2x}{y}$ y(0)=1. **07**

**Q.6** **(a)** State the finite difference quotients for first and second order derivatives. **03**

**(b)** Solve y"+y+1=0 with y(0)=0, y(1)=0, Using h=0.5 implement finite difference approach. **04**

**(c)** State the Picards formula and solve the equation for x=0.2, $\frac{dy}{dx} = x^2 - y$ y(0)=1. **07**

**Q.7** **(a)** Discuss the difference between finite difference and finite element approach **03**

**(b)** Describe the Rayleigh Ritz method in brief. **04**

**(c)** Solve using Runge Kutta $4^{th}$ order method $\frac{dy}{dx} = x + y$ y(0)=1using h=0.05 for y(0.1). **07**

**Q.8** **(a)** Discuss the shooting approach for boundary value problems. **03**

**(b)** Describe the Galerikin approach in brief. **04**

**(c)** Solve using the equation using Galerikin approach, y"+y=-x, 0<x<1 and y(0)=y(1)=0. **07**

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