



**R20 Regulation** **Subject code: 3B3AA**  
**TKR COLLEGE OF ENGINEERING AND TECHNOLOGY**  
(Autonomous, Accredited by NAAC with 'A++' Grade)

**B.Tech III Semester Supplementary Examinations, February 2024**  
**NUMERICAL METHODS**  
**(CIVIL ENGINEERING)**

**Maximum Marks: 70**

**Date: 16.02.2024 Duration: 3 hours**

- Note:**
1. This question paper contains two parts A and B.
  2. Part A is compulsory which carries 20 marks. Answer all questions in Part A.
  3. Part B consists of 5 Units. Answer any one full question from each unit.
  4. Each question carries 10 marks and may have a, b, c, d as sub questions.

**Part-A**

| All the following questions carry equal marks (10X2M=20 Marks) |                                                                                                               | CO  | Bloom Tx |
|----------------------------------------------------------------|---------------------------------------------------------------------------------------------------------------|-----|----------|
| 1                                                              | Explain about Bisection method                                                                                | CO1 | L2       |
| 2                                                              | Find any two initial positive roots of the equation $xe^x = 2$                                                | CO1 | L3       |
| 3                                                              | Prove that $\nabla = 1 - E^{-1}$                                                                              | CO2 | L3       |
| 4                                                              | Show that $\Delta^{10}[(1-x)(1-2x^2)(1-3x^3)(1-4x^4)] = 24 \times 2^{10} \times 10!$ if $h = 2$ .             | CO2 | L2       |
| 5                                                              | Write the formula of Trapezoidal rule.                                                                        | CO3 | L1       |
| 6                                                              | Evaluate $\int_0^1 x^3 dx$ by using Simpson's 3/8 rule, with $n = 5$ .                                        | CO3 | L5       |
| 7                                                              | Define initial and boundary value problems.                                                                   | CO4 | L1       |
| 8                                                              | Compute $y(0.1)$ for $dy/dx = xy + 1$ and $y(0) = 1$ using Taylor series method.                              | CO4 | L2       |
| 9                                                              | State Standard Five point formul and Diagonal Five point formula to solve a Poisson equation of second order. | CO5 | L3       |
| 10                                                             | Classify the equation<br>$u_{xx} + 4u_{xy} + (4y^2 + x^2)u_{yy} = \sin(x+y)$                                  | CO5 | L2       |

**Part-B**

| Answer All the following questions. (5X10M=50Marks) |                                                                                                                                |     |    |
|-----------------------------------------------------|--------------------------------------------------------------------------------------------------------------------------------|-----|----|
| 11                                                  | Find a real root for $x e^x = \cos x$ , using Regula Falsi method.                                                             | 10M | L3 |
|                                                     | OR                                                                                                                             |     |    |
| 12                                                  | Evaluate $\sqrt{28}$ to four decimal places by Newton's Raphson Method.                                                        | 10M | L5 |
| 13                                                  | Given the values $y(5) = 150, y(7) = 392, y(11) = 1452, y(13) = 2366, y(17) = 5202$ . Evaluate $y(9)$ using Lagranges formula. | 10M | L5 |
|                                                     | OR                                                                                                                             |     |    |

|    |                                                                                                                                                                                                                                                                                                                                                                                                                                                             |          |     |    |
|----|-------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|----------|-----|----|
| 14 | Use Gauss's forward interpolation formula to find $f(30)$ given that $f(21) = 18.4708$ , $f(25) = 17.8144$ , $f(29) = 17.1070$ , $f(33) = 16.3432$ , $f(37) = 15.5154$ .                                                                                                                                                                                                                                                                                    | 10M      | CO2 | L3 |
| 15 | a) Evaluate $\int_0^1 \sqrt{1+x^4} dx$ using Simpson's 3/8 rule.<br>b) Evaluate $\int_0^\pi \frac{\sin x}{x} dx$ using $n = 6$ , by i) Trapezoidal rule<br>ii) Simpson's 1/3 rule.                                                                                                                                                                                                                                                                          | 5M<br>5M | CO3 | L5 |
|    | OR                                                                                                                                                                                                                                                                                                                                                                                                                                                          |          |     |    |
| 16 | a) A curve passes through the points (0.18), (1,10), (3, -18), (6,90). Find the slope of the curve at $x = 2$ .<br>b) Evaluate $\int_0^6 \frac{1}{1+x^2} dx$ by using Trapezoidal rule, Simpson's 3/8 rule. Taking $h = 1$ .                                                                                                                                                                                                                                | 5M<br>5M | CO3 | L5 |
| 17 | Given $\frac{dy}{dx} = y^2 + 3x$ , $y(0) = 1$ Find $y(0.1)$ taking $h = 0.1$ by using Taylor's series method.                                                                                                                                                                                                                                                                                                                                               | 10M      | CO4 | L3 |
|    | OR                                                                                                                                                                                                                                                                                                                                                                                                                                                          |          |     |    |
| 18 | Apply 4th order Runge-Kutta method to find $y(0.1)$ given $y' = xy$ , $y(0)=1$ .                                                                                                                                                                                                                                                                                                                                                                            |          | CO4 | L3 |
| 19 | Find the numerical solution of the heat conduction equation $\frac{\partial u}{\partial t} = \frac{\partial^2 u}{\partial x^2}$ $0 \leq x \leq 1$ , $t > 0$ with boundary conditions and initial conditions $u(0,t) = u(1,t) = 1$<br>$u(x, 0) = \begin{cases} 1 + 2x & 0 \leq x \leq 1/2 \\ 3 - 2x & 1/2 \leq x \leq 1 \end{cases}$<br>Use explicit method taking $\Delta x=0.1$ , $\Delta t = 0.02$ and compute up to $t = 0.06$ up to six decimal places. | 10M      | CO5 | L3 |
|    | OR                                                                                                                                                                                                                                                                                                                                                                                                                                                          |          |     |    |
| 20 | Evaluate the pivotal values of the equation $u_{tt} = 16u_{xx}$ , taking $h=1$ upto $t=1.25$ . The boundary conditions are $u(0,t)=u(5,t)=0$ , $u_i(x,0)=0$ and $u(x,0)=x^2(5-x)$                                                                                                                                                                                                                                                                           | 10M      | CO5 | L5 |