R22 Regulation *Subject code: 4B2AA*

TKR COLLEGE OF ENGINEERING AND TECHNOLOGY

(Autonomous, Accredited by NAAC with 'A+' Grade)

B.Tech II Semester Regular/Supplementary Examinations, July 2025

NUMERICAL METHODS AND APPLICATIONS

(CE)

Maximum Marks: 60 Date: 09.07.2025 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 (10X1M=10 Marks)		Marks	CO	BTL
1.a	Define Transcendental equations.	1M	1	1
b	Write the formulae of Newton's Raphson method.	1M	1	1
c	Write the Newton's forward difference formulae.	1M	2	1
d	State the Newton's divided difference formulae.	1M	2	1
e	State Trapezoidal rule.	1M	3	2
f	Write Simpson's 1/3 rule of integration formula	1M	3	1
g	State the Taylor's series of n^{th} order	1M	4	1
h	State modified Euler's methods formula.	1M	4	1
i	Which method is unconditionally stable for the heat equation?	1M	5	1
j	In wave equation, what does the second time derivative represent?	1M	5	1

Part-B

Answer All the following questions. (5X10M=50Marks)		Marks	CO	BTL
2	a) Find the real root of the equation $x^3 - 2x - 5 = 0$ correct to 3 decimal places, by iteration method. $x^3 - 2x - 5 = 0$ b) Using the Method of False Position, compute a real root of the equation $e^x \sin x = 1$ correct to 3 decimal places.	5M 5M	1	2
	OR			
3	Solve the following system of equations by Gauss-Seidel method $10x + y + z = 12, 2x + 10y + z = 13, 2x + 2y + 10z = 14$	10M	1	3
4	Apply Lagrange's interpolation formula to find y(10), from the following table:	10M	2	3

x	5	6	9	11
y	12	13	14	16

	OR			

5	Use Gauss Central Difference interpolation formula and find $f(1.24)$, if $f(1.15) = 1.0723, f(1.20) = 1.0954, f(1.25) = 1.1180$ and $f(1.30) = 1.1401$	10M		2
6	Evaluate $\int_0^1 \frac{1}{1+x^2} dx$ using (i)Trapezoidal rule, (ii)Simpson's $\frac{3}{8}$th rule and also compare the results with its actual value.	10M	3	3
	OR			
7	Find $\frac{dy}{dx}$ and $\frac{d^2y}{dx^2}$ at x=1.2 from the following table:	10M	3	2
8	a) Using Taylor's series method, solve the equation $\frac{dy}{dx} = x^2 + y^2$ for x = 0.4, given that y = 0 when x = 0. b) Given $\frac{dy}{dx} = \frac{y-x}{y+x}$ with initial condition y = 1 at x = 0, then find y for x = 0.1 by Euler's method.	5M 5M	4	3
	OR			
9	Using Runge -Kutta method of fourth order, find $y(0.4)$for the equation $\frac{dy}{dx} = \frac{y-x}{y+x}$, $y(0) = 1$ with $h = 0.2$	10M	4	3
10	Solve the Poisson equation $u_{xx} + u_{yy} = -81xy$, $0 < x < 1$, $0 < y < 1$ given that u(0, y) = 0, u(x, 0)=0, u(1, y) =100, u(x, 1)=100 and h =1/3.	10M	5	2
	OR			
11	Solve the boundary value problem $u_t = u_{xx}$ under the conditions $u(0,t) = u(1, t) = 0$ and $u(x, 0) = \sin px$, $0 \le x \le 1$ using the Schmidt method (Take $h = 0.2$ and $\alpha = 1/2$).	10M	5	3

x	1.0	1.2	1.3	1.4	1.5	1.6
y	7.989	8.403	8.781	9.129	9.750	10.031