



R20 Regulation

TKR COLLEGE OF ENGINEERING AND TECHNOLOGY

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

Subject code: 3B3AA

**B.Tech III Semester Regular Examinations, February 2022**

**NUMERICAL METHODS**

(CIVIL ENGINEERING)

**Maximum Marks: 70**

Date: 21.02.2022 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)

- 1 Write the Newton – Raphson iterative formula for  $(i + 1)^{\text{th}}$  iteration?
- 2 Write the Regula falsi method iteration formula?
- 3 Write the Lagrange's Interpolation Formula?
- 4 Evaluate  $\Delta \log f(x)$ .
- 5 Write the Simpson's 1/3 rule to evaluate?
- 6 Write the numerical derivative formula for  $dy/dx$  at  $x = x_0$ ?
- 7 Write the Picard's general iterative formula?
- 8 Write R-K method fourth order formula of  $y_1$ ?
- 9 Write the Laplace's equation?
- 10 Write the forward difference approximation to  $u_x(x_0, y_0)$ ?

**Part-B**

Answer All the following questions.

(5X10M=50Marks)

- 11 (a) Find a positive root of  $x^3 - x - 1 = 0$  correct to two decimal places by using bisection method. 5  
(b) Using iteration method find a real root of  $f(x) = x^2 - 3x + 1$  correct up to two decimal places starting with  $x = 1$  5

OR

- 12 Find a root of  $e^x \sin x = 1$  near to 1 by using Newton-Raphson's method. 10
- 13 Find the polynomial which fits the data in the following table using Gauss forward formula 10

|   |   |    |    |     |     |
|---|---|----|----|-----|-----|
| x | 3 | 5  | 7  | 9   | 11  |
| y | 6 | 24 | 58 | 108 | 174 |

OR

- 14 Using Lagrange's formula calculate  $f(3)$  from the following table 10

|      |   |    |    |   |   |    |
|------|---|----|----|---|---|----|
| X    | 0 | 1  | 2  | 4 | 5 | 6  |
| f(x) | 1 | 14 | 15 | 5 | 6 | 19 |

- 15 Compute the first derivative for the following table of data at  $x = -3$  and at  $x=0$

|   |     |     |    |   |   |    |    |
|---|-----|-----|----|---|---|----|----|
| x | -3  | -2  | -1 | 0 | 1 | 2  | 3  |
| y | -33 | -12 | -3 | 0 | 3 | 12 | 33 |

OR

- 16 Evaluate  $\int_0^1 \frac{1}{1+x} dx$

(i) By Trapezoidal rule (ii) By Simpson's 1/3 rule

- 17 Solve  $y' = x + y$ , given that  $y(1) = 0$ . Find  $y(1.1)$  and  $y(1.2)$  by Taylor's series method.

OR

- 18 Find  $y(0.1)$  and  $y(0.2)$  using Runge Kutta fourth order formula given that  $dy/dx = x + x^2y$  and  $y(0) = 1$

- 19 Solve  $u_{xx} + u_{yy} = 0$  in  $0 \leq x \leq 4, 0 \leq y \leq 4$  given that  $u(0, y) = 0$ ;  $u(4, y) = 8 + 2y$ ;  $u(x, 0) = x^2/2$  and  $u(x, 4) = x^2$ . Take  $h=k=1$  and obtain the result correct to one decimal.

OR

- 20 Using Crank-Nicholson's method, solve  $u_{xx} = 16 u_t$ ,  $0 < x < 1, t > 0$  given  $u(x, 0) = 0$ ,  $u(0, t) = 0$ ,  $u(1, t) = 50t$ . Compute  $u$  for two steps in  $t$  direction taking  $h = 1/4$