



B.Tech III Semester Regular/Supplementary Examinations, March/April 2023
NUMERICAL METHODS
 (CIVIL ENGINEERING)

Maximum Marks: 70

Date: 27.03.2023 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 formula of Regula- falsi method.
- 2 Prove that Newton Raphson have convergence.
- 3 Show that $(1 - \nabla)(1 + \Delta) = 1$
- 4 Show that $\Delta^{10}[(1-x)(1-2x^2)(1-3x^3)(1-4x^4)] = 24 \times 2^{10} \times 10!$ if $h = 2$.
- 5 Write the formula of Trapezoidal rule.
- 6 Evaluate $\int_0^1 x^3 dx$ by using Simpson's 3/8 rule, with $n = 5$.
- 7 Define initial and boundary value problems.
- 8 Write the formula for Modified Euler's method.
- 9 Give two examples for elliptic equations.
- 10 State Standard Five-point formula to solve a Poisson equation of second order.

Part-B

Answer All the following questions.

(5X10M=50Marks)

- 11 Using bisection method, find a positive real root of the equation $x = e^{-x}$, correct to 3 decimal places.

10M

OR

- 12 Find a positive real root of $2x - 3 \sin x = 5$ near 3 decimals by Newton Raphson method.

10M

- 13 Use Newton forward interpolation formula to compute the pressure of the steam at temperature 142°C from the following table :

| | | | | | |
|----------|-------|-------|-------|-------|--------|
| temp | 140 | 150 | 160 | 170 | 180 |
| Pressure | 3.685 | 4.854 | 6.302 | 8.076 | 10.225 |

10M

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

- 15 a) Evaluate $\int_0^1 \sqrt{1+x^4} dx$ using Simpson's 3/8 rule. 5M
 b) Evaluate $\int_0^\pi \frac{\sin x}{x} dx$ using $n = 6$, by i) Trapezoidal rule 5M
- OR
- 16 a) A curve passes through the points (0,18), (1,10), (3, -18), (6,90). Find the slope of the curve at $x = 2$. 5M
 b) Evaluate $\int_0^6 \frac{1}{1+x^2} dx$ by using Simpson's 3/8 rule. Taking $h = 1$. 5M
- 17 Apply 4th order Runge-Kutta method to find $y(0.1)$ given $y' = xy, y(0)=1$. 10M
- OR
- 18 Given $dy/dx = -xy^2, y(0) = 2$ Compute $y(0.2)$ in steps of 0.1 using modified Euler's method. 10M
- 19 Solve $\frac{\partial u}{\partial t} = \frac{\partial^2 u}{\partial x^2}$, with conditions $u(0,t) = u(1,t) = 0, u(x,0) = \frac{1}{2} x(1-x)$ and $u(x,0) = 0$ taking $h = k = 0.1$ for $0 \leq t \leq 0.4$ 10M
- 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