

Level: Bachelor
Programme: BE
Course: Numerical Methods

Semester: Fall

Year : 2020
Full Marks: 100
Pass Marks: 45
Time : 3hrs.

Candidates are required to give their answers in their own words as far as practicable.

The figures in the margin indicate full marks.

Attempt all the questions.

1. a) Find the positive real root of the equation $\cos x + e^x + x^2 = 3$ using False position method, correct to 3 decimal places. 7

- b) Discuss the drawbacks of Newton – Raphson method. Find the real root of the equation $x \sin x - \cos x = 0$ using Newton – Raphson method, correct to 3 decimal places. 8

2. a) From following experimental data, it is known that the relation connects v and t as $v = at^b$. Find the possible values of a and b . 8

V	350	400	500	600
T	61	26	7	2.6

- b) The following table gives the viscosity of oil as the function of temperature. Use Lagrange's interpolation formula to find the viscosity of oil at a temperature of 140 degree Celsius. 7

T(degCelsius)	110	130	160	190
Viscosity	10.8	8.1	5.5	4.8

3. a) Integrate the given integral using Romberg integration. 8

$$\int_1^2 \frac{1}{1+x^3} dx$$

- b) Compute the integral using Gaussian 3 – point formula. 7

$$\int_2^5 \frac{e^x + \sin x}{1+x^2} dx$$

4. a) Solve the equation by Relaxation method: 7

$$9x - y + 2z = 9, x + 2y - 2z = 15, 2x - 2y - 13z = -17$$

- b) Determine the largest eigenvalue and the corresponding eigenvector of 8

the matrix: $A = \begin{bmatrix} 1 & 4 & 4 \\ 4 & 1 & 8 \\ 4 & 8 & 1 \end{bmatrix}$ using the power method

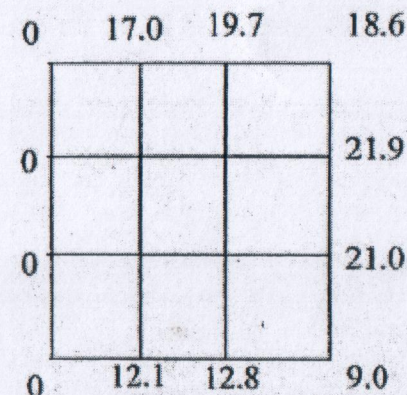
5. a) Apply Runge – Kutta fourth order method to find an approximate value of y when $x = 0.3$ give that: $y' = 2.5y + e^{0.3x}$; with an initial $y(0) = 1$, taking $h = 0.3$ 7

- b) Solve the Boundary Value Problem (BVP) using Shooting method by dividing into four sub-interval employing Euler's method. 8

$$y'' + 2y' - y = x$$

subject to boundary condition $y(1) = 2$ and $y(2) = 4$

6. a) Solve the Poisson equation $\nabla^2 f = 4x^2y + 3xy^2$, over the square domain $x \leq 3, 1 \leq y \leq 3$, with f on the boundary is given in figure below. Take $h=k=1$ 8



- b) Solve the following set of equations by using LU decomposition method. 7

$$3x + 2y + 7z = 32, 2x + 3y + z = 40, 3x + 4y + z = 56$$

7. Write short notes on: (**Any two**) 2×5

- a) Finite differences
- b) Picard's iterative formula.
- c) Algorithm for second order Runge – Kutta (RK-2) method