23124

3 Hours / 70 Marks   Seat No.

Instructions : (1) All Questions are *compulsory.*

(2) Answer each next main Question on a new page.

(3) Illustrate your answers with neat sketches wherever necessary.

(4) Figures to the right indicate full marks.

(5) Assume suitable data, if necessary.

(6) Use of Non-programmable Electronic Pocket Calculator is permissible.

(7) Mobile Phone, Pager and any other Electronic Communication devices are not permissible in Examination Hall.

Marks

1. **Attempt any FIVE of the following :**   **10**

(a) Give any two applications of SCILAB software to solve numerical methods.

(b) Give the concept of Gauss elimination method to solve linear equation.

(c) Give the condition for Simpson's 1/3 rule.

(d) State the concept of Bisection method.

(e) Give the formula to solve second order differential equation using Runge-Kutta method.

(f) Give any two applications of SCILAB software to solve integral equations.

(g) Give the formula to solve 4th order differential equation using Taylor's series method.

2. **Attempt any THREE of the following :** 12

   (a) Explain the use of SCILAB software for the solution of differential and integral equations.

   (b) Explain Gauss-Seidel iterative method in application to chemical engineering.

   (c) Using Simpson's 3/8 rule evaluate $\int\limits_{0}^{4} (1 - e^{-2x})\, dx$.

   (d) Find the root of the equation $x^3 + 2x^2 - 8 = 0$ using regula falsi method by two iterations only.

3. **Attempt any THREE of the following :** 12

   (a) Explain the use of SCILAB software for solution of algebraic equations.

   (b) Using Bisection method, find the root of $x^3 - x - 1 = 0$ (Two iterations only).

   (c) Find the root of the equation $xe^2 = \cos x$ by regula falsi method.

   (d) Find by Taylor's series method, the value of y at $x = 0.1$ from $\dfrac{dy}{dx} = y^2 + x$ $y(0) = 1$.

4. **Attempt any THREE of the following :** 12

   (a) Evaluate the integral $\int\limits_{0}^{3} (5 + 3 \cos x)\, dx$ by Trapezoidal rule.

   (b) Using Euler's method find y (0.1) given that $\dfrac{dy}{dx} = x + y$, $y(0) = 1$.

   (c) Evaluate the integral $\int\limits_{0}^{2} (1 + x^4)\, dx$ by Simpson's $\dfrac{1}{3}$ rule.

(d) Find approximate root of the equation $3x - \cos x^{-1} = 0$ by using Newton Raphson method, correct to three decimal.

(e) Evaluate the integral $\int\limits_{2}^{6} \dfrac{dx}{x+3}$ using Simpson's $\dfrac{3}{8}$ rule.

5. Attempt any TWO of the following : **12**

(a) Describe the features of SCILAB software in details.

(b) Solve by Gauss elimination method $x + y + z = 6$, $2x - 3y + 3z = 5$, $3x + 2y - z = 4$.

(c) Evaluate the integral of the following tabular data with Simpson's 3/8 rule :

x	0.0	1.0	2.0	3.0	4.0	5.0	6.0
$F(x)$	1	2.5	4.6	5.0	5.2	6.0	6.6

6. Attempt any TWO of the following : **12**

(a) Find the smallest positive root of the equation $\dfrac{1}{x} - 15 = 0$. Correct to three decimal places using Newton-Raphson method.

(b) Determine the value of y when $x = 0.1$ given that $y(0) = 1$ and $\dfrac{dy}{dx} = x^2 + y$ by using Euler's modified method.

(c) Solve the equation $\dfrac{dy}{dx} = \dfrac{1}{x+y}$, $y(0) = 1$ for $y(0.1)$ and $y(0.2)$ using second order Runge-Kutta method.

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