Reg. No. : | | | | | | | | | | | |

Question Paper Code : 62307

B.E./B.Tech. DEGREE EXAMINATION, NOVEMBER/DECEMBER 2016.

Sixth Semester

Computer Science and Engineering

080230029 — NUMERICAL METHODS

(Common to 080320009 — Numerical Methods for Fifth Semester, Chemical Engineering)

(Regulations 2008)

Time : Three hours | Maximum : 100 marks

Answer ALL questions.

PART A — (10 × 2 = 20 marks)

1. What are the important methods of solving algebraic and transcendental equations?

2. Find the root of the equation $x^3 + x - 1 = 0$ using Newton Raphson method.

3. Define Interpolation polynomial.

4. Define first, second and third order divided differences.

5. State Simpson's 3/8 rule of integration.

6. Evaluate $\int_0^1 \frac{dx}{\sqrt{1-x^4}}$, using Gaussian two point formula.

7. Apply Euler's method to find $y(0.1)$ and $y(0.2)$, given that $\frac{dy}{dx} = y - x, y(0) = 2$.

8. Explain the procedure for applying Runge-Kutta method for solving second order ordinary differential equations.

9. Give Schmidt explicit formula for one dimensional heat equation.

10. Write down the explicit scheme to solve one-dimensional wave equation.

PART B — (5 × 16 = 80 marks)

11. (a) (i) Use Regula Falsi method to find the real root of the equation $x^2 - \log_e x - 12 = 0$ correct to three decimal places. (8)

(ii) Determine the largest eigenvalue and the corresponding eigenvector of the matrix $\begin{pmatrix} 25 & 1 & 2 \\ 1 & 3 & 0 \\ 2 & 0 & -4 \end{pmatrix}$ with $(1 \ 0 \ 0)^T$ as the initial vector corrected to two decimal places. (8)

Or

(b) (i) Find the inverse of the matrix $\begin{pmatrix} 2 & 1 & -1 \\ 0 & 2 & 1 \\ 5 & 2 & -3 \end{pmatrix}$, using Gauss-Jordan method. (8)

(ii) Solve, the following equations, by Gauss-Seidel method, correct to four decimal places

$$28x + 4y - z = 32, x + 3y + 10z = 24, 2x + 17y + 4z = 35.$$ (8)

12. (a) (i) Find the interpolation polynomial for the following data, by using Lagrange's interpolation method :

x:	1	2	3	4	7
y:	2	4	8	16	128

Hence find the value of $f(2)$. (8)

(ii) Find the cubic polynomial which takes the following values, by using Newton forward difference formula : (8)

x:	0	1	2	3
$f(x)$:	1	2	1	10

Or

(b) Find the cubic spline interpolation for the following data and hence find $f(0.5)$:

x:	1	2	3	4	5
$f(x)$:	1	0	1	0	1

13. (a) (i) Find first and second derivatives of the functions at the point $x = 1.2$ from the following data : (8)

x:	1	2	3	4	5
y:	0	1	5	6	8

(ii) Evaluate $\int_0^1 \frac{dx}{1+x^2}$, using Trapezoidal rule with $h = 0.2$ and hence obtain the approximate value of π. (8)

Or

(b) (i) By dividing the range into 10 equal parts, evaluate $\int_0^{\pi} \sin x \, dx$, using Simpson's one-third rule. (8)

(ii) Using Romberg's method, evaluate $\int_0^1 \frac{dx}{1+x}$, correct to 4 decimal places and hence find $\log_e 2$. (8)

14. (a) (i) Use modified Euler's method to find $y(0.1)$ and $y(0.2)$ given that $\frac{dy}{dx} = xy$, $y(0) = 1$. (8)

(ii) Use Runge-Kutta method of order 4 to find $y(0.1)$ and $y(0.2)$ given $\frac{dy}{dx} = y - x^2$, $y(0) = 1$, taking $h = 0.1$. (8)

Or

(b) Given $\frac{dy}{dx} = xy + y^2$, $y(0) = 1$. Use Taylor's series method to find the values of $y(0.1)$, $y(0.2)$, $y(0.3)$ and find $y(0.4)$ by Millne's method. (16)

15. (a) Solve the Poisson equation $\nabla^2 = -4xy$ over the square mesh sides $x = 0, y = 0, x = 3$ and $y = 3$ with $u = 0$ on the boundary and mesh length of one unit, correct to two decimal places, using the method of iteration. (16)

Or

(b) Solve $\frac{\partial u}{\partial t} = \frac{\partial^2 u}{\partial x^2}$ satisfying $u(0, t) = 0 = u(5, t)$, when $t \geq 0$ and $u(x,0) = 10x(5 - x), 0 \leq x \leq 5$. Compute u for one time-step by Crank-Nicolson's scheme, taking $h = 1$ and $k = 1$. (16)