Total No. of Questions—**12**] [Total No. of Printed Pages—**4+2**

Seat No.	

[4657]-40

S.E. (Electrical) (Second Semester) EXAMINATION, 2014

DIGITAL COMPUTATIONAL TECHNIQUES

(2008 PATTERN)

Time : Three Hours **Maximum Marks : 100**

***N.B.* :—** (*i*) Answer *three* questions from Section I and *three* questions from Section II.

(*ii*) Answers to the two Sections should be written in separate answer-books.

(*iii*) Neat diagrams must be drawn wherever necessary.

(*iv*) Figures to the right indicate full marks.

(*v*) Use of logarithmic tables, slide rule, Mollier charts, electronic pocket calculator and steam tables is allowed.

(*vi*) Assume suitable data, if necessary.

SECTION I

1. (*a*) Explain what is error and explain relative and absolute error with examples. [6]

(*b*) State Descartes' rule of sign and determine the no. of possible roots for the equation :

$$f(x) = x^4 - 5x^3 - x^2 + 15x - 5 = 0.$$ [6]

(*c*) Perform 2 iterations of Birge Vieta method to find the smallest positive root of the following equation. Take initial approximation $p_0 = 0.5$:

$$f(x) = x^4 - 3x^3 + 3x^2 - 3x + 2 = 0.$$ [6]

Or

2. (*a*) Explain the term significant digits. What is its importance ? [6]

(*b*) Using synthetic division, obtain $f(2)$, $f'(2)$, $f''(2)$ $f'''(2)$ for

$$f(x) = 2x^3 - 6x + 13 = 0.$$ [6]

(*c*) Explain floating point representation of numbers. What is the importance of normalized floating point representation ? [6]

3. (*a*) Using NR method, find the root of the function $f(x) = e^x - 3x^2$ to an accuracy of 5 digits. Take $x_0 = 1$. [8]

(*b*) With neat diagram, explain secant method for solution of transcendental equation and derive the formula. [8]

Or

4. (*a*) Explain bisection method to find root of an equation. [8]

(*b*) Using Regula-Falsi method, find a real root of the equation $x^4 - 11x + 8 = 0$ take $x_0 = 1$ and $x_1 = 2$. Show 4 iterations. [8]

5. (*a*) Explain Jacobi iterative method to solve linear simultaneous equations. [8]

(*b*) Using Gauss-Seidel method, solve the following system of linear simultaneous equations. Show 4 iterations : [8]

$$8x + 2y - 2z = 8$$
$$x - 8y + 3z = -4$$
$$2x + y + 9z = 12.$$

Or

6. (*a*) Explain Gauss Elimination method to solve linear simultaneous equations. [8]

(*b*) Find inverse of matrix A using Gauss-Jordan method : [8]

$$A = \begin{bmatrix} 2 & 2 & 0 \\ -2 & 1 & 1 \\ 3 & 0 & 1 \end{bmatrix}.$$

SECTION II

7. (*a*) Derive the formula for Newton's forward interpolation. [8]

(*b*) Given that :

x	f
5	380
6	–2
9	196
11	508

Compute $f(10)$ using Lagrange's Interpolation formula. [8]

Or

8. (*a*) Explain least square method to fit the data into a straight line. Fit a straight line to the following data considering y as a dependent variable : [8]

x	y
1	5
2	7
3	9
4	10
5	11

(*b*) Apply Bessel's interpolation formula to obtain $f(25)$ given that : [8]

x	y
20	2860
24	3167
28	3555
32	4112

9. (*a*) Solve the equation $\frac{dy}{dx} = \sqrt{x + y}$, with $x_0 = 0$, $y_0 = 1$ to find y at $x = 0.2$ and $h = 0.1$. [8]

(*b*) Explain Taylor series method for solution of ordinary differential equation. [8]

Or

10. (*a*) Given with $y(0) = 0$, $y(0.2) = 0.2027$, $y(0.4) = 0.4228$ and $y(0.6) = 0.6841$. Compute $y(0.8)$ using Milne Simpson method. [8]

(*b*) Use Euler's method to solve ordinary differential equation :

$$\frac{dy}{dx} = \frac{1}{2}y,\ y(0) = 1 \quad \text{and} \quad h = 0.1.$$

Find $y(0.5)$. [8]

11. (*a*) Derive Newton Cote's Quadrature formula for numerical integration. From the same derive Simpson's 1/3rd rule for numerical integration. [9]

(*b*) Evaluate the integral

$$\int_0^{1.0} e^x dx,$$

by Simpson's 3/8 rule and trapezoidal rule taking 7 ordinates. [9]

Or

12. (*a*) Derive an expression for finding 1st and 2nd order differentiation using Newton's backward difference interpolation formula for equal interval data points. Write down the formula for at 1st and 2nd order differentiation at $x = xn$. [10]

(*b*) From the following table find the value of $\frac{dy}{dx}$ and $\frac{d^2y}{dx^2}$ at the points $x = 1.0$: [8]

x	y
1	5.4680
1.1	5.6665
1.2	5.9264
1.3	6.2551
1.4	6.6601
1.5	7.1488