Code : 211304

B.Tech 3rd Semester Exam., 2017

NUMERICAL METHODS AND COMPUTATIONAL TECHNIQUE

Time : 3 hours *Full Marks* : 70

Instructions :

(i) The marks are indicated in the right-hand margin.

*(ii) There are **NINE** questions in this paper.*

*(iii) Attempt **FIVE** questions in all.*

*(iv) Question No. **1** is compulsory.*

1. Choose the correct option (any *seven*) : 2×7=14

(a) Which language is directly understood by the computer without translation program?

(i) Machine language

(ii) Assembly language

(iii) High-level language

(iv) None of the above

(b) In C language, a hexadecimal number is represented by writing

(i) x

(ii) xo

(iii) ox

(iv) h

(c) Which of the following languages is not supported by C++?

(i) Exception handling

(ii) Reflection

(iii) Operator overloading

(iv) Namespaces

(d) The Newton-Raphson method fails, when

(i) $f'(x)$ is negative

(ii) $f'(x)$ is too large

(iii) $f'(x)$ is zero

(iv) Never fails

(e) To ensure that the following system of equations

$$2x_1 + 7x_2 - 11x_3 = 6$$
$$x_1 + 2x_2 + x_3 = -5$$
$$7x_1 + 5x_2 + 2x_3 = 17$$

converges using Gauss-Seidel method, one can rewrite the above equations as

(i) $$\begin{bmatrix} 2 & 7 & -11 \\ 1 & 2 & 1 \\ 7 & 5 & 2 \end{bmatrix} \begin{bmatrix} x_1 \\ x_2 \\ x_3 \end{bmatrix} = \begin{bmatrix} 6 \\ -5 \\ 17 \end{bmatrix}$$

(ii) $$\begin{bmatrix} 7 & 5 & 2 \\ 1 & 2 & 1 \\ 2 & 7 & -11 \end{bmatrix} \begin{bmatrix} x_1 \\ x_2 \\ x_3 \end{bmatrix} = \begin{bmatrix} 17 \\ -5 \\ 6 \end{bmatrix}$$

(iii) $\begin{bmatrix} 7 & 5 & 2 \\ 1 & 2 & 1 \\ 2 & 7 & -11 \end{bmatrix} \begin{bmatrix} x_1 \\ x_2 \\ x_3 \end{bmatrix} = \begin{bmatrix} 6 \\ -5 \\ 17 \end{bmatrix}$

(iv) The equations cannot be rewritten in a form to ensure convergence

(f) If x_n is the nth iterate, then the Newton-Raphson formula is

(i) $x_n = x_{n-1} + \dfrac{f(x_n)}{f'(x_n)}$

(ii) $x_n = x_{n-1} - \dfrac{f(x_{n-1})}{f'(x_{n-1})}$

(iii) $x_n = x_{n-1} - \dfrac{f(x_{n+1})}{f'(x_{n+1})}$

(iv) $x_n = x_{n-1} - \dfrac{f(x_n)}{f'(x_n)}$

(g) A unique polynomial of degree _____ passes through $n+1$ data points.

(i) $n+1$

(ii) $n+1$ or less

(iii) n

(iv) n or less

(h) Given the two points $[a, f(a)]$, $[b, f(b)]$. The linear Lagrange's polynomial $f_1(x)$ that passes through these two points is given by

(i) $f_1(x) = \dfrac{x-b}{a-b} f(a) + \dfrac{x-a}{a-b} f(b)$

(ii) $f_1(x) = \dfrac{x}{b-a} f(a) + \dfrac{x}{b-a} f(b)$

(iii) $f_1(x) = f(a) + \dfrac{f(b)-f(a)}{b-a}(b-a)$

(iv) $f_1(x) = \dfrac{x-b}{a-b} f(a) + \dfrac{x-a}{b-a} f(b)$

(i) The error in the Simpson's one-third rule is of order

(i) h

(ii) h^2

(iii) h^3

(iv) h^4

(j) The error in the Runge-Kutta method is of order

(i) h

(ii) h^2

(iii) h^3

(iv) h^4

2. *(a)* Discuss the parts of an assembly language instruction. 7

(b) Write a flowchart to evaluate the sum of the series $1 + x + x^2 + x^3 + \cdots + x^n$. 7

3. *(a)* Write a C program to print all the Fibonacci numbers less than 50. 7

(b) Write a C program to determine the area of a triangle using the formula

$$\text{area} = \sqrt{s(s-a)(s-b)(s-c)}$$

where, $s = \dfrac{a+b+c}{2}$. 7

4. *(a)* Write a C++ program to check whether a number is prime or not. 7

(b) Write a C++ program to reverse any number n using recursion. 7

5. *(a)* Prove that Regula Falsi method has linear rate of convergence. 7

(b) Find a positive real root of $x - \cos x = 0$ by bisection method, correct up to four decimal places between 0 and 1. 7

6. *(a)* Find the inverse matrix of the matrix

$$A = \begin{bmatrix} 2 & 1 & 1 \\ 3 & 2 & 3 \\ 1 & 4 & 9 \end{bmatrix}$$

by Gaussian method. 7

(b) Find the solution, to three-decimal places, of the system

$$83x + 11y - 4z = 95$$
$$7x + 52y + 13z = 104$$
$$3x + 8y + 29z = 71$$

by using Jacobi method. 7

7. *(a)* A second-degree polynomial passes through the points (0, 1), (1, 3), (2, 7) and (3, 13). Find the polynomial. 7

(b) Following is the table of half-yearly premium of the policies maturing at different ages. Estimate the premium of policies maturing at age of 63 : 7

Age	45	50	55	60	65
Premium (in ₹)	114·84	96·16	83·32	74·48	68·48

8. *(a)* Describe the method of least square curve fitting. 7

(b) Evaluate

$$\int_0^1 \frac{1}{1+x}\,dx$$

by dividing the interval of integration into 8 equal parts. Hence find $\log_e 2$ approximately. 7

9. *(a)* Find the value of $y(1\cdot1)$ using Runge-Kutta method of fourth order, given that

$$\frac{dy}{dx} = y^2 + xy,\ y(1) = 1\cdot0$$

(Take, $h = 0\cdot05$) 7

(b) A boundary value problem is defined by

$$\frac{d^2y}{dx^2} - y = 0$$

where $y(0) = 0$ and $y(2) = 3\cdot62686$. Find the value of $y(1)$ by using finite difference method. (Take, $h = 0\cdot5$) 7

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