| BICS-033 |

DIPLOMA – VIEP – COMPUTER SCIENCE AND ENGINEERING (DCSVI)

Term-End Examination

December, 2017

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BICS-033 : NUMERICAL METHODS AND COMPUTATION

Time : 2 hours   *Maximum Marks : 70*

Note : *Attempt **five** questions in all. Question no. **1** is **compulsory**. All questions carry equal marks.*

1. Choose the correct answer from the given four alternatives.   *7×2=14*

    (a) If, for a real continuous function f(x), f(a) . f(b) < 0, then in the range of [a, b] for f(x) = 0 there is

    (i) one root

    (ii) undetermined number of roots

    (iii) no root

    (iv) at least one root

(b) Which of the following is a one-point method of root finding ?

    (i) Secant Method

    (ii) Regula-Falsi Method

    (iii) Newton-Raphson Method

    (iv) None of the above

(c) In Gauss Elimination method for solving a system of linear algebraic equations, triangulation leads to

    (i) Diagonal Matrix

    (ii) Lower Triangular Matrix

    (iii) Upper Triangular Matrix

    (iv) Singular Matrix

(d) Which of the following relations, between shift operator (E) and forward difference operator (Δ), is correct ?

    (i) $E = 1 + \Delta$

    (ii) $E = \dfrac{1}{\Delta}$

    (iii) $E = \Delta$

    (iv) $E = 1 + \dfrac{1}{\Delta}$

(e) Which of the following methods has the highest rate of convergence ?

(i) Newton-Raphson Method

(ii) Regula-Falsi Method

(iii) Secant Method

(iv) None of the above

(f) In general, the ratio of truncation error to that of round-off error is

(i) $2:1$

(ii) $1:1$

(iii) $1:2$

(iv) $1:3$

(g) Which of the following expressions is/are correct for line of regression of Y on X ?

(i) $X - \overline{X} = r\dfrac{\sigma_x}{\sigma_y}(Y - \overline{Y})$

(ii) $Y - \overline{Y} = r\dfrac{\sigma_y}{\sigma_x}(X - \overline{X})$

(iii) Both (i) and (ii)

(iv) None of the above

2. (a) Perform three iterations of the Newton-Raphson method, to obtain the approximate value of $(17)^{1/3}$, starting with the initial approximation $X_0 = 2$. 7

(b) Given the data :

x :	5	7	11	13	17
f(x) :	150	392	1452	2366	5202

Determine f(a) using Newton's Divided Difference method. 7

3. (a) Solve the following system of equations using Gauss-Seidel method : 7

$$20x + y - 2z = 17$$

$$3x + 20y - z = -18$$

$$2x - 3y + 20z = 25$$

(b) Evaluate

$$\int_1^2 \log x \, dx \quad \text{by Trapezoidal rule.} \qquad 7$$

4. **(a)** Use Runge-Kutta method to find y(0·2) for the equation

$$\frac{dy}{dx} = \frac{y - x}{y + x} \; ; y(0) = 1.$$

Take h = 0·2.   7

(b) A table of x vs f(x) is given below :

x   :   1·5   3   6

f(x) :   − 0·25   2   20

Find the value of f(x) at x = 4 using Lagrange's interpolation formula.   7

5. **(a)** Find the value of $\displaystyle\int_{0}^{0·6} e^x \, dx$, taking n = 6,

using Simpson's 1/3$^{\text{rd}}$ rule.   7

(b) Find the approximate value of the root of the equation $x^3 + x - 1 = 0$, near x = 1 using Regula-Falsi method.   7

6. **(a)** Perform the following :

(i) Evaluate $\dfrac{\Delta^2}{E}(x^3)$, where E is shift operator, Δ is forward difference operator. $3\frac{1}{2}$

(ii) Prove that $\Delta \nabla = \Delta - \nabla$, where Δ and ∇ are forward and backward difference operators, respectively. $3\frac{1}{2}$

(b) Solve the following system of equations
     using Gauss Elimination method :   7
     $$2x + y + z = 10$$
     $$3x + 2y + 3z = 18$$
     $$x + 4y + 9z = 16$$

7. (a) Fit a straight line to the following data :

x :	0	1	2	3	4
y :	1	1·8	3·3	4·5	6·3

Determine its slope and intercept.   7

(b) For the data given below :

(X) Quantity produced (Tons)	(Y) Cost of Production (Thousand dollars)
1	2
2	3
4	4
8	7
6	6
5	5
8	8
9	8
7	6

Perform the following :   7

(i) Determine the regression equation
     when X is a dependent variable and
     Y is an independent variable.

(ii) Use the regression equation to
     determine Y when X = 4.

8. Explain any *four* of the following : $4 \times 3\frac{1}{2} = 14$

    (a)   Pitfalls of Gauss Elimination method

    (b)   Bisection method

    (c)   Taylor Series method for solving Ordinary Differential Equations

    (d)   Golden Section Search

    (e)   Types of Errors

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