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BICS-033

DIPLOMA – VIEP – COMPUTER SCIENCE AND ENGINEERING (DCSVI)

Term-End Examination

00353

December, 2016

BICS-033 : NUMERICAL METHODS AND COMPUTATION

Time : 2 hours *Maximum Marks : 70*

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

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

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

(i) Newton-Raphson Method

(ii) Secant Method

(iii) Regula-Falsi Method

(iv) None of the above

(b) In Bisection Method, if the function f(x) has a root in the interval [a, b], then the polarity of f(x) at point a and b i.e. f(a) and f(b) should be

(i) same

(ii) opposite

(iii) both positive only

(iv) both negative only

(c) Lagrange's interpolating polynomial $P_n(x)$ for number of nodal points (n) equal to one i.e. $P_1(x)$ is given by

(i) $l_0 f_0 + l_1 f_1$

(ii) $l_1 f_0 + l_0 f_1$

(iii) $(l_1 - l_0)(f_1 - f_0)$

(iv) All of the above

(d) The relation between finite difference operator (E) and averaging operator (μ) is

(i) $\frac{E^{1/2} + E^{-1/2}}{2}$

(ii) $\frac{E^{1/2} - E^{-1/2}}{2}$

(iii) $\frac{E^{1} + E^{-1}}{2}$

(iv) None of the above

(e) $$\int_{x_0}^{x_n} y\,dx = \frac{h}{2}\,[y_0 + 2\,(y_1 + y_2 + \ldots + y_{n-1}) + y_n]$$

is the formula for numerical integration by

(i) Trapezoidal Rule

(ii) Simpson's 1/3 rule

(iii) Simpson's 3/8 rule

(iv) None of the above

(f) In divided difference table, if n^{th} order divided difference is found to be constant, then the degree of interpolating polynomial is

(i) n

(ii) n + 1

(iii) n − 1

(iv) None of the above

(g) The point through which the lines of regression i.e.

$$y - \bar{y} = r\frac{\sigma_y}{\sigma_x}(x - \bar{x}) \text{ and } x - \bar{x} = r\frac{\sigma_x}{\sigma_y}(y - \bar{y})$$

pass, is given by

(i) $(\bar{x}, \bar{y})$

(ii) (x, y)

(iii) $(\bar{x}^2, \bar{y}^2)$

(iv) None of the above

2. (a) Find the root of the equation $x^3 - 9x + 1 = 0$, correct to three significant figures using Bisection method. 7

(b) Use Newton-Raphson method to find the root of the equation $x^3 - 6x + 4 = 0$, correct to two decimal places. 7

3. (a) Solve the following system of equations, by using Gauss Elimination method : 7

$$2x + 2y + 4z = 18$$

$$x + 3y + 2z = 13$$

$$3x + y + 3z = 14$$

(b) Solve the following system of equations, by the Gauss-Seidel method. Calculate the errors after 5^{th} iteration. 7

$$x + y - z = 0$$

$$-x + 3y = 2$$

$$x - 2z = -3$$

4. (a) Evaluate any ***two*** of the following : 7

(i) $\Delta^2 e^x$

(ii) $\Delta \sin x$

(iii) $\Delta \log x$

(b) Find Lagrange's interpolating polynomial, for the discrete data given below : 7

i	=	0	1	2
x_i	=	0	1	3
f_i	=	1	3	55

5. (a) Develop Difference table and use Newton's formula, to find $\frac{dy}{dx}$ and $\frac{d^2y}{dx^2}$ at $x = 0$, where $y = f(x)$ is given by the following values : 7

x :	0·00	0·05	0·10	0·15	0·20
y :	0·00000	0·10017	0·20134	0·30452	0·41075

(b) Apply Trapezoidal rule to calculate $\int_0^1 \frac{x}{1+x}\,dx$, correct up to three significant figures. Take six intervals. 7

6. (a) Use Euler's method to solve the equation $\frac{dy}{dx} = 1 - y$, given initial condition is $x = 0$, $y = 0$. 7

(b) Use Runge-Kutta method to approximate $\frac{dy}{dx} = x + y$, when $h = 0{\cdot}1$ and $y = 1$ at $x = 0$. 7

7. (a) Apply the method of Least Squares to find the polynomial of second degree, that fits in to the data given below : 7

x :	0	1·0	2·0
y :	1·0	6·0	17·0

(b) The following data is given for the marks in subjects A and B, in a certain examination :

	A	B
Mean Marks	36	85
Standard Deviation	11	8

Given the coefficient of correlation between A and B = ± 0·66.

Perform the following tasks : 7

(i) Determine the two equations of regression.

(ii) Calculate the expected marks in A, corresponding to 75 marks obtained in B.

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

(a) Initial Value Problem

(b) Taylor Series Method for solving ODE (Ordinary Differential Equation)

(c) Linear Programming and its Application

(d) Types of Errors

(e) Brent's Method