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MCA(6/7)/DX **5520-R**

COMPUTER ORIENTED NUMERICAL AND STATISTICAL METHODS

Paper : MCA–105

Time : Three Hours] [Maximum Marks : 80

Note : Attempt *five* questions in all. Question No. 1 is compulsory. Select *one* question from each unit. Non-programmable calculator can be used.

(Compulsory Question)

1. Attempt any *eight* of the following :

(a) If 0.333 is the approximate value of 1/3, then percentage error is

(i) 0.99

(ii) 9.9

(iii) 0.099

(iv) 0.0099.

(b) What is the maximum number of Negative roots of the equation ?

$f(x) = 5x^5 - 6x^3 + 4x^2 - 7 = 0$

(i) 3

(ii) 2

(iii) 5

(iv) 4.

(c) The convergence of which of the following is of second order ?

(i) Bisection method

(ii) False position method

(iii) Newton-Raphson's method

(iv) Iterative method of form $x = \Phi(x)$.

(d) Which of the following is *false* ?

(i) $\Delta = \delta E^{-1/2}$

(ii) $\delta^2 = \Delta^2/(1+\Delta)$

(iii) $E = \{\delta/2 + (1+\delta^2/4)^{1/2}\}^2$

(iv) $\Delta = \mu\delta + \delta^2/2$.

(e) The number of normal equations for fitting a parabola to the given set of data using method of least squares is

(i) 2

(ii) 4

(iii) 3

(iv) 1.

(f) When 537.261 is rounded to four significant digits then the relative error is

(i) 0.0007259

(ii) 0.0000729

(iii) 0.00007295

(iv) 0.00007259.

(g) The value of $f(2)$ of a function $y = f(x)$ for which $f(0) = 8, f(1) = 11, f(4) = 68, f(5) = 123$ is

(i) 28

(ii) 18

(iii) 118

(iv) 11.

(h) Statement-1: The lowest value of Chi-square is zero and highest value is infinity.

Statement-2 : In F-test, the value of F can be positive, zero or negative.

(i) Statement-1 and Statement-2 both are false

(ii) Statement-1 is false and Statement-2 is true

(iii) Statement-1 is true and Statement-2 is false

(iv) Statement-1 and Statement-2 both are true.

(i) In a difference table that contains an erroneous entry, the algebraic sum of the errors in any difference column is

(i) zero

(ii) thrice the error

(iii) the error itself

(iv) twice the error. 3×8=24

UNIT–I

2. (a) (i) Define the terms 'Error', 'Relative error' and 'Inherent error'. 3

(ii) Mention various sources of Errors. 2

(iii) Round-off and truncate the following numbers correct to four significant figures : 2

63.8543 0.0063945 83615 0.090038

(b) Find a root of

$$3x - \cos x = 1$$

by Newton-Raphson's method correct to three decimal places. 7

3. (a) Find the smallest positive root of the equation

$$x^3 - 5x + 1 = 0$$

correct to two decimal places by the False position method. 7

(b) Write short note on any *one* of the following :

(i) Error in number representation and computation.

(ii) Arithmetic operations with normalized floating point numbers and their consequences. 7

UNIT–II

4. (a) Explain Euler's method for finding the solution of ordinary differential equations. 7

(b) Solve the following system of simultaneous by Gauss elimination method :

$$x_1 + x_2 + x_3 = 6$$
$$3x_1 + 3x_2 + 4x_3 = 20$$
$$2x_1 + x_2 + 3x_3 = 13$$

Use complete pivoting wherever needed. 7

5. (a) Solve the following ordinary differential equation using Taylor's series method :

$$(dy/dx) = x + xy$$

Start with $x = 1$, $y = 0$. Find the value of y for $x = 1.2$ taking $h = 0.1$. 7

(b) Find the value of

$$I = \int_0^1 x^2(1+x^2)^{-1}dx$$

using

(i) Trapezoidal rule

(ii) Simpson's one-third rule by dividing the interval [0, 1] into 4 sub-intervals. 7

UNIT–III

6. (a) Derive an expression for Lagrange's interpolation formula. Apply it to find the value of $f(5.2)$ for the table of values : 7

x	4	6	8	10
$f(x)$	19	40	79	142

(b) For the data given below, find the equation of the best fitting exponential curve of the form $y = ae^{bx}$. 7

x	1	2	3	4	5	6
y	1.6	4.5	13.8	40.2	125	300

7. (a) What observations you make of the effect of an error in an entry in a difference table. 7

(b) Given data below, find the equation of the best fit curve of the form $y = ax^2 + bx + c$. 7

x	1	2	3	4	5	6
y	1.6	4.5	13.8	40.2	125	300

UNIT–IV

8. To study the performance of three detergents and three different water temperatures, the following whiteness readings were obtained with specially designed equipment : 14

Water Temperature	Detergent–A	Detergent–B	Detergent–C
Cold Water	57	55	67
Warm Water	49	52	68
Hot Water	54	46	58

Perform a two-way analysis of variance using 5% level of significance. Given F = 6.94.

9. Write short notes on any *two* of the following :

(i) *t*-test.

(ii) Components and analysis of Time Series.

(iii) Two-way classification. 7×2=14
