(i) Printed Pages : 4 Roll No. .....

(ii) Questions : 9 Sub. Code : 0 8 8 2

Exam. Code : 0 0 2 1

B.C.A. 3rd Semester

1125

COMPUTER BASED NUMERICAL METHODS

Paper—BCA-301

Time Allowed : Three Hours] **[Maximum Marks : 90**

Note :— Attempt **five** questions in all, including Q. **9** in Section-E, which is compulsory and taking **one** each from Sections A, B, C & D.

SECTION—A

1. (a) What do you mean by normalized floating point number ? What are the advantages of normalizing floating-point numbers ? For $x = 0.4845$ and $y = 0.4800$, calculate the value of $\frac{x^2 - y^2}{x + y}$ by using normalized floating point arithmetic. Compare the result with the value of $(x - y)$. Indicate the error in the former.

(b) Explain primary sources of errors in numerical computations. What are various measures that can be taken to eliminate or reduce such errors ? 9,9

2. (a) Given that α is the only root of the equation $x^3 - x^2 - 6 = 0$:

(i) Show that $2.2 < \alpha < 2.3$.

(ii) Taking 2.2 as first approximation to α, apply Newton-Raphson procedure once to $f(x) = x^3 - x^2 - 6$ to obtain a second approximation to α, giving your answer to 3-decimal places.

(iii) Use Bisection method once on the interval [2.2, 2.3] to find another approximation to α, giving your answer to 3-decimal places.

(b) Perform 2 iterations of the Birge-Vieta method to find the smallest positive root of the equation $x^4 - 3x^3 + 3x^2 - 3x + 2 = 0$. Use the initial approximation $p_0 = 0.5$. 9,9

SECTION—B

3. (a) Using Lagrange's interpolation formula, find y(2) for the following data :

x	1	3	4	6
y	–3	9	30	132

(b) Find the approximate value of $I = \int_0^1 \frac{dx}{1+x}$ using (i) Trapezoidal Rule and (ii) Simpson's Rule. 9,9

4. (a) Solve the following system of linear equations by Gauss-Seidal's method correct up to three decimal places :

$3x + y + z = 3$; $2x + y + 5z = 5$; $x + 4y + z = 2$.

(b) Using Gauss-Jordan method, find the inverse of the following matrix :

$$\begin{bmatrix} 1 & 2 & 3 \\ 3 & 2 & 1 \\ 2 & 1 & 3 \end{bmatrix}.$$ 9,9

SECTION—C

5. (a) A medical research team studied the ages of patients who had strokes caused by stress. The ages of 34 patients who suffered stress strokes were as follows :

29 30 36 41 45 50 57 61 28 50 36 58 60 38 36 47 40

32 58 46 61 40 55 32 61 56 45 46 62 36 38 40 50 27

Construct a frequency distribution for these ages. Use 8 classes beginning with a lower class limit of 25.

(b) Find the missing frequency M for the following distribution whose mean is 15 :

x	5	10	15	20	25
f	6	M	6	10	5

(c) Find the median of the data : 19, 25, 59, 48, 35, 37, 30, 32 and 51. If 25 is replaced by 52, then what will be the new median ? 6,6,6

6. Explain the following in Statistics with examples :

(a) Dispersion and its measures

(b) Skewness and Kurtosis and their measures. 9,9

SECTION—D

7. Fit a parabola $Y = a + bx + cx^2$ (by the method of least squares) to the following data :

x	1	2	3	4	5
y	8	10	15	21	30

18

8. What is regression analysis ? For 10 observations on price (x) and supply (y), the following data were obtained in appropriate units :

$\Sigma x = 130, \Sigma y = 220, \Sigma x^2 = 2288, \Sigma y^2 = 5506$ and $\Sigma xy = 3467$.

Obtain two lines of regression and estimate the supply when the price is 16 units. 18

SECTION—E (Compulsory Question)

9. Do the following :

(a) An approximate value of π is given by 3.1428571 and its true value is 3.1415926. Find the absolute and relative errors.

(b) Define order of convergence of iterative methods. What is order of convergence of false-position method ?

(c) Define the meaning of approximate solution to the ordinary linear differential equation. Name any two methods for solving this.

(d) What do you mean by ill-conditioned system of linear equations ? Explain.

(e) Define the concept of pivoting in the context of finding a solution to the system of simultaneous linear equations.

(f) If the regression coefficients are 0.8 and 0.2, what would be the value of Correlation Coefficient ?

(g) What is correlation analysis between two variables ?

(h) How is Mode different from Harmonic Mean ?

(i) Define moments in Statistics. $9 \times 2 = 18$