

NUMERICAL METHODS

Full Marks - 70

Time - 3 Hours

*The figures in the right hand margin indicate
full marks for the questions.*

*Answer Question No. 1 which is compulsory and
any five from the rest.*

1. Answer the following; 2×10
- (a) Convert the decimal number 2.125 into a floating point binary number in normalized form.
 - (b) Convert the binary number $(.11)_2$ into a decimal fraction.

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- (c) Use 4-digit floating point arithmetic to find the product of $1/3$ and $2/7$.
- (d) Use method of iteration to find the value of $\sqrt{3}$ to three significant digits.
- (e) Use the bisection method to find the positive root of $x^2 - 2$, correct upto three digits.
- (f) Solve the following system of equations by Gauss elimination method :

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

$$x + y = 3$$

$$x + z = 4$$

- (g) Show that :

$$\mu^2 = 1 + \frac{1}{4} \delta^2$$

where μ and δ are the average and central difference operator respectively.

- (h) Find the eigenvalues of :

$$A = \begin{pmatrix} -1 & 2 \\ 2 & 2 \end{pmatrix}$$

- (i) Write a general formula for Newton's 3/8-th rule for numerical integration.
- (j) Solve the following system of equations by matrix inversion :

$$x - 2y = 4$$

$$2x + y = 3$$

2. (a) Convert $(.614)_8$ to decimal form. 3
- (b) Convert $(A8C)_8$ to binary form. 3
- (c) Using 3-digit arithmetic compute the roots of : 4

$$x^2 - 60x + 2 = 0$$

3. (a) Using fixed point iteration method, solve the following equation correct to four significant figures : 5

$$\sin^2 x = x^2 - 1$$

- (b) Solve the equation : 5

$$x^4 + x^2 - 80 = 0$$

by the false position method.

4. (a) Use Gauss - Seidel method to solve the system of equations : 5

$$3x + 8y + 29z = 71$$

$$83x + 11y - 4z = 95$$

$$7x + 52y + 13z = 104$$

- (b) Use Gauss-Jordan method to solve the system of equations : 5

$$10x + 2y + z = 9$$

$$2x + 20y - 2z = -44$$

$$-2x + 3y + 10z = 22$$

5. (a) The curve $y = ce^{bx}$ is fitted to the following data : 5

x	1.0	2.0	3.0	4.0	5.0	6.0
y	1.5	4.6	13.9	40.1	125.1	299.5

Find the best values of c and b.

- (b) Find the values of a, b, c, so that $y = a + bx + cx^2$ is the best fit for the following data : 5

x	0	1	2	3	4
y	1	0	3	10	21

6. (a) From the following table find the approximate value of $\frac{dy}{dx}$ at $x = 6$: 5

x	4.5	5.0	5.5	6.0	6.5	7.0	7.5
y	9.69	12.90	16.71	21.18	26.37	32.34	39.15

- (b) Find the value of $\int_3^7 x^2 \log x dx$ using Simpson's 3/8th rule. 5

7. (a) Use Euler's method to solve the following differential equation : 5

$$\frac{dy}{dx} = x + y, \quad y(0) = 0$$

Choose $h = 0.2$ and compute $y(0.4)$ and $y(0.6)$.

- (b) Use Runge-Kutta fourth order method to solve

$$10 \frac{dy}{dx} = x^2 + y^2, \quad y(0) = 1$$

for the range $0.5 \leq x \leq 1.0$ 5

8. (a) Find the eigenvalues and eigenvectors of the following matrix : 5

$$\begin{pmatrix} 3 & 5 & 3 \\ 0 & 4 & 6 \\ 0 & 0 & 1 \end{pmatrix}$$

- (b) Calculate the inverse of the matrix : 5

$$\begin{pmatrix} 1.5 & -1.5 & 0.5 \\ -1.5 & 0.5 & 0.5 \\ 0.5 & 0.5 & -0.5 \end{pmatrix}$$

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