CBCS SCHEME

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17AE753

Seventh Semester B.E. Degree Examination, Jan./Feb. 2021
Numerical Methods

Time: 3 hrs. Max. Marks: 100

Note: ***Answer any FIVE full questions, choosing ONE full question from each module.***

Module-1

1 a. Define rounding errors and truncation errors. Find the absolute error if the number $x = 0.00545828$ is :
i) Truncated to three decimal digits
ii) Rounded off to three decimal digits. **(10 Marks)**

b. Using Gaussian elimination method, solve the equations :
$x + 2y + 3z - u = 10$
$2x + 3y - 3z - u = 1$
$2x - y + 2z + 3u = 7$ and
$3x + 2y - 4z + 3u = 2$. **(10 Marks)**

OR

2 a. Apply Gauss-Jordan method to solve the equations :
$x + y + z = 9$
$2x - 3y + 4z = 13$ and
$3x + 4y + 5z = 40$. **(10 Marks)**

b. Find an LU decomposition for the following system of equations :
$x + y + z = 1$
$3x + y - 3z = 5$
$x - 2y - 5z = 10$. **(10 Marks)**

Module-2

3 a. Find the polynomial f(x) by using Lagrange's formula and hence find f(3) for :

x	0	1	2	5
f(x)	2	3	12	147

(10 Marks)

b. Find the largest eigen value and the corresponding eigen vector of the matrix :

$$\begin{bmatrix} 2 & -1 & 0 \\ -1 & 2 & -1 \\ 0 & -1 & 2 \end{bmatrix}$$ using power method. Take $[1, 0, 0,]^T$ as initial eigen vector. **(10 Marks)**

OR

4 a. For the following data, calculate the differences and obtain the forward and backward difference polynomials. Interpolate at x = 0.25 and x = 0.35.

x	0.1	0.2	0.3	0.4	0.5
f(x)	1.40	1.56	1.76	2.00	2.28

(10 Marks)

b. Using the Householder's transformation reduce the matrix :

$$A = \begin{bmatrix} 2 & 1 & 1 \\ 1 & 1 & 0 \\ 1 & 0 & 1 \end{bmatrix}$$ into a tridiagonal matrix. **(10 Marks)**

Module-3

5 a. Evaluate $\int_0^6 \frac{dx}{1+x^2}$ by using trapezoidal rule and Simpson's $\frac{3}{8}^{th}$ rule. **(08 Marks)**

b. Using trapezoidal rule, evaluate $I = \int_1^2 \int_1^2 \frac{dxdy}{x+y}$, taking four sub-intervals. **(06 Marks)**

c. Use Simpson's $\frac{1}{3}^{rd}$ rule to find $\int_0^{0.6} e^{-x^2} dx$ by taking seven ordinates. **(06 Marks)**

OR

6 a. Use trapezoidal rule to estimate the integral $\int_0^2 e^{x^2} dx$ taking the Ten intervals. **(06 Marks)**

b. Compute the value of $\int_{0.2}^{1.4} (\sin x - \log x + e^x) dx$ using Simpson's $\frac{3}{8}^{th}$ rule. **(06 Marks)**

c. Evaluate $\int_0^2 \frac{x^2+2x+1}{1+(x+1)^4}$ by Gaussian 3 – point formula. **(08 Marks)**

Module-4

7 a. Using Newton's divided differences formula, evaluate f(8) an f(15) given :

x	4	5	7	10	11	13
y = f(x)	48	100	294	900	1210	2028

(10 Marks)

b. Fit a parabola of the form $y = a + bx + cx^2$ to the following data :

x	1	2	3	4	5	6	7	8	9
y	2	6	7	8	10	11	11	10	9

Estimate y when x = 4.5. **(10 Marks)**

OR

8 a. Obtain the cubic Spline for the following data:

x	0	1	2	3
y	2	–6	–8	2

(10 Marks)

b. Using the method of least squares, fit the curve $y = ax^2 + \frac{b}{x}$ to the following data :

x	1	2	3	4
y	–1.51	0.99	8.88	7.66

(10 Marks)

Module-5

9 a. Find the root of the equation $xe^x = \cos x$ using the secant method corrects to four decimal places. (10 Marks)

b. Apply Muller's method to find the root of the equation $\cos x = xe^x$ which lies between 0 and 1. (10 Marks)

OR

10 a. Using steepest descent method minimize $f(x_1, x_2) = x_1 - x_2 + 2x_1^2 + 2x_1x_2 + x_2^2$ starting from the point $x_1 = \begin{Bmatrix} 0 \\ 0 \end{Bmatrix}$. (10 Marks)

b. Find the positive root of $x^4 - x = 10$ correct to three decimal places, using Newton-Raphson method. (10 Marks)

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