

I B.Tech I Semester Supplementary Examinations, Feb/Mar 2014
MATHEMATICAL METHODS
 (Common to Civil Engineering, Electrical & Electronics Engineering,
 Computer Science & Engineering, Electronics & Instrumentation
 Engineering, Aeronautical Engineering, Bio-Technology and Automobile
 Engineering)

Time: 3 hours

Max Marks: 75

Answer any FIVE Questions
 All Questions carry equal marks

- (a) Find value of K if rank of A is 3, if $A = \begin{bmatrix} 1 & 2 & -1 & 3 \\ 4 & 1 & 2 & 1 \\ 3 & -1 & 1 & 2 \\ 1 & 2 & 0 & K \end{bmatrix}$

(b) Solve by Gauss elimination method $10x+y+z=12$; $2x+10y+z=13$; $x+y+5z=7$; [7+8]
- (a) Prove that the Eigen values of a triangular matrix are diagonal elements of the matrix

(b) Find eigen vectors of $B=2A^2 - A + 3I$ when $A = \begin{bmatrix} 8 & -4 \\ 2 & 2 \end{bmatrix}$ [5+10]
- Define the nature of the quadratic form. Identify the nature of the quadratic form $x_1^2 + 4x_2^2 + x_3^2 - 4x_1x_2 + 2x_1x_3 - 4x_2x_3$ [15]
- (a) Evaluate the real root of the equation $x^2 - 9x + 1 = 0$ by Bisection method

(b) Compute the real root of the equation $x^3 - x^2 - 1 = 0$ by the method of false position. [8+7]
- (a) Compute the approximate value of e^{-x} when $x=1.7489$ from the following table using the Gauss forward interpolation formula.

x	1.72	1.73	1.74	1.75	1.76	1.77	1.78
e^{-x}	0.179066	0.177284	0.175520	0.173774	0.172045	0.170333	0.168638

- (b) Find the Parabola passing through the points (0, 1), (1,3) and (3,5), Using Lagrange's Interpolation formula. [8+7]
- (a) Find the first and second derivatives of the function tabulated below at the point $x = 1.5$.

X	1.5	2.0	2.5	3.0	3.5	4.0
Y	3.375	7.0	13.625	24.0	38.875	59.0

- (b) Evaluate $\int_{0.6}^{2.0} y \, dx$ using Trapezoidal, Simpsons 1/3 and Simpsons 3/8 rules.

X	0.6	0.8	1.0	1.2	1.4	1.6	1.8	2.0
y	1.23	1.58	2.03	4.32	6.25	8.38	10.23	12.45

[8+7]

7. (a) Solve $y' = 3x + y/2$, $y(0) = 1$ by Taylor series method and hence find $y(0.1)$, $y(0.2)$
- (b) Solve the equation $\frac{dy}{dx} = xy + 1$, $y(0) = 1$ by Picard's method and hence find $y(0.1)$ [8+7]
8. (a) Fit a least square parabola $y = a + bx + cx^2$ to the following data

x	-3	-2	-1	0	1	2	3
y	4.63	2.11	0.67	0.09	0.63	2.15	4.58

- (b) Fit a straight line of the form $y = a + bx$ to the following data

x	1	2	4	5	6	8	9
y	2	5	7	10	12	15	19

[7+8]

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1. (a) Find rank of $A = \begin{bmatrix} 2 & 1 & 3 & 1 \\ 0 & 1 & 2 & -2 \\ 4 & 0 & 2 & 6 \end{bmatrix}$ using Normal Form
 (b) Solve by Gauss seidal method $x+4y+15z=24$, $x+12y+z=26$, $10x+y-2z=10$ [7+8]
2. (a) Find Eigen Vectors of $\begin{bmatrix} 5 & 4 \\ 1 & 2 \end{bmatrix}$
 (b) If λ is an Eigen value of A then prove that $\frac{|A|}{\lambda}$ is an Eigen value of Adj. A [7+8]
3. Find the rank, signature and index of the quadratic form $2x_1^2 + x_2^2 - 3x_3^2 + 12x_1x_2 - 4x_1x_3 - 8x_2x_3$ by reducing it to normal form .Also write the linear transformation which brings about the normal reduction [15]
4. (a) Using Newton- Raphson's method compute $\sqrt{41}$ correct to four decimal places.
 (b) Find a real root of the equation $e^x = x+2$ in the interval $[1, 1.4]$ using bisection method. [8+7]
5. (a) Apply Gauss backward interpolation formula to find y when x = 26 form the following table:

x	20	24	28	32
Y	2854	3162	3544	3992

 (b) Using Lagrange's interpolation formula, find the value of y when x = 2 from the following data:

x	1	3	4	6
y	4	40	85	259

 [8+7]
6. (a) Find the value of $f'(x)$ at $x=0.01$ from the following table using Bessel's formula.

x	0.01	0.02	0.03	0.04	0.05	0.06
f(x)	0.1023	0.1047	0.1071	0.1096	0.1122	0.1148

 (b) Find the area bounded by the curve $y = e^{-\frac{x^2}{2}}$, x - axis between $x = 0$ and $x = 3$ by using Simpson's 3/8 rule. [8+7]

7. (a) Solve $y' = x - y$, $y(0) = 1$ by modified Euler's method and find $y(0.1)$, $y(0.2)$
(b) Apply third order R-K method to find $y(0.25)$ where $y' = 1 + xy$, $y(0) = 1$ [8+7]

8. (a) Fit a power curve $y = ax^b$ to the following data

x	5	6	7	8	9	10
y	133	55	23	7	2	2

- (b) Fit a curve of the type $y = a + bx + cx^2$ to the following data

x	0	1	2	3	4	5	6
y	14	18	23	29	36	40	46

[7+8]

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1. (a) Find rank using Normal Form $A = \begin{bmatrix} 1 & 2 & 3 & 0 \\ 2 & 4 & 3 & 2 \\ 3 & 2 & 1 & 3 \\ 6 & 8 & 7 & 5 \end{bmatrix}$
 (b) Solve Homogeneous equations $x_1 + 2x_2 + 3x_3 = 0$, $2x_1 + 3x_2 + x_3 = 0$,
 $4x_1 + 5x_2 + 4x_3 = 0$, $x_1 + x_2 - 2x_3 = 0$ [7+8]
 2. (a) Find Eigen values and Eigen vectors of $\begin{bmatrix} 8 & 4 \\ 2 & 2 \end{bmatrix}$
 (b) If λ is an Eigen value of A then prove that λ^{-1} is an Eigen value of A^{-1} if it exists [7+8]
 3. Find the rank, signature and index of the quadratic form $2x_1^2 + x_2^2 - 3x_3^2 + 12x_1x_2 - 4x_1x_3 - 8x_2x_3$ by reducing it to normal form. Also write the linear transformation which brings about the normal reduction [15]
 4. (a) Find out square root of 25 given $x_0 = 2$, $x_1 = 7$ using Bisection method
 (b) Solve the equation $x^3 + 2x^2 + 10x = 20$ by iteration method [8+7]
 5. (a) Use gauss forward interpolation formula to estimate $f(32)$, given $f(25) = 0.2707$, $f(30) = 0.3027$, $f(35) = 0.3386$, $f(40) = 0.3794$.
 (b) Find the interpolating polynomial $f(x)$ from the table given below. [8+7]
- | | | | | |
|------|---|---|----|----|
| x | 0 | 1 | 4 | 5 |
| f(x) | 4 | 3 | 24 | 39 |
6. (a) Using the table below, find $f'(0)$
- | | | | | | | |
|------|---|----|----|-----|-----|-----|
| x | 0 | 2 | 3 | 4 | 7 | 9 |
| f(x) | 4 | 26 | 58 | 110 | 460 | 920 |
- (b) Evaluate $\int_0^1 \sqrt{1+x^3} dx$ taking $h = 0.1$ using Simpson's $3/8^{th}$ rule. [8+7]
 7. (a) Solve $y' = x + y$ subject to the condition $y(0) = 1$ by Taylor series method and hence find $y(0.2)$, $y(0.4)$
 (b) Solve $y' = x - y$, $y(0) = 1$ by Picard's method and hence find y at $x = 0.2$ [8+7]

8. (a) Fit a curve of the type $y = a + bx + cx^2$ to the following data

x	10	15	20	25	30	35
y	35.3	32.4	29.2	26.1	23.2	20.5

- (b) Fit a curve of the type $y = ab^x$ to the following data by the method of least squares

x	1	2	5	10	20	30	40	50
Y	98.2	91.7	81.3	64	36.4	32.6	7.1	11.3

[7+8]

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1. (a) Find rank of matrix using Normal form $A = \begin{bmatrix} 1 & 2 & 3 & -2 \\ 2 & -2 & 1 & 3 \\ 3 & 0 & 4 & 1 \end{bmatrix}$
 (b) Solve system of equations, if consistent $2x-y-z=2$, $x+2y+z=2$, $4x-7y-5z=2$ [7+8]
2. Verify Cayley - Hamilton theorem and find A^{-1} if $A = \begin{bmatrix} 2 & -1 & 2 \\ -1 & 2 & -1 \\ 1 & -1 & 2 \end{bmatrix}$ [15]
3. Reduce the quadratic form to canonical form by an orthogonal reduction and state the nature of the quadratic form $5x^2 + 26y^2 + 6xy + 4yz + 14zx$. Also find its rank signature and index. [15]
4. (a) Using Newton-Raphson's method find the square root of a number and hence find the square root of 24.
 (b) Find a real root of the equation $x=e^{-x}$, using Bisection method [8+7]
5. (a) Apply Gauss's forward formula to find $f(x)$ at $x = 3.5$ from the table below.

X	2	3	4	5
F(x)	2.626	3.454	4.784	6.986

 (b) Find $\sin 45^\circ$ using Gauss's backward interpolation formula given that $\sin 20^\circ = 0.342$, $\sin 30^\circ = 0.502$, $\sin 40^\circ = 0.642$, $\sin 50^\circ = 0.766$, $\sin 60^\circ = 0.866$, $\sin 70^\circ = 0.939$, $\sin 80^\circ = 0.984$. [8+7]
6. (a) Given the following table. Find $f'(1)$ and $f''(3)$

x	0	2	4	6	8
f(x)	7	13	43	145	367

 (b) Find approximate value of $\int_1^{1.04} f(x)dx$ using the following table.

x	1	1.01	1.02	1.03	1.04
f(x)	3.953	4.066	4.182	4.300	4.421

 [8+7]
7. (a) Given that $\frac{dy}{dx} = \frac{(1+x^2)y^2}{2}$, $y(0)=1$, $y(0.1)=1.06$, $y(0.2)=1.12$, $y(0.3)=1.21$ then evaluate $y(0.4)$ by Milne's predictor corrector method

- (b) Solve $\frac{dy}{dx} = \frac{y-x}{y+x}$, $y(0) = 1$ estimate $y(0.1)$ and $y(0.2)$ using Euler's method in 5 steps [8+7]

8. (a) Fit a least square parabola $y = a + bx + cx^2$ to the following data

x	1	2	3	4	5
y	5	12	25	44	69

- (b) Fit a straight line of the form $y = a + bx$ to the following data

x	1	2	3	4	5
y	5	12	26	60	90

[8+7]

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