$\boxed{\textbf{Set No. 1}}$

I B.Tech II Semester Supplementary Examinations, August 2014
MATHEMATICAL METHODS
(Common to Mechanical Engineering, Electronics & Communication
Engineering, Chemical Engineering, Bio-Medical Engineering, Information
Technology, Electronics & Computer Engineering, Mining and Petroliem
Technology)

Time: 3 hours   Max Marks: 75

Answer any FIVE Questions
All Questions carry equal marks
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1. (a) Find rank of $A = \begin{bmatrix} 2 & 1 & 3 & 1 \\ 0 & 1 & 2 & -2 \\ 4 & 0 & 2 & 6 \end{bmatrix}$ by reducing it to Normal Form

   (b) Solve by Gauss seidal method, x+4y+15z=24, x+12y+z=26, 10x+y-2z=10

   [7+8]

2. Find Eigen vectors of $A = \begin{bmatrix} 2 & 2 & 1 \\ 1 & 3 & 1 \\ 1 & 2 & 2 \end{bmatrix}$ [15]

3. Reduce the quadratic form $7x^2 + 6y^2 + 5z^2 - 4xy - 4yz$ to canonical from by diagonlzation. Also find the nature, index and signature and the linear transformation.   [15]

4. (a) Solve the equation $x^3+2x^2+0.4=0$ using Newton's -Raphson's Method upto three decimal places.

   (b) Show that the iteration scheme $\phi(x) = \frac{-1}{x^2-3}$ converges and hence find a real root of f(x)= x^3-3x+1=0 near x=3.   [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.

x	0	1	4	5
f(x)	4	3	24	39

   [8+7]

6. (a) The velocity v of a particle moving in a straight line covers a distance at time t. They are related as shown in the following Table. Find v (x) at x= 10 and x = 15.

x	0	10	20	30	40
v	45	60	65	54	42

   (b) Find the area bounded by the cure $y = x^3 - x + 1$, x – axis between x=0 and x=1.2 by using
   (i) Trapezoidal Rule (ii) Simpson' 1/3 rule.   [8+7]

7. (a) Solve y^1=-xy^2, y(o)=2 by modified Euler's method and hence find y(o.1), y(o.2)

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(b) Solve $\frac{dy}{dx} = \frac{y^2 - x^2}{y^2 + x^2}$, y(o)=1 by fourth order R-K method and hence find y(o.2), y(o.4) [8+7]

8. (a) Fit a least square parabola y= a+bx+cx^2 to the data (-1,2),(0,1),(1,4)

(b) By the method of least squares fit a straight line to the following data

x	5	10	15	15	20
y	15	19	23	26	30

[8+7]

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Set No. 2

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1. (a) Using Echelon form, find rank of $A = \begin{bmatrix} 1 & 2 & 1 & 0 \\ -2 & 4 & 3 & 0 \\ 1 & 0 & 2 & 8 \end{bmatrix}$

   (b) Solve system of equations x+y+z=3 , 2x+3y+2z=7 , 4x+2y+3z=9, using Gauss elimination method.   [7+8]

2. Verify Cayley – Hamilton theorem and find A^{-1} if $A = \begin{bmatrix} 1 & 0 & 3 \\ 2 & 1 & -1 \\ 1 & -1 & 1 \end{bmatrix}$ [15]

3. (a) Define quadratic form, rank and signature. Write the symmetric matrix corresponding to the quadratic form $x_1 x_3 + x_2 x_3 + x_1 x_3 + x_1 x_4 + x_2 x_4 + x_3 x_4$.

   (b) Discuss the nature of the quadratic form $x^2 - y^2 + 4z^2 + 4xy + 6xz + 2yz$ [7+8]

4. (a) Using Newton-Raphson's Method, find a positive root of Cosx-xe^x=0

   (b) Find a real root of f(x) =x+tanx-1=0 in the interval (0, 0.5) by using bisection method.   [8+7]

5. The following table gives the population of a town during the last six censuses. Estimate, using Newton's interpolation formula, the increase in the population during the period 1986 to 1988.   [15]

year	1911	1921	1931	1941	1951	1961
Population (in thousands)	12	15	20	27	39	52

6. (a) Compute $f'(1)$ using the given data:

X	1.0	1.5	2.0	2.5	3.0
f(x)	27	106.75	324	783.75	1621

   (b) Using Simpson's 3/8th rule evaluate $\int_0^6 \frac{dx}{1+x^2}$ by dividing the range into 6 equal parts   [8+7]

7. (a) Solve y^1=3x^2+1 by Euler's method and find y at x=2 by taking h=0.5

   (b) Solve by fourth order R-K method y^1=x-y, y(1)=0.4 and hence find y(1.2)   [8+7]

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8. (a) Fit a second degree polynomial to the following data by the method of least squares

x	0	1	2	3	4
y	1	1.8	1.3	2.5	6.3

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

x	0	5	10	15	20	25
y	12	15	17	22	24	30

[8+7]

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1. (a) Find rank of matrix using Echelon form $A = \begin{bmatrix} 1 & 2 & -4 & 5 \\ 2 & -1 & 3 & 6 \\ 8 & 1 & 9 & 7 \end{bmatrix}$

    (b) Solve the equations using Gauss Jordan method
       x+5y+z=9 ,   2x+y+3z=12,   3x+y+4z=16   [7+8]

2. Verify Cayley – Hamilton theorem and find A^{-1} if $A = \begin{bmatrix} 2 & 2 & 1 \\ 1 & 3 & 1 \\ 1 & 2 & 2 \end{bmatrix}$ [15]

3. (a) Define quadratic form, rank and signature. Write the symmetric matrix corresponding to the quadratic form $x_1 x_3 + x_2 x_3 + x_1 x_3 + x_1 x_4 + x_2 x_4 + x_3 x_4$.

    (b) Discuss the nature of the quadratic form $x^2 - y^2 + 4z^2 + 4xy + 6xz + 2yz$ [7+8]

4. (a) Solve the equation $x^3 + 2x^2 + 0.4 = 0$ using Newton's -Raphson's Method upto three decimal places.

    (b) Find a real root of $x = e^{-x}$, using Bisection method up to four iterations.
                                                             [8+7]

5. (a) Find the value of y from the following data at x = 0.47

X:	0	1	2	3	4	5
Y:	1	2	4	7	11	16

    (b) Use Lagrange's interpolation formula, find f(4) from the following data.

x	1	2	5	6	9
Y = f(x)	2	8	17	20	35

                                                          [8+7]

6. (a) For the function y = f(x) given by the following Table, find y' at x = 0.04 using the Bessel's formula.

x	0.01	0.02	0.03	0.04	0.05	0.06
y	0.1023	0.1047	0.1071	0.1096	0.1122	0.1148

    (b) Evaluate $\int_0^4 e^{1/x} dx$ by using the Simpson's $3/8^{th}$ rule, by dividing the interval into 3 equal parts.   [8+7]

7. (a) Solve $y^1 = y + e^x$, y(o)=0 by modified Euler's method and find y(??), y(??)
    (b) Solve $y^1 = -xy^2$, y(o)=2 , h=0.2 by R-K method and hence find y(o.2), y(o.4)
                                                                [8+7]

8. (a) Find the best fit of the type y=ae^{bx} to the data by the method of least squares

x	1	5	7	9	12
y	10	15	12	15	21

(b) Obtain the relation of the form y=ab^{x} to the following data by the method of least squares

x	2	3	4	5	6
y	8.3	15.4	33.1	65.2	127.4

[8+7]

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1. (a) Find rank of a Matrix using Echelon form where $A = \begin{bmatrix} 1 & -1 & 2 & 0 \\ 0 & 1 & 2 & 1 \\ 5 & 3 & 14 & 4 \end{bmatrix}$

   (b) Show that equations x+y+z=6 , x+2y+3z=14 x+4y+7z=30 are consistent and solve them   [7+8]

2. Verify Cayley - Hamilton theorem and find A^4 if $A = \begin{bmatrix} 1 & 2 & -1 \\ 2 & 1 & -2 \\ 2 & -2 & 1 \end{bmatrix}$ [15]

3. Find the transformation which will transform $4x^2 + 3y^2 + z^2 - 8xy - 6yz + 4zx$ into a sum of square and find the reduced from◆   [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) Find the value of y from the following data at x = 0.47

X:	0	1	2	3	4	5
Y:	1	2	4	7	11	16

   (b) Use Lagrange's interpolation formula, find f(4) from the following data.

x	1	2	5	6	9
Y = f(x)	2	8	17	20	35

   [8+7]

6. (a) From the following data find f ' (0)

x	0	1	2	3	4	5
f(x)	43	40	38	42	45	50

   (b) By considering 4 strips, find the value of $\int_3^7 x^2 \log x\,dx$ [8+7]

7. (a) Solve $y^1=xy^{1/3}$,y(1)=1 by Taylor series method and find y(1.1), y(1.2)

   (b) Find an approximate value of y for x=0.1, 0.2 if $y^1=x+y$ and y(1)=1 by Picard's method and compare the solution with exact solution.   [8+7]

8. (a) Fit a second degree polynomial to the following data by the method of least squares

x	0	1	2	3	4
y	1	1.8	1.3	2.5	6.3

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

x	0	5	10	15	20	25
y	12	15	17	22	24	30

[8+7]

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