Code No: R05010202 **Set No. 1**

I B.Tech Supplimentary Examinations, Aug/Sep 2007
MATHEMATICAL METHODS
(Common to Electrical & Electronic Engineering, Electronics & Communication Engineering, Computer Science & Engineering, Electronics & Instrumentation Engineering, Bio-Medical Engineering, Information Technology, Electronics & Control Engineering, Computer Science & Systems Engineering, Electronics & Telematics, Electronics & Computer Engineering and Instrumentation & Control Engineering)

Time: 3 hours **Max Marks: 80**

Answer any FIVE Questions
All Questions carry equal marks
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1. (a) Find a real root of the equation f(x)=x+logx-2 using Newton Raphson method
   (b) Find f(22) from the following data using Newton's Backward formula

x	20	25	30	35	40	45
y	354	332	291	260	231	204

[8+8]

2. (a) Fit acurve of the form $y = ae^{bx}$ from the following data.

x	1	2	3	4	5	6
y	1.6	4.5	13.8	40.2	125	300

   (b) Evaluate $\int\limits_0^1 e^{-x^2}$ taking h = .2 using
      i. Simpson's $\frac{1}{3}rd$
      ii. Trapenzoidal rule. [8+8]

3. Given y′ = x + sin y, y (0) = 1 compute y(0.2) and y(.4) with h=0.2 using Euler's modified method [16]

4. (a) Determine the rank of the matrix.
$$A = \begin{bmatrix} 2 & -1 & 3 & 4 \\ 0 & 3 & 4 & 1 \\ 2 & 3 & 7 & 5 \\ 2 & 5 & 11 & 6 \end{bmatrix}$$ by reducing it to the normal form.
   (b) Find whether the following equations are consistent, if so solve them.
$$x + 2y - z = 3$$
$$3x - y + 2z = 1$$
$$2x - 2y + 3z = 2$$
$$x - y + z = -1.$$
[8+8]

5. Diagonalize the matrix $\begin{bmatrix} 8 & -6 & 2 \\ -6 & 7 & -4 \\ 2 & -4 & 3 \end{bmatrix}$ [16]

6. (a) Show that every square matrix can be expressed uniquely as a sum of a symmetric and skew symmetric matrices.

   (b) Determine a, b, c so that A is orthogonal where A = $\begin{bmatrix} 0 & 2b & c \\ a & b & -c \\ a & -b & c \end{bmatrix}$ [8+8]

7. (a) Find the half range cosine series for the function $f(x) = (x-1)^2$ in the interval $0 < x < 1$ Hence show that $\sum\limits_{\mathrm{n}=1}^{\infty} \frac{1}{(2\mathrm{n}-1)^2} = \frac{\pi^2}{8}$

   (b) State and prove Fourier integral theorem. [10+6]

8. (a) Form the partial differential equation by eliminating the arbitrary constants from $(x-a)^2 + (y-b)^2 + z^2 = r^2$

   (b) Solve the partial differential equation $z^2(p^2 + q^2) = x^2 + y^2$

   (c) Find the Z - transform of $sin\alpha k, \quad k \geq 0$ [5+6+5]

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Set No. 2

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Time: 3 hours **Max Marks: 80**

Answer any FIVE Questions
All Questions carry equal marks

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1. (a) Find an iterative formula to find the cube root of a number using Newton's Raphson's method. Hence evaluate cube root of 15

   (b) For X=20,25,32,49 and Cos(x) = 0.939, 0.906, 0.848, 0.656 find Cos(43) using Lagrange's formula. [8+8]

2. Fit a parabola of the form y=a+bx+cx^2

x	1.0	1.5	2.0	2.5	3.0	3.5	4.0
y	1.1	1.3	1.6	2.0	2.7	3.4	4.1

[16]

3. Find y(.5), y(1) and y(1.5), given that y′ = 4-2x, y(0) = 2, with h = 0.5 Using Modified Euler method [16]

4. (a) Find the value of K such that the rank of the matrix is 3 $\begin{bmatrix} 1 & 2 & -1 & 3 \\ 4 & 1 & 2 & 1 \\ 3 & -1 & 1 & 2 \\ -1 & 2 & 0 & K \end{bmatrix}$

   (b) Find whether the system of equations $x_1 + 2x_2 + x_3$ - $2x_4 = 6$, $2x_1 + 3x_2 + 2x_3$ - $2x_4 = 8$ $3x_1 + x_2 + 2x_3$ - $x_4 = 4$, $4x_1$ +$2x_2 + 2x_3$ - $3x_4 = 9$ is consistant, if so solve them. [8+8]

5. Diagomalize the matrix A= $\begin{bmatrix} 8 & -8 & -2 \\ 4 & -3 & -2 \\ 3 & -4 & 1 \end{bmatrix}$ [16]

6. (a) Find a real symmetric matrix C of the quadratic form $Q = x_1^2 + 3x_2^2 + 2x_3^2 + 2x_1x_2 + 6x_2x_3$ and find the index and signature.

   (b) Find the orthogonal transformation which transforms the quadratic form $x_1^2 + 3x_2^2 + 3x_3^2 - 2x_2x_3$ to canonical form. [8+10]

7. (a) Obtain a Fourier expansion for $\sqrt{1-\cos x}$ in the interval $-\pi < x < \pi$..

   (b) If F(s) is the complex Fourier transform of f(x), then prove that
   F (f(x) cos ax) = $\frac{1}{2}$ [F(s+a) + F(s-a)]
   F[f(x-a)] = e^{isa} F(s). [10+6]

8. (a) Form the partial differential equation by eliminating the arbitrary constants z=f(x^2+y^2+z^2).
   (b) Solve the partial differential equation $p^2x + q^2y = z$.
   (c) Solve the difference equation, using Z-transforms $u_{n+2} - u_n = 2^n$ where $u_0 = 0, \quad u_1 = 1$. [5+5+6]

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Time: 3 hours **Max Marks: 80**

Answer any FIVE Questions
All Questions carry equal marks

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1. (a) Find a real root of x^4-x-10=0 using bisection method.
   (b) Find f(9) by Newton's Backward formula given that f(2)=94.8 f(5)=87.9, f(8)=81.3 f(11)=75.1. [8+8]

2. (a) By the method of least squares fit a parabola of the form y=a+bx+cx^2 for the following data.

x	2	4	6	8	10
y	3.07	12.85	31.47	57.38	91.29

   (b) Derive the formula to evaluate $\int_a^b y dx$ using trapezoidal rule.
   (c) Use the trapezoidal rule with n=4 to estimate $\int\limits_0^1 \frac{dx}{1+x^2}$ Correct to four decimal places. [8+4+4]

3. Find the solution of $\frac{dy}{dx}$ = x-y at x= 0.1, 0.2, 0.3, 0.4 and 0.5 using modified Euler method. y(0) =1 [16]

4. (a) Determine whether the following equations will have a non-trivial solution if so solve them.

$$3x + 4y - z - 6\omega = 0; \quad 2x + 3y + 2z - 3\omega = 0$$

$$2x + y - 14z - 9\omega = 0; \quad x + 3y + 13z + 3\omega = 0.$$

   (b) Solve the tridiagonal system
   $3x_1$ - x_2 = 4,
   $2x_1$ - x_2 +x_3 = 6,
   $2x_2$ + $3x_3$ + $2x_4$ = 11,
   x_3 - $2x_4$ = -1
   by writing the coefficient matrix as a product of a lower triangular and upper triangular matrices. [8+8]

5. Diagonalize the matrix $\begin{bmatrix} 8 & -6 & 2 \\ -6 & 7 & -4 \\ 2 & -4 & 3 \end{bmatrix}$ [16]

6. (a) Prove that every hermitian matrix can be written as A+iB where A is real and Symmetric and B is real and Skew-Symmetric.

   (b) Reduce the quadratic form $x_1^2 + 3x_2^2 + 3x_3^2 - 2x_2x_3$ to a canonical form. [8+8]

7. (a) Write the Dirichlet?s conditions for the existence of Fourier series of a function f(x) in the interval $(\alpha, \alpha + 2\pi)$. Find the Fourier series representing $f(x) = x, 0 < x < 2\pi$

   (b) Find the Fourier transform of $f(x) = \begin{cases} 1 - x^2 & if\ |x| < 1 \\ 0 & if\ |x| > 1 \end{cases}$

   Hence evaluate $\int\limits_0^\infty \left[\frac{x\cos x - \sin x}{x^2}\right] \cos\frac{x}{2}\ dx$. [8+8]

8. (a) Form the partial differential equation by eliminating the arbitrary constants log (az - 1) = x + ay + b.

   (b) Solve the partial differential equation $px(y^2 + z) - qy(x^2 + z) = z(x^2 - y^2)$.

   (c) If Z (u_n)=$\frac{2z^2+5z+14}{(z-1)^4}$, find u_2 and u_3 [5+6+5]

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Time: 3 hours **Max Marks: 80**

Answer any FIVE Questions
All Questions carry equal marks

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1. (a) Find a real root of the equation f(x)=x+logx-2 using Newton Raphson method

   (b) Find f(22) from the following data using Newton's Backward formula

x	20	25	30	35	40	45
y	354	332	291	260	231	204

[8+8]

2. Fit a parabola of the form $y = A_1e^{\lambda x} + A_2e^{\lambda 2x}$ for the following data

x	1.0	1.1	1.2	1.3	1.4	1.5	1.6	1.7	1.8
y	1.175	1.336	1.51	1.698	1.904	2.129	2.376	2.646	2.942

[16]

3. Find ay(.1), y(.2) and y(.3) using Taylor's series method that $\frac{dy}{dx} = l - y, y(0) = 0$ [16]

4. (a) Find whether the following equations are consistent, if so solve them.
   x+y+2z = 4 ; 2x-y+3z= 9 ; 3x-y-z=2

   (b) Find the rank of the matrix
   $\begin{bmatrix} 1 & 2 & 3 & 0 \\ 2 & 4 & 3 & 2 \\ 3 & 2 & 1 & 3 \\ 6 & 8 & 7 & 5 \end{bmatrix}$ by reducing it to the normal form. [8+8]

5. (a) Find the eigen values and the corresponding eigen vectors of the matrix. $\begin{bmatrix} 2 & 2 & 1 \\ 1 & 3 & 1 \\ 1 & 2 & 2 \end{bmatrix}$

   (b) If A and B are n rowed square matrices and if A is invertible show that A^{-1} B and BA^{-1} have the same eigen values. [10+6]

6. (a) Prove that every hermitian matrix can be written as A+iB where A is real and Symmetric and B is real and Skew-Symmetric.

   (b) Reduce the quadratic form $x_1^2 + 3x_2^2 + 3x_3^2 - 2x_2x_3$ to a canonical form. [8+8]

7. (a) Find the Fourier series for f(x) ; if f(x) is defined in $-\pi<$ x $<\pi$ as
$f(x) = \begin{cases} -\pi, & -\pi < x < 0 \\ x, & 0 < x < \pi \end{cases}$
Deduce that $\frac{\pi^2}{8} = \frac{1}{1^2} + \frac{1}{3^2} + \frac{1}{5^2} + ...$
(b) Find a half range sine series for f(x)=ax+b in $0 < x < 1$
(c) Find Fourier cosine transform of $f(x) = \begin{cases} \cos x & 0 < x < a \\ 0 & x \geq a \end{cases}$ [6+5+5]

8. (a) Form the partial differential equation by eliminating the arbitrary constants a, b from $2z = (x + a)^{1/2} + (y - a)^{1/2} + b$.
(b) Solve the partial differential equation.,$z^4p^2 + z^4q^2 = x^2y^2$.
(c) Find $Z^{-1}\left[\frac{z}{z^2+11z+24}\right]$. [5+5+6]

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