

I B.Tech Semester Regular Examinations, June 2009**MATHEMATICAL METHODS**

(Common to Electrical & Electronic Engineering, Mechanical Engineering, Electronics & Communication Engineering, Computer Science & Engineering, Electronics & Instrumentation Engineering, Bio-Medical Engineering, Information Technology, Electronics & Control Engineering, Mechatronics, Computer Science & Systems Engineering, Electronics & Telematics, Electronics & Computer Engineering, Production Engineering, Instrumentation & Control Engineering and Automobile Engineering)

Time: 3 hours**Max Marks: 80****Answer any FIVE Questions****All Questions carry equal marks**

1. (a) Find the rank of $\begin{pmatrix} 1 & 4 & 3 & -2 & 1 \\ -2 & -3 & -1 & 4 & 3 \\ -1 & 6 & 7 & 2 & 9 \\ -3 & 3 & 6 & 6 & 12 \end{pmatrix}$

(b) Solve the system of equations

$$x + y + w = 0, y + z = 0, x + y + z + w = 0, x + y + 2z = 0. \quad [8+8]$$

2. Diagonalise the matrix $\begin{bmatrix} -1 & 2 & -2 \\ 1 & 2 & 1 \\ -1 & -1 & 0 \end{bmatrix}$ [16]

3. Reduce the quadratic form $6x_1^2 + 3x_2^2 + 3x_3^2 - 4x_1x_2 - 2x_2x_3 + 4x_3x_1$ to the sum of squares and find the corresponding linear transformation. Also find the index and signature. [16]

4. (a) The following are the measurements t made on a curve recorded by the oscillograph representing a change of current I due to a change in the conditions of an electric current.

T: 1.2 2.0 2.5 3.0

I: 1.36 0.58 0.34 0.20

Using Lagrange's formula, find I at $t = 1.6$.

(b) If the interval of differencing is unity, prove that $\Delta f(x) = \frac{-\Delta f(x)}{f(x)f(x+1)}$ [8+8]

5. (a) Fit a curve of the form $y = ae^{bx}$ to the following data:

x: 0 1 2 3

y: 1.05 2.10 3.85 8.30

(b) A curve passes through the points (0,18), (1,10), (3,-18) and (6,90). Find the slope of the curve at $x=2$. [8+8]

6. Obtain $y(0.6)$ and $y(0.8)$ given $y' = x+y$, $y(0) = 1$ with $h=0.2$ by Adam's method. [16]

7. (a) If $f(x) = \begin{cases} kx; & 0 < x < \frac{\pi}{2} \\ k(\pi - x); & \frac{\pi}{2} < x < \pi \end{cases}$. Find the half-range Sine series.
- (b) Find the Fourier expansion of $f(x) = x \cos x$; $0 < x < 2\pi$. [8+8]
8. (a) Form the partial differential equations by eliminating the arbitrary functions $z = f(2x+y) + g(3x-y)$.
- (b) Find the Z-transform of
- i. $2n + 3$
 - ii. $\cos^3 n$. [8+8]

I B.Tech Semester Regular Examinations, June 2009

MATHEMATICAL METHODS

(Common to Electrical & Electronic Engineering, Mechanical Engineering,
 Electronics & Communication Engineering, Computer Science &
 Engineering, Electronics & Instrumentation Engineering, Bio-Medical
 Engineering, Information Technology, Electronics & Control Engineering,
 Mechatronics, Computer Science & Systems Engineering, Electronics &
 Telematics, Electronics & Computer Engineering, Production Engineering,
 Instrumentation & Control Engineering and Automobile Engineering)

Time: 3 hours

Max Marks: 80

Answer any FIVE Questions

All Questions carry equal marks

1. (a) Find the rank of $\begin{pmatrix} 0 & 1 & -3 & -1 \\ 1 & 0 & 1 & 1 \\ 3 & 1 & 0 & 2 \\ 1 & 1 & -2 & 0 \end{pmatrix}$
- (b) Solve the system of equations $x+2y+3z=1$, $2x+3y+8z=2$, $x+y+z=3$. [8+8]
2. Determine the characteristic roots and the corresponding characteristic vectors of the matrix $A = \begin{bmatrix} 8 & -6 & 2 \\ -6 & 7 & -4 \\ 2 & -4 & 3 \end{bmatrix}$ [16]
3. Reduce the quadratic form to canonical form by an orthogonal reduction and state the nature of the quadratic form. $x_1^2+2x_2^2+2x_3^2-2x_1x_2+2x_1x_3-2x_2x_3$. [16]
4. (a) Using bisection method, find the negative root of $x^3 - 4x + 9 = 0$ by bisection method.
- (b) Find a positive root of the equation by iteration method: $3x = \cos x + 1$. [8+8]
5. (a) Find a and b so that $y = ab^x$ best fits the following data:

x:	0.2	0.3	0.4	0.5	0.6	0.7
y:	3.16	2.38	1.75	1.34	1.00	0.74
- (b) Dividing the range in 10 equal parts, find the approximate value of $\int_0^\pi \sin x \, dx$ by
 - i. Trapezoidal rule
 - ii. Simpson's rule. [8+8]
6. Find $y(0.1)$, $z(0.1)$, $y(0.2)$ and $z(0.2)$ from the system of equations, $y' = x+z$, $z' = x - y^2$ given $y(0) = 2$, $z(0) = 1$ using Runge-Kutta method of fourth order. [16]

7. (a) Expand $f(x) = e^x, -\pi < x < \pi$ as a Fourier series. Derive a series for $\frac{\pi}{\sinh \pi}$
(b) Find the Fourier series of period 2π for the function $f(x) = x^2 - x$ in $(-\pi, \pi)$.
Hence deduce the sum of the series $\frac{1}{1^2} + \frac{1}{2^2} + \frac{1}{3^2} + \dots = \frac{\pi^2}{6}$. [8+8]
8. (a) Form the partial differential equations by eliminating the arbitrary functions
 $z = f(2x+y) + g(3x-y)$.
(b) Find the Z-transform of
i. $2n + 3$
ii. $\cos^3 n$. [8+8]

I B.Tech Semester Regular Examinations, June 2009

MATHEMATICAL METHODS

(Common to Electrical & Electronic Engineering, Mechanical Engineering, Electronics & Communication Engineering, Computer Science & Engineering, Electronics & Instrumentation Engineering, Bio-Medical Engineering, Information Technology, Electronics & Control Engineering, Mechatronics, Computer Science & Systems Engineering, Electronics & Telematics, Electronics & Computer Engineering, Production Engineering, Instrumentation & Control Engineering and Automobile Engineering)

Time: 3 hours

Max Marks: 80

Answer any FIVE Questions

All Questions carry equal marks

1. (a) Find the rank of $\begin{pmatrix} 1 & 2 & 3 & 4 \\ -2 & -3 & 1 & 2 \\ -3 & -4 & 5 & 8 \\ 1 & 3 & 10 & 14 \end{pmatrix}$
- (b) Solve the system of equations $x+y+z=6$, $x-y+2z=5$, $3x+y+z=8$ [8+8]
2. Determine the characteristic roots and the corresponding characteristic vectors of the matrix $A = \begin{bmatrix} 8 & -6 & 2 \\ -6 & 7 & -4 \\ 2 & -4 & 3 \end{bmatrix}$ [16]
3. Reduce the quadratic form to canonical form by an orthogonal reduction and state the nature of the quadratic form. $5x^2 + 26y^2 + 10z^2 + 4yz + 14zx + 6xy$. [16]
4. (a) Using Lagrange's formula to fit a polynomial to the data
 X: -1 0 2 3
 Y: -8 3 1 12
 And hence find $y(1)$.
 (b) Show that $\Delta^{10}[(1-x)(1-2x^2)(1-3x^3)(1-4x^4)] = 24 \times 2^{10} \times 10!$ If $h = 2$. [8+8]
5. (a) The variables x and y are related by $y(x)=ax^b$.
 x: 3 4 5 6 7
 y(x): 6 9 10 11 12
 (b) Find the value of $\cos(1.74)$ from the following table.
 x: 1.7 1.74 1.78 1.82 1.86
 Sinx: 0.9857 0.9916 0.9781 0.9691 0.9584 [8+8]
6. Obtain the solution of $y' = x^2(1+y)$, $y(1)=1$ at $x = 1$ (0.1) 1.2 by any numerical method and estimate at $x=1.3$ by Adam's method. [16]
7. (a) Find the Fourier series for $f(x) = 2lx - x^2$ in $0 < x < 2l$ and hence deduce $1 - \frac{1}{2^2} + \frac{1}{3^2} - \frac{1}{4^2} + \dots = \frac{\pi^2}{12}$.

(b) Find the Fourier Sine series for $f(x) = 2x - x^2$, in $0 < x < 3$ and $f(x+3)=f(x)$.
[8+8]

8. (a) Find the inverse Z-transform of $\frac{z^2-z}{(z+1)^2}$

(b) Solve $\frac{\partial^2 u}{\partial x \partial t} = e^{-t} \cos x$, given that $u=0$ when $t=0$ and $\frac{\partial u}{\partial t} = 0$ when $x=0$. Show also that as t tends to ∞ , u tends to $\sin x$.
[8+8]

I B.Tech Semester Regular Examinations, June 2009

MATHEMATICAL METHODS

(Common to Electrical & Electronic Engineering, Mechanical Engineering, Electronics & Communication Engineering, Computer Science & Engineering, Electronics & Instrumentation Engineering, Bio-Medical Engineering, Information Technology, Electronics & Control Engineering, Mechatronics, Computer Science & Systems Engineering, Electronics & Telematics, Electronics & Computer Engineering, Production Engineering, Instrumentation & Control Engineering and Automobile Engineering)

Time: 3 hours

Max Marks: 80

Answer any FIVE Questions

All Questions carry equal marks

1. (a) Express the following system in matrix form and solve by Gauss elimination method.

$$2x_1 + x_2 + 2x_3 + x_4 = 6; 6x_1 - 6x_2 + 6x_3 + 12x_4 = 36,$$

$$4x_1 + 3x_2 + 3x_3 - 3x_4 = -1; 2x_1 + 2x_2 - x_3 + x_4 = 10.$$

- (b) Show that the system of equations $3x + 3y + 2z = 1$; $x + 2y = 4$; $10y + 3z = -2$; $2x - 3y - z = 5$ is consistent and hence solve it. [8+8]

2. (a) Find the characteristic roots of the matrix $A = \begin{bmatrix} 2 & 2 & 1 \\ 1 & 3 & 1 \\ 1 & 2 & 2 \end{bmatrix}$

- (b) If $A = \begin{pmatrix} 1 & 0 \\ 0 & 3 \end{pmatrix}$, find A^{50} . [8+8]

3. Reduce the symmetric matrix $A = \begin{pmatrix} 3 & 2 & -1 \\ 2 & 2 & 3 \\ -1 & 3 & 1 \end{pmatrix}$ by congruent transformation and interpret the result in terms of quadratic form.

[16]

4. (a) Find a positive root of the following equation by bisection method $x^3 - x^2 - 1 = 0$

- (b) Find the interpolating polynomial $f(x)$ from the table

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

[8+8]

5. (a) The table given below reveals the velocity v of a body during the specified time t . Find the acceleration at $t=1.1$.

t:	1.0	1.1	1.2	1.3	1.4
v:	43.1	47.7	52.1	56.4	60.8

- (b) Evaluate $\int_0^1 \frac{dx}{1+x}$ by

- i. Trapezoidal rule
 ii. Simpson's one-third rule. [8+8]
6. (a) Solve the following using R - K fourth method $y' = y-x$, $y(0) = 2$, $h=0.2$. Find $y(0.2)$.
 (b) Given $y' = x^2 - y$, $y(0) = 1$, find correct to four decimal places the value of $y(0.1)$, by using Euler's method. [8+8]
7. Find the Fourier Transforms of $f(x) = e^{-|x|}$ and deduce that $\int_0^{\infty} \frac{\cos xt}{1+t^2} dt = \frac{\pi}{2} e^{-|x|}$.
 Hence show that $F(xe^{-|x|}) = i \sqrt{\frac{2}{\pi}} \frac{2s}{(1+s^2)^2}$. [16]
8. (a) Solve $z = px + qy + p^2 q^2$
 (b) Using Convolution theorem, find the inverse-Z transform of $\frac{1}{(1-\frac{1}{2}z^{-1})(1-\frac{1}{4}z^{-1})}$. [8+8]
