

B. Tech I Year Examinations, May/June -2012

## MATHEMATICAL METHODS

(Common to EEE, ECE, CSE, EIE, BME, IT, ETM, ECC, ICE)

Time: 3 hours

Max. Marks: 75

Answer any five questions

All questions carry equal marks

1. a) Reduce the matrix into normal form, find its rank.

$$\begin{bmatrix} 2 & 3 & -1 & -1 \\ 1 & -1 & -2 & -4 \\ 3 & 1 & 3 & -2 \\ 6 & 3 & 0 & -7 \end{bmatrix}$$

- b) Find the values of 'a' and 'b' for which the equations,  $x + y + z = 3$ ,  $x + 2y + 2z = 6$ ,  $x + 9y + az = b$  have  
 i) No solution  
 ii) A unique solution  
 iii) Infinite number of solutions.

[8+7]

2. a) Find the Eigen values and the corresponding eigen vectors of the matrix

$$\begin{bmatrix} 6 & -2 & 2 \\ -2 & 3 & -1 \\ 2 & -1 & 3 \end{bmatrix}$$

- b) If  $\lambda$  is an Eigen value of a non-singular matrix A, then S.T.  $\frac{|A|}{\lambda}$  is an Eigen value of Adj.A.

[10+5]

Reduce the quadratic form  $8x^2 + 7y^2 + 3z^2 - 12xy - 8yz + 4xz$  into a sum of squares by an orthogonal transformation and give the matrix of transformation. Also state the nature of the quadratic form.

[15]

4. a) Find a real root of the equation  $3x - \cos x - 1 = 0$  using Newton Raphson method.

- b) Find  $f(1.6)$  using Lagranges formula from the following table.

[8+7]

x	1.2	2.0	2.5	3.0
F(x)	1.36	0.58	0.34	0.20

5. a) Derive the normal equation to fit the parabola  $y = a + bx + cx^2$ .

- b) Given

x	1.0	1.1	1.2	1.3	1.4	1.5	1.6
$Y=f(x)$	7.989	8.403	8.781	9.129	9.451	9.750	10.031

Find  $y^1$  and  $y^{11}$  at  $x = 1.2$ .

[7+8]



6. Find  $y(0.1)$  and  $y(0.2)$  using Runge Kutta fourth order formula given that  $\frac{dy}{dx} = x + x^2 y$  and  $y(0) = 1$ . [15]

7. a) Obtain the Fourier series expansion of  $f(x)$  given that  $f(x) = (\pi - x)^2$  in  $0 < x < 2\pi$  and

$$\text{deduce the value of } \frac{1}{1^2} + \frac{1}{2^2} + \frac{1}{3^2} + \dots = \frac{\pi^2}{6}.$$

- b) Obtain Fourier cosine series for  $f(x) = x \sin x$   $0 < x < \pi$  and show that

$$\frac{1}{1.3} - \frac{1}{3.5} + \frac{1}{5.7} - \frac{1}{7.9} + \dots = \frac{\pi - 2}{4}. \quad [7+8]$$

8. a) Solve  $(x^2 - yz)p + (y^2 - zx)q = z^2 - xy$ .

- b) Form the partial differential equations by eliminating the arbitrary functions

i)  $z = f(x^2 + y^2)$

ii)  $z = yf(x) + xg(y)$ .

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