

MATHEMATICAL METHODS

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

Time: 3 hours

Max. Marks: 75

Answer any five questions

All questions carry equal marks

- 1.a) Discuss for all values of λ , the system of equations

$$x + y + 4z = 6, x + 2y - 2z = 6, \lambda x + y + z = 6.$$

- b) Find the inverse of the matrix

$$\begin{bmatrix} 0 & 1 & 2 & 2 \\ 1 & 1 & 2 & 3 \\ 2 & 2 & 2 & 3 \\ 2 & 3 & 3 & 3 \end{bmatrix}$$

- 2.a) State Cayley-Hamilton theorem and use it to find the inverse of the matrix

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

- b) Show that the matrices $A^{-1}B$ and BA^{-1} have the same Eigen values but different eigenvectors. [7+8]

- 3.a) If A and B are Hermitian matrices, prove that $AB - BA$ is a skew-Hermitian.

- b) Show that the matrix $\begin{bmatrix} 2 & 3+4i \\ 3-4i & 2 \end{bmatrix}$ is Hermitian. Find its Eigen values and eigenvectors. [7+8]

- 4.a) Find the value of y when $x = 2$ from the following data

x	0	1	3	4
y	-12	0	6	12

- b) By using method of false position, find the root of the equation $\cos x - xe^x = 0$. [7+8]

- 5.a) Fit a straight line to the following data giving weights to x as 1, 1, 2, 1, 1 by the method of least square

x	0	1	2	3	4
y	1	1.8	3.3	4.5	6.5

- b) Evaluate $\int_0^1 \frac{dx}{1+x}$ using Simpson's one-third rule. [7+8]

- 6.a) Find the successive approximate solution of the differential equation $y' = y$, $y(0) = 1$ by Picard's method and compare it with exact solution.

- b) Compute $y(0.1)$ by Runge-Kutta method of 4th order for the differential equation $\frac{dy}{dx} = xy + y^2$, $y(0) = 1$. [7+8]



7.a) If $f(x) = x$, $0 < x < \frac{\pi}{2}$

$$= \pi \left[-\frac{x}{2} \right]_0^{\frac{\pi}{2}} < x < \pi \text{ then}$$

$$\text{Show that } f(x) = \frac{\pi}{4} - \frac{2}{\pi} \left[\frac{\cos 2x}{1^2} + \frac{\cos 6x}{3^2} + \frac{\cos 10x}{5^2} + \dots \right]$$

b) Show that the Fourier series expansion of the function
 $f(x) = 0, -\pi \leq x \leq 0$

$$= \sin x, 0 \leq x \leq \pi \text{ and deduce } \frac{1}{1 \cdot 3} - \frac{1}{3 \cdot 5} + \frac{1}{5 \cdot 7} + \dots = \frac{\pi - 2}{4}$$

8.a) Find the general solution of $y^2 zp + x^2 zq = y^2 x$.

b) Solve $q^2 y^2 = z(z - px)$.

[7+8]



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