

**MATHEMATICS - II**

(Common to AE, BT, CE &amp; ME)

Time: 3 hours

Max. Marks: 70

Answer any FIVE questions  
All questions carry equal marks

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- 1 Find the Eigen values and Eigen vectors of A,  $A^2$  and  $A^{-1}$  where  $A = \begin{bmatrix} 1 & 3 & 4 \\ 0 & 2 & 5 \\ 0 & 0 & 3 \end{bmatrix}$ .
- 2 Find the rank, index & signature of the quadratic form  $10x^2 + 2y^2 + 5z^2 - 4xy + 6yz - 10xz$  by reducing it to canonical form.
- 3 (a) Express  $f(x) = x(2\pi - x)$  as Fourier series in  $(0, 2\pi)$   
Deduce that  $\frac{1}{1^2} + \frac{1}{2^2} + \frac{1}{3^2} + \dots = \frac{\pi^2}{6}$
- (b) Find the Fourier series to represent the function  $f(x) = \begin{cases} -x^2, & -\pi \leq x \leq 0 \\ x^2, & 0 \leq x \leq \pi \end{cases}$
- 4 Show that  $\int_0^{\infty} \frac{\sin(ax)}{x(a^2 + x^2)} dx = \frac{\pi}{2a^2} (1 - e^{-a^2})$ , using Perceval identity
- 5 Solve for steady state temperature at any point of a rectangular plate of sides 'a' and 'b' Insulated on the lateral surface and satisfying  $u(0, y) = 0 = u(a, y) = u(x, b)$  and  $u(x, 0) = x(a - x)$ .
- 6 (a) Find a real root of  $xe^x = 3$  using Regular Falsi method.  
(b) Find  $y(1.6)$  using Newton's forward difference formula from the table:

x	1	1.4	1.8	2.2
y	3.49	4.82	5.96	6.5

- 7 (a) Fit a curve of the form  $y = a + bx + cx^2$  for the following data:

x	10	15	20	25	30	35
y	35.3	32.4	29.2	26.1	23.2	20.5

- (b) Evaluate  $\int_0^6 \frac{1}{1+x} dx$  by using Simpson's  $\frac{3}{8}$  rule.

- 8 Given  $\frac{dy}{dx} = \frac{y-x}{y+x}$ ,  $y(0) = 1$  compute  $y(0.1)$  in step of 0.02 using Euler's modified method.

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