

B.Tech / I

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EEE / EEC - 101
Paper - MATHEMATICS - I

Time : 3 hours

Maximum Marks :70

(Write your Roll No. on the top immediately
on receipt of this question paper.)

Attempt any **five** questions.
All questions carry equal marks.

1 a) Discuss the nature of the following series :

(i)
$$\sum_{n=2}^{\infty} \frac{1}{\log n}$$

(ii)
$$\frac{1}{3}x + \frac{1.2}{3.5}x^2 + \frac{1.2.3}{3.5.7}x^3 + \dots, (x > 0)$$

b) *If $(a_1 + ib_1) (a_2 + ib_2) (a_3 + ib_3) \dots (a_n + ib_n)$
 $= A + iB$, prove that

(i)
$$(a_1^2 + b_1^2) (a_2^2 + b_2^2) \dots (a_n^2 + b_n^2)$$

 $= A^2 + B^2$

(ii)
$$\tan^{-1}\left(\frac{b_1}{a_1}\right) + \tan^{-1}\left(\frac{b_2}{a_2}\right) + \dots + \tan^{-1}\left(\frac{b_n}{a_n}\right)$$

 $= \tan^{-1}\left(\frac{B}{A}\right)$

P.T.O

- 2 a) Using Gauss - Jordan Method, Find A^{-1} , if

$$A = \begin{bmatrix} 1 & 0 & 2 \\ 2 & -1 & 3 \\ 4 & 1 & 5 \end{bmatrix}$$

- b) Find the rank of matrix

$$\begin{bmatrix} 1 & 2 & 3 & 2 \\ 2 & 3 & 5 & 1 \\ 1 & 3 & 4 & 5 \end{bmatrix}$$

- 3 a) Find the asymptotes of

$$(x - y)(x - 2y)^2 + (x - y)(x - 2y) - 7 = 0$$

- b) Find the Fourier series for the function $f(x)$ in the interval $(-\pi, \pi)$, where

$$\begin{aligned} f(x) &= \pi + x, & -\pi < x < 0 \\ &= \pi - x, & 0 < x < \pi \end{aligned}$$

- 4 Solve the following differential equations :

a) $\frac{d^2y}{dx^2} + 4 \frac{dy}{dx} - 12y = (x - 1)e^{2x}$

b)
$$\begin{cases} Dx + x - y = e^t \\ Dy + y - x = 0 \end{cases}$$

- 5 a) Evaluate

$$\int xy(x+y) \, dndy \text{ over the area between } y = x^2 \text{ and } y = x.$$

- b) Change the order of integration and evaluate :

$$\int_0^1 \int_x^{\sqrt{2-x^2}} \frac{x dy dx}{\sqrt{x^2 + y^2}}$$

- 6 a) Find the area common to the two parabolas
 $x^2 = 4ay$ and $y^2 = 4ax$

- b) For the curve $y = \frac{ax}{a+x}$, if ρ is the radius of curvature at any point (x, y) . Show that

$$\left(\frac{2\rho}{a}\right)^{2/3} = \left(\frac{y}{x}\right)^2 + \left(\frac{x}{y}\right)^2$$

- 7 a) Prove the following by Maclouriu's Theorem

$$e^{a\sin^{-1}x} = 1 + ax + \frac{(ax)^2}{2!} + \frac{a(1^2 + a^2)}{3!} x^3 + \frac{a^2(2^2 + a^2)}{4!} x^4 \dots\dots\dots$$

- b) Find the n^{th} derivatives of

$$\tan^{-1} \left(\frac{1+x}{1-x} \right)$$