This question paper contains 3 printed pages.

3281 *Your Roll No.....*

B.Tech / I

J

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

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

(i) $(a_1^2 + b_1^2)(a_2^2 + b_2^2) \ldots\ldots\ldots\ldots (a_n^2 + b_n^2)$
$= A^2 + B^2$

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

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

$f(x) = \pi + x, \quad -\pi < x < 0$

$= \pi - x, \quad 0 < x < \pi$

4 Solve the following differential equations :

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

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

5 a) Evaluate

$\int xy(x + y)\,dndy$ over the area between $y = x^2$ 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

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

b) Find the n^{th} derivatives of

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