This question paper contains 3 printed pages.

8471 *Your Roll No.* .....

B.Tech. / I **A**

PAPER EEE/EEC–101

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.

Assume missing data suitably, if any.

1. (*a*) Discuss the convergence of the series:

(*i*) $\sum(\sqrt{n^4+1}-\sqrt{n^4-1})$

(*ii*) $x-\frac{x^2}{2^2}+\frac{x^3}{3^2}-\frac{x^4}{4^2}+....$

(*b*) If α, β are the roots of $x^2-2x+4=0$, prove that

$$\alpha^n+\beta^n=2^{n+1}\cos\frac{n\pi}{3}.$$

2. (*a*) Obtain the eigen values and eigen vectors for the matrix:

P. T. O.

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

Verify that the eigen vectors are orthogonal.

(*b*) If $y^{1/m}+y^{-1/m}=2x$, prove that:

$(x^2-1)y_{n+2}+(2n+1)xy_{n+1}+(n^2-m^2)y_n=0.$

3. (*a*) Calculate the approximate value of $\sqrt{10}$ to four places of decimal by taking the first four terms of an appropriate expansion.

(*b*) Find the half-range cosine and sine series for the function:

$$f(x)=x(\pi-x),\ 0\le x\le\pi.$$

4. Solve:

(*a*) $\dfrac{d^3y}{dx^3}+2\dfrac{d^2y}{dx^2}+\dfrac{dy}{dx}=e^{2x}+x^2+x$

(*b*) $\dfrac{d^2y}{dx^2}-2\dfrac{dy}{dx}+y=x\sin x$

5. (*a*) Evaluate $\iint_A xy\,dx\,dy$, where A is the domain bounded by x-axis, ordinate $x=2a$ and the curve $x^2=4ay$.

(*b*) Evaluate:

$$\int_0^1 \int_0^{\sqrt{1-x^2}} \int_0^{\sqrt{1-x^2-y^2}} \frac{1}{\sqrt{1-x^2-y^2-z^2}}\, dz\ dy\ dx.$$

6. (*a*) Trace the curve:

$$3ay^2=x(x-a)^2$$

(*b*) Find the area of ellipse

$$\frac{x^2}{a^2}+\frac{y^2}{b^2}=1$$

7. (*a*) Show that for the cardioid

$$r=a(1+\cos\theta),$$

$\frac{\rho^2}{r}$ is onstant.

(*b*) Find the asymptotes of the curve:

$$x^3+4x^2y+5xy^2+2y^3+2x^2+4xy+2y^2-x-9y+2=0$$