COMBINED FIRST AND SECOND SEMESTER B.TECH (ENGINEERING) DEGREE EXAMINATION, MAY 2010

PTEN/EN09 101 - ENGINEERING MATHEMATICS-I

(2009 admissions)

Time : Three hours Maximum: 70 marks

Part A

Answer **all** questions

1. Give the formula for curvature of any Given curve in Cartesian form.

2. What is D' Alembert's ratio test?

3. State Cayley-Hamilton Theorem.

4. Find the eigen values of $2A^2$, if $A = \begin{bmatrix} 4 & 1 \\ 3 & 2 \end{bmatrix}$

5. Express $f(x) = x$ as Fourier series in the interval $-\pi < x < \pi$.

($5 \times 2 = 10$ marks)

Part B

Answer any **four** questions

6. Discuss the convergence of $\frac{5}{2} - \frac{7}{4} + \frac{9}{6} - \frac{11}{8} + \ldots$

7. Find the centre of curvature of the parabola $y^2 = 12x$ at the points (3,6).

8. Find the equation of the circle of curvature of the curve $\sqrt{x} + \sqrt{y} = \sqrt{a}$ at $\left[\frac{a}{4}, \frac{a}{4}\right]$.

[redacted]

9. Find the eigen values of adjoint of matrix A, given

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

10. Show that a constant "C" can be expanded in a infinite series $\frac{4c}{\pi}\left\{\sin x + \frac{\sin 3x}{3} + \frac{\sin 5x}{5} + \ldots\right\}$ in the range $0 < x < \pi$.

11. Develop $f(x)$ in Fourier series in the interval (-2, 2) if

$f(x) = 0, \quad -2 < x < 0$

$= 1, \quad 0 < x < 2$ $(4 \times 5 = 20$ marks)

Part C

Answer section (a) **or** section (b) of each question.

Each question carries 10 marks

12. (a) Find the equivalent of

$$\frac{\partial^2 u}{\partial x^2} + \frac{\partial^2 u}{\partial y^2}$$ in polar co-ordinates.

Or

(b) If $x = r\cos\theta, y = r\sin\theta$, verify that $\frac{\partial(x,y)}{\partial(r,\theta)} \times \frac{\partial(r,\theta)}{\partial(x,y)} = 1$.

13. (a) Test whether the series

$$1 + \frac{1}{2^2} - \frac{1}{3^2} - \frac{1}{4^2} + \frac{1}{5^2} + \frac{1}{6^2} - \frac{1}{7^2} - \ldots$$ is convergent or not?

Or

[redacted]

(b) State the values of x for which the following series converge

$$\frac{1}{1-x}+\frac{1}{2(1-x)^2}+\frac{1}{3(1-x)^3}+\cdots+\infty.$$

14. (a) Reduce the quadratic form $2x_1^2+x_2^2+x_3^2+2x_1x_2-2x_1x_3-4x_2x_3$ to canonical form by an orthogonal transformation.

or

(b) Diagonilise the matrix A =

$$A=\begin{bmatrix} 2 & 1 & -1 \\ 1 & 1 & -2 \\ -1 & -2 & 1 \end{bmatrix}$$

by means of an orthogonal transformation.

15. (a) Obtain the Fourier series for the function $f(x)$ given by

$$f(x)=1+\frac{2x}{\pi}, \quad -\pi \le x \le 0$$
$$=1-\frac{2x}{\pi}, \quad 0 \le x \le \pi$$

or

(b) Expand $f(x) = e^{-x}$ as a Fourier series in the interval $(-l, l)$. ($4 \times 10 = 40$ marks)