

Roll No.

Total Pages : 3

BT-I/D-16

**8117**

APPLIED MATHEMATICS-I

Paper : AS-105(N)

Time : Three Hours]

[Maximum Marks : 75

Note : Attempt five questions in all, selecting at least *one* question from each unit. All questions carry equal marks.

**UNIT-I**

1. (a) Use Gauss-Jordan method to find the inverse of the following matrix :

$$\begin{bmatrix} 1 & 2 & 3 \\ 5 & 6 & 7 \\ 8 & 7 & 0 \end{bmatrix}.$$

- (b) Use the Rank method to test the consistency of the system of equations  $3x + y + 2z = 3$ ,  $2x - 3y - z = -3$ ,  $x + 2y + z = 4$ . If consistent, then solve it completely.

2. (a) Find the eigen values and eigen vectors of the following matrix :

$$A = \begin{bmatrix} 8 & -6 & 2 \\ -6 & 7 & -4 \\ 2 & -4 & 3 \end{bmatrix}.$$

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[P.T.O.]

- (b) If matrix  $A = \begin{bmatrix} 2 & 1 & 1 \\ 0 & 1 & 0 \\ 1 & 1 & 2 \end{bmatrix}$ , find the matrix represented by the polynomial

$$A^8 - 5A^7 + 7A^6 - 3A^5 + A^4 - 5A^3 + 8A^2 - 2A + I.$$

**UNIT-II**

3. (a) Find the  $n^{\text{th}}$  derivative of the following functions :
- (i)  $x^2 \sin 5x$ .

(ii)  $y = x \log \left( \frac{x-1}{x+1} \right)$ .

- (b) Expand  $\tan [x + (\pi/4)]$  in ascending powers of  $x$  upto terms in  $x^4$  using Taylor's theorem. Evaluate approximately the value of  $\tan (43^\circ)$ .

4. (a) Find the asymptote of the following curve :  

$$y^3 - 2xy^2 - x^2y + 2x^3 + 3y^2 - 7xy + 2x^2 + 2y + 2x + 1 = 0.$$
- (b) Trace the lemniscate  $r^2 = a^2 \cos 2\theta$ .

**UNIT-III**

5. (a) If  $u = f(r)$  where  $r^2 = x^2 + y^2$ , prove that

$$\frac{\partial^2 u}{\partial x^2} + \frac{\partial^2 u}{\partial y^2} = f''(r) + \frac{1}{r} f'(r).$$

- (b) Expand  $xy^2 + 2x - 3y$  in powers of  $(x+2)$  and  $(y-1)$  upto third degree terms.

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6. (a) Transform the equation  $\frac{\partial^2 u}{\partial x^2} + \frac{\partial^2 u}{\partial y^2} = 0$  into the polar coordinates.
- (b) A thin closed rectangular box is to have one edge equal to twice the other, and a constant volume  $72 \text{ m}^3$ . Find the least surface area of the box.

#### UNIT-IV

7. (a) Find the volume of the solid generated by revolving the leminiscate  $r^2 = a^2 \cos 2\theta$  about the line  $\theta = \pi/2$ .
- (b) Change the order of integration and evaluate

$$\int_1^{2/4/x} \int_0^{4/x} xy \, dy \, dx.$$

8. (a) Evaluate  $\int_0^1 \int_0^{1-x} \int_0^{1-xx+y} e^z \, dx \, dy \, dz$ .

- (b) Evaluate  $\iiint \frac{dx \, dy \, dz}{(x+y+z+1)^3}$  taken over the volume bounded by the planes  $x = 0, y = 0, z = 0, z = 0$  and  $x + y + z = 1$ .