INSTITUTE OF AERONAUTICAL ENGINEERING

(Autonomous)

B.Tech I Semester End Examinations (Supplementary) – February , 2017

Regulation: IARE–R16

LINEAR ALGEBRA AND ORDINARY DIFFERENTIAL EQUATIONS

(Common to all branches)

Time: 3 Hours   **Max Marks: 70**

Answer ONE Question from each Unit
All Questions Carry Equal Marks
All parts of the question must be answered in one place only

UNIT – I

1. (a) Find the rank of the matrix $\begin{bmatrix} 1 & 1 & 1 & 6 \\ 1 & -1 & 2 & 5 \\ 3 & 1 & 1 & 8 \\ 2 & -2 & 3 & 7 \end{bmatrix}$ by reducing it into normal form. **[7M]**

   (b) Find the inverse of the matrix $\begin{bmatrix} 2 & 3 & 1 \\ 1 & 2 & 3 \\ 3 & 1 & 2 \end{bmatrix}$ using elementary row operations. **[7M]**

2. (a) Find the inverse of $A = \begin{bmatrix} 1 & 2 & 3 \\ 2 & 4 & 5 \\ 3 & 5 & 6 \end{bmatrix}$ by Gauss – Jordon method. **[7M]**

   (b) Find the rank of the matrix $A = \begin{bmatrix} -2 & -1 & -3 & -1 \\ 1 & 2 & 3 & -1 \\ 1 & 0 & 1 & 1 \\ 0 & 1 & 1 & -1 \end{bmatrix}$ by reducing it into echolon form. **[7M]**

UNIT – II

3. (a) Find the Eigen values and Eigen vectors of the matrix $\begin{bmatrix} 1 & -1 & 1 \\ 1 & 0 & 0 \\ -1 & 1 & -1 \end{bmatrix}$ **[7M]**

   (b) Find a matrix P such that $P^{-1}AP$ is diagonal matrix, where $A = \begin{bmatrix} 2 & 2 & 1 \\ 1 & 3 & 1 \\ 1 & 2 & 2 \end{bmatrix}$ **[7M]**

4. (a) Show that **[7M]**

     i. a square matrix A and its transpose A^T have same eigen values

     ii. product of two Unitary matrices is Unitary.

  (b) Find a matrix P which diagonalises the matrix A $= \begin{bmatrix} -1 & 1 & 1 \\ 0 & -1 & 2 \\ 1 & 1 & 1 \end{bmatrix}$ **[7M]**

UNIT – III

5. (a) Solve the differential equation $x\frac{dy}{dx} + (1-x)y = x^2y^2$ **[7M]**

  (b) In a murder investigation, a corpse was found by a detective at exactly 8 PM. Being alert, the detective also measured the body temperature and found it to be 70° F. Two hours later, the detective measured the body temperature again and found it be 60° F. If the room temperature is 50° F and assuming that the body temperature of the person before death was 98.6^o F, at what time did the murder occur? **[7M]**

6. (a) Find the orthogonal trajectories of the family of circles passing through the origin and the centres on the x - axis. **[7M]**

  (b) Solve the differential equation $x\left(1-x^2\right)\frac{dy}{dx} + \left(2x^2-1\right)y = x^3$ **[7M]**

UNIT – IV

7. (a) Solve the differential equation $\left(D^3 - 2D^2 - 5D + 6\right)y = 0, y(0) = 0, y'(0) = 0, y''(0) = 1$ **[7M]**

  (b) Solve the differential equation $\left[(D-1)^2\left(D^2+1\right)\right]y = e^x$ **[7M]**

8. (a) Solve the differential equation $\left(D^2 - 5D + 6\right)y = x\cos x\cos 2x$ **[7M]**

  (b) A circuit consists of an inductance of 2 Henrys, a resistance of 4 Ohms and capacitance of 0.05 Farads. If q = i = 0 at t = 0. Find q(t) and i(t) when there is a constant electromagnetic field of 100 V. **[7M]**

UNIT – V

9. (a) If U $= \left(\frac{y-x}{xy}, \frac{z-x}{xz}\right)$ then find the value of $x^2U_x + y^2U_y + z^2U_z$ **[7M]**

  (b) Examine the function $\sin x + \sin y + \sin(x+y)$ for extreme values. **[7M]**

10. (a) Find the extreme values of the function $f(x,y) = x^4 + y^4 - 2x^2 + 4xy - 2y^2$ **[7M]**

  (b) If x increases at the rate of 2 cm/sec at the instant when x $= 3$ cm, and y $= 1$ cm, at what rate must y be changing in order that $2xy - 3x^2y$ shall be neither increasing nor decreasing? **[7M]**