Hall Ticket No | | | | | | | | | | | Question Paper Code: AHS002

# INSTITUTE OF AERONAUTICAL ENGINEERING

(Autonomous)

B.Tech I/II Semester Supplementary Examinations - July, 2017

**Regulation: IA-R16**

**LINEAR ALGEBRA AND ORDINARY DIFFERENTIAL EQUATIONS**

**[Common for : I Semester (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) Reduce the matrix $\begin{bmatrix} 1 & 3 & -1 & 2 \\ 0 & 11 & -5 & 3 \\ 2 & -5 & 3 & 1 \\ 4 & 1 & 1 & 5 \end{bmatrix}$ to echelon form and hence find its rank. **[7M]**

   (b) Using Gauss Jordan method, find inverse of the matrix $A = \begin{bmatrix} 1 & 1 & 3 \\ 1 & 3 & -3 \\ -2 & -4 & -4 \end{bmatrix}$ **[7M]**

2. (a) Find the normal form of the matrix $\begin{bmatrix} 1 & 2 & 3 & 0 \\ 2 & 4 & 3 & 2 \\ 3 & 2 & 1 & 3 \\ 6 & 8 & 7 & 5 \end{bmatrix}$ and hence find its rank. **[7M]**

   (b) Using factorization method solve the equations: **[7M]**
   3x+2y+7z=4,2x+3y+z=5,3x+4y+z=7.

## UNIT – II

3. (a) Using Cayley -Hamilton theorem, express $A^5 - 4A^4 - 7A^3 + 11A^2 - A - 10I$ as a linear polynomial in A where $A = \begin{bmatrix} 1 & 4 \\ 2 & 3 \end{bmatrix}$ **[7M]**

   (b) Find the eigen values and corresponding eigen vectors of $A = \begin{bmatrix} 3 & -1 & 1 \\ -1 & 5 & -1 \\ 1 & -1 & 3 \end{bmatrix}$ **[7M]**

4. (a) If $\lambda$ is an eigenvalue of a non-singular matrix A, then show that $\frac{|A|}{\lambda}$ is an eigenvalue of adj A. **[7M]**

   (b) Reduce the matrix $A = \begin{bmatrix} -1 & 2 & -2 \\ 1 & 2 & 1 \\ -1 & -1 & 0 \end{bmatrix}$ to a diagonal form. **[7M]**

## UNIT – III

5. (a) Solve $\frac{dy}{dx} - \frac{\tan y}{1+x} = (1+x)\, e^x \sec y$. **[7M]**

   (b) A body originally at $80^0$ cools down to $60^0$ C in 12 minutes, the temperature of the air being $30^0$. What will be the temperature of the body after 24 minutes from the original? **[7M]**

6. (a) Find orthogonal trajectories of family of circles $x^2 + y^2 + 2\lambda x + c = 0$ where $\lambda$ is parameter. **[7M]**

   (b) Solve $\left(e^{2y} - y\cos xy\right) dx + \left(2xe^{2y} - x\cos xy + 2y\right) dy = 0$. **[7M]**

## UNIT – IV

7. (a) Solve $\left(D^2 + 3D + 2\right) y = e^{e^x}$. **[7M]**

   (b) Solve $y'' + y = \tan x$ by method of variation of parameters. **[7M]**

8. (a) Solve $\left(D^2 + 2D + 3\right) y = e^x \cos x$. **[7M]**

   (b) Solve $\left(D^4 + 1\right) y = \sin x$. **[7M]**

## UNIT – V

9. (a) Verify Rolle's theorem for $f(x) = (x+2)^3 (x-3)^4$ in $[-2, 3]$. **[7M]**

   (b) If $u = f(r, s), r = x + at, s = y + bt$ and x,y,t are independent variables, show that $\frac{\partial u}{\partial t} = a\frac{\partial u}{\partial x} + b\frac{\partial u}{\partial y}$. **[7M]**

10. (a) If $u = x^2 - 2y^2, v = 2x^2 - y^2, x = r\cos\theta, y = \sin\theta$ show that $\frac{\partial(u,v)}{\partial(r,\theta)} = 6r^3 \sin 2\theta$. **[7M]**

    (b) A rectangular open box of capacity 32 cubic units is to be prepared. Find the dimensions of the box, to minimize the cost of painting outside. **[7M]**