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

INSTITUTE OF AERONAUTICAL ENGINEERING

(Autonomous)

B.Tech I Semester End Examinations (Regular) - December, 2017

Regulation: IARE-R16

LINEAR ALGEBRA AND ORDINARY DIFFERENTIAL EQUATIONS

(Common for 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 by reducing it to normal form: $A = \begin{bmatrix} 1 & 2 & 3 & -1 \\ -1 & -1 & -3 & -1 \\ 1 & 0 & 1 & 1 \\ 0 & 1 & 1 & -1 \end{bmatrix}$. **[7M]**

   (b) Find the inverse of $A = \begin{bmatrix} 1 & 2 & 2 \\ -1 & 1 & 1 \\ 3 & -2 & 1 \end{bmatrix}$ using elementary column or row operation. **[7M]**

2. (a) Solve the following system of equations by Gauss – Jordon Method. **[7M]**
   2x-3y+z = -1, x+4y+5z = 25, 3x-4y+z = 2.

   (b) Prove that every Hermitian matrix can be written as P + iQ where P is real symmetric and Q is real skew symmetric. **[7M]**

UNIT – II

3. (a) Find the inverse transformation of the following linear transformation, $y_1 = x_1 + 2x_2 + 5x_3$, $y_2 = 2x_1 + 4x_2 + 11x_3$, $y_3 = -x_2 + 2x_3$ **[7M]**

   (b) Find all the Eigen Values and the corresponding Eigen vectors of $\begin{bmatrix} 8 & -6 & 2 \\ -6 & 7 & -4 \\ 2 & -4 & 3 \end{bmatrix}$. **[7M]**

4. (a) If A is an invertible matrix with Eigen Value λ having corresponding Eigen Vector X then prove that λ^{-1} is the Eigen Value of A^{-1} Eigen Vector X. **[7M]**

   (b) Verify the Cayley – Hamilton theorem for A = $\begin{bmatrix} 2 & -1 & 1 \\ -1 & 2 & -1 \\ 1 & -1 & 2 \end{bmatrix}$ and hence find A^{-1} **[7M]**

UNIT – III

5. (a) Solve $\frac{dy}{dx} - y\tan x = \frac{\sin x \cos^2 x}{y^2}$. **[7M]**

   (b) Find the orthogonal trajectory of the family of Coaxial Circles $x^2 + y^2 + 2\lambda x + C = 0$, where λ being the Parameter. **[7M]**

6. (a) Solve $\left(8xy - 9y^2\right) dx + 2\left(x^2 - 3xy\right) dy = 0$. **[7M]**

   (b) A bottle of mineral water at room temperature of 72°F is kept in a refrigerator where the temperature is 44°F. After half an hour, water cooled to 61°F. **[7M]**

      i. What is the temperature of the mineral water in another half an hour?

      ii. How long will it take to cool to 50°F?

UNIT – IV

7. (a) Solve $\left[D^2 - 4D + 4\right] y = e^{2x} + \cos 2x + 4$. **[7M]**

   (b) Using Variation of Parameters, solve $\left(D^2 - 2D + 1\right) y = e^x/x$. **[7M]**

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

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

UNIT – V

9. (a) Prove that if 0 < a < 1, 0 < b < 1, a < b. Then $\frac{b-a}{\sqrt{1-a^2}} < \sin^{-1} b - \sin^{-1} a < \frac{b-a}{\sqrt{1-b^2}}$ and hence deduce that $\frac{\pi}{6} - \frac{1}{2\sqrt{3}} < \sin^{-1}(1/4) < \frac{\pi}{6} - \frac{1}{\sqrt{15}}$. **[7M]**

   (b) If $U = x + 3y^2 - z^3,\ V = 4x^2yz,\ W = 2z^2 - xy,\ find\ \frac{\partial(U,V,W)}{\partial(x,y,z)}$ at (1, -1, 0). **[7M]**

10. (a) If z = f(x, y) where x = rcosθ, y = rsinθ prove that $(Z_x)^2 + (Z_y)^2 = (Z_r)^2 + \frac{1}{r^2}(Z_\theta)^2$. **[7M]**

    (b) If x,y,z are the angles of a triangle, find the maximum value of sinx.siny.sinz. **[7M]**

– ○ ○ ◯ ○ ○ –