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

INSTITUTE OF AERONAUTICAL ENGINEERING

(Autonomous)

B.Tech I Semester End Examinations (Regular) - December, 2016

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) Express the matrix $A = \begin{bmatrix} 2+3i & 0 & 4i \\ 5 & i & 8 \\ 1-i & -3+i & 6 \end{bmatrix}$ as sum of Hermitian and a Skew Hermitian matrices. **[7M]**

   (b) Find the rank of the matrix A= $\begin{bmatrix} 1 & -1 & 2 & -3 \\ 4 & 1 & 0 & 2 \\ 0 & 3 & 0 & 4 \\ 0 & 1 & 0 & 2 \end{bmatrix}$ by reducing it into normal form. **[7M]**

2. (a) Find the rank of the matrix $\begin{bmatrix} 4 & 0 & 2 & 1 \\ 2 & 1 & 3 & 4 \\ 2 & 3 & 4 & 7 \\ 2 & 3 & 1 & 4 \end{bmatrix}$ by applying elementary row transformations. **[7M]**

   (b) Solve: $x+2y+3z=5,\ 2x-4y+6z=18,\ 3x-9y-3z=6$ by using LU decomposition method. **[7M]**

UNIT – II

3. (a) Examine whether the vectors [2, -1, 3, 2], [1, 3, 4, 2], [3, -5, 2 ,2] are linearly independent or not **[7M]**

   (b) Find the eigen values and eigen vectors of $A = \begin{bmatrix} 2-i & 0 & i \\ 0 & 1+i & 0 \\ i & 0 & 2-i \end{bmatrix}$ **[7M]**

4. (a) Diagonalize the matrix $A = \begin{bmatrix} 8 & -6 & 2 \\ -6 & 7 & -4 \\ 2 & -4 & 3 \end{bmatrix}$ **[7M]**

(b) Verify the Cayley-Hamilton theorem for the matrix $A = \begin{bmatrix} 1 & 0 & 2 \\ 0 & 2 & 1 \\ 2 & 0 & 3 \end{bmatrix}$ and hence find A^{-1} **[7M]**

UNIT – III

5. (a) Solve the differential equation $(x + \tan y)\, dy = \sin 2y\, dx$ **[7M]**

(b) At midnight, with the temperature inside your house at 70^o F and the temperature outside at 20^o F, your furniture breaks down. Two hours later, the temperature in your house has fall down to 50^o F. Assume that the outside temperature remains constant at 20^o. At what time will the inside temperature of your house reach 40^o F? **[7M]**

6. (a) If 30% of radioactive substance disappeared in 10 days. How long will it take for 90% of it to disappear? **[7M]**

(b) Solve the differential equation $\left(xy^2 - e^{1/x^3}\right) dx - x^2 y dy = 0$ **[7M]**

UNIT – IV

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

(b) Solve the differential equation $(D^2 + 1)y = \frac{1}{1+\sin x}$ by the method of variation of parameters. **[7M]**

8. (a) Solve the differential equation $(D^3 + D^2 + 4D + 4)y = e^{-x} \cos x$ **[7M]**

(b) Solve the differential equation $(D^2 + 3D + 2)y = e^x$ by the method of variation of parameters **[7M]**

UNIT – V

9. (a) Verify Cauchy mean value theorem for the functions $f(x) = \log x$ and $g(x) = \frac{1}{x}$ in the interval $[1\,,\ e]$ **[7M]**

(b) A rectangular box open at the top is to have a volume of 32 cubic ft. Find the dimensions of the box requiring least material for its construction **[7M]**

10. (a) If $u = x + 3y^2 - z^3,\ v = 4x^2yz,\ w = 2z^2 - xy$ then find $\frac{\partial(u,v,w)}{\partial(x,y,z)}$ at $(1, -1, 0)$ **[7M]**

(b) If $x^x y^y z^z = c$ then show that $\frac{\partial^2 z}{\partial x \partial y} = -\frac{(1+\log x)(1+\log y)}{z(1+\log z)^3}$ and hence deduce that $\frac{\partial^2 z}{\partial x \partial y} = -(x \log ex)^{-1}$ when $x = y = z$. **[7M]**