Hall Ticket No | | | | | | | | | | | Question Paper Code: AHSB02

# INSTITUTE OF AERONAUTICAL ENGINEERING

**(Autonomous)**

B.Tech I Semester End Examinations (Regular) - November, 2018

**Regulation: IARE – R18**

## LINEAR ALGEBRA AND CALCULUS

**Time: 3 Hours** **(Common to All Branches)** **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) Determine a and b, if the rank of the matrix $\begin{bmatrix} 1 & -2 & 3 & 1 \\ 2 & 1 & -1 & 2 \\ 6 & -2 & a & b \end{bmatrix}$ is 3. **[7M]**

   (b) Find the eigen values and eigen vectors of the matrix $A = \begin{bmatrix} 6 & -2 & 2 \\ -2 & 3 & -1 \\ 2 & -1 & 3 \end{bmatrix}$. **[7M]**

2. (a) Find the inverse of the matrix $A = \begin{bmatrix} 2 & -1 & 3 \\ 1 & 1 & 1 \\ 1 & -1 & 1 \end{bmatrix}$ by Gauss-Jordan method. **[7M]**

   (b) Verify Cayley – Hamilton theorem for $A = \begin{bmatrix} 1 & 2 & 3 \\ 2 & -1 & 3 \\ 1 & 1 & 2 \end{bmatrix}$. **[7M]**

### UNIT – II

3. (a) Verify Rolle's theorem for $f(x) = \log\left[\frac{x^2+ab}{x\,(a+b)}\right]$ in $[a,\ b]\,,\ b > a > 0$. **[7M]**

   (b) Determine maxima and minima of the function $x^3 + y^3 - 3axy,\ a < 0$. **[7M]**

4. (a) If $u = x + y + z$; $uv = y + z$; $uvw = z$ then find $\frac{\partial(x,y,z)}{\partial(u,v,w)}$. **[7M]**

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

## UNIT – III

5. (a) Solve $\left(D^2+3D+2\right)y = 4\cos^2 x$. **[7M]**

   (b) Solve $\left(D^2+16\right)y = x\sin 3x$. **[7M]**

6. (a) Solve $\left(D^2-4D+3\right)y = e^x\cos 2x$. **[7M]**

   (b) Find the current I(t) in a series R-L circuit in which $L = 1\,H,\ R = 5\,\Omega,\ E = 1$ and I(0)=0 . **[7M]**

## UNIT – IV

7. (a) Evaluate $\int\int_A xydxdy$, where A is the region bounded by x=2a and the curve $x^2$=4ay. **[7M]**

   (b) Change the order of integration in $\int_0^1 \int_{x^2}^{2-x} xy\,dy\,dx$ and hence evaluate. **[7M]**

8. (a) Evaluate $\int_0^1 \int_0^1 \frac{dxdy}{\sqrt{(1-x^2)(1-y^2)}}$. **[7M]**

   (b) Evaluate $\int_0^1 \int_0^{\sqrt{1-x^2}} y^2 dydx$ by changing the order of integration. **[7M]**

## UNIT – V

9. (a) If $\vec{r} = x\,\vec{i} + y\,\vec{j} + z\,\vec{k}$ and $r = \left|\vec{r}\right|$ , prove that $r^n\,\vec{r}$ is solenoidal of n=-3 and irrotational for all value of n. **[7M]**

   (b) Using Green's theorem evaluate $\int_C \left[\left(x^2-y^2\right)dx + 2xy\,dy\right]$ where C is closed curve of the region bounded by $y^2 = x$ and $x^2 = y$. **[7M]**

10. (a) Verify Green's theorem for $\int_c \left(3x^2-8y^2\right)dx + (4y-6xy)\,dy$ where C is a boundary of the region bounded by x=0, y=0 and x+y=1. **[7M]**

    (b) Evaluate $\int_C \left[xydx + xy^2\,dy\right]$ by Stokes theorem where C is the square in the xy plane with vertices $(1,0)\,,(-1,0)\,,(0,1)\,,(0,-1)$. **[7M]**

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