Hall Ticket No | | | | | | | | | | | Question Paper Code: AHSD02

INSTITUTE OF AERONAUTICAL ENGINEERING

(Autonomous)
Dundigal-500043, Hyderabad

B.Tech I SEMESTER END EXAMINATIONS (REGULAR) - FEBRUARY 2024
Regulation: BT23

MATRICES AND CALCULUS

Time: 3 Hours **(COMMON TO ALL BRANCHES)** **Max Marks: 60**

Answer ALL questions in Module I and II
Answer ONE out of two questions in Modules III, IV and V
All Questions Carry Equal Marks
All parts of the question must be answered in one place only

MODULE – I

1. (a) Reduce the matrix in echelon form and find its rank $\begin{bmatrix} 2 & -4 & 3 & 1 & 0 \\ 0 & -2 & 1 & -4 & 2 \\ 0 & 1 & -1 & 3 & 1 \\ 4 & -7 & 4 & -4 & 5 \end{bmatrix}$

[BL: Apply| CO: 1|Marks: 6]

(b) Investigate for what value of λ and μ the equations x + y + z =6, x + 2y + 3z =10, $x+2y+\lambda z = \mu$ have

i) No solution
ii) Unique solution
iii) Infinite solution

[BL: Apply| CO: 1|Marks: 6]

MODULE – II

2. (a) Find the eigen values and eigen vectors of the following matrix $\begin{bmatrix} 8 & -8 & -2 \\ 4 & -3 & -2 \\ 3 & -4 & 1 \end{bmatrix}$

[BL: Apply| CO: 2|Marks: 6]

(b) Diagonalize the matrix $\begin{bmatrix} 3 & -1 & 1 \\ -1 & 5 & -1 \\ 1 & -1 & 3 \end{bmatrix}$ [BL: Apply| CO: 2|Marks: 6]

MODULE – III

3. (a) Discuss the maxima and minima of $f(x,y) = x^3 + xy^2 - 12x^2 - 2y^2 + 21x + 10$

[BL: Apply| CO: 3|Marks: 6]

(b) Determine the value of c using Lagrange's mean value theorem for $f(x) = x(x-1)(x-2)$ in $(0, \frac{1}{2})$ [BL: Apply| CO: 3|Marks: 6]

4. (a) If x+y+z=u, y+z=uv, z=uvw then show that $\frac{\partial(x,y,z)}{\partial(u,v,w)} = u^2v$ [BL: Apply| CO: 4|Marks: 6]

   (b) Examine the functional dependence or independence of $u = \frac{x-y}{x+y}$ and $v = \frac{x+y}{x}$. If dependent, find the relation between them.

   [BL: Apply| CO: 4|Marks: 6]

MODULE – IV

5. (a) Obtain the Fourier series expansion for the function $f(x) = x(2\pi - x)$ in $0 \leq x \leq 2\pi$

   [BL: Apply| CO: 5|Marks: 6]

   (b) Find the half range sine series for $f(x) = x^2$ in $(0, 2\pi)$ [BL: Apply| CO: 5|Marks: 6].

6. (a) Find the Fourier series expansion for $f(x) = \pi - x$ in $[0, 2\pi]$ with period 2π. Hence find the sum of the series $1 - \frac{1}{3} + \frac{1}{5}$.... . [BL: Apply| CO: 5|Marks: 6]

   (b) Obtain the Fourier series of $f(x) = x^3$ in $[-\pi, \pi]$ [BL: Apply| CO: 5|Marks: 6]

MODULE – V

7. (a) Evaluate $\int\int ydxdy$ over the part of the curves bounded by the line $y = x$ and the parabola $y = 4x - x^2$ [BL: Apply| CO: 6|Marks: 6]

   (b) Compute the value of integral $\int_0^{\pi/2} \int_0^{sin\theta} rdrd\theta$ [BL: Apply| CO: 6|Marks: 6]

8. (a) Change the order of integration and evaluate $\int_0^a \int_{y^2/a}^a \frac{ydxdy}{(a-x)\sqrt{ax-y^2}}$

   [BL: Apply| CO: 6|Marks: 6]

   (b) Evaluate $\int_0^1 \int_0^{1-x} \int_0^{x+y} e^z dzdydx$ [BL: Apply| CO: 6|Marks: 6]

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