Reg. No. : | | | | | | | | | | | | |

Question Paper Code: 4021392

M.E. / M.Tech. DEGREE EXAMINATIONS, NOV/ DEC 2024
First Semester
CAD / CAM
P20MA101 – APPLIED MATHEMATICS FOR ENGINEERS
(Regulation 2020)

Time: Three Hours | Maximum: 100 Marks

Answer ALL questions

PART – A (10 x 2 = 20 Marks)

1. Define linear transformation.

2. Let $T: R^2 \to R^2$ be a linear transformation represented by the matrix $A = \begin{bmatrix} 2 & 1 \\ 0 & 3 \end{bmatrix}$, and let $S: R^2 \to R^2$ be another linear transformation represented by the matrix $B = \begin{bmatrix} 0 & -1 \\ 1 & 0 \end{bmatrix}$. Find the matrix of the composite transformation SoT.

3. The production function of a commodity is given by $y = 40x + 3x^2 - \frac{x^3}{3}$, where y is the total output and x is the units of inputs. Find the number of units of input required to give the maximum output.

4. What is Quadratic Programming?

5. What is the equation for a quadratic Bézier curve defined by three control points P_0, P_1 and P_2?

6. What is the main difference between a Bézier surface and a B-spline surface in terms of control points?

7. What are the basic principles of experimental design?

8. Is a 2×2 Latin square design possible? Why?

9. Define fuzzy set.

10. What is neural network?

PART – B (5 x 16 = 80 Marks)

11. (a) Let $F: R^4 \to R^3$ be the linear mapping defined by $F(x,y,z,t) = (x-y+z+t, 2x-2y+3z+4t, 3x-3y+4z+5t)$. Find a basis and dimension of the image of F and kernel of F.

(16)

(OR)

(b) (i) Let $T: R^3 \to R^2$ be the linear mapping defined by $T(a,b,c) = (3a+2b-4c,\ a-5b+3c)$. Find the matrix of T in the following bases of R^3 and R^2 are $S = \{(1,1,1),(1,1,0),(1,0,0)\}$ and $S' = \{(1,3),(2,5)\}$ respectively.

(10)

(ii) Let $T: R^2 \to R^2$ be the linear mapping represented by the matrix $A = \begin{bmatrix} 3 & 2 \\ 1 & 4 \end{bmatrix}$. (a) Find the matrix representation of the inverse transformation T^{-1}, if it exists, (b) Verify that $A.A^{-1} = I$.

(6)

12. (a) Solve the following problem by using the method of Lagrangian multipliers.
$minimize\ Z = x_1^2 + x_2^2 + x_3^2$
Subject to the constraints (i) $x_1 + x_2 + x_3 = 2$, (ii) $5x_1 + 2x_2 + x_3 = 5$ and $x_1, x_2 \geq 0$.

(16)

(OR)

(b) Determine x_1 and x_2 so as to
Maximize $Z = 12x_1 + 21x_2 + 2x_1x_2 - 2x_1^2 - 2x_2^2$ subject to the constraints (i) $x_2 \leq 8$, (ii) $x_1 + x_2 \leq 10$ and $x_1, x_2 \geq 0$.

(16)

13. (a) Find the cubic spline approximation for the data given below. (16)

x	0	1	2	3
$y = f(x)$	1	2	33	244

Assume $M(0) = M(3) = 0$. Also find $f(2.5)$.

(OR)

(b) From the following data find $P_5(x)$ using Hermite's interpolation method and hence determine $P_5(0.5)$. (16)

x	-1	0	1
$f(x)$	1	1	3
$f'(x)$	-5	1	7

14. (a) A completely randomized design experiment with 10 plots and 3 treatments gave the following results:

Plot No.	1	2	3	4	5	6	7	8	9	10
Treatment	A	B	C	A	C	C	A	B	A	B
Yield	5	4	3	7	5	1	3	4	1	7

Analyse the results for treatment effects. (16)

(OR)

(b) Three varieties of a crop are tested in a randomized block design with four replications, the layout being as given below. The yields are given in kilograms. Analyse for significance.

C48	A51	B52	A49
A47	B49	C52	C51
B49	C53	A49	B50

(16)

15. (a) Explain fuzzy relations with appropriate examples. (16)

(OR)

(b) Explain the role of Genetic Algorithms in optimizing Fuzzy Logic Systems with example. (16)

----------xxxx----------