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

Question Paper Code : 70756

M.E./M.Tech. DEGREE EXAMINATIONS, NOVEMBER/DECEMBER 2019
First Semester
Control and Instrumentation Engineering
MA 5155 – APPLIED MATHEMATICS FOR ELECTRICAL ENGINEERS
(Common to M.E. Electrical Drives and Embedded Control/M.E. Embedded System Technologies/M.E. Instrumentation Engineering/M.E. Power Electronics and Drives/M.E. Power Systems Engineering)
(Regulations 2017)

Time : Three Hours | Maximum : 100 Marks

Answer ALL questions

PART – A **(10×2=20 Marks)**

1. State the algorithm for computation of matrix Q in the QR factorization method.

2. Determine the nature of the quadratic form
$Q = 5x_1^2 + 5x_2^2 + 14x_3^2 + 2x_1x_2 - 16x_2x_3 - 8x_3x_1$ without reducing it to canonical form.

3. Define the simplest variational problem and state the Euler-Lagrange differential equation.

4. Show that the straight line is the shortest distance between two points in a plane.

5. Write the three axioms of probability for a finite sample space.

6. State Baye's theorem along with its formula.

7. Define basic feasible solution of a general Linear Programming problem.

8. Solve graphically : Maximize $z = 3x_1 - 2x_2$ subject to $x_1 + x_2 \le 1$, $3x_1 + 3x_2 \ge 6$, $x_1, x_2 \ge 0$.

9. Find the Fourier series for $f(x) = x^4$, in the interval $[-1, 1]$.

10. Find the cosine series for $f(x) = \begin{cases} 1 & \text{for } 0 \le x \le \pi/2 \\ 2 & \text{for } \pi/2 \le x \le \pi \end{cases}$

PART – B **(5×13=65 Marks)**

11. a) Solve the system of equations $x + 2y + 3z = 9$; $2x + 8y + 22z = 6$; $3x + 22y + 82z = -10$ using the Cholesky decomposition method. **(13)**

(OR)

b) Find a generalized eigen vector of rank 3 corresponding to the Eigen value $\lambda = 7$ for the matrix $A = \begin{pmatrix} 7 & 1 & 2 \\ 0 & 7 & 1 \\ 0 & 0 & 7 \end{pmatrix}$. **(13)**

12. a) Find the extremals of the functional $J[y, z] = \int_0^{\pi} (2yz - 2y^2 + y'^2 - z'^2)\, dx$ if $y(0) = 0$, $y(\pi) = 1$, $z(0) = 0$ and $z(\pi) = -1$. **(13)**

(OR)

b) Find the shortest distance from the point A(1, 1, 1) to the sphere $x^2 + y^2 + z^2 = 1$. **(13)**

13. a) i) Find the mean, variance and moment generating function of a Poisson random variable. **(7)**

ii) If X is uniformly distributed in (0, 10), find $P(X < 2)$, $P(X > 8)$, $P(3 < X < 9)$. **(6)**

(OR)

b) The time required to a piece of machinery is a random variable having approximately a normal distribution with mean $\mu = 12.9$ minutes and $\sigma = 2.0$ minutes. What are the probabilities that the assembly of a piece of machinery of this kind will take

i) at least 11.5 minutes;

ii) anywhere from 11.0 to 14.8 minutes ? **(13)**

14. a) Solve the following LPP by Big-M method: Minimize $z = x_1 + x_2 + 2x_3$ subject to $x_1 + x_2 + x_3 \le 9$, $2x_1 - 3x_2 + 3x_3 = 1$, $-3x_1 + 6x_2 - 4x_3 = 3$, $x_1, x_2 x_3 \ge 0$. **(13)**

(OR)

b) Solve the LPP by Two-phase method: Maximize $z = -2x_1 - x_2$ subject to $3x_1 + x_2 = 3$, $4x_1 + 3x_2 \ge 6$, $x_1 + 2x_2 \le 4$, $x_1, x_2 \ge 0$. **(13)**

15. a) Calculate the average power of the periodic signal (period T = 2) given $f(t) = 2\,Cos(5\pi t) + Sin(6\pi t)$

i) using a time domain analysis and

ii) using a frequency domain analysis. **(13)**

(OR)

b) Find the eigenvalues and eigenfunctions of $y'' + \lambda y = 0, 0 < x < 1, y(0) = 0, y(1) + y'(1) = 0$. **(13)**

PART – C **(1×15=15 Marks)**

16. a) State Given's QR factorization algorithm and hence apply it on the matrix $A = \begin{pmatrix} 4 & 2 & 1 \\ 2 & 5 & -2 \\ 1 & -2 & 7 \end{pmatrix}$. **(15)**

(OR)

b) A company has three mines A, B and C and five factories V, W, X, Y and Z. The mines can supply 80, 100 and 140 tons of ore daily respectively. The daily requirements of the five factories are 40, 50, 70, 80 and 80 respectively. Transportation costs in rupees per ton ore movement are given below. What is the best distribution plan ? Also, find the optimal transportation cost. **(15)**

	V	W	X	Y	Z
A	4	2	3	2	6
B	5	4	5	2	1
C	6	5	4	7	3

Start with the feasible solution : A to W 50; A to Y 30; B to X 20; B to Z 80; C to V 40; C to X 50; C to Y 50.

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