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

Question Paper Code : 10853

M.E./M.Tech. DEGREE EXAMINATIONS, APRIL/MAY 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)

(Regulation 2017)

Time : Three hours — Maximum : 100 marks

Answer ALL questions.

PART A — (10 × 2 = 20 marks)

1. Explain the generalized eigen vectors of a square matrix A with rank m.

2. Determine a canonical basis for the matrix $A = \begin{bmatrix} 3 & 5 \\ -2 & -4 \end{bmatrix}$.

3. Find the curves on which the functional $\int [(y')^2 + 12xy]dx$ can be extremized?

4. Write down the possible solutions of Euler's equation.

5. Find the probability of getting eight heads in a row with a balanced coin.

6. Derive the moment generating function of uniform distribution.

7. Determine an initial basic feasible solution to be given transportation problem by using North-West Corner rule.

	D_1	D_2	D_3	D_4	
O_1	6	4	1	5	14
O_2	8	9	2	7	16
O_3	4	3	6	2	5
	6	10	15	4	35

where O_i and D_j represent i^{th} origin and j^{th} destination respectively.

8. Write down the mathematical formulation of Assignment problem

9. Define energy signal with an example.

10. Write down the properties of the eigen values of a regular Sturm-Liouville system.

PART B — (5 × 13 = 65 marks)

11. (a) Find a canonical basis for $A = \begin{bmatrix} 3 & 2 & 0 & 1 \\ 0 & 3 & 0 & 0 \\ 0 & 0 & 3 & -1 \\ 0 & 0 & 0 & 3 \end{bmatrix}$. (13)

Or

(b) Construct a QR decomposition for the given matrix. $A = \begin{bmatrix} 25 & -131 & -86 \\ 11 & -41 & -18 \\ -4 & 28 & 0 \end{bmatrix}$. (13)

12. (a) On which curve the functional $\int_0^{\pi/2} [y'^2 - y^2 + 2xy]\,dx$ with $y(0) = 0$ and $y(\pi/2) = 0$ be extremized? (13)

Or

(b) Prove that the sphere is the solid figure of revolution which for a given surface area, has maximum volume. (13)

13. (a) A random variable X has probability density function given by $f(x) = \begin{cases} 2e^{-2x}; & x \geq 0 \\ 0 \quad ; & x < 0 \end{cases}$

Find :

(i) Moment generating function

(ii) First four moments about origin

(iii) Mean and

(iv) Variance. (13)

Or

(b) Derive the moment generating function of normal distribution and from the M.G.F. derive the mean and variance. (13)

14. (a) Solve the following LPP using Big M method. (13)

Maximize $z = 3x_1 + 2x_2$

Subject to the constraints :

$2x_1 + x_2 \leq 2;$

$3x_1 + 4x_2 \geq 12$

where $x_1, x_2 \geq 0$.

Or

(b) Use two-phase simplex method to solve the following LPP. (13)

Minimize $z = \frac{15}{2}x_1 - 3x_2$

Subject to the constraints :

$3x_1 - x_2 - x_3 \geq 3;$

$x_1 - x_2 + x_3 \geq 2$

where $x_1, x_2, x_3 \geq 0$.

15. (a) Calculate the average power of the periodic signal (period $T = 2$) for $f(t) = 2\cos 5\pi t + \sin 6\pi t$.

(i) Using a time domain analysis

(ii) Using a frequency domain analysis. (13)

Or

(b) Find the eigen values and eigen functions of $y'' + \lambda y = 0$, $0 < x < p$, $y(0) = 0$, $y(p) = 0$. (13)

PART C — (1 × 15 = 15 marks)

16. (a) Determine the number of generalized eigen vectors of each rank corresponding to $\lambda = 4$ that will appear in a canonical basis for $A = \begin{bmatrix} 4 & 2 & 1 & 0 & 0 & 0 \\ 0 & 4 & -1 & 0 & 0 & 0 \\ 0 & 0 & 4 & 0 & 0 & 0 \\ 0 & 0 & 0 & 4 & 2 & 0 \\ 0 & 0 & 0 & 0 & 4 & 0 \\ 0 & 0 & 0 & 0 & 0 & 7 \end{bmatrix}$.

Or

(b) Solve the boundary value problem $y'' - y + x = 0$ $(0 \leq x \leq 1)$ given that $y(0) = 0$, $y(1) = 0$ by using Rayleigh-Ritz method.