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

Question Paper Code : 66198

M.E. DEGREE EXAMINATION, DECEMBER 2015/JANUARY 2016

First Semester

Power Systems Engineering

MA 7163 : APPLIED MATHEMATICS FOR ELECTRICAL ENGINEERS

(Common to M.E. Power Electronics and Drives, M.E. Control and Instrumentation Engineering / M.E. Embedded System Technologies and M.E. Electrical Drives and Embedded Control)

(Regulations – 2013)

Time : Three Hours **Maximum : 100 Marks**

Answer ALL questions.

PART – A (10 × 2 = 20 Marks)

1. Write the condition of matrix A guaranteed LL^T decomposition.

2. What is the singular value decomposition of a complex matrix A ?

3. Write the necessary condition for functional $I = \int_{x_1}^{x_2} f(x, y, y', y'')dx$ to be maximum or minimum.

4. Write the necessary condition that the integral $I = \int_{x_1}^{x_2} f(x, y, y')dx$ will be stationary.

5. Write the mean and variance of the uniform distribution.

6. Given the random variable X with density function

$$f(x) = \begin{cases} 2x, & 0 < x < 1 \\ 0, & \text{elsewhere} \end{cases}$$

Find the probability density function of $Y = 8X^3$.

7. Give an example of an LPP having feasible region as a square.

8. How many basic variables will be there for a balanced transportation with 3 rows and 3 columns ?

9. If $f(x) = x^2$ in $-\pi < x < \pi$, find the value of b_n.

10. If e^{ax} is expanded as a Fourier series in $(-\pi, \pi)$, then find the value of a_0.

PART – B (5 × 16 = 80 Marks)

11. (a) Find singular value decomposition of the following matrix : $\begin{pmatrix} 1 & 1 \\ 1 & 1 \\ 1 & 1 \end{pmatrix}$.

OR

(b) Solve the system of equations using the Choleski method.

$$4x_1 - x_2 - x_3 = 3$$
$$-x_1 + 4x_2 - 3x_3 = -0.5$$
$$-x_1 - 3x_2 + 5x_3 = 0$$

12. (a) Find the curve connecting the points (not on a vertical line) such that a particle sliding down this curve under gravity (in absence of resistance) from one point to another reaches in the shortest time.

OR

(b) Find the extremal of the functional $A = \int \frac{1}{2}(x\dot{y} + y\dot{x})dt$ subject to the integral constraint $\int_{t_1}^{t_2} \sqrt{(\dot{x}^2 + \dot{y}^2)}\, dt = 1$.

13. (a) Find the first four moments

(i) about the origin

(ii) about the mean for a random variable X having density function

$$f(x) = \begin{cases} \frac{4x(9-x^2)}{81}, & 0 \le x \le 3 \\ 0, & \text{otherwise} \end{cases}$$

OR

(b) Out of 800 families with 4 children each, how many families would be expected to have

(i) 2 boys and 2 girls

(ii) atleast one boy

(iii) atmost 2 girls and

(iv) children of both sexes ? Assume equal probabilities for boys and girls.

14. (a) A gear manufacturing company received an order for three specific type of gears for regular supply. The management is considering to devote the available excess capacity to one or more of the three types say A, B, and C. The available capacity on the machines which might limit output and the number of machine hours required for each unit of the respective gear is also given below :

Machine Type	Available Machine Hours/Week	Productivity in Machine hours/unit		
		Gear A	Gear B	Gear C
Gear Hobbing m/c	250	8	2	3
Gear Shapping m/c	150	4	3	0
Gear Grinding m/c	50	2	0	1

The unit profit would be ₹ 20, ₹ 6 and ₹ 8 respectively for the gears A, B and C. Find how much of each gear company should produce in order to maximize profit.

OR

(b) Solve the following transportation problem to maximize the profit :

	A	B	C	D	Supply
1	15	51	42	33	23
2	80	42	26	81	44
3	90	40	66	60	33
Demand	23	31	16	30	100

15. (a) Find the Fourier series of f(x) defined as

$$f(x) = \begin{cases} 1 + \frac{2x}{\pi}, & -\pi < x < 0 \\ 1 - \frac{2x}{\pi}, & 0 < x < \pi \end{cases}$$

Hence prove $\frac{1}{1^2} + \frac{1}{3^2} + \frac{1}{5^2} + \ldots\ldots = \frac{\pi^2}{8}$.

OR

(b) Find the frequency spectrum of the periodic pulse defined by

$$f(x) = \begin{cases} -1, & -1 \le x < 0 \\ 1, & 0 \le x < 1 \end{cases}$$

$f(x+2) = f(x)$.