Reg. No. : [| | | | | | | | | | |]

Question Paper Code : 13656

M.E. DEGREE EXAMINATION, JANUARY 2015.

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)

(Regulation 2013)

Time : Three hours Maximum : 100 marks

Answer ALL questions.

PART A — (10 × 2 = 20 marks)

1. Define canonical basis of a matrix.

2. What are the properties of pseudo inverse?

3. State a necessary condition for the extremum of the functional $I = \int_{x_0}^{x_1} F(x, y, y')\, dx$.

4. Define Geodesic.

5. If $f(x) = kx^2$, $0 < x < 3$ is to be a density function, find the value of 'k'.

6. If X is uniformly distributed over the interval (–1, 1), find the density function of $Y = \sin\left(\frac{\pi x}{2}\right)$.

7. Express the general form of an LP model in algebraic form.

8. What is transportation problem?

9. Find the half range sine series $f(x) = 1$ in (0, 1).

10. Write down the exponential form of Fourier series of $f(x)$ in the interval $(c, c+2l)$.

PART B — (5 × 16 = 80 marks)

11. (a) Construct a singular value decomposition for $A = \begin{pmatrix} 2 & 2 & -2 \\ 2 & 2 & -2 \\ -2 & -2 & 6 \end{pmatrix}$. (16)

Or

(b) Construct a QR decomposition for $\begin{pmatrix} -4 & 2 & 2 \\ 3 & -3 & 3 \\ 6 & 6 & 0 \end{pmatrix}$. (16)

12. (a) (i) Find the extremal of the functional $\int_{x_0}^{x_1} y'(1 + x^2 y')\, dx$. (8)

(ii) Find the extremal of the functional $v[y(x)] = \int_0^1 (1 + y'')^2\, dx$ with $y(0) = 0$, $y'(0) = 1$, $y(1) = 1$ and $y'(1) = 1$. (8)

Or

(b) (i) Find an approximate solution to the problem of minimization of the functional $I = \int_0^1 (y'^2 - y^2 + 2xy)\, dx$ with $y(0) = 0 = y(1)$ by Ritz method. (8)

(ii) Find the extremal of the functional $v[y(x)] = \int_0^{\pi/4} (y^2 - y'^2)\, dx$ such that $y(0) = 0$ and the 2nd boundary point move along the line $x = \pi/4$. (8)

13. (a) (i) Find the Moment Generating Function of Poisson distribution. Hence find its mean and variance. (8)

(ii) The mileage which car owners get with a certain kind of radial tire is a random variable having an exponential distribution with mean 40,000 km. Find the probabilities that one of these tires will last (1) at least 20,000 km and (2) atmost 30,000 km. (8)

Or

(b) (i) The marks obtained by a number of students in a certain subject are approximately normally distributed with mean 65 and standard deviation 5. If 3 students are selected at random from this group, what is the probability that atleast one of them would have scored above 75? (8)

(ii) In a certain city, the daily consumption of electric power in millions of kilowatt hours can be treated as a random variable having an Erlang distribution with parameters $\lambda = \frac{1}{2}$ and $k = 3$. If the power plant of this city has a daily capacity of 12 millions kilowatt-hours, what is the probability that this power supply will be inadequate on any given day. (8)

14. (a) Using Simplex method : (16)

Maximise $Z = x_1 + 2x_2 + 3x_3 - x_4$

subject to :

$$x_1 + 2x_2 + 3x_3 = 15$$
$$2x_1 + x_2 + 5x_3 = 20$$
$$x_1 + 2x_2 + x_3 + x_4 = 10$$
$$x_1, x_2, x_3, x_4 \geq 0.$$

Or

(b) Solve the following transportation problem : (16)

Store

		A	B	C	a_i
Factory	F_1	10	8	8	8
	F_2	10	7	10	7
	F_3	11	9	7	9
	F_4	12	14	10	4
	b_j	10	10	8	

15. (a) Expand the function $f(x) = x \sin x$ as a Fourier series in the interval $-\pi \le x \le \pi$. Hence deduce that $\frac{1}{1\cdot 3} - \frac{1}{3\cdot 5} + \frac{1}{5\cdot 7} - \frac{1}{7\cdot 9} + \cdots = \frac{\pi - 2}{4}$. (16)

Or

(b) (i) State and prove Parseval's theorem on Fourier coefficients. (8)

(ii) Find the exponential form of Fourier series for $f(x) = e^x$ in $-\pi < x < \pi$. (8)
