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**Question Paper Code : 83226**

M.E. DEGREE EXAMINATION, JANUARY 2014.

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 a generalized eigenvector of rank  $m$ , for a square matrix.
2. Write down the stable formula for the generalized inverse.
3. Write down the Euler's equation for an extremum.
4. Which method is to be applied for solving isoperimetric problems?
5. Define a random variable with an example.
6. Determine the mean of a uniform random variable.
7. Graphically solve the LPP :  
Maximise  $Z = 3x_1 + 2x_2$   
Subject to :  
 $-2x_1 + x_2 \leq 1, x_1 \leq 2, x_1 + x_2 \leq 3, x_1 \geq 0, x_2 \geq 0.$
8. Explain slack and surplus variables in LPP.
9. Explain energy signal with an example.
10. Explain periodic function with an example.

11. (a) Determine a canonical basis for the matrix  $A = \begin{bmatrix} 4 & 1 & 1 & 2 & 2 \\ -1 & 2 & 1 & 3 & 0 \\ 0 & 0 & 3 & 0 & 0 \\ 0 & 0 & 0 & 2 & 1 \\ 0 & 0 & 0 & 1 & 2 \end{bmatrix}$ . (16)

Or

(b) Construct a QR decomposition for the matrix  $A = \begin{bmatrix} 0 & 1 & 1 & 1 \\ 1 & 0 & 1 & 1 \\ 1 & 1 & 0 & 1 \\ 1 & 1 & 1 & 0 \end{bmatrix}$ . (16)

12. (a) Find the extremal of the functional  $I = \int_0^{\pi/4} (y''^2 - y^2 + x^2) dx$  under the conditions  $y(0) = 0, y'(0) = 1, y(\pi/4) = \frac{1}{\sqrt{2}}$  and  $y'(\pi/4) = \frac{1}{\sqrt{2}}$ .

Or

(b) Solve the boundary value problem  $y'' - y + x = 0$  ( $0 < x < 1$ ),  $y(0) = y(1) = 0$  by using Ritz method.

13. (a) (i) Find the moment generating function of binomial distribution and find its mean and variance.
- (ii) The length of time, a person speaks over phone follows an exponential distribution with mean  $1/6$ . What is the probability that a person will talk for (1) more than 8 minutes (2) less than 4 minutes (3) between 4 and 8 minutes? (8)

Or

- (b) (i) State and prove the memoryless property of the exponential distribution.
- (ii) On an average, a typist makes 2 mistakes per page. What is the probability that she will make (1) no mistakes (2) more than 4 mistakes on a particular day, assuming that the number of errors per page follows Poisson distribution. (8)

14. (a) Solve the following by simplex method.

Min  $z = x_1 - 3x_2 + 3x_3$  subject to

$$3x_1 - x_2 + 2x_3 \leq 7,$$

$$2x_1 + 4x_2 \geq -12,$$

$$-4x_1 + 3x_2 + 8x_3 \leq 10,$$

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

Or

- (b) (i) Obtain the initial basic feasible solution to the following transportation problem by VAM.

		To				
		P	Q	R	S	
From	A	30	25	40	20	100
	B	29	26	35	40	250
	C	31	33	37	30	150
Demand		90	160	200	50	

- (ii) There are 4 jobs to be assigned to the machines, also only job could be assigned to one machine. The amount at time in hours required for the job in machines are given in the matrix.

	$M_1$	$M_2$	$M_3$	$M_4$
$J_1$	2	3	4	5
$J_2$	4	5	6	7
$J_3$	7	8	9	8
$J_4$	3	5	8	4

Find the optimum assignment of jobs to the machines to minimize the total processing time.

15. (a) Find the eigenvalues and eigenfunctions of  $y'' + \lambda y = 0, 0 < x < p, y(0) = 0, y(p) = 0$ .

Or

- (b) Find an expression for the Fourier coefficients associated with the generalized Fourier series arising from the eigenfunctions of  $y'' + y' + \lambda y = 0, 0 < x < 3, y(0) = 0, y(3) = 0$ .