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

Question Paper Code: 41251

M.E. DEGREE EXAMINATION, DECEMBER 2014.

First Semester

Power Electronics and Drives

14PMA126 – APPLIED MATHEMATICS FOR ELECTRICAL ENGINEERS

(Regulation 2014)

Duration: Three hours Maximum: 100 Marks

Answer ALL Questions.

PART A - (5 x 1 = 5 Marks)

1. Let A be a given matrix. Then there exists a unitary matrix Q and an upper triangular matrix R such that A =

   (a) $Q + R$ (b) $Q - R$ (c) Q / R (d) QR

2. When the transportation problem is said to be balanced if

   (a) $\sum a_i \neq \sum b_j$ (b) $\sum a_i = \sum b_j$ (c) $\sum a_i < \sum b_j$ (d) $\sum a_i > \sum b_j$

3. If X is a discrete random variable with probability distribution $P(X=x) = kx$, $x = 1,2,3,4$. Find k

   (a) $\frac{1}{10}$ (b) $\frac{3}{10}$ (c) $\frac{5}{10}$ (d) $\frac{7}{10}$

4. The value of a_n in the Fourier series expansion of $f(x) = x^3$ in $-\pi \le x \le \pi$ is

   (a) $\frac{\pi^4}{2}$ (b) 0 (c) 1 (d) $\frac{\pi^4}{4}$

5. The partial differential equation $\frac{\partial^2 u}{\partial x^2} + \frac{\partial^2 u}{\partial y^2} = f(x, y)$ is called

   (a) Heat equation (b) Wave equation
   (c) Laplace equation (d) Poisson's equation

PART - B (5 x 3 = 15 Marks)

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

7. Graphically solve the LPP:

Maximize $Z = 3x_1 + 2x_2$

Subject to :

$-2x_1 + x_2 \le 1,\ x_1 \le 2,\ x_1 + x_2 \le 3,\ x_1 \ge 0,\ x_2 \ge 0$

8. Determine the mean of a uniform random variable.

9. Explain periodic function with an example.

10. State the diagonal five point formula to solve the equation $u_{xx} + u_{yy} = 0$.

PART - C (5 x 16 = 80 Marks)

11. (a) Obtain the singular value decomposition of $\begin{pmatrix} 1 & 2 \\ 1 & 1 \\ 1 & 3 \end{pmatrix}$. (16)

Or

(b) Construct a QR decomposition for the matrix $A = \begin{bmatrix} -4 & 2 & 2 \\ 3 & -3 & 3 \\ 6 & 6 & 0 \end{bmatrix}$. (16)

12. (a) (i) Using Simplex method, solve the following LPP :

Maximize Z = $5x_1 + 3x_2$

Subject to :

$x_1 + x_2 \le 2,\ 5x_1 + 2x_2 \le 10,\ 3x_1 + 8x_2 \le 12$ and $x_1,\ x_2 \ge 0$. (8)

(ii) A company has 4 machines to do 3 jobs. Each job can be assigned to one and only one machine. The cost of each job on each machine is given below. Determine the job assignments which will minimize the total cost.

$$\begin{pmatrix} 18 & 24 & 28 & 32 \\ 8 & 13 & 17 & 18 \\ 10 & 15 & 19 & 22 \end{pmatrix}$$ (8)

Or

(b) Solve the transportation problem :

	1	2	3	4	Supply
I	21	16	25	13	11
II	17	18	14	23	13
III	32	27	18	41	19
Demand	6	10	12	15	

(16)

13. (a) (i) A discrete random variable X has the following probability function :

X	0	1	2	3	4	5	6	7
$P(X)$	0	a	2a	2a	3a	a^2	$2a^2$	$7a^2+a$

(a) Find the value of a

(b) Find $P(X < 6), P(X \geq 6)$

(c) If $P(X \leq c) > \frac{1}{2}$ find the minimum value of c. (8)

(ii) State and prove the Memory less property of Geometric distribution. (8)

Or

(b) (i) 3% of the electric light bulbs manufactured by a company are found to be defectives. In a sample of 100 such bulbs, find the probability that

(a) all are good

(b) atleast 3 defectives

(c) exactly 2 defectives

(d) atmost 4 defectives (8)

(ii) Derive the MGF of Gamma distribution and find its mean and variance. (8)

14. (a) Find an expression for the Fourier co-efficients associated with generalized Fourier series arising from the eigen functions of $y'' + y' + \lambda y = 0,\ 0<x<3,\ y(0) = y(3) = 0$. (16)

Or

(b) (i) Find the Fourier series expansion of the periodic function f(x) of the period 2 defined by

$$f(x) = 1 + x \,,\ -1 \le x \le 0$$
$$= 1-x \,,\ 0 \le x \le 1 \,.\ \text{Deduce that } \sum_{n=1}^{\infty} \frac{1}{(2n-1)^2} = \frac{\pi^2}{8} \qquad (8)$$

(ii) Find the Half range cosine series of $f(x) = \sin x$ in $(0,\pi)$. (8)

15. (a) (i) Using Crank-Nicholson method, solve $u_t = u_{xx}$ given $u(x,0) = 0 = u(0,t)$ and $u(1,t) = t$ taking $k=\frac{1}{8}$; $h=\frac{1}{4}$ for one-time step. (8)

(ii) Solve $16\, u_{xx} = u_{tt}$ for u at the pivotal points given $u(0,t) = u(5,t) = 0$, $u_t(x,0) = 0$ and $u(x,0) = x^2(5-x)$ for one half-period of vibration with $h = 1$ and $k = \frac{1}{4}$. (8)

Or

(b) Solve the Poisson equation $\nabla^2 u = -10(x^2 + y^2 + 10)$ over the square mesh with sides $x = 0, y = 0, x = 3, y = 3$ with $u = 0$ on the boundary and mesh length 1 unit. (16)