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

Question Paper Code: 42106

M.E. DEGREE EXAMINATION, NOVEMBER 2015

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. Every matrix of order mxn can be factor into two produce of Q having vectors of its columns and matrix R

   (a) upper triangular (b) lower triangular (c) orthogonal (d) equivalent

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. Function f(x)= cosx is an ______ function.

   (a) even (b) odd
   (c) neither even or odd (d) none of the above

4. Find the constant function in the expansion of $\cos^2 x$ as a Fourier series in $(-\pi, \pi)$.

   (a) 1/3 (b) 1/4 (c) 1 (d) 1/2

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. Write down the algorithm of modified Gram-Schmidt process in matrix theory.

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. A random variable X has the pdf $f(x) = \begin{cases} 2x, & 0 < x < 1 \\ 0 & otherwise \end{cases}$. Find $P\left(x < \frac{1}{2}\right)$.

9. Explain periodic function with an example.

10. Write the finite difference equivalent of the differential evaluation $y'' + 2y' + y = x^2$.

PART - C (5 x 16 = 80 Marks)

11. (a) 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)

Or

(b) Consider singular value decomposition for the matrix $\begin{bmatrix} 2 & 2 & -2 \\ 2 & 2 & -2 \\ -2 & -2 & 6 \end{bmatrix}$. (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) (i) A company has four machines to do the three jobs. Each job can be assigned to one and only one machine. The cost of each job on the each machine is given below in the table. (8)

Machines

		M1	M2	M3	M4
	A	18	27	28	32
Jobs	B	8	13	17	19
	C	10	15	19	22

(ii) Solve the following transportation problem to maximize profit. (8)

		A	B	C	D	Supply
	1	40	25	22	33	100
Source	2	44	35	30	30	30
	3	38	38	28	30	70
Demand		40	20	60	30	

13. (a) Derive mgf, mean and variance of geometric distribution

x	0	1	2	3	4	5	6	7
P(x)	0	k	2k	2k	3k	k^2	$2\ k^2$	$7k^2+k$

Find (i) k (ii) P[1.5<x<4.5/x>2] (iii) $P[x \leq \lambda] > 0.5$ find the smallest value λ. (16)

Or

(b) The local authorities in a city installed 2000 electric lamps in street. If the lamps have an average life of 1000 burning hours with S.D of 200 hours.

(i) What number of lamps might be expected to fail in first 700 burning hours?

(ii) After what period of burning hours would you expect that 10% of lamps would have failed and would be still burning?.Assume that lives of lamps are normally distributed. (16)

14. (a) (i) Find the cosine series for f (x) = $\begin{cases} kx, & 0 \leq x \leq \dfrac{\pi}{2} \\ k(\pi - x), & \dfrac{\pi}{2} \leq x \leq \pi \end{cases}$. (8)

(ii) Find the half range sine series of f (x) = x cos x in (0, π). (8)

Or

(b) Find an expression for the Fourier coefficients associated with the generalized Fourier series arising from the Eigen function of $y'' + y' + \mu y = 0$, $0 < x < 2$, $y(0) = 0$, $y(2) = 0$. (16)

15. (a) (i) Using Crank –Nicholson's Scheme, solve $\mathbf{u_{xx} = 32u_t}$, $0<x<1$, $t>0$ given $u(x,0)=0$, $u(0,t)=0$, $u(1,t)=100t$. Taking $h=0.25$ (8)

(ii) Solve $\nabla^2 \mathbf{u} = \mathbf{8x^2y^2}$ for square mesh given $u=0$ on the 4 boundaries dividing the square into 16 sub-squares of length 1 unit. (8)

Or

(b) (i) Given $\frac{\partial^2 \mathbf{f}}{\partial \mathbf{x}^2} = \frac{\partial \mathbf{f}}{\partial \mathbf{t}}$ $f(0,t)=f(4,t)=0, f(x,0)=\mathbf{x(4-x)}$, find f in the range taking $h=1$ and upto 5 seconds. Using Bender-Schmidt method. (8)

(ii) Solve uxx+uyy=0 for the following square mesh with boundary conditions as shown below. Iterate until the maximum difference between successive values at any grid point is less than 0.001. (8)