Reg. No. :

Question Paper Code : 10796

M.E./M.Tech. DEGREE EXAMINATIONS, APRIL/MAY 2023.

First Semester

Power Systems Engineering

MA 4107 – APPLIED MATHEMATICS FOR POWER SYSTEMS ENGINEERS

(Regulations 2021)

Time : Three hours Maximum : 100 marks

Answer ALL questions.

PART A — (10 × 2 = 20 marks)

1. Mention any two properties of eigen values.

2. What is the length of the chain?

3. What are the sufficient conditions for the existence of Laplace transform of $f(t)$?

4. State the convolution theorem on Laplace transforms.

5. What are the basic classifications of a signal in the field of communications?

6. Identify whether the following functions are even or odd

   (a) $f(t) = t\cos t$ (b) $f(t) = t^2 + |t|$

7. What are the requirements on the constraints of the problem in simplex method?

8. What is an extreme point of the convex set?

9. What are the types of non linear programming problems?

10. Define Lagrange multiplier.

PART B — (5 × 13 = 65 marks)

11. (a) Find the QR — decomposition of $A=\begin{bmatrix}1 & 0 & 0\\ 1 & 1 & 0\\ 1 & 1 & 1\end{bmatrix}$

Or

(b) Determine the Cholesky decomposition of $A=\begin{bmatrix}16 & -3 & 5 & -8\\ -3 & 16 & -5 & -8\\ 5 & -5 & 24 & 0\\ -8 & -8 & 0 & 21\end{bmatrix}$

12. (a) State and prove the second shifting property. Hence find the Laplace transform of the function $f(t)=\begin{cases}2, & 0<t<\pi\\ 0, & \pi<t<2\pi\\ \sin t, & t>2\pi\end{cases}$

Or

(b) Using Laplace transform technique, solve the initial-boundary value problem $u_t=u_{xx}, 0<x<1, t>0, u(0,t)=1, u(1,t)=1, t>0$ and $u(x,0)=1+\sin\pi x, 0<x<1$.

13. (a) A certain type of full-wave rectifier converts the input voltage $v(t)$ to its absolute value at the output. Find the exponential Fourier series of the rectified sine wave $f(t)=|v(t)|=A|\sin\pi t|, A>0$.

Or

(b) Find the eigen values and eigen functions of $y''+\lambda y=0, 0<x<1, y(0)=0, y(1)+y'(1)=0=0$.

14. (a) Solve the following LPP by Simplex method:

Minimize $Z=8x_1-2x_2$

Subject to $-4x_1+2x_2\le 1$

$5x_1-4x_2\le 3$

$x_1,x_2\ge 0$

Or

(b) Solve the assignment problem represented by the following matrix

	1	2	3	4	5	6
A	9	22	58	11	19	27
B	43	78	72	50	63	48
C	41	28	91	37	45	33
D	74	42	27	49	39	32
E	36	11	57	22	25	18
F	3	56	53	31	17	28

15. (a) Solve:

Minimize $f(x)=x_1^2+x_2^2+x_3^3$

Subject to $g_1(x)=x_1+x_2+3x_3-2=0$

$g_2(x)=5x_1+2x_2+x_3-5=0$

Or

(b) Solve:

Minimize $z=4x_1+6x_2-2x_1^2-2x_2^2-2x_1x_2$

Subject to $x_1+2x_2\le 2$

$x_1,x_2\ge 0$

PART C — (1 × 15 = 15 marks)

16. (a) (i) Find the Laplace transform of $f(t)=te^{-4t}\sin 3t$ (7)

(ii) Find the Laplace transform of $f(t)=\frac{\cos\sqrt{t}}{\sqrt{t}}$ (8)

Or

(b) (i) Find the Laplace transform of $f(t)=tJ_0(t)$. (10)

(ii) Apply convolution theorem to evaluate $L^{-1}\left[\frac{s}{(s+2)(s^2+1)}\right]$. (5)