Reg. No.																

Question Paper Code	13343

M.E. / M.Tech. - DEGREE EXAMINATIONS, NOV / DEC 2024 (JAN - 2025)

First Semester

M.E - Embedded Systems Technologies

(Common to M.E. - Power Electronics and Derives)

20PESMA102 / 24PESMA102 - APPLIED MATHEMATICS FOR ELECTRICAL ENGINEERS

Regulations – 2020 / 2024

(Use of *Statistical Tables* is permitted)

Duration: 3 Hours Max. Marks: 100

PART - A (10 × 2 = 20 Marks)

Answer ALL Questions

		Marks	*K – Level*	*CO*
1.	When can Cholesky decomposition be used?	*2*	*K2*	*CO1*
2.	What does the singular value decomposition of a matrix represent?	*2*	*K1*	*CO1*
3.	What is Euler's equation in calculus of variation?	*2*	*K1*	*CO2*
4.	Write the Euler – Ostrogradsky equation for a functional to be extremum.	*2*	*K2*	*CO2*
5.	If X is a normal random variable with $\mu = 3, \sigma^2 = 9$, find the probability that X lies between 2 and 5.	*2*	*K3*	*CO3*
6.	Two coins are tossed. Let A denote the event "at most one head on the two tosses" and let B denote the event "one head and one tail in both tosses". Are A and B independent events?	*2*	*K2*	*CO3*
7.	Define slack and surplus variables.	*2*	*K1*	*CO4*
8.	What is the difference between transportation problems and Assignment problems?	*2*	*K2*	*CO4*
9.	Define a periodic function.	*2*	*K1*	*CO5*
10.	Define odd and even functions.	*2*	*K1*	*CO5*

PART - B (5 × 16 = 80 Marks)

Answer ALL Questions

			Marks	*K – Level*	*CO*
11.	a)	Perform LU decomposition of the matrix $\begin{bmatrix} 1 & 1 & -2 \\ -1 & 2 & 1 \\ 0 & 1 & -1 \end{bmatrix}$.	*16*	*K3*	*CO1*
		OR			
	b)	Find the singular value decomposition of the matrix $\begin{bmatrix} 0 & 1 & 2 \\ 1 & 0 & 1 \end{bmatrix}$.	*16*	*K3*	*CO1*
12.	a)	Find the extremal of the functional $J[y] = \int_0^1 (y'^2 + y)dx$ with boundary conditions $y(0) = 0$ and $y(1) = 1$.	*16*	*K3*	*CO2*

OR

b) i) By Kantorovich method, solve the Poisson equation $\frac{\partial^2 u}{\partial x^2} + \frac{\partial^2 u}{\partial y^2} = -1$ in a square defined by $|x| \leq 1, |y| \leq 1$, where $u = 0$ at $x = \pm 1$ and $y = \pm 1$. *8 K3 CO2*

ii) Find the Shortest distance between the parabola $y^2 = 4x$ and the line $x + y = -5$. *8 K3 CO2*

13. a) i) A discrete random variable X has the following probability distribution. *8 K3 CO3*

X	0	1	2	3	4	5	6	7	8
P(x)	a	3a	5a	7a	9a	11a	13a	15a	17a

Find the value of 'a'

Find $P(X < 3), P(0 < X < 3), P(X \geq 3)$.

ii) Find moment generating function of Poisson distribution and hence find its mean and variance. *8 K3 CO3*

OR

b) i) In a bolt factory, machines A, B and C produce 25, 35 and 40% of the total output respectively. Of their outputs, 5, 4 and 2%, respectively, are defective bolts. If a bolt is chosen random from the combined output, what is the probability that it is defective? If a bolt chosen at random is found to be defective, what is the probability that it was produced by C? *8 K3 CO3*

ii) The time (in hours) required to repair a machine is exponentially distributed with parameter $\lambda = \frac{1}{2}$. (a) What is the probability that the repair time exceeds 2h? (b) What is the conditional probability that a repair takes at least 10h given that its duration exceeds 9h? *8 K3 CO3*

14. a) Solve the Linear programming problem using simplex method. *16 K3 CO4*

$$\text{Max } z = 10x_1 + 15x_2 + 20x_3$$

Subject to,

$$2x_1 + 4x_2 + 6x_3 \leq 24$$
$$3x_1 + 9x_2 + 6x_3 \leq 30$$

$x_1, x_2, x_3 \geq 0$.

OR

b) Solve the Linear programming problem using Big M method. *16 K3 CO4*

$$\text{Min } Z = 2x_1 + 3x_2$$

Subject to ,

$$x_1 + x_2 \geq 6$$
$$7x_1 + x_2 \geq 14$$

$x_1, x_2 \geq 0$.

15. a) Find the optimal transportation plan so as to minimize the transportation cost. *16 K3 CO5*

	A	B	C	D	Capacity
I	10	30	50	10	7
II	70	30	40	60	9
III	40	8	70	20	18
Requirement	5	8	7	14	

OR

b) Solve the assignment problem. *16 K3 CO5*

Job	**Operator**				
	A	B	C	D	E
I	10	12	15	12	8
II	7	16	14	14	11
III	13	14	7	9	9
IV	12	10	11	13	10
V	8	13	15	11	15