



Roll No:

--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--

MTECH
(SEM I) THEORY EXAMINATION 2024-25
ADVANCED ENGINEERING MATHEMATICS

TIME: 3 HRS**M.MARKS: 70****Note:** Attempt all Sections. In case of any missing data; choose suitably.**SECTION A****1. Attempt all questions in brief.****2 x 07 = 14**

Q no.	Question	CO	Level
a.	Describe the linear transformation of a vector space.	1	K2
b.	How do you explain specific random variable?	2	K3
c.	What do you mean by joint characteristic functions?	2	K1
d.	Explain the Power Spectrum.	3	K4
e.	Define the pessimistic time.	3	K2
f.	How the simplex algorithm is useful in solving Network in queues?	4	K3
g.	What is the application of Chapman-Kolmogorov equation.	5	K2

SECTION B**2. Attempt any three of the following:****07 x 3 = 07**

Q no.	Question	CO	Level
a.	Prove that the set $S = \{(1,0,0), (0,1,0), (0,0,1)\}$ is a basis of R^3 .	1	K2
b.	Find the moment generating function of a random variable X having the probability density function $f(x) = \begin{cases} \frac{1}{3} & , -1 < x < 2 \\ 0 & , \text{otherwise} \end{cases}$	2	K3
c.	Derive the difference equations for the queuing model (M/M/1):(∞/FCFS). How would you proceed to solve the model?	3	K4
d.	In a sample of 8 observations, the sum of square of deviations from means is 94.5. In other sample of 10 observations, the sum of deviations from mean is 101.7. Test whether there is a significant difference of variance.	4	K3
e.	X and Y are two random variables having joint density function $= \frac{1}{27}(2x + y)$, where x and y can assume only integer values 0,1,2. Find conditional distribution of Y for X= x.	5	K5

SECTION C**3. Attempt any one part of the following:****07 x 1 = 07**

Q no.	Question	CO	Level
a.	If T is linear transformation on a vector space V such that $T^2 - T + 1 = 0$, Then show that T is invertible.	1	K4
b.	If P_3 be a vector space of all polynomials of degree less of equal to 3. Then $S = \{1, x, x^2, x^3\}$ is a basis of P_3 .	1	K2



Roll No:

--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--

MTECH
(SEM I) THEORY EXAMINATION 2024-25
ADVANCED ENGINEERING MATHEMATICS

TIME: 3 HRS**M.MARKS: 70****4. Attempt any one part of the following:**

Q no.	Question	CO	Level
a.	Let the random variable X assume the value r with probability function given by $P(X = r) = q^{r-1}p, r = 1, 2, 3, \dots$ Find the moment generating function and hence find its mean and variances.	2	K1
b.	State and prove Markov's inequality.	2	K1

5. Attempt any one part of the following:**07 x 1 = 07**

Q no.	Question	CO	Level
a.	Find the mean and variance of a random variable x with the following probability density function: $f(x) = 6x(1-x)$ for $0 < x < 1$.	3	K3
b.	The 9 items of a sample have the following values: 45, 47, 50, 52, 48, 47, 49, 53, 51. Does the mean of these values differ significantly from the assumed mean 47.5?	3	K3

6. Attempt any one part of the following:**07 x 1 = 07**

Q no.	Question	CO	Level
a.	Write the short notes on the following (i) conditional distribution (ii) higher-transition probability.	4	K4
b.	Explain the single channel and multi-channel queuing model.	4	K2

7. Attempt any one part of the following:**07 x 1 = 07**

Q no.	Question	CO	Level
a.	Write the short notes on the following: (i) Band limited Processes (ii) Stationary distribution (iii) Limiting probability.	5	K4
b.	At a garage, car owners arrive at the rate of 6 per hour and served at the rate of 8 per hour. It is assumed that the arrival follows Poisson's distribution and the service pattern is exponentially distributed. Determine (i) Average Queue length (ii) Average waiting time.	5	K5