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Reg No.:______________ Name:______________

APJ ABDUL KALAM TECHNOLOGICAL UNIVERSITY

B.Tech Degree S4 (R) (FT/WP) Examinations April 2026 (2024 Scheme)

Course Code: GBMAT401

Course Name: MATHEMATICS FOR ELECTRICAL SCIENCE – 4

Max. Marks: 60 Duration: 2 hours 30 minutes

PART A

(Answer all questions. Each question carries 3 marks)

		CO	Marks
1	A random variable X has PMF $p(x) = k(x+2), x = 0,1,2$. Find k and P(X>0).	CO1	(3)
2	A biased coin has probability of head p=0.6. It is tossed 5 times. Find the probability of getting exactly 3 heads	CO1	(3)
3	Let Z be a standard normal random variable. Find $P(Z < 0.65)$	CO 2	(3)
4	The lifetime of a device follows an exponential distribution with parameter λ=2. Find $P(X > 1)$.	CO 2	(3)
5	Explain the null hypothesis, Type-I error, and Type-II error	CO 3	(3)
6	A sample of size 64 has mean $\bar{x} = 50, and\ a$ standard deviation σ = 8. Find the 95% confidence interval for the population mean.	CO 3	(3)
7	Define WSS process. Also, write the expression for the autocorrelation function of a random process.	CO 4	(3)
8	What is an ergodic process? Explain the concept of a mean ergodic process.	CO 4	(3)

PART B

(Answer any one full question from each module, each question carries 9 marks)

Module -1

9	a)	If the random variable X takes values 1, 2, 3, 4 such that $2\,P(X=1) = 3\,P(X=2) = P(X=3) = 5\,P(X=4)$. Find the probability distribution(PMF) of X.	CO 1	5
	b)	It is known that 5% of the screws manufactured by an automatic machine are defective. If a sample of 20 screws is selected at random, find the	CO 1	4

probability that the sample contains

(i) exactly 2 defective screws, (ii) at least 2 defective screws.

10	a)	Derive the formulae for the mean and variance of a binomial random variable X.	CO 1	5
	b)	If the probability that a person suffers from a disease is 0.001, find the probability that out of 3000 persons, (i) exactly 4, (ii) more than 2 persons will suffer from the disease. Use Poisson distribution.	CO 1	4

Module -2

11	a)	The joint PDF of random variables X and Y is given by $f(x,y) = kxy, 0 < x < 1, 0 < y < 1.$ (i) Find k (ii) Marginal PDFs of X and Y (iii) Check the independence of X and Y.	CO 2	5
	b)	A random variable X has PDF $f(x) = 2x\,, 0 < x < 1.$ Find the mean and variance of X.	CO 2	4
12	a)	The savings bank account of a customer showed an average balance of Rs. 150 and a standard deviation of Rs. 50. Assuming that the account balances are normally distributed, find what percentage of accounts are (i) over Rs. 200. (ii) between Rs. 120 and Rs. 170. (iii) less than Rs. 75.	CO 2	5
	b)	Let X follows uniform distribution in the interval [2,6]. Find the mean and variance of X.	CO 2	4

Module -3

13	a)	A manufacturer claims that the mean lifetime of a bulb is 1000 hours. A sample of 64 bulbs gives $\bar{x}$= 960 hours. Population standard deviation is σ = 120 hours. Test at 5% level of significance whether the mean lifetime differs from 1000 hours.	CO 3	5
	b)	A sample of size 10 from a population gives $\bar{x}$= 17.5 and sample standard deviation $s = 2.4$. Test at 5% level of significance whether the population mean is 20.	CO 3	4
14	a)	A random sample of 150 recent donations at a certain blood bank reveals that 82 were type A. Does this suggest that the actual percentage of type A donations differs from 40%, the percentage of the population having type A blood? Test the appropriate hypotheses using a significance level of .01.	CO 3	5

	b)	A company claims that the mean battery life is 10 hours. A sample of 8 batteries gives $\bar{x} = 11.2$ hours, sample standard deviation $s = 1.5$ hours. Test at 1% level whether the mean battery life is greater than 10 hours.	CO 3	4

Module -4

15	a)	If $X(t) = Acos(\lambda t) + Bsin(\lambda t), t \geq 0$, is a random process, where $A \, and \, B$ are independent normally distributed random variables with mean = 0 and variance= σ^2. Check whether $X(t)$ is wide sense stationary(WSS) or not.	CO 4	5
	b)	A random process is defined as $X(t) = Acos\,\omega t + Bsin\,\omega t$, where A and B are random variables with $E(A) = E(B) = 0, E(A^2) = E(B^2) = \sigma^2$. and $E(AB) = 0$. Show that the process X(t) is mean ergodic.	CO 4	4
16	a)	Show that the random process X(t) = $Acos(\omega t + \theta)$ is WSS if A and ω are constants, and θ is a uniformly distributed random variable in $(0,2\pi)$.	CO 4	5
	b)	Given the autocorrelation function for a stationary random process $X(t)$ as $R_{XX}(\tau) = 16+\frac{2}{1+3\tau^2}$. find the mean and variance of the process.	CO 4	4

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