Reg No.:_____ Name:_____

APJ ABDUL KALAM TECHNOLOGICAL UNIVERSITY

B.Tech Degree S4 (S,FE) Examinations May 2026 (2019 Scheme)

Course Code: MAT256
Course Name: PROBABILITY AND STATISTICAL MODELLING

Max. Marks: 100 Duration: 3 Hours

(Statistical tables are allowed)

PART A

(Answer all questions; each question carries 3 marks) Marks

1 Ten coins are thrown simultaneously .Find the probability of getting at least 7 heads. 3

2 If $f(x)=\frac{k}{2^x}$ is the probability distribution for a random variable that can take values x= 0,1,2,3,4. Find E(x). 3

3 Given x is uniformly distributed with mean 1 and variance 4/3.If 3 independent observations of x are made ,what is the probability that all of them are negative. 3

4 The diameter of an electric cable is a continuous random variable with density function $f(x)=\begin{cases} kx(1-x)\ 0 \le x \le 1 \\ 0\ otherwise \end{cases}$. 3

Find the mean diameter of the cable.

5 Distinguish between confidence level and significance level. 3

6 A random sample of 200 measurements from an infinite population gives a mean value of 50 and a standard deviation 9. Determine 95% confidence interval for the population mean. 3

7 A sample survey indicates that out of 3232 births ,1705 were boys and the rest were girls. Do these figures confirm the hypothesis that the sex ratio is 50:50? Test at 5% level of significance ? 3

8 Define Type I error, Type II error and critical region. 3

9 Write three properties of correlation coefficient. 3

10 Find the linear regression equation for the following data 3

x	3	9	5	3
y	8	6	4	2

PART B

(Answer one full question from each module, each question carries 14 marks)

Module -1

11 a) If 6 out of 18 new buildings in a city violate the building code, what is the probability that a building inspector who randomly choose 4 of the new buildings will catch (i)None (ii) exactly one (iii) At least 2 of the buildings that violate building code . 7

b) If the joint probability density function of a random variable X and Y is given by $f(x,y) = c(2x+3y)$ where $x=0,1,2$; and $y=1,2,3$.
Find (i) the value of c (ii) the marginal probability distribution of X and Y
(iii) The probability distribution of x+y 7

12 a) A random variable X has the following probability mass function

X	0	1	2	3	4	5	6	7
f(x)	0	k	2k	2k	3k	K^2	$2k^2$	$7k^2+k$

7

Find (i) the value of k (ii) E(X) (iii) V(x) (iv) $P(2<x<5)$

b) A gambler plays a game for rolling a die with the following rules .He will win Rs.200 if he throws a 6 ,but will lose Rs 40 if he throws 4 or 5 and lose Rs 20 if he throws 1,2 or 3. Find the expected value that the gambler may gain. 7

Module -2

13 a) The marks obtained by a batch of students in a certain subject are normally distributed. 10% of students got less than 45 and 5% got more than 75.Find the percentage of the students who score between 45 and 60. 7

b) The distance that a car run before its battery wears out is exponentially distributed with an average value of 5000 km. If the owner deserve to take a 2000km trip, what is the probability that he will complete the trip without replacing the battery. 7

14 a) A continuous random variable has a probability density function
$f(x) = kx^2e^{-2x}$, $x \geq 0$.Find the mean and variance. 7

b) In a normal distribution 31% of the item are under 45 and 8% are over 64. Find the mean and standard deviation of the distribution. 7

Module -3

15 a) A random sample of 500 pineapples were taken from a large consignment of which 65 were found to be defective (i) Show that the standard error of defectives is 0.015. (ii) Show that the percentage of defective pineapples in the consignment lie between 8.5 and 17.5. 7

b) Mr. Kishore wants to determine the average time required to complete a job for which he concerned. As per the last studies , the population standard deviation is 8 days . How large should the sample be so that Mr. Kishore may be 99% confident that the sample average may remain within ± 2 . 7

16 a) A random sample of 100 items taken from a large batch of articles contain 5 defective items 7

(i) Set up a 95% confidence limit for the proportion of the defective items.
(ii) If the batch contain 2669 items setup 95% confidence interval for the proportion of defective items?

b) The foreman of a certain mining company has estimated that the average quantity of ore extracted to be 34.6 tons per shift and the sample standard deviation to be 2.8 tons per shift based upon the random selection of 6 shifts. Construct a 95% as well as 99% confidence interval for the average quantity of ore extracted ? 7

Module -4

17 a) The average number of articles produced by 2 machines per day are 200 and 250 with standard deviation 20 and 25 respectively on the basis of 25 days production. Can you regard both the machines as equally efficient at 1% level of significance? 7

b) The null hypothesis is that 20% of the passengers go in first class ,but management recognizes that the possibility that this percentage could be more or less. A random sample of 400 passengers includes 70 passengers holding first class tickets. Can the null hypothesis be rejected at 5%level of significance? 7

18 a) The mean of a certain production process is known to be 50 with standard deviation 2.5. The production manager may welcome any change in mean value towards higher side but would like to safeguard against decreasing the value of mean. He takes a sample of 12 items that gives a mean value of 48.5. What inference should the manager take for production process on the basis of sample result? Use 5% level of significance. 7

b) Three varieties of crops A,B,C are treated in a randomised block design with four replications. The yields are given below.

Variety	Replications			
A	6	4	8	6
B	7	6	6	9
C	8	5	10	9

Test whether there is difference between the varieties? Also check whether yield of A differs significantly from that of B?

Module -5

19 a) Calculate the regression coefficient and obtain the line of regression for the following data 7

X	1	3	10	16	26	136
Y	42	50	75	100	150	200

b) A study to assess capability of surface flow wetland systems to remove biochemical oxygen demand (BOD) and various other chemical constituents results in accompanying data on x = BOD mass loading (kg/ha/d) and y= BOD mass removal(kg/ha/d). Obtain the equation of least square line. 7

x	3	8	10	11	13	16	27	30	35	37	38	44	103	142
y	4	7	8	8	10	11	16	26	21	9	31	30	75	90

20 a) In the following data ,X= current density (Ma/cm^2) and Y= rate of deposition (μm/min.).Calculate the coefficient of correlation. 7

X	20	40	60	80
Y	0.24	1.20	1.71	2.22

b) Suppose the variables x=commuting distance and y= commuting time are related according to the simple linear regression model with σ= 10 .If n=5 observations are made at the x values x_1=5 ,x_2=10, x_3=15, x_4=20, x_5=25 ,calculate the standard deviations of the five residuals. 7

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