KUMARAGURU
college of technology
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B.E/B.TECH DEGREE EXAMINATIONS: NOV/DEC 2023

(Regulation 2018)

Fourth Semester

Common to CSE, IT, ISE

U18MAI4201 : Probability and Statistics

COURSE OUTCOMES

CO1: Compute correlation between variables and predict unknown values using regression.

CO2: Understand and apply the concept of probability and random variables and predict the probabilities of events in models following normal distribution.

CO3: Perform hypothesis testing and interpret the results.

CO4: Understand the principles of design of experiments and perform analysis of variance.

CO5: Sketch control charts and comment on the process control.

CO6: Apply the above concepts to solve problems using R Studio.

Time: Three Hours   **Maximum Marks: 100**

Answer all the Questions:-

PART A (10 x 2 = 20 Marks)

(Answer not more than 40 words)

1.	If X and Y are independent random variables, show that they are uncorrelated.	CO1	[K$_2$]
2.	The tangent of the angle between the lines of regression of Y on X and X on Y is 0.6 and $\sigma_X = \frac{\sigma_Y}{2}$. Find the correlation coefficient.	CO1	[K$_1$]
3.	In a random experiment, P(A) = 1/12, P(B) = 5/12 and P(B/A) = 1/15, Find P(A ∪ B).	CO2	[K$_1$]
4.	Find the mean value of the probability distribution function of x.	CO2	[K$_1$]

x	1	2
P(x)	2/3	1/3

5.	Define the normal distribution.	CO2	[K$_1$]
6.	What is the test statistic to test of significance of difference between sample mean and population mean.	CO3	[K$_1$]
7.	List the uses of Chi square distribution.	CO3	[K$_1$]
8.	Name the basic principles of experimental design.	CO4	[K$_1$]
9.	What is control chart? Name the types of control charts?	CO5	[K$_1$]
10.	When do you say that a process is out of control?	CO5	[K$_1$]

Answer any FIVE Questions:-
PART B (5 x 16 = 80 Marks)
(Answer not more than 400 words)

11. a) Determine the rank correlation of the following data.   8   CO1   [K5]

X	68	64	75	50	64	80	75	40	55	64
Y	62	58	68	45	81	60	68	48	50	70

   b) The two regression lines are $4x - 5y + 33 = 0 \ and \ 20x - 9y = 107$ and   8   CO1   [K5]
variance of $x = 25$. Estimate (i) mean values of $x \ and \ y$ (ii) correlation coefficient between $x \ and \ y$.

12. a) A bolt is manufactured by 3 machines A, B and C. A turns out twice as many   8   CO2   [K3]
items as B, and machines B and C produce an equal number of items. 2% of bolts produced by A and B are defective and 4 % of bolts produced by C are defective. All bolts are put into 1 stockpile and 1 is chosen from this pile. What is the probability that it is defective?

   b) A continuous random variable X has a probability density function   8   CO2   [K1]
$f(x) = kx(2 - x), 0 \leq x \leq 2$. Find (i) the value of k (ii) r^{th} raw moment
(iii) mean and variance.

13. a) Find moment generating function of normal distribution.   8   CO2   [K1]

   b) An electrical firm manufactures light bulbs that have a life, before burn-out, that   8   CO2   [K3]
is normally distributed with mean equal to 800 hours and standard deviation of 40 hours. Find (i) the probability that a bulb burns more than 834 hours.
(ii) the probability that a bulb burns between 778 and 834 hours.

14. a) The average number of articles produced by two machines per day are 200 and   8   CO3   [K3]
250 with standard deviations 20 and 25 respectively on the basis of records of 25 days production. Can you regard both the machines equally efficient at 1% level of significance by t-distribution?

   b) Two companies, A and B adopted different techniques while rating the   8   CO3   [K3]
employee's level. Can you say that the techniques adopted by them are significant?

Company	Below Average	Average	Above Average	Genius

A	40	33	25	2
B	86	60	44	10

15. a) A completely randomized design experiment with ten plots and three treatments   8   CO4   [K4]
gave the results given below. Analyze the results for the effects of treatments.

Treatment	Replications			
A	5	7	1	3
B	4	4	7	
C	3	1	5	

b) A company appoints four salesman A, B, C and D and observes their sales in   8   CO4   [K4]
three seasons summer, winter and monsoon. The figures (in lakhs) are given in
the following table (Shift the origin $X_{ij} = x_{ij} - 40$). Perform a two-way analysis
of variance at 5% level.

Seasons	Salesman			
	A	B	C	D
summer	45	40	38	37
winter	43	41	45	38
monsoon	39	39	41	41

16. a) Given below are the values of sample mean $\overline{X}$ and sample range R for 10   8   CO5   [K3]
samples, each of size 5. Draw the appropriate mean chart and comment on the
state of control of the process.

Sample No	1	2	3	4	5	6	7	8	9	10
Mean	43	49	37	44	45	37	51	46	43	47
Range	5	6	5	7	7	4	8	6	4	6

b) 10 samples each of size 50 were inspected and the number of defectives in the   8   CO5   [K3]
inspection were: 2, 1, 1, 2, 3, 5, 5, 1, 2, 3. Draw the np-chart for defectives.

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