

(b) Analyze the variance in the Latin Square of yields (in Kgs) of paddy where A, B, C, D and E denote the different methods of cultivation (16)

A48	E66	D56	C52	B61
D64	B62	A50	E64	C63
B69	A53	C60	D61	E67
C57	D58	E67	B65	A55
E67	C57	B66	A60	D57

Examine whether the different methods of cultivation have given significantly different yields.

Reg. No. :

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

Question Paper Code : 70855

B.E./B.Tech. DEGREE EXAMINATIONS, NOVEMBER/DECEMBER 2023.

Third/Fourth/Seventh Semester

Agriculture Engineering

MA 8391 — PROBABILITY AND STATISTICS

(Common to Biomedical Engineering/Electrical and Electronics Engineering/ Environmental Engineering/Industrial Engineering/Industrial Engineering and Management/Manufacturing Engineering/Mechanical Engineering (Sandwich)/ Petrochemical Engineering/Safety and Fire Engineering/Artificial Intelligence and Data Science/Bio Technology/Biotechnology and Biochemical Engineering/Chemical Engineering/Computer Science and Business Systems/Fashion Technology/ Food Technology/Handloom and Textile Technology/Information Technology/ Petrochemical Technology/Petroleum Engineering/Pharmaceutical Technology/ Plastic Technology/Polymer Technology/Textile Chemistry/Textile Technology)

(Regulations 2017)

Time : Three hours

Maximum : 100 marks

(Use of Statistical Table is permitted)

Answer ALL questions.

PART A — (10 × 2 = 20 marks)

- An integer is selected from 2 to 15. What is the probability that it is prime?
- Derive the moment generating function of uniform distribution.
- The joint density function of X and Y is given by $f_{XY}(x, y) = \begin{cases} \frac{1}{16}(x^3 y^3), & 0 \leq x \leq 2, 0 \leq y \leq 2 \\ 0 & \text{otherwise} \end{cases}$. Find the marginal densities of X and Y .
- The joint density function of W and Z is given by $f_{WZ}(wz) = \begin{cases} bwz, & 1 \leq w \leq 3, 2 \leq z \leq 4 \\ 0, & \text{otherwise} \end{cases}$. Find the value of b .
- What are the four types of sampling in testing of hypothesis?

15. (a) (i) The following are the sample mean and range for ten samples, each of size 5. Construct the control chart for mean and range and comment on the nature of control. (8)

Sample No.	1	2	3	4	5	6	7	8	9	10
Mean \bar{X}	12.8	13.1	13.5	12.9	13.2	14.1	12.1	15.5	13.9	14.2
Range R	2.1	3.1	3.9	2.1	1.9	3.0	2.5	2.8	2.5	2.0

(ii) The following data refers to visual digits found during the inspection of the first 10 samples of size 50 each from a lot of two wheelers manufactured by an automobile company (8)

Sample No.	1	2	3	4	5	6	7	8	9	10
No. of defectives	4	3	2	3	4	4	4	1	3	2

Draw p -chart to show that fraction defectives are under control.

Or

(b) (i) 20 pieces of cloth out of different rolls contained respectively. 1, 4, 3, 2, 4, 5, 6, 7, 2, 3, 2, 5, 7, 6, 4, 5, 2, 1, 3 and 8 respectively. Ascertain whether the process is in a state of statistical control. (8)

(ii) The data given below are the number of defectives in 10 samples of size 400 each. Construct a p -chart and np -chart and comment on the results. (8)

Sample No.	1	2	3	4	5	6	7	8	9	10
No. of defectives	15	12	4	26	15	9	19	9	14	17

6. Explain the terms critical region and acceptance region in testing of hypothesis.
7. What is the main aim of design of experiments?
8. Draw the general ANOVA table for one way classification.
9. Explain the method of applying statistical quality control.
10. Write down few advantages of control chart.

PART B — (5 × 16 = 80 marks)

11. (a) (i) Find the mean and variance of the random variable "X" whose probability density function is given by (8)

$$f(x) = \begin{cases} 2e^{-2x}; & x > 0 \\ 0; & \text{otherwise.} \end{cases}$$

- (ii) Assume that 10 coins are thrown simultaneously. Find the probability of getting at least 7 heads. (8)

Or

- (b) (i) The probability of an individual suffering a bad reaction from an injection of a certain antibiotic is 0.001. Out of 2000 individuals, find the probability that, (8)

(1) exactly 3 suffer and

(2) more than 2 suffer from bad reaction.

- (ii) Derive the Moment Generating Function (MGF) of Normal distribution. (8)

12. (a) (i) The Joint probability density function of (X, Y) is given by

$$f_{XY}(x, y) = \begin{cases} \frac{6}{5}(x + y^2); & 0 \leq x \leq 1, 0 \leq y \leq 1 \\ 0; & \text{otherwise} \end{cases}$$

Obtain the marginal probability density function of X and Y. (8)

- (ii) If X_1 and X_2 are independent random variables with means 5 and 10 and standard deviations 2 and 3 respectively. Obtain the correlation coefficient between U and V. (8)

if $U = 3X_1 + 4X_2$ and $V = 3X_1 - X_2$

Or

- (b) (i) If X and Y have joint probability density function $f_{XY}(x, y) = \begin{cases} x + y; & 0 < x < 1, 0 < y < 1 \\ 0; & \text{otherwise} \end{cases}$. Verify whether X and Y are independent or not. (8)

- (ii) Let X be a random variable with mean 3 and variance 2 and $Y = -6X + 22$. Find the mean of Y and correlation coefficient of X and Y. (8)

13. (a) (i) A sample of heights of 6400 Englishmen has a mean of 67.85 inches and a S.D. of 2.56 inches, while a sample of heights of 1600 Australians has a mean of 68.55 inches and a S.D. of 2.52 inches. Do the data indicate that Australians are on the average taller than Englishmen. (8)

- (ii) Time taken by workers in performing a job are given below : (8)

Method I :	5	6	8	1	12	4	3	9	6	10
Method II :	2	3	6	8	1	10	2	8	-	-

Do the estimates of the population variance differ significantly at 5% level.

Or

- (b) (i) The following table gives the values of protein from Kangeyam cow's milk and buffalo's milk. Examine if these differences are significant. (8)

Cow's milk :	1.90	1.95	2.00	2.02	1.85	1.80
Buffalo's milk :	2.12	2.00	2.20	2.45	2.20	2.10

- (ii) A sample analysis of examination results of 1000 students were made and it was found that 260 failed. 110 first class, 420 second class and rest obtained third class. By applying Chi square test whether the general examination result is in the ratio 2:1:4:3. (8)

14. (a) A company appoints 4 salesmen A, B, C, D and observed their sales in 3 seasons namely summer, winter and monsoon. The figures (in lakhs of Rupees) are given in the following table : (16)

		Salesmen			
		A	B	C	D
Seasons	Summer	45	40	38	37
	Winter	43	41	45	38
	Monsoon	39	39	41	41

Carry out the Two-way Analysis of variance at 5% level.

Or