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**Question Paper Code : 90340**

B.E./B.Tech. DEGREE EXAMINATIONS, NOVEMBER/DECEMBER 2019

Third/Fourth Semester

Agriculture Engineering

MA8391 – PROBABILITY AND STATISTICS

(Common to Biomedical Engineering/Environmental Engineering/Industrial Engineering/Industrial Engineering and Management/Manufacturing Engineering/Mechanical Engineering/Petrochemical Engineering/Bio Technology/Chemical Engineering/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

Answer ALL questions

(Statistical Tables/Charts may be permitted in the Exam Hall)

PART – A

(10×2=20 Marks)

1. If A and B are mutually exclusive events,  $P(A) = 0.29$  and  $P(B) = 0.43$  then find  $P(\bar{A})$  and  $P(A \cup B)$
2. Derive the moment generating function of uniform distribution.
3. If the joint cumulative distributive function of X and Y is given by
$$F(x,y) = \begin{cases} (1 - e^{-x})(1 - e^{-y}) & ; x > 0, y > 0 \\ 0 & ; \text{otherwise} \end{cases}$$
 find joint probability density function  $f_{XY}(x, y)$ .
4. Prove that  $\text{Cov}(X, Y) = E[XY] - E[X]E[Y]$ .
5. Explain Type I and Type II errors in testing of hypothesis.
6. Define the term critical region in testing of hypothesis.
7. What are the basic principles in the design of experiment ?
8. Write down the advantages of Latin Square Design (LSD).
9. Explain upper control limit and lower control limits in quality control.
10. Compare c-chart with p-chart.

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PART - B

(5×16=80 Marks)

11. a) i) When a die is thrown, X denotes the number that turns up. Find the values of  $E[X]$ ,  $E[X^2]$  and  $\text{Var}[X]$ .
- ii) Assume that 10 coins are thrown simultaneously. Find the probability of getting atleast 7 heads.

(OR)

- b) i) Derive the Moment Generating Function (MGF) of normal distribution.
- ii) Let X be a continuous random variable for the pdf

$$f(x) = \begin{cases} \frac{4x(9-x^2)}{81} & ; 0 \leq x \leq 3 \\ 0 & ; \text{otherwise} \end{cases}$$

Find the first four moments about the origin.

12. a) i) The random variables X and Y have joint probability density function

$$f_{XY}(x,y) = \begin{cases} x^2 + \frac{xy}{3} & , 0 < x < 1, 0 < y < 2 \\ 0 & , \text{otherwise} \end{cases}$$

Find the marginal density functions of X and Y.

- ii) If  $X_1$  and  $X_2$  are two independent random variables with means 5 and 10 and standard deviations 2 and 3 respectively. Obtain correlation coefficient of (U, V) if  $U = 3X_1 + 4X_2$  and  $V = 3X_1 - X_2$ .

(OR)

- b) i) The random variables X and Y have joint density function.  
 $f_{XY}(x,y) = K(x^3y + xy^3)$ ,  $0 \leq x \leq 2$ ,  $0 \leq y \leq 2$  find the value of K and the conditional densities of X given y and Y given x.
- ii) X is a continuous random variable uniformly distributed in the interval (0, 2). Let  $Y = 4X + 3$ . Then find  $F_Y(y)$  and  $f_Y(y)$ , for  $f_X(x) = \frac{1}{2}$  in (0, 2).

13. a) i) The average income of persons was Rs. 210 and with Rs. 10 for S.D. in a sample of 100 people of a city. For another sample of 150 people the average income was Rs. 220 with S.D. of Rs. 12. Test whether there is any significant difference between the average income of the locality.



ii) In one sample of 10 observations, the sum of squares of deviations of sample values from the sample mean was 120 and in another sample of 12 observations it was 314. Test whether this difference is significant at 5% level of significance.

(OR)

b) i) A sample of 20 items has mean 42 units and S.D. 5 units. Test the hypothesis that it is a random sample from a normal population with mean 45 units.

ii) In 120 throws of a single die, the following distribution of faces was observed.

Face	:	1	2	3	4	5	6
Frequency	:	30	25	18	10	22	15

Can you say that the die is biased ?

14. a) The table shown below gives the samples got from the normal population with equal variances. Test the hypothesis that the sample mean is equal at 5% level of significance.

A	8	10	12	8	7
B	12	11	14	9	4
C	18	16	12	8	6
D	16	15	13	12	9

(OR)

b) Four varieties A, B, C, D of a fertilizer are tested in a randomized block design with 4 replications. The plot yields, in pounds are as follows. Analyze the experimental yield.

Column Row	1	2	3	4
1	A12	D20	C16	B10
2	D18	A14	B11	C14
3	B12	C15	D19	A13
4	C16	B11	A15	D20

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15. a) The following table gives the sample means and ranges for 10 samples, each of size 6, in the production of certain component. Construct the control charts for mean and range and comment on the nature of control.

Sample No.	1	2	3	4	5	6	7	8	9	10
Mean $\bar{x}$	37.3	49.8	51.5	59.2	54.7	34.7	51.4	61.4	70.7	75.3
Range R	9.5	12.8	10.0	9.1	7.8	5.8	14.5	2.8	3.7	8.0

(OR)

- b) The data given below are the number of defectives in 10 samples of 100 items each. Construct a p-chart and an np-chart and comment on the results.

Sample No.	1	2	3	4	5	6	7	8	9	10
No. of defectives	6	16	7	3	8	12	7	11	11	4