Reg. No. : | | | | | | | | | | | | |

Question Paper Code : 80216

B.E./B.Tech. DEGREE EXAMINATIONS, APRIL/MAY 2019.

Third/Fourth Semester

Agriculture Engineering

MA 8391 – PROBABILITY AND STATISTICS

(Common to Industrial Engineering/
Industrial Engineering and Management/Food Technology/ Information Technology/
Pharmaceutical Technology/Biomedical Engineering/Environmental Engineering/
Manufacturing Engineering/ Mechanical Engineering (sandwich)/
Petrochemical Engineering/Bio Technology/Chemical Engineering/
Fashion Technology/Handloom and Textile Technology/
Petrochemical Technology/Petroleum Engineering/Plastic Technology/
Polymer Technology/Textile Chemistry/Textile Technology)

(Regulation 2017)

Time : Three hours Maximum : 100 marks

Use of Statistical Tables is permitted.

Answer ALL questions.

PART A — ($10 \times 2 = 20$ marks)

1. The probability density function of the random variable X is given by $f(x)=\begin{cases} k(1-x^2) & \text{for } 0<x<1 \\ 0 & \text{elsewhere} \end{cases}$. Find the value of k.

2. For a binomial distribution mean is 2 and variance is $\frac{4}{3}$, find the first term of the distribution.

3. Find the marginal density function of X if $f(x, y)=\begin{cases} 8xy & 0<x<y<1 \\ 0 & \text{otherwise} \end{cases}$.

4. The two lines of regression are $3x+2y-26=0$, $6x+y-31=0$. Find the value of correlation coefficient between x and y.

5. Define type I and type II errors.

6. An oil company claims that less than 20 percent of all car owners have not tried its gasoline. Test this claim at the 0.01 level of significance if a random check reveals that 22 of 200 car owners have not tried the oil company's gasoline.

7. State the identity for sum of squares for one - way of analysis of variance.

8. What is the Latin Square Design?

9. A garment was sampled on 10 consecutive hours of production. The number of defects found per garment is given below :

   Defects : 5, 1, 7, 0, 2, 3, 4, 0, 3, 2 . Compute upper and lower control limits for monitoring number of defects.

10. Define tolerance limits.

PART B — (5 × 16 = 80 marks)

11. (a) (i) Find the moment generating function of a Poisson distribution. Hence find mean and variance. (8)

(ii) Four boxes A, B, C, D contain fuses .The boxes contain 5000, 3000, 2000 and 1000 fuses respectively. The percentages of fuses in boxes which are defective are 3%, 2%, 1% and 0.5% respectively. One fuse is selected at random arbitrarily from one of the boxes. It is found to be defective fuse. Find the probability that it has come from box D. (8)

Or

(b) (i) Find mean, variance and moment generating function of Exponential distribution. Also prove the lack of memory property of the Exponential distribution. (10)

(ii) The distribution function of a random variable X is given by $F(x) = 1 - (1+x)e^{-x}$; $x \geq 0$. Find the density function, mean, variance of X. (6)

12. (a) (i) X and Y are two random variables having the joint probability mass function $f(x, y) = k(3x + 5y)$, $x = 1, 2, 3$: $y = 0, 1, 2$. Find the marginal distributions and conditional distribution of X, $P(X = x_i \mid Y = 2)$, $P(X \leq 2 \mid Y \leq 1)$. (8)

(ii) The joint density function of two random variables X and Y is given by $f(x, y) = \frac{1}{4}e^{-(x+y)/2}$, $x > 0$, $y > 0$. Find the distribution of $\frac{X-Y}{4}$. (8)

Or

(b) The joint probability density function of two random variables X and Y is given by $f(x, y) = k(xy + y^2)$, $0 \le x \le 1$, $0 \le y \le 2$.

Find $P(Y > 1)$, $P\left(X > \frac{1}{2}, Y < 1\right)$ and $P(X + Y \le 1)$. (16)

13. (a) Two random samples are drawn from normal populations are given below :

Sample 1 :	17	27	18	25	27	29	13	17
Sample 2 :	16	16	20	27	26	25	21	

Can we conclude that the two samples are drawn from the same population? Test at 5% level of significance. (16)

Or

(b) (i) Fit a Poisson's distribution to the following data and test the goodness of fit. Test at 5% level of significance. (8)

x :	0	1	2	3	4	5
f :	142	156	69	27	5	1

(ii) A drug manufacturer claims that the proportion of patients exhibiting side effects to their new arthritis drug is at least 8% lower than for the standard brand X. In a controlled experiment, 31 out of 100 patients receiving the new drug exhibited the side effects, as did 74 out of 150 patients receiving brand X. Test the manufacturer's claim at 5% level of significance. (8)

14. (a) An experiment was performed to judge the effect of four different fuels and three different types of launchers on the range of a certain rocket. Test, on the basis of following ranges in miles, whether there is a significant effect due to differences in fuels and, whether there is a significant effect due to differences in launchers. Use the 0.01 level of significance.

	Fuel 1	Fuel 2	Fuel 3	Fuel 4
Launcher X	45	47	48	42
Launcher Y	43	46	50	37
Launcher Z	51	52	55	49

Or

(b) As part of the investigation of the collapse of the roof of a building, a testing laboratory is given all the available bolts that connected the steel structure at 3 different positions on the roof .The forces required to shear each of these bolts (coded values) are as follows :

Position 1 : 90 82 79 98 83 91

Position 2 : 105 89 93 104 89 95 86

Position 3 : 83 89 80 94

Perform an analysis of variance to test at the 0.05 level of significance whether the differences among the sample means at the 3 positions are significant. (16)

15. (a) The following data gives the average life in hours and range in hours of 12 samples each of 5 lamps. Construct $\overline{X}$ –chart and R–chart, comment on state of control. (16)

Sample No :	1	2	3	4	5	6	7	8	9	10	11	12
$\overline{X}$:	120	127	152	157	160	134	137	123	140	144	120	127
R :	30	44	60	34	38	35	45	62	39	50	35	41

Or

(b) (i) The following data gives the number of defectives in 10 samples, each of size 100. Construct a np – chart for these data and also determine whether the process is in control. (8)

Sample Number :	1	2	3	4	5	6	7	8	9	10
Number of defectives :	24	38	62	34	26	36	38	52	33	44

(ii) Construct a control chart for fraction defectives (p-Chart) for the following data : (8)

Sample Number :	1	2	3	4	5	6	7	8	9	10
Sample Size :	90	65	85	70	80	80	70	95	90	75
Number of defectives :	9	7	3	2	9	5	3	9	6	7