(i) Test whether the five men differ with respect to mean productivity. (8)

(ii) Test whether the mean productivity is the same for the four different machine types. (8)

Or

(b) The following data resulted from an experiment to compare three burners B1, B2 and B3. A Latin square design was used as the tests were made on 3 engines and were spread over 3 days.

	E1	E2	E3
Day 1	B1-16	B2-17	B3-20
Day 2	B2-16	B3-21	B1-15
Day 3	B3-15	B1-12	B2-13

Test the hypothesis that there is no difference between the burners.

15. (a) Control on measurements of pitch diameter of thread in air-craft fittings is checked with 5 samples each containing 5 items at equal intervals of time. The data given below are the number. Construct $\overline{X}$ and R charts and state your inference from the charts.

Sample No.	Measurements				
1	46	45	44	43	42
2	41	41	44	42	40
3	40	40	42	40	42
4	42	43	43	42	45
5	43	44	47	47	45

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

19-06-23 - AN.

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

Question Paper Code : 50833

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

Answer ALL questions.

PART A — (10 × 2 = 20 marks)

1. Test whether $f(x)=\begin{cases}|x|, & -1\le x\le 1\\ 0 & otherwise\end{cases}$ can be the probability density function of a continuous random variable.

2. If X is a Poisson variate with parameter $\lambda>0$, prove that $E(X^2)=\lambda(E(X)+1)$.

3. If X and Y are two independent random variables with variances 4 and 2 respectively. Find Var (3X+4Y).

4. If $f(x,y);0<x<y<1$ be the joint probability density function of (X,Y), then find the marginal density functions of X and Y.

5. What do you mean by degrees of freedom in the testing of hypothesis?

6. Distinguish between parameter and statistic.

7. Is a 2×2 Latin square design possible? Why?

8. What do you mean by the term 'experiment' in design of experiments?

9. Under what situations p-chart is drawn instead of np-chart?

10. What is the statistical basis for $\overline{X}$ and R - charts?

PART B — ($5 \times 16 = 80$ marks)

11. (a) The probability mass function of a random variable X is defined as $P(X=0)=3C^2, P(X=1)=4C-10C^2$ and $P(X=2)=5C-1$, where $C>0$ and $P(X=r)=0$ if $r \neq 0,1,2$.

(i) Find the value of C (2)

(ii) $P(0<X<2/X>0)$ (3)

(iii) the distribution function of X, (3)

(iv) the largest value of X for which $F(x)<\frac{1}{2}$ and (4)

(v) the smallest value of X for which $F(x)>\frac{1}{2}$ (4)

Or

(b) (i) In a test of integrated circuits there is a probability 'p' that each circuit is rejected. Let Y equal the number of tests up to and including the first test that discovers a reject. What is the PMF of Y? Justify through tree diagram. Identify the corresponding probability distribution. (8)

(ii) The peak temperature T, as measured in degrees Fahrenheit, on a July a city is a Gaussian random variable with mean 85 and standard deviation 10, then find $P(T>100), P(T<60)$ and $P(70 \leq T \leq 100)$. (8)

12. (a) (i) If the joint pdf of (X,Y) is $f(x,y)=6e^{-2x-3y}; x \geq 0, y \geq 0$, then find the marginal density function of X and conditional density function of Y given X. (8)

(ii) The lifetime of certain brand of an electric bulb may be considered a random variable with mean 1200 h and standard deviation 250 h. Find the probability, using the central limit theorem, that the average lifetime of 60 bulbs exceeds 1250h. (8)

Or

(b) (i) The random variable Y is defined by $Y=\frac{1}{2}(X+|X|)$, where X is another random variable. Determine the density and distribution function of Y in terms of those of X. (8)

(ii) Let the joint pmf of X and Y be given by

$$P(x,y)=\begin{cases} k(2x+3y): & if \ x=0,1,2; \ y=1,2,3 \\ 0 \quad\quad : & otherwise \end{cases}$$

Find the value of k and find the marginal probability mass function of X and Y. Determine the probability distribution of $(X+Y)$. (8)

13. (a) (i) The fatality rate of typhoid patients is believed to be 17.26%. In a certain year 640 patients suffering from typhoid were treated in a metropolitan hospital and only 63 patients died. Can you consider the hospital efficient? (8)

(ii) The SD of a random sample of 1000 is found to be 2.6 and the SD of another random sample of 500 is 2.7. Assuming the samples to be independent, find whether the two samples could have come from populations with the same SD. (8)

Or

(b) (i) A sample of size 13 gave an estimated population variance of 3.0, while another sample of size 15 gave an estimate of 2.5. Could both samples be from populations with the same variance? (8)

(ii) The following data give the number of air-craft accidents that occurred during the various days of a week: (8)

Day:	Mon	Tues	Wed	Thurs	Fri	Sat
No. of accidents:	15	19	13	12	16	15

Test whether the accidents are uniformly distributed over the week.

14. (a) The following data gives the number of units of production per day turned out by 5 different workers using 4 different types of machines:

		Machine Type			
		A	B	C	D
Workers	1	44	38	47	36
	2	46	40	52	43
	3	34	36	44	32
	4	43	38	46	33
	5	38	42	49	39