(b) Analyse the variance in the following Latin Square of yields (in kilograms) of paddy where A, B, C, D denote different methods of cultivation.

D122	A121	C123	B122
B124	C123	A122	D125
A120	B119	D120	C121
C122	D123	B121	A122

Examine whether the different methods of cultivation have given significantly different yields. (16)

15. (a) In a production line, measurement were made by taking 15 samples, each containing 4 numbers. Discuss the nature of control in the process. (16)

Sample

Measurement in	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15
	1.7	0.8	1.0	0.4	1.4	1.8	1.6	2.5	2.9	1.1	1.7	4.6	2.6	2.3	1.9
	2.2	1.5	1.4	0.6	2.3	2.0	1.0	1.6	2.0	1.1	3.6	2.8	2.8	2.1	1.6
	1.9	2.1	1.0	0.7	2.8	1.1	1.5	1.8	0.5	3.1	2.5	3.5	3.2	2.1	1.8
	1.2	0.9	1.3	0.2	2.7	0.1	2.0	1.2	2.2	1.6	1.8	1.9	1.5	1.7	1.4

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: (16)

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

12/11/18 AN

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

Question Paper Code : 20757

B.E./B.Tech. DEGREE EXAMINATION, NOVEMBER/DECEMBER 2018.

Third Semester

Environmental Engineering

MA 6468 — PROBABILITY AND STATISTICS

(Common to Mechanical Engineering (Sandwich), Agriculture Engineering, Environmental Engineering, Industrial Engineering, Industrial Engineering and Management, Manufacturing Engineering, Bio Technology, Chemical Engineering, Fashion Technology, Food Technology, Handloom and Textile Technology, Petrochemical Technology, Petroleum Engineering, Pharmaceutical Technology, Plastic Technology, Polymer Technology, Textile Chemistry, Textile Technology)

(Regulations 2013)

Time : Three hours Maximum : 100 marks

(Use of statistical tables may be permitted)

Answer ALL questions.

PART A — (10 × 2 = 20 marks)

1. Give examples of discrete and continuous random variables.

2. Draw the representational curves for

   (a) symmetric

   (b) Asymmetric normal distribution

3. The joint probability density function of a random variable (X,Y) is given by

$$f(x,y) = \begin{cases} k(2x+3y), & 0 < x, y < 1 \\ 0, & \text{elsewhere} \end{cases}$$

   Find the value of the constant k.

4. If $Y = 3 - 2X$, find the covariance of (X,Y)

5. Define 'null hypothesis'.

6. State the purpose of 'test of goodness of fit.

7. State the aim of the design of experiment.

8. Define the term 'local control.

9. State 'process control'.

10. Find the control limits for the c-chart when $\bar{c} = 6$.

PART B — ($5 \times 16 = 80$ marks)

11. (a) (i) If a discrete probability distribution is given by

$$P(X = x) = \begin{cases} kx, & x = 1,2,3,4,5 \\ 0, & \text{otherwise} \end{cases}$$, find the value of k, $P(X$ is a prime number), $P\left(\frac{1}{2} < X < \frac{5}{2} / X > 1\right)$ and the distribution function. (8)

(ii) The time in hours required to be repair a machine is exponentially distributed with parameter $\lambda = \frac{1}{2}$, what is the probability that the required time (1) exceeds 2 hours and (2) exceeds 5 hours. (8)

Or

(b) (i) A continuous random variable X has the probability density function $f(x)$ given by $f(x) = \begin{cases} \frac{1}{k}, & 0 < x \leq k \\ 0, & \text{otherwise} \end{cases}$. Find the moment generating function, r^{th} moment, mean and variance. (8)

(ii) In a large consignment of electric bulbs, 10% are defective. A random sample of 20 is taken for inspection. Find the probability that (1) all are good bulbs, (2) at most there are 3 defective bulbs, (3) exactly there are 3 defective bulbs. (8)

12. (a) (i) Find the marginal density functions of X and Y, if

$$f(x,y) = \begin{cases} \frac{2}{5}(2x + 5y), & 0 \leq x \leq 1, 0 \leq y \leq 1 \\ 0, & \text{otherwise} \end{cases}$$ (8)

(ii) From the following data, find the two regression equations and the coefficient of correlation between X and Y using the observations: (8)

x	25	28	35	32	31	36	29	38	34	32
y	43	46	49	36	36	32	31	30	33	39

Or

(b) (i) The joint density function of a random variable (X, Y) is given by

$$f(x,y) = \begin{cases} \frac{1}{24}xy, & 1 \leq x \leq 3, \ 2 \leq y \leq 4 \\ 0, & \text{otherwise} \end{cases}$$.

Find the conditional densities of X given Y and Y given X. (8)

(ii) A coin is tossed 10 times. Using Central Limit theorem, find the probability of getting 3 or 4 or 5 heads? (8)

13. (a) (i) A test was given to a large group of boys who scored on the average64.5 marks. The same test was given to a group of 400 boys who scored an average of 62.5 marks with a standard deviation 12.5 marks. Examine if the difference is significant. (8)

(ii) A group of 10 rats fed on diet A and another group of 8 rats fed on a different diet B, recorded the following increase in weight in grams.

Diet A	5	6	8	1	12	4	3	9	6	10
Diet B	2	3	6	8	1	10	2	8		

Find if the variances are significantly different. (8)

Or

(b) (i) The following data are got from an investigation :

	No. of Cases	Mean wages	Standard deviation of the wage
Sample I	400	Rs.47.40	Rs. 3.10
Sample II	900	Rs.50.30	Rs.3.30

Find whether the two mean wages differ significantly. (8)

(ii) The table below gives the number of aircraft accidents that occurred during the various days of the week. Test whether the accidents are uniformly distributed over the week. (8)

Days	Mon	Tue	Wed	Thu	Fri	Sat
No. of Accidents	14	18	12	11	15	14

14. (a) Three varieties of a crop in a randomised block design with four replications, the layout is as given below: The yields are given in kilograms. Analyse for significance. (16)

C48	A51	B52	A49
A47	B49	C52	C51
B49	C53	A49	B50

Or