



$$\begin{aligned} \bar{X}_1 &= 40 & \bar{X}_2 &= 70 & \bar{X}_3 &= 90 \\ S_1 &= 3 & S_2 &= 6 & S_3 &= 7 \\ r_{12} &= 0.4 & r_{23} &= 0.5 & r_{13} &= 0.6 \end{aligned}$$

- 2(c) Use Linear Regression Model to estimate  $X_3$  when  $X_1 = 30$  and  $X_2 = 80$  5  
 From a trivariate data set the following correlations are available  
 $r_{12} = 0.86, r_{13} = 0.65, r_{23} = 0.72$ . Find  $R_{1.23}$  and  $r_{12.3}$

**Q. No** **Module 3**

- 3(a) Write a short note on (a) Maximum Likelihood Estimation (b) Estimation by Method of Moments 4

**Answer b or c**

- 3(b) Let  $x_1, x_2, x_3, \dots, x_n$  be a random sample taken from a normal population with mean  $\mu$  and variance  $\sigma^2$ . Find the maximum likelihood estimation of the mean and variance of the population 5
- 3(c) Let  $x_1, x_2, x_3, \dots, x_n$  be a random sample taken from a normal population with mean  $\mu$  and variance  $\sigma^2$ . Find the estimation of mean and variance of the population by the method of moments 5

**Q. No** **Module 4**

- 4(a) A tyre company claims that the average life of tyre is at least 28000km. A random sample of 40 tyres were tested and it is found that the mean life is 27463km with a standard deviation 1348 km. Test the claim of the claim at 1% level of significance 4

**Answer b or c**

- 4(b) The following random samples are measurements of the heat-producing capacity (in millions of calories per ton) of specimen of coal from two mines 5

Mine 1: 8260    8130    8350    8070    8340

Mine 2: 7950    7890    7900    8140    7920    7840

Use 1% level of significance to test whether the difference between the means of these two samples is significant.

- 4(c) It is desired to determine whether there is more variability in the silver plating done by company 1 than that done by company 2. If independent random samples of size 12 of the two companies work yield  $S_1 = 0.035$  mil and  $S_2 = 0.062$  mil. Test whether the variability of company 1 is more than that of company 2 at 5% level of significance 5

**Q. No****Module 5**

- 5(a)** The following are the weight losses of a certain machine parts (in milligrams ) due to friction when 3 different lubricants were used under controlled conditions. 5

Lubricant A: 12.2 11.8 13.1 11.0 3.9 4.1 10.3 8.4

Lubricant B: 10.9 5.7 13.5 9.4 11.4 15.7 10.8 14.0

Lubricant C: 12.7 19.9 13.6 11.7 18.3 14.3 22.8 20.4

Test at 1% level whether the difference among the means can be attributed to chance

**Answer b or c**

- 5(b)** A laboratory technician measures the breaking strength of each of 5 kinds of linen thread by means of 4 different instruments and obtains the following results 7

		Measuring instruments			
		I1	I2	I3	I4
Thread type	T1	20.6	20.7	20.0	21.4
	T2	24.7	26.5	27.1	24.3
	T3	25.2	23.4	21.6	23.9
	T4	24.5	21.5	23.6	25.2
	T5	19.3	21.5	22.2	20.6

Perform 2 way ANOVA to test whether the means between thread type and the mean between measuring instruments are significant or not at 1% level of significance

- 5(c)** The following data resulted from an experiment to compare three burners  $B_1$ ,  $B_2$  and  $B_3$ . A Latin square design was used as the tests were made on 3 engines and were spread over 3 days. 7

	Engine1	Engine2	Engine3
Day1	$B_1-16$	$B_2-17$	$B_3-20$
Day2	$B_2-16$	$B_3-21$	$B_1-15$
Day3	$B_3-15$	$B_1-12$	$B_2-13$

Test the hypothesis that there is no difference between the burners

Q. No

Module 6

6(a) Define multivariate analysis. Mention some basic concepts of multivariate analysis 5

**Answer b or c**

6(b) What is the importance of factor analysis in modern research? What are the four issues to which factor analysis is keyed to meet its objectives? Explain data reduction. 7

6(c) What are the types of multivariate techniques? Explain any three of them. 7