

random sample of 120 of these pumps includes 47 which required repairs within the first 5 years, test the null hypothesis $p = 0.30$ against the alternative hypothesis $p > 0.30$ at the 0.05 level of significance.

8M

- b. Theory predicts that the proportion of beans in 4 groups A, B, C, D should be 9 : 3 : 3 : 1. In an experiment among 1600 beans, the numbers in the 4 groups were 882, 313, 287 and 118. Does the experiment support the theory?

7M

UNIT-IV

8. a. The following table gives the sample means and ranges for 10 samples, each of size 5. Construct the control charts for mean and range and comment on the nature of control.

7M

Sample No.	1	2	3	4	5	6	7	8	9	10
Mean	12.8	13.1	13.5	12.9	13.2	14.1	12.1	15.5	13.9	14.2
Range R	2.1	3.1	3.9	2.1	1.9	3.0	2.5	2.8	2.5	2.0

- b. An integrated circuit chip has a constant failure rate of 0.02 per thousand hours

i) What is the probability that it will operate satisfactory for at least 20,000 hours?

ii) What is the 5,000 hour reliability of a component consisting of 4 such chips connected in series?

8M

(or)

9. a. An old-fashioned string of holiday lights has 8 bulbs connected in series. What would have to be the reliability of each bulb if there is to be a 95% chance of the string's lighting after a year's storage?

8M

- b. A system consisting of several identical components connected in parallel is to have a failure rate of at most 4×10^{-4} per hour. What is the least number of components that must be used if each has a constant failure rate of 9×10^{-4} ?

7M

Time: 3 hours

Max. Marks: 70

Part-A is compulsory

Answer One Question from each Unit of Part-B

PART-A

10 x 1 = 10M

1. a. Define Binomial Distribution.
- b. Define distribution function.
- c. Define Statistic.
- d. Define Point estimation.
- e. Define Null hypothesis.
- f. Define Two-tailed test.
- g. Write the test statistic for the hypothesis concerning one proportion.
- h. Write about Control charts.
- i. Define X-bar chart.
- j. Define Reliability.

PART-B

4 x 15 = 60M

UNIT-I

2. a. A random variable X has the following probability distribution

x	0	1	2	3	4	5	6	7
p(x)	0	K	2K	2K	3K	K ²	2 K ²	7 K ² +K

Find i) the value of K

ii) $P(1.5 < X < 4.5 / X > 2)$ iii) the smallest value of λ for which $P(X \leq \lambda) > 1/2$. **8M**

- b. It has been claimed that in 60% of all solar heat installations the utility bill is reduced by at least one-third. Accordingly, what are the probabilities that the utility bill will be reduced by at least one-third in i) four of five installations
ii) at least four of five installations **7M**

(or)

3. a. Find the probabilities that a random variable having the standard normal distribution will take on a value **8M**
i) between 0.87 and 1.28 ii) between -0.34 and 0.62
iii) greater than 0.85 iv) greater than -0.65
- b. A process for making certain bearing is under control if the diameters of the bearings have a mean of 0.5000 cm. What can we say about this process if a sample of 10 of these bearings has a mean diameter of 0.5060 cm and a standard deviation of 0.0040 cm? **7M**

UNIT-II

4. a. In six determinations of the melting point of tin, a chemist obtained a mean of 232.26 degrees of celsius with a standard deviation of 0.14 degrees. If he uses this mean to estimate the actual melting point of tin, what can the chemist assert with 98% confidence about the maximum error? **8M**

- b. According to the norms established for a mechanical aptitude test, persons who are 18 years old should average 73.2 with a standard deviation of 8.6. If 45 randomly selected persons of that age averaged 76.7, test the null hypothesis $\mu = 73.2$ against the alternative hypothesis > 73.2 at the 0.01 level of significance. **7M**

(or)

5. a. Five measurements of the tar content of a certain kind of cigarette yielded 14.5, 14.2, 14.4, 14.3 and 14.6 mg per cigarette. Show that the difference between the mean of this sample = 14.4 and the average tar claimed by the manufacturer = 14.0 is significant at 0.05. Assume normality. **8M**
- b. A simple sample of the heights of 6400 Englishmen has a mean of 67.85 inches and a S.D of 2.56 inches while a simple sample of the heights of 1600 Australians has a mean of 68.55 inches and S.D of 2.52 inches. Do the data indicate that Australians are on the average taller than the Englishmen. **7M**

UNIT-III

6. a. Use the 0.01 level of significance to test the null hypothesis that = 0.015 inch for the diameters of certain bolts against the alternative hypothesis that inch, given that a random sample of size 15 yielded $s^2 = 0.00011$. **8M**
- b. The time taken by workers in performing a job by two methods A and B is given below

A	20	16	26	27	23	22	-
B	27	33	42	35	32	34	38

Do the data show that the variances of the time distribution do not differ significantly. **7M**

(or)

7. a. A manufacturer of submersible pumps claims that at most 30% of the pumps require repairs within the first 5 years of operation. If a