



VR10

CS/IT 4001

II/IV B.Tech. DEGREE EXAMINATION, JUNE, 2014

Fourth Semester

PROBABILITY AND STATISTICS

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

- a. Define probability density function.
- b. Define normal distribution.
- c. Write the expression for finite population correction factor.
- d. Write confidence interval for μ for small samples.
- e. Define unbiased estimator.
- f. Define type-I error.
- g. Write the test statistic for F-distribution.
- h. Write χ^2 statistic for analysis of $r \times c$ tables.
- i. Write the control limits for \bar{x} charts.
- j. Write the control limits for P charts.

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PART-B

4 x 15 = 60M

UNIT-I

1. a. If the probability density function of random variable X is given by

$$f(x) = kx^2, \quad 0 < x < 1$$
$$= 0, \quad \text{elsewhere}$$

then find i) k ii) $P\left(\frac{1}{4} < X < \frac{3}{4}\right)$ iii) $P\left(X > \frac{2}{3}\right)$ **8M**

- b. In a photographic process, the time to process 8 x 10 prints from a memory card may be looked upon as a random variable having the normal distribution with a mean of 10.28 seconds and a standard deviation of 0.12 seconds. Find the probability that it will take

i) anywhere from 10 to 10.5 seconds

ii) at least 10.20 seconds

iii) at most 10.35 seconds to process one of the prints **7M**

(or)

2. a. Suppose that the time to failure (in minutes) of certain electronic components subjected to continuous vibrations may be looked upon

as a random variable having the weibull distribution with $\alpha = \frac{1}{5}$

and $\beta = \frac{1}{3}$

i) How long can such a component be expected to last?

ii) What is the probability that such a component will fail in less than 5 hours? **7M**

UNIT-III

5. a. The lapping process which is used to grind certain silicon wafers to the proper thickness is acceptable only if σ , the population standard deviation of the thickness of dice cut from the wafers, is at most 0.50 mil. Use the 0.05 level of significance to test the null hypothesis $\sigma = 0.50$ against the alternative hypothesis $\sigma > 0.50$, if the thicknesses of 15 dice cut from such wafers have a standard deviation of 0.64 mil. **8M**
- b. In a random sample of 400 industrial accidents, it was found that 231 were due at least partially to unsafe working conditions. Construct a 99% confidence interval for the corresponding true proportion using the large sample confidence interval formula. **7M**
- (or)
6. a. It is desired to estimate whether there is less variability in the silver plating done by Company 1 than in 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 the null hypothesis $\sigma_1^2 = \sigma_2^2$ against the alternative hypothesis $\sigma_1^2 < \sigma_2^2$ at 0.05 level of significance. **7M**
- b. A study shows that 16 of 200 tractors produced on one assembly line required extensive adjustment before they could be shipped, while the same was true for 14 of 400 tractors produced on another assembly line. At the 0.01 level of significance, does this support the claim that the second production line does superior work? **8M**

UNIT-IV

7. a. A plastic manufacturer extrudes blanks for use in the manufacturer of eyeglass temples. Specifications required that the thickness of

these blanks have $\mu = 0.150$ inch and $\sigma = 0.002$ inch

- i) Use the specifications to calculate a central line and three-sigma control limits for an \bar{x} charts with $n = 5$
- ii) Use the specifications to calculate a central line and three-sigma control limits for an R charts with $n = 5$ **7M**
- b. After burn-in, the life time of a solar cell is modified as an exponential distribution with failure rate $\alpha = 0.0005$ failure per day.
- i) What is the probability that the cell will fail within the first 365 days that it is in operation?
- ii) What is the probability that two such cells, operating independently, will both survive the first 365 days they are in operation? **8M**

(or)

8. a. The following data given the means and ranges of 25 samples, each consisting of 4 points compression test results on steel forgings, in thousands of pounds per square inches: **7M**

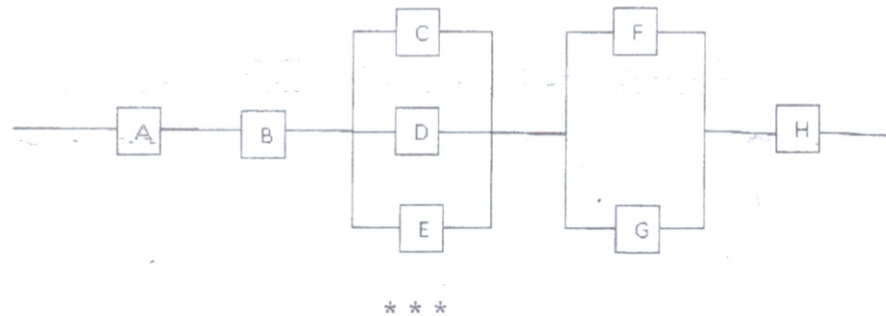
Sample	1	2	3	4	5	6	7	8	9	10	11
\bar{x}	45.4	48.1	46.2	45.7	41.9	49.4	52.6	54.5	45.1	47.6	42.8
R	2.7	3.1	5.0	1.6	2.2	5.7	6.5	3.6	2.5	1.0	3.9

Sample	12	13	14	15	16	17	18	19	20	21
\bar{x}	41.4	43.7	49.2	51.1	42.8	51.1	52.4	47.9	48.6	53.5
R	5.6	2.7	3.1	1.5	2.2	1.4	4.3	2.2	2.7	3.1

Sample	22	23	24	25
\bar{x}	49.7	48.2	51.6	52.3
R	1.1	2.1	1.6	2.4

Use the above data to find the central line and control limits for an R chart.

- b. A system consisting of 8 components connected as in the following diagram.
Find the overall reliability of the system, given that the reliability of A, B, C, D, E, F, G, and H are 0.95, 0.99, 0.70, 0.70, 0.70, 0.75, 0.75, and 0.90 respectively. **8M**



- b. If 1-gallon can of paint covers on the average 513.3 square feet with a standard deviation of 31.5 square feet, what is the probability that the sample mean area covered by a sample of 40 of these 1-gallon can will be anywhere from 510 to 520 square feet? **8M**

UNIT-II

3. a. A research worker wants to determine the average time it takes a mechanic to rotate the times of a car, and she wants to be able to assert with 95% confidence that the mean of her sample is off by atmost 0.50 minute. If she can presume from past experience that $\sigma = 1.6$ minutes, how large a sample will she have to take? **7M**
- b. The mean yield of wheat from a district was 210 pounds with S.D 10 pounds per acre from a sample of 100 plots. In another district the mean yield was 220 pounds with S.D 12 pounds from a sample of 150 plots. Assuming that the S.D of yield in the entire state was 11 pounds, test whether there is any significant difference between the mean yield of crops in the two districts. **8M**

(or)

4. a. The mean life time of a sample of 100 light tubes produced by a company is found to be 1560 hrs with a population S.D of 90 hrs. Test the hypothesis that the mean life time of the tubes produced by the company is 1580 hrs. **7M**
- b. Two horses A and B were tested according to the time (in seconds) to run a particular track with the following results. **8M**

Horse A	28	30	32	33	33	29	34
Horse B	29	30	30	24	27	29	

Test whether the two horses have the same running capacity.