CS/IT 221

Hall Ticket Number:

II/IV B.Tech (Supplementary) DEGREE EXAMINATION

November, 2019 — **Common to CSE/IT**

Third Semester — **Probability and Statistics**

Time: Three Hours **Maximum:** 60 Marks

Answer Question No.1 compulsorily. (1X12 = 12 Marks)

Answer ONE question from each unit. (4X12=48 Marks)

1. Answer all questions (1X12=12 Marks)
   a) Define a continuous random variable.
   b) Define Gamma distribution.
   c) Find the value of k when the Probability density function is given by $f(x) = kx^2$ for $0<x<1$, 0 for elsewhere.
   d) State central limit theorem.
   e) Write the $(1 - \alpha)$ 100% confidence interval for the difference of two means.
   f) Write the test statistic for several proportions.
   g) Define Type I and Type II errors.
   h) What are the various control charts for attributes.
   i) Write the formula for the statistic for the test of goodness of fit.
   j) Write the critical region for testing one mean.
   k) What are the control limits for p-chart.
   l) Define degrees of freedom.

UNIT I

For the continuous probability function $f(x)=k\, x^2e^{-x}, x\geq 0$

2. a) Find(i) K (ii) mean (iii)variance (iv) $P(3\leq X\leq 5)$ 6M

   b) If 20% of memory chips made in a certain plant are defective. Use the normal approximation to find the probabilities that in a lot of 100 randomly chosen for inspection (i) at most 15 will be defective; (ii) exactly 15 will be defective. 6M

(OR)

3. a) If two random variables have the joint density $f(x_1,x_2)=\begin{cases} x_1x_2 & for\ 0<x_1<2,\ 0<x_2<1 \\ 0 & elsewhere \end{cases}$ find the probabilities that (i) both random variables will take on values less than 1; (ii) the sum of the values taken on by the two random variables will be less than 1. 6M

   b) A wire bonding process is said to be in control if the mean pull strength is 10 pounds. It is known that the pull strength measurements are normally distributed with a standard deviation of 1.5 pounds. Periodic random samples of size 4 are taken from this process and the process is said to be "out of control" if a sample mean is less than 7.75 pounds, comment. 6M

UNIT II

4. a) The following are the average weekly losses of worker-hours due to accidents in 10 industrial plants before and after a certain kind of safety program was put into operation:

Before	45	73	46	124	33	57	83	34	26	17
After	36	60	44	119	35	51	77	29	24	11

6M

Use the 0.05 level of significance to test whether the safety program is effective.

   b) The specifications for a certain kind of ribbon call for a mean breaking strength of 180 pounds. If five pieces of the ribbon (randomly selected from different rolls) have a mean breaking strength of 169.5 pounds with a standard deviation of 5.7 pounds, test the null hypothesis $\mu = 180$ pounds against the alternative hypothesis $\mu < 180$ pounds at the 0.01 level of significance. 6M

(OR)

5. a) The following random samples are measurements of the heat producing capacity (in millions of calories per ton) of specimens of coal from two mines:

Mine 1:	8,260	8,130	8,350	8,070	8,340	
Mine 2:	7,950	7,890	7,900	8,140	7,920	7,840

Use the 0.02 level of significance to test whether it is reasonable to assume that the variances of the populations sampled are equal. 6M

b) 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 thickness of 15 dice cut from such wafers have a standard deviation of 0.64 mil. 6M

UNIT III

6. a) A study shows that 16 of 200 tractors produced on one assembly line required extensive adjustments 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? 6M

b) The following is the distribution of the hourly number trucks arriving at a company's ware house.

Trucks arriving per hour	0	1	2	3	4	5	6	7	8
Frequency	52	151	130	102	45	12	5	1	2

Fit a poisson distribution and test for good ness of fit at 5% level of significance? 6M

(OR)

7. As part of the investigations of the collapse of the roof of a building, a testing laboratory is given all the available bolts that connected the steel structure at 3 different positions on the roof. The forces required to shear each of these bolts(coded values) are as follows:

Position 1 : 90 82 79 98 83 91
Position 2 : 105 89 93 104 89 95 86
Position 3 : 83 89 80 94

Perform an analysis of variance to test at the 0.05 level of significance whether the differences among the sample means at the 3 positions are significant. 12M

UNIT IV

8. a) Thirty five successive samples of 100 castings, each taken from a production line, contained, respectively. 3,35,3,5,0,3,2,3,5,6,5,9,1,2,4,5,2,0,10,3,6,3,2,5,6,3,3,2,5,1,0,7,4 and 3 defectives. If the fraction defective is to be maintained at 0.02, construct a p chart for these data and state whether or not this standard is being met. 6M

b) The following data provides the number of defective fuses which were found in an inspection of 20 samples of 100 fuses each. Construct the fraction defective chart and state the nature of the process. 6M

Sample:	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20
Defectives	5	10	12	8	6	5	6	3	3	5	4	7	8	2	3	4	5	8	6	10

(OR)

9. a) A system consists of 5 identical components connected in parallel. What must be the reliability of each component if the overall reliability of the system is given to be 0.96 6 M

b) A sample of 200 switches was placed on life test consisting of repeated on off cycles. The test was terminated after the third failure. The first three failures times were 2076, 3667, 9102. Find a 95% lower confidence limit for the mean life, in number of cycles, of the switches. Use the exponential model. 6 M