

Code No: R22011

R10**SET - 1****II B. Tech II Semester Supplementary Examinations, April-2018****PROBABILITY AND STATISTICS**

(Com. to CE, CHEM, PE)

Time: 3 hours

Max. Marks: 80

Answer any **FIVE** Questions
All Questions carry **Equal** Marks

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**Note** :- Statistical tables and Control Chart Constants are required

1. a) If  $A$  and  $B$  are any events in  $S$  then prove that (7M)  
 $P(A \cup B) = P(A) + P(B) - P(A \cap B)$ .  
b) If the probability that a communication system will have high fidelity is 0.81 and the probability that it will have high fidelity and high selectivity is 0.18. What is the Probability that a system with high fidelity will also have high selectivity? (8M)
2. a) Define discrete random variable and discrete probability distribution. (8M)  
b) Find the value of  $k$  and the distribution function  $F(x)$  given the probability density function of a random variable  $X$  as:  
$$f(x) = \frac{k}{x^2 + 1}, \quad -\infty < x < \infty$$
3. a) Define Moment Generating Functions. Find Moment Generating Function for Binomial distribution. (8M)  
b) If the probability of a bad reaction from a certain injection is 0.001. Determine the chance that out of 2000 individuals more than two will get a bad reaction. (7M)
4. a) If a 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 cans will be anywhere from 510.0 to 520.0 square feet? (7M)  
b) Determine a 99% confidence interval for the mean of a normal distribution with variance  $\sigma^2 = 9$ , using a sample of  $n = 100$  values with mean  $\bar{x} = 5$ . (8M)
5. a) Explain the test procedure for  $Z$  - test concerning difference between two means. (7M)  
b) A study shows that 64 of 180 persons who saw a photocopying machine advertised during the telecast of a baseball game and 75 of 180 other persons who saw it advertised on a variety show remembered the brand name 2 hours later. Use the  $Z$  - statistic to test at the 0.05 level of significance whether the difference between the corresponding sample proportions is significant. (8M)

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6. Test of the fidelity and the selectivity of 190 digital radio receivers produced the results shown in the following table: (15M)

|             |         | Fidelity |         |      |
|-------------|---------|----------|---------|------|
|             |         | Low      | Average | High |
| Selectivity | Low     | 6        | 12      | 32   |
|             | Average | 33       | 61      | 18   |
|             | High    | 13       | 15      | 0    |

Use the 0.01 level of significance to test whether there is a relationship between fidelity and selectivity

7. The following means and ranges, obtained in 20 successive random samples of size 5. (15M)

| Sample | $\bar{X}$ | R    | Sample | $\bar{X}$ | R    |
|--------|-----------|------|--------|-----------|------|
| 1      | 4.24      | 0.09 | 11     | 4.20      | 0.21 |
| 2      | 4.18      | 0.12 | 12     | 4.25      | 0.20 |
| 3      | 4.26      | 0.14 | 13     | 4.25      | 0.17 |
| 4      | 4.21      | 0.24 | 14     | 4.21      | 0.07 |
| 5      | 4.22      | 0.15 | 15     | 4.19      | 0.16 |
| 6      | 4.18      | 0.28 | 16     | 4.23      | 0.16 |
| 7      | 4.23      | 0.06 | 17     | 4.27      | 0.19 |
| 8      | 4.19      | 0.15 | 18     | 4.22      | 0.20 |
| 9      | 4.21      | 0.09 | 19     | 4.20      | 0.12 |
| 10     | 4.18      | 0.15 | 20     | 4.19      | 0.16 |

- (i) Use these data to find the central line and control limits for an  $\bar{X}$  chart.  
 (ii) Use these data to find the central line and control limits for an  $R$  chart.  
 (iii) Plot the given data on  $\bar{X}$  and  $R$  charts based on the control chart constants computed in parts (i) and (ii), and interpret the results.

8. a) Explain the 'Pure Birth and Death Process'. (7M)
- b) A barber shop has two barbers and three chairs for customers. Assume that the customers according to an exponential distribution with mean of 15 minutes. Further if a customer arrives and there are no empty chairs in the shop, he will leave. What is the probability that the shop is empty? What is the expected number of customer in the shop? (8M)