Code No: RT22051 **R13** SET - 1

II B. Tech II Semester Regular/Supplementary Examinations, April/May-2017
PROBABILITY AND STATISTICS
(Com. to CSE, IT, CHEM, PE, PCE)

Time: 3 hours Max. Marks: 70

Note: 1. Question Paper consists of two parts (**Part-A** and **Part-B)**
2. Answer **ALL** the question in **Part-A**
3. Answer any **THREE** Questions from **Part-B**

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Note :- Statistical tables and Control Chart Constants are required

PART –A

1. a) Define a Random variable and Distribution function. (4M)
   b) Define the Moment Generating Function. (3M)
   c) A random sample of size 100 has a standard deviation of 5. What can you say about the maximum error with 95% confidence? (4M)
   d) Write the procedure to test the difference between two means for large sample. (4M)
   e) State the principle of lest-squares and write the normal equations for least square straight line $y = a + bx$. (4M)
   f) Write the control line and three - sigma limits for the fraction-defective chart. (3M)

PART -B

2. a) Define the Weibull Distribution and find its mean and variance. (8M)
   b) Find the value of k and the distribution function $F(x)$ given the probability density function of a random variable X as: (8M)

$$f(x)=\begin{cases} k(3+2x) & if\ 0 < x < 2 \\ 0 & otherwise \end{cases}.$$

3. Find Moment Generating Function for normal distribution and hence find its mean and variance. (16M)

4. a) Determine the probability that $\overline{X}$ will be between 75 and 78 if a random sample of size 100 is taken from an infinite population having the mean $\mu = 76\ and\ \sigma^2 = 256$. (8M)
   b) Determine a 95% confidence interval for the mean of a normal distribution with variance $\sigma^2 = 0.25$, using a sample of $n = 100$ values with mean $\overline{x} = 212.3$. (8M)

5. a) An urban community would like to show that the incidence of breast cancer is higher than in a nearby rural area. If it is found that 20 of 200 adult women in the urban community have breast cancer and 10 of 150 adult women in the rural community have breast cancer, can we conclude at the 0.01 level of significance that breast cancer is more prevalent in the urban community? (8M)
   b) Explain procedure for one-way classification of analysis of variance. (8M)
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6. The following are data on the drying time of a certain varnish and the amount of an additive that is intended to reduce the drying time: (16M)

Amount of varnish additive (grams) x	0	1	2	3	4	5	6	7	8
Drying time (hours) y	12.0	10.5	10.0	8.0	7.0	8.0	7.5	8.5	9.0

(i) Fit a second degree polynomial by the method of least squares.
(ii) Use the result of (i) to predict the drying time of the varnish when 6.5 grams of the additive is being used.

7. Samples of 100 tubes are drawn randomly from the output of a process that produces several thousand units daily. Sample items are inspected for quality and defective tubes are rejected. The results of 15 samples are shown below : (16M)

Sample No.	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15
No. of Defective tubes	8	10	13	9	8	10	14	6	10	13	18	15	12	14	9

On the basis of information given above prepare a control chart for fraction defective (p - chart). What conclusion do you draw from the control chart?

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Note :- Statistical tables and Control Chart Constants are required

PART –A

1. a) Define Gamma distribution and find its Mean. (4M)
b) Find Moment Generating Function for Normal distribution. (3M)
c) Define point and interval estimators for mean of a population. (4M)
d) Write procedure for test concerning one mean for large sample. (4M)
e) Write normal equations to fit the second degree parabola. (4M)
f) Write the control line and three - sigma limits for the range chart. (3M)

PART -B

2. a) Define continuous random variable and continuous probability distribution. (8M)
b) 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 -0.87 and 0.62;
(iii) greater than 0.85;
(iv) Greater than -0.65.

3. Find Moment Generating Function for Binomial distribution and hence find its mean and variance. (16M)

4. a) Determine a 95% confidence interval for the mean of a normal distribution with variance $\sigma^2 = 4$, using a sample of $n = 200$ values with mean $\bar{x} = 120$. (8M)
b) Find the value of $F_{0.95}$ for $\nu_1 = 12$ *and* $\nu_2 = 15$ degrees of freedom. (8M)

5. a) In a study to estimate the proportion of residents in a certain city and its suburbs who favor the construction of a nuclear power plant, it is found that 63 of 100 urban residents favor the construction while only 59 of 125 suburban residents are in favor. Is there a significant difference between the proportion of urban and suburban residents who favor construction of the nuclear plant? Use a 0.05 level of significance. (8M)
b) Explain the test procedure of χ^2 test for analysis of $r \times c$ table. (8M)
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6. The following data pertain to the demand for a product (in thousands of units) and its price (in dollars) charged in five different market areas: (16M)

Price x	20	16	10	11	14
Demand y	22	41	120	89	56

Fit a power function and use it to estimate the demand when the price of the product is 12 dollars.

7. During an inspection, 20 of successively selected samples of polished metal sheet, the number of defects observed per sheet is recorded, as shown in the following table. Construct a C-chart for the number of defects. (16M)

Sample no.	No. of defects	Sample no.	No. of defects
1	3	**11**	5
2	0	**12**	2
3	5	**13**	1
4	1	**14**	1
5	2	**15**	2
6	3	**16**	3
7	2	**17**	4
8	4	**18**	0
9	0	**19**	1
10	2	**20**	2

Code No: RT22051 **R13** SET - 3

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2. Answer **ALL** the question in **Part-A**
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Note :- Statistical tables and Control Chart Constants are required

PART –A

1. a) Define Normal distribution and standard normal distribution (4M)

b) Prove that $E(aX+b)=a\,E(X)+b$, where a and b are constants. (4M)

c) Find the value of the finite population correction factor, if the sizes of the sample and population are 100 & 5000 respectively. (3M)

d) Define one-tailed and two-tailed tests. (4M)

e) Define simple correlation and write formula for simple correlation coefficient. (4M)

f) Write the control line and three - sigma limits for the mean chart. (3M)

PART -B

2. a) Let X be a continuous random variable with distribution :

$$f(x)=\begin{cases} k\,x^2 & if\ \ 0\le x\le 1 \\ 0 & elsewhere \end{cases}$$

(i) Evaluate k (ii) Find $p(1/4\le X\le 3/4)$. (iii) Find $p(X>2/3)$. (8M)

b) Define the Gamma Distribution and find its mean and variance. (8M)

3. Find Moment Generating Function for Poisson distribution and hence find its mean and variance. (16M)

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? (8M)

b) Find the value of $F_{0.99}$ for $\nu_1=6$ *and* $\nu_2=20$ degrees of freedom. (8M)

5. a) A study of TV viewers was conducted to find the opinion about the mega serial 'Ramayana'. If 56% of a sample of 300 viewers from south and 48% of 200 viewers from north preferred the serial, , test the claim at 0.05 level of significance that there is a difference of opinion between south and north. (8M)

b) Explain the test procedure for small sample test concerning difference between two means. (8M)
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6. The following data pertains to the cosmic ray doses measured at various altitudes: (16M)

Altitude(feet) x	50	450	780	1200	4400	4800	5300
Count y	28	30	32	36	51	58	69

(i) Fit an exponential curve.
(ii) Use the result obtained in part (i) to estimate the mean does at an altitude of 3,000 feet.

7. The following data give the means and ranges of 25 samples, each consisting of 4 compression test results on steel forgings, in thousands of pounds per square inch: (16M)

Sample	$\overline{X}$	R	**Sample**	$\overline{X}$	R
1	45.4	2.7	**14**	49.2	3.1
2	48.1	3.1	**15**	51.1	1.5
3	46.2	5.0	**16**	42.8	2.2
4	45.7	1.6	**17**	51.1	1.4
5	41.9	2.2	**18**	52.4	4.3
6	49.4	5.7	**19**	47.9	2.2
7	52.6	6.5	**20**	48.6	2.7
8	54.5	3.6	**21**	53.3	3.0
9	45.1	2.5	**22**	49.7	1.1
10	47.6	1.0	**23**	48.2	2.1
11	42.8	3.9	**24**	51.6	1.6
12	41.4	5.6	**25**	52.3	2.4
13	43.7	2.7			

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

Code No: RT22051 **R13** SET - 4

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2. Answer **ALL** the question in **Part-A**
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Note :- Statistical tables and Control Chart Constants are required

PART –A

1. a) Given the probability density function of a random variable X as: (4M)

$$f(x)=\frac{k}{x^2+1},\quad -\infty < x < \infty, \text{ find } k.$$

b) Find Moment Generating Function for Poisson distribution. (3M)

c) Define Population and Sample with examples. (4M)

d) Define Type-I and Type-II errors in testing of hypothesis. (4M)

e) Explain Multiple Regressions. (4M)

f) Define Quality control. (3M)

PART -B

2. a) Let X be a continuous random variable with distribution :

$$f(x)=\begin{cases} x & for\ \ 0<x<1 \\ 2-x & for\ \ 1\le x<2 \\ 0 & elsewhere \end{cases}$$

Find (i) $p(0.2 \le X \le 0.8)$ (ii) $p(0.6 \le X \le 1.2)$ (8M)

b) An aptitude test for selecting offers in a bank is conducted on 1000 candidates. The average score is 42 and the standard deviation of score is 24. Assuming normal distribution for the scores, find (8M)
(i) The number of candidates whose scores exceed 60
(ii) The number of candidates whose scores lie between 30 and 60.

3. a) Define Mathematical Expectation and write its properties. (16M)

b) Let X be a continuous random variable having probability density function (8M)

$$f(x)=\begin{cases} 2e^{-2x} & for\ \ x>0 \\ 0 & \text{elsewhere} \end{cases}$$

Find Moment Generating Function and Obtain $E(X)$ and $E(X^2)$ by differentiating the Moment Generating Function.
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Code No: RT22051

R13

SET - 4

4. a) Take 30 slips of paper and label five each -4 and 4,four each -3 and 3,three each -2 and 2, and two each -1,0 and 1.If each slip of paper has the same probability of being drawn , find the probability of getting $-4, -3, -2, -1,$ 0, 1, 2, 3, 4 and find the mean and the variance of this distribution. (8M)

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) Intelligence tests on two groups of boys and girls gave the following results. Examine if the difference is significant. Use a 0.05 level of significance. (8M)

	Mean	S.D.	Size
Girls	70	10	70
Boys	75	11	100

b) Explain procedure for two-way classification of analysis of variance. (16M)

6. The following are measurements of the air velocity and evaporation coefficient of burning fuel droplets in an impulse engine: (16M)

Air velocity(cm/s) x	20	60	100	140	180	220	260	300	340	380
Evaporation coefficient(mm^2/s) y	0.18	0.37	0.35	0.78	.056	.075	1.18	1.36	1.17	1.65

Fit a straight line to these data by the method of least squares and use it to estimate the evaporation coefficient of a droplet when the air velocity is 190 cm/s.

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

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