Code No: R1621011 **R16** SET - 1

II B. Tech I Semester Regular Examinations, October/November - 2017
PROBABILITY AND STATISTICS
(Civil Engineering)

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 **FOUR** Questions from **Part-B**

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PART –A

1. a) Verify whether Poisson Distribution is probability mass function (3M)
   b) Define Maximum error estimate (2M)
   c) Write the test statistic for two way ANOVA classification (3M)
   d) Write the normal equations for the least square curve of the form $y = ab^x$ (2M)
   e) What is the purpose of control charts (2M)
   f) Write the mean and variance of standard normal distribution (2M)

PART -B

2. a) A sample of 4 items is selected at random from a box containing 12 items of which 5 are defective. Find the expected number of defective items (7M)
   b) A box contains 100 transistors , 20 of which are defective and 10 are selected at random , find the probability that (7M)
   (i) all are defective (ii) all are good (iii) at most 2 are defective

3. a) Show that Normal distribution is symmetrical distribution (7M)
   b) If the probability density function is $f(x) = e^{-x}$ for $x > 0$, then find mean and variance of X (7M)

4. Samples of size 2 are taken from the population 4,8,12,16,20,24 with replacement. Find (14M)
   a) The mean of the population
   b) The standard deviation of the population
   c) Mean of the sampling distribution of means
   d) The standard deviation of the sampling distribution of means

5. a) A sample of 900 members is found to have a mean of 3.4 cm .Can it be reasonably regarded as truly random sample from large population with mean 3.25cm and S.D 1.61cm (7M)
   b) Two horses A and B were tested according to the time (in seconds) to run a particular the track with the following results. (7M)

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

Test whether the two horses have the same running capacity.
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6. a) Fit the curve $y = ae^{bx}$ for the following data and also estimate y(2.4) for the following data (7M)

x	2	4	6	8	10	12
y	1.8	1.5	1.4	1.1	1.1	0.9

b) Calculate the two regression lines from the following data (7M)

x	12	10	14	11	12	9
y	18	17	23	19	20	15

7. a) Draw the control chart for $\bar{X}$, R chart for the following data for $A_2 = 0.483$ (7M)

Sample	1	2	3	4	5	6	7	8	9	10
Mean	43	49	37	44	45	37	51	46	43	47
Range	5	6	5	7	7	4	8	6	4	6

b) If the average fraction defective of a large sample of products is 0.1537 calculate the control limits (7M)

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PART –A

1. a) Write the density function of Gamma distribution. (2M)
   b) Write the moment generating function of Normal distribution. (2M)
   c) State central limit theorem. (2M)
   d) Find the z – statistics for $\bar{x} = 40, \mu = 40, \sigma = 5.8, n = 64$. (3M)
   e) What is mean by goodness of fit ? (2M)
   f) Find upper and lower 3-σ control limits for means of 4 samples with mean is 0.6230 and standard deviation of 0.032 (3M)

PART -B

2. a) Find the moment generating function for binomial distribution (7M)
   b) If $P(x = 2) = 9P(x = 4) + 90P(x = 46)$ for a Poisson variate then find (i)$P(x < 2)$ (ii) $P(x \geq 1)$ (7M)
3. a) Obtain the moment generating function of random variable X having density function $f(x) = \begin{cases} \frac{x}{2}, & 0 \leq x < 1 \\ 3 - x, & 1 \leq x < 2 \\ 0 & otherwise \end{cases}$ (7M)
   b) If X is Normally distributed with mean 2 and variance 0.1 , then find $P(|X - 2| \geq 0.01)$ (7M)
4. a) Define unbiased estimator and show that x/n is an un biased estimator of binomial parameter p. (7M)
   b) Let S = {1,5,6,8} , find the probability distribution of the sample mean for a random sample size two drawn without replacement.Also find (i) The mean of the sampling distribution of means (ii) The standard deviation of the sampling distribution of means (7M)
5. a) Three samples ,each of size 5 , were drawn from three uncorrelated normal populations with equal variances .Test the hypothesis that the population means are equal at 5% level (7M)

Sample I	10	12	9	16	13
Sample II	9	7	12	11	11
Sample III	14	11	15	14	16

   b) A sample of 26 bulbs gives a mean life of 990 hours with a S.D of 20 hours. The manufacturer claims that the mean life of bulbs is 1000 hours is the sample not up to the standard. (7M)
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6. a) Fit the curve $y = ab^x$ for the following data and also estimate y(9) for the following data (7M)

x	2	4	6	8	10	12
y	1.8	1.5	1.4	1.1	1.1	0.9

b) Calculate the coefficient of correlation from the following data (7M)

x	50	60	70	90	100
y	65	51	40	26	8

7. a) Draw the control chart for $\bar{X}$ for the following data for $A_2 = 0.483$ (7M)

Sample	1	2	3	4	5	6	7	8	9	10
Mean	383	508	505	582	557	337	514	614	707	753
Range	95	128	100	91	68	65	148	28	37	80

b) Explain "Statistical quality control (SQC)". (7M)

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PART –A

1. a) Write the distribution for tossing a coin two times (2M)
   b) Write the test statistic for differences of two means (2M)
   c) Write the normal equations for the curve $y = a + \frac{b}{x}$ (2M)
   d) Find the maximum error estimate with 95% confidence if the sample proportion (p) is 0.5775 for 400 samples (3M)
   e) Define upper and lower 2-σ limits for c-chart (2M)
   f) Find the $P(X > 2150)$ if $\mu = 2040$ & $\sigma = 60$ Assume X is Normally Distributed (3M)

PART -B

2. a) Fit a binomial distribution to the following data (7M)

x	0	1	2	3	4	5
f	42	33	14	6	4	1

   b) Find the moment generating function for Poisson distribution (7M)

3. a) Find (i) mean (iii) variance of the Distribution $f(x) = \frac{k}{x^2+1}$ $if\ -\infty < x < \infty$ (7M)
   b) Obtain the moment generating function of normal distribution (7M)

4. a) A sample of 11 rats from central population had on average blood viscosity with the S.D of 0.61.Estimate 95% confidence limits for the mean blood viscosity of the population. (7M)
   b) Define biased estimator and prove that $\left(\frac{x+1}{n+2}\right)$ is a biased estimate of binomial parameter p. (7M)

5. a) 20 people were attacked by a disease and only 18 survived. Will you reject the hypothesis that the survival rate if attacked by this disease is 85% in favour of the hypothesis that is more at 5% level. (7M)
   b) Three different machines are used for a production. On the basis of the outputs , test whether the machine are equally effective (7M)

OUT PUTS		
Machine I	Machine II	Machine III
10	9	20
5	7	16
11	5	10
10	6	4
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6. a) Fit the curve $y = a+bx+cx^2$ for the following data and also estimate y(2.4) for the following data (7M)

x	1	2	3	4
y	1.7	1.8	2.3	3.2

b) Determine the coefficient of correlation from the following data N= 25, (7M)
$\sum x = 127, \sum y = 100, \sum x^2 = 760, \sum y^2 = 449, \sum xy = 500$

7. The number of defects on 20 items are given below (14M)
Item No. 1,2,3,4,5,6,7,8,9,10,11,12,13,14,15,16,17,18,19,20
No. of defects:2,0,4,1,0,8,0,1,2,0,6,0,2,1,0,3,2,1,0,2
Devise a suitable control scheme for the future

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PART –A

1. a) Obtain the binomial distribution with mean 3 and variance 4 (2M)

   b) Kind the value of 'k' and mean if f(x) is a density function given by (3M)

$$f(x)=\begin{cases} kx^2, \ if \ \ 0<x<3 \\ 0, \quad otherwise \end{cases}$$

   c) Write all possible samples of size two with replacement from the population {5,10,14,18,13,24} (2M)

   d) Give an example for Type-I and Type-II errors (2M)

   e) Write the two regression lines X on Y and Y on X (2M)

   f) Find 3-σ limits for $\bar{X}$ chart if $\sum \bar{X} = 595.8, \sum \sigma = 8.28, n = 18, A_{1=1.03}$ (3M)

PART -B

2. a) A player wins if he gets 5 on a single throw of a die. He loses if he gets 2 or 4 If he wins he gets Rs.50, if he loses he gets Rs. 10, otherwise he has to pay Rs.15. Find the value of the game to the player (7M)

   b) Fit a Poisson distribution to the following data (7M)

x	0	1	2	3	4	5
f	142	156	69	27	5	1

3. a) Find the mean and variance of Gamma distribution (7M)

   b) Find (i) density function (ii) Mean (iii) variance of the distribution (7M)
   $F(X) = 1-e^{-2x}$ if $x>0$

4. a) A random sample of 400 items is found to be have mean 82 and S.D of 18 Find the maximum error estimate of 95% confidence interval (7M)

   b) Let S = {3,,6,9,15,27} , find the probability distribution of the sample mean for a random sample size three drawn without replacement and also find (i) The mean of the sampling distribution of means (ii) The standard deviation of the sampling distribution of means (7M)
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5. a) Three samples of 5, five and four motor car tyres are drawn respectively from three brands A, B, C manufactured by three machines. The life time of three tyres (in 1000 miles) is given below. Test whether the average life time of three brands of tyres are equal or not (10M)

A	B	C
35	30	28
40	25	24
33	34	30
36	28	26
31	33	--

b) Write the procedure for testing of the hypothesis (4M)

6. a) Fit the linear curve y = a+bx for the following data and also estimate y(4) for the following data (7M)

x	1	2	3	4	5	6
y	6	4	3	5	4	2

b) Find the rank correlation for the following data (7M)

x	2	4	5	6	8	11
y	18	12	10	8	8	5

7. Discuss the basic principles under lying control Charts. Explain in brief how control limits are determined for i) P-chart ii) C-chart (iii) np-chart (14M)