(**R13**)

(SET - 1)

II B. Tech I Semester Supplementary Examinations, June - 2015
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 **THREE** Questions from **Part-B**
4. Statistical tables are required

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PART –A

1. a) The mean and variance of binomial distribution are 4 and 4/3 respectively. Find P(X≥1). (4M)

   b) If a random variable X has the moment generating function is given by $M(t) = \dfrac{2}{2-t}$, find the variance of X (4M)

   c) A sample of size 400 is taken from an infinite population having the mean 75 and variance 225. What is the probability that $\bar{x}$ will be between 72 and 77 (4M)

   d) Explain the types of errors in sampling (3M)

   e) Show that $r = \dfrac{\sigma^2_{x+y} - \sigma^2_x - \sigma^2_y}{2\sigma_x \sigma_y}$ (3M)

   f) What is the use of control charts? Draw a typical control chart (4M)

PART –B

2. a) Given the following probability distribution of X compute (i) E(x) (ii)E(2X±3) (iii) V(X) (iv) V(2X±3) (8M)

x	-3	-2	-1	0	1	2	3
f(x)	0.05	0.10	0.30	0	0.30	0.15	0.10

   b) In a test on 2000 electric bulbs, it was found that the life of a particular make, was normally distributed with an average life of 2040 hours and S.D of hours. Estimate the number of bulbs likely to burn for
   i) more than 2140hrs   ii) between 1920 and 2080hrs
   iii) less than 1960 hrs (8M)

3. a) Show that $E(X-m)^3 = E(X^3)-3m\sigma^2_X -m^3$ where m and σ^2_X are the mean and variance respectively. (8M)

   b) Prove that moment generating function of a random variable X defined by the density function $f(x) = \begin{cases} \dfrac{1}{3}, & -1 < x < 2 \\ 0 & elsewhere \end{cases}$ is $M(t) = \begin{cases} \dfrac{e^{2t} - e^{-t}}{3t} & t \neq 0 \\ 1 & t = 0 \end{cases}$ (8M)

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4.   A population consists of six numbers 1,2,3,4,5,6 consider all samples of size two. Which can be drawn without placement from this population.   (16M)
   Find   i)   The population mean.   ii)   The population standard deviation.
          iii)   The mean of the sampling distribution of means.
          iv)   The standard deviation of the sampling distribution of means.

5. a)   Pumpkins were grown under two experimental condition. Two random samples of 11 and 9 pumpkins , show the sample S.D deviations of their weights as 0.8 and 0.5 respectively. Assuming that weight distribution are normal, test hypothesis that the true variances are equal.   (8M)

   b)   Experience had shown that 20% of a manufactured product is of the top quality. In one days, production of 400 articles only 50 are of top quality. Test the hypothesis at 0.05level.   (8M)

6. a)   Determine the constants 'a' and 'b' by the method of least squares such that $y = ae^{bx}$ fits the following data   (8M)

X	2	4	6	8	10
y	4.077	11.084	30.128	81.897	222.62

   b)   Find the coefficient of correlation between X and Y.   (8M)

X	1	2	3	4	5	6	7	8	9
Y	12	11	13	15	14	17	16	19	18

7. a)   The number of defects on 20 items are given below   (8M)
   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.

   b)   Explain "Statistical quality control (SQC)".   (8M)

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PART –A

1. a) A sample of 4 iteams is selected at random from a box containing 12 items of which 5 are defective. Find the expected numbers E of defective items.   (4M)

   b) Show that the moment generating function of poission distribution is $e^{\lambda(e^t-1)}$ (4M)

   c) A random sample of size 100 is taken from a population with σ =5.1. Given that the sample mean is $\bar{x}$ =2.16. Construct a 95% confidence interval for the population mean µ.   (4M)

   d) Write about (i) critical region(ii) left tailed test (iii) Right tailed test.   (3M)

   e) The two regression lines are having their means standard deviations 31.6 , 38 and 3.72,6.31 and $r = -0.36$ .Find the two regression lines   (4M)

   f) What is change variation and assignable variation   (3M)

PART –B

2. a) For the continuous probability function f(x)= kx^2e^{-x} when x≥0 , find (i) k (ii)mean (iii) Variance   (8M)

   b) Of a large group of mean, 5% are under 60 inches in height and 40% are between 60 and 65 inches. Assuming a normal distribution, find the mean height and standard deviation.   (8M)

3. a) Find the moment generating function of the random variable whose moments are $M_r = (r+1)!\,2^r$ (8M)

   b) What is the Mathematical Expectation and its properties?   (8M)

4. a) If the mean of breaking strength of copper wire is 575lbs, with a S.D of 8.3lbs.How large a sample must be used in order that there will be one chance in 100 that the mean breaking strength of the sample is less than572lbs.   (8M)

   b) Find 95% confidence limits for the mean of a normality distributed population form the which the following sample was taken 15,17,10,18,16,9,7,11,13,14   (8M)

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5.   To study the performance of three detergents and three different water   (16M)
temperatures the following whiteness reading were obtained with specially
designed equipment.

Water Temperature	Detergent A	Detergent B	Detergent C
Cold water	57	55	67
Warm Water	49	52	68
Hot water	54	46	58

Perform a two way analysis of variance using 5% level of significance.

6. a) Fit a second degree polynomial to the following data by the method of least   (8M)
squres:

X	10	12	15	23	20
Y	14	17	23	25	21

    b) Obtain the rank correlation coefficient for the following data   (8M)

X	68	64	75	50	64	80	75	40	55	64
Y	62	58	68	45	81	60	68	48	50	70

7. a) What is the significance of control chart for attributes? what are its two types   (8M)
explain in brief manner

    b) The past records of a factory using quality control methods show that on the   (8M)
average 4 articles produced are defective out of a batch of 100. What is the
maximum number of defective article likely to be encountered in the batch of
400, when the production process is in state of control?

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PART –A

1. a) Let X be a random variable with the standard normal distribution. Determine the value of z_1 (i) $P(0 \leq X \leq z_1) = 0.4938$ (ii) $P(X \leq z_1) = 0.834$ (4M)

   b) What are the two types of moments?   (3M)

   c) What is the effect on standard error? If a sample is taken from an infinite population of sample size is decreased from 800 to 200.   (3M)

   d) Find i) p(t<2.365) when v=7 ii) P((-1.356<t<2.179) when v=12   (4M)

   e) The angle between the two regression is $\tan^{-1}\dfrac{1}{4}$, coefficient of correlation is 2/3. Given that S.D of y is multiple of S.D of x. Find the ratio $\dfrac{\sigma_x}{\sigma_y}$.   (4M)

   f) What is the fundamental objective of the Statistical Quality control?   (4M)

PART –B

2. a) Eight coins are tossed together. Find the probability of getting 1 to 4 heads in a single toss.   (8M)

   b) Two dice are thrown. Let x assign to each point (a, b) in S the maximum of Its numbers I,e X(a, b)= max(a, b). Find the probability distribution. X is a random variable with X(s)={1,2,3,4,5,6}. Also find the mean and variance of the distribution   (8M)

3. a) Let X is the random variable with the following distribution.   (8M)

x	-3	6	9
P(X=x)	1/6	½	1/3

     Find E[X], E[X^2], E[2X+1]^2.

   b) Define Moment generating function and its properties   (8M)

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4. a) Calculate a 99% confidence interval for the true mean weight loss if 16 (8M) persons on diet control after one month had a mean weight loss of 3.42 kgs with S.D of 0.68 kgs.

   b) The guaranteed average life of a certain type of electric bulbs is 1500 hrs (8M) with a S.d of 120hrs. it is decided to sample the output so as to ensure that 95% of bulbs do not fall short of the guaranted average by more than 2%

5. a) A die is thrown 264 times with the following results. Show that the die is (8M) basied.($\chi^2_{0.05} = 11.07$ for 5 d.f)

No. appeared on the die	1	2	3	4	5	6
Frequency	40	32	28	58	54	52

   b) If a random sample of 160 workers to a certain amount of radiation, 24 (8M) experienced some ill effects. Constructs a 99% confidence interval for the corresponding true percentage.

6. a) Find the values of 'a' and 'b' so that $y = ax + b$ fits the data given in the (8M) table.

x	0	1	2	3	4
y	1	2.9	4.8	6.7	8.6

   b) Calculate the correlation coefficient and regression coefficient for the (8M) following data.

X	2	4	6	8	10	12	14
Y	4	2	5	10	4	11	12

   Find the estimate of y when x=13

7. a) The following are the figures of defectives in 22 lots each contain 2,000 (8M) rubber belts:
   425,430,216,341,225,322,280,306,337,305,356,402,216,264,126,409,193,326,280,389,451,420.
   Draw control chart for fraction dective and comment on the state of control of the process.

   b) Discuss the basic principles under lying control Charts. Explain in brief how (8M) control limits   determined for i) P-chart ii) C-chart.

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PART –A

1. a)   (4M)
   If F(x) is the distribution function of X given by

   $$F(x) = \begin{cases} 0 & if \ x \leq 1 \\ k(x-1)^4 & if \ 1 < x \leq 3 \\ 0 & if \ x > 3 \end{cases}$$

   Find (i) f(x)   (ii) K

   b) A coin is tossed until a tail appears. What is the expectation of the number of tosses?   (4M)

   c) What is the size of the smallest sample required to estimate an unknown proportion to within a maximum error of 0.06 with atleast 95% confidence.   (3M)

   d) If two independent random sample of size n_1 =13 and n_2=7 are taken from a normal population. What is the probability that the variance of the first sample will be atleast four times as large as that of the second sample?   (4M)

   e) The coefficient of rank correlation between marks in statistics and marks in mathematics obtained by a certain group of student is 0.8. if the sum of the squares of the difference in ranks is given to be 33.   (4M)

   f) Write about the process P -Chart.   (3M)

PART –B

2. a) Write about the importance and application of the normal distribution   (8M)

   b) Is the function defined as follows a density function $f(x) = \begin{cases} e^{-x}, x \geq 0 \\ 0, x < 0 \end{cases}$ (8M)

   If so determine the probability that the variate having will fall in the interval(1,2)? Find the cumulative probability F(2)?

3. a) let X be the random variable with probability law: (8M)
   $\rho(X = r) = q^{r-1}p; r = 1,2,3,4......$ Find the moment generating function and hence mean and the variance (Assume p + q=1).

   b) Show that the moment generating function of a normal distribution is $e^{\mu t + (\sigma^2 t^2 / 2)}$ (8M)

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4. a) The mean voltage of a battery is 15 and S.D is 0.2. Find the probability that four　(8M)
such batteries connected in series will have a combined voltage of 60.8 or mor
volts.

b)　The mean and the standard deviation of a population are 11,795 and 14,054　(8M)
respectively. If n=50, find 95% confidence interval for the mean.

5. a) The mean of two random samples of sizes 9 and 7 are 196.42 and 198.82　(8M)
Respectively. The sum of the squares of the deviations from the mean are
26.94and 18.73 respectively. Can the sample be considered to have been drawn
from the same normal population?

b) The nicotine contents in milligrams in two samples of tobacco found to be as　(8M)
follows:

Sample A	24	27	26	21	25	----
Sample B	27	30	28	31	22	36

Can it be said that two samples came from same normal population.

6. a) By the method of least squares fit a parabola of the from $y = a+bx+cx^2$ to the　(8M)
following data.

X	2	4	6	8	10
Y	3.07	12.85	31.47	57.38	91.29

b) Ten competitors in a test were ranked test were ranked by the judges A,B and c　(8M)
in the following order

Ranks by A	1	6	5	10	3	2	4	9	7	8
Ranks by A	3	5	8	4	7	10	2	1	6	9
Ranks by A	6	4	9	8	1	2	3	10	5	7

Using rank correlation method, discuss which pair of judges has the nearest
approach to common likings in music

7. a) If the average fraction defective of a large sample of products is 0.1537.　(8M)
Calculate the control limits .(Given that sub –group size is 2,000)

b) Explain the term statistical quality control. Discuss its aspects and advantages.　(8M)

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