**R13**

**SET - 1**

**II B. Tech II Semester Regular Examinations, May/June - 2015**
**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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## PART-A

1.  a) The diameter of an electric cable is assumed to be continuous random variables X with
    Probability density function $f(x) = 6x(1-x), \ 0 \leq x \leq 1$. Determine b such that
    $P(X < b) = P(X > b)$.

    b) Four coins are tossed. What is the its expectation of the number of heads?

    c) A population random variable has mean 100 and standard deviation 16. What are the
    mean and standard deviation of the sample mean for random samples of size 4 drawn
    with replacement.

    d) Define (i) Test of statistical hypothesis (ii) Type – I and Type – II error.

    e) Fit a Straight line $y = a + bx$ to the following data by the method of least squares:

    | $x$ | 0 | 1 | 3 | 6 | 8 |
    |---|---|---|---|---|---|
    | $y$ | 1 | 3 | 2 | 5 | 4 |

    f) What is a control chart? Explain briefly the construction and uses of Mean chart and
    Range hart.                                                          (3M+4M+4M+4M+4M+3M)

## PART-B

2.  a) Find the probability that by guess work a student can correctly answer 25 to 30 questions
    in a multiple choice quiz consisting of 80 questions. Assume that in each question    with
    four choices only one choice is correct and student has no knowledge of     the subject.

    b) If the mean and standard deviation of a normal distribution are 70 and 16, find
    P(38 < x < 46).

                                                                                  (8M+8M)

3.  a) A variate X has the probability distribution

        x  :   -3           6              9
    P(X=x):  1/6        1/2          1/3
    Find E(X) and $E(X^2)$. Hence evaluate $E(2X + 1)^2$

    b) Find Mean and Standard deviation of Binomial Distribution.            (8M+8M)

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4.　a) Define Point Estimation and Interval Estimation.
　　b) A population consists of the four numbers 2, 3, 6, 8. Consider all possible samples of size
　　　 Two that can be drawn with replacement from this population.
　　　 Find (i) The populations mean,
　　　 (ii) The population standard deviation,
　　　 (iii) The mean of the sampling distribution of means　　　　　　　　　　　(7M+9M)

5.　a) The lifetime of electric bulbs for a random sample of 10 from a large shipment gave the
　　　 following data :

| Item | 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 | 9 | 10 |
|---|---|---|---|---|---|---|---|---|---|---|
| Life in 1000s of hrs. | 4.2 | 4.6 | 3.9 | 4.1 | 5.2 | 3.8 | 3.9 | 4.3 | 4.4 | 5.6 |

　　　 Can we accept the hypothesis that the average life time of bulb is 4000 hrs? Use a 0.05
　　　 level of significance.
　　b) A random sample of 10 boys had the following I.Q's 70, 120, 110, 101, 88, 83, 95, 98,
　　　 107, 100. Do these data support the assumption of a population mean I.Q of 100?
　　　　　　　　　　　　　　　　　　　　　　　　　　　　　　　　　　　　(8M+8M)

6.　The following table gives the figures of monthly drop in Acidity level and Chlorine
　　concentration in a swimming pool. Set up a two-way variance analysis table and analyze
　　the results.　　　　　　　　　　　　　　　　　　　　　　　　　　　　　(16M)

| Chlorine Concentration | Acidity Level | | | | Total |
|---|---|---|---|---|---|
| | Low | Medium | High | Very High | |
| Low | 23 | 18 | 9 | 7 | 57 |
| Medium | 10 | 12 | 8 | 4 | 34 |
| High | 9 | 9 | 7 | 4 | 29 |
| Total | 42 | 39 | 24 | 15 | 120 |

7.　a) What is a control chart? Explain briefly the construction and uses of mean chart, p-chart and
　　　 range chart.
　　b) During an examination of equal length of cloths the following are the number of
　　　 defects observed.
　　　 2, 3, 4, 0, 5, 6, 7, 4, 3, 2
　　　 Draw a control chart for the number of defects and comment whether the process is under
　　　 control or not.　　　　　　　　　　　　　　　　　　　　　　　　　　(8M+8M)

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## PART-A

1. a) A random variable x has the following probability function: values of

   x:      -2     -1     0      1      2      3
   p(x):   0.1    k      0.2    2k     0.3    k

   Find the value of k and calculate mean.

   b) If $f(x) = \begin{cases} \dfrac{1}{2}(x+1), & -1 < x < 1 \\ 0, & elsewhere \end{cases}$

   represents the density of a random variable X, find E(X).

   c) A sample of 11 rats from a central population had an average blood viscosity of 3.92 with a S.D of 0.61. Estimate the 95% confidence limits for the mean blood viscosity of the population. 1 of 2

   d) Explain briefly the following
   i) Type I error  ii) Type II error  iii) One tailed test  iv) Two tailed test

   e) Find the co-efficient of correlation between industrial production and export using the Following data and comment on the result.

   | Production(in corer tons) | 55 | 56 | 58 | 59 | 60 | 60 | 62 |
   |---|---|---|---|---|---|---|---|
   | Exports(in corer tons) | 35 | 38 | 38 | 39 | 44 | 43 | 45 |

   f) Explain the clearly the construction and function of  (i) X - chart  and  (ii) C – chart

   (3M+4M+4M+4M+4M+3M)

## PART-B

2. a) Find the probability of getting at least 55 heads  when 100 coins are tossed using Normal distribution.

   b) If X is normally distributed with mean 30 and standard deviation 5.  Find $P(|X - 30| > 5)$.

   (8M+8M)

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3. a) A Continuous distribution of a variable x in the range(-3, 3) is defined as

$$f(x) = \begin{cases} \dfrac{1}{16}(3+x)^2 & -3 \leq x < -1 \\[2mm] \dfrac{1}{16}(2-6x^2) & -1 \leq x < 1 \\[2mm] \dfrac{1}{16}(3-x)^2 & 1 \leq x < 3 \end{cases}$$

Show that the mean is zero.

b) Find Mean and Standard deviation of Binomial Distribution. (8M+8M)

4. a) The mean and standard deviation of a population are 11,795 and 14,054 respectively. What can one assert that 95% confidence about the maximum error if $\bar{X}$ = 11,795 and n = 50. And also construct 95% confidence interval for the true mean.

b) If the population is 3, 7, 9, 11, 15
i) List all possible samples of size 3 that can be taken without replacement from the finite population. ii) Calculate the mean of each of the sampling distribution of means.
iii) Find the standard deviation of sampling distribution of means. (8M+8M)

5. a) A sample poll of 300 voters from district A and 200 voters from district B showed that 56% and 48%, respectively, were in favor of a given candidate. At a level of significance of 0.05, test the hypothesis that the candidate is preferred in district A

b) Two horses A and B were tested according to the time (in seconds) to run a particular track with the following results.

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

Test whether the two horses have the same running capacity. (8M+8M)

6. a) The following are data on the drying time of a certain paint and the amount of an additive that is intended to reduce the drying time

| Amount of paint additive (grams) x | 0 | 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 |
|---|---|---|---|---|---|---|---|---|---|
| Drying time (hrs) y | 12 | 10.5 | 10 | 8 | 7 | 8 | 7.5 | 8.5 | 9 |

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

b) Find the correlation co efficient between x and y from the given data (9M+7M)

| x | 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 | 9 | 10 |
|---|----|----|----|----|----|----|----|----|----|----|
| y | 10 | 12 | 16 | 28 | 25 | 36 | 41 | 49 | 40 | 50 |

7. a) What is a control chart? Explain briefly the construction and uses of mean chart, p-chart and range chart.

b) During an examination of equal length of cloths the following are the number of defects observed.

2, 3, 4, 0, 5, 6, 7, 4, 3, 2

Draw a control chart for the number of defects and comment whether the process is under control or not. (8M+8M)

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## PART-A

1. a) A random variable x has the following probability function:

     values of x:   0    1    3     4     5     6      7
         $p(x)$ :   0    k   2k    2k    3k    $k^2$    $7k^2$ +k

     Find the value of k and also find P(0<x<5).

   b) Find the moment generating function of the exponential distribution

     $f(x) = \frac{1}{c} e^{-\frac{x}{c}}$ , $0 \le x \le \infty$, $c > 0$. Also find its means.

   c) A random sample of size 100 has a standard deviation of 5. What can you say about the maximum error with 95% confidence.

   d) Explain briefly the following

     i) Null Hypothesis, ii) Alternative hypothesis iii) Type I error & Type II error

   e) Calculate the coefficient of correlation from the following data.

| x | 1 | 2 | 3 | 4 | 5 | 6 | 7 |
|---|---|---|----|----|----|----|----|
| y | 9 | 8 | 10 | 12 | 11 | 13 | 14 |

   f) What is a control chart? Explain briefly the construction of p- chart.

                                                          (3M+4M+4M+4M+4M+3M)

## PART-B

2. a) In a referendum 60% of voters voted in favour. A random sample of 200 voters was selected. Find the probability by using normal distribution that in the sample
     i) more than 130 voted in favour ?
     ii) between 105 and 130 inclusive voted in favour?
     iii) 120 voted in favour?

   b) Find the mean and Standard deviation of a normal distribution in which 31% of items are under 45 and 8% of over 64.                    (8M+8M)

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3.  a) X is a random variable giving time(in minutes) during which a certain electrical equipment is used at maximum load in a specified time period. If the probability density function is given by

$$f(x) = \begin{cases} \dfrac{x}{(1500)^2} & 0 \le x < 1500 \\ \dfrac{-(x-3000)}{(1500)^2} & 1500 \le x < 3000 \\ 0 & elsewhere \end{cases}$$

Find the expected value of X.

b) Find Mean and Standard deviation of Poison distribution.    (8M+8M)

4.  a) When a sample is taken from an infinite population, what happen to the standard error of the mean, if the sample size is decreased from 800 to 200.

b)  If the population is 3, 6, 9, 15, 27
i) List all possible samples of size 3 that can be taken without replacement from the finite population.
(ii) Calculate the mean of each of the sampling distribution of means.
(iii) Find the standard deviation of sampling distribution of means.    (8M+8M)

5.  a) In a mathematics examination 9 students of class A and 6 students of class B obtained the following marks. Test at 0.01 level of significance whether the performance in mathematics is same or not for the two classes A and B. Assume that the samples are drawn from normal populations having same variance.
       A:  44   71   63   59   68   46   69   54   48
       B:  52   70   41   62   36   50

b)  Fit a Binomial distribution to the following data and test for its goodness of fit at level of significance 0.05.    (8M+8M)

| No. of Heads | 0 | 1 | 2 | 3 | 4 | 5 |
|---|---|---|---|---|---|---|
| No.of Tosses(Frequency) | 38 | 144 | 342 | 287 | 164 | 25 |

6.  a) The following table shows the respective heights x and y of a sample of fathers and their Oldest sons. Find the regression line of x on y.

| Height x of Father (inches) | 65 | 63 | 67 | 64 | 68 | 62 | 70 | 66 | 68 | 67 | 69 | 71 |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Height y of son (inches) | 68 | 66 | 68 | 65 | 69 | 66 | 68 | 65 | 71 | 67 | 68 | 70 |

b) Obtain the rank correlation coefficient for the following data:    (8M+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)  Discuss the need and utility of statistical quality control.
b) Draw the mean and range charts from the following data and state your conclusion.

| Sample No. | 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 | 9 | 10 | Total |
|---|---|---|---|---|---|---|---|---|---|---|---|
| Sample Mean | 12.8 | 13.1 | 13.5 | 12.9 | 13.2 | 14.1 | 12.1 | 15.5 | 13.9 | 14.2 | 135.3 |
| Sample Range | 2.1 | 3.1 | 3.9 | 2.1 | 1.9 | 3.0 | 2.5 | 2.8 | 2.5 | 2.0 | 25.9 |

(Given n = 5, $A_2 = 0.577$, $D_3 = 0$, $D_4 = 2.115$)    (8M+8M)

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## PART-A

1. a) The probability density function of a variable X is
   X :   0       1       2       3       4       5       6
   p(X): k       5k      7k      9k      11k     13k     15k
   Find P(x<4) and P(x≥ 5).
   b) If   x be random variable with probability generating function $P_x(t)$,  find the probability generating function of  (x+2) .
   c)  What is the maximum error one can expect to make with probability 0.90 when using the mean of a random sample of size n = 64 to estimate the mean of population with $\sigma^2$ .
   d) Explain briefly the following
   i) Null Hypothesis,  ii)  Alternative hypothesis iii)  Type I error &  Type II error
   e) The following are data on the drying time of a certain paint and the amount of an additive that is intended to reduce the drying time

   | Amount of paint additive (grams) x | 0 | 1 | 2 | 3 | 4 | 5 | 6 |
   |---|---|---|---|---|---|---|---|
   | Drying time (hrs) y | 12 | 10.5 | 10 | 8 | 7 | 8 | 7.5 |

   Fit a straight line y = a + bx ,  by the method of least squares.

   f)  What is a control chart? Explain briefly the construction and uses of Mean chart and Range chart.

   (3M+4M+4M+4M+4M+3M)

## PART-B

2. a)  Find the mean and Standard deviation of  a normal distribution in which 31% of items are under 45 and 8% of over 64.
   b)  If the mean and standard deviation of a normal distribution are 70 and 16, find
   P(38 < x < 46).                                                          (8M+8M)

3. a) If $f(x) = \begin{cases} \dfrac{1}{4}(x+1), & -1 < x < 1 \\ 0, & elsewhere \end{cases}$

   represents the density of a random variable X, find E(X) and Var(X).
   b) Find Mean and Standard deviation of Poison distribution.              (8M+8M)

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4.  a) A normal population has a mean of 0.1 and standard deviation of 2.1. Find the probability that mean of a sample of size 900 will be negative.
    b) A population consists of the four numbers 2, 3, 4, 5. Consider all possible samples of size two that can be drawn with replacement from this population.
    Find (i) The population mean, (ii) The population standard deviation,
    (iii) The mean of the sampling distribution of means                                                    (7M+9M)

5.  a) The IQ s (intelligence quotients) of 16 students from one area of a city showed a mean of 107 with a standard deviation of 10, while the IQs of 14 students from another area of the city showed a mean of 112 with a standard deviation of 8. Is there a significant difference between the IQs of the two groups at a 0.05 level of significance?
    b) In experiments on pea breeding, the following frequencies of seeds were obtained:

| Round and yellow | Wrinkled and yellow | Round and green | Wrinkled and green | Total |
|---|---|---|---|---|
| 315 | 101 | 108 | 32 | 556 |

    Theory predicts that the frequencies should be in proportions 9:3:3:1. Examine the correspondence between theory and experiment. Use a 0.01 level of significance.  (7M+9M)

6.  a) For a set of values of x and y, the two regression lines are $31x - 37y + 5 = 0$ and $50x - 36y - 612 = 0$. Identify the regression line of y on x and that of x on y. Also obtain the values of $\bar{x}$, $\bar{y}$ and r.
    b) The following are measurements of the air velocity and evaporation coefficient of burning fuel droplets in an impulse engine:

| Air velocity x cm/sec | 20 | 60 | 100 | 140 | 180 | 220 | 260 | 300 | 340 | 380 |
|---|---|---|---|---|---|---|---|---|---|---|
| Evaporation Coefficient y $mm^2$/sec | 0.18 | 0.37 | 0.35 | 0.78 | 0.56 | 0.75 | 1.18 | 1.36 | 1.17 | 1.65 |

    Fit 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/sec.        (8M+8M)

7.  a) What is a control chart? Explain briefly the construction and uses of mean chart, p-chart and range chart.
    b) A manufacturer of transistors found the following number of defectives in 25 sub-groups of 50 transistors.
    3,  5,  4,  2,  3,  2,  7,  0,  2,  4,  2,  3,  4,
    1,  2,  4,  8,  2,  4,  2,  6,  4,  3,  1,  4,
    Construct a control chart for the fraction defective, plot the sample data on the chart and comment on the state of control.                                                    (8M+8M)

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