

III B.Tech I Semester Regular Examinations, November 2006
PROBABILITY AND STATISTICS
(Metallurgy & Material Technology)

Time: 3 hours**Max Marks: 80**

Answer any FIVE Questions
All Questions carry equal marks

1. (a) Define a random experiment, sample space, event and mutually exclusive events. Give examples of each.
- (b) Box A contains 5 red and 3 white marbles and box B contains 2 red and 6 white marbles.
 - i. If a marble is drawn from each box, what is the probability that they are both of the same color? [8+8]

2. (a) Let $F(x)$ be the distribution function of a random variable X given by

$$\begin{aligned} F(x) &= cx^3 \quad \text{when } 0 \leq x < 3 \\ &= 1 \quad \text{when } x \geq 3 \\ &= 0 \quad \text{when } x < 0. \end{aligned}$$

If $P(X=3) = 0$ Determine

- i. c
 - ii. mean
 - iii. $P(x > 1)$
 - (b) A student takes a true false examination consisting of 8 questions. He guesses each answer. The guesses are made at random. Find the smallest value of n that the probability of guessing at least n correct answers is less than $\frac{1}{2}$. [8+8]
3. (a) A Poisson distribution has a double mode at $x = 2$ and $x = 3$, find the maximum probability and also find $p(x \geq 2)$.
 - (b) The weekly wages of 1000 workers are normally distributed around a mean of Rs.70 and S.D of Rs.5/- Estimate the number of workers whose weekly wages will be
 - i. between Rs.70 and Rs.72
 - ii. between 69 and 72
 - iii. more than 80 [8+8]
4. (a) Write about
 - i. Null hypothesis
 - ii. Alternate Hypothesis.

- (b) An ambulance service claims that it takes on the average less than 10 minutes to reach its destination in emergency calls. A sample of 36 calls has a mean of 11 minutes and the variance of 16 minutes.
Test the significance at .05 level. [8+8]
5. (a) A random sample of size 81 was taken whose variance is 20.25 and mean 32 construct 98% confidence interval
- (b) A manufacturer claims that only 4% of his products are defective. A random sample of 500 were taken among which 100 defective Test the hypothesis at .05 level [8+8]
6. (a) Five measurements of tar content of a certain kind of cigarettes yielded 14.5, 14.2, 14.4, 14.3 and 14.6 mg per cigarettes. Show that the difference between the mean of this sample $\bar{x} = 14.4$, and the average tar claimed by the manufacturer $\mu = 14.0$, is significant at $\alpha = 0.05$. Assume normality?
- (b) Mechanical Engineers, testing a new arc welding technique, classified welds both with respect to appearance and an X-ray inspection.

Quality

		<i>Bad</i>	<i>Normal</i>	<i>Good</i>	<i>Total</i>
X-ray	Bad	20	7	3	30
	Normal	13	51	16	80
	Good	7	12	21	40
	Total	40	70	40	150

Test for independence using $\alpha = 0.05$ and find the individual cell contribution to the χ^2 - statistic. [8+8]

7. (a) The following are the measurements of the air velocity and evaporation coefficient of burning fuel droplets in air impulse engine

Air velocity x	20	60	100	140	180	220	260	300	340	380
Evaporation Coefficient y	.18	.37	.35	.78	.56	.75	1.18	1.36	1.17	1.65

- (b) Fit a straight line to the above data. Fit a curve of the form $y = a.(b)^x$ by the method of least squares for the following data.

x	0	1	2	3	4	5	6	7
y	10	21	35	59	92	200	400	610

[8+8]

8. For the following data, compute the correlation coefficient between weight of dry fibre and length of the green plant:

length of the green plant \rightarrow

Weights of dry fibre ↓					
	111.5	127.5	143.5	159.5	
1.175	12	25	15	1	53
2.775	1	4	33	59	97
4.375	1	-	4	28	33
5.975	-	-	-	2	2
Total	14	29	52	90	185

[16]

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1. (a) A class has 10 boys and 5 girls. Three students are selected at random one after the other. Find the probability that
 - i. first two are boys and third is girl
 - ii. first and third of same sex and second is of opposite sex.(b) A box contains n tickets marked 1 through n . Two tickets are drawn without replacement. Determine the probability that the number on the tickets are consecutive integers. [8+8]
2. (a) If X is a continuous random variable and K is a constant then prove that
 - i. $\text{Var}(X+K) = \text{Var}(X)$
 - ii. $\text{Var}(kX) = k^2 \text{Var}(X)$(b) The probability of a man hitting a target is $1/3$.
 - i. If he fires 5 times, what is the probability of his hitting the target at least twice
 - ii. How many times must he fire so that the probability of his hitting the target at least once is more than 90%. [8+8]
3. (a) Define Poisson distribution and find its variance and the mean.
(b) Find the mean and standard deviation of a normal distribution in which 7% of items are under 35 and 89% are under 63. [8+8]
4. (a) The mean of certain normal population is equal to the standard error of the mean of the samples of 64 from that distribution. Find the probability that the mean of the sample size 36 will be negative.
(b) A sample of 64 students have a mean weight of 70kgs. Can this be regarded as a sample from a population with mean weight 65kgs and standard deviation 25kgs. [8+8]
5. (a) A lady stenographer claims that she can take dictation at the rate of 118 words per minute can we reject her claim on the basis of 100 trials in which she demonstrates a mean of 116 words and a S.D of 15 words.
(b) In a large consignment of oranges a random sample of 64 oranges revealed that 14 oranges were bad. If it reasonable to ensure that 20% of the oranges are bad? [8+8]

6. (a) A large electronic firm that hires many workers with disabilities wants to determine whether their disabilities affect such workers performance. Use the level of significance of α 0.05 to decide on the basis of the following data, whether it is reasonable to maintain that the disabilities have no effect on the worker's performance;

	<i>Above average</i>	<i>Average</i>	<i>Below average</i>
Blind	21	64	17
Deaf	16	49	14
No disability	29	93	28

- (b) It has been suggested that an average college teacher in Andhra Pradesh spends less than 10 hours in a week on his own academic schedule. The figures for the time spent during a week are given below for 12 teachers:

7.1	13.1	7.8	3.6	8.4	4.9
9.6	3.4	0.1	7.2	20.3	11.1

Is the claim justified with the level of significance of 0.05? [8+8]

7. (a) The measurements of humidity and the moisture content in a raw material are given in the following table. Fit a St. line of the form $y = ax + b$ Humidity (x)

42	35	50	43	48	62	31	36	44	39	55	48
12	8	14	9	1	16	7	9	12	10	13	11

- (b) By the method of least squares, fit the curve of the form $y = ae^{bx}$ for the following data.

x	0.0	.5	1.0	1.5	2.0	2.5
y	0.10	.45	2.15	9.15	40.35	180.75

[8+8]

8. For the following data, compute the correlation coefficient between weight of dry fibre and length of the green plant:

length of the green plant \rightarrow

Weights of dry fibre \downarrow					
	111.5	127.5	143.5	159.5	
1.175	12	25	15	1	53
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1. (a) For any three arbitrary events A,B,C , prove that $P(A \cup B \cup C) = P(A) + P(B) + P(C) - P(A \cap B) - P(B \cap C) - P(C \cap A) + P(A \cap B \cap C)$
- (b) In a certain town 40% have brown hair, 25% have brown eyes and 15% have both brown hair and brown eyes. A person is select at random from the town
 - i. If he has brown hair, what is the probability that he has brown eyes also
 - ii. If he has brown eyes, determine the probability that he does not have brown hair

[8+8]
2. (a) Calculate expectation and variance of x, if the probability distribution of the random variable x is given by

X	-1	0	1	2	3
f	0.3	0.1	0.1	0.3	0.2

- (b) Determine the probability of getting 9 exactly twice in 3 throws with a pair of fair dice.

[8+8]
3. (a) The mean diameter is 12 mm and standard deviation 0.02 mm in a sample of 200 washers produced by a machine. Find the percentage of washers produced whose diameters lie
 - i. within 11.97 to 12.03 mm
 - ii. outside 11.97 and 12.03 mm
- (b) Suppose the heights of American men are normally distributed with mean=68 inches and standard deviation 2.5 inches. Find the percentage of people whose heights lie between
 - i. 66 inches and 71 inches
 - ii. at least 6ft.

[8+8]
4. A population consists of 5,10,14,18,13,24 consider all possible samples of size two which can be drawn without replacement from the population. Find
 - (a) The mean of the population.
 - (b) The standard deviation of the population.
 - (c) The mean of the sampling distribution of means
 - (d) The standard deviation of sampling distribution of means.

[4X4]

5. (a) In a random sample of 125 cola drinkers, 68 said they prefer thums up to pepsi. Test the null hypothesis $p = .5$ against the alternate hypothesis $p > .5$
- (b) A random sample of 100 teachers in a large metropolitan area revealed a mean weekly salary of Rs. 487 with a standard deviation Rs. 48. With what degree of confidence can we assert that the average weekly salary of all teachers in the metropolitan area is between 472 to 502? [8+8]
6. (a) The following are the samples of skills. Test the significant different between the means at .05 level.

Sample-I	74.1	77.7	74.4	74	73.8	-
Sample-II	70.8	74.9	74.2	70.4	69.2	72.2

- (b) A machine puts out 20 imperfect articles in a sample of 500. After machine is overhauled it puts out 2 imperfect articles in a batch of 100. Find 95% confidence interval. [8+8]
7. Fit a parabola of the form $y = a + bx + cx^2$ for the following data by the method of least squares

x	20	40	60	80	100	120
y	5.5	9.1	14.9	22.8	33.3	46

[16]

8. Show that the correlation coefficient in between x and y is given by $\rho = \frac{\sigma_{x+y}^2 - \sigma_x^2 - \sigma_y^2}{2\sigma_x\sigma_y}$
- r = where σ_x, σ_y , and σ_{x+y} are standard deviations of x, y and x + y. [16]

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If $P(X=3) = 0$ Determine

- i. c
 - ii. mean
 - iii. $P(x > 1)$
- (b) A student takes a true false examination consisting of 8 questions. He guesses each answer. The guesses are made at random. Find the smallest value of n that the probability of guessing at least n correct answers is less than $\frac{1}{2}$. [8+8]
3. (a) Seeds are packed in packets of 20. It is known that 5% do not germinate. Determine the number of packets containing
 - i. at least 2
 - ii. at most 2 non germinating seeds in a consignment of 1000 packets.
- (b) When the mean of marks was 50% and standard deviation 5% then 60% of the students failed in mathematics examination. Determine the 'grace' marks to be awarded in order to show that 70% of the students passed, assuming that the marks are normally distributed. [8+8]
4. (a) If the distribution of all weights of all men traveling by train from Hyderabad to Delhi has a mean of 70 kgs and a standard deviation of 4 kgs, what is the probability that the combined gross weight of 36 such men is more than 300 kgs.

- (b) It has been suggested that an average college teacher in Andhra Pradesh spends less than 10 hours in a week on his own academic schedule. The figures for the time spent during a week are given below for 12 teachers:

7.1	13.1	7.8	3.6	8.4	4.9
9.6	3.4	0.1	7.2	20.3	11.1

Is the claim justified with the level of significance of 0.05? [8+8]

5. (a) The mean and the standard deviation of a population are 11,795 and 14054 respectively. If $n=50$, find 95% confidence interval for the mean
- (b) In a city 250 men out of 750 were found to be smokers. Does this information support the conclusion that the majority of men in this city are smokers. [8+8]
6. (a) In a city A 20% of a random sample of 900 school boys had a certain slight physical defect. In another city B 18.5% of a random sample of 1600 school boys had the same effect. Is the difference between the proportions, test at 0.05 level
- (b) The measurements of the output of two units have given the following results. Assuming that both samples have been level whether the two populations have the same variance.

Unit-A	14.1	10.1	14.7	13.7	14.0
Unit-B	14.0	14.5	13.7	12.7	14.1

[8+8]

7. (a) The following data pertain to the demand for a product (in thousands of units) and its price (in cents) charged in five different market areas:

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

Fit a parabola of the form $y = a_0 + a_1x$ to the above data

- (b) Fit the model $y = ax^b$ to the following data:

x:	1	2	3	4	5	6
y:	2.98	4.26	5.21	6.10	6.80	7.50

[8+8]

8. 10 observations on price x and supply y the following data was obtained.

$$\sum x = 130, \sum y = 220, \sum x^2 = 2288, \sum y^2 = 5506 \text{ and } \sum xy = 3467$$

Find

- (a) coefficient of correlation
- (b) The line of regression of y or x
- (c) The standard error of estimate.

[6+5+6]
