

II B.Tech II Semester Supplementary Examinations, Apr/May 2008
PROBABILITY AND STATISTICS
(Common to Civil Engineering, Mechanical Engineering, Computer Science
& Engineering, Chemical Engineering, Information Technology,
Mechatronics, Computer Science & Systems Engineering, Electronics &
Computer Engineering, Production Engineering, Bio-Technology and
Automobile Engineering)

Time: 3 hours

Max Marks: 80

Answer any FIVE Questions
All Questions carry equal marks

1. (a) The probabilities of passing in subject A, B, C, D are $\frac{3}{4}$, $\frac{2}{3}$, $\frac{4}{5}$ and $\frac{1}{2}$ respectively. To qualify in the examination a student should pass in A and two subjects among the three what is the probability of qualifying in that examination.
(b) There are two boxes. In box -I, 11 cards are there numbered 1 to 11 and in box-II, 5 cards numbered 1 to 5. A box is chosen and a card is drawn. If the card shows an even number then another card is drawn from the same box. If card shows an odd number another card is drawn from the other box. Find the probability that
 - i. Both are even
 - ii. Both are odd
 - iii. If both are even, it is from box I. [8+8]
2. (a) For the continuous probability function $f(x) = kx^2 e^{-x} \quad x \geq 0$ find
 - i. k
 - ii. mean
 - iii. variance(b) 20% of items produced from a factory are defective. Find the probability that in a sample of 5 chosen at random.
 - i. none is defective
 - ii. one is defective
 - iii. $p(1 < x < 4)$ [8+8]
3. (a) Find the probability that at most 5 defective components will be found in a lot of 200 it experience. Shows that 2% of such components are defective. Also find the probability of more than five defective components.
(b) Write the importance of normal distribution.
(c) If the mean and S.D of normal distribution are 70 and 16, find $p(x=38) < x < p(x=45)$ [8+8]

4. To compare two kinds of bumper guards, 6 of each kind were mounted on a car and then the car has ran into a concrete wall. The following are the costs of repairs:

<i>Guard1</i>	107	148	123	165	102	119
<i>Guard2</i>	134	115	112	151	133	129

Use the 0.01 level of significance to test whether the difference between two sample means is significant? [16]

5. (a) A sample of size 64 and mean 60 was taken from a population whose standard deviation is 10. Find 95% confidence interval for the mean.
- (b) Experience has shown that 10% of a manufactured product is of top quality. What can you say about the maximum error with 95% confidence for 100 items
- (c) A coin is tossed 512 times. Head turned up 244 times. Can you say that the coin is unbiased. [5+5+6]
6. (a) A random sample from a company's very extensive files shows that the orders for a certain kind of machinery were filed, respectively in 10,12,19,14,15,18,11 and 13 days. Use the level of significance $\alpha=0.01$ to test the claim that on the average such orders are filed in 10.5 days. Assume normality?
- (b) The results of polls conducted 2 weeks and 4 weeks before a gubernatorial election are shown in the following table:

	Two weeks before election	Four weeks before election
For Republican candidate	79	91
For Democratic candidate	84	66
Undecided	37	43

Use the 0.05 level of significance to test whether there has been a change in opinion during the 2 weeks between the polls. [8+8]

7. (a) Derive normal equations to fit a parabola $y = a_0 + a_1x + a_2x^2$
- (b) Fit the curve $y = ae^{bx}$ for the following data [6+10]

x	1	5	7	9	12
y	10	15	12	15	21

8. Use the formula $\rho = \frac{\sigma_{x+y}^2 - \sigma_x^2 - \sigma_y^2}{2\sigma_x\sigma_y}$ to compute the correlation coefficient to the following data

x :	62	56	36	66	25	75	82	78
y :	58	44	51	58	60	68	62	84 [16]

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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) Define random variable, discrete probability distribution, continuous probability distribution and cumulative distribution. Give an example of each.
(b) Assume that 50% of all engineering students are good in mathematics. Determine the probabilities that among 18 engineering students
 - i. exactly 10
 - ii. at least 10
 - iii. at most 8
 - iv. at least 2 and at most 9 , are good in mathematics.[8+8]
3. (a) Show that the mean and variance of a Poisson distribution are equal.
(b) Determine the minimum mark a student should get in order to receive an A grade if the top 10% of the students are awarded A grades in an examination where the mean mark is 72 and standard deviation is 9. [8+8]
4. (a) The mean life time of light bulbs produced by company is 1500 hours with standard deviation of 150 hours. Determine the probability that lighting will take place for
 - i. at least 5000 hours
 - ii. at most 4200 hours if three bulbs are connected such that when one bulb burns out another bulb will go on. Assume that the life times are normally distributed.

- (b) Find the probability that random samples of 100 bolts, chosen from a lot of 500 bolts having mean weight of 142.30 gms and standard deviation of 8.50 gms, will have a combined weight of
- i. between 14061 and 14175 gms
 - ii. more than 14460 gms. [8+8]
5. (a) A random sample of size 100 has a standard deviation of 5. What can you say about the maximum error with 95% confidence.
- (b) Among 900 people in a state 90 are found to be chapatti eaters. Construct 99% confidence interval for the true proportion.
- (c) A random sample of 1200 apples was taken from a large consignment and found that 10% of them are bad. The supplier claims that only 2% are bad. Test his claim at 95% level. [5+5+6]

6. (a) To examine the hypothesis that the husbands are more intelligent than the wives, an investigator took a sample of 10 couples and administered them a test which measures the IQ as follows:

Husbands:	117	105	97	105	123	109	86	78	103	107
Wives:	106	98	87	104	116	95	90	69	108	85

Test the hypothesis with a reasonable test at the level of significance of 0.05?

- (b) In an investigation on the machine performance the following results were obtained:

	No. of Units inspected	No. of defectives
Machine 1	375	17
Machine 2	450	22

Test whether there is any significant performance of two machines at $\alpha=0.05$ [8+8]

7. (a) Derive normal equations to fit the curve $y = ax + bx^2$
- (b) Obtain a relation of the form $y = a \cdot (b)^x$ for the following data by the method of least squares. [6+10]

x	2	3	4	5	6
y	8.3	15.4	33.1	65.2	17.4

8. A chemical company wishing to study the effect of extraction time on the efficiency of an extraction operation obtained in the data shown in the following table.

Extraction time x	27	45	41	19	35	39	19	49	15	31
Extraction efficiency y	57	64	80	46	62	72	52	77	57	68

Calculate the coefficient of correlation between x and y and the two lines of regression. [16]

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1. (a) Out of 15 items 4 are not in good condition. 4 are selected at random. Find the probability that
 - i. All are not good
 - ii. Two are not good
- (b) If A and B are any two events, then prove that $P(A \cup B) = P(A) + P(B) - P(A \cap B)$.
- (c) In a class 2% of boys and 3% of girls are having blue eyes. There are 30% girls in the class. If a student is selected and having blue eyes, what is the probability that the student is girl. [8+8]
2. (a) Find the variance of the binomial distribution .
- (b) Determine the probability distribution of the number of bad eggs in a basket containing 6 eggs given that 10% of eggs are bad in a large consignment [8+8]
3. (a) The average number of phone calls/minute coming into a switch board between 2 p.m. and 4. p.m. is 2.5. Determine the probability that during one particular minute there will be
 - i. 4 or fewer
 - ii. more than 6 calls
- (b) The marks obtained in mathematics by 1000 students is normally distributed with mean 78% and standard deviation 11%. Determine
 - i. how many students got marks above 90%
 - ii. what was the highest mark obtained by the lowest 10% of the student
 - iii. within what limits did the middle of 90% of the students lie [8+8]
4. (a) Suppose that we want to investigate whether on the average men earn more than Rs.20 per week more than women in a certain industry. A sample data show that 60 men earn on the average while 60 women earn on an average $\bar{x}_2 = 266.10$ per week with a standard deviation of Rs.18.20, what can we conclude at 0.01 level of significance?

- (b) A sample of 900 members has a mean 3-4cms and S.D 2.61cms. Is this sample has been taken from a large population of mean 3.25cms and S.D 2.61cms. [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) 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) Fit a straight line $y = a + bx$ for the following data

x	1	2	3	4	5	6
y	14	33	40	63	76	85

- (b) Fit a curve of the $y = ax^b$ for the following data [8+8]

x	1	2	3	4	5
y	.5	.2	4.5	8	12.5

8. Use the formula $\rho = \frac{\sigma_{x+y}^2 - \sigma_x^2 - \sigma_y^2}{2\sigma_x\sigma_y}$ to compute the correlation coefficient to the following data

x :	62	56	36	66	25	75	82	78
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1. (a) Out of 10 girls in a class , 3 have blue eyes. If 2 of the girls are chosen at random, what is the probability that
 - i. both have blue eyes
 - ii. at least one has blue eyes
- (b) Define conditional probability. Give an example. State the general multiplicative rule and special multiplication rule (when the events are independent) [8+8]
2. (a) If 3 cars drawn from a lot of 6 cars containing 2 defective cars, find the probability distribution of the number of defective cars.
- (b) For the discrete probability distribution.

x	0	1	2	3	4	5	6	7
f	0	k	2k	2k	3k	k^2	$2k^2$	$7k^2+k$

Determine

- i. k
- ii. mean
- iii. variance [8+8]
3. (a) Suppose 2% of the people on the average are left handed. Find
 - i. the probability of finding 3 or more left handed
 - ii. the probability of finding ≤ 1 left handed.
- (b) The mean and standard deviation of a normal variate are 8 and 4 respectively find
 - i. $P(5 \leq x \leq 10)$
 - ii. $P(x \geq 5)$ [8+8]
4. (a) A random sample of size 144 is taken from an infinite population having the mean 75 and variance 225. What is the probability that \bar{x} will lie between 72 and 77?

- (b) It is claimed that a random sample of 49 tyres is a mean life of 15200km. This sample was drawn from a population whose mean is 15150kms and a standard deviation of 1200km. Test the significance at 0.5 level. [8+8]
5. (a) The mean and the standard deviation of a population are 11,795 and 14,054 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. Measurements of the fat content of two kinds of ice creams Brand A and brand B yielded the following sample data.

Brand A	13.5	14.0	13.6	12.9	13.0
Brand B	12.9	13.0	12.4	13.5	12.7

Test the significant between the means at 0.05 level. [16]

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. [8+8]

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

8. (a) A sample of 12 fathers and their eldest sons gave the following data about their height in inches calculate the coefficient of rank correlation. [8+8]

Fathers	65	63	67	64	68	62	70	66	68	67	69	71
Sons	68	66	68	65	69	66	68	65	71	67	68	70

- (b) Given that $x = 4y + 5$ and $y = kx + 4$ are the regression lines of x on y and y on x, respectively, show that $0 \leq k \leq 25$. If $k = 0.10$ actually, find the means of the variables c and y and also their coefficient of correlation.
