



**B.TECH DEGREE EXAMINATIONS: MAY 2015**

(Regulation 2013)

Third Semester

**U13MAT305: PROBABILITY AND APPLIED STATISTICS**

(Common to TXT/FT/BT)

**Time: Three Hours**

**Maximum Marks: 100**

**Answer all the Questions:-  
PART A (10 x 1 = 10 Marks)**

- The median of 23, 16, 48, 60, 53, 12, 21, 19 is
  - 22
  - 21
  - 23
  - 24
- If  $\text{Cov}(x, y) = 3$  and  $v(x) = 4.5$   $v(y) = 5.5$  then the correlation co-efficient is \_\_\_\_\_
- If an even cannot take place then the probability will be
  - +1
  - 1
  - 0
  - Not defined
- If Mean = 1 and  $E(X^2) = 7/6$  then variance of X is\_\_\_\_\_.
- In a normal distribution
  - standard deviation = mean
  - median = variance
  - mean = mode=median
  - mean = variance
- In a binomial distribution mean is 2.4 and variance is 1.44. Then the probability of success p is\_\_\_\_\_
- The 95% confidence limits for the population mean of large sample in terms of population standard deviation is given by
  - $\bar{x} + 1.96 \frac{\sigma}{\sqrt{n}} < \mu < \bar{x} - 1.96 \frac{\sigma}{\sqrt{n}}$
  - $\bar{x} - 1.96 \sigma < \mu < \bar{x} + 1.96 \sigma$
  - $\bar{x} - 1.96 \frac{\sigma}{\sqrt{n}} < \mu < 1.96 \frac{\sigma}{\sqrt{n}} + \bar{x}$
  - $\bar{x} - \frac{\sigma}{\sqrt{n}} < \mu < \bar{x} + \frac{\sigma}{\sqrt{n}}$
- Type I error means\_\_\_\_\_
- It is impossible to have a Latin square of size\_\_\_\_
  - 3 x 3
  - 4 x 4
  - 2 x 2
  - 5 x 5
- If  $\bar{x} = 44.2$  &  $\bar{R} = 5.8$  with  $A_2 = 0.557$ , then the upper control limit of the  $\bar{X}$  chart is \_\_\_.

**PART B (10 x 2 = 20 Marks)  
(Not more than 40 words)**

- Write empirical relation between mean, median and mode and using it find mode if mean = 25, median = 24.

12. Compute standard deviation for the data 66.1, 77.1, 74.6, 61.8, 71.5.
13. State the Baye's Theorem.
14. If  $f(x) = \begin{cases} k(x-1)^3 & ; 1 \leq x \leq 3 \\ 0 & , otherwise \end{cases}$  ; find k.
15. For a binomial distribution of mean 4 and variance 2, find the probability of getting at least two successes.
16. State the basic properties of Standard Normal Curve.
17. Define critical region.
18. Write down any two properties of  $\chi^2$  - distribution.
19. What are the three basic principles of design of experiments and write the purpose of applying these principles in experiments.
20. When do you say that a process is out of control?

**PART C (5 x 14 = 70 Marks)**  
**(Not more than 400 words)**

**Q.No. 21 is Compulsory**

21. In order to eliminate sources of error due to variability in soil fertility, he uses the fertilizers in a Latin Square arrangement as indicated in the following table, where the numbers indicate yields in bushels per unit area.

A18	C21	D25	B11
D22	B12	A15	C19
B15	A20	C23	D24
C22	D21	B10	A17

Perform an analysis of variance to determine whether there is a significant difference between the fertilizers at  $\alpha = 0.05$  levels of significance.

22. a) (i) Calculate Median and Mode of the data given below. Using them find arithmetic mean. (7)
- |                  |    |    |    |    |    |    |
|------------------|----|----|----|----|----|----|
| Marks:           | 10 | 20 | 30 | 40 | 50 | 60 |
| No. of Students: | 8  | 23 | 45 | 65 | 75 | 80 |

- (ii) In a correlation study the following values are obtained: (7)

	X	Y
Mean	30	35
Standard Deviation	10	7
Coefficient of correlation	0.8	

Find the two regression equations that are associated with the above values.

**(OR)**

- b) Lives of two models of refrigerators turned in for new models in a recent survey are: (6)

Life (yrs)	Model A	Model B
0-2	5	2
2-4	16	7

4-6	13	12
6-8	7	19
8-10	5	9
10-12	4	1

What is the average life of each model of these refrigerators?

- (ii) A random sample of 5 college students is selected and their grades in mathematics and statistics are found to be: (8)

	1	2	3	4	5
Mathematics :	85	60	73	40	90
Statistics :	93	75	65	50	80

Calculate Spearman's rank correlation coefficient.

23. a) (i) A manufacturer firm produces steel pipes in three plants, with daily production volume 500, 1000 and 2000 units respectively. According to past experience, it is known that the fractions of defective outputs produced by these plants are respectively 0.005, 0.008 and 0.010. If a pipe is selected from day's total production and found to be defective, what is the probability that it came from the first plant? (7)

- (ii) A discrete random variable X has the probability function given below. (7)

Values of X:	0	1	2	3	4	5	6	
P(X) :	0	k	2k	2k	3k	k <sup>2</sup>	2k <sup>2</sup>	7k <sup>2</sup> + k

Find (i) The value of k (ii)  $P(X < 6)$ ,  $P(X \geq 6)$  &  $P(0 < X < 4)$

(iii) The distribution function of X.

**(OR)**

- b) (i) Find the moment generating function of a random variable X with the pdf  $f(x) = pq^{x-1}$ ,  $x = 1, 2, 3, \dots$  and hence obtain its mean and variance. (7)
- (ii) The mileage X (in thousands of miles) which the vehicle owners get with a certain kind of vehicle is a random variable having a probability density function (7)

$$f(x) = \begin{cases} \frac{1}{20} e^{-\frac{x}{20}}, & x > 0 \\ 0 & x \leq 0 \end{cases}$$

Find the probabilities that one of these tyres will last

(i) at most 10,000 miles. (ii) Anywhere from 16,000 to 24,000. (iii) At least 30,000 miles.

24. a) (i) In a certain factory manufacturing razor blades, there is small chance of 1/500 for any blade to be defective. The blades are in packets of 10. Use Poisson distribution to calculate the approximate number of packets containing (i) no defective (ii) one defective (iii) 2 defective blades respectively in a consignment of 10,000 packets. (7)
- (ii) The average daily sales of 500 Branch offices was Rs. 150,000 and the standard deviation of Rs.15,000. Assuming the distribution to be Normal, indicate how many branches have sales between : (7)
- Rs.1,20,000 and Rs.1,60,000,
  - Below Rs.1,40,000 and

(OR)

b) (i) For usual notation with binomial variant X, find p when n = 6 and  $9P(x = 4) = P(x = 2)$ . (6)

(ii) The mean population of a random sample of 400 villages in Jaipur District was found to be 400 with a standard deviation of 12. The mean population of a random sample of 400 villagers in Meerut District was found to be 395 with a standard deviation of 15. Is the difference between the two district means statistically significant? (8)

25. a) (i) A certain injection administered to each of 12 patients resulted in the following increases of blood pressure :5, 2, 8, -1, 3, 0, 6, -2, 1, 5, 0, 4 (7)

Can it be concluded that the injection will be, in general, accompanied by an increase in B.P?

(ii) In an experiment on immunization of cattle from tuberculosis, the following results were obtained. (7)

	Affected	Unaffected
Inoculated	12	28
Not Inoculated	13	7

Examine the effect of vaccine in controlling the incidence of the disease.

(Use  $\alpha = 0.05$ ).

(OR)

b) (i) In a certain sampling inspection, the number of defectives found in 10 samples of 100 each are as given below: (7)

16, 18, 11, 18, 21, 10, 20, 18, 17 and 21.

Do these indicate that the quality characteristic under inspection is under statistical control?

(ii) Draw the mean chart and range chart using the following data relating to 10 (7)

$\bar{X}$  : 43 49 37 44 45 37 51 46 43 47  
R : 5 6 5 7 7 4 8 6 4 6

samples each of size 5 and comment on the state of control.

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