



**B.E/B.TECH DEGREE EXAMINATIONS: NOV/DEC 2023**

(Regulation 2018)

Fifth Semester

**FASHION TECHNOLOGY**

U18MAT5102: PROBABILITY AND STATISTICS

**COURSE OUTCOMES**

- CO1:** Compute measures of central tendencies, dispersion and correlation between variables, and predict unknown values using regression.
- CO2:** Understand and apply the concept of probability and random variables.
- CO3:** Construct probabilistic models for observed phenomena through distributions, which play an important role in many engineering applications.
- CO4:** Perform hypothesis testing and interpret the results.
- CO5:** Understand the principles of design of experiments and perform analysis of variance.
- CO6:** Sketch control charts and comment on the process control.

**Time: Three Hours**

**Maximum Marks: 100**

**Answer all the Questions:-**

**PART A (10 x 2 = 20 Marks)**

**(Answer not more than 40 words)**

- The average marks secured by 50 students was 44. Later on, it was discovered that a score 36 was misread as 56. Find the correct average marks secured by the students. CO1 [K<sub>2</sub>]
- Define coefficient of variation. CO1 [K<sub>1</sub>]
- From a pack of 52 cards two cards are drawn, the first being replaced before the second is drawn. Find the probability that the first one is diamond and second is king. CO2 [K<sub>2</sub>]
- A continuous random variable X follows the probability law  $f(x) = Ax^2$ ,  $0 \leq x \leq 1$ . Determine the value of A. CO2 [K<sub>2</sub>]
- The overall percentage of failure in a certain examination is 40. What is the probability that out of a group of 6 candidates, atleast 4 passed the examination? CO3 [K<sub>3</sub>]
- Let X be normally distributed with mean 12 and standard deviation 4. Find  $P(X \leq 20)$ . CO3 [K<sub>2</sub>]
- The mean lifetime of a sample of 100 light bulbs produced by a company is found to be 1580 hours with standard deviation of 90 hours. Test the hypothesis that the mean lifetime of the tubes produced by the company is 1600 hours. CO4 [K<sub>2</sub>]
- Define Type-I and Type-II errors in the testing of hypothesis. CO4 [K<sub>1</sub>]

9. What are the basic principles of Experimental Design CO5 [K<sub>1</sub>]
10. What are control charts? List the types of control charts. CO6 [K<sub>2</sub>]

**Answer any FIVE Questions:-**  
**PART B (5 x 16 = 80 Marks)**  
**(Answer not more than 400 words)**

11. a) Calculate the mean, mean deviation from the following data. 8 CO1 [K<sub>3</sub>]

Marks	0-10	10-20	20-30	30-40	40-50
Number of students	5	8	15	16	6

- b) Marks obtained by 10 students in Mathematics (X) and Statistics (Y) are given below: 8 CO1 [K<sub>3</sub>]

X: 60 34 40 50 45 40 22 43 42 64

Y: 75 32 33 40 45 33 12 30 34 51

Find the two regression lines. Also find Y when X = 55.

12. a) One factory A produces 1000 articles, 20 of them being defective products, second factory B produces 4000 articles, 40 of them being defective and third factory C produces 5000 articles 50 of them being defective. All these articles are put in one stock pile. One of them is chosen and is found to be defective. What is the probability that it is from factory A? 8 CO2 [K<sub>3</sub>]

- b) A continuous random variable X has the probability density function given by  $f(x) = kx^2 e^{-x}$ ,  $x \geq 0$ . Find the value of k, mean and variance. 8 CO2 [K<sub>3</sub>]

13. a) In a company, the monthly breakdown of a machine is a random variable with Poisson distribution, with average 1.8. Find the probability that the machine will function for a month (i) without breakdown (ii) with exactly one breakdown (iii) with at least one breakdown. 8 CO3 [K<sub>3</sub>]

- b) It has been claimed that in 60% of all solar heat installations the utility bill is reduced by at least one-third. Accordingly, what are the probabilities that the utility bill will be reduced by at least one-third in (i) four of five installations (ii) at least four of five installations? 8 CO3 [K<sub>3</sub>]

14. a) A quality control engineer suspects that the proportion of defective units among certain manufactured items has increased from the set limit of 0.01. To test his claim, he randomly selected 100 of these items and found that the proportion of defective units in the sample was 0.02. Test the engineer's hypothesis at 0.05 level of significance. 8 CO4 [K<sub>4</sub>]

- b) Two samples of 6 and 7 items respectively have the following values for a variable 8 CO4 [K4]

Sample 1 39 41 42 42 44 40

Sample 2 40 42 39 45 38 39 40

Do the sample variances differ significantly?

15. a) A random sample is selected from each of 3 makes of ropes and their breaking strength are measured with the following results. 8 CO5 [K3]

I 70 72 75 80 83

II 100 110 108 112 113 120 107

III 60 65 57 84 87 73

Test whether the breaking strength of the ropes differ significantly.

- b) Ten oil cans are taken at random from an automatic filling machine. The mean weight of tins is 15.8kg and standard deviation is 0.5kg. Does the sample mean differ significantly from the intended weight of 16kg? 8 CO4 [K4]

16. a) The figures in the following 5x5 Latin Square are the numbers of minutes, the engines E<sub>1</sub>, E<sub>2</sub>, E<sub>3</sub>, E<sub>4</sub>&E<sub>5</sub> tuned up by mechanics M<sub>1</sub>, M<sub>2</sub>, M<sub>3</sub>, M<sub>4</sub>&M<sub>5</sub> ran with gallon of fuel A, B, C, D and E. (16) CO5 [K4]

	E <sub>1</sub>	E <sub>2</sub>	E <sub>3</sub>	E <sub>4</sub>	E <sub>5</sub>
M <sub>1</sub>	A31	B24	C20	D20	E18
M <sub>2</sub>	B21	C27	D23	E25	A31
M <sub>3</sub>	C21	D27	E25	A29	B21
M <sub>4</sub>	D21	E25	A33	B25	C22
M <sub>5</sub>	E21	A37	B24	C24	D20

Use the level of significance  $\alpha = 0.01$  to test

- (i) the null hypothesis  $H_0$  that there is no difference in the performance of the five engines.
- (ii) (ii)  $H_0$  that the persons who tuned up these engines have no effect on their performance

(iii)  $H_0$  that the engines perform equally well with each of the fuels.