



# GUJARAT TECHNOLOGICAL UNIVERSITY

Program Name: Bachelor of Engineering

Level: UG

Branch: Textile Technology

Subject Code : BE03029041

Course / Subject Name : Statistical Techniques for Textile Engineering

w. e. f. Academic Year:	2024 -2025
Semester:	3
Category of the Course:	BSC

<b>Prerequisite:</b>	Basic knowledge of subjects like mathematics and statistics.
<b>Rationale:</b>	Knowledge of Statistics tool is the first step to control/improve quality of textile material / process for any textile engineer.

### Course Outcome:

After Completion of the Course, Student will able to:

No	Course Outcomes	RBT Level
01	Understand the centre tendency and significance of dispersion for textile material / process	R, U
02	Conduct various types of significance tests	U, A, E, C
03	Develop the regression equations and determine the correlation coefficient	U, A, E, C
04	Understand the significance of DOE, its calculation and interpretation of ANOVA	U, A, E, C
05	Develop the control chart for variables and attributes	U, A, E, C

\*Revised Bloom's Taxonomy (RBT)

### Teaching and Examination Scheme:

Teaching - Learning Scheme (in Hours per Semester)					Total Credits = TH/30	Assessment Pattern and Marks					Total Marks
L	T	P	PBL*	TH		Theory		Tutorial / Practical			
						ESE (E)	PA (M)	PA/ (I)	PBL (I)	ESE (V)	
45	15	0	60	120	04	70	30	50	30	0	180

Where L = Lecture, T= Tutorial, P= Practical, TW/SL = Term-Work / Self-Learning, TH = Total Hours, ESE = End-Semester Examination, PA = Progressive Assessment

### Course Content:

Unit No.	Content	No. of Hours	% of Weightage
1.	Descriptive statistics, frequency tables, histogram, scatterplot; Measures of central tendency, mean, median, mode; Measures of dispersion, standard deviation, variance; Measures of position, quartiles, deciles, percentile; Textile applications.	06	10



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2.	Correlation and regression, concepts, types of correlation, partial correlation, rank correlation; Confounding variable, interpretation of correlation coefficient; Linear regression, assumptions, least square method, estimation of regression coefficients, significance testing of regression equation, slope and intercept, residual analysis; coefficient of determination ( $R^2$ ), adjusted $R^2$ ; Numerical examples related to textiles.	08	20
3.	Probability, random variables, discrete and continuous random variables; Probability density functions, cumulative distribution function, expectation, variance; Discrete and continuous probability distributions, hypergeometric distribution, Binomial distribution, Normal distribution, Poisson distribution, Exponential distribution, Chi-square distribution.	08	20
4.	Types of sampling methods – Probability and Non-Probability, Number of Test for assessment of quality of textile product & its impacts. Formation of Hypothesis, Test of significance for Small samples: t- Test for single mean, difference of means, t-test for correlation coefficients, F- test for ratio of variances, Chi-square test for goodness of fit and independence of attributes.	08	20
5.	Analysis of variance, random variations in experiments, randomisation, randomised block design; One-way and two-way ANOVA.	08	20
6.	Quality control charts, random and assignable variations, Type I and Type II errors for random and assignable variations, Ishikawa's fishbone diagram, warning and action limits; Control chart for variables and attributes, selection of appropriate control chart, control chart for mean ( $\bar{X}$ ), range (R), defectives (np), fraction defectives (p), defects (C) etc., Cusum control chart; Numerical examples related to textiles	04	10
<b>Total</b>			<b>100</b>

### Suggested Specification Table with Marks (Theory):

Distribution of Theory Marks (in %)					
R Level	U Level	A Level	N Level	E Level	C Level
10	20	20	25	25	0

Where R: Remember; U: Understanding; A: Application, N: Analyze and E: Evaluate C: Create (as per Revised Bloom's Taxonomy)

### References/Suggested Learning Resources:

#### (a) Books:

1. Statistics for Textile Engineers by J. R. Nagla, Woodhead Publication India Pvt Ltd.
2. Practical Statistics for the Textile Industry, Part I & II by G. A. V. Leaf, The Textile Institute, UK, 1984.



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3. Introduction to Statistical Quality Control by Douglas C. Montgomery published by John Wiley & Sons, Inc.
4. Principles of Textile Testing by J.E.Booth, CBS Publishers & Distributors.
5. Statistical Techniques in Spinning Mills by T.V. Ratnam published by South India Textile Research Association, Coimbatore.
6. Introduction to Probability and Statistics, by S. Lipschutz and J. Schiller, Tata McGraw- Hill, 2017.
7. Applied Reliability and Quality: Fundamentals, methods, and Procedures by B. S. Dhillon, Springer, London, 2007.
8. Engineering statistics by A.H. Bowker, and G.J. Liberman, Prentice Hall, N.J.1972
9. Applied Statistics and Probability for Engineers by D. C. Montgomery and G. C. Runger, Wiley-India, 2008.
10. Statistical Techniques, Design of Experiments and Stochastic Modeling by A. Ghosh, B. Saha and P. Mal, CRC Press, 2021.
11. Miller and Freund's Probability and Statistics for Engineers by R. A. Johnson and C. B. Gupta, Pearson Education, 2009.
12. Statistical concepts and methods by G. K. Bhattacharya and R. A. Johnson, John Wiley, New Delhi, 2002
13. Statistics for textile and Apparel management by J. Hayavadana, Woodhead Publication India Pvt Ltd.

**(b) Open source software and website:**

1. <http://nptel.iitm.ac.in>, World Wide Web, Google Search Engine etc.

**Tutorial Exercise:**

1. Calculate Mean, Median, and Mode using textile mill data.
2. Calculate Range, Mean Range and Percentage Mean Range using Textile mill data.
3. Calculate Mean Deviation, Percentage Mean Deviation of textile material / Processes.
4. Numerical based on Standard Deviation, Coefficient of Variation, Variance
5. Determination of Number of sample test for assessment of any textile raw material or its product.
6. Find Normal Distribution, Binomial Distribution etc. of textile mill data.
7. Calculate Karl Pearson's coefficient of correlation, Rank correlation coefficient and lines of regression for textile material/processes.
8. Numerical based on probability of textile mill data.
9. Produced Variable Control Charts of textile data,
10. Numerical based on Attribute Control Charts
11. To design the textile experiment for given factor and level combinations by different using different DOE methods.
12. Numerical based on one way ANOVA.
13. Numerical based on two way ANOVA.



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## • List of suggested activities for Problem Based Learning:

Sl. No.	Name of the activity	No. of hours	Evaluation Criteria
1.	Industry/Research laboratory visit	Visit = 5h, Report preparation = 5h Total = 10h	Based on report submitted. Report should contain observations and calculations based on industry/ lab data.
2.	Assignment writing. Numericals based assignment is preferable.	5 assignments of 2h each. Total = 10h	Based on the assignment submitted.
3.	Self learning on-line course	Minimum duration of the course should be 10h.	Examination based assessment at the end of course. Based on the certificate produced.
4.	Poster/chart/power point preparation on technical topics	Duration = 6 h	Based on poster/chart preparation and presentation skills
5.	Technical Video based learning related to the subject	Duration of video = 5h Report preparation = 5h Total = 10h	Report /presentation based on the video learning outcomes.
6.	Working/non-working model on technical topics	Working = 12 h Non- working = 8 h	Based on inter department/external evaluation
7.	Industrial exposure for 2-3 days to observe and provide tentative solutions on society/environment/health/any other issue	Duration = 15 h for industrial exposure  Problem identification and tentative solution = 10 h Total = 20 h	Based on evaluation of critical problems and solutions
8.	Group Discussion on emerging/trending technical topics based on subject	Duration = 1 h each	Based on performance in group discussion, technical depth, knowledge etc.
9.	Real world case studies-based learning	Duration of data collection/study = 5h Report preparation = 5h Total = 10h	Based on in-depth study, technical depth, data collected, fact finding, etc.

- All records pertaining to the evaluation and assessment of self-learning activities must be properly maintained and preserved at the institute level. These records should be made available to the university upon request.
- Institutes are encouraged to utilize digital platforms, such as Microsoft Teams, for effective record-keeping and to ensure transparency in the evaluation and assessment of self-learning activities.

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