



# GUJARAT TECHNOLOGICAL UNIVERSITY

Program Name: Engineering

Level: Master of Engineering

Branch: Textile Engineering

Course / Subject Code : ME01025061

Course / Subject Name : Statistical Techniques and Design of Experiments

|                         |                          |
|-------------------------|--------------------------|
| w. e. f. Academic Year: | 2024-25                  |
| Semester:               | 1 <sup>st</sup> Semester |
| Category of the Course: | PEC                      |

|                      |   |
|----------------------|---|
| <b>Prerequisite:</b> | Basic mathematics and statistics at BE level  |
| <b>Rationale:</b>    | At the PG level students are required to develop analytical abilities. They also have to undergo research thesis. Knowledge of statistical tools for validating the results is very essential for textile experiments. Also designing an experiment will lead to valid conclusions which may be replicated elsewhere. |

## Course Outcome:

After Completion of the Course, Student will able to:

| No | Course Outcomes  |
|----|--|
| 01 | Acquire more knowledge in basic concepts of application of statistics in textile       |
| 02 | Improve problem evaluation technique.  |
| 03 | Select an appropriate method to solve a practical problem.                             |
| 04 | Develop suitable design for experimental work and validating the results of experiment |

\*Revised Bloom's Taxonomy (RBT)

## Teaching and Examination Scheme:

| Teaching Scheme<br>(in Hours) |   |    | Total<br>Credits<br>L+T+<br>(PR/2) | Assessment Pattern and Marks |                |                      |         | Total<br>Marks |
|-------------------------------|---|----|------------------------------------|------------------------------|----------------|----------------------|---------|----------------|
| L                             | T | PR | C                                  | Theory                       |                | Tutorial / Practical |         |                |
|                               |   |    |                                    | ESE<br>(E)                   | PA / CA<br>(M) | PA/CA (I)            | ESE (V) |                |
| 3                             | 1 | 0  | 4                                  | 70                           | 30             | 0                    | 0       | 100            |



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## Course Content:

| Unit No. | Content   | No. of Hours | % of Weightage |
|----------|---|--------------|----------------|
| 1.       | Basic Statistics for Textile materials/processes: Collection of Data for textile material or process, Graphical representation of data, types of distribution curves, Measure of central tendency - Mean, Median and Mode, Partition values – Quartiles, Deciles and Percentiles.                   | 5            | 10             |
| 2.       | Measurement of Dispersion of Textile raw materials, intermediate products and processes: Dispersion – Range, Quartile Deviation, Mean Deviation, Standard Deviation, Coefficient of Range, Coefficient of Quartile Deviation, Coefficient of mean Deviation, Coefficient of Variation, Variance.    | 6            | 15             |
| 3.       | Correlation and Regression of Industrial data: Types of Correlation, Measure of correlation – Scatter Diagram and Karl Pearson's Coefficient of Correlation, Coefficient of determination, Spearman's Rank Correlation Coefficient, Line of Regression analysis.                                    | 6            | 15             |
| 4.       | Basic of Probability & Probability Distribution of textile data: Binomial, Poisson, Normal, T, Chi-square, and F distributions distribution,  | 6            | 15             |
| 5.       | Application of Statistics for textile data: 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. | 7            | 15             |
| 6.       | Control Charts to control quality of textile product / processes: Introduction and Significance of Control Chart, Control Charts for Variable (X-bar and R Chart), Control Charts for Attributes (p, n p, c charts), Acceptance of sampling   | 5            | 10             |
| 7.       | Planning of textile Experiment using Design of Experiment (DOE): Use of DOE, Guideline for designing of experiment, Classification of Design of Experiment, Two level and three level factorial design, One way ANOVA and Two way ANOVA,  | 10           | 20             |
|          | <b>Total</b>  | <b>45</b>    | <b>100</b>     |



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## 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      | 20      | 20      | 10      |

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. Anindya Ghosh, Bapi Saha, and Prithwiraj Mal, "Textile Engineering, Statistical Techniques, Design of Experiments and Stochastic Modeling". CRC Press, New York.
2. J. R. Nagla, "Statistics for Textile Engineers", Woodhead Publication India.
3. Cochran W G and Cox G M, "Experimental Designs", Second Edition, John Wiley and Sons, Inc., New York, 1957.
4. Montgomery D C, "Design and Analysis of Experiments", Fifth Edition, John Wiley and Sons, Inc., New York, 1957.
5. Leaf G A V, "Practical Statistics for the Textile Industry", (Part-I and II), The Textile Institute, UK, 1984.
6. Journals: Textile Research Journal, Princeton, USA and Journal of Textile Institute, Manchester, UK.

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

1. <http://nptel.iitm.ac.in>
2. World Wide Web, Google Search Engine etc.
1. Rahul Dubey, "An Introduction to Internet of Things: Connecting Devices, Edge Gateway, and Cloud with Applications", Cengage India Publication
2. Raj Kamal, "Internet of Things: Architecture and Design Principles, Mc Graw Hill Education
3. Hanes et al "IoT Fundamentals", Cisco Press
4. Vijay Madiseti and ArshdeepBahga, "Internet of Things (A Hands-on-Approach)", , Paperback, 2015.
5. A. McEwen, H. Cassimally, "Designing the Internet of Things", Wiley, 2013.
6. YashwantKanetkar, "21 Internet of Things Experiments", Kindle edition
7. AdeelJaved, "Building Arduino projects for Internet of Things", Apress publication
8. Donald Noris, "The Internet of Things: Do it yourself Projects with Arduino, Raspberry PI and
9. BeagleBone Black" Mc Graw Hill Publication
10. Adrian McEwen & Hakim Cassimally, "Designing the Internet of things", Willey publication



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