

# GUJARAT TECHNOLOGICAL UNIVERSITY

## MECHANICAL (INDUSTRIAL ENGINEERING) (46)

STATISTICS FOR ENGINEERS

SUBJECT CODE: 2714601

SEMESTER: I

**Type of course:** Core I

**Prerequisite:** NA

**Rationale:** The aim of the course is to familiarize students with the fundamentals of statistics in engineering. It helps students to apply this knowledge in Industrial Engineering area. The knowledge of probability, hypothesis, regression and time series application helps in decision making application. Design of experiments is keen requirements for industry as well as research and development area.

### Teaching and Examination Scheme:

Teaching Scheme			Credits	Examination Marks						Total Marks
L	T	P		Theory Marks		Practical Marks				
			ESE (E)	PA (M)	PA (V)		PA (I)			
					ESE	OEP	PA	RP		
3	2#	2	5	70	30	20	10	10	10	150

### Content:

Sr. No.	Content	Total Hrs	% Weightage
A	<b>Probability Theory</b>		
1	<b>Discrete Distributions:</b> Random variables, Standard probability distributions-Binomial, Poisson and Geometric distributions, Mean, Variance, Moment generating function of respective distributions. Two dimensional random variables.	<b>6</b>	15
2	<b>Continuous Distributions:</b> Special distributions- Normal, Uniform, Exponential, Gamma, Weibull and Beta distributions - Mean, Variance, Raw moments from moment generating functions of respective distributions.	<b>5</b>	10
3	<b>Sampling Distributions:</b> Random Sampling, Sampling distributions of mean and variance, T-test, F-test and Chi-square test	<b>6</b>	15
4	<b>Estimation Theory:</b> Estimation of Parameters, Maximum likelihood estimates, Confidence interval estimation of population parameters Method of moments.	<b>5</b>	10
5	<b>Hypothesis Testing:</b> Large sample tests for mean and proportion, Non parametric tests, Goodness of fit tests, Analysis of variance - One way and two way classifications	<b>5</b>	10
6	<b>Design of Experiments:</b> Completely Randomized Design, Randomized Block design, Latin square design - 2 Factorial Design, Fundamental Assumptions of analysis of variance, Single factor experiments – Fixed/random effects model – Model adequacy checking - Multiple comparisons - Design of experiments with several factors - Two factor factorial experiments, Taguchi Approach to Design of Experiments - The	<b>7</b>	15

	Loss Function – Orthogonal array – Signal-to- Noise ratio.		
<b>B</b>	<b>Descriptive Statistics:</b>		
7	<b>Regression and Correlation:</b> Method of least squares, Linear Regression, Polynomial Regression and Multiple Regression, Karl Pearson's Coefficient of Correlation, Rank Correlation, Multiple and partial correlation	<b>6</b>	15
8	<b>Time Series Analysis:</b> Characteristics and Representation, Moving Averages, Exponential smoothening, Auto Regressive Processes.	<b>5</b>	10

### Reference Books:

1. Probability and Statistics for Engineering, Freund John, E. And Miller, Irwin, 5th Edition, Prentice Hall, 1994.
2. Statistics for Management, Levin and Rubin, PHI, 2001.
3. Fundamentals of Mathematical Statistics, Gupta, S.C. and Kapoor, V.K. Sultan Chand and Sons.
4. Probability & Statistics for Engineers and Scientists, Ronald E. Walpole, Pearson Education Asia Edition.
5. Probability and Statistics for Engineering and Sciences, Jay, L. Devore, Brooks/Cole Publishing Company Monterey, California, 1982.
6. Probability and Statistics, SPIEGEL, MURRAY R., , Schaum's series.
7. Statistics, Schaum's Series. SPIEGEL, MURRAY R,
8. Probability and Statistics with Reliability and Queuing and Computer Science Applications , Trivedi K S., Prentice Hall Of India
9. Principles of Experimental Design and Analysis, Garcia-Diaz, A and Phillips, D. T., Chapman & Hall, New York, 1995.
10. Probability and Statistics in Engineering and Management Science, Hines, W. W, and Montgomery, D. C., John Wiley and Sons, New York, 1990.
11. Engineering Statistics, Bowker and Liberman, Prentice-Hall. Forecasting and Time Series, Montgomery D.C and Johnson, L. AMcGraw Hill.

### Course Outcome:

After learning the course the students should be able to:

- 1) Demonstrate Probability distribution and understand application of discrete, continuous and sampling distribution.
- 2) Demonstrate estimation theory in different areas
- 3) Demonstrate hypothesis testing for different application
- 4) Apply design of experiments for different engineering application
- 5) Demonstrate descriptive statistics in the area of regression and correlation
- 6) Demonstrate time series analysis

### List of Experiments:

- 1) Study of Probability distribution and apply application of discrete, continuous and sampling distribution for different case problem.
- 2) Study of Estimation theory and apply its application
- 3) Study of hypothesis testing for different application
- 4) Study of design of experiments by considering different case problems
- 5) Study of descriptive statistics and solve problems on regression and correlation
- 6) Study and apply time series analysis

### Open Ended Problems:

1. Students can survey for data and prepare sampling test, also apply data on T-test, F-test and Chi-square test, they can do analysis and conclude their results
2. Students can collect data to perform time series analysis

**Major Equipments:**

Case problems supported by software application wherever possible