GUJARAT TECHNOLOGICAL UNIVERSITY

MECHANICAL (ADVANCE MANUFACTURING SYSTEM) (50)
DESIGN AND ANALYSIS OF EXPERIMENTS
SUBJECT CODE: 2735005
M.E. 3rd SEMESTER

Type of course: Engineering Science

Prerequisite: Fundamentals of probability and statistics

Rationale: This course is designed for those interested in the design, conduct, and analysis of experiments in the physical, chemical, engineering, or industrial sciences. The course will examine how to design experiments, carry them out, and analyze the data they yield.

Teaching and Examination Scheme:

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

Content:

Sr. No.	Contents	Total Hrs.	% Weightage
1	**Introduction:** • Strategy of Experimentation • Some Typical Applications of Experimental Design • Basic Principles • Guidelines for Designing Experiments	4	5%
2	**Simple Comparative Experiments:** • Introduction • Basic Statistical Concepts • Sampling and Sampling Distributions • Inferences About the Differences in Means, Randomized Designs ▪ Hypothesis Testing ▪ Choice of Sample Size ▪ Confidence Intervals ▪ The Case Where $\sigma_1^2 \neq \sigma_2^2$ ▪ The Case Where σ_1^2 and σ_2^2 are Known ▪ Comparing a Single Mean to a Specified Value • Inferences About the Differences in Means, Paired Comparison Designs • The Paired Comparison Problem • Advantages of the Paired Comparison Design • Inferences About the Variances of Normal Distributions	6	15%
3	**Experiments with a Single Factor: The Analysis of Variance** • The Analysis of Variance • Analysis of the Fixed Effects Model	4	15%

	• Model Adequacy checking		
4	**Randomized Block and Latin Square Designs:** • The Randomized Complete Block Design ▪ Statistical Analysis of the RCBD ▪ Model Adequacy Checking • The Latin Square Design	6	15%
5	**Introduction to Factorial Designs:** • Basic Definitions and Principles • The Advantage of Factorials • The Two-Factor Factorial Design ▪ Statistical Analysis of the Fixed Effects Model ▪ Model Adequacy Checking ▪ Estimating the Model Parameters • Concept of the General Factorial Design	6	15%
6	**The 2^k Factorial Design:** • Introduction • The 2^2Design • The 2^3 Design • The General 2^k Design	6	15%
7	**Fitting Regression Models:** • Introduction • Linear Regression Models • Estimation of the Parameters in Linear Regression Models	5	10%
8	**Introduction to Response Surface Methodology:** • Introduction • Method of Steepest Ascent • Analysis of second order response surface	5	10%

Reference Books:

1. "Design and analysis of experiments" by D.C. Montgomery, 7th edition John Wiley and sons, NewYork
2. Das. M.M. and Giri N.C. : - Design and Analysis of Experiments.
3. Fisher R.A. :- Design of Experiments.
4. Dean Voss :- Design and Analysis of Experiments

Course Outcome:

It is desired that at the end of the course, the student will be equipped with the basic knowledge and art of statistical data analysis combined with systematic approaches to experimental design.

List of Experiments:

1. Students should conduct few experiments in the Institute laboratory like workshop and should apply the knowledge of experimental analysis to perform data analysis.
2. Students are required to solve various exercise problems using any statistical analysis software packages like SPSS, Minitab.
3. Students are advised to take up the real world problems from nearby Industries as a part of OEP.

Design based Problems (DP)/Open Ended Problem:

Review Presentation (RP): The concerned faculty member shall provide the list of peer reviewed Journals and Tier-I and Tier-II Conferences relating to the subject (or relating to the area of thesis for seminar) to the students in the beginning of the semester. The same list will be uploaded on GTU website during the first two weeks of the start of the semester. Every student or a group of students shall critically study 2 papers, integrate the details and make presentation in the last two weeks of the semester. The GTU marks entry portal will allow entry of marks only after uploading of the best 3 presentations. A unique id number will be generated only after uploading the presentations. Thereafter the entry of marks will be allowed. The best 3 presentations of each college will be uploaded on GTU website.