

Gautam Buddha University, Greater Noida

School of Engineering (Mechanical Engineering)

| Degree | Course Name | Course Code | Marks:100 |
|-----------------|-----------------------|--------------------|----------------------|
| M. Tech. | Design of Experiments | MEE 504 | SM+MT+ET 25+25+50 |
| Semester | Credits | L-T-P | Exam. |
| II | 4 | 3-1-0 | 3 Hours |

Unit - I

Introduction: Components of an experiment; Strategy of experimentation; Terms and concepts; Basic principles; Guidelines for designing experiments; A brief history of statistical design; Use of statistical techniques in experimentation. **(04 Hours)**

Unit - II

Statistical Methods: Basic statistical concepts; Sampling and sampling distribution; Hypothesis testing- single mean, two means, dependant/ correlated samples – confidence intervals; Experimentation – need; Conventional test strategies; Analysis of variance; F-test, terminology; Basic principles of design; Steps in experimentation; Choice of sample size; Normal and half normal probability plot; Simple linear and multiple linear regression **(08 Hours)**

Unit - III

Analysis of Models: Testing using analysis of variance; Analysis of fixed model effects; Decomposition of total sum of squares; Estimation of model parameters; Model adequacy checking- Normality, plots of residual, residual Vs fitted value, residual Vs other variable; Regression model; Comparison among treatment means; Graphical comparison of means; Contrast, Orthogonal contrast; Regression approach to the analysis of variance. **(09 Hours)**

Unit - IV

Factorial Methods: Basic definition and principles; Advantages of full factorial experimentation; Three factor full factorial design (2 levels)- an example – Graphical representation; Statistical analysis of fixed effects model; Estimating the model parameters; Main factor effects; Interaction effects; Plot of main factor and interaction effects; Model adequacy checking; General 2^K full factorial design; Three full factor factorial design (3 levels) and General 3^K full factorial design. **(08 Hours)**

Unit - V

Basic Definition and Principles of Fractional Factorial Design: Advantages and disadvantages of factorial experimentation; Half fractional factorial design (2 levels)- an example – Design generator; Resolution; Statistical analysis of fixed effects model; Estimating the model parameters; Main factor effects; Interaction effects; Alias algebra; Aliased effects; Plot of main factor and interaction effects; Model adequacy checking; General 2^{K-P} factorial design; Three factor factorial design (3 levels) and General 3^{K-P} factorial design. **(08 Hours)**

Unit - VI

Introduction to Taguchi Techniques: Concept of loss function; Quality characteristics- lower is better, higher is better, normal is better; Orthogonal array (OA): Use of linear graph and triangular tables; Factor assignment to columns; Average effect analysis; Signal to noise (S/N) ratio analysis; Determination of optimum quality; Advantages of S/ N ratio over average analysis; Application softwares. **(08 Hours)**

Recommended Books:

1. Design and Analysis of Experiments; Douglas C. Montgomery; John Wiley India; 2005.
2. A First Course in Design and Analysis of Experiments; Gary W. Oehlert; 2000.
3. Statistics for Experimenters; G. E. P. Box, W. G. Hunter and J. S. Hunter; Wiley, New York; 2005.
4. Experimental Design; W. G. Cochran and G. M. Cox; Wiley, New York; 1992.
5. Modern Experimental Design; Thomas P. Ryan; John Wiley; 2007.
6. A primer on Taguchi Methods; Ranjit K. Roy; Society of Manufacturing Engineers; 2009.