# NATIONAL INSTITUTE OF TECHNOLOGY, TIRUCHIRAPPALLI

| COURSE OUTLINE TEMPLATE | | | |
|---|---|---|---|
| **Course Title** | Design and Analysis of Experiments | | |
| **Programme** | M.Tech. Industrial Engineering and Management – I Semester | | |
| **Course Code** | PR 664 | **No. of Credits** | 3 |
| **Department** | Production Engineering | **Faculty** | R. JEYAPAUL |
| **Pre-requisites Course Code** | General awareness about Statistical Theory and applications | | |
| **Course Coordinator(s) (if, applicable)** | **-** | | |
| **Other Course Teacher(s)/Tutor(s) E-mail** | jeyapaul@nitt.edu | **Telephone No.** | 9444290049 |
| **Course Type** | ☐ **Core course** | ☑ **Elective course** | |

## COURSE OVERVIEW

Design of Experiments (DOE) is a systematic method to determine the relationship between factors affecting a process and the output of that process. In other words, it is used to find cause-and-effect relationships. This information is needed to manage process inputs in order to optimize the output.

In an experiment, we deliberately change one or more process parameters in order to observe the effect the changes on one or more response variables. The design of experiments is an efficient procedure for planning experiments so that the obtained data can be analysed to yield valid and objective conclusions.

This course enables students to design, data collection and perform analysis to solve any problem by the application of DOE methodology.

## COURSE OBJECTIVES

- To provide an introduction to fundamental concepts of experimentation methodology
- To enhance student understanding of the complexities of experimental design and control of manufacturing processes
- To analyze the effect of total number of experiments on the conclusion about process parameter

**COURSE OUTCOMES (CO)**

| Course Outcomes | Aligned Programme Outcomes (PO) |
|---|---|
| After studying this course, students are able to:<br>1. Understand the need, steps to be followed for conducting experiments<br>2. Create experimental designs using factorial experiments and other special experimental techniques<br>3. Apply Taguchi techniques for various parameter design problems | PO 3, PO 4 and PO 6 |

**COURSE TEACHING AND LEARNING ACTIVITIES**

| S.No. | Week | Topic | Mode of Delivery |
|---|---|---|---|
| 1 | Week 1 | Introduction to design of experiments, Review of statistics, Basic terminologies, principles | Chalk and Talk / PPT |
| 2 | Week 2 | Steps to be followed for conducting experimentation, examples | Chalk and Talk |
| 3 | Week 3 | Single factor experiments, ANOVA, Test on means | Chalk and Talk |
| 4 | Week 4 | Randomized Block design, Latin Square Design, Greaco Latin Square Design, Tutorials | Chalk and Talk |
| Descriptive Assessment - 1 | | | |
| 5 | Week 5 | Balanced Incomplete Block Design, missing observations, Tutorials | Chalk and Talk |
| 6 | Week 6 | Introduction to Factorial design (FD), 2 & 3 factor factorial design, tutorials | Chalk and Talk |

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|---|---|---|---|
| 7 | Week 7 | blocking in FD, $2^k$ Design, Contrast Equations, Yate's algorithm, Tutorials | Chalk and Talk |
| 8 | Week 8 | Blocking in $2^k$ design, Tutorials | Chalk and Talk |
| 9 | Week 9 | Confounding in $2^k$ design, Confounding in 2 Blocks, Tutorials | Chalk and Talk |
| 10 | Week 10 | Confounding in 4 blocks, partial confounding, tutorials | Chalk and Talk |
| Descriptive Assessment -2 | | | |
| 11 | Week 11 | Taguchi Design, steps, methodology for design and data collection | PPT |
| In Class Assignment | | | |
| 12 | Week 12 | Data Analysis in Taguchi method, Case Studies, Tutorials | PPT |
| Objective type quiz | | | |
| Compensation Assessment | | | |
| Descriptive Semester Examination | | | |

**COURSE ASSESSMENT METHODS**

| S.No. | Mode of Assessment | Week/Date | Duration | % Weightage |
|---|---|---|---|---|
| 1 | Descriptive Assessment – 1 | End of 4 Weeks | 45 Min | 15% |
| 2 | Descriptive Assessment – 2 | End of 10 Weeks | 1 Hr | 20% |
| 3 | In class Assignment | End of 11 Weeks | 1 Hr | 5% |
| 4 | Objective type Quiz | End of 12 Weeks | 10 Min | 10% |
| 5 | Compensation Assessment | End of 12 Weeks | 1.5 Hrs | 30% |
| 6 | Descriptive Semester Exam | End of Semester | 3 Hrs | 50% |

**ESSENTIAL READINGS : Textbooks, reference books Website addresses, journals, etc**

***TEXT BOOK:***

*1.* Montgomery, D.C. “Design and Analysis of Experiments”, John Wiley and Sons, 5th Edition,2002.

***REFERENCE BOOKS:***

*1.* Hicks,C.R. “Fundamental concepts in the Design of Experiments”, Holt, Rinehort and Winston, 2000.

2. Bagchi, T.P. “Taguchi Methods explained”, PHI, 2002.

3. Ross, P.J. “Taguchi Techniques for quality Engineering”, Prentice Hall, 2000.

**COURSE EXIT SURVEY (mention the ways in which the feedback about the course is assessed and indicate the attainment also)**

Course Exit survey will be collected at the end of the semester before the start of semester examination through online. Students can log in their MIS account to give the feedback. Mid-semester anonymous feedback shall be collected to improve the teaching-learning process. Apart from this, students can share feedback during class committee meetings.

**COURSE POLICY (including plagiarism, academic honesty, attendance, etc.)**

- Attending classes regularly and continuously is required for the students to understand the concepts.
- Participation in the discussions is mandatory during the tutorial classes.
- Strict academic disciplines have to be maintained inside the class room.
- If any student is not able to attend any of the continuous assessments (1, 2, 3 and 4) due to genuine reason, student is permitted to attend the compensation assessment with % weightage equal to maximum of the CAs. However, a student absent for more than one CAs, maximum of the % weightage among the assessments for which the student was absent will be considered for computing marks for CA.

**ADDITIONAL COURSE INFORMATION**

The Course teacher is available for consultation in the department after class hours. Queries may also be emailed to the Course Coordinator directly at jeyapaul@nitt.edu

**FOR SENATE’S CONSIDERATION**

**Course Faculty** _____ **CC-Chairperson** _____ **HOD** _____