DEPARTMENT OF PRODUCTION ENGINEERING

NATIONAL INSTITUTE OF TECHNOLOGY, TIRUCHIRAPPALLI

COURSE PLAN – PART I			
Course Title	**Design and Analysis of Experiments (M.Tech. Industrial Engineering & Management–I Semester)**		
Course Code	**PR664**	No. of Credits	**3**
Course Code of Pre-requisite subject(s)			
Session	**July 2019**	Section (if, applicable)	**-**
Name of Faculty	**R. JEYAPAUL**	Department	**Production**
Email	jeyapaul@nitt.edu	Telephone No.	**0431-2503517**
Name of Course Coordinator(s) (if, applicable)			
E-mail		Telephone No.	
Course Type	☐ **Core course**	✓ **Elective course**	

Syllabus (approved in BoS)

Introduction- Planning of experiments – Steps – Need - Terminology: Factors, levels, variables, experimental error, replication, Randomization, Blocking, Confounding.

Single Factor Experiments- ANOVA rationale - Sum of squares – Completely randomized design, Randomized block design, effect of coding, Comparison of treatment means – Newman Kuel's test, Duncan's Multiple Range test, Latin Square Design, Graeco-Latin Square Design, Balanced incomplete design.

Factorial Experiments-Main and interaction effects –Two and three Factor full factorial Designs, 2^k deigns with Two and Three factors-Unreplicated design- Yate's Algorithm

Special Experimental Designs: Blocking in factorial design, Confounding of 2k design, nested design-Response Surface Methods.

Taguchi Techniques- Fundamentals of Taguchi methods, Quality Loss function, orthogonal designs, application to Process and Parameter design.

REFERENCE BOOKS:

1. Montgomery, D.C. "Design and Analysis of Experiments", John Wiley and Sons, 5th Edition,2002.
2. Hicks,C.R. "Fundamental concepts in the Design of Experiments", Holt, Rinehort and Winston, 2000.
3. Bagchi, T.P. "Taguchi Methods explained", PHI, 2002.
4. Ross, P.J. "Taguchi Techniques for quality Engineering", Prentice Hall, 2000.

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)
1. Understand the need, steps to be followed for conducting experiments	PO 3, PO 4
2. Apply blocking designs while conducting experiments	PO 5
3. Create experimental designs using factorial experiments and other special experimental techniques	PO 6
4. Understand the applications of confounded designs	PO 6
5. Apply Taguchi techniques for various parameter design problems	PO 8, PO 9

COURSE PLAN – PART II

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 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
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
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
11	Week 11	Taguchi Design, steps, methodology for design and data collection	PPT
12	Week 12	Data Analysis in Taguchi method, Case Studies, Tutorials	PPT

COURSE ASSESSMENT METHODS

S.No.	Mode of Assessment	Week/Date	Duration	% Weightage
1	Descriptive Assessment – 1	End of 5 Weeks	60 min	20
2	Descriptive Assessment – 2	End of 10 Weeks	60 min	20
3	Objective type Quiz	End of 12 Weeks	10 min	10
*CPA**	*Compensation Assessment*	*End of 12 Weeks*	*60 min*	*20*
4	Final Assessment	End of Session	180 min	50

** Refer the policy for conducting the CPA*

COURSE EXIT SURVEY

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

MODE OF CORRESPONDENCE

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

ATTENDANCE

- At least 75% attendance in each course is mandatory.
- A maximum of 10% shall be allowed under On Duty (OD) category.
- Students with less than 65% of attendance shall be prevented from writing the final assessment and shall be awarded 'V' grade.

COMPENSATION ASSESSMENT (CPA)

If any student is not able to attend any of the continuous assessments (CA) (1, 2 and 3) due to genuine reason, student is permitted to attend the compensation assessment with % weightage equal to maximum of the CA(s). However, a student absent for more than one CAs, maximum of the % weightage among the continuous assessments for which the student was absent will be considered for computing marks for CA.

ACADEMIC HONESTY & PLAGIARISM

- Possessing a mobile phone, carrying bits of paper, talking to other students, copying from others during an assessment will be treated as punishable dishonesty.
- Zero mark to be awarded for the offenders. For copying from another student, both students get the same penalty of zero mark.
- The departmental disciplinary committee including the course faculty member, PAC chairperson and the HoD, as members shall verify the facts of the malpractice and award the punishment if the student is found guilty. The report shall be submitted to the Academic office.
- All the students are expected to be genuine during the course work. Taking of information by means of copying simulations, assignments, looking or attempting to look at another student's paper or bringing and using study material in any form for copying during any assessments is considered dishonest.
- Tendering of information such as giving one's program, simulation work, assignments to another student to use or copy is also considered dishonest.
- Preventing or hampering other students from pursuing their academic activities is also considered as academic dishonesty.

FOR APPROVAL

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