EXPERIMENTAL TECHNIQUES AND DATA ANALYSIS-EL 1
Semester III (Production Engineering)
SUB CODE: MEPR302-A
Teaching Scheme (Credits and Hours)

Teaching Scheme				Total Credit	Evaluation Scheme					Total Marks
L	T	P	Total		THEORY		IE	CIA	PR. / VIVO	
					Hrs	Marks	Marks	Marks	Marks	
Hrs	Hrs	Hrs	Hrs							
3	0	2	5	4	3	70	30	20	30	150

LEARNING OBJECTIVES:

The objective of this course is

- To learn various concepts of experimental techniques and data analysis

LESSON PLANNING

SR.NO	CHAPTER NO	DATE/WEEK	%WEIGTAGE
1	1	1st 2nd 3rd	20
2	2	4th 5th 6th	20
3	3	7th 8th 9th	20
4	4	10th 11th 12th	20
5	5	13th 14th 15th	20

Total hours (Theory): 45, Total hours (Practical): 30, Total hours: 75

DETAILED SYLLABUS

Chap. No.	Topic
1	Measurement of Cutting Forces: Strain gauge and piezoelectric transducers and their characteristics. Dynamometer construction, Bridge circuits. Instrumentation and calibration. Displacement and strain measurements by photoelasticity. Holography, interferometer, Moir techniques, strain gauge rosettes
2	Temperature Measurement: Circuits and instrumentation for different transducers viz, bimetallic, expanding fluid, electrical resistance, thermister, thermocouples, pyrometers. Flow Measurement: Transducers for flow measurements of Non-compressible and compressible fluids. Obstruction and drag methods. Vortex shredding flow meters. Ultrasonic, Laser Dopler and Hotwire anemometer. Flow visualization techniques, Shadow graphs, Schlieren photography. Interferometer.
3	Metallurgical Studies: Optical and electron microscopy, X-Ray diffraction, Bragg's Law and its application for studying crystal structure and residual stresses. Electron spectroscopy, electron microprobe. Surface Measurements: Micro hardness, roughness, accuracy of dimensions and forms. 3-D co-ordinate measuring machines.
4	Experiment design & data analysis: Statistical methods, Randomized block design, Latin and orthogonal squares, factorial design. Replication and randomization. Data Analysis: Deterministic and random data, uncertainty analysis, tests for significance: Chi-square, student's 't' test. Regression modeling, direct and interaction effects. ANOVA, F-test. Time Series analysis, Autocorrelation and autoregressive modeling
5	Taguchi Methods: Experiment design and planning with Orthogonal arrays and linear graphs. Additive cause effect model. Optimization of response level. Identification of Design and noise factors. Performance evaluation and Optimization by signal to noise ratios. Concept of loss function and its application

LIST OF PRACTICALS

Sr. No.	Practical Content
1	TO DETERMINE CHIP TOOL INTERFACE TEMPERATURE USING THERMOCOUPLE PRINCIPLE.
2	TO DETERMINE THE EFFECT OF CUTTING PARAMETERS ON THE CUTTING FORCE IN METAL CUTTING.
3	DETERMINATION OF FLOW USING OBSTRUCTION METHODS.
4	DETERMINATION OF CRYSTAL STRUCTURE BY X-RAY DIFFRACTION METHOD FOR A GIVEN MATERIAL.
5	UNCERTAINTY ANALYSIS & SIGNIFICANCE TEST USING CHI SQUARE FOR A GIVEN SET OF CONDITIONS.
6	REGRESSION MODELING FOR OPTIMIZING THE PARAMETERS IN EDM.
7	EXPERIMENTAL DESIGN BY TAGUCHI METHOD FOR THE PERFORMANCE PARAMETERS IN EDM.
8	PERFORMANCE EVALUATION AND OPTIMIZATION BY SIGNAL TO NOISE RATIOS FOR THE PERFORMANCE PARAMETERS IN EDM.
9	DISPLACEMENT AND STRAIN MEASUREMENTS BY PHOTOELASTICITY UNDER DIFFERENT LOADING CONDITION.
10	MEASUREMENT OF SURFACE ROUGHNESS OF THE COMPONENT WHICH HAS UNDERGONE VARIOUS MACHINING PROCESS.

INSTRUCTIONAL METHOD AND PEDAGOGY (Continuous Internal Assessment (CIA) Scheme)
- At the start of course, the course delivery pattern, prerequisite of the subject will be discussed
- Lecture may be conducted with the aid of multi-media projector, black board, OHP etc. & equal weightage should be given to all units while conducting teaching & examination.
- Attendance is compulsory in lectures and Tutorial.
- Viva Voce will be conducted at the end of the semester of 30 Marks.
- One internal exam of 30 marks is conducted as a part of Mid semester evaluation.

STUDENTS LEARNING OUTCOMES:
At the end of the course
   The students will gain an insight to various experimental and data analysis techniques be applied in the field of engineering

Reference Books:
1. Holman, J.P.: Experimental Methods for Engineers, McGraw Hill Int., New York.
2. Venkatesh, V.C., and Chandrasekharan, Experimental Methods in Metal Cutting, Prentice Hall of India, Delhi.
3. Davis, O.V. The Design and Analysis of Industrial Experiments, Longman, London.
4. Box and Jenkins; Time Series analysis, Forecasting and control, Holden Day, Sanfrancisco.
5. Dove and Adams, Experimental stress analysis and motion measurement, Prentice Hall of India, Delhi.
6. Tapan P. Bagchi, Taguchi Methods Explained, Prentice Hall of India, Delhi.