



## FACULTY OF ENGINEERING & TECHNOLOGY

### First Year Master of Engineering

#### Semester II

**Course Code: 102440203**

**Course Title: Experimental Techniques and Instrumentations for Engineers**

**Type of Course: Core Course V**

**Course Objectives: This subject is designed to provide knowledge of different experiment techniques and instruments used for thermal engineering applications.**

#### Teaching & Examination Scheme:

Contact hours per week			Course Credits	Examination Marks (Maximum / Passing)				
Lecture	Tutorial	Practical		Internal		External		Total
				Theory	J/V/P*	Theory	J/V/P*	
3	0	2	4	40/16	20/08	60/24	30/12	150/60

\* J: Jury; V: Viva; P: Practical

#### Detailed Syllabus:

Sr.	Contents	Hours
1	BASIC CONCEPTS Definition of terms, Calibration, System response, Important of experimental analysis, Experiment planning, TAGUCHI method.	3
2	DESIGN OF EXPERIMENT Statistical design of experiments, strategy of experimentation, guideline for designing of experiments, Factorial design, concept of two level, Fractional Factorial design, Analysis of variance.	6
3	ANALYSIS OF EXPERIMENTAL DATA Causes and type of experimental errors, Uncertainty analysis, Statistical analysis of experimental data, Distributions, estimators, confidence levels, sample size, test of hypothesis, Goodness-of-fit test Chauvenet's criteria; Regression analysis, co-relations.	8
4	MEASURING SYSTEMS Selection of measuring system, static & dynamic characteristics, Response of general form of instrument, random and transient input, instrument loading under static and dynamic condition, transducer and sensor, measurement of strain, noise, pressure, temperature, velocity, flow rate, level, speed, force, torque, noise and chemical analyses.	8
5	ADVANCED MEASUREMENT TECHNIQUES Shadowgraph, Schlieren, Interferometer, Laser Doppler Anemometer, Hot wire Anemometer, Telemetry in measurement, Orsat apparatus, Gas Analyzers, Smoke meters, gas chromatography, spectrometry	8



<b>6</b>	<b>CONTROL SYSTEMS</b> Types, block diagrams and performance analysis, signal flow graphs, Hydraulic, Pneumatic and electronic controllers, Transient and steady state response; time domain and Laplace transform representation of P, P + D & P + I control action; frequency response analysis and stability of control systems; applications, Programmable Logical Controllers-programming, applications.	<b>6</b>
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## Suggested Specification table with Marks (Theory) (Revised Bloom's Taxonomy):

Distribution of Theory Marks						R: Remembering; U: Understanding; A: Application, N: Analyze; E: Evaluate; C: Create
R	U	A	N	E	C	
10%	20%	25%	20%	20%	05%	

Note: This specification table shall be treated as a general guideline for students and teachers. The actual distribution of marks in the question paper may vary slightly from above table.

## Reference Books:

1	Mechanical Measurements, T.G. Beckwith, J.H. Lienhard V, R. D. Marngoni, Pearson Publication.
2	Experiments: Planning, Analysis, and Optimization, C. F. Jeff Wu, Michael S. Hamada, Wiley Publication
3	Measurement systems, Application and Design, E O Doebelin, McGraw-Hill
4	Measurements and Instrumentation in Heat Engineering, Prebrashensky V, MIR Publishers.
5	Experimental Methods for Engineers, J P Holman, McGraw-Hill.
6	Instrumentation Devices and Systems, Raman C S, Sharma G R, Mani V S N, McGrawHill.
7	Principles of Measurements and Instrumentation, Morris AS, Prentice Hall of India
8	Measurement Techniques in Heat Transfer, E R G Eckert and Goldsteen, Technovision
9	Mechanical and Industrial Measurements, R K Jain, Khanna Publishers
10	Experimentation and Uncertainty Analysis for Engineers, Huge W Coleman, W Glenn Steele, John Wiley & Sons.

## Course Outcomes (CO):

Sr.	Course Outcome Statements	%weightage
CO-1	Understand the concept and design of various experiment techniques.	18
CO-2	Students able to know the various measuring techniques.	34
CO-3	Understanding of the various control systems.	18
CO-4	Students able to analysis the experimental techniques.	30
CO-5	Click or tap here to enter text.	Click
CO-6	Click or tap here to enter text.	Click
CO-7	Click or tap here to enter text.	Click
CO-8	Click or tap here to enter text.	Click
CO-9	Click or tap here to enter text.	Click
CO-10	Click or tap here to enter text.	Click



## List of Practicals / Tutorials:

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1	To study and understand basic concepts of calibration and importance of experimental analysis.
2	To study about design of experiments and to select appropriate techniques.
3	To perform experiment with any thermal system and to carry out uncertainty analysis for the same.
4	To calibrate and measure temperature using thermocouple, RTD.
5	To carry out calibration of pressure measuring devices: U-tube manometer, pressure gauge.
6	To measure the thermal conductivity of any fluid.
7	To carry out calibration of flow measuring devices: orifice meter, rotameter and venturimeter.
8	To carry out exhaust gas analysis with gas chromatographer.
9	To study and compare various advanced measurement techniques.
10	To study various electronics controllers used in thermal measurements.
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## Supplementary learning Material:

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## Curriculum Revision:

Version:	1
Drafted on (Month-Year):	Apr-20
Last Reviewed on (Month-Year):	Jul-20
Next Review on (Month-Year):	Apr-22