



A) COURSE

Course Id: 5685	Course METROLOGY
---------------------------	-----------------------------------

Class Hours per Week	Lab hours per week	Complementary practices	Credits	Total hour course
3	2	3	8	48 hrs Theory 32 hrs. Lab 80 hrs Total.

B) GENERAL COURSE INFORMATION:

	EE (IEA)	ME (IM)	MME (IMA)	EME (IME)	MTE (IMT)
Level:	N.A	IV	VII		
Course Type (Required/Elective)		Obligatory	Obligatory		
Prerequisite Course:		Mechanical engineering drafting (5690) Probability and Statistical Inference (5643)	Mechanical engineering drafting (5690) Probability and Statistical Inference (5643)		
CACEI Classification:		CI	CI		

C) COURSE OBJECTIVE

At the end of the course, the student will be capable of:

The student will be able to implement and use the most common engineering methods used to measure and register process parameters, and to estimate the uncertainty and traceability together with the application of verification methods.

D) TOPICS (CONTENTS AND METHODOLOGY)

1. Basics		10 Hours
Specific Objective:	Objective 1. To know the basic concept and principles used in metrology.	
	1.1. History of metrology and system units. 1.2. Definition of measurement. 1.3. Measurement errors. 1.4. Reproducibility and repeatability. 1.5. Pattern and reference material. 1.6. Traceability. 1.7. Calibration. 1.8. Uncertainty. 1.9. Metrology and quality.	
Readings and other resources	Books, technical papers, complementary bibliography, internet pages.	
Teaching Methodologies	Course presentations, analysis of concepts, problem solving, collaborative work, traditional exposition, specific practices, learning-orientated projects.	



Learning Activities	Team work activities, homework and discussion, reproduction and repeatability studies, error estimation, uncertainty and calibration. Analysis of readings and power point presentations.
----------------------------	-------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------

2. Electrical and electronic aids		9 Hours
Specific Objective:	Objective 2. To identify the elements used in electrical and electronics systems, and their relationship with the different measurements.	
	2.1 Transformation of measurement parameters. 2.2 Transducers and amplifiers. 2.3 Registration of the measured value.	
Readings and other resources	Books, technical papers, standards, complementary bibliography, internet pages.	
Teaching Methodologies	Course presentations, learning-orientated problems, collaborative work.	
Learning Activities	Team work activities, homework and discussion, estimations of electrical parameters in an electrical circuit. Analysis of readings and power point presentations.	

3. Measurements of mechanical engineering techniques		15 Hours
Specific Objective:	Objective 3. To apply the measurement units and instruments most commonly used in engineering.	
	3.1. Pressure and fluid level. 3.2. Quantity, speed and flow. 3.3. Strength, time and rotation speed. 3.4. Temperature, humidity and heat flow. 3.5. Analysis of exhaust gases. 3.6. Measurements of sound and vibration.	
Readings and other resources	Books, technical papers, standards, complementary bibliography, internet pages.	
Teaching Methodologies	Course presentations, collaborative work, learning-orientated projects, oriented activities.	
Learning Activities	Team work activities, homework and discussion, noise studies, weight, torque and angular speed measurements. Temperature measurements. Analysis of readings.	

4. Measurement techniques in manufacturing processes		14 Hours
Specific Objective:	Objective 4. To implement different measurement methods and techniques used in manufacturing processes.	
	4.1. Measurements of lengths and angles. 4.2. Measurements of surface quality. 4.3. Measurements in threads. 4.4. Measurement and Testing in gear.	
Readings and other resources	Books, technical papers, standards, complementary bibliography, internet pages.	
Teaching Methodologies	Course presentations, collaborative work, learning-orientated projects.	
Learning Activities	Team work activities, homework and discussion, roughness studies, analysis of geometrical tolerances, thread selection, etc.	

E) TEACHING AND LEARNING METHODOLOGIES

- a) Presentation and explanation of topics in class.
- b) Analysis and synthesis of concepts.
- c) Problem solving.
- d) Power Point presentations (PPT)



- e) Homework and discussion.
- f) Laboratory practices
- g) Exams.

F) EVALUATION CRITERIA:

Evaluation:	Schedule	Suggested Form of Evaluation and weighting	Topics
1 st partial evaluation.	Session 16	33 % Total Evaluation Partial evaluation: Exam 90% , Assignments 10%	1
2 nd partial evaluation.	Session 32	33 % Total Evaluation Partial evaluation: Exam 90% , Assignments 10%	2,3
3 rd partial evaluation.	Session 48	33 % Total Evaluation Partial evaluation: Exam 90% , Assignments 10%	4
Ordinary final evaluation		100% (Average value of the partial evaluations)	
Others activities:	Metrology laboratory and practices		
Second chance final exam	Week 17 of the semester in progress	100% Exam	100% topics
Third chance final exam	According to Secretary school setting	100% Exam	100% topics
Regularization Exam	According to Secretary school setting	100% Exam	100% topics

G) BIBLIOGRAPHY AND ELECTRONIC RESOURCES

Main bibliography

Metrología.
González C., Zeleny, R.
Ed. Mc. Graw Hill. Primera edición.
México 1995. Ilus. 692 páginas.
ISBN:970-10-0370-5

Metrología Dimensional.
Zeleny, R.
Ed. Mc. Graw Hill. Primera edición.
México 1999. Ilus. 510 páginas.
ISBN:970-10-2387-0



Complementary bibliography

Handbook of Mechanical Engineering
DUBBEL,
Edited by W. Beitz and K.-H. Küttner.
English Edition edited by M.J. Shields.
Springer Verlag London Limited 1994.

Measurement, instrumentation and
sensors and book John G.
Westler editor in chief.
1999.

Introduction to
Instrumentation and Measurements.
Robert B. Northrop

Bela G. Liptak (Editor), Instrument Engineers' Handbook,
Fourth Edition: Process Measurement and Analysis

Carro de Vicente-Portela J. Trazabilidad.
Sección de Publicaciones de la ETSII-UPM,
I.S.B.N.:84-7484-140-2. 152 páginas.

JCGM 200:2008. Vocabulario Internacional de Metrología –
Conceptos fundamentales y generales, y términos asociados (VIM) .
1ª edición en Español 2008.

Informatics resources

<http://www.cenam.mx>

<http://www.mitutoyo.com.mx>