Course Specifications

Program on which this course is given:	**Diploma of Applications of Automatic Control of Mech. Power Systems**
Department offering the program:	**Mechanical Power Engineering Department - ACC control Lab**
Department offering the course:	**Mechanical Power Engineering Department - ACC control Lab**
Academic Level:	**Mandatory Course - 1st Term of the Diploma of Graduate Studies**
Date	**1st Term 2015/2016**
Semester (based on final exam timing)	√ Fall ☐ Spring

A- Basic Information

1. Title:	**Instrumentations for Measurements, Tests & Control in Mechanical Power Systems**						**Code:**	**MEP 560**
2. Units/Credit hrs per week:	**Lectures**	**3 Credit hours per week**	**Tutorial**	**--**	**Practical**	**--**	**Total**	**3**

B- Professional Information

1. Course description:

Overall Aims:

This is a mandatory course as one of the 6 mandatory core courses of the Diploma. It is designed to show the closeness and direct relation between measurement and control system. The course shows that system output measurement is a must for any closed-loop control system. The measurement system provides the essential feed-back signal which to be compared with the required set-point in order to produce the input of the system controller. Without doing output measurement, the system shall be an open loop control system. Accuracy &efficiency of control system shall greatly depend on the measurement system.

Course overall aims is to introduce basic measurement definitions–Concept of Calibration, static and dynamic response – Importance of accuracy, error-propagation and uncertainty analysis in experimental data–Methods of statistical analysis and graphical presentation of experimental results – Practical applications of measurement devices, electrical instruments, and signal conditioning devices – Using of Personal Computers in data accusation, processing and analysis during and after experimental measurements. Measurements of pressure, temperature, flow rate, fluid velocity, force. Control of Pressure, temperature, and flow rate.

2. Intended Learning Outcomes of Course (ILOs):

a) Knowledge and Understanding:

Having successfully completed this course, the post-graduate student should have knowledge and understanding of:

-Basics of experimental measurement definitions such as: transducers, uncertainty, accuracy, random or biased errors, various types of hysteresis, impedance matching, ...etc.

-Importance of measurements and feed-back processes in closed-loop automatic control systems.

-Concepts and importance of instrument calibration, static response and dynamic response of a measurement system.

-Uncertainty analysis, Statistical calculations of experimental measurement results/outputs, and graphical data presentation.

-Various types of practical measurement transducers, types of signal conditioning devices, data acquisition hardware and software systems, and data output processing and displaying tools.

-Various equations for experimental error propagation and data uncertainty analysis.

-Structure, function, and theory of different types of transducers and sensors used for measurement of electric signals, pressure, temperature, flow rate, flow velocity, force, ...etc.

b) Intellectual Skills:

Having successfully completed this course, the student should have the ability to do:

-Select & apply appropriate mathematical, and technical optimum methods to design, model and analyze measurement problems relevant to automatic control systems.

-Verify accuracy & validity of calibration different types of transducers and measurement device

-Search for scientific & technical information and adopt control self-learning capabilities.

	- Analyze and compare the performance and time response of different types of transducers and measurement devices. **-Compare between practical measurement devices, transducers and several methods for signal conditioning, data acquisition, and different output displaying and processing systems.** **-Solve numerical examples on uncertainty analysis&error propagation in measurement systems.** **- Study, describe, and compare between different methods for measurement of pressure, temperature, flow rate, flow velocity, and force ...etc.**
	c) Professional and Practical Skills: **Having successfully completed this course, the student should have the ability to do:** **-Identify several types of measurement problems which are essential for operation and control of mech. power systems and energy transfer processes.** **-Performprofessionaldesignfordifferentmeasurement&data acquisition/processing systems.** **-Use, apply & calibrate different types of measurement & data acquisition/processing systems.** **-Diagnose accuracy, uncertainty, and error propagation problems of measurement & signal conditioning devices.** **-Assess performance & Compare the technical specifications of different types of measurement and data acquisition and processing systems.** **-Suggest possible alternatives for various types of transducers and measurement devices.**
	d) General and Transferable Skills: **Having successfully completed this course, the student should have the ability to do:** **-Perform engineering calculations, draw feed-back control circuits, block diagrams, graphical presentation of experimental data, and perform data-regression analysis.** **-Transfer knowledge, Work in group, & Communicate in written & oral forms, in English.** **- Use IT& evolutionary technological tools& PC applications (Excel, Mat lab, Virtual labs, .etc).** **- Prepare&write reports,Manipulate&sort data, Think logically, and continuous self-E-learning.** **- Identify practical problems, compare between different technologies for measurement systems.** **-Organise & manage time & resources effectively; for short-term and longer-term commitments.**

3. Contents

Topics:	Total hrs	Lectures hours	Tutorial/ Practical hrs
-Introduction to basic definitions of instrumentation and engineering measurement –Definitions of accuracy, error-propagation & performing uncertainty analysis of output data experimental measurements. **-Concept and importance of calibration, types of calibration methods, static and dynamic responses.** **–Mathematical methods of statistical analysis and graphical presentation of experimental results** **–Typical examples&Practicalapplications of measurement transducers, devices, electrical instruments, and signal conditioning devices.** **–Using of Personal Computers in data accusation, processing & analysis during and after experimental measurements.** **-Methods, transducers and devices used for measurement of pressure, temperature, flow rate, fluid velocity, force.** **-Control of Pressure, temperature, and flow rate.**	**42 hrs**	**3hrs/week for 14 weeks before the final term exam**	---

4. Teaching and Learning Methods

Lectures	Practical/ Training	Seminar/ Workshop	Class Activity	Case Study	Projects	Laboratory	E-learning	Assignments /Homework	Other: Submitting reports
(√)	( )	( )	(√)	(√)	( )	( )	(√)	(√)	

5. Student Assessment Methods	
Assessment Schedule	**Week**
-Assessment 1; Report # 1–Measurements-Concepts	Week # 1
-Assessment 2; Report # 2–Measurements-Systems	Week # 3
-Assessment 3; Report # 3–Measurements-Experimental Planning	Week # 5
-Assessment 4; Report # 4–Measurements-Uncertainity Analysis	Week # 7
-Assessment 5; Report # 5–Measurements-Statistical Analysis	Week # 9
-Assessment 6; Report # 6–Measurements-Data Acquisition	Week # 10
-Assessment 7; Report # 7–Measurements- Electrical measurement	Week # 11
-Assessment 8; Report # 8–Measurements- Transducers	Week # 12
-Assessment 9; Report # 9–Measurements- General course Report	Week # 14

- **Weighting of Assessments**

-All in-term works and Reports	30%
-Final-term formal, written Examination	70%
-Project	--
-Class Test	--
-Presentation	--
-Total	100%

6. List of References:

1- J. P. Holman, "Experimental Methods for Engineers", McGraw-Hill Book, Inc. 1978.
2-E. L.Upp&Paul J. LaNasa, "Fluid Flow Measurement- A practical guide to accurate Flow measurement", Gulf Professional Publishing Company, 2nd edition 2002.

7. Facilities Required for Teaching and Learning: Data Show and Laptop Computer

Course Coordinator:	Associate Professor Dr. Mohsen S. Soliman
Head of Department:	Professor Ashraf S. Sabery