



## COURSE DETAILED SYLLABUS

### 1. Course name and type:

MEP 365: THERMAL ENGINEERING MEASUREMENTS, Required course

### 2. Course Instructor

<i>Dr. Omar M. Al-Rabghi</i>	
Office	24F31A, Engineering Building 40

### 3. Course Information

#### Class Time/Place

Lectures: Sun., Tue, and.: 11:00-12:15 **Location:**

Laboratory: Thu. (11:00-12:40) **Location:** Thermal measurement Lab. (L4A05-1), Ground floor, Engineering Building 40.

### 4. Catalog course description:

Thermal Engineering Measurements (3: 2, 3) Introductions on the use of computers on the Lab., Error analysis, Temperature measurement, Pressure measurement, Flow measurement (Mass flow rate, velocity, flow visualization), Torque, Speed, Power Measurements, Introduction to Data Acquisition Systems, Experiments for basic and comparative calibration of different instruments and their applications.

### 5. Prerequisite:

MEP 261 Thermodynamics I, MEP 290 Fluid Mechanics, and EE251 Intro. to Electric Eng., IE255 Engineering Economy

### 6. Textbooks and/or other Required Material:

1. R. S. Figliola and D. E. Beasley, **Theory and Design for Mechanical Measurements**, John Wiley & Sons, Inc., 5<sup>th</sup> Ed., NY, 2011, or 6<sup>th</sup> edition 2015, or 7<sup>th</sup> edition 2019.
2. Lab. handouts can be downloaded from the course web site.

### 7. Additional References

1. Holman J.P., **Experimental Methods for Engineers**, Eighth Edition, McGraw-Hill, 7<sup>th</sup> Edition, 2012.



2. Beckwith, T. G., R. D., Marangoni, J. H. Lienhard V, **Mechanical Measurements**, 6<sup>th</sup> edition, Pearson Publication, 2006.

3. Doebelin, E. O., **Measurement systems: Application and Design**, McGraw-Hill, 4<sup>th</sup> edition, 1990.

٤-عالية، محمد و محمد ابوزنطة، " أجهزة الاستشعار و تطبيقاتها" مكتبة المجتمع العربي للنشر، عمان، الاردن،

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## 8. Course topics and Course Learning Outcomes:

**Table A-1.** Course topics and Course Learning Outcomes

Topics Covered	Course Learning Outcomes: (Students will be able to)
Measurements systems Probability and Statistics	CLO_1: Explain general measurement system, calibration and standards. Apply statistics and probability concepts
Error, uncertainty analysis and presentation of data	CLO_2: Apply uncertainty analysis on a measurement system & error propagation
Temperature measurements	CLO_3: Describe temperature measurements techniques as well as to explain their physical principals.
Pressure measurements	CLO_4: Describe pressure measurements techniques as well as to explain their physical principals.
Flow measurements	CLO_5: Describe flow measurements techniques as well as to explain their physical principals.
Strain Torque, Speed, Power Measurements	CLO_6: Describe strain force, torque, rotational speed and power measurements techniques as well as to explain their physical principals.
Data Acquisition System	CLO_7 Describe the basic components of DAQ and its component functions
Conducting Experiments	CLO_8 Conducting lab. experiments related to the course measurement variables (such T,P,V), and prepare technical reports
Design experiment	CLO_9: Be able to design an experiment, choose sensors, carry on experimental procedure and analyze results

## 9. Grading Distribution

- Homework 00%
- Quizzes 25%
- Lab. Reports 10%
- Mid-Term Exam 20%
- Term Design Project 10%
- Final Exam 35%

## 10. Computer Usage

- To prepare Lab. & project reports
- Data acquisitions software programming



- Internet search for related topics
- Use of Excel

### 11. Laboratory Experiments

Students will carry experiments and calibration on thermal measurements. Students should prepare a lab. report. Topics of the experiments are:

1. Temperature, pressure, and flow measurements
2. Data collection and analysis
3. Technical report writing
4. Data acquisition system.

### 12. Term Projects

A term project covering the topics of this course is also requested with an oral presentation and a written report.

### 13. Contribution of course to meeting the professional component:

As estimated by the faculty member who prepared this course description:

*Engineering science* : 65%  
*Engineering design* : 35%

### 14. Relationship of this course to Student Outcomes (SO):

**Table A-2.** Relationship of the course to student outcomes

MEP 365	Student Outcomes						
	1	2	3	4	5	6	7
					<b>K</b> <b>(F)</b>	<b>K</b> <b>(S)</b>	

Outcome 5: An ability to function effectively on a team work  
 Outcome 6: An ability to develop and conduct experimentation

K: Key outcome, F: Formative assessment, S: Summative assessment.

### 15. Person Who Prepared This Description and Date of Preparation:

Dr. Omar M. Al-Rabghi, (Email: [orabghi@kau.edu.sa](mailto:orabghi@kau.edu.sa)) Updated: Aug. 2021.

16. **Course website:** <http://orabghi.kau.edu.sa/>



MEP 365 Course Syllabus

Textbook: Theory and Design for Mechanical Measurements, by R. Figliola & D. Beasley, Wiley, 5th Edition, 2011.

#	Ch.	Title	Excluded parts	
				Pages
1	1	Basic Concepts of Measurement methods	None	
2	2	Statics and dynamic characteristics of signals	2.5 Fourier transform and frequency spectrum	63-70
3	3	Measurement system behavior	3.4 to end of chapter	104-110
4	4	Probability and Statistics	Pooled statistics, 4.5 CHI-squared distribution 4.9 Monte Carlo Simulation	134 135-139 150-151
5	5	Uncertainty Analysis	5.9 Correction for correlated systematic errors 5.10 Harmonization	190-197 197-198
6	8	Temperature measurements	None	
7	9	Pressure and velocity measurements	9.8 Design and Installation: Transmission effects	401-405
8	10	Flow measurements	Coriolis flow meters	456-459
9	11	Strain measurement	Sec. 11.6 to end & p. 432-433	482-end
10	12	Mechatronics: Sensors, Actuators, and Control	See table below	
11	7	Sampling, Digital Devices, and Data Acquisition	See table below	

**Included and excluded parts in Ch.12**

Subject	pages	Excluding
Angular velocity measurements	522-525	-
Force measurement	525-529	-
Torque measurement	529-530	-
Mechanical power measurements	530-533	-

**Included and excluded parts in Ch.7**

Subject	pages	Excluding
7.1 Introduction	260	None
7.2 Sampling Concepts	261-263	Alias Frequency to the end of section
7.3 Digital devices: Bit and words	269-271	None
7.4 Transmitting digital numbers:	271	None
7.5 Voltage measurements	271-279	Ramp (integration) Converters to the end of section
7.6 Data-Acquisition Systems	283-284	None
7.7 Data-Acquisition System Components	284-288	None