Course Specifications

Program(s) on which this course is given:	Aerospace Engineering
Department offering the program:	Aerospace Engineering Department
Department offering the course:	Aerospace Engineering Department
Academic Level:	Master of Science
Date	September 2014 to December 2014
Semester (based on final exam timing)	☒ Fall ☐ Spring

A- Basic Information

1. Title:	Experimental Methods in Aerospace Engineering			**Code:**		AER 602		
2. Units/Credit hours per week:	Lectures	2	Tutorial	0	Practical	0	Total	2

B- Professional Information

1. Course description:	This course aims at teaching the theoretical background and practical technicalities necessary to design and implement experiments for measuring static and dynamic properties, with emphasis on structural, aerodynamic, propulsion and control properties. This covers measurement system calibration, response, statistical error analysis and electronic data acquisition.
2. Intended Learning Outcomes of Course (ILOs):	**a) Knowledge and Understanding**
	1) Know the advanced structure, aerodynamics, thermodynamics and propulsion systems experiments techniques.
	2) Know the elements and concepts of a measurement system
	3) Know properties describing and factors affecting a static measurement
	4) Know different types of measurement errors
	5) Understand the basics of Fourier analysis and signal processing
	6) Understand the elements of electronic data acquisition
	7) Understand a resistance-based-sensor design and operation
	b) Intellectual Skills
	8) Use principles and concepts in solving problems
	9) Calculate measuring error
	10) Calculate the continuous and discrete Fourier transform of signals
	11) Design experiment parameters for least errors and maximum precision and resolution
	12) Practice simple static experiment design and operation
	13) Practice using resistance based sensors
	14) Practice complex dynamic experiment design and operation
	c) Professional and Practical Skills
	d) General and Transferable Skills
	15) Work in team
	16) Write reports
	17) Analyze results and reach conclusion

3. Contents

Topic	Total hours	Lectures hours	Tutorial/ Practical hours

Introduction to experimental methods	2	2	
Static measurements	2	2	
Experiment 1; Calibration of Pressure Transducer	2		2
Dynamic Measurements: Signal Processing Basics	8	6	2
Resistance Measurement	2	2	
Electronic Data Acquisition	4	3	1
Experiment 2; Strain Measurement	2		2
Experiment 3; Natural frequency measurement	2		2
4. Teaching and Learning Methods	Lectures (√)	Practical Training/ Laboratory (√)	Seminar/Workshop ( )
	Class Activity ( )	Case Study (√)	Projects (√)
	E-learning (√)	Assignments /Homework (√)	Other:

5. Student Assessment Methods

• **Assessment Schedule**	**Week**
-Assessment 1; Report Assignment	1
-Assessment 2; Report Assignment	2
-Assessment 3; Report Assignment	3
-Assessment 4; Report Assignment	4
-Assessment 5; Experiment	5
-Assessment 6; Report Assignment	6
-Assessment 7; Report Assignment	7
-Assessment 8; Experiment	8
-Assessment 9; Report Assignment	9
-Assessment 11; Experiment	10
-Assessment 12; Final Exam	15
-Assessment 13; Project	16
• **Weighting of Assessments**	
-Project	15
-Final-term Examination	70
-Reports/Practical/laboratory work	10.5
-Class Attendance	4.5
-Total	100

6. List of References

1) R. S. Figliola and D. E. Beasley, Theory and Design for Mechanical Measurements, John Wiley and Sons, 5th ed., 2010.

2) K. Shin and J. K. Hammond, Fundamentals of Signal Processing for Sound and Vibration Engineers, John Wiley & Sons, 2008.

3) National Instruments, LabView data acquisition basics manual,

4) Brüel & Kjær lecture notes, Vibration Transducers & Signal conditioning.

7. Facilities Required for Teaching and Learning

Projector, white board, Aerodynamics laboratory (air compressor, pressurized air tank, pressure gauge, pressure sensor, signal conditioner and electronic data acquisition system), Advanced materials laboratory, strain gauges, test specimens, strain amplifier, oscilloscope, data acquisition system, Modal analysis laboratory (Signal analyzer, multichannel dynamic data acquisition, vibration sensors (accelerometers), force transducers, programmable function generators, shakers, impact hummer, test structure, data acquisition/analysis software, experimental modal analysis software), Arduino microcontroller, signal conditioning circuits, …

Course Coordinator:	**Dr. Ahmed Mohamed Rashed Desoki**
Head of Department:	**Prof. Ayman Hamdy Kassem**