SYLLABUS

1. **Course name:** Electrical Measurement and Instruments
2. **Course code:** EMIN330244
3. **Credits:** 3 (3/0/6)
   Duration: 15 weeks (45h main course and 90h self-study)
4. **Instructors:**
   1- Truong Van Hien, MEng
   2- Nguyen Thi Ngoc Thao, MEng
   3- Le Thi Thanh Hoang, MEng
5. **Course conditions**
   Prerequisites: Electrical Circuits
   Corequisites: Basic electronics
6. **Course description**

This course provides students the underpinning knowledge of electrical measurement; types of indicators; the principles and techniques used in measurement of electrical parameters including voltage, current, capacitance, inductance, frequency, phase, power, electrical energy, power factor. In addition, students will learn the structures and operational principles of instruments.

7. **Course Goals**

Goals	***Goal description*** *(This course provides students:)*	ELOs
G1	An ability to apply basic knowledge of mathematics, science and engineering in the field of the measurements and instruments.	01 (H)
G2	An ability to analyze, explain, calculate and design the measurement circuits.	02 (M)
G3	An ability to apply the measurement techniques to design and operate electrical measurement systems.	07 (M)
G4	An ability to conduct standard tests and measurements	10 (M)

** Note: High: H; Medium: M; Low: L*

8. **Course Learning Outcomes (CLOs)**

CLOs		***Description*** *(After completing this course, students can have:)*	Outcome
	G1.1	the ability to understand the underpinning knowledge of electrical measurement	01
	G1.2	the ability to analyse and evaluate measurement errors	01
	G1.3	the ability to apply the measurement techniques and explain the measurement circuits	02 05

	G1.4	the ability to understand the structures and operations of measuring instruments	02 05
G2	**G2**	the ability to analyze, calculate and design the electrical measurement circuits.	02
	G3.1	the ability to apply the measurement techniques to operate electrical measurement systems	07 05
	G3.2	the ability to design electrical measurement systems in industrial applications	07
G4	**G4**	the ability to conduct standard tests and measurements	10

9. Study materials

- Textbooks:

[1] Nguyen Ngoc Tan, Ngo Van Ky, *Ky thuat đo*, NXB Đại học Quốc gia 2012.

- References:

[2] Pham Thuong Han – Nguyen Trong Que - Nguyen Van Hoa, *Ky thuat đo luong cac đai luong vat ly*, NXB Giáo Dục, 1996.

[3] Vu Quy Điem, Pham Van Tuan, Đo Le Phu, *Co so ky thuat đo luong đien tu,* NXB Khoa hoc va ky thuat, 2004.

[4] S Tumanski, *Principles of electrical measurement*, Taylor & Francis Group, 2006.

10. Sudent Assessments

- Grading points: 10

- Planning for students assessment is followed:

Type	Contents	Linetime	Assessment techniques	CLOs	Rates (%)
Midterms					**50**
Exam01	Chapters: 1 to 2	Week 5	Individual paper assessment in class	G1.1, G1.3	15
Exam02	Chapters: 3 to 4	Week 9	Individual paper assessment in class	G1.2, G1.3 G1.4, G2	15
Exam03	Chapters: 5 to 6	Week 13	Individual paper assessment in class	G1.4, G3.1 G4	20
Final exam					**50**
	- The exam covers all contents related to the expected learning outcomes of the course.		Individual paper assessment in class	G1.1, G1.2, G1.3, G2, G1.4, G3.1, G3.2, G4	

11. Course details:

Weeks	Contents	CLOs
	Chapter 1: THE CONCEPTS OF MEASUREMENT *(6/0/12)*	
	A/ **Contents and teaching methods***: (3)* **Contents:** 1.1 Common concepts 1.2 Objects 1.3 Measurement Units 1.4 Functions and characteristics of instruments 1.5 The structure diagram of instrument **Teaching methods**: + Theoretical lectures + Questions	G1.1
	B/ **Self-study contents**: *(6)* + Types of instruments + Measurement standards	G1.1
	Chapter 1: THE CONCEPTS OF MEASUREMENT **(cont.)** *(6/0/12)*	
	A/ **Contents and teaching methods***: (3)* **Contents:** 1.6 Measurement standardizations 1.7 Measurement errors 1.8 Multi-channel measuring system 1.9 Exercises **Teaching methods**: + Theoretical lectures + Questions	G1.2 G3.1
	B/ **Self-study contents**: *(6)* + Measurement system applications + Exercises	G1.2 G3.1
	Chapter 2: INDICATORS *(6/0/12)*	
	A/ **Contents and teaching methods***: (3)* **Contents:** 2.1 Electromechanical indicators 2.2 Moving coil meters 2.3 Moving iron meters 2.4 Electrodynamic meters **Teaching methods**: + Theoretical lectures + Questions	G1.4
	B/ **Self-study contents**: *(6)* + Types of indicators	G1.4

	+ Moving coil logomet, Moving iron logomet, electrodynamic iron.	
	***Chapter 2: INDICATORS* (cont.)** *(6/0/12)*	
	A/* Contents and teaching methods: (3)* **Contents:** 2.5 Induction-type meters 2.6 Digital meters 2.7 Recorder meters **Teaching methods**: + Theoretical lectures + Questions	G1.4
	***B/* Self-study contents**: *(6)* + Number systems + 7-segment Led, Liquid Crystal Display	G1.4
	Chapter 3: CURRENT AND VOLTAGE MEASUREMENT *(6/0/12)*	
	A/* Contents and teaching methods: (3)* **Contents:** 3.1 DC current measurement 3.2 AC current measurement 3.3 DC voltage measurement 3.4 AC voltage measurement 3.5 DC voltage measurement using electronic voltmeters **Teaching methods**: + Theoretical lectures + Questions	G1.3 G2 G3.2 G4
	***B/* Self-study contents**: *(6)* + Current transformers. + Potential transformers	G1.3 G2
	***Chapter 3: CURRENT AND VOLTAGE MEASUREMENT* (cont.)** *(6/0/12)*	
	A/* Contents and teaching methods: (3)* **Contents:** 3.6 AC voltage measurement using electronic voltmeters 3.7 DC and AC current measurement using electronic ammeters 3.8 Digital voltmeters 3.9 Exercises **Teaching methods**: + Theoretical lectures + Questions	G1.3 G1.4 G2 G4
	***B/* Self-study contents**: *(6)* + Digital to analog conversion + Counters and decoders	G1.3 G1.4

7	***Chapter 4: RESISTANCE MEASUREMENT*** *(6/0/12)*	
	A/ **Contents and teaching methods***: (3)* **Contents:** 4.1 Voltmeter–ammeter method 4.2 Ohmmeter method for measuring resistance 4.3 Wheatstone bridge method for measuring resistance 4.4 Balance Kelvin's Double-Bridge **Teaching methods**: + Theoretical lectures + Questions	G2 G1.4 G4
	B/ **Self-study contents**: *(6)* + Types of resistors + Application of Wheatstone Bridge	G2
	Chapter 4: RESISTANCE MEASUREMENT **(cont.)** *(6/0/12)*	
	A/ **Contents and teaching methods***: (3)* **Contents:** 4.5 Measurement of high resistance 4.6 Measurement of earth resistance 4.7 Exercises **Teaching methods**: + Theoretical lectures + Questions	G2 G1.4 G4
	B/ **Self-study contents**: *(6)* + High resistance + Earth resistance	G2 G1.4
	Chapter 5: CAPACITANCE AND INDUCTANCE MEASUREMENT *(3/0/6)*	
	A/ **Contents and teaching methods***: (3)* **Contents:** 5.1 Capacitance and inductance measurement using voltmeter–ammeter method 5.2 Capacitance and inductance measurement using AC bridges 5.3 Exercises **Teaching methods**: + Theoretical lectures + Questions	G2 G1.4 G4
	B/ **Self-study contents**: *(6)* + Capacitor, inductor + Types of AC bridges	G2
	Chapter 6: POWER AND ENERGY MEASUREMENT *(6/0/12)*	

	A/* Contents and teaching methods: (3)* **Contents:** 6.1 Power measurement in DC circuits 6.2 Power measurement in single-phase AC circuits 6.3 Power measurement in three-phase AC circuits 6.4 Reactive power measurement in single-phase AC circuits 6.5 Reactive power measurement in three-phase AC circuits **Teaching methods**: + Theoretical lectures + Questions	G1.3 G1.4 G3.2 G4
	***B/* Self-study contents**: *(6)* + Power types in DC and AC circuits + Three-phase AC circuits	G1.3 G1.4
	***Chapter 6: POWER AND ENERGY MEASUREMENT* (cont.)** *(6/0/12)*	
	A/* Contents and teaching methods: (3)* **Contents:** 6.6 Energy measuremenrt in single-phase AC circuits 6.7 Energy measuremenrt in three-phase AC circuits 6.8 Energy measuremenrt using electronic-type energy-meter 6.9 Exercises **Teaching methods**: + Theoretical lectures + Questions	G1.3 G1.4 G3.2 G4
	***B/* Self-study contents**: *(6)* + Induction-type indicators + Electronic-type energy-meter	G1.3 G3.2
	Chapter 7: FREQUENCY AND POWER FACTOR MEASUREMENT *(6/0/12)*	
	A/* Contents and teaching methods: (3)* **Contents:** 7.1 Frequency measurement using indirect methods 7.2 Electrodynamometer-type frequency meter 7.3 Frequency measurement using Wien's bridge 7.4 Digital frequency meter **Teaching methods**: + Theoretical lectures + Questions	G1.3 G1.4 G4
	***B/* Self-study contents**: *(6)* + Resonance frequency meter + Electronic frequency meter	G1.3

13	***Chapter 7: FREQUENCY AND POWER FACTOR MEASUREMENT*** **(cont.)** *(6/0/12)*	
	A/ **Contents and teaching methods***: (3)* **Contents:** 7.5 Power factor measurement using wattmeter, voltmeter and ammeter 7.6 Single-phase electrodynamometer-type power factor meter 7.7 Three-phase electrodynamometer-type power factor meter 7.8 Digital phazometer **Teaching methods**: + Theoretical lectures + Questions	G1.3 G1.4 G4
	B/ **Self-study contents**: *(6)* + Phase shift and power factor + Electronic phazomet	G1.3
	Chapter 8: OSCILLOSCOPE *(6/0/12)*	
	A/ **Contents and teaching methods***: (3)* **Contents:** 8.1 Cathode Ray Tube 8.2 Block diagram of an oscilloscope 8.3 Dual channel oscilloscope **Teaching methods**: + Theoretical lectures + Questions	G1.4
	B/ **Self-study contents**: *(6)* + Sampling oscilloscope	G1.4
	Chapter 8: OSCILLOSCOPE **(cont.)** *(6/0/12)*	
	A/ **Contents and teaching methods***: (3)* **Contents:** 8.4 Digital oscilloscope 8.5 Applications of an oscilloscope 8.6 Review **Teaching methods**: + Theoretical lectures + Questions	G1.3 G1.4
	B/ **Self-study contents**: *(6)* + Reinforce the knowledge learned	G1.1, G1.2, G1.3, G2, G1.4, G3.1, G3.2, G4

12. Learning ethics:

Home assignments must be done by the students themselves and not copied or plagiarized from any source. Plagiarism found in the assessments will get zero point.

13. First approved date: August 01 2012

14. Approval level:

Dean	Department	Instructor

15. Syllabus updated process

1st time: Updated content dated	Instructors Head of department
2st time: Updated content dated	Instructors Head of department