

# 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- M.Eng. Truong Van Hien
- 2- M.Eng. Nguyen Thi Ngoc Thao
- 3- M.Eng. Le Thi Thanh Hoang

**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	<i>Goal description</i> (This course provides students:)	ELOs
<b>G1</b>	An ability to apply basic knowledge of mathematics, science and engineering in the field of the measurements and instruments.	1.1, 1.2
<b>G2</b>	An ability to analyze, explain, calculate and design the measurement circuits.	2.2
<b>G3</b>	An ability to apply the measurement techniques to design and operate electrical measurement systems.	4.6
<b>G4</b>	An ability to conduct standard tests and measurements.	4.1

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

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

CLOs		<i>Description</i> (After completing this course, students can have:)	Outcome
<b>G1</b>	<b>G1.1</b>	the ability to understand the underpinning knowledge of electrical measurement.	1.1, 1.2

	<b>G1.2</b>	the ability to analyse and evaluate measurement errors.	1.1, 1.2
	<b>G1.3</b>	the ability to apply the measurement techniques and explain the measurement circuits.	1.1, 1.2
	<b>G1.4</b>	the ability to understand the structures and operations of measuring instruments.	1.1, 1.2
<b>G2</b>	<b>G2</b>	the ability to analyze, calculate and design the electrical measurement circuits.	2.2
<b>G3</b>	<b>G3.1</b>	the ability to apply the measurement techniques to operate electrical measurement systems.	4.6
	<b>G3.2</b>	the ability to design electrical measurement systems in industrial applications.	4.6
<b>G4</b>	<b>G4</b>	The ability to conduct standard tests and measurements.	4.1

## 9. Study materials

### - Textbooks:

[1] Nguyen Ngoc Tan, Ngo Van Ky, *Ky thuat do-tap 1*, NXB Dai hoc Quoc gia TP.HCM 2010.

### - References:

[1] Pham Thuong Han, Nguyen Trong Que, Nguyen Van Hoa, Nguyen Thi Van, *Ky thuat do luong cac dai luong vat ly-tap 2*, NXB Giao Duc, 2009.

[2] Vu Quy Diem, Pham Van Tuan, Do Le Phu, *Co so ky thuat do luong dien tu*, NXB Khoa hoc va ky thuat, 2004.

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

## 10. Student Assessments

- Grading points: 10

- Planning for students assessment is followed:

Type	Contents	Linetime	Assessment techniques	CLOs	Rates (%)
<b>Midterms</b>					<b>50</b>
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
<b>Final exam</b>					<b>50</b>
	- 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
1	<b>Chapter 1: &lt;THE CONCEPTS OF MEASUREMENT&gt; (6/0/12)</b>	
	<b>A/ Contents and teaching methods: (3)</b> <b>Contents:</b> <ul style="list-style-type: none"> <li>1.1 Common concepts.</li> <li>1.2 Objects.</li> <li>1.3 Measurement Units.</li> <li>1.4 Functions and characteristics of instruments.</li> <li>1.5 The structure diagram of instrument.</li> </ul> <b>Teaching methods:</b> <ul style="list-style-type: none"> <li>+ Theoretical lectures; questions.</li> </ul>	G1.1
	<b>B/ Self-study contents: (6)</b> <ul style="list-style-type: none"> <li>+ Types of instruments.</li> <li>+ Measurement standards.</li> </ul>	G1.1
2	<b>Chapter 1: &lt;THE CONCEPTS OF MEASUREMENT (cont.)&gt; (6/0/12)</b>	
	<b>A/ Contents and teaching methods: (3)</b> <b>Contents:</b> <ul style="list-style-type: none"> <li>1.6 Measurement standardizations.</li> <li>1.7 Measurement errors.</li> <li>1.8 Multi-channel measuring system.</li> <li>1.9 Exercises.</li> </ul> <b>Teaching methods:</b> <ul style="list-style-type: none"> <li>+ Theoretical lectures; questions.</li> </ul>	G1.2 G3.1
	<b>B/ Self-study contents: (6)</b> <ul style="list-style-type: none"> <li>+ Measurement system applications.</li> <li>+ Exercises.</li> </ul>	G1.2 G3.1
3	<b>Chapter 2: &lt;INDICATORS&gt; (6/0/12)</b>	
	<b>A/ Contents and teaching methods: (3)</b> <b>Contents:</b> <ul style="list-style-type: none"> <li>2.1 Electromechanical indicators.</li> <li>2.2 Moving coil meters.</li> <li>2.3 Moving iron meters.</li> <li>2.4 Electrodynamical meters.</li> </ul> <b>Teaching methods:</b> <ul style="list-style-type: none"> <li>+ Theoretical lectures; questions.</li> </ul>	G1.4
	<b>B/ Self-study contents: (6)</b> <ul style="list-style-type: none"> <li>+ Types of indicators.</li> </ul>	G1.4

	+ Moving coil logomet, Moving iron logomet, electrodynamic iron.	
4	<b>Chapter 2: &lt;INDICATORS (cont.)&gt; (6/0/12)</b>	
	<b>A/ Contents and teaching methods: (3)</b> <b>Contents:</b> 2.5 Induction-type meters. 2.6 Digital meters. 2.7 Recorder meters. <b>Teaching methods:</b> + Theoretical lectures. + Questions.	G1.4
	<b>B/ Self-study contents: (6)</b> + Number systems. + 7-segment Led, Liquid Crystal Display.	G1.4
5	<b>Chapter 3: &lt;CURRENT AND VOLTAGE MEASUREMENT&gt; (6/0/12)</b>	
	<b>A/ Contents and teaching methods: (3)</b> <b>Contents:</b> 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. <b>Teaching methods:</b> + Theoretical lectures. + Questions.	G1.3 G2 G3.2 G4
	<b>B/ Self-study contents: (6)</b> + Current transformers. + Potential transformers.	G1.3 G2
6	<b>Chapter 3: &lt;CURRENT AND VOLTAGE MEASUREMENT (cont.)&gt; (6/0/12)</b>	
	<b>A/ Contents and teaching methods: (3)</b> <b>Contents:</b> 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. <b>Teaching methods:</b> + Theoretical lectures. + Questions.	G1.3 G1.4 G2 G4
	<b>B/ Self-study contents: (6)</b> + Digital to analog conversion.	G1.3 G1.4

	+ Counters and decoders.	
7	<b>Chapter 4: &lt;RESISTANCE MEASUREMENT&gt; (6/0/12)</b>	
	<b>A/ Contents and teaching methods: (3)</b> <b>Contents:</b> 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. <b>Teaching methods:</b> + Theoretical lectures. + Questions.	G2 G1.4 G4
	<b>B/ Self-study contents: (6)</b> + Types of resistors. + Application of Wheatstone Bridge.	G2
8	<b>Chapter 4: &lt;RESISTANCE MEASUREMENT (cont.)&gt; (6/0/12)</b>	
	<b>A/ Contents and teaching methods: (3)</b> <b>Contents:</b> 4.5 Measurement of high resistance. 4.6 Measurement of earth resistance. 4.7 Exercises. <b>Teaching methods:</b> + Theoretical lectures; Questions.	G2 G1.4 G4
	<b>B/ Self-study contents: (6)</b> + High resistance. + Earth resistance.	G2 G1.4
9	<b>Chapter 5: &lt;CAPACITANCE AND INDUCTANCE MEASUREMENT&gt; (3/0/6)</b>	
	<b>A/ Contents and teaching methods: (3)</b> <b>Contents:</b> 5.1 Capacitance and inductance measurement using voltmeter–ammeter method. 5.2 Capacitance and inductance measurement using AC bridges. 5.3 Exercises. <b>Teaching methods:</b> + Theoretical lectures. + Questions.	G2 G1.4 G4
	<b>B/ Self-study contents: (6)</b> + Capacitor, inductor. + Types of AC bridges.	G2
10	<b>Chapter 6: &lt;POWER AND ENERGY MEASUREMENT&gt; (6/0/12)</b>	

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

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

<b>Dean</b>	<b>Department</b>	<b>Instructor</b>
<b>Assoc. Prof. PhD. Nguyen Minh Tam</b>	<b>PhD. Le My Ha</b>	<b>M.Eng. Truong Van Hien</b>

**15. Syllabus updated process**

<b>1<sup>st</sup> time:</b> Updated content dated:	Instructors  Head of department
<b>2<sup>nd</sup> time:</b> Updated content dated:	Instructors  Head of department