

University of Macau  
Faculty of Science and Technology  
Department of Electrical and Electronics Engineering

**Part A: Course Outline**

Course Title:	Measurement and Instrumentation I		
Course Code:	ELEC251	Year of Study:	2
Compulsory/Elective:	Compulsory		
Course Prerequisites:	None		
Prerequisite Knowledge	Circuit Analysis, fundamental electronics circuits		
Class/Laboratory Schedule:	2-hours lecturer and 2-hours laboratory per week		
Duration	1 semester	Credit Units	3
Text Books and References:	<p>[1] Larry D. Jones / A. Foster Chin, "Electronic Instruments and Measurements", Second Edition, Prentice Hall.</p> <p>[2] Cooper, "Electronic Instrumentation and Measurement Techniques ", Second Edition, Prentice-Hall.</p> <p>[3] David A. Bell, "Electronic Instrumentation and Measurements", Prentice-Hall.</p>		
Course Description:	<p>The ability of electrical and electronics engineering students to make measurements is vital to an understanding of the physical world, especially for electrical sites. Measurement provides us an understanding of electrical phenomena and instruments are tools for measurement. The topics that discussed in this first part of instrumentation and measurement course are: error and data manipulation, DC Ammeter, DC Voltmeters, AC meters Ohmmeters, Multi-meters, bridges, Oscilloscopes and different probes.</p>		
Topics Covered	<ol style="list-style-type: none"> <li>1. Measurement standards; Statistical analysis of error in measurement, instrumentation methods</li> <li>2. DC, AC current meters , Ohmmeter, Multi-meter</li> <li>3. DC potential meter and reference voltage</li> <li>4. DC and AC bridges</li> <li>5. Oscilloscopes and Probes</li> </ol>		
Course Objectives:	<ol style="list-style-type: none"> <li>1. To introduce to students the theory and applications of measurement and instrumentation systems for electrical and electronics engineering, [a, e, k]</li> <li>2. To prepare students to know the characteristics of different instrumentation systems, [a, b, c, d, e]</li> </ol>		
Course Assessment:	<p>Assignments and experiments: 15%, Case Study Report and Presentation:15%, Group Project: 20%, Mid-term Exam. : 25% , Final Exam. : 25%</p>		

<p>Relationship to Program Objectives and Outcomes</p>	<p>This course primarily contributes to EEE program outcomes that develop students abilities to:</p> <ul style="list-style-type: none"> <li>a. Ability to apply knowledge of mathematics, science and engineering.</li> <li>e. Ability to identify, formulate and solve engineering problems.</li> <li>k. Ability to use the techniques, skills and modern engineering tools necessary for engineering practice.</li> </ul> <p>This course secondarily contributes to EEE program outcomes that develop students abilities to:</p> <ul style="list-style-type: none"> <li>b. Ability to design and conduct experiments.</li> <li>c. Ability to design a system, component or process to meet desired needs.</li> <li>d. Ability to function on multidisciplinary teams.</li> <li>g. Ability to communicate effectively</li> </ul>																								
<p>Course Contents and Relationship to Program Criteria:</p>	<table border="1"> <thead> <tr> <th data-bbox="469 819 564 891">Week no.</th> <th data-bbox="564 819 1323 891">Topics</th> <th data-bbox="1323 819 1482 891">Program Criteria</th> </tr> </thead> <tbody> <tr> <td data-bbox="469 891 564 992">2</td> <td data-bbox="564 891 1323 992"> <b>Introduction</b>            A brief look for electrical and electronics measurement purpose and their application, terms, error calculation, limiting error, etc.         </td> <td data-bbox="1323 891 1482 992">PS, DIC, CS, ES, DE, LA, CV, DM</td> </tr> <tr> <td data-bbox="469 992 564 1093">2</td> <td data-bbox="564 992 1323 1093"> <b>Case Study</b>            Manipulation of measurement data, error analysis and detection methods         </td> <td data-bbox="1323 992 1482 1093">PS, DIC, CS, ES, DE, LA, CV, DM</td> </tr> <tr> <td data-bbox="469 1093 564 1227">3</td> <td data-bbox="564 1093 1323 1227"> <b>DC and AC Meter, Ohmmeter</b>            To learn the basic operations of DC and AC meters, to state the difference between d' Arsonval meter and electro-dynamometer, error comparison,         </td> <td data-bbox="1323 1093 1482 1227">DIC, ES, CV</td> </tr> <tr> <td data-bbox="469 1227 564 1339">3</td> <td data-bbox="564 1227 1323 1339"> <b>Multi-meter Group Project</b>            2 students make an multi-meter with proper operations and error analysis         </td> <td data-bbox="1323 1227 1482 1339">DIC, ES, CV</td> </tr> <tr> <td data-bbox="469 1339 564 1451">1</td> <td data-bbox="564 1339 1323 1451"> <b>DC potential meter and reference Voltage Operations of Potentiometer, Ground-reference voltage and floating voltage,</b> </td> <td data-bbox="1323 1339 1482 1451">ES, CV</td> </tr> <tr> <td data-bbox="469 1451 564 1552">1</td> <td data-bbox="564 1451 1323 1552"> <b>DC and Ac Bridges</b>            Operation and calculation of different Dc and AC bridges to measure inductance, capacitance and frequency         </td> <td data-bbox="1323 1451 1482 1552">ES, CV</td> </tr> <tr> <td data-bbox="469 1552 564 1626">2</td> <td data-bbox="564 1552 1323 1626"> <b>Oscilloscopes and Probes</b>            To familiar with oscilloscope operations and selection of probes         </td> <td data-bbox="1323 1552 1482 1626">CS, ES, CV</td> </tr> </tbody> </table>	Week no.	Topics	Program Criteria	2	<b>Introduction</b> A brief look for electrical and electronics measurement purpose and their application, terms, error calculation, limiting error, etc.	PS, DIC, CS, ES, DE, LA, CV, DM	2	<b>Case Study</b> Manipulation of measurement data, error analysis and detection methods	PS, DIC, CS, ES, DE, LA, CV, DM	3	<b>DC and AC Meter, Ohmmeter</b> To learn the basic operations of DC and AC meters, to state the difference between d' Arsonval meter and electro-dynamometer, error comparison,	DIC, ES, CV	3	<b>Multi-meter Group Project</b> 2 students make an multi-meter with proper operations and error analysis	DIC, ES, CV	1	<b>DC potential meter and reference Voltage Operations of Potentiometer, Ground-reference voltage and floating voltage,</b>	ES, CV	1	<b>DC and Ac Bridges</b> Operation and calculation of different Dc and AC bridges to measure inductance, capacitance and frequency	ES, CV	2	<b>Oscilloscopes and Probes</b> To familiar with oscilloscope operations and selection of probes	CS, ES, CV
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<p>Contribution of Course to meet the professional component:</p>	<p>This course prepares students to work professionally in the area of EEE instrumentation fields. Students should be able to apply knowledge of mathematics and engineering, and identify formulas to solve eee measurement and instrumentation engineering problems.</p>																								
<p>Course Instructor(s):</p>	<p>Dr. Han Ying- Duo, Dr. Wong Man-Chung</p>																								
<p>Prepared by:</p>	<p>Dr. Man-Chung Wong</p>																								



**Course Assessment Policy:**

- Homework assignments will be given to students according to the course progress, no late homework is accepted. Zero mark will be given when homework is copied.
- All students must attend the experimental sections and group experimental reports need to hand up within one week after the experiment.
- A case study for measurement will be given and all students need to make a 15 minutes presentation about his case study topic with a summery. .
- A group project will be given and students must design his or her owned hardware system. A hardware testing and a report are needed for assessment.
- 2 students form one group and group report should be handed up.
- 1 mid-term exam and 1 final exam will be performed with 2 hours and 3 hours respectively.