MODULE DESCRIPTION FORM

نموذج وصف المادة الدراسية

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| **Module Information****معلومات المادة الدراسية** |
| **Module Title** | Instrumentation and Measurement | **Module Delivery** |
| **Module Type** | Core | * **☒ Theory**
* **☐ Lecture**
* **☒ Lab**
* **☐ Tutorial**
* **☐ Practical**
* **☐ Seminar**
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| **Module Code** | CET2206 |
| **ECTS Credits**  | 5 |
| **SWL (hr/sem)** | 125 |
| **Module Level** | UGx11 2 | **Semester of Delivery** | 4 |
| **Administering Department** | CET |  **College** | EETC |
| **Module Leader** | Omar Nameer M. Salim |  **e-mail** | omarnmsalim@mtu.edu.iq |
| **Module Leader’s Acad. Title** | Assoc. Professor. | **Module Leader’s Qualification** | M.Sc. |
| **Module Tutor** | Omar Ibrahim Mustafa |  **e-mail** | omar.ibrahim@mtu.edu.iq |
| **Peer Reviewer Name** | Alhamzah Taher Mohammed |  **e-mail** | alhamza\_tm@mtu.edu.iq |
| **Scientific Committee Approval Date** | 29/10/2023 | **Version Number** | 1.0 |

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| **Relation with other Modules****العلاقة مع المواد الدراسية الأخرى** |
| **Prerequisite module** | None | **Semester** |  |
| **Co-requisites module** | None | **Semester** |  |

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| **Module Aims, Learning Outcomes and Indicative Contents****أهداف المادة الدراسية ونتائج التعلم والمحتويات الإرشادية** |
|  **Module Aims****أهداف المادة الدراسية** | 1. Identify and analyze factors affecting the performance of measuring systems and errors types and cause
2. Understand voltage and current measurements from a given circuit.
3. Choose appropriate instruments for the measurement of voltage, and current in ac and dc measurements
4. Describe the operating principle of DC and AC bridges
5. Identify Oscilloscopes, signal generators, and transducers
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| **Module Learning Outcomes****مخرجات التعلم للمادة الدراسية** | 1. Explain the static characteristics of measuring systems.
2. Discuss problems related to measurement errors.
3. Explain the construction and working indicating Instruments.
4. Explain the principle of operation of the galvanometer.
5. Discuss the DC bridges- Wheatstone Bridge, Kelvin Bridge
6. Discuss the AC bridges, Capacitance Comparison Bridges, Maxwell’s Bridge, Wein’s bridge
7. Explain the Design of DC voltmeter and ammeter.
8. Describe Cathode Ray Tube Oscilloscope.
9. Identify High Bandwidth Digital Storage Oscilloscope.
10. Identify Spectrum Analyzer and BER Tester
11. Discuss Signal Generator.
12. Identify Arbitrary Waveform Generator
13. Explain Transducers.
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| **Indicative Contents****المحتويات الإرشادية** | Indicative content includes the following.Part A – Measurement and Error Analysis  Basics of Measurements, Accuracy, Precision, Resolution, Gross errors and systematic errors, Absolute and relative errors, Accuracy, Precision, Resolution, and significant figures, standard of measurements [24 hrs.]Part B – Measuring Instruments Measurement of resistance, inductance, and capacitance Whetstone’s Bridge, Kelvin Bridge; AC bridges, Capacitance Comparison Bridge, Maxwell’s Bridge, Wein’s Bridge, [9 hrs]. **Voltmeters and Ammeters Introduction**, voltmeter, Multirange voltmeter, ammeter, Multirange ammeter Extending voltmeter and ammeter ranges [11hrs]Introduction Oscilloscopes, Basic principles, CRT features, Block diagram and working of each block High Bandwidth Digital Storage Oscilloscope- Spectrum Analyzer -BER Tester [8 hrs] Introduction Signal Generators, Fixed and variable AF oscillator, Standard signal generator Arbitrary Waveform Generator. [4 hrs]Introduction Transducers, Electrical transducers, Selecting a transducer, Resistive transducer [2 hrs] |

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| **Learning and Teaching Strategies****استراتيجيات التعلم والتعليم** |
| **Strategies** | lecture and seminars will be used to explain the theory and principles of the module. Also, laboratory reports and mini-projects will be used. Quantitative instruments such as pre-test and post-test will be used to check students’ conceptual knowledge of electrical measurement after the theory lecture or laboratories work. Video will be used to explain the electrical measurement instruments. Observation form and laboratory rubric will be used to analyze the skills of the students. The observer comments from the laboratory staff on student skills will be classified according to thematic analysis to evaluate students learned skills.  |

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| **Student Workload (SWL)****الحمل الدراسي للطالب موزع على (15) اسبوع** |
| **Structured SWL (h/sem)****الحمل الدراسي المنتظم للطالب خلال الفصل** | 64 | **Structured SWL (h/w)****الحمل الدراسي المنتظم للطالب أسبوعيا** | 4.26 |
| **Unstructured SWL (h/sem)****الحمل الدراسي غير المنتظم للطالب خلال الفصل** | 61 | **Unstructured SWL (h/w)****الحمل الدراسي غير المنتظم للطالب أسبوعيا** | 4.06 |
| **Total SWL (h/sem)****الحمل الدراسي الكلي للطالب خلال الفصل** | 125 |

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| **Module Evaluation****تقييم المادة الدراسية** |
| **As** | **Time/Number** | **Weight (Marks)** | **Week Due** | **Relevant Learning Outcome** |
| **Formative assessment** | **Quizzes** | 2 | 10% (5) | 3, 12 | LO #1, 2, LO # 3-11 |
| **Assignments** | 2 | 10% (5) | 5, 10 | LO # 1-4, LO # 5-9 |
| **Project / Lab.** | 1 | 10% (10) | Continuous |  |
| **Report** | 1 | 10% (10) | 13 | LO # 1- 12 |
| **Summative assessment** | **Midterm Exam** | 2 hr | 10% (20) | 9 | LO # 1-7 |
| **Final Exam** | 4 hr | 50% (50) | 16 | All |
| **Total assessment** | 100% (100 Marks) |  |  |

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| **Delivery Plan (Weekly Syllabus)****المنهاج الاسبوعي النظري** |
| **Week**  | **Material Covered** |
| **Week 1** | Introduction - System of Units- Basics of Measurements |
| **Week 2** | Accuracy, Precision, Resolution |
| **Week 3** | Reliability, Repeatability, Validity |
| **Week 4** | Types of Errors |
| **Week 5** | Errors analysis |
| **Week 6** | Standard of Measurements |
| **Week 7** | Bridge Measurement .DC bridges- Wheatstone Bridge, Kelvin Bridge |
| **Week 8** | AC bridges, Capacitance Comparison Bridges, Maxwell’s Bridge, Wein’s bridge |
| **Week 9** | **Midterm Exam** |
| **Week 10** | Measuring of Basic Electrical Parameters- DC Voltmeter |
| **Week 11** | DC Ammeter- Extension of DC Voltmeter and Ammeter Range |
| **Week 12** | Cathode Ray Tube Oscilloscope  |
| **Week 13** | High Bandwidth Digital Storage Oscilloscope- Spectrum Analyzer -BER Tester |
| **Week 14** | Signal Generator - Arbitrary Waveform Generator |
| **Week 15** | Transducers |

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| **Delivery Plan (Weekly Lab. Syllabus)****المنهاج الاسبوعي للمختبر** |
| **Week**  | **Material Covered** |
| **Week 1** | Lab 1: Introduction to Galvanometer – sensitivity of Galvanometer |
| **Week 2** | Lab 2: measurement of DC current |
| **Week 3** | Lab 3: measurement of DC voltage |
| **Week 4** | Lab 4: measurement of AC current |
| **Week 5** | Lab 5: measurement of AC Voltage |
| **Week 6** | Lab 6: loading effect on the voltmeter |
| **Week 7** | Lab 7: Wheatstone Bridge |
| **Week 8** | Lab 8: Maxwell’s Bridge |
| **Week 9** | Lab 9: **Mid-term Exam**  |
| **Week 10** | Lab 10: DC Voltmeter Design |
| **Week 11** | Lab 11: DC Ammeter Design |
| **Week 12** | Lab 12: Oscilloscope and frequency measurement |
| **Week 13** | Lab 13: Project Discussion  |
| **Week 14** | Lab 14: A preparatory week before the Final Exam |
| **Week 15** | Lab 15: **Final Exam** |

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| **Learning and Teaching Resources****مصادر التعلم والتدريس** |
|  | **Text** | **Available in the Library?** |
| **Required Texts** |  **Electronic Instrumentation and Measurements,** David A Bell, PHI / Pearson Education. | Yes |
| **Recommended Texts** | **“Principles of measurement systems”,** John P. Beately, Pearson Education. **Modern electronic instrumentation and measuring techniques”,** Cooper D & A D Helfrick, PHI | No |
| **Websites** |  |

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|  **Grading Scheme****مخطط الدرجات** |
| **Group** | **Grade** | التقدير | **Marks (%)** | **Definition** |
| **Success Group****(50 - 100)** | **A -** Excellent | **امتياز** | 90 - 100 | Outstanding Performance |
| **B -** Very Good | **جيد جدا**  | 80 - 89 | Above average with some errors |
| **C -** Good | **جيد** | 70 - 79 | Sound work with notable errors |
| **D -** Satisfactory | **متوسط**  | 60 - 69 | Fair but with major shortcomings |
| **E -** Sufficient | **مقبول**  | 50 - 59 | Work meets minimum criteria |
| **Fail Group****(0 – 49)** | **FX –** Fail | **راسب (قيد المعالجة)** | (45-49) | More work required but credit awarded |
| **F –** Fail | **راسب** | (0-44) | Considerable amount of work required |
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| **Note:** Marks Decimal places above or below 0.5 will be rounded to the higher or lower full mark (for example a mark of 54.5 will be rounded to 55, whereas a mark of 54.4 will be rounded to 54. The University has a policy NOT to condone "near-pass fails" so the only adjustment to marks awarded by the original marker(s) will be the automatic rounding outlined above. |