**Subject Description Form**

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| **Subject Code** | ISE2002 | |
| **Subject Title** | Instrumentation and Automation Systems | |
| **Credit Value** | 3 | |
| **Level** | 2 | |
| **Pre-requisite / Co-requisite/ Exclusion** | HKDSE Physics, Physics I (AP10005), or relevant background | |
| **Objectives** | This subject will enable students to   1. understand the basics of instrumentation, control, and automation; and 2. apply the basic techniques in measurement and automatic control. | |
| **Intended Learning Outcomes** | Upon completion of the subject, students will be able to   1. understand the fundamentals and applications of instrumentation and automation systems; 2. understand the static and dynamic characteristics of a system and the concepts on system design and integration; and 3. design automation systems for simple engineering tasks. | |
| **Subject Synopsis/ Indicative Syllabus** | 1. Introduction   Roles of instrumentation, control, and automation in engineering. Low cost automation. Physical quantities, their units and standards, calibration, and traceability. General factors affecting measurement and control accuracy. Planning for measurement and automation.   1. Fundamentals of Instrumentation and Automation Systems   Basic elements of instrumentation and automation systems. Open-loop and Closed-loop controls. Schematic representation of instrumentation and control systems.   1. System Characteristics   Static and dynamic characteristics. Block Diagrams. Calculations of errors and accuracy improvement. Analogue-to-digital and digital-to-analogue conversions.   1. Sensing, Control, and Actuation   Sensors and machine vision. Human-machine interface. Programmable controllers. Actuators and feedback. Stepper motor operation. Rotational and Linear motions in an operational system under restricted control. | |
| **Teaching/Learning Methodology** | A mixture of lectures, laboratory exercises, and tutorials will be used to deliver the various topics in this subject. Some parts of the syllabus will be covered in a problem-based format where this enhances the learning objectives. Others will be covered through directed study in order to enhance the students’ self and life-long learning ability.  In particular, some laboratory exercises are application-oriented and thus help students to understand how various testing techniques are inter-related and how they can be integrated in real life situations. | |
| **Assessment Methods in Alignment with Intended Learning Outcomes** | |  |  |  |  |  | | --- | --- | --- | --- | --- | | Specific assessment methods/tasks | % weighting | Intended subject learning outcomes to be assessed | | | | a | b | c | | Quizzes | 20% | ✓ | ✓ | ✓ | | Laboratory exercises | 30% |  | ✓ | ✓ | | Competency tests | 30% | ✓ | ✓ | ✓ | | Mini-project | 20% |  | ✓ | ✓ | | Total | 100% |  | | |   Quizzes are used for assessing students’ performance as well as monitoring their progress in attaining the intended learning outcomes. Additional tutorial classes will be given to those who need assistance. Students’ experimental skills are assessed by the laboratory exercises. The mini-project is used to assess a student’s performance in developing simple automation systems. The competency tests are used to assess an individual’s ability to apply his/her knowledge and skills learnt from this subject. | |
| **Student Study Effort Required** | Class contact: |  |
| * Lecture | 21 Hrs. |
| * Laboratory | 9 Hrs. |
| * Tutorial | 6 Hrs. |
| * Mini-project | 3 Hrs. |
| Other student study effort: |  |
| * Revision for assessment | 46 Hrs. |
| * Preparation for Laboratory Exercises, Assignments, and Mini-project | 30 Hrs. |
| Total student study effort | 115 Hrs. |
| **Reading List and References** | 1. B. C. Nakra, K. K. Chaudhry 2004, *Instrumentation, Measurement and Analysis*, Third edition, Tata McGraw-Hill Publishing Co. Ltd. 2. B. R. Mehta, Y. J. Reddy 2015, *Industrial Process Automation Systems, Design and Implementation,* Elsevier Inc 3. Javier Fernandez de Canete 2011, *System Engineering and Automation*, Springer-Verlag Berlin Heidelberg 4. Richard A. Schmitt 2019, *Motor Control and Learning,* Sixth Edition,   Human Kinetics | |