Subject Description Form

Subject Code	EIE2901/IC2114
Subject Title	Industrial Centre Training I for EIE
Credit Value	5 training credits
Level	2
Pre-requisite/ Co-requisite/ Exclusion	Nil
Objectives	The objective of this subject is to equip students with knowledge and skills through technical training that are fundamental and essential in their study and professional practice in electronic and information engineering (EIE).
Intended Subject Learning Outcomes	**Upon completion of the subject, students will be able to:** 1. apply the features and functions of typical CAD system for producing CAD models and drawing with application in engineering, as well as applying 3D CAD drawings for technical communication; 2. explain legal duties related to occupational safety, identify common workplace health and safety hazards, corresponding control measures and apply personal protection equipment; 3. apply and create computer programs for scientific and engineering applications; 4. design electronic circuit on printed wiring board with EDA tool; 5. prescribe and use basic electronic instruments to perform parametric tests and analysis on simple electronic circuits, troubleshooting, create and apply virtual instruments and identify common electronic product safety tests; 6. recognize training as an important part of a professional engineering career and the need for multi-disciplinary training and continual professional development in professional engineering practice. 7. explain the manufacturing, assembly, interconnection, and operation of mechatronic products and machines, specify system components and production process, and construct simple prototypes for testing and investigation; 8. generate control programs for building or industrial embedded systems.

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Contribution of the Subject to the Attainment of the Programme Outcomes	**Programme Outcomes:** This subject contributes to programme outcomes 1, 5, 8 and 10 through practical training in electronic and information engineering. Category A: Professional/academic knowledge and skills • Programme Outcomes 1 and 5: This subject contributes to the programme outcome through practical training and practice in the design, development, fabrication, testing and troubleshooting of electronic or information equipment and products with hardware and software tools. Category B: Attributes for all-roundedness • Programme Outcome 8 and 10: This subject contributes to the programme outcome through induction, practical training and industrial safety teaching with practical training in a recognized professional engineer training centre. Through this subject and subsequent professional training, student will be aware of and recognize the importance of training, life-long learning, responsibility and ethics that are demanded for a professional engineer.
Subject Synopsis/ Indicative Syllabus	**Syllabus:** 1. 3D CAD Modelling for EIE (18 hours) 1.1. Introduction to Computer-aided Design (CAD); general concepts on 3D computer modelling; parametric feature-based solid modelling; construction and detailing of solid features; solid model modification and its limitations; concepts of assembly modelling - bottom-up approach for the generation of subassemblies, and final assembly; 1.2. Generation of 2D drawings from 3D parts and assemblies; data exchange; techniques for export files for different prototyping processes (e.g. 3D printing, laser machining). 2. Industrial Safety Overview (15 hours) 2.1. Safety Management: Overview, essential elements of safety management, safety training, accident management, and emergency procedures. 2.2. Safety Law: F&IU Ordinance and principal regulations, OSH Ordinance and principal regulations. 2.3. Occupational Hygiene and Environmental Safety: Noise hazard and control; dust hazard and control; ergonomics of manual handling.

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	Safety Technology: Mechanical lifting, fire prevention, dangerous substances and chemical safety, machinery hazards and guarding, electrical safety, first aid, job safety analysis, fault tree analysis, personal protective equipment. 3. Electronic Circuit Design Practice (18 hours) 3.1. Introduction to electronic design automation (EDA) software; circuit schematics capture and representation; placement of components, capturing, annotation, labelling, net list. Electronic parts library, symbols, decals, physical packages, discrete components, integrated circuits, logic and analogue circuits, electronic parts creation and application. 3.2. Printed Circuit Board (PCB) design, hands on practice on PCB circuit design with EDA tools. 3.3. Wiring diagram and wiring table for electronic and electrical installation, functional representation of circuit, system block diagram, electrical & electronic device symbols and layout, circuit artwork, etching process, prototype PCB fabrication. 4. Electronic Measurement with Product Safety Test and Practice (15 hours) 4.1. Application and use of electronic test instruments: current and voltage measurements, two wire and four wire techniques, power supply and signal sources, oscilloscope probes and oscilloscopes. 4.2. Introduction to Virtual Instrument, application and hands-on practice on LabVIEW. 4.3. Electronic product safety test methods: for example, High Voltage Isolation Test, Insulation Resistance Test, Continuity Test, Leakage Current Measurement. *One of the following streams as decided by the hosting programme:* **Stream A:** 5. Application of Computing Tool (21 hours) 5.1. Introduction to Python; interactive calculations and basic operations with basic data type; mathematical operations, matrix and array operations, data analysis and curve fitting; data manipulation and data file processing. 5.2. Script programming & debugging; logic operations & flow control; Use of functions and popular Python packages, such as Numpy, Panda, and Matplotlib; Data visualization by using graphics packa ges.

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	6. Electronic Workshop Practice for EIE (36 hours) 6.1. Introduction to common electronics parts, use of basic test instruments, best practice and basic troubleshooting techniques, electronic workshop safety. 6.2. Introduction to electronic assembly design and manufacturing process, components, tools and machines. 6.3. Introduction to electronic circuit interconnect technologies like Surface Mounted Technology (SMT) and Chip-on-board (COB). 6.4. Introduction to advanced electronic packaging and assembly process such as: fine-pitch SMT, Ball Grid Array (BGA), Flip-chip and Chip Scale Package (CSP). 6.5. Soldering and de-soldering techniques, mounting and installation of electronic circuits, wiring of subassemblies. 6.6. Hands-on practice on basic electronic circuit troubleshooting, including both digital & analogue circuitries. 6.7. Introduction to rapid prototyping for electronic design using tools like breadboard and circuit simulation software. 6.8. Introduction to rapid prototyping for mechanical design using 3D printing equipment and CAD tools. 7. Embedded System Application and Practice (27 hours) 7.1. Introduction to a contemporary Microcomputer family and its development tools. 7.2. Hands-on practice on memory, I/O, data communications, ADC operations. 7.3. Hands-on practice on LED and LCD displays. 7.4. Hands-on practice on motor control and sensors. 7.5. Application of Microcomputer on consumer electronic products, mechatronics, home automation products, wired and wireless connectivity. **Stream B:** 8. Application of Computing Tool (21 hours) 8.1. Introduction to Python; interactive calculations and basic operations with basic data type; mathematical operations, matrix and array operations, data analysis and curve fitting; data manipulation and data file processing.

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	8.2. Script programming & debugging; logic operations & flow control; Use of functions and popular Python packages, such as Numpy, Panda and Matplotlib; Data visualization by using graphics packages. 9. Basic Mechatronics Practice (27 hours) 9.1. Design approach of mechatronic system design; Key elements of mechatronic system, sensing device, controller, actuators, human-machine interfaces and input & output signal conditioning unit. 9.2. Introduction of design and operation of typical mechatronic systems. 9.3. Introduction of controllers and basic programmable control concept, overview of system structure of controllers, Input/Output (I/O), programming languages, instructions and technique, programming software and applications of controllers such as Programmable Logic Controller (PLC). 10. Integrated Building Systems (36 hours) 10.1. Basic concepts and application methods for integrated building system. 10.2. Lighting control systems; dimming functions, blind / shutter controls, light-scene controls. 10.3. Heating/Cooling HVAC system control scheme. 10.4. PID control function loops; BMS control system for industrial applications. 10.5. Building system project planning for realistic work applications; On-line and Off-line program integration test; Fault monitoring and reporting systems. **Stream C:** 11. Basic Progamming Techniques (21 hours) 11.1. Introduction to a programming language meeting students' study needs; basic operations with basic data types; Matrix and array operations; Functions, arrays, and pointers; Object-oriented programming concepts and data file processing. 11.2. Debugging, logic operations, and flow controls; Library importing and practical applications with embedded controllers if applicable.

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	12. Electronic Workshop Practice for EIE (36 hours) 12.1. Introduction to common electronics parts, use of basic test instruments, best practice and basic troubleshooting techniques, electronic workshop safety. 12.2. Introduction to electronic assembly design and manufacturing process, components, tools and machines. 12.3. Introduction to electronic circuit interconnect technologies like Surface Mounted Technology (SMT) and Chip-on-board (COB). 12.4. Introduction to advanced electronic packaging and assembly process such as: fine-pitch SMT, Ball Grid Array (BGA), Flip-chip and Chip Scale Package (CSP). 12.5. Soldering and de-soldering techniques, mounting and installation of electronic circuits, wiring of subassemblies. 12.6. Hands-on practice on basic electronic circuit troubleshooting, including both digital & analogue circuitries. 12.7. Introduction to rapid prototyping for electronic design using tools like breadboard and circuit simulation software. 12.8. Introduction to rapid prototyping for mechanical design using 3D printing equipment and CAD tools. 13. Embedded System Application and Practice (27 hours) 13.1. Introduction to a contemporary Microcomputer family and its development tools. 13.2. Hands-on practice on memory, I/O, data communications, ADC operations. 13.3. Hands-on practice on LED and LCD displays. 13.4. Hands-on practice on motor control and sensors. 13.5. Application of Microcomputer on consumer electronic products, mechatronics, home automation products, wired and wireless connectivity.
Learning Methodology	The teaching and learning methods include lectures, workshop tutorials, and practical works. The lectures aim at providing students with an overall and concrete background knowledge required for understanding key issues in engineering communication, use of standard engineering components and systems, and importance of industrial safety.

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<table>
<tr><td></td><td>The workshop tutorials aim at enhancing students' in-depth knowledge and ability in applying the knowledge and skills to complete specific tasks.

The practical works aim at facilitating students to review the diverse topics covered in this course and perform active learning with research, practice, questioning, and problem solving in a unified activity.</td></tr>
<tr><td>Alignment of Assessment and Intended Subject Learning Outcomes</td><td>
Stream A (for EIE DG SY)/ Stream C (for ESIoT DG)
<table>
<tr><th rowspan="2">Specific Assessment Methods/ Task</th><th rowspan="2">% Weighting</th><th colspan="8">Intended Subject Learning Outcomes to be Assessed</th></tr>
<tr><th>1</th><th>2</th><th>3</th><th>4</th><th>5</th><th>6</th><th>7</th><th>8</th></tr>
<tr><td>Continuous Assessment</td><td></td><td></td><td></td><td></td><td></td><td></td><td></td><td></td><td></td></tr>
<tr><td>• Assignment / Project</td><td>46%</td><td>✓</td><td>✓</td><td>✓</td><td>✓</td><td>✓</td><td></td><td>✓</td><td>✓</td></tr>
<tr><td>• Tests</td><td>28%</td><td></td><td>✓</td><td>✓</td><td>✓</td><td>✓</td><td></td><td>✓</td><td>✓</td></tr>
<tr><td>• Reports</td><td>26%</td><td></td><td>✓</td><td></td><td>✓</td><td>✓</td><td>✓</td><td>✓</td><td>✓</td></tr>
<tr><td>Total</td><td>100%</td><td colspan="8"></td></tr>
</table>
Stream B (for graduates of HD in EIE, PolyU)
<table>
<tr><th rowspan="2">Specific Assessment Methods/ Task</th><th rowspan="2">% Weighting</th><th colspan="8">Intended Subject Learning Outcomes to be Assessed</th></tr>
<tr><th>1</th><th>2</th><th>3</th><th>4</th><th>5</th><th>6</th><th>7</th><th>8</th></tr>
<tr><td>Continuous Assessment</td><td></td><td></td><td></td><td></td><td></td><td></td><td></td><td></td><td></td></tr>
<tr><td>• Assignment / Project</td><td>50%</td><td>✓</td><td>✓</td><td>✓</td><td>✓</td><td>✓</td><td></td><td>✓</td><td>✓</td></tr>
<tr><td>• Tests</td><td>29%</td><td></td><td>✓</td><td>✓</td><td>✓</td><td>✓</td><td></td><td>✓</td><td>✓</td></tr>
<tr><td>• Reports</td><td>21%</td><td></td><td>✓</td><td></td><td>✓</td><td>✓</td><td>✓</td><td>✓</td><td>✓</td></tr>
<tr><td>Total</td><td>100%</td><td colspan="8"></td></tr>
</table>
<table>
<tr><th>Specific Assessment Methods/ Task</th><th>Remarks</th></tr>
<tr><td>Assignment / Project</td><td>The projects are designed to facilitate students to reflect and apply the</td></tr>
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		knowledge periodically throughout the training.
	Tests	Tests are designed to facilitate students to review the breadth and depth of their understanding on specific topics.
	Reports	Report writing is designed to facilitate students to acquire deep understanding on the topics of the training and to present those concepts clearly.

Student Study Effort Expected

Class contact (Time-tabled)	
• Lecture/Workshop	150 Hours
Other student study effort	0 Hour
Total student study effort	150 Hours

Reading List and References

Reference Software List:

1. SolidWorks from Assault Systemes
2. PADS from Mentor Graphics Inc.
3. LabVIEW from National Instrument
4. CubeMX from STM Electronics
5. uVision IDE from ARM KEIL

Reference Standards and Handbooks:

6. IEEE Standard 315 / ANSI Y32.2 / CSA Z99 Graphic Symbols for Electrical and Electronics Diagrams
7. IEC 61082 Preparation of Documents used in Electrotechnology
8. IPC-D-279-1996, Design Guidelines for Reliable Surface Mount Technology Printed Board Assemblies, IPC.
9. IPC-J-STD-001F-2014, Requirements for Soldered Electrical and Electronic Assemblies, IPC.
10. IPC-A-610F-2014, Acceptability of Electronic Assemblies, IPC.

Reference Books:

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	11. R.S. Villanucci, A.W. Avtgis, W.F. Megow, *Electronic Techniques: Shop Practices and Construction*, 7th ed., Practice-Hall, 2002. 12. Training material, manual and articles published by Industrial Centre 13. D. Shetty, R. Kolk, "Mechatronics System Design", PWS Publishing Company, 1997 14. EMSD, Code of Practice for the Electricity (Wiring) regulations, 2003 Edition. 15. S. Rao, *Sams Teach Yourself C++ in One Hour a Day*, 8th ed. Indianapolis, IN: Sams, 2017. 16. Padmanabhan, T. (2016). Programming with Python. Singapore: Springer.
Last Updated	Aug 2023
Prepared by	Industrial Centre
Affected cohorts	From cohort 23/24 EIE SY DG; and From cohort 23/24 ESIoT DG