

Module Synopsis

Diploma in Engineering (Microelectronics & Semiconductor Technology)

MC 1: Modular Certificate in Electrical & Digital Circuit Fundamentals (180 hours)	
1. ET0803: Digital Principles	(75 hours)
This module covers the principles and design techniques to enable students to design simple combinational circuits using commercial SSI and MSI integrated circuits. Simple sequential logic circuits such as flip-flops and mono-stables are also introduced.	
2. ET0805: Electrical Principles	(105 hours)
This module covers the basic laws and theorems that govern the operation of electrical circuits. Topics covered include scientific notation, engineering notation, metric prefixes, definitions of energy and power, power sources, measuring instruments, DC and AC concepts, simple series and parallel networks, electromagnetism, inductor, inductance, transformers, Kirchhoff's Voltage and Current Laws, Current and Voltage Divider Rules.	

MC 2: Modular Certificate in Electronics (180 hours)	
1. ET0804: Digital Electronics	(75 hours)
This module builds upon and extends the fundamentals covered in Digital Principles. More complex circuits such as adders, multiplexers/de-multiplexers, decoders/encoders, counters, and shift registers are covered.	
2. ET0806: Analog Electronics	(105 hours)
This module builds upon and extends the fundamentals covered in Electrical Principles. Topics covered include capacitor, capacitance, Superposition Theorem, semiconductor physics, semiconductor devices such as diodes, special diodes and bipolar transistors, transducers such as thermistors, and application of operational amplifiers.	

MC 3: Modular Certificate in IC Design & Wafer Fabrication Fundamentals (180 hours)	
1. ET0870: Fundamentals of IC Design	(90 hours)
This module provides students with a fundamental understanding of Integrated Circuit (IC) design, covering modern techniques and practices used in the industry. It starts with an introduction to basic IC concepts, followed by exploring Bipolar IC design techniques, MOS	

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transistor theory, and CMOS technology, including the benefits of CMOS for digital circuits. Students will delve into CMOS VLSI layout principles to optimize circuit design, and learn Verilog for modelling, simulating, and synthesizing digital systems. The module also covers standard cell design, layout planning with a focus on design for testability, and simulation techniques for design verification. Practical skills in using Computer-Aided Design (CAD) tools are emphasized, equipping students to effectively design, layout, and verify integrated circuits.

2. ET0871: Wafer Fabrication Process Fundamental

(90 hours)

The aim of the module is to provide the students with the fundamental knowledge and understanding of wafer fabrication processes and their relationship to the entire semiconductor & electronic devices and appliances industry supply chain, including IC Design, masks production, Integrated Circuit (IC), MEMS, sensors, and photonics devices. It will include silicon substrate manufacturing from sand, fabrication processes of oxidation, photolithography, etching, thin film deposition techniques using physical vapour deposition (PVD), chemical vapour deposition (CVD) and Copper Electroplating (ECP) and doping techniques like diffusion and ion implantation. Students will also learn Chemical Mechanical Polishing (CMP), Clean Technology (CT), Rapid Thermal Processing (RTP), Contamination-Free-Manufacturing (CFM), Electrostatic Discharge (ESD) control and Vacuum Technology basics.

MC 4: Modular Certificate in Wafer Fabrication Technology & Packaging & IC Testing (180 hours)

1. ET0872: Wafer Fabrication Technology & Packaging

(90 hours)

This module builds upon and extends the learnings on wafer fabrication processes with more in-depth understanding and quantitative treatment and comprehensive integrated CMOS and Bipolar process fabrication flow. Students are introduced to metrology process and tools on how industry monitor the processes like thickness and critical dimension (CD). Surface and bulk micromachining techniques and processes used for manufacturing MEMS devices would also be covered. This course will introduce the function of packaging and various type of packaging technologies (Chip Interconnect, BGA, CSP, WLP). Students will learn about the packaging process and the performance of the various technologies to meet the semiconductor application needs. The module will also cover how semiconductor industry contributes to the UN Sustainable Development Goals (UNSDG), while having negative impact to the environment.

2. ET0877: IC Testing

(90 hours)

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This module provides students with the knowledge of Automated Test Systems and the various techniques used for testing digital devices, memory devices and loaded Printed Circuit Boards. Students will also acquire skills in writing test programs for component and board testing. This module also supports the overall course aim to equip students with the relevant knowledge, concepts and skills required in an electronic manufacturing environment.

MC 5: Modular Certificate in Quality, Yield & Excellence in Semiconductor Manufacturing		(180 hours)
1. ET0878: Quality & Reliability		(60 hours)
This module provides the fundamentals of two very important fields in the area of product design and manufacture. These refer to quality and reliability. Topics include SQC, SPC, control charts, reliability concepts, accelerated testing and system reliability. There will also be assignments on TQM, ISO9000, SPC, DOE, COQ, and environmental stress testing.		
2. ET0879: Yield, Defect & Failure Analysis		(60 hours)
This module provides a comprehensive understand of yield and the various yield models used in the semiconductor industry to benchmark the performance of wafer fabrication processes. Students will also learn about the importance of defect inspection in the fab, the techniques and strategies commonly adopted by the industry. The various electrical and physical failure analysis methodologies to debug yield issues will be introduced as well. Working principles will be included with actual case studies.		
3. ET0880: Manufacturing Excellence		(60 hours)
This module focuses on Manufacturing Excellence. Common terms like Continuous Improvement Programme (CIP), Process Robustness, Scrap, Line Yield, Change Management and Standard Operation Procedure (SOP) will be introduced. It will also cover fundamentals on Equipment Preventive Maintenance and Predictive Maintenance. Important industry practices such as “5-Whys” and “8D report” for troubleshooting will also be included with real-world case studies.		