UNIVERSITI KUALA LUMPUR
KAMPUS CAWANGAN MALAYSIAN SPANISH INSTITUTE

FINAL EXAMINATION
OCTOBER 2025 SEMESTER

COURSE CODE	: SAB12503
COURSE NAME	: SEMICONDUCTOR TECHNOLOGY
PROGRAMME NAME (FOR MPU: PROGRAMME LEVEL)	: BACHELOR OF APPLIED ELECTRONICS
DATE	: 25 JANUARY 2026
TIME	: 02.00 PM – 4.30 PM
DURATION	: 2 HOUR 30 MINS

INSTRUCTIONS TO CANDIDATES

1. Please CAREFULLY read the instructions given in the question paper.
2. This question paper has information printed on both sides of the paper.
3. This question paper consists of TWO (2) sections; Section A and Section B.
4. Answer ALL questions in Section A. For Section B, answer THREE (3) questions from FOUR (4) questions.
5. Please write your answers on the answer booklet provided.
6. Answer all questions in English language ONLY.

THERE ARE 3 PAGES OF QUESTIONS, EXCLUDING THIS PAGE.

SECTION A (40 MARKS)

Answer all questions.

Question 1

Semiconductor manufacturing is the process of creating integrated circuits (ICs) using semiconductor materials such as silicon. It involves multiple fabrication steps performed on semiconductor wafers to build electronic components.

(a) Define thermal oxidation and its purpose.

(4 marks)

(b) Describe photolithography and its role in semiconductor manufacturing.

(4 marks)

(c) Explain etching and its types.

(6 marks)

(d) Elaborate doping in semiconductors and its purpose.

(6 marks)

Question 2

Crystal growth in semiconductor manufacturing involves techniques to produce large, high-quality single crystals or poly-crystalline structures with uniform properties.

(a) Name two methods of crystal growth.

(2 marks)

(b) Draw a schematic of the FZ process.

(6 marks)

(c) State the working principle behind the floating-zone crystal growth technique.

(12 marks)

SECTION B (60 MARKS)
Answer THREE questions ONLY

Question 3

Photolithography is a precise fabrication process used in semiconductor manufacturing to transfer geometric patterns from a photomask onto a substrate, typically a silicon wafer, using light exposure and photosensitive materials called photoresists.

(a) Describe the steps involved in the photolithography process using photoresist.

(12 marks)

(b) Outline the three main exposure methods in photolithography and justify the selection of the most used approach in present-day semiconductor manufacturing.

(8 marks)

Question 4

The integrated circuit was first invented by Jack Kilby in 1958 at Texas Instruments. In 1959, Robert Noyce at Fairchild Semiconductor improved the design by using silicon and developing the planar process

(a) Draw and label a simplified version of the first integrated circuit invented by Jack Kilby.

(6 marks)

(b) Briefly explain the function of each component.

(6 marks)

(c) Discuss the fundamental differences between the integrated circuit designs developed by Jack Kilby and Robert Noyce. In your answer, explain the materials, methods, and scalability of each approach, and evaluate how their contributions collectively advanced the field of microelectronics.

(8 marks)

Question 5

Thermal oxidation is a process used in semiconductor fabrication to grow a thin, high-quality layer of silicon dioxide (SiO_2) on the surface of a silicon wafer by exposing it to oxygen at high temperatures.

(a) Compare dry oxidation and wet oxidation. Include mechanism, oxide quality, growth rate, and typical applications.

(12 marks)

(a) Discuss the FOUR (4) factors that influence thermal oxidation rate of silicon.

(8 marks)

Question 6

Compare different semiconductor materials such as Silicon (Si), Germanium (Ge), and Gallium Arsenide (GaAs) in terms of bandgap energy, carrier mobility, thermal stability, and applications in electronic devices.

(a) Compare the bandgap energies of Si, Ge, and GaAs, and relate the bandgap type (direct or indirect) to their optical and electronic performance

(10 marks)

(b) Discuss the electron and hole mobilities in the three materials and their impact on device switching speed and frequency performance.

(10 marks)

END OF EXAMINATION PAPER