UNIVERSITY OF PORTSMOUTH

FACULTY OF TECHNOLOGY

Department of Electronic and Computer Engineering

M528 – Electronics Manufacturing

U09167B

Date: 4 June 2007 **Time:** 2 hours

INSTRUCTIONS

Write your student ID number clearly on page 2.

Write your answers to all 5 questions in this examination paper.

For each question, indicate your answer to **part A** by placing an "X" in the box next to the appropriate boxes on the answer sheet. For each question, write your answer to **part B** by writing in the appropriate space in this examination paper.

Handwritten notes are permitted with this examination.

Calculators permitted are:

Casio FX 85WA

Casio FX 83WA

Casio FX 85MS

Examiner:

Mr Chi Nguyen

Student ID Number

Question 1A. Place an "X" in the box next to 5 terms that are important developments in the historical context of the electronics manufacturing industry. [5 marks]

	business model		cost of manufacture
X	division of labor		bullwhip effect
	time value of money	X	interchangeable parts
X	company stock	X	assembly line
	prime cost		transfer pricing
X	monolithic production		data warehouse

Question 1B. Use all of the terms you selected in question 1A to describe how they affect key activities and/or areas of the modern electronics manufacturing industry. [15 marks]

Development of limited companies that issue **company stock** enabled the necessary amount of financing to invest in research and building of factories and semiconductor fabrication facilities. (+3)

The **division of labor** concept affects the modern electronics manufacturing supply chain where each participating company specialise in a different business activity or manage a different business risk. (+3)

The **interchangeable parts** concept affects the design of modern electronic products where components, assembly and delivery may occur all around the world. (+3)

The **assembly line** concept affects the design of factories and fabrication facilities which emphasize the importance of having low numbers of inventory sitting idle. (+3)

The **monolithic production** concept enabled the mass fabrication of integrated circuits. This is reflected in the importance of the silicon wafer size as a key metric for effectiveness of semiconductor fabrication. (+3)

Question 2A. Place an "X" in the box next to 5 terms that are most directly related to the fabrication of silicon wafers. [5 marks]

	spindles	X	silicon isolation
X	acceptors		crystal reduction
X	donors		transplants
X	crystal growth		receptors
	silicon condensation	X	ingots
	premium bonding		monochrome

Question 2B. Use all of the terms you selected in question 2A to describe key activities in the fabrication of silicon wafers. [15 marks]

Silicon isolation produces polycrystalline silicon from naturally occurring silicon oxide materials such as sand or quartz. (+3)

Single **crystal growth** procedures such as the Czochralski process are used to produce monocrystalline silicon known as **ingots**. Wafers are sliced from ingots. (+6)

Doping is a technique to increase the conductivity of a silicon wafer by adding small amounts of atoms from another material. **Acceptors** are atoms that accept electrons from nearby atoms and **donors** are atoms that release electrons to nearby atoms. (+6)

Question 3A. Place an "X" in the box next to 5 terms that are most directly related to factors that affect the design of supply chains in the electronics industry. [5 marks]

X	stock		yield specialisation
X	standards		design repositories
	merchandising		prototyping
X	demand aggregation	X	information
	virtual inventory		matrix
X	risk specialisation		silos

Question 3B. Use all of the terms you selected in question 3A to describe how businesses in the electronics industry use their supply chain to support 3 different strategic objectives of cost, flexibility and service. Use a different company to illustrate each strategic objective. [15 marks]

Examples such as:

HP focuses on **demand aggregation** for consumer electronics by creating a network of partners that design new products, manufacture components and assemble products. In this supply chain, HP achieves low product cost for its customers by minimising the amount of idle **stock** produced by its partners. (+6)

Apple has a **risk specialisation** for new product designs which requires that it has close and secretive relationships with partners in its supply chain. (+3)

Tesco waits until electronic products have achieved enough maturity or market success that de facto **standards** have been implemented in the products, such as the MP3 audio encoding standard. The Tesco supply chain has an emphasis on collecting, managing and making available **information** about the demand for commodity electronic products to its partners. (+6)

Question 4A. Place an "X" in the box next to 5 terms that are most directly related to design principles that apply to electronics products. [5 marks]

	functional content		interlocking
	tolerance level		freedom
	accelerate	X	customisation steps
X	independence		fitness for quality
X	information content	X	functional requirements
	assembly steps	X	delay

Question 4B. Use all of the terms you selected in question 4A to describe 3 design principles and 1 specific product example to illustrate each principle. [15 marks]

Similar to the following:

Computers that permit the CD/DVD player to play music CD or DVD movies without starting up the operating system software is an example of the principle that product designs should maintain **independence** of **functional requirements**. (+5)

USB flash disks are examples of the principle that designs should minimise the **information content** of products. The plug and play simplicity of USB flash disks are a stark contrast to the multiple steps required to use a writable CD or DVD. (+5)

Power adapter plugs are examples of the design principle that encourages **delay** of product **customisation steps**. Printers and mobile phones are produced with a common interface for power then combined a power adapter specific for one local region. (+5)

Question 5A. Place an "X" in the box next to 5 terms that are elements used in conceptual models for describing and comparing businesses. [5 marks]

	employees	X	relationships
	marketing	X	capabilities
	sourcing		channels
X	ownership	X	integration
X	coordination		valuation
	distribution		procurement

Question 5B. Use all of the terms you selected in question 5A to compare the business model of 3 companies who compete against each other in the electronics industry. [15 marks]

Similar to the following:

Acer is a computer business with high levels of vertical **integration** because it has complete or majority **ownership** in many different types of businesses that cooperate to produce Acer computers. (+5)

Sony is a computer business with many **capabilities** besides computer sales who operates with more of a horizontal **integration** to promote one common brand amongst all of its various products. (+5)

Dell is a computer business with emphasis on **coordination** of its partners in order to produce computers on demand. This business model places a high value on the business **relationships** between Dell and its partners. (+5)