UNIVERSITY OF PORTSMOUTH

FACULTY OF TECHNOLOGY

Department of Electronic and Computer Engineering

M528 – Electronics Manufacturing

U09167B

Date: **May 2009** **Time:** **90 minutes**

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 choices 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 85 series

Casio FX 83 series

Examiner:

Professor Ron Pethig, Mr Chi Nguyen

Student ID Number | *** SOLUTIONS ***

QUESTION 1

a) Place an "X" in the box next to the **3 most important dependencies** for factories that manufacture electronic products. [**6 Marks**]

2	access to transportation		coordination of suppliers
	access to energy		coordination of resources
2	access to information		coordination of prices
2	access to markets		coordination of buyers
	access to designs		coordination of designers

b) **Provide one specific example of each dependency selected in part (a)**. [**9 Marks**]
Explain which dependency was **most important during the Industrial Revolution** and which dependency is **most important today**. [**5 Marks**]

Similar to the following:

Access to road transportation is a key negotiating point when Intel selects the location for a new semiconductor fabrication plant, such as the new factories in China and Viet Nam. [**3 Marks**]

The use of computers in supply chain management activities shows the importance of having **access to information**. [**3 Marks**]

Acer is a Taiwanese company which is currently the second largest computer manufacturer (behind Hewlett Packard). This growth is only possible because Acer has **access to markets** around the world. [**3 Marks**]

During the Industrial Revolution, the global markets were heavily dependent on the national governments, which made **access to markets** difficult and therefore valuable. The colonies of the British Empire were also important markets for British companies. [**3 Marks**]

Access to information is the most important dependency today because companies are becoming better at making use of real time information to manage their supply chain. By comparison, transportation and markets are more predictable dependencies. [**2 Marks**]

QUESTION 2

a) Place an "X" in the box next to **3 semiconductor fabrication processes**. [**6 Marks**]

	fusion		heating
	mixing	**2**	etching
2	lithography		spray
	plating		drilling
2	doping		exposure

b) **Use the fabrication processes selected in part (a) to explain the steps for developing the feature displayed below**. [**14 Marks**]

Similar to the following:

(1) Design a lithographic mask with a similar pattern to the top view.
(2) Apply a layer of silicon oxide to the silicon wafer.
(3) Apply photoresist to the silicon wafer.
(4) Expose the silicon wafer using the **lithography** mask developed in step 1.
(5) Use dry **etching** to remove the silicon oxide in the trench area that was not covered by the photoresist.
(6) Remove the remaining photoresist.
(7) **Dope** the silicon oxide feature to create specific conductive properties.

[**2 Marks** for each step]

QUESTION 3

a) Place an "X" in the box next to **3 strategic goals** that are supported by supply chain design at electronics businesses. [**6 Marks**]

	inventory
	size
	finance
	buffers
2	quality

2	flexibility
	quantity
	risks
2	costs
	resources

b) **For each goal selected in part (a), provide a supply chain principle and a specific example of a company using the principle to achieve that goal.** [**14 Marks**]

Similar to the following:

The principle that "flexibility reduces the amount of buffering required in a supply chain" is used by manufacturers to improve quality by having suppliers compete on the price and quality of the resources sold to the factory. For example, Apple encourages competitive bids from suppliers of flash storage memory to increase the quality of their iPod products. [**5 Marks**]

The principle that "variability in a supply chain may be buffered by some combination of inventory, capacity and time" is used by manufacturers to increase the flexibility of their business. For example, Acer Computers uses their inventory to increase their flexibility while Intel manages the capacity at their fabrication facilities to create flexibility for the business. [**5 Marks**]

Companies can reduce costs by applying the principle of "combining sources of variability so that they can share a common buffer reduces the total amount of buffering required to achieve a specific level of supply chain performance." For example, Amazon uses strategic warehouse locations around the world to minimize sources of variability in local sales demand while maximizing the use of a common buffer by having very large warehouses. [**4 Marks**]

QUESTION 4

a) Place an "X" in the box next to **3 terms** that are most directly related to the classic inventory model, **Economic order quantity (EOQ)**. [**6 Marks**]

2	average order frequency	**2**	unit holding cost
	average order time		unit storage time
	average sale price		unit sale price
	maximum unit holding cost	**2**	total annual cost of inventory
	maximum unit sale price		total annual profit margin

b) **Calculate the optimal number of orders per year** using the values provided below.
Indicate the values for each term selected in part (a). [**14 Marks**]

Annual demand is 3,400 Unit product cost is £80
Cost of each order is £15 Annual cost of storage is 20% of product cost

Let the **unit holding cost** be H:

£80 x 0.20 = £16 [**1 Mark**]

Apply the EOQ equation:

SQRT((2 x £15 x 3,400) ÷ £16) = SQRT(£102,000 ÷ £16) = SQRT(6375) = 79.8 [**5 Marks**]

The **average order frequency** is a synonym for the optimal number of orders per year:

3,400 ÷ 79.8 = 42.6 [**4 Marks**]

The **total annual cost of inventory** is:

79.8 x £16 = £1,276.80 [**4 Marks**]

QUESTION 5

a) Place an "X" in the box next to **3 design principles that affect product quality**. [**6 Marks**]

	fitness for requirements	**2**	fitness for market
	fitness for environment	**2**	fitness for purpose
2	fitness for standards		minimum resources
	minimum re-use		minimum prototyping
	minimum tolerance		minimum components

b) **For each term selected in part (a)**, provide a **product example with high quality** and a **product example with low quality** when using that design principle to compare product quality. [**14 Marks**]

Similar to the following:

If the MP3 audio encoding **standard** is used as a comparison of product quality, the Creative Zen portable music device has high quality because its default encoding format is MP3, whereas the Apple iPod has low quality because its default encoding format is encrypted AAC, which restricts usage of audio tracks on other music players. [**5 Marks**]

When comparing **fitness for market**, the Apple iPod line of products have high quality due to the combination of small form factor, innovative user interface controls and innovative marketing. In contrast, the Microsoft Zune players have similar hardware and software functionality but much lower quality with respect to fitness for market, as evidenced by its poor sales results. [**5 Marks**]

Although a variety of display technology are available, such as LCD screens and HDTV, they all have low quality when considering **fitness for purpose** as media for reading. By contrast, printed media such as books and magazines have high quality when considering fitness for purpose as media for reading. [**4 Marks**]