IB DIPLOMA PROGRAMME
PROGRAMME DU DIPLÔME DU BI
PROGRAMA DEL DIPLOMA DEL BI

DESIGN TECHNOLOGY
STANDARD LEVEL
PAPER 2

Monday 20 May 2002 (afternoon)

1 hour

Name

Number

INSTRUCTIONS TO CANDIDATES

• Write your candidate name and number in the boxes above.
• Do not open this examination paper until instructed to do so.
• Section A: Answer all of Section A in the spaces provided.
• Section B: Answer one question from Section B. Write your answers in a continuation answer booklet, and indicate the number of booklets used in the box below. Write your name and candidate number on the front cover of the continuation answer booklets, and attach them to this question paper using the tag provided.
• At the end of the examination, indicate the number of the Section B question answered in the box below.

QUESTIONS ANSWERED		EXAMINER	TEAM LEADER	IBCA
SECTION A	ALL	/20	/20	/20
SECTION B	. . . .	/20	/20	/20
NUMBER OF CONTINUATION BOOKLETS USED	. . . .	TOTAL /40	TOTAL /40	TOTAL /40

SECTION A

*Candidates must answer **all** questions in the spaces provided.*

1. Home security has become easier and less intrusive with the development of Passive Infrared Detectors (PIR) as shown below. PIRs use the natural emission of infrared radiation from humans and other animals to generate signals which can open locks or trigger alarms. Large animals emit more infra-red radiation which can be detected by lower sensitivity PIRs.
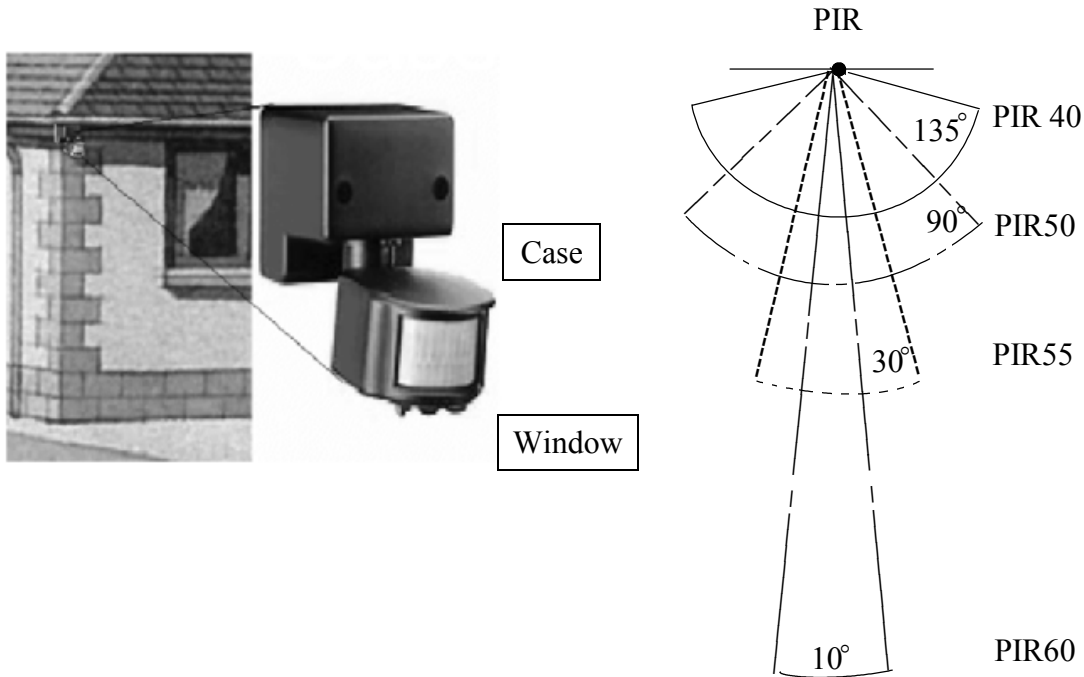
Model	Operating Voltage (V)	Sensitivity			Range (m) with PIR at 2.30 m above ground level	Field of View	Preferred Location	
		High	Medium	Low			Int.	Ext.
PIR40	12-15	*			5	135°		*
PIR50	6-14		*		8	90°	*	
PIR55	10-20			*	12	30°	*	*
PIR60	8-24	*			20	10°	*	*

(a) (i) State the most sensitive model.   *[1]*

....

(ii) Identify the operating voltage that would allow any of the detectors to operate.   *[1]*

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(This question continues on the following page)

(Question 1 continued)

(b)   Calculate the area covered by Model PIR55 with the PIR at 2.30 m above ground level.   *[2]*

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A family pet cat requires to access a pet door. The pet door is to be in the main door shown in the picture below. The door is secured by a solenoid bolt released when the system is activated. The door must only be released by the cat, not by a human or larger animal.

(c)   In the picture below a sensor (A) is shown that will detect the cat when 2.5 m from the door. This will also detect the human as it is of high sensitivity:-

(i)   Select a sensor (B) that will detect the human but not the cat.   *[1]*

. . . .

(ii)   Annotate the diagram to show the preferred position of sensor B.   *[1]*

(This question continues on the following page)

(Question 1 continued)

(d) (i) Complete the truth table so that the solenoid is activated (logic = 1) to allow the cat to enter only when alone. *[1]*

Sensor A (Human)	Sensor B (Cat)	Solenoid

(ii) Design a logic circuit to satisfy the truth table. *[3]*

2. List **three** strategies used by designers to obtain information. *[3]*

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3. Outline what is meant by a balanced diet. *[2]*

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4. (a) Draw the circuit symbol for a thermistor. *[1]*

(b) Outline why a thermistor could be used to provide an input signal to an operational amplifier used as a thermostat. *[2]*

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5. Outline the relevance of using the 5th-95th percentile range of sizes in designing a range of "off the peg" (not tailored) clothing. *[2]*

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SECTION B

*Answer **one** question. Up to three additional marks are available for the construction of your answer. Write your answers in a continuation answer booklet. Write your name and candidate number on the front cover of the continuation answer booklets, and attach them to this question paper using the tag provided.*

6. A saw mill has an automated cross-cut saw to prepare lengths of timber for batch production of 'flat-pack' furniture.
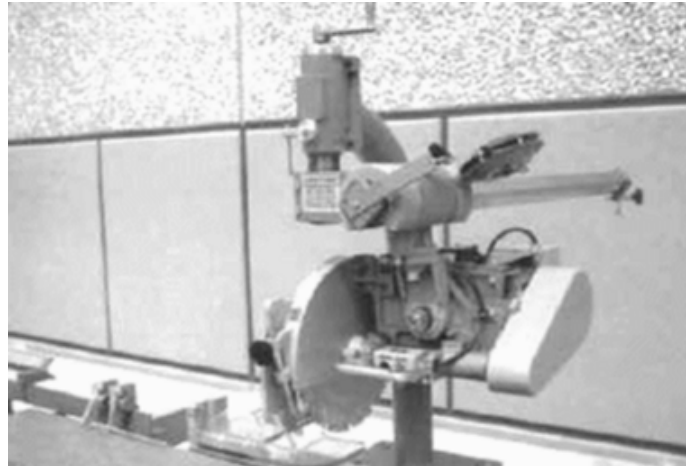
The timber is moved by rollers driven by a 24 V DC motor. Clamped at a pre-set length, the wood is then cut by the descending saw. The cycle then repeats until the number required is produced.

    (a)   (i)   List **two** mechanical properties of timber.   *[2]*

            (ii)   State the relative values of the two properties listed.   *[2]*

    (b)   (i)   Describe the way in which the timber is positioned under the saw using a process block diagram.   *[3]*

            (ii)   State **two** non-contact sensors that could detect the position of the end of the length of timber.   *[2]*

    (c)   Design a control system that uses operational amplifiers to drive the motors and position the timber correctly.   *[8]*

7. The pictures show vacuum cleaners made in 1950 and in 2000.

1950

2000

The 1950 model is manufactured predominantly from metals. The 2000 model is manufactured predominantly from plastics.

(a) (i) Outline how planned obsolescence influences the design of vacuum cleaners. *[2]*

(ii) Outline how the two materials used affects the recycling of the cleaners at the end of their product life. *[2]*

(b) (i) Outline how changes in social values affects the work of the designer. *[2]*

(ii) Identify **three** ways in which the design can influence the development of the vacuum cleaner to lessen the environmental impact. *[3]*

(c) Explain how the vacuum cleaner would be most economically manufactured with reference to automation, scale of production, and relevant materials. *[8]*

8. The photograph below shows a suspension bridge.

(a) (i) Define thermal expansion. *[1]*

(ii) Outline the significance of thermal expansion in design. *[2]*

(b) (i) Outline the difference between a physical model and a symbolic model. *[2]*

(ii) List **two** uses of physical models in bridge design. *[2]*

(iii) List **two** uses of symbolic models in bridge design. *[2]*

(c) Discuss the advantages and disadvantages of physical and symbolic modelling in the design of a bridge. *[8]*