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

N03/470/H(3)

DESIGN TECHNOLOGY
HIGHER LEVEL
PAPER 3

Candidate number

Monday 10 November 2003 (morning)

1 hour 15 minutes

INSTRUCTIONS TO CANDIDATES

- Write your candidate number in the box above.
- Do not open this examination paper until instructed to do so.
- Answer all of the questions from two of the Options in the spaces provided. You may continue your answers on answer sheets. Write your candidate number on each answer sheet, and attach them to this examination paper and your cover sheet using the tag provided.
- At the end of the examination, indicate the letters of the Options answered in the candidate box on your cover sheet and indicate the number of answer sheets used in the appropriate box on your cover sheet.

Option D – Food technology

Figure D1 shows two packets of organic potato crisps. Figure D2 shows the logos for a range of fruit and vegetable crisps from the same manufacturer. The raw fruit or vegetable is sliced, dried and vacuum fried in organic sunflower oil, which is rich in unsaturated fatty acids. Crisps and snack products have a short shelf life due to the development of rancidity.

Figure D1

Figure D2

[Source: http://www.fruitchips.nl]

D1. (a) List **two** organoleptic properties of foods. *[2]*

. . . . . .

. . . . . .

(b) Explain how the organoleptic properties of crisps are designed for particular market segments. *[3]*

. . . . . .

. . . . . .

. . . . . .

. . . . . .

. . . . . .

D2. Describe oxidative rancidity. *[2]*

. . . . . .

. . . . . .

. . . . . .

. . . . . .

D3. Outline how health consciousness promotes the development of new food products, such as the fruit and vegetable crisps. *[2]*

. . . . . .

. . . . . .

. . . . . .

. . . . . .

D4. Describe how secondary processing of fruits and vegetables into crisps and other products on-farm increases their value and enhances farm sustainability. *[2]*

. . . . . .

. . . . . .

. . . . . .

. . . . . .

D5. Discuss the problems associated with the use of synthetic fertilizers and pesticides and explain how organic agriculture can be considered an "alternative technology" contributing to "sustainable development". *[9]*

Option E – Computer aided design and manufacturing

Figure E1 shows a computer numerically controlled (CNC) lathe.

Figure E1

E1. (a) Outline the axes that are available on a CNC lathe. *[2]*

. . . . . .

. . . . . .

. . . . . .

. . . . . .

(b) Outline **one** problem of machining wooden parts on a CNC lathe. *[2]*

. . . . . .

. . . . . .

. . . . . .

. . . . . .

(c) Explain how a computer and a CNC lathe can be combined to produce a CAD/CAM system. *[3]*

. . . . . .

. . . . . .

. . . . . .

. . . . . .

. . . . . .

E2. Outline how a digital camera might contribute to a CAD system. *[2]*

. . . . . .
. . . . . .
. . . . . .
. . . . . .
. . . . . .

E3. Describe how CAD/CAM has improved the quality of products available to the consumer. *[2]*

. . . . . .
. . . . . .
. . . . . .
. . . . . .

E4. Explain why global manufacturers establish production units in different parts of the world. *[9]*

Option F – Invention, innovation and design

The first patent for a toaster was submitted in 1905 although it is uncertain if the design ever went into commercial production. The toaster patent was based on the invention of an alloy of nickel and chromium, Nichrome, which was described in its patent as *"very low in electrical conductivity, very infusable, non-oxydizable to a very high degree, tough and sufficiently ductile to permit drawing ... into wire ... for use as an electrical resistance element"*. Figure F1 shows a very early toaster made by General Electric and patented in 1915. Figure F2 shows the first pop-up toaster produced for the domestic market in 1926.

Figure F1

Figure F2

[Source: http://www.toaster.org/1900.html]

F1. (a) Outline **one** safety issue in the design of the toaster shown in Figure F1. *[2]*

. . . . . .

. . . . . .

. . . . . .

. . . . . .

(b) Explain **one** factor which has promoted the reinnovation of the toaster. *[3]*

. . . . . .

. . . . . .

. . . . . .

. . . . . .

. . . . . .

F2. Describe the role of design in the continued development of the toaster. *[2]*

. . . . . .
. . . . . .
. . . . . .
. . . . . .

F3. Outline why a pioneering corporate strategy has the potential to make the largest profit. *[2]*

. . . . . .
. . . . . .
. . . . . .
. . . . . .

F4. Outline why it is becoming increasingly difficult to be a successful lone inventor. *[2]*

. . . . . .
. . . . . .
. . . . . .
. . . . . .

F5. Discuss how the global shopping via the Internet has affected the consumer. *[9]*

Option G – Health by design

Figure G1 show human bone. Figure G2 shows Pro Osteon, which can be used as an implant material. Pro Osteon is produced by chemically treating coral to produce a material with a pore structure very similar to human bone.

Figure G1 – Human bone

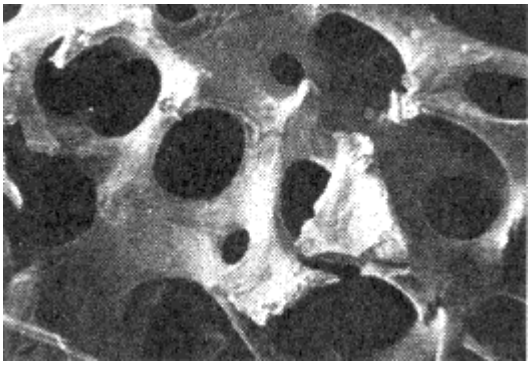
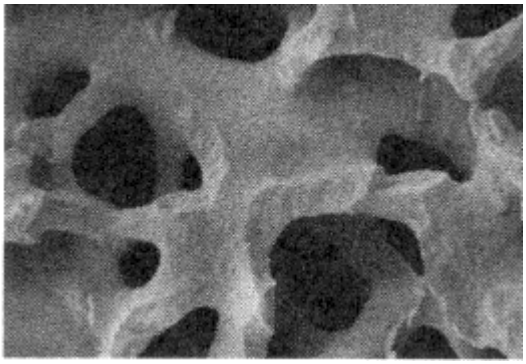


Figure G2 – Pro Osteon



G1. (a) Outline how Pro Osteon would be tested for biocompatability. *[2]*

. . . . . .

. . . . . .

. . . . . .

. . . . . .

(b) Explain how Pro Osteon acts as a temporary framework for bone regrowth. *[3]*

. . . . . .

. . . . . .

. . . . . .

. . . . . .

. . . . . .

G2. List **two** materials used in vascular grafts. *[2]*

. . . . . .

. . . . . .

G3. Outline how hearing aids are selected to fit in with the lifestyles of users. *[2]*

. . . . . .
. . . . . .
. . . . . .
. . . . . .

G4. Outline the function of a catalytic converter. *[2]*

. . . . . .
. . . . . .
. . . . . .
. . . . . .

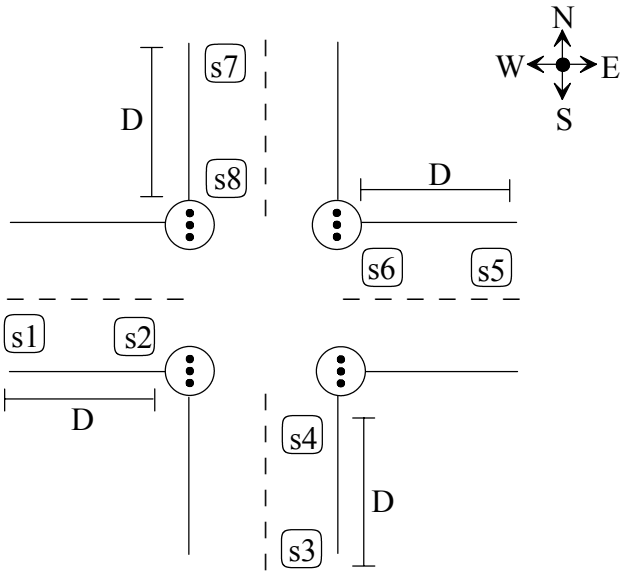
G5. Explain the importance to health of controlling disease vectors. *[9]*

Option H – Electronic products

Figure H1 shows a traffic intersection controlled by traffic lights. A conventional traffic light controller changes the lights using a constant cycle time. Using fuzzy logic and sensors (s1 – s8) it is possible to change the cycle time according to the traffic conditions. The first sensor at each traffic light counts the number of cars coming to the intersection and the second counts the cars passing the traffic lights. Simple IF-THEN rules are used to define the control system, *e.g.*

IF (cycle time is medium) AND (cars behind red is low) AND (cars behind green is medium) THEN change = (probably not).

Figure H1



[Source: http://www.doc.ic.ac.uk/~nd/surprise_96/journal/vol4/sbaa/report.traff.html]

H1. (a) Explain how the fuzzy logic controller works. *[3]*

. . . . . .

. . . . . .

. . . . . .

. . . . . .

. . . . . .

(b) Outline **one** benefit for drivers of applying fuzzy logic in this context. *[2]*

. . . . . .

. . . . . .

. . . . . .

. . . . . .

H2. Outline the importance of feedback in the traffic lights system. *[2]*

. . . . . .

. . . . . .

. . . . . .

. . . . . .

H3. Describe a sensor which could be used as one of the sensors s1 – s8 to input information on traffic conditions. *[2]*

. . . . . .

. . . . . .

. . . . . .

H4. Describe the effect of adding impurities (doping) to semiconductor materials. *[2]*

. . . . . .

. . . . . .

. . . . . .

. . . . . .

H5. Discuss the implications of downloading music from the Internet for users and the traditional music industry. *[9]*