



Leaving Certificate Examination, 2011

Technology

Higher Level

Friday, 24 June
Afternoon, 2:00 - 4:30

Section B - Core (48 marks)

Answer both questions.

Each question in Section B carries 24 marks.

Section C - Options (80 marks)

Answer two of the five options presented.

All questions in Section C carry 40 marks.

Instructions:

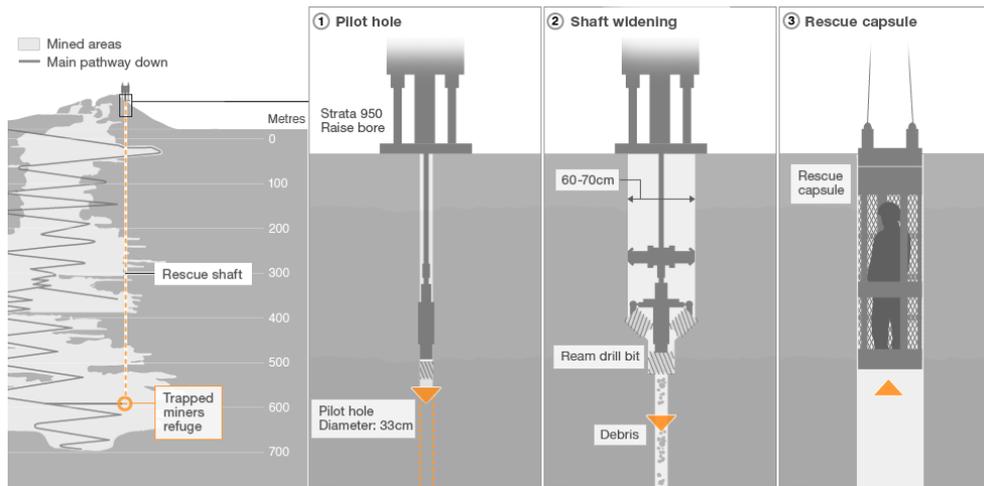
- (a) *Answer these questions in the answerbook provided.*
- (b) *Write your examination number on the answerbook.*
- (c) *Draw all sketches in pencil.*
- (d) *Hand up the answerbook at the end of the examination.*

Section B - Core - Answer Question 2 and Question 3.

Question 2 - Answer 2(a) and 2(b)

2(a) In October 2010, a group of miners were trapped 700m underground for 69 days in San Jose, Chile. Shannon-based manufacturing company, Mincom International, provided the drill that facilitated initial contact with the 33 trapped miners, as shown in the graphics below.

- Describe **two** dangers associated with underground mineral mining.
- After seven attempts, a *pilot hole* was drilled to make contact with the group of miners. What is the purpose of drilling a pilot hole?



2(b) A rescue capsule was designed to bring each miner to the surface. Using neat, well-proportioned, annotated sketches propose a design for a suitable rescue capsule making reference to the following essential details:

- appropriate anthropometric data
- entry and escape from the capsule
- suitable materials
- manufacturing methods.



Answer 2(c) or 2(d)

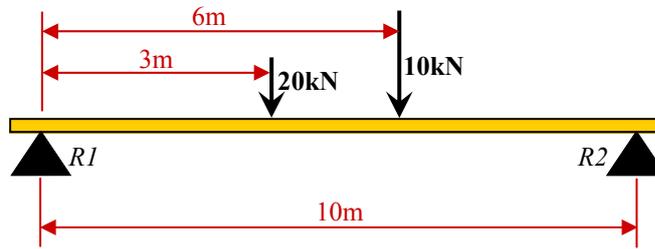
- Outline, with annotated sketches, a mechanism for raising and lowering the capsule in a safe and controlled manner to bring each miner to the surface.
- The structure of the rock raised a concern that the drilled hole might collapse. Propose a design modification to the drilled hole to help prevent the collapse of its walls.

OR

- Images of the rescue of this group of miners were transmitted around the world in 'real-time' by satellite technology. Outline the impact of *satellite technology* and the *internet* on the reporting of this event.
- Optical fibres transmit light rather than electrical signals and have the potential to revolutionise communication systems. Describe **two** advantages of the use of fibre-optic cables rather than traditional communication cables.

Question 3 - Answer 3(a) and 3(b)

- 3(a) (i) Distinguish clearly between a *static* load and a *dynamic* load. Use specific examples to support your answer.
 (ii) From the information given, calculate the forces acting on **each** of the supports R1 and R2.



- 3(b) An airport car-hire company monitors its fleet of vehicles from the booking office. A number of surveillance cameras have been installed. One of the cameras can be manipulated by the office staff.



- (i) Using annotated sketches, outline a control system at **A** to slowly rotate the camera in both directions.
 (ii) Name a mechanism at **B** to tilt the camera through an angle of 45°.
 (iii) Outline some possible effects on the camera casing of prolonged exposure to ultra-violet rays from sunlight and acidic pollution from the atmosphere.

Answer 3(c) or 3(d)

- 3(c) The surveillance camera needs to sense light levels to operate effectively.

- (i) Draw a suitable circuit diagram which contains both a low voltage circuit that will sense changing light levels **and** a means of switching on a 240V floodlight at night-time.
 (ii) Specify the correct fuse rating in amps to protect a 600W floodlight operating on a mains supply at 240V.



OR

- 3(d) The plastic dome protecting the camera is produced by vacuum forming.

- (i) The table shows the schedule of tasks for the production of the plastic dome and the assembly of the camera housing.
 Draw a critical path diagram for the project.

Task		Time (weeks)	Depends on
A	Source plastic for dome	1	-
B	Design and make mould	2	-
C	Vacuum form dome	1	B
D	Trim to size	1	C
E	Assemble housing	1	D

- (ii) Construct a Gantt chart for the scheduling of the tasks involved.

Section C - Options - Answer any two of the Options.

Option 1 - Applied Control Systems - Answer 1(a) and 1(b)

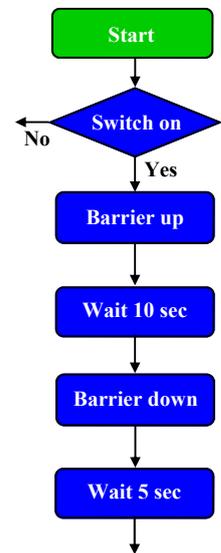
1(a) In the design of electronic circuits, their effectiveness can be tested by:

- prototyping with real components or
- simulation using a computer software package.

Explain how **each** of these methods can be used and outline **two** advantages of each method.

1(b) Shown is an incomplete program sequence which is intended to restrict the number of cars allowed into a car park to 8.

- Complete the programme sequence so that a maximum of 8 cars are allowed to enter the car park.
- Modify your completed programme sequence so that a red LED will illuminate when the car park is full.
- Servo motors are used to control the car park entry barrier. Why are servo motors suitable for this application?



Answer 1(c) or 1(d)

1(c) The 'hands' of a robot are often referred to as *end effectors*. Mechanical grippers and vacuum grippers are examples of such end effectors.

- Distinguish between the use of mechanical grippers and vacuum grippers as methods of robotic manipulation of objects.
- Describe the main features of a SCARA robot such as the one shown. (SCARA - Selective Compliant Assembly Robot Arm)



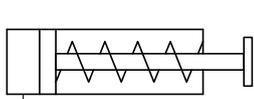
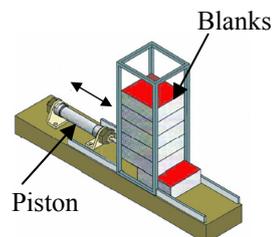
OR

1(d) (i) The compressor in a pneumatic control system supplies compressed air in a conditioned form through the stages of *filtration*, *pressure regulation* and *lubrication*. Explain **each** of these stages.

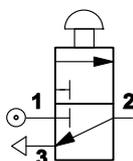
(ii) A pneumatic device supplies blanks to a machine for stamping. In this device:

- the piston advances a blank when a push-button is pressed
- on releasing the push-button the piston retracts ready to advance the next blank.

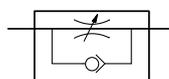
By selecting from the given symbols, draw a suitable pneumatic control circuit for the stamping operation.



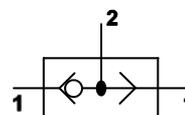
A



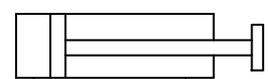
B



C



D



E

Option 2 - Electronics and Control - Answer 2(a) and 2(b)

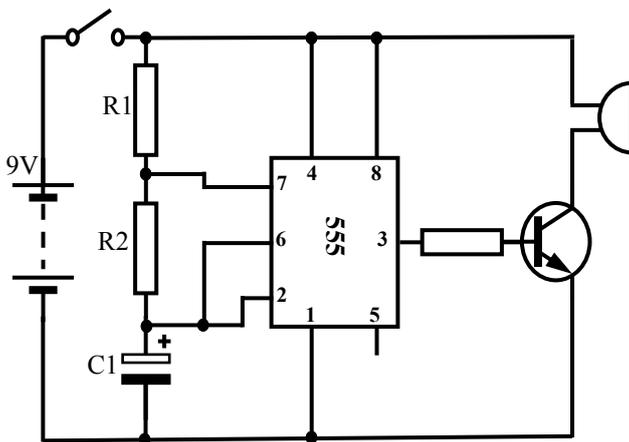
- 2(a) (i) The 'WEEE man' sculpture was made from 3 tonnes of electrical waste and used to promote the WEEE directive. All electrical and electronic goods are subject to the PRF in Ireland to offset the cost of their recycling.



Explain the terms WEEE and PRF.

- (ii) Outline the environmental impact of sending household batteries to landfill sites instead of to recycling centres.

- 2(b) A student's design for an audible warning device is shown. The device is based on an Astable circuit.



- (i) Redraw the circuit and identify the three main elements shown.



- (ii) Draw the output waveform of the 555 Astable circuit.

- (iii) Calculate the frequency of the circuit using the following resistor and capacitor values:

$$R1 = 100K; R2 = 47K \text{ and } C1 = 100\mu F$$

$$\text{Where frequency} = \frac{1.4}{(2R2 + R1) \times C1}$$

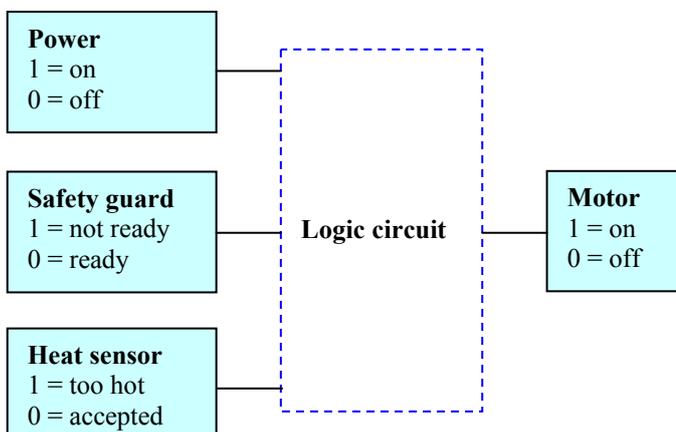
Answer 2(c) or 2(d)

- 2(c) DC motors are inexpensive and versatile but need to be controlled effectively. Describe, using appropriate diagrams, a method of achieving **each** of the following:

- (i) Reversing the direction of a DC motor using a relay.
 (ii) Reducing the speed of a DC motor.

OR

- 2(d) The scroll saw shown will only operate if the power is switched on, the safety guard is in place and a heat sensor detects that the saw has not overheated.



- (i) Draw and label the logic gates required.
 (ii) Draw the truth table for the system.

Option 3 - Information and Communications Technology - Answer 3(a) and 3(b)

- 3(a) (i) Email can be subject to *security issues*, *spam* and *viruses*. Explain any **two** of these terms.
- (ii) Outline, with examples, **two** functions of *encryption* in the use of information technology.
- 3(b) (i) Among the different types of computer software are *system software*, *utility programmes* and *device drivers*. Describe, with specific examples, **each** of these software types.
- (ii) A network interface card is needed for the networking of computers. State **two** functions of a network interface card.
- (iii) Using notes and sketches, distinguish between *ring* and *star* as network topologies.

Answer 3(c) or 3(d)

- 3(c) (i) Explain **two** functions of the power supply unit of a computer.
- (ii) Describe how pixels are used to form a bitmapped image.



OR

- 3(d) Audio sounds are converted into digital data through the process of digitisation. A series of three sound qualities, with their sample sizes and sampling rates are shown in the table below.

Sound Quality	Sampling rate (kHz)	Sample size (bits)
A	8	8
B	11.025	8
C	44.1	16

- (i) C represents the sound quality for commercial CD music tracks. Outline the effect that reducing the sampling rate and sample size would have on sound quality.
- (ii) Describe **two** functions of a sound card such as the one shown.



Option 4 - Manufacturing Systems - Answer 4(a) and 4(b)

4(a) The office printer shown runs for an average of three hours each day. It has been subjected to a series of accelerated tests before release onto the market.

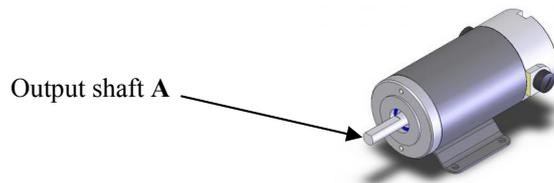


- (i) Describe **one** quantitative accelerated test that may be employed by the manufacturer of the printer.
- (ii) Outline **two** aspects of the design of this printer that may be evaluated by qualitative testing.
- (iii) The printer was tested for 3000 operating hours before a repair issue arose. Suggest, with reasons, a suitable guarantee period to be offered by the manufacturer.

4(b) (i) Sampling is an important consideration in conducting market research. Describe the consequences of:

- not sampling enough of the target group
- excessive sampling of the target group.

(ii) A large batch of DC motors is manufactured using an automated process. A sample of the motors will be tested to assess the conformance of the length of the output shaft A.



The formula for calculating sample size is $S = (Z/E)^2$ where:

S = sample size;

E = the error which is acceptable as a proportion of standard deviation;

Z is a number relating to the confidence in the accuracy of the sample as shown in the given table.

Confidence value for Z	
99%	2.58
95%	1.96
90%	1.64
80%	1.28

The standard deviation of the length of shaft A is already known and an error of 10% (0.1) of this is acceptable.

Calculate the sample size that will allow the conformance of shaft A to be determined with 95% confidence.

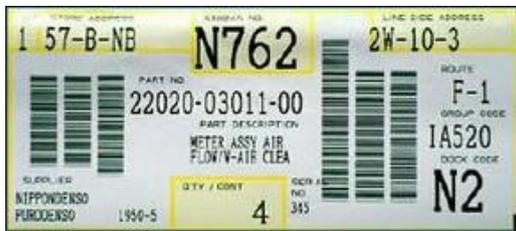
Answer 4(c) or 4(d)

4(c) (i) Just in Time Manufacturing (JIT) systems are used by many large companies such as car manufacturers.



Outline the key impacts of a JIT strategy for a large manufacturer.

(ii) Shown are two examples of a Kanban card system.

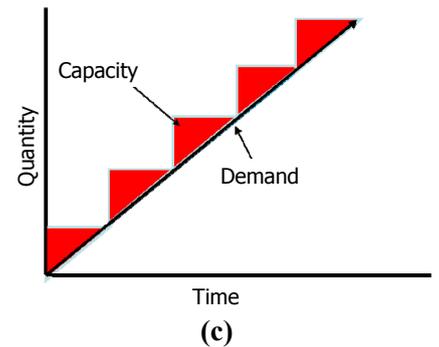
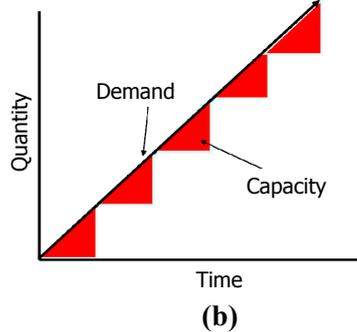
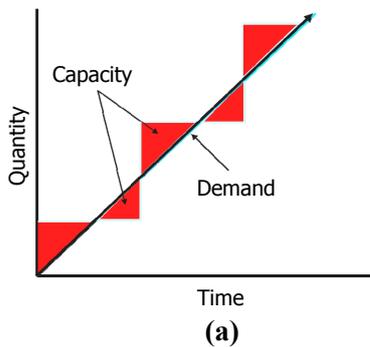


Product Line 1		KANBAN	
Supply source / Quelle PWH-MSTK	Demand source / Senke VERZ	Control cycle / Regelkreisnummer 0906928 - C1	
Material 0906928	Materialdescription / Materialkurztext Bosch Polkern 1 263 104 811		
	Size / Menge 320*000	Base unit / Mengeneinheit ST	
	Shipping unit / Transporteinheit 1 x 14 x	Printed / Gedruckt: 02.08.2008	

Outline the main features of a Kanban card system and give a specific application of its use.

OR

4(d) Three basic capacity strategies utilised by companies are shown graphically below at (a), (b) and (c).



(i) Name and explain each strategy.

(ii) Select a suitable strategy for a new business wishing to attract customers away from its competitors and justify your answer.

Option 5 - Materials Technology - Answer 5(a) and 5(b)

- 5(a) (i) Outline the main environmental consequences of **each** of the following:
- promoting the use of softwoods rather than hardwoods for classroom furniture
 - using thermosetting plastics.
- Use specific examples to support your answer.
- (ii) Describe a method of testing samples of ash, brass and polystyrene foam for thermal insulation properties.

5(b) The casing for a computer mouse is shown. The casing can be made from either aluminium or plastic.

- (i) Select a suitable plastic material for the casing and justify your selection.
- (ii) Describe, using annotated sketches, how the casing might be commercially manufactured.
- (iii) Explain, in detail, how the top and bottom parts of the mouse could be joined together while allowing for occasional disassembly to facilitate cleaning and maintenance.



Answer 5(c) or 5(d)

5(c) (i) The plastic casing for the mouse could be manufactured using:

- Once-off production
- Batch production
- Mass production.

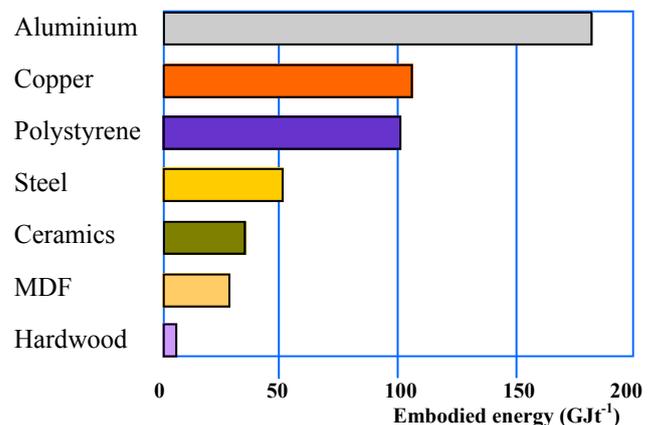
In the case of **two** of these production methods, name a specific manufacturing process which could be used. Outline **one** advantage of each process.

- (ii) Describe, using annotated sketches, **two** safety features that are integrated into the design of a CNC lathe or CNC router.

OR

5(d) Embodied energy is the total of the energy used in the extraction, manufacturing, marketing and disposal of a product throughout its lifecycle. The graphic shows the embodied energy values for some materials.

- (i) Outline the reasons for the high level of embodied energy in aluminium products.
- (ii) Metals are among the most widely recycled materials. Discuss the key reasons for this.



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