2005 HSC Notes from the Marking Centre Engineering Studies

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Contents

2005 HSC NOTES FROM THE MARKING CENTRE ENGINEERING STUDIES

Introduction

This document has been produced for the teachers and candidates of the Stage 6 course in Engineering Studies. It provides comments with regard to responses to the 2005 Higher School Certificate examination, indicating the quality of candidate responses and highlighting the relative strengths and weaknesses of the candidature in each section for each question. Comments have been made to indicate how candidates could improve their responses.

This document should be read along with the relevant syllabus, the 2005 Higher School Certificate examination, the marking guidelines and other support documents that have been developed by the Board of Studies to assist in the teaching and learning of Engineering Studies.

General Comments

In 2005, 1400 candidates attempted the Engineering Studies examination.

Teachers and candidates should be aware that each examination includes a number of different question styles. These range from questions that require the simple recall of knowledge through to those that expect candidates to respond by integrating the knowledge and skills they have developed through a comprehensive understanding of the entire course.

Section I

This section contained ten multiple-choice questions based on application modules. In several of these questions candidates were expected to complete calculations or interpret graphics in order to select the most appropriate response from the four choices given.

Question	Correct Response
1	C
2	C
3	D
4	B
5	C
6	A
7	B
8	A
9	D
10	B

Section II

General Comments

Overall, responses indicated that the majority of candidates had a good grasp of engineering concepts, appropriate for Higher School Certificate candidates. Candidates need to be aware that the answer space allocated for each question is a guide to the length of the required response.

Question 11 – Historical and Societal Influences, and the Scope of the Profession

(a) (i) This question was well answered, with a majority of responses identifying, and in most cases describing, a social issue connected with the design of the telephone booth. Issues commonly described in responses related to an impact on the local area and aesthetics; provision of a design that caters for all users including the aged and disabled; provision of a secure design that allows for privacy, or a design that was vandal-resistant. These responses then identified a group of people who should be consulted and have an input during the design of the telephone booth. Some responses identified a social issue but were unable to describe the issue further. Weaker responses found difficulty in identifying an interest group connected to the social issue and discussed technical issues only.

(ii) Responses demonstrated a sound understanding of a technical issue arising during the design of the new public telephone booth. A majority of responses then related this issue to a field of engineering other than telecommunication. Technical issues varied widely, from the structural strength and stability of the design and the availability of power cables to power the booth, to materials selection to resist corrosion and vandalism. These technical issues were related well to a corresponding engineering field. Some responses identified a relevant technical issue but then were unable to describe it in detail. A small number of responses were unable to identify appropriate fields of engineering that should be consulted.

(b) Candidates were able to identify many technological upgrades that may have been applied to large commercial aircraft. These upgrades included engines and engine components, wing tip modifications, and instrumentation such as navigation and digital control systems. Many candidates were well briefed on the role of the engineer and were able to explain the possible role and responsibilities that the engineer would perform. Weaker responses were unable to explain the role of the engineer in this process and this highlights the importance of candidates having a thorough understanding of the engineer's role and the scope of the profession.

(c) The quality of responses to this question was quite varied. Many responses discussed the duty of care to passengers and flight crew balanced with company pressure to reduce maintenance costs. Other responses discussed the recognition of and compliance with existing patents, copyrights and intellectual property and the temptation to copy existing designs in the development of aeronautical technologies. Another common ethical issue discussed was the development of aeronautical systems that are friendly to the environment, without reducing service to society or increasing costs to the company. While many responses were able to identify aeronautical engineering issues, they had difficulty providing a discussion of the ethical dilemmas engineers may face.

A majority of candidates provided well structured discussions and explanations in the Historical and Societal Influences, and the Scope of the Profession question. This year it was

clear that candidates had a sound knowledge of this area of study, but some responses indicated a lack of depth and of clear understanding of the work and issues engineers face. Many responses contained little discussion of engineering issues. Candidates should develop an understanding of the many technical, social and ethical issues that engineers face in their role at work.

Question 12 – Civil Structures

a) (i) The majority of responses outlined a property of either reinforced concrete or of prefabricated walls. However, only a few related this property to the material's suitability for the type of assembly indicated in the accompanying stimulus photograph, or to the in-service suitability as a finished wall. A large number of candidates misunderstood the intent of this question and simply described the properties of reinforced concrete – its strength in compression and improved tensile strength due to the steel reinforcement. Most responses did not attempt to outline the characteristics of this type of concrete construction.

(ii) Most responses recognised the benefits gained by this construction method at both locations and provided good discussions. A number of responses incorrectly identified 'dimensional accuracy' as an advantage and others simply listed the advantages rather than discussing the issues.

(b) (i) Most candidates were able to correctly relate the load and the area of the strut, and convert the given values to the appropriate units for use in calculations. However, a significant number of responses demonstrated a lack of understanding of 'kN' and 'mm^2' and could not use them correctly in calculations of the stress. Some responses used the given cross-sectional area of the strut as a diameter and then incorrectly calculated a different area.

(ii) While the majority of candidates were able to correctly identify compression as the nature of the force in the truss member, only a small number were able to calculate the magnitude of this force. Generally candidates who used the 'method of joint' or the 'method of section' were able to calculate a correct force in member A-B. However, a significant number of candidates did not use the correct perpendicular distance in their equations. Many candidates calculated the reaction at the roller support and incorrectly assumed that this was the magnitude of the internal force in member 'AB'.

Question 13 – Personal and Public Transport

(a) (i) A large number of candidates identified aerodynamics as the primary function of the canopy and then provided reasons such as 'lightweight', 'easily moulded or shaped' and 'durability' as the reason for a fibre-reinforced composite being used.
A small number of responses were unable to identify a physical function of the canopy, but correctly gave two reasons for the use of fibre-reinforced composite or alternatively gave a description relating the properties of a fibre-reinforced composite.

(ii) The majority of candidates correctly stated two properties of the canopy surface finish. Common acceptable answers included 'a smooth surface to assist with aerodynamics', 'ability to select suitable colours', 'aesthetics' and 'resistance to chemicals or corrosion'. Some responses did not identify a second property but repeated the first property in different terms. Another small group of responses identified properties of a fibre-reinforced composite that had no connection to the surface finish.

(b) (i) This question was poorly answered. Many candidates were able to calculate a height of the incline, the constant velocity or find an acceptable mass for either the truck or the panel. However, they were not able to complete the calculation necessary to determine the correct number of panels that could be carried.
A small number of candidates attempted unsuccessfully to solve the problem by substituting kinetic energy as a value for work.

(ii) This part of the question was reasonably well answered with a large number of responses that correctly explained the need to place the battens so that the bending stresses the panels are subjected to, while horizontal, can be minimised.
Another group of candidates interpreted the question to mean vertical spacing between the panels and then discussed the ease of loading/unloading, or protection of the panels from surface damage.

Question 14 – Lifting Devices

(a) Candidates should note that questions requiring calculations to be made should show the full working that leads to their final answer. Marks cannot be awarded to candidates who simply put an incorrect answer on the page without working. Often, candidates who show the working they follow towards their answer, even an incorrect one, will be awarded some marks for their method.

(i) Candidates either multiplied the two Velocity Ratios given to achieve a correct solution, or divided one by the other to get an incorrect solution. Generally responses displayed a sound understanding of Velocity Ratio for the electric motor and gearbox system.

(ii) Correct solutions noted that there were two cables lifting the door and therefore either halved the load on each cable or doubled the given cross-sectional area of the cable in their calculations. This question highlighted some common, but serious, errors amongst responses. Many did not convert units correctly for use in calculations or did not correctly manipulate formulae to achieve correct solutions.

(b) (i) Better responses identified the advantages of the induction motor and then compared these advantages to other possible electric motors for the door-lifting mechanism. Many responses displayed a limited understanding of the concepts of an induction motor and this resulted in very general answers, not specific enough to achieve maximum marks.

(ii) A large number of responses displayed a good understanding of powder forming and were able to outline the link between the service properties of the gear and the properties resulting from the gears being manufactured in this manner. A number of responses indicated a lack of understanding of the service properties and requirements of gears and were therefore unable to relate these to the appropriate benefits of the manufacturing process. A small but significant number of responses misinterpreted the question and simply described the manufacturing process.

(c) Better responses linked two of the safety features listed and then explained how each of these features made the door safer for the user. Many responses misinterpreted the question and simply explained how the feature worked without linking any OHS issues to the feature in their explanation. A number of responses did not relate a cause and effect in their explanation.

Question 15 – Aeronautical Engineering

(a) (i) Candidates who constructed a simple free-body diagram of the plane and then used a moment equation had little difficulty in successfully completing a solution to this question. However, many responses did not recognise the need to undertake this calculation of moments to correctly determine the horizontal distance *d*.

Many responses displayed a limited understanding of basic sign convention and substitution of correct values in the moment equation, resulting in errors in mathematical calculations. Candidates who attempted to use proportions in their calculations had difficulty obtaining an acceptable solution.

A small group of responses took measurements directly from the airplane graphic and scaled these to provide a solution. Candidates are reminded that unless a diagram indicates otherwise, diagrams are not drawn to scale.

(ii) Most responses indicated a limited understanding of the mechanics of flight as they relate to a tailplane.
Bernoulli's principle was often erroneously linked with the function of the tail to provide an upward lifting force rather than the counterbalancing downward force that keeps the aircraft level. Some candidates confused pitching, descending, ascending and rolling with the conditions required during level flight. Some responses misinterpreted the question and considered the vertical tailplane which was not mentioned in the question.

(iii) Better responses included information relating to mechanical advantage, reliability and maintenance requirements.
Many responses gave a limited explanation to support the use of the electric pump/hydraulic ram system.

(b) (i) Many responses provided a superficial response to this question by making statements like 'cracks were caused by the forces to which an aeroplane is subjected'. The two important aspects of the question involved cyclic stress and how cracks are initiated. Many responses stated corrosion as a crack initiator but few mentioned stress raisers, such a sharp corners and surface defects. Other responses used terms such as 'constant stress' and 'stress and strain' to incorrectly describe cyclic stress.

(ii) Dye penetrant test was the most popular non-destructive test explained in many responses. Ultra-sonic and radiation testing were also selected in many responses. While these tests are correct, many responses indicated a lack of knowledge about the testing processes and procedures, and many poor explanations were given.

(c) (i) Most candidates explained that the purpose of compressing the air immediately before the combustion chamber is to increase the charge density in the combustion chamber, thereby producing a high energy thrust after combustion.
A number of responses explained how the turbojet works rather than the purpose of compressing the air.

(ii) Better responses detailed the required properties of turbine blades indicating that they resist the high temperatures and velocities that occur after combustion: stiffness, high Young's Modulus, resistance to creep, fatigue, abrasion, oxidation and hot corrosion. Many responses simply stated properties rather than explaining them.

Question 16 – Telecommunication

(a) (i) The majority of candidates were able to identify the cable as the main characteristic of the headphones and were then able to explain that the length of the cable limited the user's movement around the room or the distance they could move from the source.

(ii) Better responses were able to identify that the carrier signal is used to transport the information, or audio, signal from the stereo unit to the headphones. Some responses indicated a limited knowledge of the process but were unable to explain it clearly. Many responses incorrectly focused on areas such as interference and data loss and tried to link these to the type of headphones.

(iii) The majority of candidates with better responses described line of sight for the infrared headphones and interference for the wireless headphones.

(b) (i) Although this was a complicated sketch, candidates were able to assemble most of the components correctly. Some responses indicated a problem recognising the small size of the connector and reading dimensioning standards. A limited knowledge and understanding of basic AS1100 drawing standards was noted in many responses: in particular those relating to sectioning of components and screw thread representation. Marks in this style of question are awarded for understanding of engineering component assembly and drawing standards and not for 'straight lines' and 'perfect arcs'. Candidates are strongly advised to gain more confidence in their freehand sketching techniques and thereby save time in examinations.

(ii) Many candidates correctly responded with manufacturing methods such as drawing and cropping or extrusion and cutting. Other responses did not read the drawing and failed to realise the small size of the brass insert and incorrectly gave methods such as forging, die casting, casting or powder forming.

(c) (i) Better responses explained the difference in sampling rates and related them to the amplitude and went on to explain why accurate reproduction was possible. These responses used the graphs provided to help explain their answer by using points obtained at the sampling instants on the signal. Very few responses explained that sampling needed to be carried out at greater than two times the frequency – the Nyquist rate – so that accurate reproduction is possible. A large number of responses restated what was happening in the graphs without explaining why accurate reproduction was or was not possible.

(ii) Generally candidates who were able to understand the relationship between frequency and sampling instants were able to sketch the correct answer. Some responses indicated that the candidates had plotted the instants and amplitude from the graphs supplied and developed the straight horizontal line. A large number of candidates simply redrew one of the graphs provided.

Section III

This section of the examination relates to engineering and the engineering report.

Question 17

(a) (i) This part was well answered by the majority of candidates. Better responses included corrosion resistance and aesthetic qualities.

(ii) This part was also well answered by the majority of candidates who were able to give a manufacturing property and a service property for the polymer roof structure.

(b) (i) Better responses identified tensile strength and shear strength as desirable mechanical properties for the bolts, and then explained the reasons these properties were important, such as resisting forces from collisions, wind and vandalism. Many responses simply listed the mechanical property.

(ii) Better responses described the use of similar corrosion free metals for the bolts and anchors, using nylon washers or silicon to isolate dissimilar metals to avoid corrosion cells. Some responses displayed a lack of understanding or knowledge of what an anchoring system for a phone booth might be. This made it difficult for them to suggest an appropriate corrosion prevention method. Many responses suggested using stainless or galvanised bolts but failed to make any reference to the rest of the anchoring system.

(c) This part of the question was well answered with most responses discussing good advantages of the single column design. These responses referred to the booth being smaller and less obtrusive, better access for all users and fewer panels making it less prone to vandalism.

Question 18

(a) Better responses addressed two of the three safety concerns that had been provided in the question and incorporated the material choice into their response. Weaker responses assumed that the hole in the grab handle still existed and did not address the safety concerns identified in the engineering report.
A small number of responses incorrectly identified the method of manufacture of the grab handle.

(b) This part of the question was well answered by the majority of candidates who were able to offer a wide variety of manufacturing, technical and societal changes and improvements that could initiate a design change after a period of time.

(c) The majority of candidates were able to correctly sketch the head of the tamper proof screw but neglected to include the depth of the features in the hexagonal head cavity and the locating pin.
Some responses demonstrated a disappointing level of skill in producing pictorial sketches.

Engineering Studies

2005 HSC Examination Mapping Grid

Question	Marks	Content	Syllabus outcomes
Section I			
1	1	Civil Structures/Materials Processes	H1.2, H2.1
2	1	Personal and Public Transport/ Friction	H3.1
3	1	Personal and Public Transport/ Materials Processes	H1.2, H2.1
4	1	Lifting Devices/Hydraulics/Materials	H1.2, H2.1
5	1	Personal and Public Transport/ Hydraulics	H3.1, H6.1
6	1	Personal and Public Transport/AC Power Generation	H2.2
7	1	Personal and Public Transport/AC Power Generation	H2.2, H4.2
8	1	Personal and Public Transport/DC Power Supply	H1.2, H2.2, H6.2
9	1	Civil Structures/Bending Stress	H3.1, H6.1
10	1	Lifting Devices/Force/Couples	H3.1
Section II **Question 11 — Historical and Societal Influences, and the Scope of the Profession**			
11 (a) (i)	2	Telecommunication – Historical and Societal Influences	H1.1, H2.2
11 (a) (ii)	2	Telecommunication – Scope of the Profession	H1.1
11 (b)	3	Aeronautical Engineering – Scope of the Profession	H1.1, H4.2
11 (c)	3	Aeronautical Engineering – Scope of the Profession	H1.1, H4.3, H5.2
Section II **Question 12 — Civil Structures**			
12 (a) (i)	2	Materials	H1.1, H2.1, H4.1
12 (a) (ii)	3	Materials	H1.1, H4.3, H5.2
12 (b) (i)	2	Mechanics	H3.1
12 (b) (ii)	3	Mechanics	H3.1

Question	Marks	Content	Syllabus outcomes
Section II **Question 13 — Personal and Public Transport**			
13 (a) (i)	3	Materials	H2.1, H3.2
13 (a) (ii)	2	Materials, Properties	H2.1
13 (b) (i)	3	Mechanics Power/Force	H3.1
13 (b) (ii)	2	Bending Materials	H1.2, H2.1
Section II **Question 14 — Lifting Devices**			
14 (a) (i)	1	Velocity Radio Calculation	H3.1, H5.1, H6.2
14 (a) (ii)	3	Load/Extension Calculation	H3.1, H5.1, H6.2
14 (b) (i)	2	Electric Motor Selection	H1.2, H2.1
14 (b) (ii)	2	Metal/Gear Manufacture	H1.2, H2.1
14 (c)	2	Safety Systems	H1.1, H4.3, H5.1, H6.2
Section II **Question 15 — Aeronautical Engineering**			
15 (a) (i)	2	Engineering	H2.2, H3.1
15 (a) (ii)	2	Basic Aerodynamics and Engineering Mechanics	H2.2, H4.1, H6.2
15 (a) (iii)	3	Hydraulic Systems used in Aircraft	H4.2, H6.1
15 (b) (i)	2	Engineering Mechanics – Bending Stresses in Airframes/Corrosion	H1.2, H4.2
15 (b) (ii)	2	Specialised Testing of Aircraft Materials	H1.2, H2.2
15 (c) (i)	2	Propulsion Systems	H2.2, H6.2
15 (c) (ii)	2	Engineering Materials/Properties/ Applications	H1.2, H2.1, H4.1

Question	Marks	Content	Syllabus outcomes
Section II **Question 16 — Telecommunication**			
16 (a) (i)	2	Transmission Media	H1.2, H2.1
16 (a) (ii)	2	Modulation & Modulators	H3.1
16 (a) (iii)	2	Transmission Media	H1.2, H2.1
16 (b) (i)	5	Sectional Drawing/Communication	H3.2, H3.3, H5.1, H6.2
16 (b) (ii)	1	Electrical/Materials	H1.1, H3.2, H6.2
16 (c) (i)	2	Electricity/Electronics	H3.1, H6.2
16 (c) (ii)	1	Electricity/Electronics	H3.1, H6.2
Section III **Question 17 — Engineering and the Engineering Report**			
17 (a) (i)	2	Civil Structures/Telecommunication	H1.1, H1.2, H2.1
17 (a) (ii)	2	Civil Structures/Telecommunication	H1.2, H2.1
17 (b) (i)	2	Civil Structures/Telecommunication	H1.2, H2.1
17 (b) (ii)	2	Civil Structures/Telecommunication	H1.2, H2.1
17 (c)	2	Civil Structures/Telecommunication	H1.1, H2.2, H4.3
Section III **Question 18 — Engineering and the Engineering Report**			
18 (a)	4	Civil Structures/Transport	H1.2, H2.1, H2.2, H3.2, H4.3
18 (b)	3	Civil Structures/Communications/ Scope of the Profession	H1.2, H4.1, H4.3
18 (c)	3	Pictorial Drawing/Communication	H3.1, H3.2, H3.3

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2005 HSC Engineering Studies
Marking Guidelines

Section II

Question 11 (a) (i)

Outcomes assessed: H1.2, H2.2

MARKING GUIDELINES

Criteria	Marks
• Describes a social issue and identifies an appropriate consultation group	2
• Identifies a social issue with no appropriate consultation OR • Identifies an appropriate consultation group without a social issue	1

Question 11 (a) (ii)

Outcomes assessed: H1.1

MARKING GUIDELINES

Criteria	Marks
• Provides a description of a technical issue and identifies one engineering field	2
• Identifies a technical issue and no appropriate engineering field to consult OR • Identifies an engineering field and no technical issue described	1

Question 11 (b)

Outcomes assessed: H1.1, H4.2

MARKING GUIDELINES

Criteria	Marks
• Identifies an appropriate technological upgrade AND • Provides a clear explanation of the role of an aeronautical engineer	3
• Identifies a technological upgrade AND • Provides limited understanding of the role of the aeronautical engineer	2
• Identifies an appropriate technological upgrade OR • Provides limited understanding of the role of an aeronautical engineer	1

Question 11 (c)

Outcomes assessed: H1.1, H4.3, H5.2

MARKING GUIDELINES

Criteria	Marks
• Discusses a relevant ethical issue that an aeronautical engineer may need to consider in their work	3
• Identifies a relevant ethical issue and provides a limited discussion	2
• Identifies an ethical issue relevant to engineering OR • Identifies an engineering issue	1

Question 12 (a) (i)

Outcomes assessed: H1.1, H2.1, H4.1

MARKING GUIDELINES

Criteria	Marks
• Outlines ONE characteristic or property that makes it suitable for use in tilt-up assembly AND • Outlines ONE characteristic or property that makes it suitable for service in a finished wall	2
• Outlines ONE characteristic or property that makes it suitable for use in tilt-up assembly or service in a finished wall OR • Lists ONE characteristic or property for both assembly and service	1

Question 12 (a) (ii)

Outcomes assessed: H1.1, H4.3, H5.2

MARKING GUIDELINES

Criteria	Marks
• Discusses the issues in fabrication of tilt-up walls off and on-site	3
• Identifies ONE advantage each for off and on-site construction of tilt-up walls	2
• Identifies ONE advantage relating to on or off-site fabrication of tilt-up walls	1

Question 12 (b) (i)

Outcomes assessed: H3.1

MARKING GUIDELINES

Criteria	Marks
• Uses an appropriate method or gives correct solution	2
• Uses an appropriate method with minor errors	1

Question 12 (b) (ii)

Outcomes assessed: H3.1

MARKING GUIDELINES

Criteria	Marks
• Uses correct method or gives correct solution	3
• Uses a correct method but with minor errors	2
• Uses a correct method with significant errors	1

Question 13 (a) (i)

Outcomes assessed: H2.1, H3.2

MARKING GUIDELINES

Criteria	Marks
• Gives at least one physical function of canopy AND • Gives two reasons for the choice of fibre-reinforced composite materials	3
• Gives one physical function of canopy AND • Gives one reason for the choice of fibre-reinforced composite materials OR • Two reasons for the choice of fibre-reinforced composite materials	2
• Gives one physical function of canopy OR • Gives one reason for the use of fibre-reinforced composite materials	1

Question 13 (a) (ii)

Outcomes assessed: H2.1

MARKING GUIDELINES

Criteria	Marks
• Gives two properties	2
• Gives one property	1

Question 13 (b) (i)

Outcomes assessed: H3.1

MARKING GUIDELINES

Criteria	Marks
• Uses correct method OR gives correct answer	3
• Uses correct method with minor errors	2
• Uses a correct method with significant errors	1

Question 13 (b) (ii)

Outcomes assessed: H1.2, H2.1

MARKING GUIDELINES

Criteria	Marks
• Explains the reason of importance for spacing in terms of force or moment distribution	2
• Gives one reason for the importance of spacing	1

Question 14 (a) (i)

Outcomes assessed: H3.1, H5.1, H6.2

MARKING GUIDELINES

Criteria	Marks
• Uses a correct method or gives a correct answer	1

Question 14 (a) (ii)

Outcomes assessed: H3.1, H5.1, H6.2

MARKING GUIDELINES

Criteria	Marks
• Uses a correct method or gives a correct answer	3
• Uses a correct method with minor errors	2
• Uses a correct method with significant errors	1

Question 14 (b) (i)

Outcomes assessed: H1.2, H2.1

MARKING GUIDELINES

Criteria	Marks
• Identifies TWO appropriate reasons for choice	2
• Gives ONE appropriate reason for choice	1

Question 14 (b) (ii)

Outcomes assessed: H1.2, H2.1

MARKING GUIDELINES

Criteria	Marks
• Two correct explanations for using powder forming	2
• One correct explanation for using powder forming	1

Question 14 (c)

Outcomes assessed: H1.1, H4.3, H5.1, H6.2

MARKING GUIDELINES

Criteria	Marks
• Explains two improvements in safety related to given features	2
• Explains one improvement in safety related to given features OR • Describes accurately two safety features	1

Question 15 (a) (i)

Outcomes assessed: H2.2, H3.1

MARKING GUIDELINES

Criteria	Marks
• Uses a correct method or gives a correct answer	2
• Uses an appropriate method with minor errors	1

Question 15 (a) (ii)

Outcomes assessed: H2.2, H4.1, H6.2

MARKING GUIDELINES

Criteria	Marks
• Provides a clear explanation of properties/principles of aerodynamics related to flight stability	2
• Provides some link between properties/principles of aerodynamics and flight stability	1

Question 15 (a) (iii)

Outcomes assessed: H4.2, H6.1

MARKING GUIDELINES

Criteria	Marks
• Provides a clear understanding of 2 or more reasons	3
• Provides a clear understanding of one reason OR • Provides some understanding of two reasons	2
• Provides limited understanding	1

Question 15 (b) (i)

Outcomes assessed: H1.2, H4.2

MARKING GUIDELINES

Criteria	Marks
• Provides clear explanation of two reasons for crack formation OR • Mentions cyclic loads/stress and one reason for crack formation	2
• Provides clear explanation of one reason for crack formation OR • Demonstrates some understanding of crack formation OR • Mentions cyclic loads/stress	1

Question 15 (b) (ii)

Outcomes assessed: H1.2, H2.2

MARKING GUIDELINES

Criteria	Marks
• Names and provides a clear understanding of one suitable method of testing	2
• Names a suitable method OR • Shows an understanding of an appropriate test	1

Question 15 (c) (i)

Outcomes assessed: H2.2, H6.2

MARKING GUIDELINES

Criteria	Marks
• Provides a clear explanation of two reasons why the air is compressed	2
• Shows some understanding of the compressor stage	1

Question 15 (c) (ii)

Outcomes assessed: H1.2, H2.1, H4.1

MARKING GUIDELINES

Criteria	Marks
• Explains two engineering properties of turbine blades	2
• Explains one engineering property of turbine blades OR • Provides limited understanding of turbine blades OR • States two engineering properties of turbine blades	1

Question 16 (a) (i)

Outcomes assessed: H1.2, H2.1

MARKING GUIDELINES

Criteria	Marks
• Identifies a property or characteristic of cable connected headphone AND • Identifies a performance limitation associated with identified property or characteristic	2
• Identifies a property or characteristic of cable connected headphone OR • Identifies a performance limitation with identified property or characteristic	1

Question 16 (a) (ii)

Outcomes assessed: H3.1

MARKING GUIDELINES

Criteria	Marks
• Explains the purpose of modulation in linking the carrier and information signal for transmission	2
• Discriminates between carrier and information signals OR • Identifies that carrier signal conveys no information	1

Question 16 (a) (iii)

Outcomes assessed: H1.2, H2.1

MARKING GUIDELINES

Criteria	Marks
• Description of a performance limitation of infra-red linked headphones AND • Description of a performance limitation of radio-linked headphones	2
• Description of a performance limitation of infra-red linked or radio-linked headphones OR • Reasonable description of a performance limitation of infra-red linked and radio-linked headphones	1

Question 16 (b) (i)

Outcomes assessed: H3.2, H3.3, H5.1, H6.2

MARKING GUIDELINES

Criteria	Marks
• Provides correct assembly and proportion of components with correct standards	5
• Provides correct assembly and proportion of components with substantially correct standards	4
• Provides substantially correct assembly and proportion of components with some correct standards	3
• Provides basic assembly and proportion of components or accurately draws and sections the insulator	2
• Provides poor assembly and proportion of components or accurately draws and sections the insulator	1

Question 16 (b) (ii)

Outcomes assessed: H1.1, H3.2, H6.2

MARKING GUIDELINES

Criteria	Marks
• Names an appropriate manufacturing method.	1

Question 16 (c) (i)

Outcomes assessed: H3.1, H6.2

MARKING GUIDELINES

Criteria	Marks
• Identifies that Graph 1 is sampled at greater than 2f signal (Nyquist rate) OR by explanation with reference to the graph shows that the sampling rate of Graph 1 can provide an accurate reproduction of the original signal AND • Identifies that Graph 2 is sampled at less than 2f signal OR by explanation with reference to the Graph 2 shows that the resulting output signal will not be a good reproduction of the original signal	2
• Identifies that sampling needs to be at a greater rate than the signal frequency to approximate original signal	1

Question 16 (c) (ii)

Outcomes assessed: H3.1, H6.2

MARKING GUIDELINES

Criteria	Marks
• Draws a straight line to represent the signal	1

Section III

Question 17 (a) (i)

Outcomes assessed: H1.1, H1.2, H2.1

MARKING GUIDELINES

Criteria	Marks
• Outlines at least two advantages of stainless steel panels	2
• Outlines one advantage of stainless steel panels	1

Question 17 (a) (ii)

Outcomes assessed: H1.2, H2.1

MARKING GUIDELINES

Criteria	Marks
• Lists at least one property required during manufacture AND • Lists at least one property required in service	2
• Lists at least one property required during manufacture OR • Lists at least one property required in service	1

Question 17 (b) (i)

Outcomes assessed: H1.2, H2.1

MARKING GUIDELINES

Criteria	Marks
• Explains TWO mechanical requirements that include the essential property and why it is required	2
• Gives ONE mechanical requirement that includes the essential property and why it is required OR • Gives TWO mechanical requirements	1

Question 17 (b) (ii)

Outcomes assessed: H1.2, H2.1

MARKING GUIDELINES

Criteria	Marks
• Describes two approaches to reduce the effect of corrosion	2
• Describes one approach to reduce the effect of corrosion	1

Question 17 (c)

Outcomes assessed: H1.1, H2.2, H4.3

MARKING GUIDELINES

Criteria	Marks
• Provides at least two advantages with some discussion	2
• Provides one advantage with some discussion OR • Lists two advantages with no discussion	1

Question 18 (a)

Outcomes assessed: H1.2, H2.1, H2.2, H3.2, H4.3

MARKING GUIDELINES

Criteria	Marks
• Discusses the relationship of the selected material and redesigned shape to the THREE safety concerns	4
• Selects material and lists THREE reasons for redesign improvements OR • Selects material and discusses TWO design aspects	3
• Selects material and lists TWO reasons for redesign OR • Selects material and discusses ONE design aspect only	2
• Selects material and comments on ONE design aspect OR • Comments on TWO design aspects	1

Question 18 (b)

Outcomes assessed: H1.2, H4.1, H4.3

MARKING GUIDELINES

Criteria	Marks
• Good explanation of at least TWO reasons for changing requirements about acceptable design	3
• Explanation with good detail of ONE reason for changing requirements • Inadequate detail about TWO reasons for changing requirements	2
• States a reason for changing requirements	1

Question 18 (c)

Outcomes assessed: H3.1, H3.2, H3.3

MARKING GUIDELINES

Criteria	Marks
• Provides appropriate detail and shape using a pictorial method	3
• Provides a substantially correct sketch using a pictorial method	2
• Provides some aspects of the shape and proportion of the pin	1