BOARD OF STUDIES
NEW SOUTH WALES

2011 HSC Engineering Studies
Marking Guidelines

Section I

Multiple-choice Answer Key

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

Section II

Question 11 (a) (i)

Criteria	Marks
• Recognises and names TWO innovations between the two bikes OR • Recognises and names ONE material innovation between the two bikes and outlines how or why it is used	1

Question 11 (a) (ii)

Criteria	Marks
• Recognises and names TWO changes in characteristics/features of the mechanical system between the 2 bikes OR • Recognises and names ONE change in characteristics/features of the mechanical system between the 2 bikes and justifies how it has led to improved efficiency	2
• Recognises and names ONE change in characteristic/feature of the mechanical system between the two bikes	1

Question 11 (a) (iii)

Criteria	Marks
• Correctly identifies an appropriate engineering field and outlines developments that have contributed to bicycle manufacture	2
• Correctly identifies an appropriate engineering field but without an outline OR lists some developments	1

Question 11 (b)

Criteria	Marks
• Identifies and provides points for or against the use of bicycles to address TWO environmental issues	3
• Identifies and provides points for or against the use of bicycles to address ONE environmental issue that relates to the use of bicycles as a transport system OR covers TWO or more environmental issues briefly	2
• Lists points for or against the use of bicycles and the environment	1

Question 11 (c)

Criteria	Marks
• Indicates the main features of an appropriate project and identifies an ethical issue from within that project, providing points for OR against this issue	2
• Names an ethical issue from within a project without giving for OR against points in regard to this issue	1

Question 12 (a) (i)

Criteria	Marks
• States an advantage or advantages	1

Question 12 (a) (ii)

Criteria	Marks
• Names and describes the compression testing process correctly	2
• Only names the correct process OR describes an incorrect process	1

Question 12 (b)

Criteria	Marks
• Provides detail on the process of glass toughening and relates the properties to building application	2
• Provides a limited discussion OR identifies appropriate application	1

Question 12 (c) (i)

Criteria	Marks
• Demonstrates correct use of moments with consistent sign convention • Resolves components to determine the magnitude and direction of A	3
• Demonstrates moments principles with some minor errors/or some wrong sign convention • Determines answer in vertical and horizontal components only	2
• Demonstrates limited understanding and application of moments with errors	1

Question 12 (c) (ii)

Criteria	Marks
• Demonstrates correct use of method (method of sections or methods of joints) to calculate correct answer • Determines correct nature of the force	2
• Determines correct magnitude with incorrect nature of force • Determines correct nature of force with incorrect or no magnitude of force found	1

Question 13 (a) (i)

Criteria	Marks
• Demonstrates correct use of moments with correct signs and perpendicular distances to calculate answer	2
• Demonstrates use of moments with some minor errors (signs or distances)	1

Question 13 (a) (ii)

Criteria	Marks
• Demonstrates an understanding of VR and calculates velocity ratio using all drive mechanism	2
• Demonstrates an understanding of VR and calculates velocity ratio using part of drive mechanism	1

Question 13 (b)

Criteria	Marks
• Correctly identifies a process and a description of the manufacture	2
• Correctly identifies a process with an incorrect explanation OR • Identifies an incorrect process followed by a correct explanation of that process	1

Question 13 (c)

Criteria	Marks
• Names a correct type of motor and provides justification	2
• Names type of motor with no justification	1

Question 13 (d)

Criteria	Marks
• Explains the process of vulcanisation and describes how this enhances mechanical properties	2
• Explains the process of vulcanisation OR • Mentions some changes in properties without reference to cross-linking	1

Question 14 (a)

Criteria	Marks
• All inputs connected correctly and brake applied has a value of 1	2
• Determines that reverse gear selected is the input to the NOT gate, other inputs incorrectly connected	1
• Determines that sensor 1 and sensor 2 are inputs to the OR gate, with other inputs incorrectly connected	1

Question 14 (b)

Criteria	Marks
• Calculates the correct load applying the correct factor of safety	2
• Calculates correct load with no use of factor of safety, or incorrectly uses factor of safety • Demonstrates use of moments OR correct use of factor of safety	1

Question 14 (c) (i)

Criteria	Marks
• Correctly sketches a normalised 0.4% carbon steel microstructure and labels/names both pearlite and ferrite	2
• Sketches an appropriate diagram without labels, OR incorrect sketch with one appropriate label • Indicates fine/refined grains due to normalising	1

Question 14 (c) (ii)

Criteria	Marks
• Correct shear force AND bending moment diagrams with appropriate values	3
• Correct shear force OR bending moment diagrams with appropriate values	2
• Shows some understanding of shear force OR bending moments	1

Question 14 (d)

Criteria	Marks
• Gives a valid reason why the process is suitable	1

Question 15 (a) (i)

Criteria	Marks
• Shows laminar flow over aerofoil at 4° and turbulent flow over 25° aerofoil	1

Question 15 (a) (ii)

Criteria	Marks
• Highlights the change in lift force angle and relates this to reduction in vertical lift and drop in altitude	2
• States only that vertical lift is reduced or gives only mathematical answer	1

Question 15 (b)

Criteria	Marks
• Correct connection between concept of proportion expansion of diaphragm with falling pressure due to altitude	2
• Limited understanding of concepts eg ‘Instrument measures change in air pressure’	1

Question 15 (c) (i)

Criteria	Marks
• Correct sketch, correctly identifying two suitable components to form laminate	2
• No sketch, but listing two components OR • Materials listed, but not forming a laminate OR foam laminate OR honeycomb laminate • Appropriate sketch but components not labelled	1

Question 15 (c) (ii)

Criteria	Marks
• Correctly describes two different properties that are enhanced by laminating the two materials	2
• Correctly describes one property that is enhanced by process of lamination OR • Names (identifies) two properties without description	1

Question 15 (d)

Criteria	Marks
• Correctly names and describes a suitable non-destructive test	2
• Limited understanding of a non-destructive test OR • Names an appropriate non-destructive test	1

Question 15 (e)

Criteria	Marks
• Provides a pictorial drawing in proportion AND correct shape	4
• Provides a substantially correct pictorial drawing, mostly complete	3
• Provides a pictorial drawing with some aspects correct	2
• Provides a limited AND/OR incomplete pictorial sketch	1

Question 16 (a)

Criteria	Marks
• Provides correct comparison for TWO types of orbit	2
• Provides a correct explanation of ONE type of orbit OR names TWO types of orbits without providing a correct explanation	1

Question 16 (b)

Criteria	Marks
• Outlines TWO forms of multiplexing	2
• Names ONE form of multiplexing and provides a correct description	1
• Demonstrates an understanding of multiplexing	1

Question 16 (c)

Criteria	Marks
• Suitability of Bakelite discussed, demonstrating sound understanding of reasons	2
• A suitable advantage listed without being discussed	1

Question 16 (d) (i)

Criteria	Marks
• Provides a correct description of an advantage and provides an explanation	2
• Names an advantage without providing an explanation	1

Question 16 (d) (ii)

Criteria	Marks
• Provides a correct sketch to represent the output of the FSK modulator	2
• Demonstrates knowledge of modulation in sketch	1

Question 16 (e)

Criteria	Marks
• Provides correct assembly AND proportion of components with correct standards or only minor errors	5
• Provides partial assembly AND proportion of components with some errors	4
• Provides partial assembly AND proportion of components with a significant error	3
• Provides partial assembly AND proportion of components	2
• Provides partial assembly AND proportion of components with significant errors OR unassembled but correct proportion of components with minor errors • Unassembled but correct proportion of components with significant errors	1

Question 17 (a) (i)

Criteria	Marks
• Understanding that any statement made in an Engineering report must be based on accepted and identified standards and texts	1

Question 17 (a) (ii)

Criteria	Marks
• Lists TWO appropriate criteria	2
• Lists ONE appropriate criteria	1

Question 17 (a) (iii)

Criteria	Marks
• Viable test selected and relevant features of the test described	3
• Viable test selected and described with some detail	2
• Names a viable test without detail	1

Question 17 (b) (i)

Criteria	Marks
• Correct formula leading to correct answer	2
• Partial solution with some sort of equation with an energy/work value divided by time	1

Question 17 (b) (ii)

Criteria	Marks
• Correct formula leading to a correct answer	2
• Correctly determined theoretical power value OR a reasonable expression for efficiency	1

Question 18 (a)

Criteria	Marks
• Outlines advantage(s) AND disadvantage(s) of increased access	2
• Outlines only advantage(s) OR disadvantage(s) • Only states/lists advantage(s) and disadvantage(s)	1

Question 18 (b) (i)

Criteria	Marks
• Describes more than one advantage in sufficient detail	2
• Describes only one advantage, or only lists advantages	1

Question 18 (b) (ii)

Criteria	Marks
• Outlines key purposes of both components	2
• Outlines purpose of only one component, or states a property for both without detailing purposes	1

Question 18 (b) (iii)

Criteria	Marks
• Correctly calculates the current	2
• Calculates the current using the wrong voltage	1
• Correctly calculates voltage across resistor but fails to get correct answer for the current	1

Question 18 (c)

Criteria	Marks
• Correct use of formulae to determine correct answer	2
• Incompatible orders of magnitude of units used in calculations • Reasonable substitution into appropriate formulae	1

Engineering Studies

2011 HSC Examination Mapping Grid

Section I

Question	Marks	Content	Syllabus outcomes
1	1	Lifting devices – Engineering mechanics and hydraulics; fluid mechanics	H3.1
2	1	Civil structures – Engineering materials; corrosion	H1.2
3	1	Civil structures – Communication; Australian Standard AS1100	H3.3
4	1	Civil structures – Engineering mechanics and hydraulics; crack theory	H6.1
5	1	Personal and public transport – Engineering mechanics and hydraulics; energy, power	H3.1
6	1	Personal and public transport – Engineering electricity/electronics; electric motors used in transport systems	H2.2
7	1	Lifting devices – Engineering materials; structure/property relationships in forming processes	H1.2
8	1	Lifting devices – Engineering electricity/electronics; motors	H2.1
9	1	Personal and public transport – Engineering mechanics and hydraulics; static friction	H3.1
10	1	Civil structures – Communication; orthogonal assembly drawings	H3.3

Section II

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

Question	Marks	Content	Syllabus outcomes
11 (a) (i)	1	Personal and public transport – Historical and societal influences; effects of engineering innovation in transport on people's lives	H1.2, H2.1
11 (a) (ii)	2	Personal and public transport – Historical and societal influences; effects of engineering innovation in transport on people's lives	H1.2, H4.2
11 (a) (iii)	2	Personal and public transport – Historical and societal influences; historical developments in transport systems	H4.3
11 (b)	3	Personal and public transport – Historical and societal influences; environmental effects of transport systems	H1.1
11 (c)	2	Aeronautical engineering – Scope of the profession: Ethical implications	H6.1

Section II
Question 12 — Civil Structures

Question	Marks	Content	Syllabus outcomes
12 (a) (i)	1	Civil structures – Engineering materials; composites	H2.1, H6.1, H6.2
12 (a) (ii)	2	Civil structures – Engineering materials; testing of materials	H1.2, H2.1, H6.2
12 (b)	2	Civil structures – Engineering materials; ceramics; glass	H1.2, H2.1
12 (c) (i)	3	Civil structures – Engineering mechanics and hydraulics; truss analysis	H3.1, H6.2
12 (c) (ii)	2	Civil structures – Engineering mechanics and hydraulics; truss analysis	H3.1, H6.2

Section II
Question 13 — Personal and Public Transport

Question	Marks	Content	Syllabus outcomes
13 (a) (i)	2	Personal and public transport – Engineering mechanics and hydraulics; apply mathematical and/or graphical methods to solve engineering problems related to transport. Syllabus p34, p37.	H3.1, H6.2
13 (a) (ii)	2	Personal and public transport – Engineering mechanics and hydraulics; apply mathematical and/or graphical methods to solve engineering problems related to transport	H3.1, H6.2
13 (b)	2	Personal and public transport – Engineering materials; structure/property relationship in the material forming processes	H1.2
13 (c)	2	Personal and public transport – Engineering electricity/electronics; electric motors used in transport systems	H2.1
13 (d)	2	Personal and public transport – Engineering materials; polymers	H2.1

Section II
Question 14 — Lifting Devices

Question	Marks	Content	Syllabus outcomes
14 (a)	2	Lifting devices – Engineering electricity/electronics; motor control	H3.1, H6.2
14 (b)	2	Lifting devices – Engineering mechanics and hydraulics; conditions of equilibrium for concurrent non-coplanar forces	H3.1, H6.2
14 (c) (i)	2	Lifting devices – Engineering materials; structure/property relationships in the material forming processes	H1.2

14 (c) (ii)	3	Lifting devices – Engineering mechanics and hydraulics; conditions of equilibrium for concurrent non-coplanar forces	H3.1, H6.2
14 (d)	1	Lifting devices – Engineering materials; powder forming	H1.2, H2.1

Section II
Question 15 — Aeronautical Engineering

Question	Marks	Content	Syllabus outcomes
15 (a) (i)	1	Aeronautical Engineering – Engineering mechanics and hydraulics; basic aerodynamics	H3.1, H6.2
15 (a) (ii)	2	Aeronautical Engineering – Engineering mechanics and hydraulics; forces	H3.1, H6.2
15 (b)	2	Aeronautical Engineering – Engineering mechanics and hydraulics; application to aircraft instruments	H3.1
15 (c) (i)	2	Aeronautical Engineering – Engineering materials; composites	H1.2, H2.1
15 (c) (ii)	2	Aeronautical Engineering – Engineering materials; composites	H1.2
15 (d)	2	Aeronautical Engineering – Engineering materials; specialised testing of aircraft materials	H1.2, H6.2, H3.3
15 (e)	4	Aeronautical Engineering – Communication; freehand and technical drawing; pictorial and orthogonal projections	H3.3

Section II
Question 16 — Telecommunication

Question	Marks	Content	Syllabus outcomes
16 (a)	2	Telecommunication – Engineering electricity/electronics; satellite communication systems, geostations	H4.1, H1.2
16 (b)	2	Telecommunication – Engineering electricity/electronics; modulation, demodulation	H1.2
16 (c)	2	Telecommunication – Engineering materials; polymers	H1.2, H2.1, H4.1
16 (d) (i)	2	Telecommunication – Engineering electricity/electronics; modulation, demodulation	H1.2, H6.2
16 (d) (ii)	2	Telecommunication – Engineering electricity/electronics; modulation, demodulation	H6.2
16 (e)	5	Telecommunication – Communication; freehand and pictorial drawing, pictorial and dimensioned orthogonal drawings	H3.3

Section III
Question 17 — Engineering and the Engineering Report

Question	Marks	Content	Syllabus outcomes
17 (a) (i)	1	Personal and public transport – Communication; Engineering Report writing	H2.2
17 (a) (ii)	2	Personal and public transport – Communication; Engineering Report writing	H1.2
17 (a) (iii)	3	Personal and public transport – Communication; Engineering Report writing	H2.2
17 (b) (i)	2	Personal and public transport – Engineering mechanics and hydraulics; energy, power	H3.1
17 (b) (ii)	2	Personal and public transport – Engineering mechanics and hydraulics; energy, power	H3.1

Section III
Question 18 — Engineering and the Engineering Report

Question	Marks	Content	Syllabus outcomes
18 (a)	2	Telecommunication – Historical and societal influences; the effect of telecommunication engineering innovation on people's lives	H1.1, H2.2, H3.2
18 (b) (i)	2	Telecommunication – Engineering electricity/electronics; transmission media, fibre-optics	H1.1, H1.2, H2.2
18 (b) (ii)	2	Telecommunication – Engineering materials; copper and its alloys used in telecommunications; polymers	H1.2, H2.1, H3.3
18 (b) (iii)	2	Personal and public transport – Engineering electricity/electronics; AC/DC circuits	H3.1
18 (c)	2	Civil structures – Engineering mechanics and hydraulics; stress and strain; Young's modulus	H3.1