BOARD OF STUDIES
NEW SOUTH WALES

2013 HSC Industrial Technology
Electronics Technologies
Marking Guidelines

Section I

Multiple-choice Answer Key

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

Section II

Question 11

Criteria	Marks
• Correctly lists two appropriate visual checks to identify faults within a non operational PCB	2
• Correctly lists one appropriate visual check to identify faults within a non operational PCB	1

Sample answer:

Two common faults in a non-operational PCB that could be identified visually would be dry joints and broken tracks.

Answers could include:

- Broken tracks
- Missing components
- Components placed incorrectly
- Wrong values of components
- Faulty solder joins including dry joints or cross soldered
- Broken wires
- Fuses blown
- Burnt component
- Incorrect PCB design/layout

Question 12

Criteria	Marks
• Provides features and characteristics of a piezo device • Accurately identifies how the device's functional properties are applicable to the operation of the dance floor	3
• Sketches or outlines features of a piezo device • Identifies with partial accuracy how the device's functional properties are applicable to the operation of the dance floor	2
• Lists the basic operation of a piezo device • Lists or provides minimal evidence of how the device is applicable to the dance floor	1

Sample answer:

Piezo electric devices convert mechanical strain into electric current or voltage. When pressure is applied to the piezo electric material a negative charge is produced on the expanded side, and a positive charge on the compressed side. Once pressure is released current flows across the material. Current generated is then captured to provide power to operate the lights on the dance floor. Each subsequent move of the dancer compresses or strains the piezo device generating an ongoing supply of current to run the dance floor lights.

Answers could include:

- A clear description of how mechanical strain creates current across piezo electric materials
- Explanation of how the sprung floor allows for compression or strain of the piezo device to generate current with each dancer movement
- Responses may indicate the current generated may act in a closed loop or be stored to run a more complex circuit for the lights
- Use crystals to produce electronic pulses/charges
- Converts kinetic energy into electrical energy (positive and negative charges)

Question 13

Criteria	Marks
• Provides detailed and accurate characteristics and features of stepped motor operation / function • Includes an appropriate application	3
• Provides an outline or partially accurate characteristics or features of stepped motor operation or function • Includes an appropriate application	2
• Provides limited or inaccurate characteristics and / or features of stepped motors • Example not given or inaccurate	1

Sample answer

A stepped motor requires pulses to drive it. They consist of a permanent magnet rotating shaft called the rotor, and multiple electromagnets on the stationary portion that surrounds the motor called the stator. Activating each electromagnet individually around the stator allows the rotor to move in highly accurate, fixed amounts for each pulse to be received. Stepped motors are relatively low torque devices and do not rotate quickly as compared to DC motors. They suit applications where controlled, precision movements are required such as laser cutters where CAD drawings must be plotted and cut out in stock material.

Answers could include:

Stepped motors move in fixed amounts due to electromagnets positioned around the stator, with the rotor moving a designated distance with each pulse received.

Stepped motors are commonly applied in but not limited to laser equipment, flatbed scanner, printers, plotters, slot machines and CD drives, robots and intelligent lighting.

Question 14

Criteria	Marks
• Provides a correct answer (quantum and units) for both voltage and current readings in the prescribed points on the circuit • A clear and accurate sequence of appropriate working / calculations evident	3
• Provides a correct answer (quantum and units) for either current and voltage readings at the prescribed points on the circuit • Working / calculations provided show evidence of only minor errors in the use of formulae and process	2
• Provides an incorrect answer for both current and voltage readings at the prescribed points on the circuit • Working / calculations provide some evidence of appropriate formulae and process to use	1

Sample answer:

To determine the current in the circuit convert R_1 and R_2 from parallel to series.

$$\frac{1}{R_T} = \frac{1}{R_1} + \frac{1}{R_2}$$

$$\frac{1}{R_T} = \frac{1}{4} + \frac{1}{2}$$

$$\frac{1}{R_T} = 0.75 \text{ k}\Omega$$

$$R_T = 1.3 \text{ k}\Omega$$

Now consider circuit as series.
Total resistance in series circuit:

$$R_T = 1.3 \text{ k}\Omega + 4 \text{ k}\Omega$$
$$R_T = 5.3 \text{ k}\Omega$$

Using $V = IR$ where $V = 12$ V and $R = 5.3$ kΩ

$$12 = I \times 5.3 \times 10^3$$
$$I = \frac{12}{5.3 \times 10^3}$$
$$I = 0.0023 \text{ A}$$
$$I = 2.3 \text{ mA}$$

To determine V
R_{TOTAL} in the parallel section = 1.3 kΩ

$I = 2.3$ mA

Using $V = IR$

$$V = 2.3 \times 10^{-3} \times 1.3 \times 10^3$$
$$V = 2.99 \text{ V}$$

Answers could include:

$V = 3$ V to allow for students rounding up calculation as long as working is correct.

Question 15

Criteria	Marks
• Provides detailed and accurate characteristics and features of the components and how they control the operation of the circuit	4
• Provides partially accurate characteristics and features of the components and how they control the operation of the circuit	3
• Provides partially accurate characteristics or features of the components OR • Provides/sketches in general terms how the components operate the circuit	2
• Lists some features of one component OR • Provides a basic understanding of the operation of the circuit	1

Sample answer:

In the LED flasher unit, the flashing operation is achieved by the use of transistors and capacitors. Transistors act as a switch allowing current to flow across the positive collector and negative emitter junction when a small current is received at the base. Capacitors store and release charge/current. In the circuit the periodic charging of the capacitors and subsequent release of that charge provides the current to the transistors' base that allows them to switch on, allowing the LEDs to light up. As the charge from the capacitors dissipates the transistors switch off and the LEDs go out. The process repeats as capacitors charge and discharge.

Answers could include:

- Identifies transistor as a switch
- Identifies capacitors charging plus discharging as allowing the transistors to open and close thus creating on+off or flashing of the LEDs
- Correctly identifies transistors Q1 and Q2 as NPN transistors and explains that the Base (B) acts as a control switch that allows current to pass between the Collector (C) and the Emitter (E).

Section III

Question 16 (a)

Criteria	Marks
• Provides a detailed explanation of why it is important for a company to comply with safety standards	6
• Provides s sound explanation of why it is important for a company to comply with safety standards	4–5
• Provides a limited explanation of why it is important for a company to comply with safety standards	2–3
• Provides some relevant information	1

Sample answer:

It is important for a company to comply with safety standards for a number of reasons. Firstly, they are legally responsible for the safety of their employees and can be both financially and even criminally liable should the company be at fault for the injury or death of an employee. Another reason to comply with safety standards is to ensure that production is not disrupted. An industrial accident can cause a stop in production, which in turn will result in financial losses on top of the financial losses to paying worker's compensation for an injured worker. Injured employees may also have to be replaced and this will also add to the cost of workplace injuries, as it will be an extra wage to pay out. Morale and productivity could suffer as employees do not feel safe in the workplace and can even reach a point of production being stopped by employees until their right to a safe work environment is met.

Answers could include:

- Duty of care
- Government legislation
- Financial security
- Marketability of a product
- Good will of company
- Ethical issue

Question 16 (b)

Criteria	Marks
• Provides a detailed assessment of strategies a company could implement to establish and maintain a safe work culture	9
• Provides an assessment of strategies a company could implement to establish and maintain a safe work culture	7–8
• Relates strategies a company could implement to establish and maintain a safe work culture	4–6
• Attempts to provide strategies a company could implement to establish and maintain a safe work culture	2–3
• Provides some relevant information	1

Sample answer:

A range of methods could implement to establish and maintain a safe work culture are; establish a WHS committee, erect clear signage, and train employees.

Establishing a WHS committee ensures that all members of the work place are represented and participate in risk assessments, site maintenance and site inspections. This method is very effective in ensuring communication of WHS requirements is clearly spread between all levels of the work force. It provides the opportunity for different perspectives on work place safety to be considered. A WHS committee also spreads responsibility for workplace safety across the entire company, which ensures everyone applies a consistent approach to safe work practices and management practices and fosters a positive and safe work place culture.

Erecting clear signage that utilises graphical information, over complex written policies, allows for both a reminder of safe work practices in hazardous areas and clear communication of safe work practices to workers with limited literacy. Signage is an excellent method to maintain a safe workplace culture as they are quick to recognise and serve as constant reminders of safe work practices and hazards to people who may not have any training eg visitors to the workplace. Signage is particularly useful in the event of new safety requirement or hazard. It is far quicker to erect a slippery floor sign over a spill than send a memo out to all staff.

Training is another excellent method to ensure and maintain a safe workplace culture. It directly communicates safe work practices to employees and can ensure each employee is assessed as to how well they understand safety requirements or the correct procedure to work with hazardous materials, machinery or environments. It gives the employees a chance to clarify their understanding of the safe work practices as well as possibly develop their own skills in the use of machinery. When it is registered what an employee is trained to do, it is easier for management to ensure the employees are placed appropriately in a production line to ensure the employees own safety and the safety of others.

Answers may include:

Assess a range of methods that could implement effectively to establish and maintain a safe work culture.

- Establish a WHS committee (Risk assessments / Site maintenance + inspection)
- Improve signage so that people who can't read can understand what is required
- Train employees re: WHS procedures eg evacuation
- Practice evacuation procedures once every 6 months
- Improve communication — meetings, posters, emails, message boards
- Train employees — in service and keep a register of trained personnel to identify training required
- Keep and maintain a register of incidents
- Monitoring
- Maintenance
- Supply PPE
- Site meeting
- Risk assessments

Industrial Technology
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2013 HSC Examination Mapping Grid

Section I

Question	Marks	Content	Syllabus outcomes
1	1	Electrical principles – current flow	H4.3
2	1	Electrical principles – circuitry	H4.3
3	1	Electrical principles – rectification	H3.1, H4.3
4	1	Components – LDRs	H4.3
5	1	Electrical principles – calculation	H3.2, H4.3
6	1	Components – relays	H4.3
7	1	Processes – calculation	H3.1, H3.2, H4.3
8	1	Digital electronics – truth tables	H4.3
9	1	Components – thermistors	H4.3
10	1	Integrated circuits – op amps	H3.1, H4.3

Section II

Question	Marks	Content	Syllabus outcomes
11	2	Processes – fault finding	H1.2, H4.3
12	3	Components – piezo	H1.2, H4.3, H6.1
13	3	Components – stepped motors	H1.2, H4.3, H6.1
14	3	Circuitry – calculation	H1.2, H3.1, H3.2, H4.3
15	4	Circuitry / components – transistors and capacitors	H1.2, H3.1, H4.3, H6.1

Section III

Question	Marks	Content	Syllabus outcomes
16 (a)	6	OHS (WHS)	H2.1, H6.1, H7.1, H7.2
16 (b)	9	OHS (WHS)	H2.1, H7.1, H7.2