

## Industrial Electronics

### Competition brief

#### Entry requirements

Candidates should be undertaking or have completed a minimum course of study at NVQ level 3 or above in an electronic discipline at the time of the application.  
Have practical experience in the electronics or associated industry or carrying out a programme of study at a college, university or training provider.

#### WorldSkills London 2011 eligibility criteria

The rule for the Industrial Electronics WorldSkills Competitions states that competitors are required to be under the age of 23 in the year of the competition; This means that for the WorldSkills London 2011, competitors must be born on or after 1 January 1989.

#### Competition structure

The online registration facility is available from October 2009. Please note, you must register and set up an account in order to enter a competition.

**Enter a competition:** between 5<sup>th</sup> October and 19<sup>th</sup> March 2010.

**For guidance registering or entering competitions, please visit page 13 of the yellow part of the WorldSkills UK brochure.**

**Stage one:** enter online at [www.worldskillsuk.org](http://www.worldskillsuk.org) by **19<sup>th</sup> March 2010**.

**Stage two:** Competitors will be invited to compete in a one day **regional heat** in May 2010 (venues to be confirmed).

**Stage three:** highest scoring competitors from across all heats that meet the required standard will be invited to compete in a two day live **UK final**.

#### About the competition

**Project Brief:** Competitors will work individually on each of the competition tasks and demonstrate their level of skill in the following :

- practical project building
- fault finding and repair
- test and measurement
- circuit design and printed circuit board component layout using computer assisted software
- basic 'C' programming.

**Stage one:** enter online at [www.worldskillsuk.org](http://www.worldskillsuk.org) by 19<sup>th</sup> March 2010.

**Stage two** (Regional heats):

Will consist of a one day event in a designated region ,candidates will attempt four separate tasks:

- **Task1 Analogue and digital fundamentals;** consists of a series of short theory questions designed to establish the depth and width of analogue and digital electronic theoretical knowledge.
- **Task 2 Assembly and Construction;** involves soldering various types of electronic components using lead free solder onto a printed circuit board, assembly of sub units, wiring, and safe handling of electrostatic sensitivity components.
- **Task3 Test and measurement;** involves wiring a selection of electronic components onto a prototype circuit board. The circuit is then tested by recording measurements taken at specific points on the circuit using test equipment . e.g. oscilloscope.
- **Task 4 'C' Programming;** will requires the candidate to modify a 'C' programme. The candidate will demonstrate the programme working on the computer screen.

**Stage three:** (National Final)

Will consist of a two day event in a designated location within the UK where four separate tasks are to be attempted:

- **Task1 Fault finding and repair;** Troubleshooting electronic circuits, determining the cause of incorrect circuit operation and location of the source of the problem. Replace and /or adjust defective improperly functioning electronic component. Use hand tools and soldering equipment to make repairs to recognised industrial quality standards.
- **Task 2 Hardware design;** involves designing a small modification to an electronic circuit and producing a schematic diagram using printed circuit design software. The final artwork diagram should be ready for use in the production of a single sided printed circuit board.
- **Task 3 Assembly and Construction;** involves, wiring, cabling and soldering conventional electronic components and surface mounted devices using lead free solder. Assembling mechanical sub units using bolts, washers, nuts etc. It is expected that workmanship practice and quality will to a recognised industrial standard.
- **Task 4 Measurement and testing;** The competitors are expected to work with conventional measuring and testing equipment to test, set, adjust and measure electronic components, modules and equipment that are based in DC, AC, digital and analogue electronics. They are further expected to record, present measured results and analyse. Circuit boards will be pre-built before the Competition.

**Fundamental Theoretical knowledge that could be included in the competition:**

#### **Electrical circuit principles**

- Basics of AC and DC technology.
- Two ports LRC network, resistive networks with up to three meshes.
- RC oscillators.

#### **Electronic Components**

- Properties, behaviour, characteristics and application (elementary circuits) of mechanically, electrically and physically adjustable components i.e. capacitors, resistors, Coils, transformers and.
- Diodes: rectifying diodes, switch diodes, zener diodes, capacitive diodes, PIN diodes
- Trigger components, diac, triac, thyristor and Uni. -junction transistors.
- Surface mounted devices
- Transducers and sensors

### **Analogue Electronics—(Multistage and special amplifier circuits)**

- Basic amplifier circuits (AC, DC and power amplifiers)
- Differential amplifiers/operational amplifiers
- Ideal operational amplifier: (infinite input resistance, zero output resistance and infinite open loop gain) Basic circuits with operational amplifier, analogue adder and sub-tractor, differentiator, comparator, impedance transducer.
- Real operational amplifier: Offset voltage and offset current, compensation, common mode gain and rejection, temperature drift, frequency response

### **Generators and Pulse Shapers**

- Generators for sine wave voltage: RC, quartz, LC oscillators; wien bridge generator, phase generator
- Pulse shaper: Schmitt trigger, differentiator, and integrator.
- Timers—555.

### **Digital Electronics**

- Basic logic gates including level switching function, function table, pulse, diagram, circuit symbols
- Properties of basic gates AND, OR, NOT, NAND, NOR, EXCLUSIVE OR EXCLUSIVE NOR
- Substituting basic NAND or NOR gates for basic gates.
- Creating switching functions from given circuits and vice versa.
- Making function table from circuit diagrams and switching functions
- Simplifying switching networks using Karnaugh diagram or mathematical techniques.
- Flip-flops, RS Flip-flop, D Flip-flop, JK Master slave Flip-flop (especially counter circuits, shift register and frequency divider).
- Memory circuits, selection, addressing and memory decoding volume.

### **Programming**

- 'C'programming.

## **Marking and assessment**

Each competition task will be assessed and marked independently of every other task. Each task will be assessed and marked in accordance with the general and specific competition rules.

A panel of judges will be drawn from industry and education. The judges' decisions will be moderated and quality assured before being confirmed.

The allocation of marks should reflect the relative significance of each task to the work role. The following percentages will therefore be applied:

<b>Criterion ID</b>	<b>Regional Criterion Description</b>	<b>Max Marks</b>
<b>A ( 2hr)</b>	<b>Assembly and Build project</b>	<b>30</b>
<b>B (1hr)</b>	<b>Design and Measurements</b>	<b>15</b>
<b>C (2hr)</b>	<b>Electronic Fundamentals(Digital and Analogue)</b>	<b>40</b>
<b>D (½hr)</b>	<b>'C' Programming</b>	<b>15</b>

		Total Marks	100
Criterion ID	Final Criterion Description	Max Marks	
A (3hr)	Fault finding and repair	20	
B (3hr)	Hardware Design and PCB master artwork	30	
C (4hr)	Electronic build project	40	
D (1hr)	Test and Measurement	10	
		Total Marks	100

## Rules

The competition:

- will be largely practical
- will be for individuals

The competition will be provided in the format advised. This will include

- The description of the test projects
- The marking criteria
- The material and equipment list

Candidates may enter only one regional competition in any one year.

### Conduct for competitors during live competitions :

- All competitors will receive a health and safety briefing at the start of the competition and these rules must be adhered to throughout the competition
- Competitors who arrive late for the finals will not normally receive additional time.
- Competitors will start and finish work as instructed by the judges.
- During the competition competitors should not disturb other competitors or speak to members of the public.
- Any competitor who wishes to leave the area during the competition must seek the permission of the judges. Competitors will not be allowed contact with tutors/coaches during the live competition. Non compliance with this may result in deduction of points.
- If there is a power stoppage or accident, the competitors must act according to the instructions of the judges
- Competitors who break or damage equipment during the competition will not receive any additional time.
- Where a competitor is observed working in an unsafe manner s/he will be stopped and not permitted to continue unless willing to follow the judges' directions.
- The competition will be assessed and marked by a panel of judges (from industry, colleges or training providers) using the competition criteria and allocation of marks.
- The panel's decisions will be quality assured by UK Skills or a UK Skills representative before the winners are announced.

## Contact details

For technical advice about the competition contact:

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For general information about competitions please contact WorldSkills UK:

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