Sample Test Project

Regional Skill Competition – Level 3

Skill 16– Electronics

Category: Manufacturing and Engineering Technology

Table of Contents

Section - A

A. Preface

Skill Explained:
The electronics industry is very diverse and has evolved into several specialisms. Some technicians/engineers will work across many aspects of electronics, but increasing specialization and technical developments means that specialist technician/engineers are widely employed. The key areas of specialism which can be seen as careers in their own right include Designing of prototype circuits to specifications. Developing and designing PCB for the given circuit. The assembly of electronic component on PCB, testing, provision of customer support, service and maintenance.

The electronics specialist will work with a wide range of tools, specialist hi-tech equipment and materials. Increasingly, computers and specialist software for communications technology is embedded into the work. In addition, tasks will also require the use of specialist hand tools for the assembly and maintenance of circuits and surface mounted technology.

Eligibility Criteria (for IndiaSkills 2018 and WorldSkills 2019):
Competitors born on or after 01 Jan 1997 are only eligible to attend the Competition.

Total Duration: 12 Hrs

Section - B

B. Test Project

Task A – BLOCK DIGRAM AND SCHEMATIC DESIGN

Smoke Detector using MQ2 Gas Sensor and Arduino.

Competitor Instruction Sheet

You have **180 Minutes (3 hrs)** to complete this task

You are to complete designs, keep in the mind the following observations

  1. Please complete the design according to the following requirements.
  2. Use only the component from the part list of your designs.
  3. You may not need all components in the parts list.
  4. You can start using PCB design only after submitting the paper schematic.

Competitors can read component data sheet that is provided with only personal computer which contains data sheet pack. The hard copies brought by competitor can't be used, but competitors can read the hard copies provided with competition organizer.
When you have completed your designs you are to submit to the Expert. You will then be given the schematic solution for schematic entry into PCB design software. You cannot start your PCB design in this phase of the Test Project.

Task B – *Designing of Printed Circuit Board*

Competitor Instruction Sheet

You have **240 Minutes (4 hrs)** to complete this task

  1. Design printed circuit board using PCB design software tool with simulation output.
  2. Prepare the PCB design as per specified position of components in shown figures.
  3. Complete the design, save PCB Gerber files in the pen drive.
  4. Create a BOM, containing all information for your schematic design.
  5. Create a pdf files as requested in the statement.
  6. Prepare a 3D-visulizer copy as shown in Fig.
  7. Follow the rules as specified in the statement.

NOTE: Submit the following PCB Gerber files to the experts in the USB sticks.

Top layer

Bottom Layer

Keep Out Layer (Dimension)

NC Drill File

Submit the following files as *.pdf Data

All schematics

PCB Top Layer routing/split plain

PCB Bottom Layer   routing/split plain

Component Placement Side & 3D-picture.

PCB should be double side PCB.

Task C – Build and Test Hardware design project on the given PCB.

Competitor Instruction Sheet

You have **240 Minutes** to complete this task.

1. Assemble PCB, calibrate and check its operation.
2. Place and solder the components at appropriate place.
3. Record and note the input and output voltages with given load.
4. Completing the project, submit all the product and documents.

NOTE: submit all the assembled PCB, with all the left-over components & Tools.

Task D – Answer the questions related to this project (MCQ)

You have **60 Minutes** to complete this task

Re Check the circuit and answer the given questions.

Note: Answer sheet provided for writing the answer.

Section – C

C. Marking Scheme

The Assessment is done by awarding points by adopting two methods, Measurement and Judgments

- Measurement – One which is measurable
- Judgments – Based on Industry expectations
- Aspects are criteria's which are judged for assessment

Block Diagram & Schematic Design:

Aspect ID	Marking Criteria or Description	Requirement	Max Mark	Mark Awarded
1.1	Block diagram	For both the section.	2	
1.2	Circuit diagram		3	
1.3	Connections from Arduino board		2	
1.4	Connections to 16x2 LCD		2	
1.5	Power supply points		3	
1.6	Identification &connection to MCU		2	
1.7	Identification of components.		1	
1.8	Placement of component on the schematics		2	
1.9	Connection to component		1	
1.10	Neatness in drawing schematic diagram		2	
		Total Marks	20	

Designing of Printed Circuit Board

Aspect ID	Marking Criteria or Description	Requirement	Max Mark	Mark Awarded
1.1	**Schematic on PCB design software**		2	
1.2	Understanding schematic tools		2	
1.3	Component Positioning schematic		3	
1.4	Component Positioning on schematics.		3	
1.5	Understanding on PCB layout operation		2	
1.6	Component organization on PCB layout software.		2	

Aspect ID	Marking Criteria or Description	Requirement	Max Mark	Mark Awarded
1.7	PCB Design Quality: Difference in the track widths		2	
1.8	PCB file generation & pdf files		2	
1.9	PCB layout and Component Positioning		2	
1.10	PCB layout and Component Positioning of sensor		2	
1.11	PCB layout and Component Positioning of MCU		2	
1.12	PCB routing as per IPC standards.		2	
1.13	Simulation output.		2	
1.14	Overall design flow.		2	
	Total		30	

Build and Test Hardware design project on the given PCB.

Aspect ID	Marking Criteria or Description	Requirement	Max Mark	Mark Awarded
1.1	The application of electronic principles		2	
1.2	Component Forming		2	
1.3	Component Placement		2	
1.4	Component Soldering Quality		2	
1.5	Component Orientation		2	
1.6	Design without any correction (no cutting of tracks or rewiring.		2	
1.7	Assembled quality		2	
1.8	Functionality/Operation Check		2	
1.9	Functionality/Operation Check Operating condition		2	
1.10	Measurement tools used in electronic assembly		3	
1.11	The purposes and functions of components to fulfil required tasks		2	
1.12	Proper tools used for soldering.		2	
1.13	Cleaning and neatness'.		2	
1.14	Overall design output.		3	
		Total :	**30**	

Answer the questions related to this project (MCQ)

Aspect ID	Marking Criteria or Description	Requirement	Max Mark	Mark Awarded
1.1	Safe working practices adhered to throughout task		1	
1.2	MCQ		18	
1.3	Task completed in allocated time.		1	
		Total Marks	**20**	

Section - D

D. Infrastructure List

- Infrastructure List (Tool and equipment including raw material)
- The quantity is given for each candidate

S. No.	Item	Requirements/Specification	Qty
1	Workbench	2'x3'	2
2	Soldering iron	25 W	1
3	Soldering iron stand	Metal	1
4	Solder wire	0.6/0.7/0.8mm	100gm
5	Magnifying glass	Hand/table mounted	1
6	Calculator	Scientific	1
7	Desktop/Laptop with PCB designing & simulation software.	I3,4gb,500gb HDD or higher	1
8	Printer	Deskjet/LaserJet	1
9	Electronics components	As per specified in the task	1 set.
10	Multimeter	Digital 3 ½ digit	1
11	Paper	A4 Size	6
12	Pen/Pencil/Eraser	Blue/HB	2
13	Power Supply	Digital Power supply 3-15V/5A	1
14	Power Socket	AC socket	3
15	ESD Mat	2'x3'	2
16	ESD point	Grounding point	2
17	ESD wrist Band	ESD compliance	1
18	Cleaning brush		1
19	Cleaning solution	PCB cleaner	100 ml.
20	Cutting and Bending tool set.	Cutting plier, tweezer, and nose plier.	1 set.
21	Screw driver set	Assorted	1set.

Section – E

E. Instructions for candidates

- All Competitors must use safety glasses when using any hand, power, or machine tools or

- Equipment likely to cause or create chips or fragments that may injure the eyes

- Experts will use the appropriate personal safety equipment when inspecting, checking, or working with a Competitor's project.

- The documentation 'Safety and Fairness' will be prepared by the Experts;

- The Competitor must comply with the machine manufacturer's safety instructions.

- All individuals must have Electrostatic Discharge (ESD) awareness and use ESD straps when working with components/circuits.

- All individuals must wear eye protection while soldering or cutting components. It is recommended that shoes have closed toes and be ESD safe

Section – F

F. Health, Safety, and Environment

1. All accredited participants, and supporting volunteers will abide by rules and regulations with regards to Health, Safety, and Environment of the Competition venue.
2. All participants, technicians and supporting staff will wear the required protective Personnel clothing.
3. All participants will assume liability for all risks of injury and damage to property, loss of property, which might be associated with or result from participation in the event. The organizers will not be liable for any damage, however in case of Injury the competitor will immediately inform the immediate organizer for medical attention.