Skill India
कौशल भारत - कुशल भारत

India skills

N·S·D·C
National
Skill Development
Corporation
Transforming the skill landscape

Sample Test Project

District / Zonal Skill Competitions

Skill- Electronics

Category: Manufacturing & Engineering Technology

Table of Contents

Section - A

A. Preface

Skill Explained:

The electronics industry is very diverse and has evolved into several special domains. Almost every aspect of today's world relies on, or directly uses, electronics technology.

Engineering Technicians/Technologists will work across many aspects of electronics, with increasing specialization and technical developments. The key areas of specialization, which can be seen as careers in their own right include the designing of prototype circuits, schematic capture and layout to create/verify/simulate schematic circuits and printed circuit boards. This is a specialized occupation in its own right, and also involves the creation of production documents such as Bill of Materials, Gerber Files and drill files.

Electronics specialists work in a wide range of industries supported by highly technical specialist equipment. These tools are often specialized, and also include measurement test equipment. Computers and specialist software development tools are used to create programs for embedded systems and programmable devices. Embedded System design involves interfacing Microcontroller unit (MCUs) to the outside world via sensors/communication interfaces.

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: 4 Hrs

Task A	**:**	60 Minutes
Task B	**:**	90 Minutes
Task C	**:**	90 Minutes

Section - B

B. Test Project

Task A – Schematic Design

Competitor Instruction Sheet

You have **60 Minutes** 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 your answers on the provided Answer Sheets 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 – Design of Printed Circuit Board

Competitor Instruction Sheet

You have **90 Minutes** to complete this task

1. Design printed circuit board using PCB design software tool.
2. Prepare the PCB design as per specified position of components in shown figure.
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.
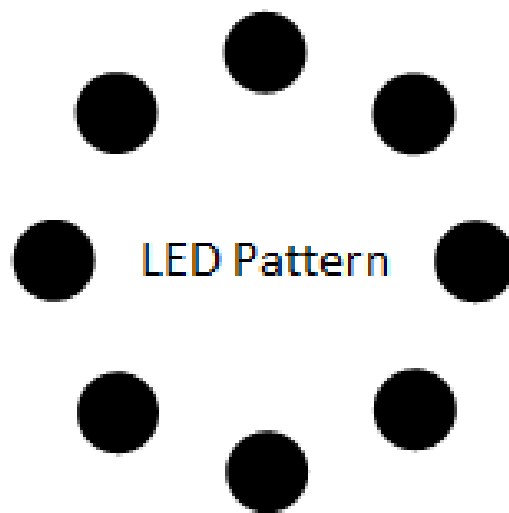6. Follow the rules as specified in the statement.

Task C – Build and Test Hardware design project

Competitor Instruction Sheet

You have **90 Minutes** to complete this task.

1. Assemble PCB, calibrate and check its operation.
2. Completing the project, submit all the product and documents.

# Example of Test Project-Hardware Design

"LED Running Light"

Introduction

Make an electronic circuit in which there are eight LEDs in circular pattern and they should be glowing one by one in a sequence with a time difference of 0.5 seconds.

The circuit must be designed using the components provided in the given list. Components other than the list will not be provided.

Block Diagram
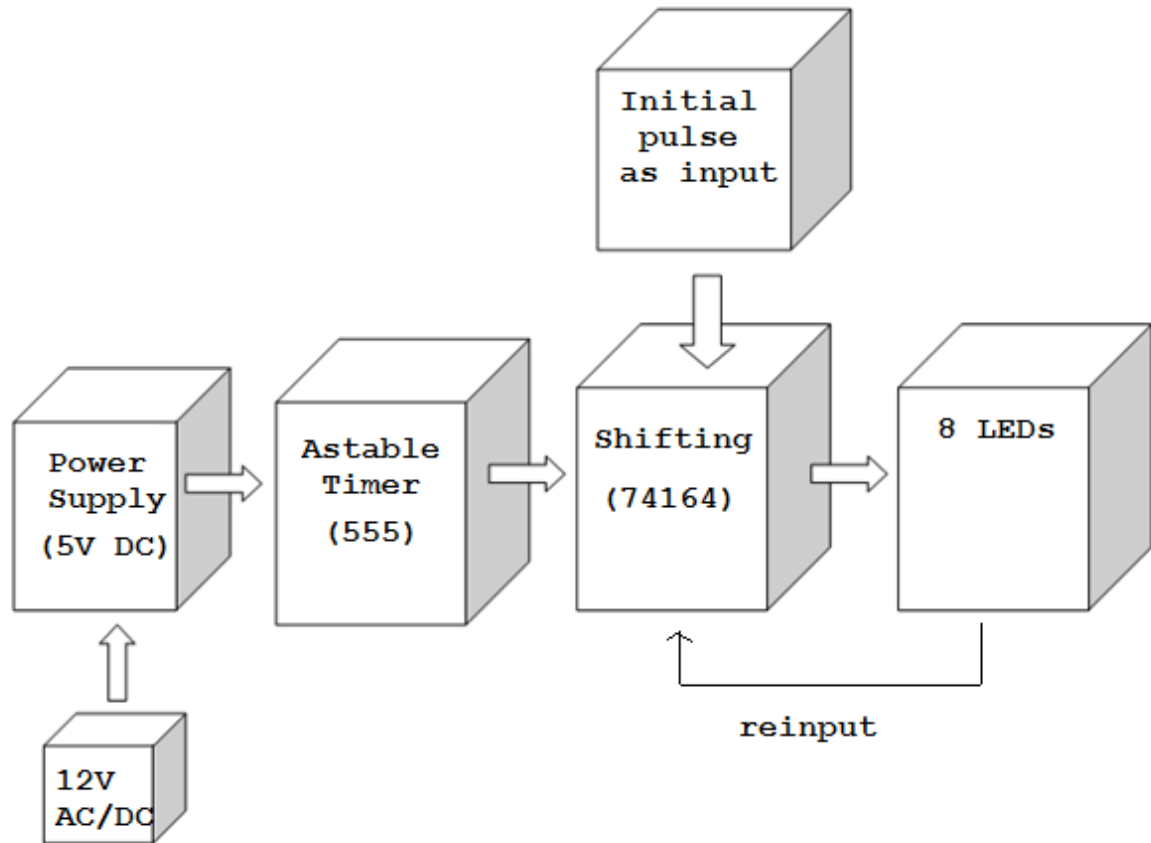
PCB Design

Submit the following PCB Gerber files to the experts in the usb sticks.

*.GBL   Bottom Layer

*.GKO   Keep Out Layer (Dimension)

*.txt   NC Drill File

Submit the following files as *.pdf Data

All schematics

PCB Top Layer   (scale 1:1)

PCB Bottom Layer   (scale 1:1)

Component Placement Side   (scale 1:1)

PCB size is 120mm x 80mm and should be Single side PCB.

Place Power supply, 8 LEDs and controlling part as shown in the "Figure".

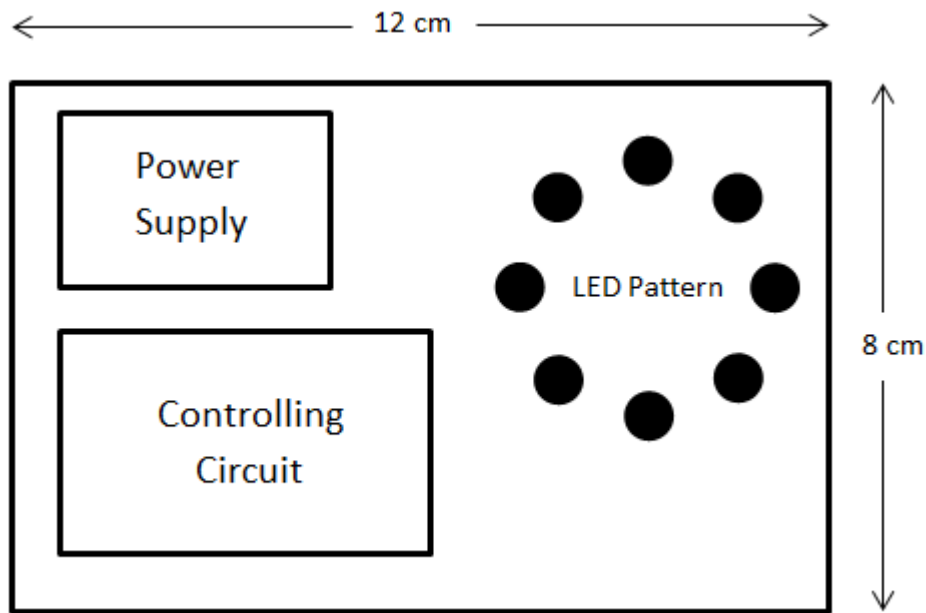Place wherever competitor wants to be electronically stable except assigned Component

Figure. PCB layout

The participant has to design the circuit using the component given below:

Item	Parts name	Parts value (Model)	Qty.	Remarks
1	IC-Timer	NE555	4	
2	IC-Counter	4029	1	
3	IC-NOT Gate	7404	1	

4	IC- Quad bilateral switches	74HC/HCT4066	1	
5	IC-NAND Gate	7400	2	
6	IC-AND Gate	7408	2	
7	IC-Voltage regulator	LM7805	1	
8	IC-Opamp	LM358	2	
9	IC-Frequency to Voltage Converter	LM2907	1	
10	IC- 3 ½ Digit A/D Converters	**ICL7107**	1	
11	IC- Decade and Binary Counters	**74LS90**	1	
12	Seven Segment Displays	**14.2 mm (0.56 inch)**	5	
13	LED 5mm	**Red**	5	
14	DC socket	**12v**	1	
15	Resistor	330Ω, 1/4W, 5%	5	
16	Resistor	1KΩ, 1/4W, 5%	10	
17	Resistor	4.7KΩ, 1/4W, 5%	5	
18	Resistor	10KΩ, 1/4W, 5%	5	
19	Resistor	220KΩ, 1/4W, 5%	5	
20	Resistor	100k, 1/4W, 5%	5	
21	Resistor	1M, 1/4W, 5%	5	
22	Ceramic Capacitor	0.1uF	1	

23	Ceramic Capacitor	0.47uF	1	
24	Ceramic Capacitor	0.22uF	1	
25	Ceramic Capacitor	100pF	1	
26	Ceramic Capacitor	0.02uF	1	
27	Ceramic Capacitor	0.001uf	2	
28	Ceramic Capacitor	0.01u F	5	
29	Ceramic Capacitor	0.1u F	5	
26	Electrolytic Capacitor	220u F/16V	2	
27	Potentiometer	10KΩ, 1/4 W, 5%	3	
28	Rectifier Diode	1N4001 - 1N4007	5	
29	Transistor	BC548	5	

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.

**In Electronics skill all markings are done on measurement basis.
   Marks awarded will be 0 or full marks.**

a. Marking Scheme module wise with detailed assessment criteria

   (a) Hardware Prototype Design module - 100 marks

   (i) Phase 1: Development of circuit(s) - 20 marks

   (ii) Phase 2: Design of PCB-board layout and production of Gerber files -40 marks

   (iii) Phase 3: Prototype Assembly -40 marks

      a. Production and assembly of PCB – 20 marks

      b. Functionality of PCB prototype to specification- 20 marks

b. Marking Scheme with detailed assessment criteria

Sub Criteria ID	Sub - Criteria Name or Description	Aspect ID	Aspect - Description	Max Mark	Marks Obtained
Module a (i)	**Hardware Module-Schematic Design (20 Marks)**	1.1	Connection of 12V AC/DC Block	2.00	
		1.2	Connection of 5V DC Block	2.00	
		1.3	Connections of 555 Timer in Astable Mode for 0.5 Sec pulses	2.50	

		1.4	Connections of Shift register block	2.50	
		1.5	Connections of 8 LEDs	2.00	
		1.6	Connections to Shift register IC to re-initialize the LED Rotation	2.50	
		1.7	Connections to Shift register for initial pulse as input	2.50	
		1.8	VDD Connection of all components as per specifications	2.00	
		1.9	GND Connections of all components as per specifications	2.00	
Module a (ii)	**Hardware Module - PCB Design** **(40 Marks)**				
		2.1	PCB Design Quality: Difference in the track widths	3	
		2.2	PCB Design Quality: Jumper Wires	3	
		2.3	PCB file generation & pdf files	3	
		2.4	PCB layout and Component Positioning- (Power supply block)	4	
		2.5	PCB layout and Component Positioning- (555 Timer Block)	4	
		2.6	PCB layout and Component Positioning- (Shift Register Block)	4	
		2.7	PCB layout and Component Positioning- (LEDs Block)	4	
		2.8	PCB layout and Component Positioning- (Other Components)	4	

		2.9	PCB routing as per IPC standards	4	
		2.10	Overall design as per IPC standards	3	
		2.11	PCB Design Size	4	
Module a (iii)a	**Hardware Module – Production & Assembly of PCB (20 Marks)**	3.1	Component Forming	4	
		3.2	Component Placement	4	
		3.2	Component Soldering Quality	4	
		3.3	Component Orientation	4	
		3.4	Design without any correction (no cutting of tracks or rewiring)	4	
Module a (iii) b	**Functionality of Proto unit (20 Marks)**	4.1	Functionality/Operation Check #1: +12V Block	3	
		4.2	Functionality/Operation Check #2: +5V Block	3	
		4.3	Functionality/Operation Check #3: 555 Timer Output pulses at 0.5 Sec	4	
		4.4	Functionality/Operation Check #4: Shift Register Block	3	
		4.5	Functionality/Operation Check #5: 8 LEDS	3	
		4.6	Functionality/Operation Check #6: initialization of LED rotation	4	
			Total	**100**	

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	15 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	I3,4gb,500gb HDD or higher	1
8	Printer	Deskjet/LaserJet	1
9	Electronics components	As per specified in the task	1
10	Multimeter	Digital 3 ½ digit	1
11	Software	PCB design (Eagle/Proteus/Altium)	1
12	Paper	A4 Size	2
13	Pen/Pencil/Eraser	Blue/HB	1
14	Power Supply	Digital Power supply 3-15V/5A	1
15	Power Socket	AC socket	3
16	ESD Mat	2'x3'	2
16	ESD point	Grounding point	2

Section – E

E. Instructions for candidates

The Participating Competitors must consider the following;

- Experts shall not be allowed to give any help to Competitors to interpret the Test Project except where agreed by the Jury before the start of the competition

- Every Competitor has the right to expect that no other Competitor will receive unfair assistance or any intervention that may provide an advantage

- Accredited personnel at the Competition shall ensure that the above principles of honesty, fairness and transparency are observed at all times

- When the Competition is over, Competitors shall be given time to exchange views and experiences with other Competitors and Experts.

- In case a Competitor has to withdraw due to illness or accident; marks will be awarded for the work completed.

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 individuals must have Electrostatic Discharge (ESD) awareness and use ESD straps
   a. when working with components/circuits
   b. Must wear eye protection while soldering or cutting components.

4. 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.

5. 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.