



**Strathmore**  
UNIVERSITY

SCHOOL OF COMPUTING AND ENGINEERING SCIENCES  
BACHELOR OF SCIENCE IN ELECTRICAL AND ELECTRONIC ENGINEERING  
END OF (THIRD) SEMESTER EXAMINATION

BEE2106: PCB DESIGN AND FABRICATION

DATE: 30<sup>th</sup> July 2004

Time: 10:30-12:30 Hrs

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**Instructions**

1. This examination consists of **THREE** questions.
2. Answer **ALL** the questions.

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**QUESTION ONE (20 marks)**

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- a) Answer these questions based on the IoT project you undertook during the third semester:
- i. Write down the title of the project. **(1 mark)**
  - ii. Explain the role of professionals in other fields you may need to work with to improve the quality of the project. **(5 marks)**
  - iii. Describe the challenges you encountered, if any, and how you overcame them. **(4 marks)**
- b) You have fabricated your PCB by printing the Gerber file in the CNC machine in the makerspace lab. State other essential procedures you may not undertake in the lab and how they will affect the quality of your PCB product. **(5 marks)**
- c) Assume you were the group leader of your group. Explain how you will ensure every member of your group participates actively in the project. **(5 marks)**

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**QUESTION TWO (20 marks)**

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- a) The following is a list of processes in PCB fabrication:
- Exposing the PCB to a high intensity UV light
  - Applying an etching solution
  - Applying photosensitive photoresist
- List them in the order in which they are applied. **(3 marks)**
- b) Distinguish between

- i. Positive and negative photoresist;
  - ii. Pads and traces .
- (4 marks)**

c) Table 1 shows a list of selected PCB processes and what they are supposed to achieve in no particular order. Match the processes to their purpose. **(7 marks)**

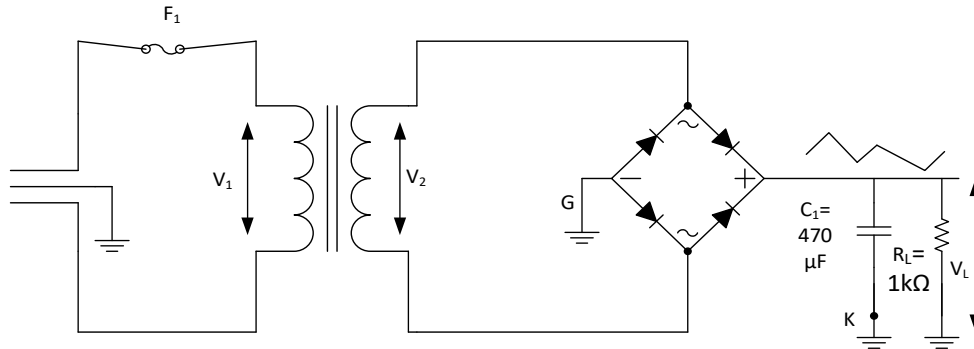
**TABLE 1**

Process	Purpose
• Electroless copper deposition	• Protecting plated copper during etching
• Pattern plating	• Restrict areas that will be covered with solder
• Addition of tin	• Preserve exposed copper circuitry
• Solder mask	• Electrically connects different PCB layers
• Silk screen	• Thickening of copper in the holes
• Film generation	• Identification of components
• Surface finish	• Creation of a board image on the film

- d) With the help of examples, explain the difference between sensors and actuators as used in IoT. **(4 marks)**
- e) Distinguish between **through hole components** and **surface mount components**. **(2 marks)**

**QUESTION THREE (20 marks)**

- a) In your soldering workshop, you are using a 555 timer lead to drive a LED circuit. The circuit works on a bread board but after completing the soldering on the strip board, it doesn't work. Outline how you would diagnose the problem, given a multi-meter. **(2 marks)**
- b) Figure 2 shows a bridge rectifier circuit with ideal circuit values and 8-trouble points T1-T8. Find all eight troubles. **(8 marks)**



**Figure 1**

Table 2: TROUBLESHOOTING (T-TROUBLE)

	V <sub>1</sub>	V <sub>2</sub>	V <sub>L</sub>	V <sub>R</sub>	f	R <sub>L</sub>	C <sub>1</sub>	F <sub>1</sub>
ok	115 V	12.7 V	18 V	0.3 V	120 Hz	1kΩ	0kF	0kF
T1	115 V	12.7 V	11.4 V	18 V	120 Hz	1kΩ	∞	0kF
T2	115 V	12.7 V	17.7 V	0.6 V	60 Hz	1kΩ	0kF	0kF
T3	0 V	0 V	0 V	0 V	0 Hz	0kΩ	0kF	∞
T4	115 V	12.7 V	0 V	0 V	0 Hz	1kΩ	0kΩ	0kF
T5	0 V	0 V	0 V	0 V	0 Hz	1kΩ	0kF	∞
T6	115 V	12.7 V	18 V	0 V	0 Hz	∞	0kF	0kF
T7	115 V	0 V	0 V	0 V	0 Hz	1kΩ	0kF	0kF
T8	0 V	0 V	0 V	0 V	0 Hz	1kΩ	0	∞

- f) Distinguish between soldering and desoldering (2 marks)
- g) List any **two** hazards involved in soldering. (2 marks)
- h) Name **TWO PCB** design softwares, stating whether they are proprietary or freeware (2 marks)
- i) Distinguish between schematic diagrams and footprints as used in CAD (4 marks)