GroundLab

GroundLab
Paper-Based Exam

Spring 2021-2022
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Name	Surname	Student ID	Signature

Part A: Mandatory Questions: Questions asked in this part are expected to be answered with high success. If you can not answer all of the questions in part A, your exam will be graded as unsatisfactory.

A-1) A Mechanical safety switch located next to the GroundLab door is given in Fig. 1. Briefly explain two of its purposes.

(Expected Answer) When the button in Fig. 1 is pressed. The 220VAC going through the workbenches are cut down. Thus, whenever we are the last person to exit the ground lab, we should press this button to ensure no device is mistakenly left on. Similarly, whenever we are the first person to use GroundLab, we should turn this switch to power all the workbenches. In addition, it should be used when electricity should be turned off immediately due to an emergency.

Figure 1: Mechanical Safety Switch

A-2) GroundLab has many drilling tools. While using them, the drill bit is very likely to break as shown in Fig. 2, especially the drilling is not performed perpendicularly to the surface and the bit is cheap. Since the bit is under extreme tension, broken pieces may flow in any direction with high speeds, and one of the directions may be through your eyes. Thus, there are two mandatory safety measures while drilling in terms of protective equipment and behavior. Explain them in the below box.

Protective Equipment: *(Expected Answer)* I have to use eye goggles (i.e safety goggles, safety glasses) since it provides protection from impact and does not allow the drill bit to reach my eye.

Figure 2: Broken drill bit.

Behavior: *(Expected Answer)* When drilling, I have to keep a distance between myself and the drill bit. I will never look closely because the probability of a drill bit flying through my eye is reduced as the distance is increased. (Hint: probability ~ $\frac{K}{4\pi D^2}$, the surface area of a sphere)

Future Reading:
Accident report, What happens if you don't wear safety goggles?

A-3) Assume you do not know how to use one of the equipments available in the GroundLab. Write two different approaches to learn how to use that equipment. What is expected from you by GroundLab if you still do not feel qualified enough to use that device after going through those two steps.

The first approach I take would be: *(Expected Answer)* GroundLab shares the tutorials of almost all of the equipment available in the laboratory. Thus, I would watch tutorial videos and read documentation prepared by Groundlab. I can reach such materials over the webpage of GroundLab

The second approach I take would be: *(Expected Answer)* Googling the device and reading blogs, watching videos on the related topic.

If I still do not feel comfortable with the device and still do not know which occupational injuries it may cause: *(Expected Answer)* I must reach an administrative GroundLab member(s). I know that at least one of the administrative GroundLab members must arrange a one-to-one in-site tutorial for me in the GroundLab. This arrangement should take place in the upcoming seven days. I know that I have the right to demand such help for all of the devices including the ones I may be able to use and ı may ask for help infinitely many times.

A-4) Assume you are a GroundLab member. Are you allowed to carry devices from where it is placed to somewhere you want them to be inside the laboratory?

(Expected Answer) As a GroundLab member, I am allowed to carry devices from where it is placed to somewhere I want to use it. Because sometimes default table configurations are not enough. I may need more than one power supply, signal generator, etc. Yet, if it is not a requirement, I should not make changes in the laboratory. Because while carrying them, they may fall down, cable connections may be harmed or like so.

A-5) Assume you are a GroundLab member. Are you allowed to take devices outside of the laboratory even for short durations?

(Expected Answer) Absolutely no. I am not allowed to carry electronic devices, hand tools, measuring tools or such things outside of the GroundLab. I know that this act would result in the immediate cancelation of my membership. Yet, I am allowed to take consumable things such as resistors, capacitors, LEDs, etc.

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A-6) Assume you are a GroundLab member. You may cut and drill things resulting in a mess. Are you allowed to do such?

(Expected Answer) Partially yes. As long as I am working on my project, I may cause the lab to be dirty. Dust, metal chips, resistor legs, cables and such can be around everywhere. However, before I quit the laboratory, I have to clean up my mess. I know if I do not clean up my mess, *my membership will be canceled.*

A-7) Assume you quit the laboratory. Complete the expected procedure you have to follow in the below box.

Electricity: *(Expected Answer)* I must turn off the power switches of the tables I have worked on, and I must be sure that no device is left in the ON position.

Tidying up: *(Expected Answer)* I must clean up the mess related to me. Then I must put the equipment to where I picked them up.

If there are people in the laboratory: *(Expected Answer)* I may just quit.

If I am the last person to quit: *(Expected Answer)* I must turn off the power switches of the tables not just I have worked on but also all other tables. Then I should push the button in Figure 1. Then after turning the lights off, I may quit ensuring the laboratory door is closed.

A-8) Assume you are a GroundLab member. Can you allow your friend(s) who are not GroundLab members to come inside of the laboratory considering they do not use any of the equipment and just sit there?

(Expected Answer) Absolutely no. I am not allowed to invite anyone into the laboratory. I know this will result in the immediate cancellation of my membership. Only administrative GroundLab members are allowed to invite other people into the laboratory. Even such invitations must have a purpose and validation is granted by other members.

A-9) Is GroundLab free to use, When are you allowed to use it?

(Expected Answer) Yes is it totally free and I may use it on 7 day and 24 hours basis.

Part B: Practical questions: Part B is graded over 100 points. The maximum point to receive from each question is written next to the relative question, If your grade for part B is less than 50, your exam will be graded as unsatisfactory.

B-1) Match the purpose of the devices with their images given below. (72 points)

Purposes

(1): Blows hot air. The temperature of blown air ranges between 50C to 650C when the device is on.
(2): Generates arbitrary waveforms.
(3): Drills. Immovable
(4): May be used for soldering purposes.
(5): May be used as a voltage source. Offers the current limit.
(6): Drills & screws. Lightweight and cordless.
(7): Generates vibration. May be used for cutting or sanding.
(8): Cuts wood like materials with a back and forth moving saw
(9): Drills & screws. and cordless.

Images

				
(Expected A.) 3	*(Expected A.) 4*	*(Expected A.) 1*	*(Expected A.) 2*	*(Expected A.) 6*
				
(Expected A.) 7	*(Expected A.) 9*	*(Expected A.) 8*	*(Expected A.) 5*	

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B-2) Explain the purpose of the bracelet given in Fig. 3 (14 points)

(Expected) Some devices are sensitive to electrostatic discharge. When the wristband given in Fig. 3 is worn, it is guaranteed no charge is accumulated on the body since the body is actively grounded (earthed) over a 1Mohm resistor. This means no static electricity voltages that may result in harmed electronics.

Future Reading:
Why use an Electrostatic Wrist Strap - two reasons!
Why You Should Use a Anti-Static Wrist Band and Anti-Static Mat

Figure 3: Electro static discharge wristband

B-3) In Fig. 4, the image of typical soldering flux is given. Why do we use soldering flux while soldering? (14 points)

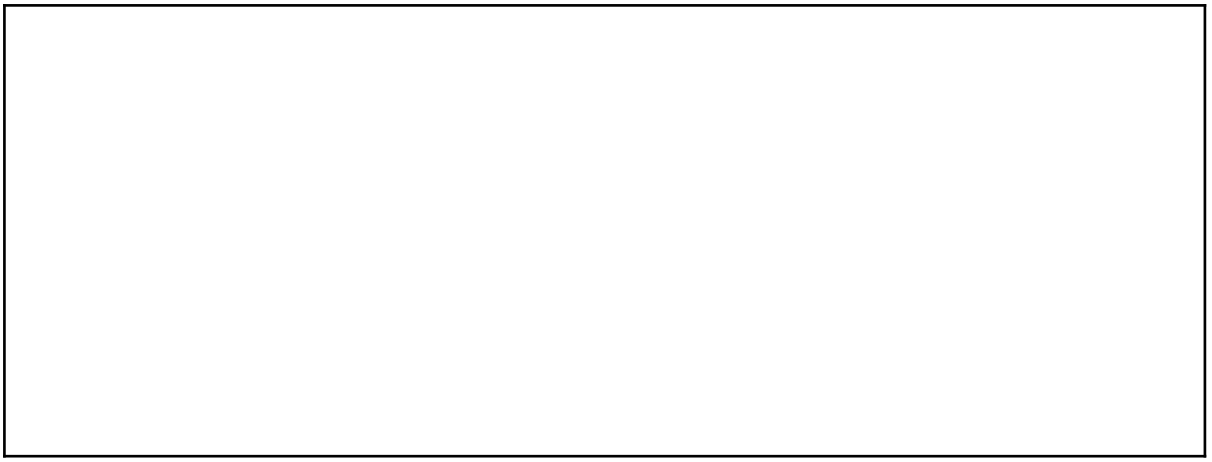
Oxidization (rust): *(Expected Answer)* Surfaces of some materials, such as copper, are likely to be oxidized over time. This oxide layer makes soldering harder. Flux removes that oxide layer and makes it easier to solder.

Prevention: *(Expected Answer)* Even though soldering surfaces are shiny and not oxidized, at the instant soldering iron touches the surface, an oxide layer forms. Solder flux acts as a seal and prevents air from coming in. Thus the soldering quality is increased and its difficulty is decreased.

Figure 4: A typical soldering Flux

Part C: Discussion: These questions are not graded and no answer is true or wrong. To pass this part, you have to write your thoughts on the issue. If your answer is not sufficient enough, your exam will be graded as unsatisfactory.

C-1: Assume you are entering the laboratory and it smells like Beyti Kebap due to someone throwing away its package in one of the GroundLab bins. Then you go to an empty desk and see food leftovers. What would you feel? (about 4 sentences is needed)



C-2) Assume there are two ground lab members, X & Y. X use different resistors from the resistors box for his laboratory project. Thinking it is wasteful to throw away resistors, X puts them into the relative resistor boxes after he finishes with them. Yet he mistakenly puts a 1Ohm resistor into the 10k Ohm resistor box and lefts the laboratory. Then Y comes into the labratory. He takes a resistor from a 10K resistor box. Not checking the color codes of the resistor, he mistakenly uses a 10ohm resistor in his circuit and his circuit blows. What do you think about this? Would you put used resistors into the resistor box after you finished with them? Would you trust the labels only or would you check the component value before using it? (about a paragraph is needed)

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