



ELECTRICAL TEAM TRAINING

TASK 3

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Introduction

Earth is a wonderful place and has been keeping humanity for a long time, but unfortunately the human population is growing too quickly. Some scientists believe that Earth will not keep up with this growth due to scarcity of resources. World leaders decided to explore other planets outside our solar system. They assign you to go on trip to a planet called **Panthalassic** that scientists believe is a planet of water. On your journey, you and your colleagues faced many problems.



Task 3.1

STEP-DOWN TRANSFORMER

Your generator output is 220V, and you need 12V for your circuits and Microcontrollers to operate, therefore you need a step-down circuit for achieving that goal.

First: You are required to design a step-down voltage rectifier ^[1] that converts from 220V AC to 12V DC.

You can only use the following (you don't have to use all of them):

1. Transformer (220V-24V)
2. Rectifier
3. Voltage regulator
4. Capacitors
5. Resistors
6. Inductances

[1] Step down: convert from high voltage AC to low voltage.

Rectifier: convert from AC signal to DC signal.

Second: Use the output signal from the rectifier to control a vacuum door and use two switches to control the door. You can open the door from one switch and close from the other one and vice versa. Also, you can open and close using the same switch. For this task you can use:

1. The output signal in the previous part
2. Two switches
3. DC motor

You can use the DC motor to represent the door. When it is on the door is open and when it is off the door is closed.

Required:

- Use proteus to design the step-down voltage rectifier circuit.
- Connect this circuit and use it to control a DC motor using switches.

Task 3.2

Design a simple digital communication system between the astronaut and the spaceship.

Where the astronaut has three push buttons to send his status to the spaceship with the following conditions:



1. The oxygen tank ran out.
LED 1 ON and LED2 ON when the **red button** is pressed.
2. He is returning to the station.
LED 1 ON and LED 2 OFF when the **green button** is pressed.
3. Something is wrong with the astronaut 's suit.
LED 1 ON and LED 2 ON when the **blue button** is pressed.
4. Two LEDs are OFF when there are **no buttons** are pressed.
5. LED 1 OFF and LED 2 ON when **the green and blue** or **the green and red** are pressed.

Required:

- Use proteus to design a combinational circuit using logic gates.
- Buttons can be represented by logic states. LEDs can be represented by logic probes.
- (Hint) You may use a truth table or Karnaugh-map.
- Bonus for minimum number of gates.

Task 3.3



We want to make the astronaut land on the surface of the planet and then return to the spaceship. The astronaut is connected to the spaceship through a steel cable tied to a motor. We want to control the motor's movement in two directions (landing-returning).

Design a simple circuit using a suitable type of transistor to control the direction of a 15 A motor. We need to use a maximum of four transistors for this task.

Required:

- Use Proteus to design the required circuit and answer the following questions in your report:
Q1: What type of transistors have you used and why?
Q2: If the current of the motor is reduced to 10A can we use a different type of switches?
If yes, mention them with image and links **and** implement the circuit using proteus. (Hint: recap the switches video)

Task 3.4

In this planet we want to discover the underwater environment using a vertical float, it is a non ROV device which is used to measure the pressure and capture footage by Camera.



This device is supplied with restricted specification as follow:

1. Max 12 V and Max 6A
2. Non rechargeable batteries must be used such as Alkaline batteries.

Required:

- In your report: Mention the types and the suitable specifications for the batteries you can choose.
- Use proteus to implement the batteries connections.

Notes

- You should design the circuits required using Proteus.
- You should submit your proteus files.
- You should submit a report that contains:
 - 1- Screenshots of your circuits
 - 2- Answers for the questions required
- Remember that Google is your friend.

Submission

- Submit a zip file that contains your circuits designs and your report.
- The file should follow this naming convention:
phoneNumber_task3.zip
- Submit your solution using this form:
<https://forms.gle/Prd1zwkNYZ3c3SUy8>
- DEADLINE Thursday 28/7 at 11:59PM