



**UNIVERSITY OF ZAMBIA-UNZA,
SCHOOL OF ENGINEERING,
DEPARTMENT OF ELECTRICAL
AND ELECTRONICS
ENGINEERING**



UNZA, School of Engineering Department of Electrical and Electronics Engineering EEE Group.	EEE3112 Electrical Engineering Practice	
	Assignment: Electrical Drawing/ Design	
	Date: 14/07/2021	Due Date: 01/09/2021

ASSIGNMENT 1

Rechargeable Solar Powered Lamp System:

Draw a simple automatic solar powered lamp circuit diagram. The design should automatically switches on ten (10) high power white LEDs each with rating of 1.8Volts, 35mA connected five (5) LEDs in series and only operate in the evening and stay on for 10 hours using a 12 Volt, 20Ah rechargeable battery. During the day time the solar panel should charge the 20Ah battery and switches off the white LEDs. The design should consist the following:

- 12 volt solar panel, used to charge the battery during the day time.
- The battery should be automatically connected to the input line through NO and Common contacts of relay.
- 12Volt 100 ohms PCB Relay which switches on and off the LED lights during the evening and night respectively.
- Charger controller resistor connected in series with Silicon diode D1 with 0.7V and the solar panel to drop the voltage and block the battery reverse current flowing back to the solar panel.
- Charger indicator Red LED which uses 1.8volts, 30mA-during the day time it is switched on and off during the evening when the battery is not charging.
- The high value 4700 μ F capacitor C1 to act as a buffer for the clean switching of the relay and also to prevent relay clicking when the input voltage reduces momentarily
- Switch S1 to turn off the lamps when not in used

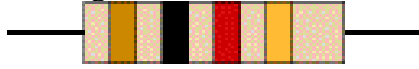
Questions:

- 1) What size of resistor is needed to connect in series with the two white LEDs to restrict the current flow and reduce the voltage across the two White LEDs?
- 2) What size of the resistor should be connected in series with the charger indicator red LED to restrict the current flow through the LED and reduce the voltage across the LED to 1.8V?
- 3) What size of the charger controller resistor to be connected in series with silicon diode D1 to restrict the flow of current and reduce the voltage across the battery to 6Volts?
- 4) What size of solar panel active power in watts is needed charge the battery?

- 5) Draw the circuit in multisim and simulate the circuit
 - i. How much current is flowing from the solar source to charge the battery?
 - ii. How much current is flowing from the battery to LEDs total current?

ASSIGNMENT 2

a) The figures below show two resistors, state the resistance of each of the resistors.



i.) Color Code: Orange, Black, Red



ii.) Color Code : Red, Violet, yellow

[10 Marks]

b) State four types of diagrams commonly used in electrical and electronics drawing.

[20 Marks]

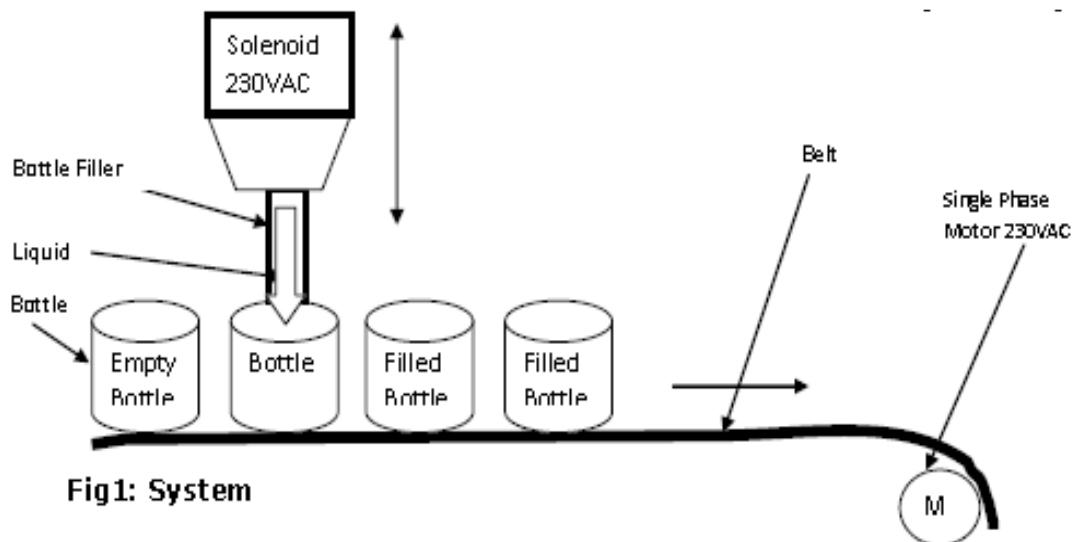
c) Briefly describe four main uses of electrical circuit diagram

[20 Marks]

d) Design a liquid level detector alarm (12V Relay) relay switch circuit diagram. The device is to be used for alerting when the liquid bottle is filled up and automatically stop filling the bottle, move the bottle filler up and move the filled bottle to a new position for putting the bottle lid. The device should give a red light with alarm when bottle is filled up and stop the filling, while moving the bottle filler up and the bottle to new position. The bottle filler is moved up and down using solenoid. Liquid level sensor is fitted at the filling end of the filler. Fig 1 shows the system.

[50 Marks]

Total [100 Marks]



ASSIGNMENT 3

- a) Design and draw a 230VAC main supply based multipurpose mobile and laptop charger. A 230VAC main supply is used as source of current. The circuit diagram should be able to charge a 3.7V, 600mA mobile phone battery and 19V, 3.42A laptop battery. The following components should be used in the circuit diagram
- IC1 KIA7820API to give 20V output
 - Use a Zener Diode as regulator to give 3.7V output, with resistor R2 to restrict charging current to a safer level and restrict current through Zener diode
 - High value capacitors C1 and C2 4700 μ F, 25V to act as current smoother and buffers so that a short duration interruption in current flow from the panel will not affect the charging process.
 - Red LED 2V, 30mA, to indicate the charging process
 - Diode D1 1N6204 to protect battery current to flow back to solar panel
 - Diode D2-D5 1N6204 for converting AC to DC
 - A step down transformer 240/19V 7000mA [20Marks]
 1. Calculate the resistance of the resistor to limit the current through the Zener diode and the resistor power rating. [5Marks]
 2. Calculate the Zener power rating. [5 Marks]
 3. Draw the circuit in multism and carry out simulation [70Marks]
 - i. What is the output voltage across the laptop battery port (connect a voltmeter to the port)
 - ii. What is the current flowing through Red LED (connect an ammeter in series with LED)
 - iii. What is the output voltage across the mobile battery port (connect a voltmeter to the port)
 - iv. Show the observed output waveforms for the circuit for both output ports (connect an oscilloscope)

Total [100 Marks]