MAKEATHON CONTEST

PCB design

Problem statement

ID: MKCE-ECE-PCB-001

A team of engineers is developing a battery-less IoT sensor network for an agricultural monitoring system. The sensors require a stable 3V DC power supply to operate. Due to the remote location, the power source is a standard 230V AC mains supply available in the nearby control station. The engineers decide to design a regulated power supply circuit based on the schematic provided.

ID: MKCE-ECE-PCB-002

A research team is designing a remote weather monitoring station to collect temperature, humidity, and air pressure data using a microcontroller-based system (e.g., Arduino or ESP8266). The microcontroller requires a stable 5V DC power supply to function properly. Since the station is deployed in an area with only AC mains power available (230V AC), the engineers need to step down and regulate the voltage efficiently.

ID: MKCE-ECE-PCB-003

A team of engineers is developing a solar-powered IoT weather station that collects environmental data in a remote, off-grid location. Since solar power generation fluctuates due to weather conditions, they need a reliable battery charging system to ensure uninterrupted operation. The team decides to use a 12V rechargeable battery as the power source and employs a battery charger circuit with auto cut-off.

ID: MKCE-ECE- PCB -004

You have designed a battery charging system that includes a Charger Circuit Failure Alarm as shown in the schematic. After assembling the circuit, you notice that the buzzer (BZ1) is not activating when the charger circuit fails, even though you expect it to.

Upon troubleshooting, you observe the following conditions:

The LED (D1) is turning ON when the charger is connected.

The voltage across J1 (charger input) drops to 0V when the charger is disconnected.

Both transistors (Q1 and Q2) remain in their off state when the charger is removed.

ID: MKCE-ECE- PCB - 005

You are designing a robotic system that requires an Obstacle Identification Sensor Circuit, as shown in the schematic. The circuit uses an IR LED (D1) and a photodiode (D2) to detect obstacles, with an LM358P operational amplifier acting as a comparator. The output of the circuit controls an LED (D3) to indicate obstacle detection. After assembling the circuit, you observe that:

The IR LED (D1) is glowing properly.

The photodiode (D2) responds to external IR light sources but does not trigger the comparator when an obstacle is placed in front of it.

The output LED (D3) remains off regardless of the presence of an obstacle.

ID: MKCE-ECE- PCB - 006

You are working on a project that requires a regulated DC power supply without using a dedicated voltage regulator IC. You decide to use the circuit shown in the schematic, which utilizes a bridge rectifier, a capacitor filter, and a transistor-based regulation stage to provide a 6V to 12V DC output. After assembling the circuit, you observe the following issues:

The output voltage fluctuates under varying load conditions.

The transistor 2N1613 (Q1) is heating up significantly.

The capacitor C1 (1000µF/25V) is functioning correctly, but the ripple voltage seems higher than expected.

ID: MKCE-ECE- PCB - 007

7. A technician is troubleshooting the given 12V/1A SMPS circuit, which is not providing the expected 12V DC output. Upon inspection, they find the following symptoms:

The neon lamp is glowing, indicating the presence of AC input.

The output voltage is significantly lower than 12V (around 5V).

The Schottky diode (D4, SB160) is getting warm abnormally.

The optocoupler (IC2, EL817) appears to be functioning correctly.
