

Technical Questions:

MCQ:

Which of the following aerodynamic forces is responsible for the lift of a UAV/drone?

- a. Thrust
- b. Weight
- c. Drag
- d. Lift

Which of the following propulsion systems is commonly used in small drones?

- a. Turbofan
- b. Turboprop
- c. Electric motor
- d. Piston engine

What is the purpose of a flight controller in a UAV/drone?

- a. To generate lift
- b. To navigate the drone
- c. To stabilize the drone
- d. To communicate with the ground station

Which of the following sensors can be used to measure altitude in a UAV/drone?

- a. GPS
- b. Gyroscope
- c. Barometer
- d. Accelerometer

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Which of the following design factors affects the range of a UAV/drone?

- a. Weight
- b. Wing span
- c. Thrust-to-weight ratio
- d. All of the above

What is the function of a gimbal in a UAV/drone camera system?

- a. To stabilize the camera
- b. To control the camera's orientation
- c. To transmit video signals to the ground station
- d. To reduce the weight of the camera system

Which of the following materials is commonly used to build UAV/drone airframes?

- a. Steel
- b. Aluminum
- c. Carbon fiber
- d. Plastic

What is the purpose of an ESC (Electronic Speed Controller) in a UAV/drone?

- a. To control the drone's speed
- b. To regulate the drone's power supply
- c. To stabilize the drone's flight
- d. To transmit flight data to the ground station

Which of the following control systems is commonly used in UAV/drone flight control?

- a. PID (Proportional-Integral-Derivative)
- b. Fuzzy logic
- c. Artificial neural networks
- d. Genetic algorithms

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Which of the following design factors affects the endurance of a UAV/drone?

- a. Battery capacity
- b. Wing span
- c. Propulsion system
- d. All of the above

Short Questions:

1. What is the maximum range of a typical consumer drone with a fully charged battery?
2. Describe the difference between a quadcopter and a fixed-wing drone in terms of aerodynamics.
3. Explain the concept of thrust-to-weight ratio and how it affects the flight performance of a drone.
4. Name three types of sensors commonly used in UAV/drone navigation and describe their functions.
5. What is the purpose of the PID (Proportional-Integral-Derivative) controller in UAV/drone flight control?
6. Describe the difference between a brushed and a brushless motor and explain which one is commonly used in UAV/drone propulsion.
7. Name three factors that affect the flight endurance of a drone and explain how they impact it.
8. What is the purpose of a fail-safe mechanism in a drone and how does it work?
9. Describe the difference between a LiPo (Lithium Polymer) and a Li-ion (Lithium-ion) battery and explain which one is commonly used in UAV/drone applications.
10. Explain the concept of stall in aerodynamics and how it can affect the flight performance of a drone.

Design Challenge

Long Question

You are tasked with designing a fixed-wing UAV for surveying and mapping purposes that can operate in a variety of conditions. The UAV must be capable of carrying a payload of at least 2 kg, have a minimum range of 100 km, and a minimum endurance of 4 hours. The UAV should be able to fly at an altitude of up to 2,000 feet and withstand winds of up to 20 knots. The UAV should also be able to operate in temperatures ranging from -5°C to 40°C.

Your design must include the following:

- **Airframe:** The airframe should be designed to be lightweight and durable. The wingspan should be at least 3 meters, and the airframe should be able to accommodate the payload of at least 2 kg. The airframe should also be able to withstand the environmental conditions specified.
- **Propulsion:** The propulsion system should be able to provide enough power to propel the UAV to a maximum speed of 80 km/h. The propulsion system should also be efficient enough to allow the UAV to meet the minimum range and endurance requirements. The propulsion system should be gasoline-powered.
- **Control System:** The control system should include a flight controller, autopilot, and a GPS system. The control system should be able to maintain stable flight, navigate the UAV to designated locations, and maintain a safe altitude. The control system should also be able to handle a payload of at least 2 kg.
- **Communication System:** The communication system should be able to transmit telemetry data, video feed, and other mission-critical information to the ground station. The communication system should also be able to receive commands from the ground station.
- **Payload:** The payload should be designed to be easily interchangeable and should be able to capture high-resolution aerial imagery and topographical data. The payload should also be designed to be lightweight and durable.

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- **Power System:** The power system should be designed to provide enough energy to operate the UAV for the minimum endurance specified. The power system should also be able to recharge the batteries during flight using solar panels or other renewable energy sources.

Your design should include detailed schematics and drawings, along with a detailed description of each component and its specifications. Your design should also include an estimated cost breakdown for each component and an overall estimate for the complete UAV. Additionally, you should describe the data processing and analysis software that will be used to process the data collected by the UAV