

316335

25226

3 Hours / 70 Marks

Seat No.

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- Instructions* – (1) All Questions are *Compulsory*.
(2) Answer each next main Question on a new page.
(3) Illustrate your answers with neat sketches wherever necessary.
(4) Figures to the right indicate full marks.
(5) Assume suitable data, if necessary.
(6) Use of Non-programmable Electronic Pocket Calculator is permissible.
(7) Mobile Phone, Pager and any other Electronic Communication devices are not permissible in Examination Hall.
(8) Use of Steam tables, logarithmic, Mollier's chart is permitted.

Marks

1. Attempt any FIVE of the following : 10
- a) Define Unmanned Aircraft System (UAS) as per drone rules, 2021.
 - b) State the function of Electronic Speed Controllers (ESC) in a drone.
 - c) List two key components of a brushless DC (BLDC) motor.
 - d) List any two applications of magnetometer in the context of drone.
 - e) Define drone swarming.
 - f) Define Visual Line of Sight (VLOS) in drone operations.

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- g) List the possible causes of the following battery problems in a drone:
- i) Swelling of the battery
 - ii) Rapid discharge

2. Attempt any THREE of the following : 12

- a) Explain the working principle of a multi-rotor (quadcopter) drone.
- b) Explain the general rules for flying a drone in India. (Any 4 points).
- c) Explain the operation of a brushless DC (BLDC) motor in a drone, with a neat labeled diagram.
- d) Explain the key safety considerations to be followed during drone assembly.

3. Attempt any THREE of the following : 12

- a) Explain the concept of green zone in relation to drone operations in India.
- b) Compare medium and large type of drones. Discuss your answer in 4 points covering:
 - i) Weight
 - ii) Size
 - iii) Payload capacity
 - iv) Applications
- c) A drone is powered by a 6S LiPo battery with the following specifications:

Battery voltage: 22.2 V

Battery capacity: 4000 mAh (4.0 Ah)

Average current draw during flight: 40 A

 - i) Calculate the raw flight time (in minutes) the drone can achieve based on the battery capacity and average current draw.
 - ii) To protect the battery and prolong its lifespan, only 85% of the total battery capacity should be used. Calculate the safe flight time (in minutes) based on this safety margin.

- d) Suggest the possible causes and appropriate solutions for propeller problems in a drone that shows symptoms such as vibration, unstable flight, low thrust.

4. Attempt any THREE of the following : 12

- a) Explain the role of object detection in autonomous drones.
- b) Compare the power subsystem and control subsystem of a drone. Discuss your answer in 4 points covering:
- i) Definition
 - ii) Primary function
 - iii) Components
 - iv) Effect on drone performance
- c) Describe the key parameters related to a drone battery voltage(V), capacity (mAh), c-rating, and energy(Wh) and explain how each parameter affects the drone's performance.
- d) Explain the selection criteria for the following parts of a agriculture drone and justify your choices:
- i) Frame
 - ii) Flight controller
 - iii) Motors
 - iv) Propellers
- e) Explain the working principle of a fixed-wing drone. List its advantages, disadvantages, and applications.

5. Attempt any TWO of the following : 12

- a) Explain the terms diameter and pitch with regards to drone propeller. Compare 2-blade, 3-blade, and 4-blade propellers in terms of thrust, stability, drag, battery life, and typical applications.
- b) Describe the step-by-step procedure to take-off the drone, ensuring stability and safety of both the drone and surroundings.
- c) Explain the working of a solar-powered drone. List its advantages, limitations, and applications.

6. Attempt any TWO of the following : 12

- a) Describe how stability is maintained during drone flight with a neat labeled diagram.
 - b) Explain the troubleshooting and maintenance practices for a drone.
 - c) Explain how drones are transforming the construction industry by considering the factors of surveying, progress tracking, safety checks, volume calculation, and inspection.
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