



M.TECH DEGREE EXAMINATIONS: APRIL / MAY 2023

(Regulation 2018)

Second Semester

DEFENCE TECHNOLOGY

P18DTE0022: Unmanned Aerial Vehicle Design

COURSE OUTCOMES

CO1: Understand the design requirements, design parameters of UAV.

CO2: Perform the aerodynamic analysis, performance and stability analysis.

CO3: Understand the performance testing of the UAVs.

CO4: Understand the airworthiness and safety requirements of UAV.

Time: Three Hours

Maximum Marks: 100

Answer all the Questions:-

PART A (10 x 1 = 10 Marks)

1. Arrange the following UAV classification in the correct sequence CO1 [K₁]
 - a) Medium UAV
 - b) Small UAV
 - c) Nano UAV
 - d) Micro UAV
2. Arrange the following System Life Cycle Phases in Correct Sequence CO1 [K₁]
 - a) Production/ Construction
 - b) Need
 - c) Product use and Disposal
 - d) Conceptual Design
 - e) Preliminary design
 - f) Detailed Design
3. Arrange Flight Phases in sequence CO2 [K₁]
 - a) Land
 - b) Cruise
 - c) Take off
 - d) Climb
4. Matching type item with multiple choice code CO4 [K₁]

List I	List II
A. Red Zone	i. Between 8 to 12 km
B. Yellow Zone	ii. More than 12 km
C. Green Zone	iii. Less than or equal to 5 km

CO4

5. GCS stand for [K₁]
 a) Ground Communication Station b) Grass Cutting Station
 c) Ground Control Station d) Gross Cumulative Station
6. ADSB stands for CO4 [K₁]
 a) Aircraft Dependent Surveillance Broadcast b) Aircraft Directional Surveillance Broadcast
 c) Aircraft Dependent Satellite Broadcast d) Automatic Dependent Surveillance Broadcast
7. TCAS stands for CO4 [K₁]
 a) Tacan Communication Automatic System b) Traffic Collision Avoidance System
 c) Traffic Communication Augmenting System d) Tacan based Collision Avoidance System
8. In UAV, AFCS stands for CO4 [K₁]
 a) Aircraft Flight Control System b) Automatic Traffic Control System
 c) Aircraft Traffic Control System d) Automatic Flight Control System
9. The most popular GPS currently used is based on CO4 [K₁]
 a) Navstar Satellite Constellation b) Galileo Satellite Constellation
 c) Starlink Satellite Constellation d) Iridium Satellite Constellation
10. In UAV, BVLOS stands for CO2 [K₁]
 a) Bi Vector Long Operating System b) Binary Variable Line of Sight
 c) Beyond Visual Line of Sight d) Beyond Variable Light Operating System

PART B (10 x 2 = 20 Marks)

11. Explain Green Zone for UAV Operations CO1 [K₂]
12. What is Concurrent Certification Philosophy CO4 [K₂]
13. What is Risk Severity and what are the levels of Risk Severity CO4 [K₁]
14. What are the phases of flight. CO2 [K₁]
15. What are the categories and sub categories of UAV defined by DGCA CO1 [K₁]
16. What are the levels of Risk Likelihood in airworthiness evaluation CO4 [K₁]
17. What is induced velocity; how does it change from hover to forward flight CO2 [K₂]
18. Write briefly on Packaging Density in UAV CO2 [K₂]
19. Define on Reynolds number and Mach Number CO2 [K₂]
20. What are the various propulsion systems used in UAV CO2 [K₂]

PART C (6 x 5 = 30 Marks)

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|-----|---|---|-----|-------------------|
| 21. | Explain Scale Effect and Froude Number in UAV | 5 | CO3 | [K ₂] |
| 22. | What are the types of drag and explain variation of drag with speed in fixed wing UAV | 5 | CO2 | [K ₂] |
| 23. | What is Handling Qualities? Explain the three levels of Handling Qualities | 5 | CO3 | [K ₂] |
| 24. | With reference to maneuverability explain the requirements with respect to structures, powerplant and payload | 5 | CO3 | [K ₂] |
| 25. | Explain project lifecycle of UAV | 5 | CO3 | [K ₂] |
| 26. | What is Wind Tunnel Testing. Briefly write about Wind Tunnel testing of UAV | 5 | CO3 | [K ₃] |

Answer any FOUR Questions

PART D (4 x 10 = 40 Marks)

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|-----|--|----|-----|-------------------|
| 27. | What is design requirement? What are the design requirements of UAV. Explain briefly any five of them. | 10 | CO1 | [K ₂] |
| 28. | What are the various manoeuvres required in UAV. Write briefly any three of them. | 10 | CO3 | [K ₂] |
| 29. | Explain UAS architecture with a diagram and what is the role of each element | 10 | CO2 | [K ₂] |
| 30. | What are the stages of aircraft design, with a block diagram briefly explain each stage. | 10 | CO2 | [K ₂] |
| 31. | What are the various navigation systems used in UAV. Explain in detail any one system. | 10 | CO3 | [K ₂] |
