

Hall Ticket No

Question Paper Code: AAE506



INSTITUTE OF AERONAUTICAL ENGINEERING
(Autonomous)
Dundigal, Hyderabad - 500 043

MODEL QUESTION PAPER-I

B.Tech VII Semester End Examinations, November/December – 2019

Regulations: IARE - R16

UNMANNED AIR VEHICLES
(AERONAUTICAL ENGINEERING)

Time: 3 hours

Max. Marks: 70

Answer ONE Question from each Unit

All Questions Carry Equal Marks

All parts of the question must be answered in one place only

UNIT – I

1. a) Discuss briefly the functions of major sub-systems of UAS. [7M]
b) Why do we need UAS? Discuss in detail. [7M]
2. a) Describe the different phases of design of UAS [7M]
b) Discuss 'Navigation Systems' and 'Communication Systems' of UAS [7M]

UNIT – II

3. a) Discuss the 'Lift Induced Drag' in detail with necessary diagrams [7M]
b) How does airspeed, wing loading and drag are related? Discuss with necessary diagrams? [7M]
4. a) Discuss 'Different VTOL Airframe Configurations' [7M]
b) Explain 'Ducted Fan Aircraft' and 'Jet-life Aircraft' airframe configurations. [7M]

UNIT – III

5. a) What are the three main concerns of the Long-endurance, Long-range Role UAV designer, discuss in detail with the necessary diagram? [7M]
b) Discuss about the Medium-range, Tactical VTOL (Rotary wing) UAV [7M]
6. a) Explain Close-range/ Battlefield VTOL aircraft systems with necessary details. [7M]
b) What are the different novel hybrid aircraft configurations, discuss with necessary examples? [7M]

UNIT – IV

7. a) What are the different ways of achieving communication between GCS and UAV, explain in detail? [7M]
b) Discuss radio frequencies and LOS range with necessary diagrams. [7M]

8. a) Write short notes on (i) Transmitter power output and receiver sensitivity, (ii) Antenna gain, (iii) Polarization and (iv) Multi-path propagation. [7M]
- b) What are the different types of Antennas, discuss them briefly. [7M]

UNIT – V

9. a) Discuss HTOL Aero-stable configuration with AFCS. [7M]
- b) Discuss the control and stability aspects of Single-main- rotor helicopter with AFCS diagram. [7M]
- 10 a) Write the method of aerodynamic control of Coaxial-rotor helicopter using AFCS [7M]
- b) Differentiate ‘Directional’ Airframe Coaxial-rotor Helicopter (CRH) and Symmetrical Airframe Coaxial-rotor Helicopter with the help of AFCS [7M]



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COURSE OBJECTIVES:

The course should enable the students to:	
I	Introduce to the student about the basic ideas of Unmanned Air Vehicles
II	Familiarize the students about the aerodynamics and airframe configurations
III	Accustom the student to the wide variety of unmanned air vehicles
IV	Acquaint the student about the various communication and navigation systems of unmanned air vehicles

COURSE OUTCOMES (COs):

CO 1	Describe the concept of UAS-system composition and design concepts with some applications of UAS
CO 2	Understand the concept of aerodynamics, airframe configurations, structures, mechanisms, selection of power-plants, modular construction and ancillary equipment
CO 3	Explore the concept of Long-endurance, long range, Medium-range, tactical aircraft and aircraft configurations
CO 4	Describe the concept of communications, Mid-air collision avoidance, communications data rate and bandwidth usage Inertial Navigation - Radio Tracking - Way-point Navigation
CO 5	Understand the concept of convertible rotor aircraft payload control, culmion filter and autonomy

COURSE LEARNING OUTCOMES (CLOs):

AAE506.01	Understand the unmanned aerial vehicle types based on the design and application
AAE506.02	Understand different elements of UAS (composition) and their importance.
AAE506.03	Describe the design concepts of UAS
AAE506.04	Apply the knowledge of selection of the system
AAE506.05	Understand the different types of drags for UAVs.
AAE506.06	Describe the range of airframe configurations available for UAVs
AAE506.07	Remember the aerodynamic efficiency factors
AAE506.08	Analyze the structures and mechanical design factors in the design of UAVs
AAE506.09	Understand the design of a UAS-based flight mission.
AAE506.10	Apply the knowledge of different types of power-plants in selection.
AAE506.11	Recognize and recommend potential airframe for long-endurance long-range UAVs

AAE506.12	Apply acquired knowledge and critical thinking skills to select airframe for medium-range, tactical aircraft
AAE506.13	Understand the MUAV types
AAE506.14	Analyze the different types of MAV, NAV and UCAV
AAE506.15	Understand the novel hybrid aircraft configurations and UAVs for Research purpose
AAE506.16	Understand the communication media and radio communication between GCS and aircraft
AAE506.17	Apply the knowledge of regulations to avoid mid-air collision
AAE506.18	Understand the technology of communication data rate and bandwidth usage
AAE506.19	Apply knowledge of GPS
AAE506.20	Identify the different navigation systems and tracking
AAE506.21	Understand the issues and challenges of control and stability of different types of UAVs
AAE506.22	Apply the knowledge of payload control
AAE506.23	Ability to understand the role of different sensors and autonomy in control and stability of UAV systems

MAPPING OF SEMESTER END EXAMINATION TO COURSE OUTCOMES

SEE Question No.		Course Learning Outcomes	Course Outcomes	Blooms' Taxonomy Level	
1	a	AAE506.02	Understand different elements of UAS (composition) and their importance.	CO 1	Remember
	b	AAE506.01	Understand the unmanned aerial vehicle types based on the design and application	CO 1	Understand
2	a	AAE506.03	Describe the design concepts of UAS	CO 1	Remember
	b	AAE506.02	Understand different elements of UAS (composition) and their importance.	CO 1	Understand
3	a	AAE506.05	Understand the different types of drags for UAVs.	CO 2	Understand
	b	AAE506.05	Understand the different types of drags for UAVs.	CO 2	Understand
4	a	AAE506.06	Describe the range of airframe configurations available for UAVs	CO 2	Remember
	b	AAE506.06	Describe the range of airframe configurations available for UAVs	CO 2	Understand
5	a	AAE506.11	Recognize and recommend potential airframe for long-endurance long-range UAVs	CO 3	Understand
	b	AAE506.12	Apply acquired knowledge and critical thinking skills to select airframe for medium-range, tactical aircraft	CO 3	Understand
6	a	AAE506.12	Apply acquired knowledge and critical thinking skills to select airframe for medium-range, tactical aircraft	CO 3	Understand
	b	AAE506.15	Understand the novel hybrid aircraft configurations and UAVs for Research purpose	CO 3	Understand

7	a	AAE506.16	Understand the communication media and radio communication between GCS and aircraft	CO 4	Remember
	b	AAE506.16	Understand the communication media and radio communication between GCS and aircraft	CO 4	Understand
8	a	AAE506.18	Understand the technology of communication data rate and bandwidth usage	CO 4	Remember
	b	AAE506.18	Understand the technology of communication data rate and bandwidth usage	CO 4	Understand
9	a	AAE506.21	Understand the issues and challenges of control and stability of different types of UAVs	CO 5	Remember
	b	AAE506.21	Understand the issues and challenges of control and stability of different types of UAVs	CO 5	Understand
10	a	AAE506.21	Understand the issues and challenges of control and stability of different types of UAVs	CO 5	Remember
	b	AAE506.21	Understand the issues and challenges of control and stability of different types of UAVs	CO 5	Understand

Signature of Course Coordinator

HOD, AE