U.S.N.										

B.M.S. College of Engineering, Bengaluru-560019

Autonomous Institute Affiliated to VTU

June 2025 Semester End Main Examinations

Programme: B.E. **Semester: V**

Branch: Mechanical Engineering **Duration: 3 hrs.**

Course Code: 23ME5PEDUT / 22ME5PEDUT **Max Marks: 100**

Course: Drones and UAV Technology

Instructions: 1. Answer any FIVE full questions, choosing one full question from each unit.
2. Missing data, if any, may be suitably assumed.

Important Note: Completing your answers, compulsorily draw diagonal cross lines on the remaining blank pages. Revealing of identification, appeal to evaluator will be treated as malpractice.

			UNIT - I	*CO*	*PO*	Marks
1	a)		Define 'Unmanned Aerial Vehicles (UAVs)' and explain the key differences between an aircraft and a UAV. List and describe the DGCA classifications of UAVs, providing examples for each category.	*CO1*	*PO1*	**06**
	b)		Compare between the fixed-wing drones and multi-rotor drones for forest surveying. Discuss any one advantage and disadvantage of fixed-wing drones on the same application.	*CO1*	*PO1*	**07**
	c)		Compare the anatomy of multi-rotor drones and fixed-wing drones, highlighting three key differences. Describe how drones are used in environmental monitoring. Illustrate your answer with an example.	*CO1*	*PO2*	**07**
			OR			
2	a)		Briefly explain their historical evolution of UAV's. Compare fixed-wing drones and multi-rotor drones in terms of their characteristics and typical applications.	*CO1*	*PO1*	**08**
	b)		Describe the role of drones in defense applications highlighting their advantages over manned systems.	*CO1*	*PO1*	**06**
	c)		Analyze how the specifications of a multi-rotor drone, such as maximum flight time and coverage area per flight, affect its efficiency in surveying a 10 m^2 area. Additionally, discuss two advantages and two disadvantages of using multi-rotor drones for such surveys.	*CO1*	*PO2*	**06**
			UNIT - II			
3	a)		Describe the four main forces acting on an airplane during flight. List and briefly explain two factors that affect the lift generated by an aerofoil.	*CO1*	*PO1*	**06**
	b)		Define the term Mach number and explain its significance in	*CO2*	*PO2*	**07**

			aerodynamics. An airplane is flying at a speed of 300 m/s at sea level where the speed of sound is 340 m/s. Calculate the Mach number of the airplane.			
		c)	Explain the concept 'angle of attack' and its influence on the lift and drag forces experienced by an aircraft. Additionally, discuss how the drag coefficient (C_d) is determined and its significance in aerodynamics.	*CO2*	*PO2*	**07**
			OR			
	4	a)	Define dynamic stability and differentiate it from static stability in an aircraft. Explain the role of an autopilot system in maintaining stability and control during flight.	*CO2*	*PO1*	**07**
		b)	Define 'Longitudinal' and 'Lateral' stability in an aircraft. Discuss any three differences between them.	*CO2*	*PO1*	**06**
		c)	Define the term 'stability' in the context of flight and explain its importance in aircraft design.	*CO2*	*PO1*	**07**
			UNIT - III			
	5	a)	Define electromagnetic spectrum and explain its significance in UAV communication and navigation systems.	*CO3*	*PO1*	**07**
		b)	Explain the difference between passive sensing and active sensing in the context of UAV navigation. Provide one example for each type of sensing.	*CO3*	*PO1*	**07**
		c)	Discuss the role of the Electronic Speed Controller (ESC) in UAV propulsion systems and its importance for a stable flight.	*CO3*	*PO1*	**06**
			OR			
	6	a)	Describe the classification of UAV payloads based on their applications and provide examples for each type.	*CO3*	*PO1*	**08**
		b)	Explain how 'Laser Detection and Ranging (LiDAR)' technology works and any three applications of it in UAV systems.	*CO3*	*PO1*	**06**
		c)	Discuss the any three navigation systems used in UAV's and their significance for enabling autonomous flight.	*CO3*	*PO1*	**06**
			UNIT - IV			
	7	a)	Enumerate the different sources of power used in UAV propulsion systems. Explain the advantages of using electric power compared to internal combustion engines.	*CO4*	*PO1*	**06**
		b)	Explain the principle of thrust generation in UAV propulsion systems. Highlight how the propeller design impacts thrust efficiency. Compare a two-cycle engine with a four-cycle engine in terms of power-to-weight ratio, and efficiency.	*CO5*	*PO2*	**07**
		c)	Explain the concept of power lift and its significance in UAV vertical takeoff and landing (VTOL) systems.	*CO6*	*PO1*	**07**

			OR			
	8	a)	Explain the working principle of a rotary engine and compare its advantages and disadvantages with gas turbines when used in UAV propulsion.	*CO4*	*PO1*	**06**
		b)	How energy storage and power consumption influence the endurance of electric UAVs.	*CO5*	*PO1*	**08**
		c)	Briefly, describe the working of solar cells and fuel cells in UAV applications.	*CO6*	*PO2*	**06**
			UNIT - V			
	9	a)	Explain how UAV's can be utilized for population assessment in urban areas. Discuss the advantages and challenges of using UAVs for this purpose.	*CO5*	*PO2*	**06**
		b)	Describe the role of UAV's in habitat studies and monitoring ecological changes over time. Provide examples of sensors typically used for these applications.	*CO5*	*PO2*	**06**
		c)	Discuss how UAV's can be employed to study animal behavior and morphometrics. Highlight the key benefits of using UAV's over traditional methods.	*CO5*	*PO2*	**08**
			OR			
	10	a)	Explain how advanced geo-processing techniques can be applied to drone data for land use analysis. Provide examples of tools used in geo-processing.	*CO5*	*PO2*	**06**
		b)	Discuss how artificial intelligence (AI) can enhance the analysis of large volumes of drone data in civil applications, such as agriculture or urban planning. Include at least two use cases.	*CO5*	*PO2*	**06**
		c)	Explain the key safety and privacy concerns associated with UAV operations in civil and commercial applications. Propose at least two measures to address these concerns.	*CO5*	*PO2*	**08**

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