Enrollment No......................................

Faculty of Engineering
End Sem Examination Dec 2024
RA3EL17 Advanced Drones Technology

Programme: B.Tech.   Branch/Specialisation: RA

Duration: 3 Hrs.   **Maximum Marks: 60**

Note: All questions are compulsory. Internal choices, if any, are indicated. Answers of Q.1 (MCQs) should be written in full instead of only a, b, c or d. Assume suitable data if necessary. Notations and symbols have their usual meaning.

			Marks	BL	PO	CO	PSO
Q.1	i.	The inertial coordinate system is a coordinate system with its origin at the defined home location- (a) Object-fixed (b) Sky-fixed (c) Earth-fixed (d) Earth-movable	1	1	1,12	1	2
	ii.	To derive the dynamic equations of motion for the MAV, which law is applied? (a) Newton's second law (b) Euler's second law (c) Newton's third law (d) Euler's third law	1	1	1,12	1	1,2
	iii.	A simple model for the thrust generated by a propeller can be developed by applying _____ to calculate the pressure ahead of and behind the propeller and then applying the pressure difference to the propeller area. (a) Newton's principle (b) Bernoulli's principle (c) Euler's principle (d) General principle	1	1	1,12	2	1,2
	iv.	A second component of the lateral dynamics is the _____ behavior in response to rudder inputs. (a) Roll (b) Pitch (c) Velocity (d) Yaw	1	1	1,12	2	1

v.	The Global Positioning System (GPS) is a satellite-based navigation system that provides _____ position information for objects on or near the earth's surface. (a) 2-D (b) 3-D (c) 4-D (d) 2.5-D	**1**	1	1,12	3	1,2
vi.	Which maneuver commands longitudinal and lateral motions simultaneously? (a) Benchmark (b) Non benchmark (c) Upper benchmark (d) Lower benchmark	**1**	1	1,12	3	1,2
vii.	The _____ problem is most easily solved in a frame relative to the straight-line path. (a) Path-following (b) Path lagging (c) Path control (d) Following path.	**1**	1	1,12	4	1,2
viii.	The straight-line and orbit guidance strategies are used to synthesize_____, (a) Non Dubins paths (b) Dubins paths (c) Waypoints (d) Waylines	**1**	1	1,12	4	1,2
ix.	Small and miniature air vehicles are used primarily for intelligence, surveillance, and _____tasks. (a) Reconnaissance (ISR) (b) Renaissance (ISR) (c) Intelligent (ISR) (d) Surveillance (ISR)	**1**	1	1,12	4	1,2
x.	Which method is essentially restricted to 2.5-D (or constant predefined altitude) path planning, where the altitude at each node is fixed in the map. (a) Rapidly Exploring Random Trees (b) Gimbal (c) Voronoi (d) None of these	**1**	1	1,12	4	1,2

Q.2	i.	Classify drones used in India.	**3**	1	1,12	1	2
	ii.	Explain about degrees of freedom and stick movements.	**7**	2	1,12	1	1,2
OR	iii.	Explain the UAV based on range, altitude, and size.	**7**	2	1,12	1	1
Q.3		Attempt any two:					

	i.	Define the control surfaces that are used to maneuver the aircraft.	**5**	2	1,12	2	1
	ii.	Explain in brief lift, drag, and pitching moment.	**5**	1	1,12	2	1
	iii.	Explain propeller thrust and propeller moment.	**5**	1	1,12	2	1
Q.4	i.	Enlist the various sensors used in drones.	**3**	1	1	3	1
	ii.	What is Global Positioning System (GPS)? How it can be used for agricultural purpose?	**7**	2	1,12	3	1,2
OR	iii.	Derive the continuous-discrete Kalman Filter	**7**	2	1,12	3	1,2
Q.5		Attempt any two:					
	i.	Define kinematic guidance flight control.	**5**	1	1	4	1
	ii.	Explain longitudinal guidance strategy for straight-line following.	**5**	2	1,12	4	1
	iii.	Explain lateral guidance strategy for straight-line following.	**5**	2	1,12	4	1
Q.6		Attempt any two:					
	i.	Define Dubins path.	**5**	1	4	1	1
	ii.	Explain camera model in drone.	**5**	1	4	1	1
	iii.	Explain gimbal pointing.	**5**	1	4	1	1

*****

<div style="text-align:center">

Marking Scheme

RA3EL17 (T) Advance Drones Technology (T)

</div>

Q.1	i)	(c) earth-fixed	**1**
	ii)	(a) Newton's second law	**1**
	iii)	(b) Bernoulli's principle	**1**
	iv)	(d) Yaw	**1**
	v)	(b) 3-D	**1**
	vi)	(a) benchmark	**1**
	vii)	(a) path-following	**1**
	viii)	(b) Dubins paths	**1**
	ix)	(a) reconnaissance (ISR)	**1**
	x)	(c) Voronoi	**1**

Q.2 i. Classify Drones used in India. **3**
Main Classification - 1.5 marks
Sub Classification - 1.5 marks

ii. Explain about Degrees of freedom and Stick movements. **7**
Definition Degree of freedom - 3.5 marks
Definition Stick movements - 3.5 marks

OR iii. Explain the UAV based on range, altitude, and size. **7**
Range - 3 marks
Altitude - 2 marks
Size - 2 marks

Q.3 i. Define the control surfaces that are used to maneuver the aircraft. **5**
Definition - 3 marks
Uses - 2 marks

ii. Explain in brief lift, drag, and pitching moment. **5**
Lift - 2 marks
Drag - 1.5 marks
Pitching - 1.5 marks

OR iii. Explain propeller Thrust and Propeller moment. **5**
Definition Propeller thrust - 2.5 marks
Definition Propeller moment - 2.5 marks

Q.4 i. Enlist the various sensors used in drones. **3**
List of sensors - 3 marks

ii. What is Global Positioning System (GPS)? How it can be used for agricultural purpose? **7**
Definition of GPS - 3 marks
Agricultural uses - 4 marks

OR iii. Derive the Continuous-discrete Kalman Filter **7**
Initial parameter/steps - 2.5 marks
Mid parameters/steps - 2.5 marks
Final parameters/steps - 2 marks

Q.5 i. Define kinematic guidance flight control. **5**
Definition - 4 marks
Uses - 1 marks

ii. Explain Longitudinal Guidance Strategy for Straight-line Following **5**
Definition Guidance strategy - 2 marks
Definition Longitudinal Guidance Strategy - 2 marks
Uses - 1 marks

OR iii. Explain Lateral Guidance Strategy for Straight-line Following **5**
Definition Guidance strategy - 2 marks
Definition Lateral Guidance Strategy - 2 marks
Uses - 1 marks

Q.6 Attempt any two:
i. Define Dubins Path **5**
Definition - 3 marks
Uses/applications - 2 marks

ii. Explain Camera Model in drone **5**
Definition of Models - 1 marks
Classification of Models - 1 marks
Explanation and uses of camera model - 3 marks

iii.   Explain Gimbal Pointing   **5**
       Classification of Pointing   - 1 marks
       Definition of Pointing   - 2 marks
       Uses of Gimbal   - 2 marks

                           ******