



GUJARAT TECHNOLOGICAL UNIVERSITY

Bachelor of Engineering

Subject Code: 3160114

Semester –VI

Subject Name: Introduction to UAV

Type of course: Professional core course

Prerequisite: Fundamentals of Aeronautical Engineering, Fluid Mechanics, Aerodynamics, Flight Mechanics, Avionics

Rationale: Unmanned Aerial Vehicle are developing aggressively, and many government and non-government agencies are considering acquiring such vehicle. This course imparts fundamental knowledge regarding manufacturing process of Unmanned Aerial Vehicle, various types of payloads and its characteristics.

Teaching and Examination Scheme:

Teaching Scheme			Credits C	Examination Marks				Total Marks
L	T	P		Theory Marks		Practical Marks		
				ESE (E)	PA (M)	ESE (V)	PA (I)	
4	0	2	5	70	30	30	20	150

Content:

Sr. No.	Content	Total Hrs	Weightage%
1	Unmanned Aerial Vehicle:- Difference between aircraft and UAV - Parts and functions of Fixed, Rotorcraft and flapping wing UAV, Various Operational History of UAV's, Applications and Uses. Characteristics of Multi rotor vehicle, Fixed Wing vehicle, Flapping wing Vehicles and their applications – Defense, Civil, Environmental monitoring (physical, chemical and biological).	12	20
2	Payloads for UAV Payloads, Classification of Payloads, Camera, Sensors, Radars, Various measuring devices, Classification of payload based on applications, Hyper spectral sensors, Laser detection and range, Synthetic aperture radar, Thermal cameras, Ultra sonic detectors, and recreational payloads, Delivery payloads. Case study on payloads.	10	20
3	Launch and Recovery Launching systems, UAV Launch Methods for Fixed-Wing Vehicles, Vertical Takeoff and Landing, UAV Launch - Recovery systems.	6	10
4	Navigation and Guidance Systems Navigation, Dead Reckoning, Inertial, Radio Navigation, Satellite, Way point Navigation, Dijkstra's Algorithm, A- star Algorithm, UAV Guidance, Types of guidance, UAV communication systems, Ground control station, Telemetry.	12	15
5	Classification of UAV Very small UAVs, Small UAVs, Medium UAVs, Large UAVs, Expendable UAVs, UAV classification by range and endurance, Informal categories of small UAV systems by size.	8	15
6	UAV system Testing UAV Component Testing, UAV Sub-assembly and Sub-system Testing, Testing	12	20

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Complete UAV, Control Station Testing, Catapult Launch System Tests, Preparation for In-flight Testing.		
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Suggested Specification table with Marks (Theory):

Distribution of Theory Marks					
R Level	U Level	A Level	N Level	E Level	C Level
30%	30%	40%	-	-	-

Legends: R: Remembrance; U: Understanding; A: Application, N: Analyze and E: Evaluate C: Create and above Levels (Revised Bloom's Taxonomy)

Note: This specification table shall be treated as a general guideline for students and teachers. The actual distribution of marks in the question paper may vary slightly from above table.

Reference Books:

1. Douglas M. Marshall, Richard K. Barnhart, Eric Shappee, Michael Thomas Most. "Introduction to Unmanned Aircraft Systems, Second Edition. May 24, 2016 by CRC Press. Textbook.
2. Randal W. Beard & Timothy W. McLain. Small Unmanned Aircraft: Theory and Practice. Princeton University Press. 2012
3. Reg Austin. Unmanned Aircraft Systems: UAVS Design, Development and Deployment. 2010. Wiley. ISBN: 978-0-470-05819-0
4. Valavanis, Kimon P., Vachtsevanos, George J. (Eds.). Handbook of Unmanned Aerial Vehicles. Springer. 2015 Paul Fahlstrom,
5. Thomas Gleason. Introduction to UAV Systems, 4th Edition. ISBN: 978-1-119-97866-4; 306 pages; September 2012.
6. DingyüXue and YangQuan Chen. Modeling, Analysis and Design of Control Systems in MATLAB and Simulink. World Scientific Publishing Co. 580pp, Nov 2014, ISBN: 978-981-4618-45-8

Course Outcomes:

Upon completion of this course students should be able to:

Sr. No.	CO statement	Marks % weightage
CO1	Comprehend and explain various components of UAVs	30%
CO2	Obtain basic knowledge of UAV guidance, navigation and control	30%
CO3	Obtain basic knowledge of UAS payloads	20%
CO4	Demonstrate the design process of UAV Testing	20%

List of Practical:

1. Introduction to Unmanned aerial vehicle.
2. To Study different types of unmanned aerial vehicle with applications and its characteristics.
3. To understand parts and function of fix wing UAVs.
4. To learn about manual control system of UAVs
5. To study different types of payloads.
6. To study Propulsion systems of UAVs



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7. To understand parts and function of Quad copter.
8. To study airframes of UAVs
9. To study rigging techniques for failsafe operation of UAVs.
10. To study autopilot system of UAVs.

List of Open Source Software/learning website:

<https://nptel.ac.in/>