COURSE HANDOUT

UAVs and Drone Technology (COM-802(A))

ECE-8TH SEMESTER

ACADEMIC YEAR (2024-25)

Ms. Shiveta Bhat

Assistant Professor

Department of Electronics and Communication Engineering

Department of Computer Science Engineering

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Course Code	Course Name	Course Type	Cd	L	T	P	Marks		
							Sessional	Final Exam	Total
COM-802(A)	UAVs and Drone Technology	PEC	3	2	1	0	50	100	150

COURSE OUTCOMES

	At the end of the course the student will be able to:
CO1	Articulate the basic principles, components, and applications of drone technology.
CO2	Demonstrate knowledge of drone hardware components and their functionality.
CO3	Appreciate drone flight dynamics, control systems, and navigation techniques.
CO4	Develop knowledge of drone navigation and synchronization techniques.
CO5	Formulate algorithms for drone operations, control, and intelligence.

Unit-I

Introduction to Drones: Basics of drone technology and its historical background, Types of drones and their applications in different industries, Current trends, and prospects of drone technology. Drone applications in industries such as agriculture, construction, cinematography.   (6 Hours)

Unit-II

Drone Components and Systems: Understanding drone hardware components: frame, motors, propellers, and batteries, Introduction to drone sensors like GPS, accelerometers, gyroscopes, and camera.   (9 Hours)

Unit-III

Overview of drone software and control: Drone Flight Dynamics and Control, Principles of flight including aerodynamics, lift, drag, and thrust, Drone stabilization and control mechanisms, Introduction to flight modes and maneuvers.   (11 Hours)

Unit-IV

Drone Navigation and Synchronization: Global Positioning System (GPS) and its role in drone navigation, Autonomous flight and obstacle avoidance systems, Sensor technologies for mapping, imaging, and data collection, Drone Operation and Flight Planning, Practical Implementation of application-based Drone Model. (9 Hours)

Unit-V

Algorithms: Flight Control Algorithms, Navigation Algorithms, Path Planning Algorithms, Obstacle Detection and Avoidance, Target Tracking Algorithms, Swarm Algorithms, Image, and Video Processing.   (8 Hours)

Textbooks

S.No.	Name of the Books	Name of the Author	Publisher Name	Edition (Pub.Yr.)
1	Introduction to UAV Systems	Paul Fahlstrom and Thomas Gleason	Wiley Publication	4th (2012)

Reference Books

S.No	Name of the Books	Name of the Author	Publisher Name	Edition (Pub.Yr.)
1	Drone Technology: Future Trends and Practical Applications	Sachi Nandan Mohanty	Wiley Publication	1st (2023)
2	Drone Technology in Architecture, Engineering	Daniel Tal, John Altschuld	Wiley Publication	1st (2021)

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COURSE PLAN		
Unit-I Introduction to Drones		
S.No	**Topics**	**Recommended Books**
1	Basics of drone technology and its historical background	Book 1, Ch.1
2	Types of drones and their applications in different industries	https://onlinecourses.swayam2.ac.in/ntr24_ed12/preview
3	Current trends, and prospects of drone technology	Book 1, Ch.1
4	Drone applications in industries such as agriculture	https://www.researchgate.net/publication/355125734_Drone_-Applications_in_Agriculture
5	Drone applications in industries such as construction	https://www.mdpi.com/2504-446X/7/8/515
6	Drone applications in industries such as cinematography	https://adam.edu.sg/drone-technology-its-impact-on-filmmaking-cinematography/
Unit-II Drone Components and Systems		
7	Understanding drone hardware components: frame	https://youtu.be/jOugJpQfUDU
8	Understanding drone hardware components: motors	https://youtu.be/jOugJpQfUDU
9	Understanding drone hardware components: propellers	https://youtu.be/jOugJpQfUDU
10	Understanding drone hardware components: batteries	https://youtu.be/jOugJpQfUDU
11	Introduction to drone sensors	https://youtu.be/P9adBgSz--g
12	Introduction to drone sensors like GPS	https://youtu.be/wCcARVbL_Dk
13	Introduction to drone sensors like accelerometers	https://youtu.be/KuekQ-m9xpw
14	Introduction to drone sensors like gyroscopes	https://youtu.be/KuekQ-m9xpw
15	Introduction to drone sensors like camera	https://youtu.be/CpLdL8ONEm4
Unit-III Overview of drone software and control		
16	Overview of drone software and control	https://youtu.be/AP1UC0DlIrE
17	Drone Flight Dynamics	https://youtu.be/C0KBu2ihp-s
18	Drone Flight Control	https://youtu.be/4dmrahCJonM
19	Principles of flight including aerodynamics	https://youtu.be/5ltjFEei3AI
20	Principles of flight including lift	https://youtu.be/E3i_XHlVCeU
21	Principles of flight including drag	https://youtu.be/9sYxyUQulHc
22	Principles of flight including thrust	https://youtu.be/yldLbCuEQwo
23	Drone stabilization	https://youtu.be/jY6bBcMtseY
24	Control mechanisms	https://youtu.be/2BwUMk10WqI
25	Introduction to flight modes	https://youtu.be/Bd_W6WlbMik
26	Introduction to maneuvers.	https://youtu.be/O0ydRf3e5iM
Unit-IV Drone Navigation and Synchronization		
27	Global Positioning System (GPS)	https://youtu.be/fjmzjGtB_VA
28	GPS role in drone navigation	https://youtu.be/fjmzjGtB_VA
29	Autonomous flight and obstacle avoidance systems	https://youtu.be/Nrzs3dQ9exw
30	Sensor technologies for mapping	https://youtu.be/N49PzLDUIFQ

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31	Sensor technologies for imaging	https://youtu.be/_-Kedx--a48
32	Sensor technologies for data collection	https://youtu.be/cDx0_ybpSFE
33	Drone Operation	https://youtu.be/1tnc0Vx3sXU
34	Flight Planning	https://youtu.be/3aSoeY6Ih4c
35	Practical Implementation of application-based Drone Model.	Ref Book 1, Ch 1
Unit-V Algorithms		
38	Flight Control Algorithms	https://youtu.be/ULPw-sTEQXM
39	Navigation Algorithms	https://abhivruddhi.mituniversity.ac.in/journals/2021/Mechanical/Path%20Planning%20for%20autonomous%20drone%20using%20ROS%20updated.pdf
40	Path Planning Algorithms	https://youtu.be/8frpg52TzQ8
41	Obstacle Detection and Avoidance	https://youtu.be/6OtrUQ3p9Jo
42	Target Tracking Algorithms	https://ieeexplore.ieee.org/document/8612263
43	Swarm Algorithms	https://pentoz.com/uav-swarming-algorithms/#:~:text=UAV%20swarming%20algorithms%20are%20the%20backbone%20of%20swarm,and%20make%20collective%20decisions.%20Here%E2%80%99s%20how%20they%20work%3A
44	Image	https://youtu.be/-Js9Byn7Cqo
45	Video Processing	https://www.folio3.ai/blog/drone-computer-vision/#:~:text=Computer%20vision%20in%20drones%20helps%20them%20to%20interpret,and%20videos%20from%20a%20camera%20in%20real%20time

ADDITIONAL WEB RESOURCES

1	*NPTEL: Course on* UAV in Engineering Applications *by Dr. E. Balasubramanian of National Institute of Technical Teachers Training and Research, Chennai.* https://onlinecourses.swayam2.ac.in/ntr24_ed12/preview

GRADING AND ASSESSMENT

- **Sessional Test** 1: 10 marks
- **Sessional Test 2**: 10 marks
- **Assignment**: 20 marks
- **Attendance**: 10 marks
- **Final Examination**: 100 marks

COURSE POLICIES

- **Attendance**: Minimum 75% attendance is mandatory to appear in the final examination of the course.

- **Academic Integrity**: MIET's academic integrity policies apply. Plagiarism will not be tolerated.

- **Late Submissions**: Assignments and projects must be submitted by the specified timelines.

FACULTY INFORMATION

- **Office Hours**

  Tuesday (01:00 PM - 01:40 PM)
  Thursdays (01:00 PM - 01:40 PM)

- **Contact Information**
  shiveta.ece@mietjammu.in