

**IV B.Tech I Semester**

23A30703b	<b>DRONE TECHNOLOGY (Professional Elective-V)</b>	<b>L</b>	<b>T</b>	<b>P</b>	<b>C</b>
		<b>3</b>	<b>0</b>	<b>0</b>	<b>3</b>

**Course Objectives:**

- Introduce the fundamentals of Unmanned Aerial Vehicles (UAVs), their classification, and working principles.
- Explain the components, aerodynamics, and propulsion systems essential for drone flight and control.
- Develop skills in drone programming, control systems, and communication protocols.
- Explore applications of drones across industries, such as agriculture, defense, surveillance, logistics, and mapping.
- Educate learners on regulatory, safety, and ethical concerns related to the use of drone technologies.

**Course Outcomes:**

- Understand and describe the types, parts, and functioning of drones and UAV systems.
- Design and evaluate flight dynamics, control systems, and navigation technologies used in drones.
- Demonstrate the ability to program, assemble, and test drones using open-source and commercial platforms.
- Apply drone technology to solve real-world problems in agriculture, disaster management, defense, and delivery systems.
- Exhibit awareness of drone policy regulations, airspace restrictions, and privacy/security guidelines.

**UNIT I – Introduction to Drone Systems**

History and evolution of UAVs, Classification of drones – fixed wing, rotary wing, hybrid, Key components of a drone – frame, ESC, flight controller, GPS, camera, etc., Introduction to drone subsystems – propulsion, navigation, payload, Basic flight physics and principles of lift, thrust, drag, UAV vs. traditional aircraft systems, Overview of global drone market and applications, Introduction to drone platforms (DJI, Ardupilot, PX4).

**UNIT II – Drone Hardware and Aerodynamics**

Airframe types and material selection, Brushless motors and electronic speed controllers (ESC), Propeller dynamics and thrust calculations, Battery technologies – Li-Po, Li-ion: specifications and management, Sensors – IMU, gyroscope, magnetometer, barometer, GPS and real-time positioning systems, Flight control boards – Ardupilot, Pixhawk, Naza, Aerodynamic challenges in drone flight and tuning PID parameters.

**UNIT III – Drone Communication and Control System**

Remote control and ground station basics, Telemetry and radio communication protocols (LoRa, WiFi, RF, LTE), First Person View (FPV) systems – components and latency issues, Drone programming and mission planning using Mission Planner, QGroundControl, Fail-safe, return-to-home, and geo-fencing functionalities, Integration of autopilot systems, Indoor and outdoor localization techniques, Introduction to swarm drone communication.

#### **UNIT IV – Drone Applications and Emerging Use Cases**

Drones in precision agriculture – spraying, mapping, crop monitoring, Disaster management and rescue operations, Aerial surveillance and security, Environmental monitoring and wildlife conservation, Logistics and delivery drones – case studies (Amazon, Zipline), Construction and infrastructure inspections, Cinematography and media production, AI integration in drones – object detection, tracking, anomaly alerts.

#### **UNIT V – Safety, Regulations, and Future Trends**

DGCA guidelines and certification requirements, International drone policies (FAA, EASA), UAV flight permissions and NPNT (No Permission, No Takeoff) protocol, Safety procedures and risk mitigation, Drone cybersecurity and data protection, Ethical concerns – surveillance, privacy, military applications, Future of drone technology – nano drones, delivery drones, flying taxis, Career opportunities and entrepreneurship in drone industry

#### **Textbooks**

1. Unmanned Aircraft Systems: UAVS Design, Development and Deployment by Reg Austin, Wiley
2. Introduction to UAV Systems by Paul G. Fahlstrom and Thomas J. Gleason
3. Building Your Own Drones: A Beginners' Guide to Drones, UAVs, and ROVs by John Baichtal

#### **Reference Books**

1. Small Unmanned Aircraft: Theory and Practice by Randal W. Beard and Timothy W. McLain
2. Drones (The MIT Press Essential Knowledge series) by Andy Miah
3. FPV Flight Dynamics by Christian Mollica
4. DGCA Drone Training Manual (India) – Latest Version