KIET GROUP OF INSTITUTIONS
(An Autonomous Institution, Affiliated to AKTU, Lucknow, UP)

Approved by AICTE, New Delhi

Delhi-NCR, Ghaziabad-Meerut Road, Ghaziabad-201206

EVALUATION SCHEME & SYLLABUS

FOR

B. Tech (Minor Degree)
in
Drone Technology

[Effective from the Session: 2025-26]

DEPARTMENT OF ELECTRONICS & COMMUNICATION ENGINEERING

Minor Degree in Drone Technology for Agriculture

S No.	Semester	Course Category (UGC)	BOS	Course Code	Course Name	Type	Academic Learning (AL)			Continuous Internal Examination (CIE)			End Sem Examination	Total Marks	Total Credits
							L	T	P	MSE	CA	TOTAL		CIE+ ESE	
1	3rd sem	Major (core)	ECE	EC214B	Introduction to Drone Technology	B	2	0	2	60	15	75	75	150	3
2	4th sem	Major (core)	ECE	EC215B	Drone Controllers and Sensors	B	2	0	2	60	15	75	75	150	3
3	5th sem	Major (core)	ECE	EC303B	Drone Data Analysis and AI in Agriculture	B	2	0	2	60	15	75	75	150	3
4	6th sem	Major (core)	ECE	EC304B	Business and Entrepreneurship in Agri-Drones	B	2	0	2	60	15	75	75	150	3
Lab/Practical															
5	7th sem	Research Project / Dissertation	ECE	EC305P	Minor Project	P	0	0	8	-	100	100	100	200	4
Total Hours : 24 hrs.							**8**	**0**	**16**					**800**	**16**

Course Code EC214B	Course Name: Introduction to Drone Technology	L	T	P	C
		2	0	2	3

Course Objectives:

1. To introduce students to the Recent Developments in Drone Technology.
2. To equip students with practical skills in assembling and programming using embedded systems and control algorithms.

Course Outcome: After completion of the course, the student will be able to

1. Understand the concept of UAV, UAS & Quadcopter.
2. Analyze the difference between different types of drones.
3. Interpret the Aerospace Design & Structure in UAV.
4. Understand the Software & Algorithms in UAV / Drone Systems.
5. Understand the concept of Autonomy in Drones.

Co-PO Mapping (scale 1: low, 2: Medium, 3: High)

CO-PO Mapping	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1	3	2	2	1	2	-	-	-	-	-	-	1
CO2	3	3	2	3	2	-	-	-	-	-	-	1
CO3	3	2	3	2	3	-	-	-	-	-	-	2
CO4	3	2	3	2	2	-	-	-	-	-	-	2
CO5	3	3	2	3	3	1	-	-	-	-	-	1

Unit 1	Introduction	12 hours

Introduction to UAS, History of UAV, Recent Developments in Drone Technology, System Composition, Future & Advances of Drone Technology, Applications & Challenges of Drone Technology, Differences between Drone, UAVs, UAS & Quadcopter.

Unit 2	Classification of Drones	12 hours

Classification of Drones, Working of Drone & Flow Pattern, Forces & Moments Acting on Drone, Drone Features, Basics of Bicopter, Triplecopter, Quadcopter, Hexacopter & Octacopter.

Unit 3	Aerospace Design & Structure	12 hours

Aerospace Design & Structure in UAV, Propulsion System of Drone, Flight Control Systems, Communication & Data Links, Payload Design in UAV, Safety & Redundancy in UAV systems.

Unit 4	Introduction to Drone Programming	12 hours

Introduction to Drone Programming Using Python / C / C++ / JavaScript, Overview of Robotic Operating System (ROS), Software & Algorithms in UAV / Drone Systems: Flight Control Software, Navigation & Path Planning Algo, Sensor Fusion Algo, Obstacle Detection & Avoidance Algo, Autonomous Decision-Making & AI Algo, Ground Control Software.

Unit 5	Autonomy in Drones & their Computing	12 hours

Autonomy in Drones & their Computing Needs, Power Management in UAV Drone Systems, Aerodynamics & Airframe Configurations, Characteristics of Aircraft Types.

List of Experiments:

1. To identify and understand the function of major drone components such as the frame, motors, propellers, ESCs, battery, flight controller, and onboard sensors.
2. To assemble a basic quadcopter frame and connect the motors and ESCs to a power distribution board for power management.
3. To install and configure ground control software (Mission Planner/QGroundControl) and connect it to the flight controller for basic setup and calibration.
4. To simulate a drone flight using MATLAB or a dedicated simulator and analyze drone behaviour under various flight conditions.
5. To familiarize with Q Ground Control and Mission Planner for parameter tuning, motor testing, flight mode configuration, and firmware flashing for PX4 and ArduPilot platforms, along with the use of simulation tools for system diagnostics.

Total Hours	**60 hours**

Textbook

1. Reg Austin "Unmanned Aircraft Systems UAV design, development and deployment", Wiley, 2010.
2. Robert C. Nelson, Flight Stability and Automatic Control, McGraw-Hill, Inc, 1998.
3. Kimon P. Valavanis, "Advances in Unmanned Aerial Vehicles: State of the Art and the Road to Autonomy", Springer, 2007.

Reference Books

1. Paul G Fahlstrom, Thomas J Gleason, "Introduction to UAV Systems", UAV Systems, Inc, 1998
2. Dr. Armand J. Chaput, "Design of Unmanned Air Vehicle Systems", Lockheed Martin Aeronautics.

Mode of Evaluation:

Evaluation Scheme						
MSE		**CA**			**ESE**	**Total Marks**
MSE 1	**MSE 2**	**CA1**	**CA2**	**CA3(ATT)**		
30	30	6	6	3	**75**	**150**
60		**15**				

Course Code EC215B	**Course Name: Drone Controllers and Sensors**	**L**	**T**	**P**	**C**
		2	**0**	**2**	**3**

Course Objectives:

1. To introduce the foundational concepts of autonomous systems, including agent-based architecture and system components.
2. To equip students with practical skills in developing aerial robots and integrating sensors, actuators, and communication protocols.
3. To enable students to design, build, and evaluate various autonomous systems for real-world applications.

Course Outcome: After completion of the course, the student will be able to

1. Analyze and deploy different communication protocols used in Autonomous Systems.
2. Understand the concept of drive motors in drone system.
3. Understand the different sensors and actuators used in Autonomous systems.
4. Develop Basic Aerial Robots.
5. Design and development of different Autonomous Systems

Co-PO Mapping (scale 1: low, 2: Medium, 3: High)

CO-PO Mapping	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1	3	2	2	1	2	-	-	-	-	-	-	1
CO2	3	3	2	3	2	-	-	-	-	-	-	1
CO3	3	2	3	2	3	-	-	-	-	-	-	2
CO4	3	2	3	2	2	-	-	-	-	-	-	2
CO5	3	3	2	3	3	1	-	-	-	-	-	1

Unit 1	**Communication Systems**	**12 hours**

Communication Systems, Telemetry & Tracking in Drones, PID Controller - Working & Integration, Radio Control Frequency Range, Modems & Memory Systems.

Unit 2	**Drone Motor Drive**	**12 hours**

Drone Motor Drive, DC Motor, Brushless DC Motor, AC Motor, Induction Motor Drive, Permanent Magnet Synchronous Motor (PMSM) Drive, Switched Reluctance Motor Drive.

Unit 3	**Flight Control System**	**12 hours**

Flight Control System (FCS), Power Management Systems in Drones, Ground Control Station (GCS), Autopilot System.

Unit 4	**Sensors in Drones**	**12 hours**

Sensors in Drones, AGL (Above Ground Level) in Drone Systems, Pressure Sensors in Drones, Servos in Drones.

Unit 5	**Accelerometre in Drones**	**12 hours**

Accelerometre in Drones, Gyroscopes (Gyros) in Drones, Actuators in Drones, Power Supply in Drones, Processor in Drones.

List of Experiments:

1. To connect and test onboard sensors like the IMU, GPS, and ultrasonic module, and observe real-time sensor data using ground control software.
2. To test and verify RC transmitter and receiver communication by checking the response of throttle, yaw, pitch, and roll channels.
3. To study the effect of PID controller parameters on drone flight stability using a simple MATLAB model or simulation interface.
4. To plan and execute a basic autonomous flight mission using waypoint navigation in ground control software.
5. To perform telemetry range and signal quality tests between the drone and the ground station using telemetry modules.

Total Hours | **60 hours**

Textbook

1. Roland Siegwart, Illah Reza Nourbakhsh, Davide Scaramuzza (2018), Introduction to Autonomous Mobile Robots, MIT Press.
2. Gerhard Weiss (Ed.) (2013), Multiagent Systems, 2nd Edition, MIT Press.
3. Stuart J. Russell and Peter Norvig (2019), Artificial Intelligence: A Modern Approach, 4th Edition, Pearson.
4. Spyros G. Tzafestas (2014), Introduction to Mobile Robot Control, Elsevier.
5. H. Sjafrie (2019), Introduction to Self-Driving Vehicle Technology, 1st Edition, Chapman and Hall/CRC.

Reference Books

1. Gerald Cook (2011), Mobile Robots: Navigation, Control and Remote Sensing, Wiley.
2. H. M. Choset, S. Hutchinson, K. M. Lynch, G. Kantor, W. Burgard, L. E. Kavraki, and S. Thrun (2005), Principles of Robot Motion: Theory, Algorithms, and Implementation, MIT Press.
3. Umit Ozguner, Tamer Acarman, and Keith Redmill (2011), Autonomous Ground Vehicles, 1st Edition, Artech House Publishers.
4. Sahiba Wadoo and Pushkin Kachroo (2011), Autonomous Underwater Vehicles: Modeling, Control Design and Simulation, 1st Edition, CRC Press.
5. Kenzo Nonami et al. (2010), Autonomous Flying Robots: Unmanned Aerial Vehicles and Micro Aerial Vehicles, 1st Edition, Springer.
6. Christoph Sommer and Falko Dressler (2014), Vehicular Networking, 1st Edition, Cambridge University Press.
7. Dr. Armand J. Chaput, "Design of Unmanned Air Vehicle Systems", Lockheed Martin Aeronautics.

Mode of Evaluation:

Evaluation Scheme						
MSE		**CA**			**ESE**	**Total Marks**
MSE 1	**MSE 2**	**CA1**	**CA2**	**CA3(ATT)**		
30	30	6	6	3	**75**	**150**
60		**15**				

Course Code EC303B	**Course Name: Drone Data Analysis and AI in Agriculture**	**L**	**T**	**P**	**C**
		2	**0**	**2**	**3**

Course Objectives:

1. To develop understanding of data types and formats collected through drones.
2. To train students in data cleaning, geospatial processing, and visual analytics.
3. To introduce AI and ML methods used in interpreting drone imagery and telemetry data.
4. To apply AI models for real-world drone-based applications (e.g., agriculture, traffic, surveillance).

Course Outcome: After completion of the course, the student will be able to

1. Identify and interpret various drone data types and formats.
2. Apply preprocessing and geospatial tools to clean and visualize aerial data.
3. Use image processing techniques for extracting features from drone data.
4. Develop and evaluate ML models for classification and prediction using drone datasets.
5. Implement a mini-project showcasing drone data analytics using real-world scenarios.

Co-PO Mapping (scale 1: low, 2: Medium, 3: High)

CO-PO Mapping	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1	3	2	2	1	2	–	–	–	–	1	–	1
CO2	3	3	3	2	3	–	–	–	–	1	–	2
CO3	3	2	3	3	3	–	–	–	–	2	–	2
CO4	3	3	3	3	3	–	–	–	1	2	–	2
CO5	3	3	3	3	3	–	–	–	2	2	–	2

Unit 1	Introduction to Drone Data	12 hours

Types of drone data including aerial images, videos, telemetry logs, and LiDAR; structure and format of drone data; metadata and GPS integration; data storage, management, and handling practices.

Unit 2	Preprocessing and Geospatial Analytics	12 hours

Organization and cleaning of raw drone data; image denoising and georeferencing techniques; creation of orthomosaics and terrain models; introduction to geospatial tools such as QGIS and Drone Deploy.

Unit 3	Image Processing for Drone Data	12 hours

Histogram analysis, edge detection, and feature extraction; image enhancement and visual pattern recognition; application of Python libraries such as OpenCV and PIL for drone image analysis.

Unit 4	Machine Learning Applications	12 hours

Machine learning techniques including classification, regression, and clustering; dataset preparation and feature engineering; real-world applications such as crop classification, terrain segmentation, and object detection; evaluation of model performance using accuracy metrics.

Unit 5	Tools and Case Studies	12 hours

Overview of platforms and tools including TensorFlow, Keras, Google Earth Engine, and Drone Deploy; analysis of drone-based case studies in agriculture, disaster management, and surveillance; project-based exploration of AI-driven drone solutions.

List of Experiment

1. To get familiar with the MATLAB environment and perform basic operations such as matrix manipulation, plotting, and scripting.
2. To model and simulate first-order and second-order linear systems using transfer functions in MATLAB and Simulink.
3. To simulate the spring-mass-damper system and observe the effect of damping on system response using Simulink.
4. To model and analyze the motion of a simple pendulum system using ordinary differential equations in Simulink.
5. To implement and simulate dynamic systems using state-space representation in MATLAB and Simulink.
6. To understand and simulate the basic kinematic model of a drone with 3 degrees of freedom using Simulink blocks.
7. To design and simulate a block diagram for pitch, roll, and yaw angle dynamics of a quadcopter in Simulink.
8. To implement a closed-loop control system for altitude control of a drone using a proportional (P) controller.
9. To design and analyze the effect of PI and PD controllers on the altitude response of a UAV system.
10. To implement and tune a PID controller for vertical motion (altitude control) of a quadcopter using Simulink.

Total Hours 60 hours

Textbook

1. Aurélien Géron – Hands-On Machine Learning with Scikit-Learn, Keras, and TensorFlow, O'Reilly Media (Covers ML/DL applications, image classification, and TensorFlow use relevant to drone datasets.)
2. Rafael C. Gonzalez and Richard E. Woods – Digital Image Processing, Pearson (Foundational text for image processing concepts like edge detection, histograms, and segmentation.)
3. Paul Crickard – QGIS for Hydrological Applications, Locate Press (Applied QGIS for terrain modeling and geospatial analysis.)

1. Ian Goodfellow, Yoshua Bengio, and Aaron Courville – Deep Learning, MIT Press (In-depth coverage of deep neural networks and CNNs.)

2. Jay A. Storer – Computer Vision: Algorithms and Applications, Springer (Covers object detection, feature extraction, and drone vision systems.)
3. Satyanarayan G. – Getting Started with Drone Data Analytics, Packt Publishing (if available) (Focused guide for aerial data interpretation and analytics.)
4. Online Documentation – DroneDeploy, Google Earth Engine, OpenCV, TensorFlow, QGIS (Official resources and tutorials for practical learning and implementation.)

Mode of Evaluation:

Evaluation Scheme						
MSE		CA			ESE	Total Marks
MSE 1	MSE 2	CA1	CA2	CA3(ATT)		
30	30	6	6	3	75	150
60		15				

Course Code EC304B	Course Name: Business and Entrepreneurship in Agri-Drones	L	T	P	C
		2	0	2	3

Course Objectives:

1. To introduce students to the drone business ecosystem, startup models, and regulatory aspects.
2. To empower students with knowledge to build drone-based ventures or pursue innovation projects.
3. To integrate business, policy, and technical aspects for real-world applications.

Course Outcome: After completion of the course, the student will be able to

1. Understand the drone industry landscape, market sectors, and growth potential.
2. Interpret drone regulations and design appropriate business models.
3. Apply startup methodologies for MVP development and validation.
4. Analyze cost structures, funding options, and financial planning strategies.
5. Develop a complete drone-based business proposal with pitch and execution plan.

Co-PO Mapping (scale 1: low, 2: Medium, 3: High)

CO-PO Mapping	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1	2	–	2	–	–	2	1	2	–	2	1	2
CO2	2	2	3	–	2	2	–	1	–	2	2	2
CO3	2	2	3	2	2	2	–	1	2	3	2	3
CO4	2	3	2	2	–	2	–	–	2	3	3	3
CO5	3	2	3	3	2	2	–	1	3	3	3	3

Unit 1	Drone Industry Overview	12 hours

Macro-level understanding of the global and Indian drone ecosystems. Major sectors utilizing drones, key players, market trends, and emerging business opportunities in defense, agriculture, logistics, and infrastructure.

Unit 2	Regulatory Framework and Business Model Development	12 hours

Legal environment governing drone operations, especially DGCA's Drone Rules 2021 in India. Students learn about permissions, licensing, NPNT compliance, airspace categorization, and ethical issues related to privacy and security. Various business models for drone products and services. DaaS (Drone-as-a-Service), hardware sales, subscription models, and value-added services. Techniques for identifying value propositions and revenue streams

Unit 3	Financial Planning and Funding	12 hours

Cost structure analysis and estimation; pricing strategies and budgeting techniques; revenue modeling and profitability analysis; sources of funding including government grants, startup incubators, angel investors, and venture capital; investment readiness and financial forecasting.

Unit 4	Operations and Risk Management	12 hours

Operational planning for drone businesses; fleet management and maintenance protocols; risk identification including weather, technical failure, legal compliance, and safety breaches; mitigation strategies and business continuity planning.

Unit 5	Startup Case Studies and Capstone Project	12 hours

Analysis of successful drone startups such as Garuda Aerospace and Zipline; business strategy and scaling insights; development of drone-based business plans by student groups; preparation of business model canvas, feasibility study, and investor pitch; final presentation and evaluation.

List of Experiment

1. Preparation of Business Model Canvas for a Drone-Based Startup
2. Specification Sheet Comparison of Commercial and Industrial Drones
3. Market Research and Opportunity Mapping in Drone Applications
4. Cost Analysis and Financial Planning for a Drone-Based Service
5. Case Study Presentation on Successful Indian or Global Drone Startups
6. Industrial Visit to a Drone Manufacturing Company or Drone Service Provider
7. User/Stakeholder Survey for Drone Solution Validation (Field or Online)
8. Drone Business Startup Feasibility Study and Report Preparation
9. Final Capstone Project: End-to-End Drone Business Plan and Prototype Demo
10. Simulation of Investor Pitch / Shark Tank-style Presentation

Total Hours	**60 hours**

Textbook

1. Eric Ries – The Lean Startup: How Today's Entrepreneurs Use Continuous Innovation to Create Radically Successful Businesses, Crown Publishing (Fundamental text for MVP development, iteration, and startup strategy.)
2. Ash Maurya – Running Lean: Iterate from Plan A to a Plan That Works, O'Reilly Media (Practical guide for business model canvas and product-market fit.)
3. Tata McGraw Hill – Entrepreneurship Development by S.S. Khanka (Covers entrepreneurship fundamentals, financial planning, and startup environment in India.)

1. Peter F. Drucker – Innovation and Entrepreneurship, HarperBusiness (Classic reference for innovation-driven business models.)
2. Harvard Business Review – HBR Guide to Building Your Business Case (Useful for preparing feasibility reports and investment proposals.)
3. DGCA India – Drone Rules 2021 (UAS Rulebook) – Government of India (official online source) (Regulatory framework and compliance information for drone startups in India.)
4. Case Studies & White Papers – From industry sources like Garuda Aerospace, ideaForge, Zipline, Drone Federation of India (Real-world insight into drone business models, scaling, and regulatory navigation.

Mode of Evaluation:

Evaluation Scheme						
MSE		**CA**			**ESE**	**Total Marks**
MSE 1	**MSE 2**	**CA1**	**CA2**	**CA3(ATT)**		
30	30	6	6	3	**75**	**150**
60		**15**				