

Semester 1:

Course Code	Title	Semester	Credit
DR501	Drone Aerodynamics and Autonomous Control	1	2-0-2-5-3
DR502	Sensor Systems & Autonomy	1	2-0-2-5-3
XXX	Elective 1	1	3/4 credits
XXX	Elective 2	1	3/4 credits
DR551	Drone Design Lab	1	0-0-6-3-3

Semester 2:

Course Code	Title	Semester	Credit
DR503	Drone Data Processing and GIS	2	2-0-2-5-3
XXX	Elective 3	2	3/4 credits
XXX	Elective 4	2	3/4 credits
XXX	Elective 5	2	3/4 credits
DR552	Autonomous Systems Design Lab	2	0-0-6-3-3

Semester 3:

Course Code	Title	Semester	Credit
DR699	MTech Project I	3	0-0-32-16-16

Semester 4:

Course Code	Title	Semester	Credit
DR799	MTech Project II	3	0-0-32-16-16

Total Minimum Program Credits: 62

List of Elective Courses*:

This list is non-exhaustive, with scope for more relevant courses to be added/removed as the case may be. Since this is an interdisciplinary program, the students might benefit from the Btech course of another branch (i.e. branch other than they hold Btech degree), thus out of five electives, one of the electives can be taken as below 500 level courses.

Course Code	Title	Credit
EE207	Control Engineering	3-1-0-5-3
EE316	Embedded Systems & Applications	3-0-0-6-3

AI 207	Control theory for Intelligent Autonomous Systems	3-1-0-5-3
EE521	Analytical Techniques For Signal Processing And Communication	3-0-0-6-3
EE645	Modern Radar Systems	3-0-0-6-3
EE646	IoT and its Applications	3-0-0-6-3
EE653	Digital Signal Processing For VLSI	3-0-0-6-3
EE721	Optical Fiber Communication	3-0-0-6-3
DR511	Drone Forensics, Security, and Privacy	2-0-2-5-3
DR701	Advanced Topics in Autonomous Systems	2-0-2-5-3
AI511	HCI & Visualization	2-0-2-5-3
CS503	Machine Learning	3-0-2-7-4
CS504	Artificial Neural Networks	3-0-0-6-3
CS505	Digital Imaging Systems	2-0-2-5-3
CS507	Multimedia System	2-0-2-5-3
CS511	Real Time Systems	2-0-2-5-3
CS512	Artificial Intelligence	3-0-2-7-4
CS515	Computer Graphics	3-0-0-6-3
CS516	Wireless Ad-Hoc Networks	2-0-2-5-3
CS517	Digital Image Processing and Analysis	2-1-2-4-3
CS518	Computer Vision	2-0-2-5-3
CS519	System Level Design And Modelling	3-0-0-6-3
CS523	Applied Cryptography	3-0-2-7-4
CS525	Post-Quantum Crypto	3-0-0-6-3
CS530	Autonomous MultiAgent Systems	2-0-2-5-3

CS533	Reinforcement Learning	3-0-0-6-3
CS539	Internet of Things	3-0-0-6-3
CS612	Advanced Machine Learning	2-0-2-5-3
CS616	Advanced Computer Vision	2-0-2-5-3
CS620	Introduction to Spatial Computing	3-0-2-7-4
CS622	Advanced Image Processing	2-0-2-5-3
CS623	Multimedia Surveillance Systems	2-0-2-5-3
CE304	Geomatics Engineering	2-1-2-5-3
CE563	Geoinformatics For Landuse Planning	3-0-2-7-4
CE562	Global Navigation Satellite Systems (GNSS)	3-0-2-7-4
CE561	Geographic Information System (GIS)	3-0-2-7-4
CE560	Geoinformatics For Natural Disasters	3-0-2-7-4
CE605	Advance Remote Sensing	2-0-2-5-3
ME518	Multibody Dynamics	3-0-0-6-3
ME520A	Composite Material	3-0-0-6-3
ME624	Machine Vibration Analysis	3-0-0-6-3
ME512	Robot Manipulators: Kinematics, Dynamics, and Control	3-0-0-6-3
ME 580	Computational Fluid Dynamics	3-0-0-6-3
ME508	Wave Propagation	3-0-0-6-3
ME504	Deep learning for physical systems	3-0-0-6-3
CH516	Advanced process control	3-0-2-6-4

Course Contents:

DR501: Drone Aerodynamics and Autonomous Control

Credits: 2-0-2-5-3

Course Description:

This course introduces the fundamental principles underlying drones and autonomous systems from a systems engineering perspective. The course focuses on the architecture and control components that enable autonomous behavior in aerial systems. Emphasis is placed on understanding drone structures, aerodynamics, autonomy pipelines, control hierarchies, simulation-based development, and safety and regulatory considerations.

Learning Outcomes:

Upon completion of this course, students will be able to:

1. Explain the architecture, structure and functional components of drone and autonomous systems.
2. Describe flight mechanics, aerodynamics and control hierarchies used in drones/UAVs.
3. Understand coordinate frames, state variables, and the role of estimation in autonomous flight.
4. Explain autonomy pipelines and levels of autonomy in unmanned systems.
5. Use simulation tools to analyze basic drone behavior and system performance.
6. Recognize safety, regulatory, and ethical considerations in drone operations.

DR502: Sensor Systems & Autonomy

Credits: 2-0-2-5-3

Course Description:

This course introduces sensor systems used in drones and autonomous platforms, emphasizing their role in enabling autonomous navigation and control. Sensors are studied as sources of uncertain information from which autonomous systems estimate their state. The course covers inertial, navigation, optical, and range sensors, along with calibration, signal conditioning, and data acquisition. Fundamental concepts of sensor fusion and state estimation are introduced to explain how multiple sensors are integrated to support guidance and control. Issues of sensor reliability, failure modes, and security relevant to trustworthy autonomy are also discussed.

Learning Outcomes:

Upon completion of this course, students will be able to:

1. Identify sensors commonly used in drone and autonomous systems and describe their operating principles.
2. Analyze sensor performance in terms of noise, bias, drift, and uncertainty.
3. Perform basic sensor calibration and validation.
4. Explain the role of state estimation and sensor fusion in autonomous navigation and control.

5. Interface sensors with embedded systems for data acquisition and preprocessing.
6. Recognize sensor-related failures and vulnerabilities affecting safe autonomous operation.

DR503: Drone Data Processing and GIS

Credits: 2-0-2-5-3

Course Description:

This course introduces the processing and analysis of drone-acquired spatial data for mapping, environmental modeling, and autonomous decision support. The emphasis is on transforming raw drone data into structured environment representations that can be used for navigation, planning, and analysis. The course integrates geospatial concepts with drone data workflows and real-world applications.

Learning Outcomes:

Upon completion of this course, students will be able to:

1. Plan drone data acquisition for geospatial applications.
2. Process drone imagery and sensor data into spatial datasets.
3. Construct terrain and environment models from drone data.
4. Analyze spatial data for decision-making and planning.
5. Understand spatial accuracy, uncertainty, and error propagation.
6. Apply drone-based geospatial analysis to real-world scenarios.

DR551: Drone Design Lab

Credits: 0-0-6-3-3

Course Description:

Embedded foundation, Arduino & ESP32 programming, Basic Python programming, UAV platforms, Sensors & Calibration, Control Systems Implementation, IoT & Communication.

DR552: Autonomous Systems Lab

Credits: 0-0-6-3-3

Course Description:

Ground/Aerial Autonomous Systems, Integrate sensors with controllers, Autonomous Navigation, Vision, ROS programming, Advance control implementation.