Drone Basics, Design, Assembly, Test

Course Learning Objectives	● Learn the basics of flight control, Drone aerodynamics ● Drone parts and its working principle ● Drone assembly, calibration and flying
Course Outcomes	● Skill input about basics of flight, Aerodynamics and theories behind it ● Hands on experience about the parts of drone, working principle and troubleshooting ● Component selection and simulation with selected components ● Assembling the drone parts and testing it after calibration of assembled drone ● Flight test and trimming.

Course Duration: 45 Hours

UNIT I BASICS & AERODYNAMICS

Theory

Aerodynamics, Bernoulli's effect, Aerofoil theory 3 Axis control

Skill Training

Softwares : NASA Foilsim – Hand on paper aero design - 3 Axis control system

UNIT II DRONES and PARTS

Theory

Drone - Overview, History, Challenges, Market - Types of Drones, Parts of drone, working principle

Skill Training

Hands on identification of Drone parts and How they work, working etc.,

UNIT III DRONE ASSEMBLY, TEST, CALIBRATION

Theory

Drone assembly layout, connections, how to test, how to calibrate

Skill Training

Hands on assembly, test, calibration using software Mission Planner software

(Pix hawk & APM) for DJI NAZA (NAZA M lite)

UNIT IV DRONE SIMULATION, COMPONENT SELECTION, SOFTWARE SIMULATION WITH VARIOUS DIFFERENT SET OF COMPONENTS

Theory

How to use Phoenix RC Simulator, E-Calc multi rotor for component selection and simulation

Skill Training

Hands on Simulator training, E-Calc usage and test with various components

UNIT V FLIGHT TEST, TRIMMING AND TROUBLE SHOOT, CAREER IN DRONE SECTOR

Theory   (Pre-recorded   videos)

Testing of Assembled drone, trimming it

Skill Training

Hands on testing, trimming, flying etc., Type of application, career guidance, opportunities, How to start your drone startup

Test Projects:

Industry use cases:
1. Dismantle, Assembling a drone kit and replacing repaired components

Task 1 : Identifying the right components to assemble the drone

Task 2 : Testing each component

Task 3 : Replacing the faulty components

Task 4 : Performing the calibration with flight computer

Task 5 : Test without propellers and making sure everything is right

2. Comparing different battery packs for specific payloads, range and endurance

Task 1 : Hands on experience on specifications of different drone batteries

Task 2 : Creating a table of technical naming system of drone batteries

Task 3 : Creating a time chart of charging and discharging for various drone batteries

Task 4 : Find payload and range for different types of battery packs

Task 5 : Weight calculations for drone batteries

3. Testing range performance of drones using software's, GPS trackers, various sensors

Task 1 : Finding Performance of drone using ardupilot software

Task 2 : Creating a table for Drone tracking systems

Task 3 : Analyse recovery methods for drones which go out of range

Task 4 : Use sensors / GPS for Drone tracking practically

Task 5 : How GPS works, create a report

4. Validating safety and functionalities of a Drone

Task 1 : Exhibit safety factors to be considered before flying a drone

Task 2 : Find case studies related to safety issues in drones

Task 3 : Analyse technical safety issues and safety issues while flying

Task 4 : Implement the trouble shooting concepts during emergency cases like battery burn or component failures

Task 5 : Exhibit government norms related to safety precautions for drones.

5. Implementing manufacturing principles, prototyping of drone parts

Task 1 : Hands on Experience on softwares used for design of drones

Task 2 : Analyze the manufacturing process related to drone prototyping

Task 3 : Make a drone design / download a existing design convert stl to gcode for 3 print process

Task 4 : Exhibit 3d printer works and how it makes drone prototypes

Task 5 : Develop 5 designs, possibly 3 print them if equipment is available in college

6. Optimizing the assembly process of drones

Task 1 : Hands on experience on drone assembly performance in current industry

Task 2 : Hands on experience on how AI plays a role in automated drone assembly in nano drones

Task 3 : Assembly process involved in high payload category drones

Task 4 : Check the assembled drone

Task 5 : Draw the assembly chart for drones

7. Performing maintenance tasks for drones and drone parts

Task 1 : Hands on maintenance procedures for drone motors

Task 2 : Obtain maintenance procedures for drone batteries

Task 3 : Hands on maintenance procedures for drone propellers and connections

Task 4 : Cleaning procedures of a drone.

Task 5 : Hands on maintenance task using assembled drone.

8. Performing the charging procedures for drone batteries

Task 1 : Develop different chargers available in market for drone batteries

Task 2 : Implement charging procedures for different types of batteries

Task 3 : Exhibit the use of power chord and power distribution board

Task 4 : Analyze the reason behind why battery cannot be fully drained or over charged

Task 5 : Revive fully drained batteries possible options

9. Quality control checking procedures for drones

Task 1 : After assemble check the drone vibrations and balance

Task 2 : Motor speed calibration

Task 3 : Payload and battery balance checking procedures

Task 4 : Stable flight and trimming procedures

Task 5 : GPS tracking checking and automated take-off and landing mechanisms

10. Troubleshooting and diagnosing issues in drones

Task 1 : Study various case studies related to drone failures

Task 2 : Perform the procedures to trouble shoot ESC Failure

Task 3 : Exhibit the procedures to trouble shoot Battery Failure

Task 4 : Hands on training on procedures to trouble shoot GPS Failure

Task 5 : Implement the procedures to trouble shoot data transfer / data storage Failure

11. Add a sensor and build an Application of Drones in Agriculture Industry

Task 1 : Exhibit the various applications of drones in agriculture industry

Task 2 : Create a road map of how using drones in agriculture will help humans in near future.

Task 3 : Choose few problem statements in your locality and come up with simple solutions using drones.

Task 4 : Hands on practice by adding sensor to the flight computer

Task 5 : Try doing an amateur level collecting sample data or simple application test using the added sensor.

12. **Add a sensor and build an Application of Drones in Inspecting Bridges**

Task 1 : Access various applications of drones in Inspection and quality check industry

Task 2 : Create a road map of how using drones in construction of bridges will help humans in near future.

Task 3 : Choose few problem statements related to bridge inspection in your locality and come up with simple solutions using drones.

Task 4 : Hands on practice by adding sensor to the flight computer

Task 5 : Try doing an amateur level collecting sample data or simple application test using the added sensor.

13. **Add a sensor and build an Application of Drones in Construction**

Task 1 : Hands on experience on various applications of drones in construction industry

Task 2 : Create a road map of how using drones in construction will help humans in near future.

Task 3 : Choose few problem statements related to construction in your locality and come up with simple solutions using drones.

Task 4 : Hands on practice by adding sensor to the flight computer

Task 5 : Try doing an amateur level collecting sample data or simple application test using the added sensor.

14. **Add a sensor and build an Application of Drones in Geographic mapping**

Task 1 : List down various applications of drones in Mapping industry

Task 2 : Create a road map of how using drones in Geographic mapping will help humans in near future.

Task 3 : Choose few problem statements related to mapping in your locality and come up with simple solutions using drones.

Task 4 : Hands on practice by adding sensor to the flight computer

Task 5 : Try doing an amateur level collecting sample data or simple application test using the added sensor.

15. Add a sensor and build an Application of Drones in Mining

Task 1 : Hands on experience on various applications of drones in Mining industry

Task 2 : Create a road map of how using drones in Mining will help humans in near future.

Task 3 : Choose few problem statements related to mining in your locality and come up with simple solutions using drones.

Task 4 : Hands on practice by adding sensor to the flight computer

Task 5 : Try doing an amateur level collecting sample data or simple application test using the added sensor.

16. Add a sensor and build an Application of Drones in Photography & Film making

Task 1 : Hands on experience on various applications of drones in Photography & Film making industry

Task 2 : Create a road map of how using drones in Photography & Film making will help humans in near future.

Task 3 : Choose few problem statements related to Photography & Film making in your locality and come up with simple solutions using drones.

Task 4 : Hands on practice by adding sensor to the flight computer

Task 5 : Do an amateur level collecting sample data or simple application test using the added sensor.

17. Add a sensor and build an Application of Drones in Defence & Security

Task 1 : Perform various applications of drones in Defence & Security industry

Task 2 : Create a road map of how using drones in Defence & Security making will help humans in near future.

Task 3 : Choose few problem statements related to Defence & Security making in your locality and come up with simple solutions using drones.

Task 4 : Hands on practice by adding sensor to the flight computer

Task 5 : Do an amateur level collecting sample data or simple application test using the added sensor.

18. Add a sensor and build an Application of Drones in well & pipeline inspection

Task 1 : Perform various applications of drones in well & pipeline industry

Task 2 : Create a road map of how using drones in well & pipeline will help humans in near future.

Task 3 : Choose few problem statements related to well & pipeline in your locality and come up with simple solutions using drones.

Task 4 : Hands on practice by adding sensor to the flight computer

Task 5 : Do an amateur level collecting sample data or simple application test using the added sensor.

19. Add a sensor and build an Application of Drones in medical industry

Task 1 : Hands on experience on various applications of drones in medical industry

Task 2 : Create a road map of how using drones in medical will help humans in near future.

Task 3 : Choose few problem statements related to medical in your locality and come up with simple solutions using drones.

Task 4 : Hands on practice by adding sensor to the flight computer

Task 5 : Do an amateur level collecting sample data or simple application test using the added sensor.

20. Add a sensor and build an Application of Drones in Object recognition, A.I industry

Task 1 : Hands on experience on various applications of drones in Object recognition, A.I industry

Task 2 : Create a road map of how using drones in Object recognition, A.I will help humans in near future.

Task 3 : Choose few problem statements related to usage of Object recognition, A.I in your locality and come up with simple solutions using drones.

Task 4 : Hands on practice by adding sensor to the flight computer

Task 5 : Do an amateur level collecting sample data or simple application test using the added sensor.

TOTAL:45hours Student Assessment Plan:

Each of the above-mentioned test projects will be divided into tasks by the training partner for each specific institution. Such tasks will be jointly evaluated by the faculty and the training partner and the following weightage is to be followed.

- 70% weightage to the external practical assessment.
- 30% weightage to the internal assessment.

Final Test Project/External Assessment Plan:

The Final Test Project will be chosen from the list given above, jointly by the college faculty and the Training Partner. The Final Test Project will be assessed on the following tasks, for 70%

Details	Marks
Task: 1	20
Task: 2	20
Task: 3	20
Task: 4	20
Task: 5	20