SRI CHANDRASEKHARENDRA SARASWATHI VISWA MAHA VIDYALAYA

(University established under section 3 of UGC Act 1956)

(Accredited with 'A' Grade by NAAC)

CURRICULUM AND SYLLABUS FOR FULLTIMEBE-ELECTRONICS AND COMMUNICATION ENGINEERING HONS. /MINOR DEGREE IN EMERGING AREAS (OPTIONAL)

DEPARTMENT OF ELECTRONICS AND COMMUNICATION ENGINEERING

ELECTRONICS AND COMMUNICATION ENGINEERING WITH HONS. /MINOR DEGREE DRONE TECHNOLOGY

CURRICULUM & SYLLABUS

For B.E. (Hons.) Electronics and Communication Engineering with Specialization in

Drone Technology

S.No	Year	Sem	Course Code	Course Name	L	T	P	C	IA	EA	TM
1	II	IV		Introduction To Drone Technology	2	1	0	3	40	60	100
2	III	V		Drone MRO Lab	0	1	3	3	40	60	100
3	III	VI		Embedded Avionics	2	1	0	3	40	60	100
4	IV	VII		Drone Innovation Lab	0	1	3	3	40	60	100
5	IV	VIII		Real Time Project Design	0	0	0	6	40	60	100
Total Credits					**18**						

Course Code		L	T	P	C	IA	EA	TM
Course Name	INTRODUCTION TO DRONE TECHNOLOGY	2	1	0	3	40	60	100
Course Category	PROFESSIONAL SPECIALIZED COURSE	Syllabus Revision					V.1.0	
Pre-requisite	Basic Electrical and Electronics							

Course Objectives:

The course should enable the students

1. To understand the historical development of unmannedaerial vehicles.
2. To understand the structure of unmannedaerial vehicles.
3. To learn about the various types of Drones and its application.
4. To understand different types of drone circuits/electronic parts and control system
5. To learn the criterion for the selection of various drone materials.

Course Outcomes:

On completion of the course,the student will be able to

Course Outcomes	Description	Highest Bloom's Taxonomy
CO1	Under standing the history and Classification of UAV.	K2
CO2	Under standing the selection of drone components.	K2
CO3	Analyze Air frame Selection.	K3
CO4	Under standing the communication between ground station and drone.	K2
CO5	Under standing the tuning of PID controller.	K3

Correlation between Course Outcomes (COs) and Program Outcomes (POs):

COs	ProgramOutcomes (POs)												Program Specific Outcomes(PSOs)		
	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO 11	PO 12	PSO 1	PSO2	PSO3
CO1	M	-	-	-	-	-	-	-	-	-	-	-	L	-	-
CO2	M	M	L	-	-	-	-	-	-	-	-	-	L	-	-
CO3	S	-	-	L	L	-	-	-	-	-	-	-	-	L	L
CO4	M	-	L	-	-	-	-	-	-	-	-	-	L	-	-
CO5	S	M	M	L	M	-	-	-	-	-	-	-	-	M	L

UNIT-I	Introduction to Drones	9Hours
History of UAV: Introduction to UAV Drones and its Sub systems -Classification–Airframe configurations –Multi-rotor. Trocopter, Quad, Hexa and Octocopter- Fixed-Wing control surfaces-Applications.		
UNIT-II	**Components Selection**	**9Hours**
Selection of the System Components: Flight Controllers, Sensors, Propeller ESCs Control Surface Actuators, Battery –Ground Control Software –Integration.		
UNIT-III	**AirFrame Selection and Integration**	**9Hours**
Airframe Selection: Selection requirements–Integration of Motors, Controllers and Pay loadsWith airframe-Motor Configuration for multi-rotor.		
UNIT-IV	**Transmitter Receiver**	**9Hours**
Transmitter Selection –Frequency Hopping Spread Spectrum, Tx-Rx Pairing and configuration, Telemetry Selection and Configuration.		
UNIT-V	**Control and Testing**	**9Hours**
Drone Control. Altitude, Pitch, Roll and Heading Control- Tuning of PID Control system, Ground control system, Flight Testing and Trouble shooting.		
	Total Hours	**45Hours**

Text Book(s)

1.	M.LaFay,“Building Drones for Dummies”,JohnWiley & Sons,Inc., 2015.
2.	E.Tooley,“Practical Drones: Building, Programming, and Applications”,Apress,2021.
3	S.K.Kopparthy,“Drone Technology: Theory and Practice”, Springer,2020.

Reference Book(s)

1.	D.McLeod,“Getting Started with Drone: How to Build, Fly, and ProgramYourOwn Drone”, Apress, 2019.
2.	M.A.Banks,“Building and Flying Electric Model Aircraft”,O'Reilly Media,Inc.,2014.

Course Code		L	T	P	C	IA	EA	TM
Course Name	DRONE MRO LABORATORY	0	1	3	4	40	60	100
Course Category	PROFESSIONAL SPECIALIZED COURSE	Syllabus Revision					V.1.0	
Pre-requisite	-							

Course Objectives:

The course should enable the students

1. To identify the battery to be used for UAV application.
2. To understand working of motor that can be used inUAV.
3. To Learn and exercise various measuring devices in drone.
4. To perform assembly practice of drones.
5. To understand the guide lines of drone flying in India.

Course Outcomes:

On completion of the course,the student will be able to

Course Outcome	Description	Highest Bloom's Taxonomy
CO1	Understanding of GCS Application & Operations.	K2
CO2	Able to assemble a drone.	K3
CO3	Analyze the performance of battery.	K3
CO4	Design controller for drone stability.	K4
CO5	Perform calibration of different measuring devices.	K5

Correlation between Course Outcomes (COs) and Program Outcomes (POs):

COs	ProgramOutcomes(POs)												Program Specific Outcomes (PSOs)		
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
CO1	S	S	-	-	S	-	-	-	S	S	M	M	L	L	-
CO2	S	S	L	M	S	-	-	-	S	S	M	M	-	L	-
CO3	S	S	M	M	S	-	-	-	S	S	M	M	L	-	-
CO4	S	S	M	M	S	M	M	L	S	S	M	M	-	L	M
CO5	S	S	L	M	S	L	M	L	S	S	M	M	M	M	M

	LIST OF EXPERIMENTS
1.	**Study of GCS Application & Operations -** User Interface with App - Working of GCS Application Control Drone using GCS
2.	**Assembly**-Component Handling Soldering Techniques, Routing of Wires,
3.	**Assembly**-Fitment of Components.
4.	**Battery Management –**Battery Charging- Battery Storage-Battery Handling
5.	**Calibration Steps for Drone-**Accelerometer Calibration- Compass Calibration Magnetometer Connection
6.	**Calibration Steps for Drone-**PID Tuning, GPS Reception
7.	**Drone Connections & Operations**-Auto Pilot Connection
8.	**Drone Connections & Operations-**Altitude Sensor Connections, GPS Connection
9.	**Payload Integration-**Electro-Mechanical Integration Camera Integrations
10.	**Debugging-**HardwareVisual Test, Hardware Function Test
Tools:Ground Control Station (GCS) Application, MATLAB	

Course Code		L	T	P	C	IA	EA	TM
Course Name	EMBEDDED AVIONICS	2	1	0	3	40	60	100
Course Category	PROFESSIONAL SPECIALIZED COURSE	Syllabus Revision					V.1.0	
Pre-requisite	Digital Communication							

Course Objectives:

The course should enable the students

1. To understand different types of sensors used in drone technology.
2. To explain the basic concept of communication system.
3. To understand different types of pay loads used in drone technology.
4. To identify the best Protocols for given project.
5. To understand different types of drone applications.

Course Outcomes:

On completion of the course, the student will be able to

Course Outcomes	Description	Highest Bloom's Taxonomy
CO1	Understanding selection of sensors and Placement of sensor.	K2
CO2	Design peripheral interface protocols	K3
CO3	Analyze payloads to drone	K3
CO4	Analyze Drone Data	K3
CO5	Develop AI based Drone applications.	K5

Correlation between Course Outcomes (COs) and Program Outcomes (POs):

COs	ProgramOutcomes (POs)												Program Specific Outcomes (PSOs)		
	PO1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO 11	PO 12	PSO 1	PSO 2	PSO3
CO1	M	L	L	-	-	-	-	-	-	-	-	-	L	-	-
CO2	M	L	L	-	M	-	-	-	-	-	-	-	-	L	-
CO3	S	M	M	-	M	-	-	-	-	-	-	-	M	-	-
CO4	L	-	-	M	-	-	-	-	-	-	-	-	-	-	-
CO5	L	M	M	S	S	-	-	-	-	-	-	-	S	L	L

UNIT-I	**Sensors & Input Elements**	**9Hours**
Sensor Selection Rules, Sensor Placement Considerations, Sensor Interfacing Methods, User Input Element Functions, Protocols & Peripherals Used Sensor Types, S-Bus Communication, and PWM- PPM Communication.		
UNIT-II	**Protocols & Peripherals**	**9Hours**
User Input Protocols, Control Element Protocols, Peripheral Interface Protocols, Telemetry Protocols, Multi-platform Communication.		
UNIT-III	**Drone Payl oads**	**9Hours**
Types of payloads, LIDAR working, Gimbal working, Camera sensor working, Frame Segmentation& Analysis, Image Frame Filtering.		
UNIT-IV	**Data Logging Analysis**	**9Hours**
Drone Data Logging Format, Flight Parameters & Path Analysis, Embedded Data Extraction, RC Analysis for Avionics System.		
UNIT-V	**AI-Based Realtime Applications**	**9Hours**
Python SDK Interface – Command Sequence Execution, DRONES WARM, Vision – based Object Tracking, Vision-based Landing.		
	Total Hours	**45Hours**

Text Book(s)

1.	Cary R. Spitzer, Avionics: Development and Implementation, CRC Press, 2006.
2.	R.P.G. Collinson, Introduction to Avionics Systems, Springer, 2011.
3.	Programmable Microcontrollers with Applications (Cem Unsalan, H.DenizGurhan).

Reference Book(s)

1.	Haykin," An Introduction to Analog and Digital Communications", Wiley India Pvt. Limited, 2009.
2.	Daniel Tal and Jon Altschuld," Drone Technology in Architecture, Engineering and Construction: Astrategic Guide to Unmanned Aerial Vehicle Operation and Implementation", Willey, 2021.

Course Code		L	T	P	C	IA	EA	TM
Course Name	DRONE INNOVATION LABORATORY	0	1	3	4	40	60	100
Course Category	PROFESSIONAL SPECIALIZED COURSE	Syllabus Revision					V.1.0	
Pre-requisite	-							

Course Objectives:

The course should enable the students

1. Classify different microcontrollers and flight controllers.
2. Identify different types of ports and connectors.
3. Program different types of Protocols for communication.
4. Understand interfacing of payload used in drone technology.

Course Outcomes:

On completion of the course, the student will be able to

Course Outcome	Description	Highest Bloom's Taxonomy
CO1	Under standing the programming of different types of microcontrollers.	K2
CO2	Able to program and configure PWM.	K3
CO3	Able to program and configure USAT.	K3
CO4	Able to program and configure SPI&I2C.	K3
CO5	Able to do AI based Drone applications.	K4

Correlation between Course Outcomes (COs) and Program Outcomes (POs):

COs	ProgramOutcomes (POs)												Program Specific Outcomes (PSOs)		
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
CO1	S	S	-	-	S	-	-	-	S	S	M	M	L	L	-
CO2	S	S	L	M	S	-	-	-	S	S	M	M	-	L	-
CO3	S	S	M	M	S	-	-	-	S	S	M	M	L	-	-
CO4	S	S	M	M	S	M	M	L	S	S	M	M	-	L	M
CO5	S	S	L	M	S	L	M	L	S	S	M	M	M	M	M

	LISTOF EXPERIMENTS
1.	Study and configure STM32.
2.	Blink the LED every two seconds using a microcontroller
3.	Measure the distance between the drone and the obstacle using an ultrasonic sensor.
4.	Embedded C Program to configure and use PWM
5.	Embedded C Program to configure and use UART
6.	Embedded C Program to configure and use SPI
7.	Embedded C Program to configure and use I2C
8.	Interfacing of Pay load- Camera/ Spray/ Box
9.	Al-based real-time applications-Object Detection
10.	Swarm Flying
Tools: Ground Control Station (GCS) Application, HILSimulator, MATLAB	

Course Code		L	T	P	C	IA	EA	TM
Course Name	REAL TIME PROJECT DESIGN	0	0	2	4	40	60	100
Course Category	PROFESSIONAL SPECIALIZED COURSE	Syllabus Revision					V.1.0	
Pre-requisite								

Course Objectives:

The course should enable the students

1. To carry out research / investigation and development work and to solve practical problems in the field of Drone.
2. To write and present a substantial technical report / documentin the field of Drone.
3. To Demonstrate the Research findings the Drone Technology.

Course Outcomes:

On completion of the course, the student will be able to

Course Outcomes	Description	Highest Bloom's Taxonomy
CO1	Synthesize knowledge and skills previously gained and apply to an in-depth study and execution of new technical problems in the area of Drone.	K3
CO2	Defines pecification, adopt new methodologies and analyze to produce a suitable research design and justify the design.	K5
CO3	Demonstrate the research findings through hardware ands of tware tools.	K5
CO4	Present the findings of their technical solution in a written report.	K6
CO5	Publish the work inreputed journals and International Conferences.	K6

Correlation between Course Outcomes (COs) and Program Outcomes (POs):

COs	ProgramOutcomes(POs)												Program Specific Outcomes (PSOs)		
	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO 11	PO 12	PSO 1	PSO2	PSO 3
CO1	S	S	S	S	S	-	-	-	-	-	-	M	S	S	-
CO2	S	S	S	S	S	S	S	-	-	-	-	S	S	S	-
CO3	-	-	S	S	S	S	S	-	-	-	S	M	S	S	-

CO4	-	-	-	-	-	-	-	S	S	M	-	S	-	-	S
CO5	-	-	-	-	-	-	-	S	S	M	-	M	-	-	S

PRACTICAL SYLLABUS:	
The project topic should be selected to ensure the satisfaction need to establish a direct link between education, national development and productivity and reduce the gap between the world of work and the world of study.	
The project should have the following	
1.	Relevance to social needs of society.
2.	Relevance to value addition to existing facilities in the institute.
3.	Relevance to industry need.
4.	Problems of nation alimportance.
5.	Research and development in various domains.
The student should complete the following for Mini Project	
1	Literature survey and Problem Definition.
2	Motivation for study and Objectives.
3	Preliminary design approaches.
4	Development and Verification.
5	Report and presentation.
6	Presenting the workin Reputed journals / International Conferences.