INSTITUTE OF AERONAUTICAL ENGINEERING

(Autonomous)

Dundigal - 500 043, Hyderabad, Telangana

COURSE CONTENT

UNMANNED AERIAL VEHICLES								
I Semester: AE								
Course Code	**Category**	**Hours / Week**			**Credits**	**Maximum Marks**		
		L	**T**	**P**	**C**	**CIA**	**SEE**	**Total**
BAEE07	Elective	3	-	-	3	40	60	100
Contact Classes: 45	**Tutorial Classes: Nil**	**Practical Classes: Nil**				**Total Classes: 45**		
Prerequisite: Aerodynamics								

I. COURSE OVERVIEW:

The course focuses on fundamentals related to powered, aerial vehicle systems that do not carry a human operator, including the terminology related to unmanned air vehicle systems (UAS), subsystems, the basic design of UAS for stealth and reliability, and also provides insight into different types of airframes and power-plants. It imparts knowledge about navigation, communications, control, and stability of UAVs. The course is aimed to obtain knowledge also in certification, testing and deployment, and future applications.

II. COURSE OBJECTIVES:

The students will try to learn:

I. The major subsystems and the fundamental design concepts of Unmanned Air Vehicle Systems (UAS).
II. The important design concepts like reliability, stealth, and maintenance of UAS.
III. The various communication media, navigation systems, control, and stability of UAVs.
IV. The development, testing, certification, and deployment of UAS.

III. COURSE OUTCOMES:

After successful completion of the course, students will be able to:

CO 1 Apply the concept of major sub-systems, and performance Characteristics for designing the UAV/ UAS.
CO 2 Identify the appropriate communication, navigation and guidance systems for maneuvering of Unmanned Air Vehicles.
CO 3 Categorize the techniques of the stability and control of UAV for desired maneuvering of Unmanned Air Vehicles.
CO 4 Analyze the design and development of Unmanned Aircraft System for stealth, reliability and Manufacturing.
CO 5 Identify the appropriate testing and certification process for the development of UAS to meet the international standard.
CO 6 Make use of the concepts of network-centric operations for the deployment of UAS in field operations.

IV. COURSE CONTENT:

MODULE-I: INTRODUCTION TO UNMANNED AIRCRAFT SYSTEMS (09)

Applications of UAS, categories of UAV systems, roles of unmanned aircraft, composition of UAV system. Introduction to design and selection of the systems-conceptual phase, preliminary design, detailed design; Aerodynamics and airframe configurations-Lift-induced Drag, Parasitic Drag, Rotary-wing Aerodynamics, Response to Air Turbulence,

MODULE-II: DESIGN OF UAV SYSTEMS-I (09)

Airframe Configurations Medium-range, Tactical Aircraft, Characteristics of Aircraft Types-Long-endurance, Long-range Role Aircraft, Medium-range, Tactical Aircraft, Close-range/Battle field Aircraft, MUAV Types, MAV and NAV Types, UCAV, Novel Hybrid Aircraft Configurations, Aspects of Airframe Design: Scale Effects, Packaging Density, Aerodynamics, Structures and Mechanisms, Selection of power-plants, Modular Construction, Ancillary Equipment, Design for Stealth: Acoustic Signature, Visual Signature, Thermal Signature, Radio/Radar Signature, Payload Types: Non-dispensable and dispensable payloads.

MODULE-III: DESIGN OF UAV SYSTEMS-II (09)

Communications-Communication Media, Radio Communication, Mid-air Collision (MAC) Avoidance, Communications Data Rate and Band width Usage, Antenna Type; Control and Stability: HTOL Aircraft, Convertible Rotor Aircraft, Payload Control, Sensors, Autonomy; Navigation: NAVSTAR Global Positioning System (GPS), TACAN, LORAN C, Inertial Navigation, Radio Tracking, Way-point Navigation; Launch and Recovery.

Design for Reliability: Determination of the Required Level of Reliability, Achieving Reliability, Reliability Data Presentation, Multiplexed Systems, Reliability by Design, Design for Ease of Maintenance; Design for manufacture and Development.

MODULE-IV: THE DEVELOPMENT OF UAV SYSTEMS (09)

System Development and Certification-System Development, Certification, Establishing Reliability; System Ground Testing: UAV Component Testing, UAV Sub- assembly and Sub-system Testing, Testing Complete UAV, Control Station Testing, Catapult Launch System Tests, Documentation; System In-flight Testing: Test Sites, Preparation for In-flight Testing, In-flight Testing, System certification.

MODULE-V: DEPLOYMENT AND FUTURE OF UAV SYSTEMS (09)

Operational trials and full certification; UAV System Deployment- Network-centric Operations (NCO), Teaming with Manned and Other Unmanned System; Naval, arm and air force roles, civilian, paramilitary and commercial roles.

V. TEXT BOOKS:

1. Reg Austin, Wiley, "Unmanned Aircraft Systems, UAVS Design and Deployment", 2nd edition, 2010.

VI. REFERENCE BOOKS:

1. Richard K. Barnhart, Stephen B. Hottman, Douglas M. Marshall, Eric Shappee, (eds.), "Introduction to Unmanned Aircraft Systems", CRC Press, 2012.
2. Valavanis, Kimon P., Vachtsevanos, George J. "Handbook of Unmanned Aerial Vehicles" AIAA series, 3rd edition, 2004.

VII. ELECTRONICS RESOURCES:

1. http://www.tndte.com
2. http://www.scribd.com
3. http://www.sbtebihar.gov.in
4. http://www.ritchennai.org

VIII. MATERIALS ONLINE

1. Course template
2. Assignments
3. Tutorial question bank
4. Model question paper – I
5. Model question paper – II
6. Lecture notes
7. Power point presentations