AIRCRAFT SYSTEMS

VI Semester: AE

Course Code	Category	Hours / Week			Credits	Maximum Marks		
		L	T	P	C	CIA	SEE	Total
AAEB21	Core	3	-	-	3	30	70	100
Contact Classes: 45	Tutorial Classes: Nil	Practical Classes: Nil				Total Classes: 45		

I. COURSE OVERVIEW:

Aircraft system is required to introduce for operating an aircraft efficiently and safely, their complexity varies with the type of aircraft. This is involved with many subsystems which must meet demanding customer and operational lifecycle. This course comprises into simpler sub-systems such as electrical systems, hydraulic systems, pneumatic and engine control systems etc., that carry out homogeneous functions. The course also aims to provide methods for safety assessment in relation to the design, reliability, safety and certification of aircraft systems.

II. OBJECTIVES:

The course should enable the students to:

I	The fundamental concepts of aircraft systems its classification and contributiontowards the aircraft to fulfill the requirements and missions.
II	Various subsystems: Electrical, air conditioning, hydraulic and pneumatic, of anaircraft system.
III	The working principles of engine control and airplane control subsystems of the modern aircraft system.
IV	The design concepts of advanced aircraft systems and controls like fly by wire andautopilots.

III. COURSE OUTCOMES:

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

CO 1	**Develop** the concept of aircraft systems and subsystems like airframe systems, vehicle systems, avionic system and missionsystems by using concept of system theory and operating principles.	Apply
CO 2	**Make use of** electrical power generation and air-conditioning systems on the airplane for power distribution and to maintaining pressure and required temperature in the airplane.	Apply
CO 3	**Identify** the principle of operation of hydraulic and pneumatic system with its functions, merits, applications, design requirements and fluid properties for transforming the energy in different hydraulically operated systems.	Apply
CO 4	**Apply** the working principle of aircraft engines its fuel systems and fuel control system	Apply
CO 5	**Develop** the concept of automation in modern flight and enginecontrol systems used in aircraft for safe and sustained flight.	Apply
CO 6	**Examine** the futuristic applications of modern control systems, avionics, and power generation systems used for aerospace applications for enhancing aircraft operations, safety and flight performance.	Analyze

IV. SYLLABUS:

MODULE-I	INTRODUCTION TO AIRCRAFT SYSTEMS	Classes: 10
System concepts, sub-systems; Generic system definition, inputs, outputs, feedback, external influence. Aircraft systems- airframe systems, vehicle systems, avionics systems, mission systems and their sub-systems; Specification of requirements, mission requirements, performance requirements.		
MODULE-II	ELECTRICAL SYSTEMS AND AIR CONDITIONING, PRESSURIZING SYSTEMS	Classes: 10

Electrical loads in aircraft. Electrical power generation and control- DC, AC- types. Power distribution- primary, secondary. Power conversion and energy storage; Load protection; Electrical load management systems, 270 V DC system;
Basic air cycle systems; Vapour cycle systems, boost-strap air cycle system; Evaporative Vapour cycle systems; Evaporative air cycle systems; Oxygen systems; deicing and anti-icing systems.

MODULE-III	HYDRAULIC SYSTEMS AND PNEUMATIC SYSTEMS	Classes: 09

Hydraulic systems: function, merits, application, system loads, design requirements; Principal components; Hydraulic fluid: required properties; Hydraulic piping, pumps, reservoir, accumulator;

Pneumatic systems ; Advantages;- Working principles ; Typical air pressure system ; Brake system; Typical pneumatic power system ; Components, landing gear systems ; Landing gear and brake management systems.

MODULE-IV	ENGINE CONTROL AND FUEL SYSTEMS	Classes: 08

Principle of operation of aircraft gas turbine engines; Engine - airframe interfaces; Control of fuel flow, air flow, Limited authority control systems, full authority control systems- examples; Power off takes- need, types; Fuel systems- characteristics, components, operating modes; Fuel tank safety- fuel inserting system.

MODULE-V	AIRPLANE CONTROL SYSTEMS	Classes: 08

Flight control systems- primary and secondary flight control conventional systems; Power assisted and fully powered flight controls ; Power actuated systems; Engine control systems; Push pull rod system, flexible push full rod system; Control linkages, actuation- types, description and redundancy. Components; Modern control systems; Digital fly by wire systems, control laws, implementation; Auto pilot system.

Text Books:

1. Moir, I. and Sea bridge, A, "Aircraft Systems: Mechanical, Electrical and Avionics Subsystems Integration", John Wiley, 3rd Edition 2008.
2. Moir, I. and Sea bridge, A, "Design and Development of Aircraft Systems- An Introduction", AIAA Education Series", AIAA, 2004.

Reference Books:

1. Pallett, E.H.J., "Aircraft Instruments and Integrated Systems", Longman Scientific &Technical 10th Edition, 1992.
2. Harris, D, "Flight Instruments and Automatic Flight Control Systems", 6th Edition, 2004.
3. Bolton, W., "Pneumatic and Hydraulic Systems", Butterworth-Heinemann.

Web References:

1. https://www.aircraftsystemscomjet.com/
2. https://www.srmuniv.ac.in/sites/default/files/downloads/Aircraft_ctrl_Systems.pdf
3. https://hydraulicspneumatics.com/other-technologies/chapter-5-pneumatic-and-hydraulic-systems
4. https://www.stahl.de/fileadmin/Dateien/download_publikationen/web havc_and_pressurization.pdf

E-Text Books:

1. https://www.amazon.in/Aircraft-Systems-Mechanical-ElectricalIntegration/dp/0470059966
2. https://www.scribd.com/book/142412367/Aircraft-Systems-Mechanical-Electrical-and Avionics-Subsystems-Integration
3. https://www.scribd.com/document/231235694/n-0447376