AVIONICS AND INSTRUMENTATION

VIII Semester: AERO

Course Code	Category	Hours / Week			Credits	Maximum Marks		
		L	T	P	C	CIA	SEE	Total
AAE525	Elective	3	-	-	3	30	70	100
Contact Classes: 45	Tutorial Classes: NIL	Practical Classes: Nil				Total Classes: 45		

COURSE OBJECTIVES:

The course should enable the students to:

I. Impart the knowledge in various types of Avionics systems, its components & its applications in aerospace industries.
II. Offer a rigorous avionics technology, Review of the basic system integration and the different type of avionics architectures.
III. Provide necessary knowledge to study the aircraft instrumentation sensors, displays and different type of sensors.
IV. Give knowledge about military aircraft adaptation, avionics and mission system interface and gives the difference between civilian aircraft avionics and military aircraft avionics.

COURSE OUTCOMES (COs):

CO 1: Describing aviation technology, bus systems and few basics of aircraft systems

CO 2: Differentiating aircraft instrumentation - sensors and displays systems

CO 3: Understanding communication systems and navigation aids

CO 4: Estimation of military aircraft adaptation mission system interface, navigation and flight management

CO 5: Acquiring knowledge on airborne radar, avionics for spacecraft

COURSE LEARNING OUTCOMES (CLOs):

1. Understanding the evolution of electronics and microelectronics in avionics technology
2. Interpret the need of bus systems in avionics.
3. Constructing the integrating modular avionics architectures, shelf systems and avionics packaging systems
4. Understanding the concept of sensing system in aircraft instrumentation system.
5. Development of different types of indication systems.
6. Constructing different display systems in instrumentation system.
7. Developing the concept of different communication system.
8. Understanding different navigation systems, global and local area augmentation
9. Understanding flight management system control and display unit
10. Measuring of avionic and mission system interface, navigation and flight management
11. Understanding airborne early warning, ground surveillance
12. Explanation of electro-optics and the infra-red
13. Characterizing of types of radar- pulse Doppler
14. Perception of attitude determination and control of spacecraft, magnetometers
15. Adaptation methods of command and telemetry

SYLLABUS		
UNIT-1	**AVIONICS TECHNOLOGY**	**Classes: 10**
Evolution of electronics; The nature of microelectronic devices, processors, memory devices; Introduction to avionics, systems integration, need - data bus systems, MIL STD 1553 bus system, ARINC 429/ARINC 629 bus systems, optical data bus systems; Integrated modular avionics architectures , commercial off the shelf systems; Avionics packaging.		
UNIT -II	**AIRCRAFT INSTRUMENTATION - SENSORS AND DISPLAYS**	**Classes: 10**
Air data sensors, magnetic sensing, inertial sensing, and radar sensors. The electromechanical instrumented flight deck, early flight deck instruments, attitude direction indicator, horizontal situation indicator, altimeter, airspeed indicator; Advanced flight deck display system architectures, display systems, display media, future flight deck displays.		
UNIT-III	**COMMUNICATION AND NAVIGATION AIDS**	**Classes: 10**
Radio frequency spectrum, communication systems, HF, VHF, satellite communications; ATC transponder, traffic collision avoidance system; Navigational aids; Automatic direction finding, VHF Omni range, distance measuring equipment; TACAN, VORTAC; Satellite navigation systems, the GPS. Basic navigation, radio, inertial navigations, satellite navigation; GPS, differential GPS, wide area augmentation systems, local area augmentation system, and GPS overlay program; Integrated navigation, sensor usage; Flight management system (FMS); FMS control and display unit; Lateral navigation.		
UNIT-IV	**MILITARY AIRCRAFT ADAPTATION**	**Classes: 10**
Avionic and mission system interface, navigation and flight management; Navigation aids, flight deck displays, communications, aircraft systems; Applications, personnel, material and vehicle transport, air-to-air refueling, maritime patrol, airborne early warning, ground surveillance; Electronic warfare, the EW spectrum, electronic support measures, electronic countermeasures, electro-optics and the infra-red.		
UNIT-V	**AIRBORNE RADAR, ASTRIONICS - AVIONICS FOR SPACECRAFT**	**Classes: 10**
Propagation of Radar waves, functional elements of radar, antenna- transmitter; Types of radar- pulse Doppler, civil aviation applications, military applications; Attitude determination and control of spacecraft, magnetometers, sun sensors, star trackers, earth and horizon sensors; Command and telemetry.		
Text Books:		
1. Moir, I. and Seabridge, A., Civil Avionics Systems, AIAA Education Series, AIAA, 2002. 2. Collinson, R.P.G., Introduction to Avionics Systems, second edition, Springer, 2003.		
Reference Books:		
1. Helfrick, A., Principles of Avionics, Avionics Communications Inc. Leesburg, 2000. 2. Henderson, M. F., Aircraft Instruments & Avionics for A &P Technicians, Jeppesen Sanderson Training Products, 1993.		
Web References:		
1. https://soaneemrana.org/onewebmedia/INTRODUCTION%20TO%20SPACE%20DYNAMICS1 2. https://nptel.ac.in/courses/101105030/		
E-Text Books:		
1. https://store.doverpublications.com/0486651134.html 2. https://www.worldcat.org/title/introduction-to-space-dynamics/oclc/867680515		