INSTITUTE OF AERONAUTICAL ENGINEERING
(Autonomous)
Dundigal - 500 043, Hyderabad, Telangana

COURSE CONTENT

AVIONICS AND INSTRUMENTATION								
VII Semester: AE								
Course Code	**Category**	**Hours / Week**			**Credits**	**Maximum Marks**		
AAED49	**Elective**	**L**	**T**	**P**	**C**	**CIA**	**SEE**	**Total**
		3	0	-	3	40	60	100
Contact Classes: 48	**Tutorial Classes: Nil**	**Practical Classes: Nil**				**Total Classes: 48**		
Prerequisite: Aircraft systems								

I. COURSE OVERVIEW:

Avionics deals with electronic systems which are used on aircraft, satellites and spacecrafts. This course covers the major phases of avionics from navigation, guidance, and communication to sophisticated system using state of art sensors and radars used in aerospace systems. Various electronic instrument systems, numbering systems, data buses, data conversion and logic gates are also covered. The course provides an understanding of the sensors, display system and communication system for various aerospace applications. This course introduces the electronic flight instrument systems with advanced avionics. The course includes different adaptations involved in a military aircraft.

II. COURSES OBJECTIVES:

The students will try to learn

I. The working principle and classification of sensors, radars, radio communication and navigation systems with respect to their application.
II. Concept of microelectronic devices along with their evolution and applications, with the emphasis on digital data buses.
III. Different adaptations, avionics Systems, and its application in military aircraft when compared to civilian aircraft.

III. COURSE OUTCOMES:

At the end of the course students should be able to:

CO1 Make use of various electronic instrument and avionics systems used for the design of modem aircraft.
CO2 Analyse the fundamental principles of various types of sensors for monitoring the parameters in an aircraft.
CO3 Choose the working principles of various flight instruments in flight deck for monitoring the status of the flight in one integrated display
CO4 Develop the basic principle and various types of navigation systems for providing accurate position of a moving aircraft relative to the earth.
CO5 Make use of the concept of various navigational aids that guide the pilot for landing the aircraft safely on a runway.
CO6 Choose the working principle of different sensors, radars, transmitters and magnetometers for determination of dipole moment, position and attitude.

IV. COURSE CONTENT:

MODULE-I: AVIONICS TECHNOLOGY (09)

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, ARINC429/ARINC 629 bus systems, optical data bus systems; Integrated modular avionics architectures, commercial off the shelf systems; Avionics packaging.

MODULE-II: AIRCRAFTINSTRUMENTATION-SENSORSANDDISPLAYS (09)

Air data sensors, magnet censing inertial sensing, and radar sensors. The electro mechanical 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.

MODULE-III: COMMUNICATION AND NAVIGATION AIDS (11)

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 MODULE; Lateral navigation.

MODULE-IV: MILITARY AIRCRAFT ADAPTATION (09)

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.

MODULE-V: AIRBORNERADAR, ASTRIONICS-AVIONICS FOR SPACECRAFT (10)

Introduction to Avionics and Aerospace Electronics, Basic Radar Principles, Airborne Radar Systems, Antenna Systems for Aircraft, Avionics Systems Architecture, Spacecraft Avionics; Inertial Navigation Systems, Electromagnetic Compatibility (EMC) in Avionics, Advanced Avionics Technologies, Satellite Communication Systems, Cyber security in Avionics, Case Studies

V. 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”,2nd Edition, Springer, 2003.

VI. REFERENCE BOOKS:

1. Helfrick A, “Principles of Avionics”, Avionics Communications, Leesburg,3rd Edition,2000.
2. Henderson M. F, “Aircraft Instruments & Avionics for A&P Technicians”, Jeppesen Sanderson Training Products, 1993.

VII. ELECTRONICS RESOURCES:

1. https://akanksha.iare.ac.in/index?route=course/details&course id=1756

VIII. MATERIALS ONLINE

1. Course template
2. Tutorial question bank
3. Tech talk topics
4. Open end experiments
5. Definitions and terminology
6. Assignments
7. Model question paper – I
8. Model question paper - II

9. Lecture notes
10. E-learning readiness videos (ELRV)
11. Power point presentation