

## AVIONICS AND INSTRUMENTATION

<b>PE-V</b>								
Course Code	Category	Hours / Week			Credits	Maximum Marks		
		L	T	P		CIA	SEE	Total
AAEB45	Elective	3	-	-	3	30	70	100
<b>Contact Classes: 45</b>	<b>Tutorial Classes: Nil</b>	<b>Practical Classes: Nil</b>			<b>Total Classes: 45</b>			
<p><b>I. COURSE OVERVIEW:</b>                      Avionics deals with electronic systems which are used on aircraft, satellites and spacecrafts. This course introduces the major phases of avionics from the basic navigation, guidance, and communication to sophisticated systems comprising of state of art sensors and radars used in aerospace systems. The course introduces various electronic instrument systems, numbering systems, data buses, data conversion and logic gates and provides an understanding of the sensors, display system and communication system for various aerospace applications. The course also discusses advanced avionics systems and different adaptations involved in a military aircraft</p>								
<p><b>II. OBJECTIVES:</b>  <b>The course should enable the students to:</b></p> <ul style="list-style-type: none"> <li>I The fundamental principles of sensors, radars, radio communication and navigation systems and their application.</li> <li>II Concept of microelectronic devices along with their evolution and applications, with the emphasis on digital data buses.</li> <li>III Learn the advances in modern avionics systems, and their application in military and civil aircrafts.</li> </ul>								
<p><b>III. COURSE OUTCOMES:</b>  <b>After successful completion of the course, students should be able to:</b></p> <ul style="list-style-type: none"> <li>CO 1 <b>Make use of various electronic instrument and avionics systems used for the design of modern aircraft.</b> Apply</li> <li>CO 2 <b>Utilize the fundamental principles of various types of sensors for monitoring the parameters in an aircraft.</b> Apply</li> <li>CO 3 <b>Identify the working principles of various flight instruments in flight deck for monitoring the status of the flight in one integrated display.</b> Apply</li> <li>CO 4 <b>Develop the basic principle and various types of navigation systems for providing accurate position of a moving aircraft relative to the earth.</b> Apply</li> <li>CO 5 <b>Make use of the concept of various navigational aids that guide the pilot for landing the aircraft safely on a runway.</b> Apply</li> <li>CO 6 <b>Identify the working principle of different sensors, radars, transmitters and magnetometers for determination of dipole moment, position and attitude.</b> Apply</li> </ul>								
<b>IV. SYLLABUS:</b>								
<b>MODULE-I</b>	<b>AVIONICS TECHNOLOGY</b>						<b>Classes: 10</b>	
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.								
<b>MODULE-II</b>	<b>AIRCRAFT INSTRUMENTATION - SENSORS AND DISPLAYS</b>						<b>Classes: 10</b>	
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.								

<b>MODULE-III</b>	<b>COMMUNICATION AND NAVIGATION AIDS</b>	<b>Classes: 09</b>
<p>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.</p> <p>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.</p>		
<b>MODULE-IV</b>	<b>MILITARY AIRCRAFT ADAPTATION</b>	<b>Classes: 08</b>
<p>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.</p>		
<b>MODULE-V</b>	<b>AIRBORNE RADAR, ASTRIONICS - AVIONICS FOR SPACECRAFT</b>	<b>Classes: 08</b>
<p>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</p>		
<b>Text Books:</b>		
<ol style="list-style-type: none"> <li>1. Moir, I. and Seabridge, A., Civil Avionics Systems, AIAA Education Series, AIAA, 2002.</li> <li>2. Collinson, R.P.G., Introduction to Avionics Systems, Springer, 2<sup>nd</sup> Edition, 2003.</li> </ol>		
<b>Reference Books:</b>		
<ol style="list-style-type: none"> <li>1. Helfrick, A., Principles of Avionics, Avionics Communications Inc. Leesburg, 2000.</li> <li>2. Henderson, M. F., Aircraft Instruments &amp; Avionics for A &amp; P Technicians, Jeppesen Sanderson Training Products, 1993.</li> </ol>		
<b>Web References:</b>		
<ol style="list-style-type: none"> <li>1. <a href="https://soaneemrana.org/onewebmedia/INTRODUCTION%20TO%20SPACE%20DYNAMICS1">https://soaneemrana.org/onewebmedia/INTRODUCTION%20TO%20SPACE%20DYNAMICS1</a></li> <li>2. <a href="https://nptel.ac.in/courses/101105030/">https://nptel.ac.in/courses/101105030/</a></li> </ol>		
<b>E-Text Books:</b>		
<ol style="list-style-type: none"> <li>1. <a href="https://store.doverpublications.com/0486651134.html">https://store.doverpublications.com/0486651134.html</a></li> <li>2. <a href="https://www.worldcat.org/title/introduction-to-space-dynamics/oclc/867680515">https://www.worldcat.org/title/introduction-to-space-dynamics/oclc/867680515</a></li> </ol>		