Course code	Course name	L-T-P-Credits	Year of Introduction
AE463	AEROSPACE & NAVIGATION INSTRUMENTS	3-0-0-3	2016

Prerequisite : Nil

Course Objective

- To introduce the basics of aerospace engineering
- To impart ideas on aircraft and navigation instruments

Syllabus

History of aviation and space flight - - basics of aerodynamics - Airplane performance- Introduction to turbojet and turbofan engines- Basic engine instruments- Aircraft compass- Air speed indicator- GPS and GNSS- Introduction to guidance, navigation and avionics- Introduction to navigation and guidance instrumentation- MEMS gyroscopes and accelerometers.

Expected outcome

At the end of semester, the students will

i. be familiar with the basics of aerospace engg and navigation
ii. have an idea about the instrumentation used in aerospace engineering

Text Books

1. Nagaraja.M.S, Elements of electronic navigation, Tata McGraw Hill
2. Pallet.E.H.J , Aircraft instruments- Principles and applications, Pitman Pub

Reference books

1. Ernest O Doebelin, Dhanesh N Manik , Measurement Systems-Application and Design,5th Edition, Tata McGraw Hill, 2007
2. Jewel B Barlow, William H. Rae, Jr. , Alan Pope , Low-Speed Wind Tunnel Testing, , John Wiley, Third Edition, 1999
3. Marcel J. Sidi, Spacecraft Dynamics and Control-A Practical Engineering Approach, , Cambridge University Press, 1997.

Course Plan

Module	Contents	Hours	Semester Exam Marks
I	History of aviation and space flight- anatomy of airplane and space vehicle with emphasis on control surfaces- airfoil nomenclature- basics of aerodynamics to illustrate lift and drag- types of drag – finite wings – swept wings –flaps.	6	15%
II	Airplane performance- thrust –power- rate of climb absolute and service ceiling- range and endurance. Introduction to turbojet and turbofan engines. Space vehicle trajectories- Kepler's laws- rocket engines, propellants and staging. (Introductory treatment of the above topics is only expected, no detailed derivations)	8	15%
	FIRST INTERNAL EXAMINATION		
III	Basic engine instruments- Capacitive fuel content- Gauges. Standard atmosphere- Altimeters Aneroid and radio	6	15%

	altimeters.		
IV	Aircraft compass- Remote indicating magnetic compass- Rate of climb indicator- Pitot static system- Air speed indicator- Mach meters- Integrated flight instruments	6	15%
SECOND INTERNAL EXAMINATION			
V	GPS and GNSS, - Automatic Pilots- Aircraft flight simulation instrumentation Introduction to guidance, navigation and avionics- Radio navigational aids- automatic direction finder VHF- Phase-Comparison direction finder.	8	20%
VI	Introduction to navigation and guidance instrumentation- Principle, construction and applications of inertial sensors- Gyroscope and accelerometers- Ring laser gyroscope- Fibre optic gyroscope, MEMS gyroscopes and accelerometers.	8	20%
END SEMESTER EXAMINATION			

QUESTION PAPER PATTERN:

Maximum Marks:100 Exam Duration: 3 Hours

Part A

Answer any two out of three questions uniformly covering Modules 1 and 2 together. Each question carries 15 marks and may have not more than four sub divisions.

(15 x 2 = 30 marks)

Part B

Answer any two out of three questions uniformly covering Modules 3 and 4 together. Each question carries 15 marks and may have not more than four sub divisions.

(15 x 2 = 30 marks)

Part C

Answer any two out of three questions uniformly covering Modules 5 and 6 together. Each question carries 15 marks and may have not more than four sub divisions.

(20 x 2 = 40 marks)