

SEMESTER 4

AEROSPACE ENGINEERING AND NAVIGATION INSTRUMENTATION

Course Code	PEAOT417	CIE Marks	40
Teaching Hours/Week (L: T:P: R)	3:0:0:0	ESE Marks	60
Credits	3	Exam Hours	2 Hrs. 30 Min.
Prerequisites (if any)	GCPHT121 PCAOT205	Course Type	Theory

Course Objectives:

1. Understand basic principles of aviation and the history of space vehicles
2. Acquire the basics of space propulsion, space crafts and their orbits .
3. Comprehend the navigation concepts and navigation systems.

SYLLABUS

Module No.	Syllabus Description	Contact Hours
1	Introduction to Space Flight: History of aviation, International Standard atmosphere, Atmosphere and its properties, Temperature, pressure and altitude relationships, Classification of aircrafts, Modern developments in Aviation like UAV. History of Space Flight & spacecraft technologies Difference between space and atmosphere, upper atmosphere, Introduction to basic orbital mechanics, types of Orbits (LEO, MEO, Geosynchronous and Geostationary, Polar orbits), Kepler's Laws of planetary motion.	9

2	Aircraft & Rocket Propulsion: Introduction, Classification, Piston Engine & its application, Principle of operation of Turboprop, turbojet and turbofan engines, Introduction to ramjets and scramjets; performance characteristics, Principles of operation of rocket, Classification of Rockets, Types of rockets and typical applications, Introduction to Space Exploration.	9
3	Navigation Concepts: Introduction. Radio navigational aids. Radio navigation systems. VHF-Omni directional range system. Distance Measuring Equipment. Instrument landing system. Area navigation. Global positioning system. Automatic Flight Control Systems – Aircraft Autopilot. Aircraft controls in modern aircrafts. Intelligent Flight Control Systems- Aircraft flight simulation instrumentation.	9
4	In-flight Navigation: Use of visual observations and application to in-flight navigation, Navigation in climb descent, average airspeed, average wind velocity, ground speed/distance covered during climb or descent, Navigation in cruising flight, use of fixes to revise navigation data, ground speed revision, off-track corrections. Principle, construction and applications of inertial sensors. Gyroscope and accelerometer, Radar- continuous wave and frequency modulated radar- MTI and pulse Doppler radar. Airborne Surveillance Radars.	9

Course Assessment Method
(CIE: 40 marks,ESE: 60 marks)

Continuous Internal Evaluation Marks (CIE):

Attendance	Assignment/ Microproject	Internal Examination-1 (Written)	Internal Examination- 2 (Written)	Total
5	15	10	10	40

End Semester Examination Marks (ESE)

In Part A, all questions need to be answered and in Part B, each student can choose any one full question out of two questions

Part A	Part B	Total
2 Questions from each module. Total of 8 Questions, each carrying 3 marks (8x3 =24marks)	Each question carries 9 marks. Two questions will be given from each module, out of which 1 question should be answered. Each question can have a maximum of 3 sub divisions. (4x9 = 36 marks)	60

Course Outcomes (COs)

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

Course Outcome		Bloom's Knowledge Level (KL)
CO1	Understand the basic knowledge & principles of aviation & spaceflight.	K2
CO2	Discuss the concepts of fundamentals of aircraft & rocket propulsion.	K2
CO3	Inferring the navigation basics, concepts and controls.	K2
CO4	Evaluate the inflight navigation principles, controls and measurements.	K4

Note: K1- Remember, K2- Understand, K3- Apply, K4- Analyse, K5- Evaluate, K6- Create

CO-PO Mapping Table (Mapping of Course Outcomes to Program Outcomes)

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1	3	2	1	1	-	-	-	-	-	-	-	2
CO2	3	2	1	1	-	-	-	-	-	-	-	2
CO3	3	2	1	1	-	-	-	-	-	-	-	2
CO4	3	3	2	2	-	-	-	-	-	-	-	2
CO5												

Note: 1: Slight (Low), 2: Moderate (Medium), 3: Substantial (High), -: No Correlation

Text Books				
Sl. No	Title of the Book	Name of the Author/s	Name of the Publisher	Edition and Year
1	Aircraft Systems: Mechanical, Electrical and Avionics Subsystems Integration	Ian Moir, Allan Seabridge	John Wiley & Sons	3rd edition, 2011
2	Flight without formulae	A.C. Kermode	Pearson Education India	5 th edition, 1989
3	Flight stability and automatic control	Nelson R.C	McGraw-Hill	2nd edition, 1998
4	Aircraft Instruments- Principles and Applications	Pallet. E.H.J	Pitman	1981

Reference Books				
Sl. No	Title of the Book	Name of the Author/s	Name of the Publisher	Edition and Year
1	Fundamentals of Airplane Flight Mechanics	David.G.Hull	Springer	2007
2	Avionics Navigation Systems	Keyton.M and Walker.R. Fried	John Wiley	2nd edition, 1996
3	Space Flight: History, Technology, and Operations	Lance K. Erickson	The Scarecrow press	2010

Video Links (NPTEL, SWAYAM...)	
Module No.	Link ID
1	https://archive.nptel.ac.in/courses/101/101/101101079/
2	https://nptel.ac.in/courses/101104019
3	https://archive.nptel.ac.in/courses/101/108/101108056/
4	https://archive.nptel.ac.in/courses/101/108/101108056/