GUJARAT TECHNOLOGICAL UNIVERSITY

Bachelor of Engineering
Subject Code: 3170108
Semester –VII
Subject Name: Aircraft Control and Navigation

Type of course: Professional Elective Course

Prerequisite: Avionics, Basic control theory

Rationale: Aircraft control and navigation is one of the core areas in the field of aviation. The concepts of aircraft control and navigation are vitally important to the aeronautical engineer.

Teaching and Examination Scheme:

Teaching Scheme			Credits	Examination Marks				Total Marks
				Theory Marks		Practical Marks		
L	T	P	C	ESE (E)	PA (M)	ESE (V)	PA (I)	
3	0	2	4	70	30	30	20	150

Content:

Sr. No.	Content	Total Hrs
1	**Longitudinal Dynamics :** Introduction, Development of Equation of motion, Aircraft Reference Frames, Primary Definitions, Aerodynamic Angles, Forces and Torques, Aircraft attitude with respect to earth, Longitudinal Transfer Function for Elevator displacement, Short period and phugoid mode, Transient response of Aircraft.	12
2	**Longitudinal Autopilot :** Pitch orientation control system, Acceleration control System, Guide slop coupler, Automatic Fuel Control	5
3	**Lateral Auto Pilot:** Introduction, Damping of Dutch roll, Yaw orientation control system, Turn compensation.	4
4	**Inertial Cross coupling:** Introduction, Determination of Aircraft parameters affecting stability, System for controlling cross coupling condition of Aircraft.	8
5	**Aircraft Auto Pilot Systems:** Principle and applications, Integration with Flight Management and Flight Direction system, Automatic approach and landing, height and throttle control system.	7
6	**Navigation:** Navigation principles and applications, Kinds of navigation – Position Fixing and Dead-reckoning systems. LORAN; DECCA; OMEGA. Very High Frequency Omni-Directional Range (VOR). Celestial navigation and GPS based navigation; Inertial Navigation Systems.	9

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Suggested Specification table with Marks (Theory):

Distribution of Theory Marks					
R Level	U Level	A Level	N Level	E Level	C Level
20%	**20%**	**30%**	**15%**	**10%**	**5%**

Legends: R: Remembrance; U: Understanding; A: Application, N: Analyze and E: Evaluate C: Create and above Levels (Revised Bloom's Taxonomy)

Note: This specification table shall be treated as a general guideline for students and teachers. The actual distribution of marks in the question paper may vary slightly from above table.

Reference Books:

1. Automatic control of Aircraft and Missiles by John H Blakelock :: John Wiley and Sons, Inc.
2. Avionics Navigational Systems II Edn By Myron Kayton, Walter R Fried :: John Wiley and Sons, Inc.
3. Stevens, B. L. and Lewis, F. L., Aircraft Control and Simulation, Second Edition, John Wiley and Sons, Inc., Hoboken, New Jersey, 2003.
4. N.S. Nise: Control Systems Engineering, Wiley-India, 2004.
5. B. Friedland: Control System Design, Dover, 2005.

Course Outcomes:
After completion of this course students shall be able to

Sr. No.	CO statement	Marks % weightage
1	Compute and demonstrate understanding of aircraft lateral and longitudinal modes and effects	30
2	Demonstrate basic understanding of aircraft control response	25
3	Analyze dynamic aircraft flight conditions using inertial cross coupling	25
4	Interpret aircraft autopilot and navigation system.	20

List of Experiments:

Sr No	Title
1.	To Study Longitudinal Autopilot of Boeing aircraft.
2.	To study Lateral Autopilot of airbus aircraft.
3.	To study Altitude and Mach hold control system.
4.	To study Inertial cross-coupling in fighter Aircraft.
5.	To study GPS receiver.
6.	To study Missile control system.
7.	To study Weather radar.
8.	To study about Static Discharger.
9.	To study Radio Wave propagation.

10.	To study inertial navigation system of aircraft.

List of Open Source Software/learning website: https://nptel.ac.in/course.php