GUJARAT TECHNOLOGICAL UNIVERSITY

AERONAUTICAL ENGINEERING
AIRCRAFT CONTROL AND NAVIGATION
SUBJECT CODE: 2180104
B.E. 8th SEMESTER

Type of course: Engineering Science

Prerequisite: Basics of Electrical and Electronics, Aircraft Science

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
L	T	P	C	Theory Marks			Practical Marks			
				ESE (E)	PA (M)		ESE (V)		PA (I)	
					PA	ALA	ESE	OEP		
4	0	2	6	70	20	10	20	10	20	150

Content:

Sr. No.	Content	Total Hrs	% Weightage
1	**Longitudinal Dynamics :** Introduction, Development of Equation of motion, Aircraft attitude with respect to earth, Longitudinal Transfer Function for Elevator displacement, Transient response of Aircraft.	10	20
2	**Longitudinal Autopilot :** Pitch orientation control system, Acceleration control System, Guide slop coupler, Automatic Fuel Control	4	15
3	**Lateral Auto Pilot:** Introduction, Damping of Dutch roll, Yaw orientation control system, Turn compensation.	4	10
4	**Inertial Cross coupling:** Introduction, Determination of Aircraft parameters affecting stability, System for controlling cross coupling condition of Aircraft.	8	10
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, ILS/MLS coupled autopilot system.	8	20
6	**Navigation:** Navigation principles and applications, Types of Navigation. Advanced navigation Systems	10	25

Suggested Specification table with Marks (Theory):

Distribution of Theory Marks					
R Level	U Level	A Level	N Level	E Level	C Level
35%	**25%**	**20%**	**15**	**5**	**0%**

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. Automatic Flight Control by EHJ Pallet & Shawn Coyle :: Blackwell Publishing.

Course Outcome:

After learning the course the students should be able to learn about fundamental principles and applications of avionics equipments and should be able to learn about control and navigation systems of the aircraft.

List of Experiments:

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 Missile control system.
6. To study Weather radar.
7. To study GPS receiver.
8. To study about Static Discharger.
9. To study Radio Wave propagation.
10. To study inertial navigation system of aircraft.

Design based Problems (DP)/Open Ended Problem:

1. Make a chart of autopilot system of any Boeing aircraft.
2. Make a chart of weather radar system.

3. Make a working model of any feedback system.

Major Equipment: Flight simulator software, joy stick, rudder paddle set, computer, approach charts, navigation maps, cockpit instrument panel charts, GPS receiver.

List of Open Source Software/learning website: http://nptel.iitm.ac.in/ , youtube.com

ACTIVE LEARNING ASSIGNMENTS: Preparation of power-point slides, which include videos, animations, pictures, graphics for better understanding theory and practical work – The faculty will allocate chapters/ parts of chapters to groups of students so that the entire syllabus to be covered. The power-point slides should be put up on the web-site of the College/ Institute, along with the names of the students of the group, the name of the faculty, Department and College on the first slide. The best three works should be submitted to GTU.

Principle, Application And Errors Of: Weather Radar, Longitudinal And Lateral Autopilot, Naviagation Systems, Statis Dischargers, Height And Throttle Control System Etc.