

FLIGHT SIMULATION AND CONTROLS LABORATORY

II Semester: AE								
Course Code	Category	Hours /Week			Credits	Maximum Marks		
BAEC23	Core	L	T	P	C	CIA	SEE	Total
		-	-	4	2	30	70	100
Contact Classes: Nil	Tutorial Classes: Nil	Practical Classes: 36			Total Classes:36			
<p>I. COURSE OVERVIEW: Flight simulation and Control is the science that investigates the stability and control of aircrafts and all other flying vehicles. From the advent of the first flight by the Wright Brothers, it was observed that flight without knowledge of stability and control was not viable. Since then, several different concepts for controlling aircraft flight have been devised including control surfaces, deformable surfaces, morphing of wings etc. This course introduces some of these concepts and describes their operation, as well as the degree of stability that these devices can provide. Modern aircraft control is ensured through automatic control systems known as autopilot. Their role is to increase safety, facilitate the pilot's task and improve flight qualities. The course will introduce modern aircraft stability and control and discuss some of its objectives and applications</p>								
<p>II. COURSE OBJECTIVES: The students will try to learn:</p> <p>I. The basics simulation of un accelerated and accelerated level flight for climb and descend. II. The takeoff and landing performance and ground roll for different modes of aircraft. III. The basic controls and maneuver of in complex flight path.</p>								
<p>III. COURSE OUTCOMES: After successful completion of the course, students will be able to:</p>								
CO 1	Choose the appropriate flight path using flight simulator for simulating the un-accelerated and accelerated flights.						Understand	
CO 2	Estimate the take-off velocity, ground roll distance, and landing distance using flight simulator for the Cessna aircraft.						Apply	
CO 3	Make use of flight simulator's mission profiles for simulating the different flight maneuvers.						Analyze	
CO 4	Examine the longitudinal and lateral perturbed stability of aircraft for obtaining desired operational ability.						Apply	
CO 5	Analyze lateral and directional coupled dynamic stability for a given aircraft to simulate spin recovery.						Apply	
CO 6	Determine turn rates, radius and barrel roll by using flight simulator for assessing flight performance in given condition.						Analyze	
<p>IV. LIST OF EXPERIMENTS</p> <p>Week-1: SIMULATION OF UNACCELERATED AND ACCELERATED LEVEL FLIGHT Implement the following tasks</p> <ol style="list-style-type: none"> 1. Simulation of steady flight 2. Simulation of accelerated level flight at various altitudes 								

Week-2: SIMULATION OF UNACCELERATED AND ACCELERATED CLIMB

Implement the following tasks

1. Simulation of steady climb
2. Simulation of accelerated climb at various climb rates

Week-3: SIMULATION OF UNACCELERATED AND ACCELERATED DESCENT

Implement the following tasks

1. Simulation of steady descent
2. Simulation of accelerated descent at various descent rates

Week-4: SIMULATION OF TAKE-OFF PERFORMANCE

Implement the following tasks

1. Estimation of take off velocity for Cessna flight.

Week-5: SIMULATION OF LANDING PERFORMANCE

Implement the following tasks

1. Estimation of ground roll distance for Cessna flight
2. Estimation of total landing distance for Cessna flight

Week-6: SIMULATION OF CONVENTIONAL FLIGHT PATH

Implement the following tasks

1. Perform the given mission profiles

Week-7: STABILIZATION OF LONGITUDINAL PERTURBED AIRCRAFT

Implement the following tasks

1. Perform the operation from disturbed flight to trim flight
2. Perform long period and short period modes.

Week-8: STABILIZATION OF LATERAL PERTURBED AIRCRAFT

Implement the following tasks

1. Perform the operation from disturbed flight to trim flight
2. Simulate lateral directional modes.

Week-9: SIMULATION OF SPIN RECOVERY

Implement the following tasks

1. Perform the operation of spin recovery

Week-10: SIMULATION OF COORDINATED LEVEL TURN

Implement the following tasks

1. Perform the level turn at given turn rate.
2. Perform the level turn at given turn radius.

Week-11: SIMULATION OF BARREL ROLL MANEUVER

Implement the following tasks

1. Perform the barrel roll maneuver

Week-12: SIMULATION OF A COMPLEX FLIGHT PATH

Implement the following tasks

1. Perform flight simulation for given mission profiles

V. REFERENCE BOOKS:

1. Peter John Davison, "A summary of studies conducted on the effect of motion in flight simulator pilot training", 5th February, 2014.
2. Beard, Steven;etal, "Space Shuttle Landing and Rollout Training at the Vertical Motion Simulator", (PDF).AIAA. Retrieved 5th February, 2014.

VI. WEBREFERENCES:

1. www.helijah.free.fr/dev/Principles-of-Flight-Simulation.pdf/
2. www.faa.gov/news/safety_briefing/2012/media/SepOct2012ATD.pdf
3. www.aerosociety.com/Assets/Docs/Publications/DiscussionPapers/The_impact_of_flight_simulation_in_aero_space.pdf