

Course code	Course Name	L-T-P-Credits	Year of Introduction
AO364	ACTUATORS AND CONTROLS IN AIRCRAFT	3-0-0-3	2016
Prerequisite : Nil			
Course Objectives			
<ul style="list-style-type: none"> To impart knowledge of the hydraulic and pneumatic systems components and types of instruments and its operation including navigational instruments to the students. 			
Syllabus			
Introduction to oil hydraulics and pneumatics. - Hydraulic pumps and motors -Hydraulic actuators - Nonlinearities in control systems .Design and analysis of typical hydraulic circuits - Valve configurations- General valve analysis -Basic air cycle systems-fire protection systems-Deicing and anti-icing system -Flight instruments and navigation instruments			
Expected Outcome			
The students will be able to			
<ul style="list-style-type: none"> Know the operation of airplane control system, Engine system, Air conditioning and pressing system. Know the operation of air data Instruments system. 			
Text Books:			
<ol style="list-style-type: none"> Mekinley, J.L. and R.D. Bent, "Aircraft Power Plants", McGraw Hill 1993. Pallet, E.H.J, "Aircraft Instruments & Principles", Pitman & Co 1993. 			
References:			
<ol style="list-style-type: none"> Handbooks of Airframe and Power plant Mechanics, US dept. of Transportation, Federal Aviation Administration, The English Book Store, New Delhi, 1995 Mckinley, J.L. and Bent R.D. "Aircraft Maintenance & Repair", McGraw Hill, 1993. Treager, S., "Gas Turbine Technology", McGraw Hill 1997. 			
Course Plan			
Module	Contents	Hours	End Sem. Exam Marks
I	Introduction to oil hydraulics and pneumatics, their structure, advantages and limitations.	1	15%
	Properties of fluids, Fluids for hydraulic systems, governing laws. Distribution of fluid power, ISO symbols, energy losses in hydraulic systems.	5	
	Applications, Basic types and constructions of Hydraulic pumps and motors. Pump and motor analysis.	2	
	Performance curves and parameters	2	
II	Hydraulic actuators.	1	15%
	Types and constructional details, lever systems, control elements.	3	
	Direction, pressure and flow control valves.	2	

FIRST INTERNAL EXAM			
III	Proportional control valves and servo valves. Nonlinearities in control systems (backlash, hysteresis, dead band and friction nonlinearities).	2	15%
	Design and analysis of typical hydraulic circuits. Regenerative circuits, high low circuits, Synchronization circuits, and accumulator sizing.	1	
	Intensifier circuits Meter-in, Meter-out and Bleed-off circuits; Fail Safe and Counter balancing circuits, accessories used in fluid power system.	3	
	Filtration systems and maintenance of system.	1	
IV	Valve configurations.	1	15%
	General valve analysis, valve lap, flow forces and lateral forces on spool valves.	2	
	Series and parallel pressure compensation flow control valves.	2	
	Flapper valve Analysis and Design.	2	
SECOND INTERNAL EXAM			
V	Basic air cycle systems – vapour cycle systems, boot-strap air cycle system.	1	20%
	Evaporative vapour cycle systems – evaporation air cycle systems	1	
	Oxygen systems – fire protection systems.	1	
	Deicing and anti-icing system.	2	
VI	Flight instruments and navigation instruments.	2	20%
	Accelerometers, air speed indicators – Mach meters – altimeters - gyroscopic instruments– principles and operation.	2	
	Study of various types of engine instruments – tachometers – temperature gauges – pressure gauge – operation and principles.	2	
END SEMESTER EXAM			

Question Paper Pattern

Maximum marks: 100

Exam duration: 3 hours

The question paper shall consist of three parts

Part A : 4 questions uniformly covering modules I and II. Each question carries 10 marks
Students will have to answer any three questions out of 4 (3X10 marks =30 marks)

Part B: 4 questions uniformly covering modules III and IV. Each question carries 10 marks
Students will have to answer any three questions out of 4 (3X10 marks =30 marks)

Part C: 6 questions uniformly covering modules V and VI. Each question carries 10 marks
Students will have to answer any four questions out of 6 (4X10 marks =40 marks)

Note: In all parts, each question can have a maximum of four sub questions, if needed.