INSTITUTE OF AERONAUTICAL ENGINEERING

(Autonomous)
Dundigal, Hyderabad - 500 043

AERONAUTICAL ENGINEERING

TUTORIAL QUESTION BANK

Course Title	**AIRCRAFT SYSTEMS AND CONTROL**				
Course Code	AAE010				
Programme	B.Tech				
Semester	V	AE			
Course Type	core				
Regulation	IARE - R16				
Course Structure	**Theory**			**Practical**	
	Lectures	**Tutorials**	**Credits**	**Laboratory**	**Credits**
	3	-	3	-	-
Chief Coordinator	Mr. R. Suresh Kumar, Assistant Professor				
Course Faculty	Mr. P Anudeep, Assistant Professor Mr. Suresh Kumar, AssistantProfessor				

COURSE OBJECTIVES:

The course should enable the students to:	
I	Explain the concept and meaning of system and classify the various systems required for aircraft andtheir contribution in order to fulfill the aircraft tasks.
II	Describe the various types of Electrical power generations and distribution in aircraft and impart the knowledge of pneumatic, hydraulic and environmental control system.
III	Demonstrate the different flight control actuators and flight control system and fly-by-wire control laws and give knowledge about the landing gears systems and brake management system.
IV	Explain the concept of different aircraft gas turbine engines and their control systems and describe the fuel system characteristics and their operating modes and knowledge about the fuel safety management.

COURSE OUTCOMES (COs):

CO 1	Define the System concepts, sub-systems, Generic system definition, inputs, outputs, feedback, external influence and describe the Aircraft systems- airframe systems, vehicle systems, avionics systems, mission systems and their sub-systems
CO 2	Describe the Electrical loads in aircraft. Explain Electrical power generation and control- DC, AC-types, variable speed constant frequency (VSCS) cycloconverter, 270 V DC systems. Explain the Basic air cycle systems, Vapour cycle systems, boost-strap systems.
CO 3	Define Hydraulic systems and pneumatic systems. Explain their Working principles, Typical air pressure system, Brake system, landing gear systems.
CO 4	Describe the Principle of operation of aircraft gas turbine engines, Engine monitoring sensors, indicators. Describe the Fuel systems- characteristics, components, operating modes, Fuel Tank safety- fuel inserting system.

CO 5	Define Flight control systems- primary and secondary flight control explain Engine control systems, Push pull rod system, Modern control systems, Digital fly by wire systems Control linkages, actuation- types.

COURSE LEARNING OUTCOMES (CLOs):

AAE010.01	Define the meaning of the system and its characteristics and identify different types of aircraft systems.
AAE010.02	Describe the various electrical power generations in the aircraft and discover more electric aircraft.
AAE010.03	Estimate the electrical power requirements and can optimize the load distribution.
AAE010.04	Describe the importance of hydraulic systems and its components and develop hydraulic systems.
AAE010.05	Illustrate the importance and criticality of landing gears.
AAE010.06	Recognize the applications of pneumatic systems and the application of the bleed air.
AAE010.07	Classify the various types of engine control system including advanced digital controls.
AAE010.08	Identify important flight control operations and selects suitable flight control actuations.
AAE010.09	Demonstrate the various types of air conditioning systems and vapour cycle systems.
AAE010.10	Identify the environmental control systems relating to aircraft systems.
AAE010.11	Classify the types of hydraulic fluids applied in aircraft industry and advancement in it.
AAE010.12	Estimate the various fuel inerting systems and indications for aircraft systems.
AAE010.13	Illustrate the importance of fly-by-wire technology in aircraft systems.
AAE010.14	Describe the pneumatics systems and its components.
AAE010.15	Estimate the various engine performances and their application in aircraft systems.

TUTORIAL QUESTION BANK

UNIT -I				
INTRODUCTION TO AIRCRAFT SYSTEMS				
Part - A (Short Answer Questions)				
S No	**QUESTIONS**	**Blooms taxonomy level**	**Course Outcomes**	**Course Learning Outcomes**
1	Sketch the block diagram of aircraft as a set of subsystems.	Remember	CO 1	AAE010:01
2	State the Vehicle System of the aircraft.	Understand	CO 1	AAE010:01
3	Define the Avionic System of the aircraft.	Understand	CO 1	AAE010:01
4	Define the mission System of the aircraft.	Understand	CO 1	AAE010:01
5	State the generic aircraft system.	Remember	CO 1	AAE010:01
6	Define system in terms of aircraft systems.	Understand	CO 1	AAE010:01
7	Write some everyday examples of system.	Remember	CO 1	AAE010:01
8	Write the full form of TCAS.	Remember	CO 1	AAE010:01
9	State product system of product environment.	Understand	CO 1	AAE010:01
10	Define design drivers concept in aircraft system.	Remember	CO 1	AAE010:02
Part - B (Long Answer Questions)				
1	Describe the Vehicle System of the aircraft with examples.	Understand	CO 1	AAE010:01
2	Define system and explain every day examples of system.	Understand	CO 1	AAE010:01
3	Describe the Avionic System of the aircraft with examples.	Understand	CO 1	AAE010:01
4	Describe the mission System of the aircraft with examples.	Remember	CO 1	AAE010:01
5	Explain the generic aircraft system with examples and diagram.	Understand	CO 1	AAE010:01
6	Enumerate the major aircraft systems and their subsystems of civil transport aircraft.	Remember	CO 1	AAE010:01
7	Justify how external environment will affect the system with examples.	Understand	CO 1	AAE010:01
8	Explain the radio frequency radiation, altitude and temperature of product environment.	Remember	CO 1	AAE010:01
9	Sketch and explain the hierarchical view of a project system.	Understand	CO 1	AAE010:01
10	Sketch and explain the hierarchical view of a product system.	Remember	CO 1	AAE010:01
Part - C (Problem Solving And Critical Thinking Questions)				
1	Explain the health, safety and environmental issues and standards, regulations of project environment.	Understand	CO 1	AAE010:02
2	Explain briefly system thinking of system integration.	Remember	CO 1	AAE010:01
3	Explain dual redundant aircraft systems with block diagram	Understand	CO 1	AAE010:01
4	Explain the head up display unit with neat sketch and explain its advantages and disadvantages over CRT display.	Remember	CO 1	AAE010:01
5	What are the flight instruments in aircraft? What are the standby instruments in case of each type of instrument?	Understand	CO 1	AAE010:01
6	Describe the business environment with neat sketches.	Remember	CO 1	AAE010:0
7	What is flight management system? With neat sketch explain flight management system.	Understand	CO 1	AAE010:01
8	Explain how the operating environment conditions of an aircraft are maintained.	Remember	CO 1	AAE010:01
9	Explain product operating environment with neat sketches..	Understand	CO 1	AAE010:02
10	Explain air data measurement and flight management system briefly with sketches.	Understand	CO 1	AAE010:01
UNIT -II				
ELECTRICAL SYSTEMS AND AIR CONDITIONING, PRESSURIZING SYSTEMS				

Part - A (Short Answer Questions)				
1	Define Power conversions of electrical systems.	Remember	CO 2	AAE010:02
2	Define Energy storage devices and give examples.	Remember	CO 2	AAE010:02
3	Describe Electrical load protection devices.	Understand	CO 2	AAE010:03
4	What is Transformer Rectifier Unit with neat sketch?	Remember	CO 2	AAE010:02
5	Write the full form of ELMS.	Understand	CO 2	AAE010:03
6	Define g tolerance in air conditioning systems.	Understand	CO 2	AAE010:03
7	Define Humidity control in air conditioning systems.	Understand	CO 2	AAE010:02
8	Write the full form of MSOC in air conditioning systems.	Remember	CO 2	AAE010:03
9	Define Cabin pressurization in pressurizing systems.	Understand	CO 2	AAE010:02
10	Define hypoxia in air conditioning systems.	Remember	CO 2	AAE010:03
Part - B (Long Answer Questions)				
1	Explain AC power generation in aircraft.	Remember	CO 2	AAE010:02
2	Explain Emergency power generation in aircraft.	Understand	CO 2	AAE010:02
3	Explain different electrical loads in aircraft.	Remember	CO 2	AAE010:03
4	Describe working principle of Variable Speed Constant Frequency (VSCS).	Understand	CO 2	AAE010:02
5	Explain the Electrical Load Management System with neat sketch.	Understand	CO 2	AAE010:03
6	Explain turbofan and bootstrap system refrigeration systems with sketch.	Remember	CO 2	AAE010:04
7	Discuss about anti -icing systems	Understand	CO 2	AAE010:02
8	Explain about fire detection systems.	Remember	CO 2	AAE010:03
9	Explain passenger evacuation and crew escape of emergency systems.	Understand	CO 2	AAE010:02
10	Explain power conversion and energy storage systems with sketches	Remember	CO 2	AAE010:02
Part – C (Problem Solving And Critical Thinking)				
1	Write the different types of Power conversions required in aircraft.	Remember	CO 2	AAE010:02
2	Explain the primary power distribution of aircraft with neat sketch.	Remember	CO 2	AAE010:02
3	Explain DC power generation in aircraft electrical system.	Understand	CO 2	AAE010:03
4	Explain vapour cycle systems with neat sketch.	Remember	CO 2	AAE010:02
5	List out the various types of modern electrical power generations in aircraft and their applications.	Remember	CO 2	AAE010:03
6	Explain emergency oxygen systems of aircraft sytems.	Understand	CO 2	AAE010:02
7	Explain 270VDC system and more electric aircraft.	Remember	CO 2	AAE010:03
8	Explain the secondary power distribution of aircraft with sketch.	Understand	CO 2	AAE010:02
9	What is fire protection system? Explain any one fire protection system?	Remember	CO 2	AAE010:02
10	Explain reversed bootstrap and ram powered bootstrap systems with sketches.	Understand	CO 2	AAE010:03
UNIT –III				
HYDRAULIC SYSTEMS AND PNEUMATIC SYSTEMS				
Part - A (Short Answer Questions)				
1	What is hydraulic system in aircraft system.	Understand	CO 3	AAE010:04
2	Write any two Hydraulic fluids of hydraulic systems.	Understand	CO 3	AAE010:05
3	Define Fluid temperature of hydraulic systems.	Understand	CO 3	AAE010:04
4	Define Hydraulic fluid flow rate of hydraulic systems.	Understand	CO 3	AAE010:04
5	What is a landing gear with sketch?	Understand	CO 3	AAE010:05
6	Write the full form of ABS in hydraulic systems.	Remember	CO 3	AAE010:04
7	What is anti skidding system of hydraulics.	Understand	CO 3	AAE010:05
8	Sketch the nose gear of Boeing aircraft.	Remember	CO 3	AAE010:05
9	Define oleo strut in landing gear mechanism.	Understand	CO 3	AAE010:05
10	Define hydraulic pressure in hydraulic actuation.	Remember	CO 3	AAE010:02

11	Define bleed air system in pitot and static systems.	Remember	CO 3	AAE010:06
12	What is Wing anti icing system with sketches?	Understand	CO 3	AAE010:06
13	Discuss engine anti icing system.	Understand	CO 3	AAE010:06
14	Define Engine Start in pneumatic systems.	Remember	CO 3	AAE010:04
15	Define Thrust reversers in pneumatic systems.	Remember	CO 3	AAE010:06
16	Write the equation for total pressure in pitot and static systems.	Understand	CO 3	AAE010:04
17	Define ADM in pneumatic systems.	Remember	CO 3	AAE010:04
18	Define pitot and static probes in pitot and static systems.	Understand	CO 3	AAE010:06
19	Write the full form of PRSOV and HP SOV	Remember	CO 3	AAE010:06
20	What is meant by bypass ratio.	Understand	CO 3	AAE010:04
Part – B (Long Answer Questions)				
1	Explain the principal design requirements of hydraulic system in application of aircraft.	Remember	CO 3	AAE010:04
2	Write the applications of hydraulic Systems in aircraft.	Understand	CO 3	AAE010:02
3	Examine the important components of a typical hydraulic system and their functions.	Remember	CO 3	AAE010:04
4	Explain the fluid conditioning and reservoir.	Understand	CO 3	AAE010:04
5	Explain the different types of hydraulic pumps.	Remember	CO 3	AAE010:04
6	List out various types of braking and anti skidding systems in aircraft and discus the working principle briefly.	Understand	CO 3	AAE010:02
8	What is a bleed air and write use of bleed air in aircraft systems?	Remember	CO 3	AAE010:06
9	Explain Wing and engine anti icing system with sketches.	Understand	CO 3	AAE010:04
10	Explain Engine Start and Thrust reverser's process.	Understand	CO 3	AAE010:06
11	Explain how a pitot static pressure is used for measuring airspeeds, aircraft altitudes and vehicle speeds.	Understand	CO 3	AAE010:04
12	Explain the operating principle and constructional features of bleed air control in pneumatic systems.	Remember	CO 3	AAE010:06
Part – C (Problem Solving And Critical Thinking)				
1	Justify how a hydraulic system takes an important role in aircraft.	Remember	CO 3	AAE010:04
2	Explain the multi wheel systems with neat sketches.	Understand	CO 3	AAE010:03
3	Explain with suitable diagram the working of a hydraulic system.	Remember	CO 3	AAE010:04
4	Write short notes on Hydraulic fluids, Fluid temperature, and Hydraulic fluid flow rate.	Understand	CO 3	AAE010:04
5	Explain the main landing gear with neat sketches.	Remember	CO 3	AAE010:04
6	Explain the working principle of the fallowing braking and anti skidding system in use in aircrafts - Dunlop Maxaret Anti skidding system, Electronic control of braking and anti skidding system and Dunlop Automatic brake control system.	Understand	CO 3	AAE010:05
8	Explain the difference between hydraulics system and pneumatic system.	Understand	CO 3	AAE010:06
9	Explain the green channel hydraulic system.	Remember	CO 3	AAE010:04
10	Sketch and write the working principle of pressure reducing shut off valves.	Understand	CO 3	AAE010:06
11	Sketch and explain the pneumatic and hydraulic system interaction.	Remember	CO 3	AAE010:04
12	Explain air data system using ADM.	Understand	CO 3	AAE010:06
UNIT -IV				

ENGINE CONTROL AND FUEL SYSTEMS				
Part – A (Short Answer Questions)				
1	Define flow control in fuel systems.	Understand	CO 4	AAE010:07
2	What is FADEC of fuel systems.	Remember	CO 4	AAE010:08
3	Write input and output signals of engine control system.	Understand	CO 4	AAE010:09
4	Discuss Engine Power off takes of engine control systems.	Remember	CO 4	AAE010:08
5	Define Fuel Tank safety of fuel systems.	Understand	CO 4	AAE010:07
6	What is Fuel jettison of fuel systems?	Remember	CO 4	AAE010:07
7	Write the Fuel System Components.	Understand	CO 4	AAE010:09
8	What is fuel inverting system of fuel systems?	Remember	CO 4	AAE010:10
9	What is gas turbine engine of engine control systems?	Understand	CO 4	AAE010:07
10	Define Fuel Quantity measuring sensors of fuel systems.	Understand	CO 4	AAE010:10
Part – B (Long Answer Questions)				
1	Explain briefly few early jet engines.	Understand	CO 4	AAE010:07
2	Explain engine control system parameters.	Remember	CO 4	AAE010:10
3	Describe a gas turbine engine with neat sketch.	Understand	CO 4	AAE010:10
4	Explain inflight refueling system with examples.	Remember	CO 4	AAE010:11
5	Explain the fuel booster pumps in fuel systems.	Understand	CO 4	AAE010:07
6	Explain the engine indicators in the cockpit controller.	Understand	CO 4	AAE010:07
7	Justify How fuel transfer pump differs from fuel booster pump.	Remember	CO 4	AAE010:11
8	Enumerate the different fuel transfer valves.	Understand	CO 4	AAE010:12
9	How can you measure the fuel quantity in fuel tank?	Remember	CO 4	AAE010:07
10	Discuss the concept of heat sink.	Understand	CO 4	AAE010:12
Part – C(Problem Solving And Critical Thinking)				
1	Evaluate the two important types of flow controls?	Remember	CO 4	AAE010:07
2	Justify input and output signals of engine control system. List out these signals.	Understand	CO 4	AAE010:12
3	Write the important components of FADEC and Write its advantages.	Remember	CO 4	AAE010:12
4	Explain pilot in loop Engine control system (Manual).	Understand	CO 4	AAE010:11
5	Explain Limited authority engine control system with suitable blockDiagram.	Understand	CO 4	AAE010:07
6	Explain the Sequence of Engine starting.	Remember	CO 4	AAE010:07
7	Explain the important Engine indicators/reading parameters/ Engine Monitoring- sensors.	Understand	CO 4	AAE010:11
8	Explain fuel quantity measurement.	Understand	CO 4	AAE010:12
9	Write Short notes on Engine Power off takes, Fuel Tank safety and Inflight fuelling system.	Remember	CO 4	AAE010:07
10	Describe the Fuel System Components.	Understand	CO 4	AAE010:12
UNIT -V				
AIRPLANE CONTROL SYSTEMS				
Part - A (Short Answer Questions)				
1	Write primary flight controls of aircraft of flight controls systems.	Remember	CO 5	AAE010:15
2	What are secondary flight controls of aircraft?	Understand	CO 5	AAE010:14
3	What is actuation in terms of aircraft systems.	Remember	CO 5	AAE010:13
4	Define multiple redundancy actuations.	Understand	CO 5	AAE010:12
5	Define Flyby wire technology of aircraft systems.	Understand	CO 5	AAE010:14
6	Write the principles of flight control of flight control systems.	Understand	CO 5	AAE010:13
7	Define Redundancy in terms of aircraft systems.	Remember	CO 5	AAE010:13
8	What are the different power control units.	Understand	CO 5	AAE010:14
9	State aircraft communication and navigation systems	Remember	CO 5	AAE010:15

10	Define instrument landing systems of aircraft systems.	Understand	CO 5	AAE010:08
Part - B (Long Answer Questions)				
1	Justify How a push pull control rod system mechanism helped for flight controls.	Remember	CO 5	AAE010:15
2	Discuss the merits and de merits of cable and pulley system for Controlling the flight control surfaces.	Understand	CO 5	AAE010:14
3	Explain any one advanced actuation system.	Remember	CO 5	AAE010:13
4	Explain Mechanical Screw jack Actuator.	Understand	CO 5	AAE010:08
5	Explain direct drive actuation and electro hydrostatic actuator.	Understand	CO 5	AAE010:15
6	Write the inter-relationship of flight control, guidance and flight Management.	Understand	CO 5	AAE010:13
7	Write the communication and navigation aids systems and explain very high frequency?	Remember	CO 5	AAE010:15
8	Explain the concept of trim and feel.	Understand	CO 5	AAE010:10
9	Explain the communications and navigation system.	Remember	CO 5	AAE010:12
10	Explain briefly satellite communication systems?	Understand	CO 5	AAE010:13
Part – C (Problem Solving And Critical Thinking)				
1	Explain high lift control devices of acommercial aircraft.	Remember	CO 5	AAE010:12
2	Justify Why redundancy is required in flight control actuation? Explain the multiple redundancy actuations with suitable sketch.	Understand	CO 5	AAE010:12
3	Explain push pull control rod systems with neat sketch.	Remember	CO 5	AAE010:13
4	Illustrate the usage of cable and pulley systems.	Understand	CO 5	AAE010:14
5	Explain multiple redundancy actuation system with neat sketch	Understand	CO 5	AAE010:12
6	Discuss any two systems of the communication and navigation aids.	Understand	CO 5	AAE010:13
7	Explain mechanical actuation with electrical signaling.	Remember	CO 5	AAE010:13
8	What is A330 FBW system? Explain with block diagram.	Understand	CO 5	AAE010:14
9	Explain briefly instrument landing system.	Remember	CO 5	AAE010:15
10	Write and explain briefly the aircraft control surfaces with a neat sketch.	Understand	CO 5	AAE010:13

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