J.J COLLEGE OF ENGINEERING AND TECHNOLOGY

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SOWDAMBIKAA GROUP OF INSTITUTIONS

ESTD. 1994

DEPARTMENT OF AERONAUTICAL ENGINEERING

AE3302– AIRCRAFT SYSTEMS AND INSTRUMENTS

QUESTION BANK

R-2021

INSTITUTE VISION & MISSION

VISION:

To become a globally recognized "Centre of Academic Excellence" providing Quality Education to all students.

MISSION:

To provide Quality Education in the fields of Engineering, Management, Information, Technology and other Engineering areas.

DEPARTMENT VISION & MISSION

VISION:

To prepare technically skilled and competent intellectual professional graduates to meet the challenges in the Aerospace industry.

MISSION:

M1: To produce technologically competent graduates to be front-runner in their profession.

M2: To provide state-of-the-art facilities and laboratories so as to enhance excellence in teaching and learning process.

M3: To provide need-based quality training programmes in the field of the Aerospace industry.

M4: Enhance the students' sound knowledge in the latest technologies by organizing technical programs and encouraging students to make them present papers and participate in technical events.

PROGRAM EDUCATIONAL OBJECTIVES (PEOs)

PEO1	To employ comprehensive knowledge in Aeronautical Engineering and analytical skills to work towards solving complex problems to excel in the professional career.
PEO2	To design, analyze and produce cutting edge engineering solutions by employing modern techniques and adhering to moral values for sustainable development.
PEO3	To assume global careers and leadership responsibilities through consistent learning with idealistic managerial practices.

PROGRAM OUTCOMES (POs)

PO1	**Engineering knowledge**: Apply the knowledge of mathematics, science, engineering fundamentals and an engineering specialization to the solution of complex engineering problems.
PO2	**Problem analysis:** Identify, formulate, review research literature, and analyze complex engineering problems reaching substantiated conclusions Using first principles of mathematics, natural sciences, and engineering sciences.
PO3	**Design/development of solutions:** Design solutions for complex engineering problems and design system components or processes that meet the specified needs with appropriate consideration for public health and safety, and the cultural, societal, and environmental considerations.
PO4	**Conduct investigations of complex problems:** Use research-based knowledge and research methods including the design of experiments, Analysis and interpretation of data, and synthesis of the information to provide valid conclusions.
PO5	**Modern tool usage:** Create, select, and apply appropriate techniques, resources, and modern engineering and IT tools including prediction and modeling to complex Engineering activities with an understanding of the limitations.
PO6	**The engineer and society:** Apply to reason in formed by the contextual Knowledge to assess societal, health, safety, legal and cultural issues and the Consequent responsibilities relevant to the professional engineering practice.
PO7	**Environment and sustainability:** Understand the impact of the professional engineering solutions in societal and environmental contexts, and demonstrate the knowledge of, and need for sustainable development.

PO8	**Ethics:** Apply ethical principles and commit to professional ethics and Responsibilities and norms of the engineering practice.
PO9	**Individual and team work:** Function effectively as an individual, and as a Member or leader in Diverse teams, and in multidisciplinary settings.
PO10	**Communication:** Communicate effectively on complex engineering activities with the engineering community and with society at large, such as, being able To comprehend And write effective reports and design documentation, make effective presentations, and give and Receive clear instructions.
PO11	**Project management and finance**: Demonstrate knowledge and understanding of the engineering and management principles and apply These to one's own work, as a member and leader in a team, to manage projects and in multidisciplinary environments.
PO12	**Life-long learning:** Recognize the need for, and have the preparation and ability to Engage in in dependent and life-long learning in the broadest context of technological change.

PROGRAM SPECIFIC OUTCOMES (PSOs)

PSO1	To gather data using modern tools and apply design techniques to develop solutions for challenges in the domain of Aerodynamics, Propulsion, Aircraft Structures and Aircraft Maintenance with professional ethics.
PSO2	To function as engineering solution providers or entrepreneurs, who are able to manage, innovate, communicate, train and lead a team for continuous improvement.
PSO3	Graduate will be able to work as a team member which will be a main requirement in industry or research organisation or in any business enterprise. This will pave the way for successful career for the graduate and also play a role for the success of the organisation in which the graduate is employed.

AE3302	AIRCRAFT SYSTEMS AND INSTRUMENTS	L	T	P	C
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COURSE OBJECTIVES:

This course will familiarize the students with the Aircraft engine maintenance procedure and practice, acquire knowledge of basics of Aeronautics and engine components, learn the concepts of Piston engines, aware of aircraft propellers and repair and aircraft jet engines and repair.

UNIT I AIRCRAFT SYSTEMS 9

Hydraulic systems – Study of typical systems – components – Hydraulic systems controllers – Modes of operation – Pneumatic systems – Working principles – Typical Pneumatic Power system – Brake system – Components, Landing Gear Systems – Classification – Shock absorbers – Retractive mechanism.

UNIT II AIRPLANE CONTROL SYSTEMS 9

Conventional Systems – Power assisted and fully powered flight controls – Power actuated systems – Engine control systems – Push pull rod system – operating principles – Modern control systems – Digital fly by wire systems – Auto pilot system.

UNIT III AIRPLANE CONTROL SYSTEMS 9

Piston and Jet Engines- Fuel systems – Components - Multi-engine fuel systems, lubricating systems – Starting and Ignition systems.

UNIT IV AIRCONDITIONING AND PRESSURIZING SYSTEM 9

Basic Air Cycle systems – Vapour Cycle Systems, Boot-strap air cycle system – Evaporative vapour cycle systems – Evaporation air cycle systems – Oxygen systems – Fire extinguishing system and smoke detection system, Deicing and anti-icing system.
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UNIT V AIRCRAFT INSTRUMENTS 9

Flight Instruments and Navigation Instruments – Accelerometers, Air speed Indicators – Mach Meters – Altimeters - Gyroscopic Instruments– Principles and operation – Study of various types of engine instruments – Tachometers – Temperature and Pressure gauges.

TOTAL:45 PERIODS

COURSE OUTCOMES (COs)

On completion of the course, the student is expected :	
CO1	Demonstrate the ability to design a various system using pneumatic and hydraulic components
CO2	Keep abreast knowledge on various flight control system and its recent advancements
CO3	Demonstrate the fundamental understanding of the operation of engine auxiliary systems.
CO4	To understand the various cabin comfort system used in aircraft modern display systems
CO5	Describe the principle behind the operation of various vital parameter displays and its uses in effective conduct of the flight .

CO's – PO's & PSO's MAPPING

Correlation of COs with POs / PSOs															
COs	**PO1**	**PO2**	**PO3**	**PO4**	**PO5**	**PO6**	**PO7**	**PO8**	**PO9**	**PO10**	**PO11**	**PO12**	**PSO1**	**PSO2**	**PSO3**
CO1	3	2	3	2	2	2	2	1	2	3	1	2	3	1	1
CO2	3	3	2	2	1	2	1	1	2	3	1	1	3	1	1
CO3	3	3	2	2	3	1	2	1	2	3	1	1	3	1	1
CO4	3	3	2	2	3	3	3	1	2	3	1	1	3	1	1
CO5	3	3	3	2	2	1	2	1	1	3	1	1	3	1	1
AVG	**3**	**2.8**	**2.4**	**2**	**2.2**	**1.8**	**2**	**1**	**1.8**	**3**	**1**	**1.2**	**3**	**1**	**1**
3 – High; 2 – Medium; 1 – Low; – No correlation															

TEXT BOOKS:

1. Mekinley, J.L. and R.D. Bent, Aircraft Power Plants, McGraw Hill, 1993.
2. Pallet, E.H.J. Aircraft Instruments & Principles, Pitman & Co, 1993ill,

REFERENCE BOOKS:

1. Handbooks of Airframe and Power Plant Mechanics, US dept. of Transportation, Federal, Aviation Administration, the English Book Store, New Delhi, 1995.
2. McKinley, J.L. and Bent R.D. Aircraft Maintenance & Repair, McGraw Hill, 1993.
3. Teager, S, "Aircraft Gas Turbine technology, McGraw Hill 1997.

UNIT– I

AIRCRAFT SYSTEMS

PART–A				
Q. No	**Questions**	**CO Mapping**	**BT Level**	**Complexity**
1	What are the different types of hydraulic fluids used in aircraft?	CO1	Understand	Low
2	Define the function of an aircraft electrical system.	CO1	Remember	Low
3	What is the purpose of an aircraft fuel system?	CO1	Understand	Low
4	Differentiate between open loop and closed loop hydraulic systems.	CO1	Understand	Low
5	What are the primary components of an aircraft hydraulic system?	CO1	Understand	Low
6	Explain the importance of redundancy in aircraft electrical systems.	CO1	Understand	Medium
7	What is the role of a fuel booster pump in an aircraft?	CO1	Understand	Low
8	Define the term "fly by wire" system.	CO1	Remember	Low
9	What is the function of an auxiliary power unit (APU)?	CO1	Understand	Low
10	How does an aircraft braking system work?	CO1	Remember	Low

PART–B				
Q. No	**Questions**	**CO Mapping**	**BT Level**	**Complexity**
1	Explain the working principle and components of an aircraft hydraulic system.	CO1	Understand	Medium
2	Describe the electrical power generation system in modern aircraft.	CO1	Understand	Medium
3	Discuss the different types of aircraft fuel systems and their working principles.	CO1	Understand	Medium
4	Explain the importance and operation of an auxiliary power unit (APU) in aircraft.	CO1	Understand	Medium
5	Describe the working principle of the fly by wire system and its advantages.	CO1	Understand	Medium
6	Explain the various redundancy features in an aircraft electrical system.	CO1	Understand	Medium
7	Discuss the working and importance of the aircraft braking system.	CO1	Understand	Medium
8	Describe the function and operation of an emergency backup system in aircraft.	CO1	Understand	Medium
9	Explain the operation of an aircraft pneumatic system and its applications.	CO1	Understand	Medium
10	Discuss the safety measures involved in aircraft hydraulic systems.	CO1	Understand	Medium

UNIT– II

AIRPLANE CONTROL SYSTEMS

PART–A				
Q. No	**Questions**	**CO Mapping**	**BT Level**	**Complexity**
1	What are primary flight control surfaces?	CO2	Understand	Low
2	Define the function of an aileron.	CO2	Remember	Low
3	What is the purpose of a trim tab in an aircraft?	CO2	Understand	Low
4	Differentiate between mechanical and powered flight control systems.	CO2	Understand	Low
5	What is the purpose of an autopilot system in an aircraft?	CO2	Understand	Low
6	Explain the function of a yaw damper.	CO2	Understand	Low
7	What is a stability augmentation system?	CO2	Understand	Low
8	Define artificial feel in flight control systems.	CO2	Remember	Low
9	What are secondary flight control surfaces?	CO2	Understand	Low
10	Explain the role of a servo actuator in flight control.	CO2	Understand	Low

PART–B				
Q.No	**Questions**	**CO Mapping**	**BT Level**	**Complexity**
1	Explain the working of primary flight control surfaces with neat sketches.	CO2	Understand	Medium
2	Discuss the types of secondary flight control surfaces and their functions.	CO2	Understand	Medium
3	Explain the working and advantages of the fly By wire control system.	CO2	Understand	Medium
4	Describe the working principle of an autopilot system in modern aircraft.	CO2	Understand	Medium
5	Explain the operation of stability augmentation systems in an aircraft.	CO2	Understand	Medium
6	Discuss the importance and working of yaw dampers.	CO2	Understand	Medium
7	Explain how trim tabs help in maintaining level flight.	CO2	Understand	Medium
8	Describe the difference between manual and hydraulic flight control systems.	CO2	Understand	Medium
9	Discuss the importance of artificial feel systems in aircraft.	CO2	Understand	Medium
10	Explain the operation of mechanical and power	CO2	Understand	Medium

UNIT – III
ENGINE SYSTEMS

PART–A				
Q. No	**Questions**	**CO Mapping**	**BT Level**	**Complexity**
1	What are the major components of an aircraft fuel system?	CO3	Understand	Low
2	Define the function of an engine lubrication system.	CO3	Remember	Low
3	What is the purpose of a thrust reverser?	CO3	Understand	Low
4	What are the types of fuel used in aircraft engines?	CO3	Understand	Low
5	Differentiate between a wet sump and a dry sump lubrication system.	CO3	Understand	Low
6	What is the function of an ignition system in an aircraft engine?	CO3	Understand	Low
7	Explain the importance of an engine monitoring system.	CO3	Understand	Low
8	What is the purpose of engine bleed air?	CO3	Understand	Low
9	Define the term "engine fire detection system."	CO3	Remember	Low
10	What is the purpose of the fuel control unit in jet engines?	CO3	Understand	Low

PART–B				
Q. No	**Questions**	**CO Mapping**	**BT Level**	**Complexity**
1	Explain the operation and components of an aircraft engine fuel systems.	CO3	Understand	Medium
2	Discuss the different types of aircraft lubrication systems.	CO3	Understand	Medium
3	Explain the working of an engine fire detection and suppression system.	CO3	Understand	Medium
4	Describe the thrust reverser mechanism and its importance.	CO3	Understand	Medium
5	Explain the operation of a jet engine ignition system.	CO3	Understand	Medium
6	Discuss the working and advantages of engine monitoring systems.	CO3	Understand	Medium
7	Explain the concept of engine bleed air and its applications.	CO3	Understand	Medium
8	Describe the function and importance of the fuel control unit.	CO3	Understand	Medium
9	Discuss the role of FADEC (Full Authority Digital Engine Control) in modern engines.	CO3	Understand	Medium
10	Explain the different types of aircraft engine starting systems.	CO3	Understand	Medium

UNIT – IV

AIRCONDITIONING AND PRESSURIZING SYSTEM

PART–A				
Q. No	**Questions**	**CO Mapping**	**BT Level**	**Complexity**
1	What is the purpose of an aircraft air conditioning system?	CO4	Understand	Low
2	Define cabin pressurization and its importance in aircraft.	CO4	Remember	Low
3	What is the function of an outflow valve in a pressurization system?	CO4	Understand	Low
4	Explain the concept of isobaric and isobaric differential pressurization.	CO4	Understand	Medium
5	What are the sources of bleed air for aircraft air conditioning?	CO4	Understand	Low
6	What is an air cycle machine (ACM) in aircraft?	CO4	Understand	Low
7	Define the term "cabin altitude" in pressurization systems.	CO4	Remember	Low
8	What is the significance of an oxygen system in an aircraft?	CO4	Understand	Low
9	What is the function of a cabin pressure regulator?	CO4	Understand	Low
10	Explain the difference between manual and automatic cabin pressurization control.	CO4	Understand	Medium

PART–B				
Q. No	**Questions**	**CO Mapping**	**BT Level**	**Complexity**
1	Explain the working principle and components of an aircraft air conditioning system.	CO4	Understand	Medium
2	Describe the cabin pressurization system and its different modes of operation.	CO4	Understand	Medium
3	Explain the working of an air cycle machine (ACM) with a neat sketch.	CO4	Understand	Medium
4	Discuss the different types of oxygen systems used in aircraft.	CO4	Understand	Medium
5	Explain the importance of cabin altitude control and how it affects passengers.	CO4	Understand	Medium
6	Describe the role of the outflow valve and safety valve in a pressurization system.	CO4	Understand	Medium
7	Discuss the environmental control system (ECS) in aircraft and its significance.	CO4	Understand	Medium
8	Explain the effects of high altitude flight on human physiology and the role of the pressurization system.	CO4	Understand	Medium
9	Describe the cooling process in an aircraft air conditioning system.	CO4	Understand	Medium
10	Discuss the safety measures and emergency operations related to cabin pressurization failure.	CO4	Understand	Medium

UNIT – V

AIRCRAFT INSTRUMENTS

PART–A				
Q. No	**Questions**	**CO Mapping**	**BT Level**	**Complexity**
1	What are aircraft instruments?	CO5	Understand	Low
2	List the classifications of aircraft instruments.	CO5	Remember	Low
3	What is the function of a pitot-static system?	CO5	Understand	Low
4	Differentiate between gyroscopic and magnetic compass.	CO5	Understand	Low
5	What is the purpose of an altimeter?	CO5	Understand	Low
6	Define the principle of operation of an airspeed indicator.	CO5	Remember	Low
7	What are the errors in a Vertical Speed Indicator (VSI)?	CO5	Understand	Low
8	Explain the function of an attitude indicator.	CO5	Understand	Medium
9	What is the purpose of a turn and slip indicator?	CO5	Understand	Low
10	Define Mach number and explain its significance in aircraft instruments.	CO5	Remember	Low

PART–B				
Q. No	**Questions**	**CO Mapping**	**BT Level**	**Complexity**
1	Explain the working principle and operation of the Pitot-Static System with a neat sketch.	CO5	Understand	Medium
2	Discuss in detail the construction and working of an altimeter and its types.	CO5	Understand	Medium
3	Explain the airspeed indicator with a schematic diagram and discuss its errors.	CO5	Understand	Medium
4	Describe the Vertical Speed Indicator (VSI) with its principle of operation and error sources.	CO5	Understand	Medium
5	Explain the working of gyroscopic instruments such as attitude indicator, turn coordinator, and heading indicator.	CO5	Understand	Medium
6	Discuss the principle and operation of the magnetic compass and its errors.	CO5	Understand	Medium
7	Explain the Mach meter and its importance in high-speed aircraft.	CO5	Understand	Medium
8	Describe the Engine Indicating and Crew Alerting System (EICAS) in modern aircraft.	CO5	Understand	Medium
9	Write a detailed note on the Flight Data Recorder (FDR) and Cockpit Voice Recorder (CVR).	CO5	Understand	Medium
10	Explain the working principle of Electronic Flight Instrument System (EFIS) and its advantages.	CO5	Understand	Medium

THANK YOU

ALL THE BEST