J.J COLLEGE OF ENGINEERING AND TECHNOLOGY

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SOWDAMBIKAA GROUP OF INSTITUTIONS

ESTD. 1994

DEPARTMENT OF AERONAUTICAL ENGINEERING

AE3004–AIRCRAFT ENGINE MAINTENANCE AND REPAIR

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, engineeringfundamentalsandanengineeringspecializationtothesolutionof 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:**Communicateeffectivelyoncomplexengineeringactivities 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.

AE3004 AIRCRAFT ENGINE MAINTENANCE AND REPAIR 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 PISTON ENGINES 9

Carburation and Fuel injection systems for small and large engines - Ignition system components - spark plug detail - Engine operating conditions at various altitudes – Engine power measurements – Classification of engine lubricants and fuels – Induction, Exhaust and cooling system - Maintenance and inspection check to be carried out. Inspection and maintenance and troubleshooting - Inspection of all engine components - Daily and routine checks - Overhaul procedures - Compression testing of cylinders - Special inspection schedules - Engine fuel, control and exhaust systems - Engine mount and super charger - Checks and inspection procedures.

UNIT – II PROPELLERS 9

Propeller theory - operation, construction assembly and installation - Pitch change mechanism- Propeller axially system- Damage and repair criteria - General Inspection procedures - Checks on constant speed propellers - Pitch setting, Propeller Balancing, Blade cuffs, Governor/Propeller operating conditions – Damage and repair criteria.

UNIT – III JET ENGINES 9

Types of jet engines – Fundamental principles – Bearings and seals - Inlets – compressors turbines exhaust section – classification and types of lubrication and fuels- Materials used – Details of control, starting around running and operating procedures – Inspection and Maintenance- permissible limits of damage and repair criteria of engine components- internal inspection of engines- compressor washing- field balancing of compressor fans- Component maintenance procedures - Systems maintenance procedures - use of instruments for online maintenance - Special inspection procedures-Foreign Object Damage - Blade damage.

UNIT – IV TESTING AND INSPECTION 9

Symptoms of failure - Fault diagnostics - Case studies of different engine systems – Rectification during testing equipment's for overhaul: Tools and equipment's requirements for various checks and alignment during overhauling - Tools for inspection - Tools for safety and for visual inspection- Methods and instruments for non-destructive testing techniques - Equipment for replacement of parts and their repair. Engine testing: Engine testing procedures and schedule preparation – Online maintenance.

UNIT – V OVERHAULING 9

Engine Overhaul - Overhaul procedures - Inspections and cleaning of components – Repairs schedules for overhaul - Balancing of Gas turbine components. Trouble Shooting: Procedures for trouble shooting - Condition monitoring of the engine on ground and at altitude - engine health monitoring and corrective methods.

TOTAL:45 PERIODS

COURSE OUTCOMES (COs)

Students will be able to:	
CO1	Apply maintenance procedure to Aircraft Engines
CO2	Identify the engine components and faults
CO3	Apply non-destructive testing procedures to identify the defects
CO4	Apply overhauling procedure to new engines
CO5	Apply the compression testing of cylinders

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	2	-	-	-	-	-	-	-	-	-	-	-	2	-	-
CO2	2	-	1	-	-	-	1	1	-	-	-	2	-	-	-
CO3	3	1	-	-	-	-	1	1	1	2	1	3	2	1	-
CO4	3	1	-	-	-	-	-	-	1	-	-	-	2	1	1
CO5	2	-	-	-	-	-	-	-	-	-	-	-	2	2	1
AVG	**2.4**	**1**	**1**	**-**	**-**	**-**	**1**	**-**	**1.5**	**1**	**1.5**	**1**	**2.2**	**1.66**	**1**
3 – High; 2 – Medium; 1 – Low; – No correlation															

TEXT BOOKS:

1. Kroes & Wild, "Aircraft Power plants ", 7th Edition - McGraw Hill, New York,1994.

REFERENCE BOOKS:

1. Turbomeca, “Gas Turbine Engines ", The English Book Store ", New Delhi, 1993.
2. United Technologies’ Pratt & Whitney, "The Aircraft Gas Turbine Engine and its Operation”, The English Book Store, New Delhi

UNIT– I

PISTON ENGINES

PART–A				
Q. No	**Questions**	**CO Mapping**	**BT Level**	**Complexity**
1	Define carburation and its significance in piston engines.	CO1	Remember	Low
2	What are the primary functions of engine lubricants?	CO1	Understand	Low
3	Explain the purpose of a spark plug in an ignition system.	CO1	Understand	Medium
4	How does altitude affect engine operating conditions?	CO1	Understand	Low
5	What is the role of a supercharger in piston engines?	CO1	Understand	Low
6	Describe the process of compression testing in cylinders.	CO1	Understand	Low
7	What are the common troubleshooting steps for piston engines?	CO1	Understand	Low
8	List the components involved in the exhaust system of a piston engine.	CO1	Remember	Low
9	Define the term 'engine overhaul' in the context of piston engines.	CO1	Remember	Low
10	What is the significance of engine power measurements?	CO1	Understand	Low

PART–B				
Q. No	**Questions**	**CO Mapping**	**BT Level**	**Complexity**
1	Explain the carburation and fuel injection systems used in small and large piston engines, highlighting their operational differences and maintenance challenges.	CO1	Understand	Medium
2	Discuss the components of the ignition system in aircraft piston engines, focusing on the role and maintenance of spark plugs under various operating conditions at different altitudes.	CO1	Understand	Medium
3	Describe the procedures involved in the inspection, maintenance, and troubleshooting of piston engine components, including daily checks, overhaul procedures, and compression testing of cylinders.	CO1	Understand	Medium
4	Explain the classification of engine lubricants and fuels, and discuss their significance in the induction, exhaust, and cooling systems of piston engines.	CO1	Understand	Medium
5	Briefly explain the inspection and maintenance procedures for engine mounts and superchargers, detailing the checks and inspection protocols to ensure optimal performance.	CO1	Understand	Medium
6	Explain the working principles and performance characteristics of four-stroke and two-stroke aircraft piston engines.	CO1	Understand	Medium
7	Discuss the impact of altitude changes on the performance of piston engines and the corrective measures taken.	CO1	Understand	Medium
8	What is the types of cooling systems used in aircraft piston engines and their maintenance procedures?	CO1	Understand	Medium

9	Explain the importance of engine operating limitations and the factors affecting engine life and reliability.	CO1	Understand	Medium
10	Describe the detailed procedure for dismantling, inspecting, and assembling a piston engine for overhaul.	CO1	Understand	Medium

UNIT – II

PROPELLERS

PART–A				
Q. No	**Questions**	**CO Mapping**	**BT Level**	**Complexity**
1	What is the purpose of a pitch change mechanism in propellers?	CO2	Understand	Low
2	Define propeller balancing and its necessity.	CO2	Remember	Low
3	Explain the term 'propeller axial system.'	CO2	Understand	Medium
4	What are blade cuffs, and why are they used?	CO2	Understand	Low
5	Describe the function of a propeller governor.	CO2	Understand	Low
6	What is meant by propeller pitch setting?	CO2	Understand	Low
7	List common damages observed in propellers.	CO2	Remember	Low
8	Define 'constant speed propeller.'	CO2	Remember	Low
9	What is the significance of propeller assembly and installation?	CO2	Understand	Low
10	Explain the concept of propeller theory.	CO2	Understand	Medium

PART–B				
Q. No	**Questions**	**CO Mapping**	**BT Level**	**Complexity**
1	Explain the theory of propeller operation, including construction, assembly, installation, and the pitch change mechanism, and analyze how these factors influence aircraft performance.	CO2	Understand	Medium
2	Discuss the damage and repair criteria for propellers, focusing on general inspection procedures, checks on constant speed propellers, pitch setting, propeller balancing, blade cuffs, and governor/propeller operating conditions.	CO2	Understand	Medium
3	Describe the procedures for propeller balancing and pitch setting, emphasizing their importance in maintaining aircraft stability and performance.	CO2	Understand	Medium
4	Explain the general inspection procedures for propellers, including checks on constant speed propellers and the assessment of blade cuffs and governor operating conditions.	CO2	Understand	Medium
5	Discuss about the impact of propeller damage on aircraft performance and discuss the repair criteria to restore optimal functionality.	CO2	Understand	Medium
6	Explain the effect of propeller aerodynamics on aircraft performance and engine efficiency.	CO2	Understand	Medium
7	Explain the role of constant speed propellers and their advantages over fixed pitch propellers.	CO2	Understand	Medium
8	Discuss the methods of blade tracking and balancing in propeller maintenance.	CO2	Understand	Medium
9	Explain the causes of propeller vibration and the troubleshooting techniques used in maintenance.	CO2	Understand	Medium

10	Discuss about the safety precautions and handling procedures during propeller servicing and installation.	CO2	Understand	Medium

UNIT – III
JET ENGINES

PART–A				
Q. No	**Questions**	**CO Mapping**	**BT Level**	**Complexity**
1	List the main types of jet engines used in aircraft.	CO3	Remember	Low
2	What is Foreign Object Damage (FOD) in jet engines?	CO3	Remember	Low
3	Define the role of bearings in jet engines.	CO3	Remember	Low
4	What materials are commonly used in jet engine components?	CO3	Understand	Low
5	Explain the function of the compressor in a jet engine.	CO3	Understand	Medium
6	What is the purpose of turbine blades in jet engines?	CO3	Understand	Low
7	Describe the significance of lubrication in jet engines.	CO3	Understand	Low
8	What are common causes of blade damage in jet engines?	CO3	Understand	Low
9	Define 'compressor washing' in jet engine maintenance.	CO3	Remember	Low
10	What is the function of the exhaust section in a jet engine?	CO3	Understand	Low

PART–B				
Q. No	**Questions**	**CO Mapping**	**BT Level**	**Complexity**
1	Explain the fundamental principles of different types of jet engines, including the roles of bearings, seals, inlets, compressors, turbines, and exhaust sections, and discuss the materials used in their construction.	CO3	Understand	Medium
2	Discuss the classification and types of lubrication and fuels used in jet engines, and evaluate their impact on engine performance and maintenance requirements	CO3	Understand	Medium
3	Describe the inspection and maintenance procedures for jet engines, focusing on permissible limits of damage, repair criteria of engine components, internal inspection protocols, compressor washing, and field balancing of compressor fans.	CO3	Understand	Medium
4	Describe the use of instruments for online maintenance of jet engines, including special inspection procedures and techniques to address foreign object damage and blade damage.	CO3	Understand	Medium
5	Explain the effectiveness of component and systems maintenance procedures in ensuring the reliability and safety of jet engines during operation.	CO3	Understand	Medium
6	Explain the significance of thrust augmentation techniques such as afterburners and water injection.	CO3	Understand	Medium
7	Discuss the classification of compressors used in jet engines and compare axial and centrifugal compressors.	CO3	Understand	Medium
8	Illustrate the damage and failure modes of turbine blades and their impact on engine performance.	CO3	Analyze	High

9	Briefly explain the methods of thermal barrier coatings (TBCs) and cooling techniques used in turbine sections.	CO3	Understand	Medium
10	Describe the maintenance procedures and operational checks for jet engine accessory systems such as fuel control units and ignition systems.	CO3	Understand	Medium

UNIT – IV
TESTING AND INSPECTION

PART–A				
Q. No	**Questions**	**CO Mapping**	**BT Level**	**Complexity**
1	What are non-destructive testing techniques? Provide examples.	CO4	Understand	Low
2	Define fault diagnostics in the context of aircraft engines.	CO4	Remember	Low
3	What is the purpose of engine testing procedures?	CO4	Understand	Low
4	List common tools used for engine inspection.	CO4	Remember	Low
5	Explain the term 'condition monitoring' in engine maintenance.	CO4	Understand	Medium
6	What are symptoms of engine failure?	CO4	Understand	Low
7	Describe the role of alignment checks during engine overhauling.	CO4	Understand	Low
8	What is the significance of safety tools in engine inspection?	CO4	Understand	Low
9	Define 'engine health monitoring.'	CO4	Remember	Low
10	What is the role of case studies in fault diagnostics?	CO4	Understand	Low

PART–B				
Q. No	**Questions**	**CO Mapping**	**BT Level**	**Complexity**
1	Write the symptoms of engine failure and discuss fault diagnostic techniques, supported by case studies of different engine systems, to identify and rectify issues during testing.	CO4	Understand	Medium
2	Discuss the tools and equipment requirements for various checks and alignments during engine overhauling, including those used for inspection, safety, visual inspection, non-destructive testing techniques, and the replacement or repair of parts.	CO4	Understand	Medium
3	Describe the engine testing procedures and schedule preparation, emphasizing the importance of online maintenance in ensuring continuous engine reliability	CO4	Understand	Medium
4	Illustrate the methods and instruments used for non-destructive testing techniques in engine maintenance, highlighting their role in detecting potential issues without causing damage.	CO4	Analyze	High
5	Briefly Explain the significance of special inspection procedures in maintaining engine performance, and discuss how these procedures contribute to the overall safety and efficiency of aircraft operations.	CO4	Understand	Medium
6	Explain the procedures for conducting engine ground runs and the precautions involved.	CO4	Understand	Medium

7	Discuss the importance of vibration analysis and borescope inspections in aero engine health monitoring.	CO4	Understand	Medium
8	Illustrate the role of performance checks in identifying potential issues in an engine before failure.	CO4	Analyze	High
9	Explain the effectiveness of fault diagnosis and predictive maintenance techniques in engine reliability.	CO4	Understand	Medium
10	Describe the step By step process of leak detection tests for fuel and lubrication systems in aircraft engines.	CO4	Understand	Medium

UNIT – V

OVERHAULING

PART–A				
Q. No	**Questions**	**CO Mapping**	**BT Level**	**Complexity**
1	Define engine overhauling.	CO5	Remember	Low
2	What is condition monitoring in aircraft engines?	CO5	Understand	Low
3	List any two common maintenance checks performed on aero engines.	CO5	Remember	Low
4	What are the functions of a turbofan engine?	CO5	Understand	Low
5	What is the purpose of engine oil analysis?	CO5	Understand	Low
6	Define hot section inspection in gas turbine engines.	CO5	Remember	Low
7	Mention two methods used for detecting cracks in engine components.	CO5	Remember	Low
8	What is the significance of the boroscope inspection?	CO5	Understand	Low
9	Define compressor blade fouling and its effects.	CO5	Remember	Low
10	What is the function of the fuel nozzle in a jet engine?	CO5	Understand	Low

PART–B				
Q. No	**Questions**	**CO Mapping**	**BT Level**	**Complexity**
1	Analyze the engine overhaul procedures, including inspections, cleaning of components, repair schedules, and balancing of gas turbine components, to ensure optimal engine performance.	CO5	Analyze	High
2	Discuss the procedures for troubleshooting and condition monitoring of engines both on the ground and at altitude, and evaluate the methods used for engine health monitoring and corrective actions.	CO5	Understand	Medium
3	Describe the importance of engine health monitoring systems, including condition monitoring techniques and corrective methods, in maintaining engine reliability and performance.	CO5	Understand	Medium
4	Illustrate the balancing procedures for gas turbine components during overhauling, emphasizing their impact on engine efficiency and longevity.	CO5	Analyze	High
5	Evaluate the role of troubleshooting procedures in identifying and resolving engine issues, and discuss how effective troubleshooting contributes to overall flight safety.	CO5	Evaluate	High
6	Explain the process of strip inspection, cleaning, and reassembly in an engine overhaul cycle.	CO5	Understand	Medium
7	Illustrate the different methods of condition monitoring used for predicting engine failures.	CO5	Analyze	High

8	Evaluate the impact of foreign object damage (FOD) on engine components and the preventive measures taken.	CO5	Evaluate	High
9	Describe the process of vibration balancing and its importance in extending the service life of aero engines.	CO5	Understand	Medium

THANK YOU

ALL THE BEST