Hall Ticket No | | | | | | | | | | | Question Paper Code: BAEB02

INSTITUTE OF AERONAUTICAL ENGINEERING

(Autonomous)

Dundigal, Hyderabad - 500 043

MODEL QUESTION PAPER-I

M. Tech I Semester End Examinations, January -2020

Regulations: IARE - R18

AEROSPACE PROPULSION

(AEROSPACE ENGINEERING)

Time: 3hours **Max. Marks: 70**

Answer ONE Question from each Unit
All Questions Carry Equal Marks
All parts of the question must be answered in one place only

		UNIT – I	
1.	a)	Derive thrust equation for ideal turbojet engine and clearly expand the nomenclature of each equation.	**[7M]**
	b)	Explain and draw a detailed diagram of a turbojet engine with neat sketch. Is a turboprop different from turbofan? Justify.	**[7M]**
2.	a)	Sketch a neat and labeled diagram of a turbofan engine and explain its working principle.	**[7M]**
	b)	Explain in detail the working of a ramjet engine. Also, explain how a ramjet engine is different from a scramjet engine.	**[7M]**
		UNIT – II	
3.	a)	Classify combustion chambers and elaborate on each type of combustion chamber with highlights on each type.	**[7M]**
	b)	Derive the equations for performance of subsonic inlets. Draw a neat sketch of the various supersonic inlets.	**[7M]**
4.	a)	Explain the process of initiating the combustion in a solid propellant rocket motor.	**[7M]**
	b)	Describe the different phases of solid propellant burning from initial to the final phase.	**[7M]**
		UNIT – III	
5.	a)	Brief about the theory of flow through nozzle and derive an equation for the showing the flow through nozzle.	**[7M]**
	b)	Derive the equation for work done and pressure rise across centrifugal compressor.	**[7M]**
6.	a)	Derive the equation for stage efficiency. What are the advantages of centrifugal flow compressor over the axial flow compressor? Justify with appropriate reasoning.	**[7M]**
	b)	Explain in details about the basic operation of axial flow compressor and illustrate a labeled diagram of a compressor.	**[7M]**
		UNIT – IV	
7.	a)	Describe the different phases of solid propellant burning from initial to the final phase?	**[7M]**
	b)	With neat sketch explain the hybrid rocket propulsion system and label the parts.	**[7M]**

8.	a)	Why the initial temperature change causes much less change in the regression rate of a hybrid fuel than in the burning rate of a solid propellant. Explain and derive an equation for regression rate.	**[7M]**
	b)	Explain the major application categories for solid propellant rocket motors.	**[7M]**
UNIT – V			
9.	a)	Explain the combustion instabilities in liquid propellant rockets and the corrective measure to minimize the effect.	**[7M]**
	b)	Describe about the different types of liquid fuel injectors used in liquid rocket engines with the help of sketches.	**[7M]**
10	a)	Explain basic configuration of Liquid propellant rocket system using neat sketche.	**[7M]**
	b)	Discuss about oxidizers and fuels of liquid propellant rocks. Also state what is monopropellant and bipropellant?	**[7M]**

COURSE OBJECTIVES (CO):

The course should enable the students to:

S No	Description
I	Understand the basic working principles of different types of air breathing engines.
II	Understand analysis and design principles of IC engines.
III	Design and analyze and different components of gas turbines.
IV	Analyze and design different components of solid and liquid propellant rockets.

COURSE OUTCOMES (COs):

The course should enable the students to:

S No	Description
I	Describe the various types, basic function, and performance analysis of air-breathing engine.
II	Understand the various inlets and combustion chamber performance parameters affecting it.
III	Describe principle operations of compressors, with work done and pressure rise explaining the design and performance parameters of turbine, understand configuration associated
IV	Discuss the working principle of solid and liquid propellant rockets and gain basic knowledge of hybrid rocket propulsion.
V	Demonstrate the working principle of liquid propellant rockets and gain basic knowledge of rocket propulsion and its feed systems.

COURSE LEARNING OUTCOMES (CLOs):

Students, who complete the course, will have demonstrated the ability to do the following:

BAEB02.01	Demonstrate different type's aircraft engine operating principle.
BAEB02.02	Understand steps involved in performance analysis of all aircraft engine.
BAEB02.03	Analyze the engine performance parameters and parameters influencing them.
BAEB02.04	Describe operational modes of subsonic inlets and parameters influencing it.
BAEB02.05	Understand different types of combustion chamber and functions of all the components.
BAEB02.06	Describe supersonic inlets, starting problem in it and their operating modes.
BAEB02.07	Understand different design of compressor and limitations of each method.
BAEB02.08	Describe principle of operation of centrifugal and axial flow turbine.
BAEB02.09	Analyze performance characteristics of axial and centrifugal compressor.
BAEB02.10	Appreciate the different propellant feed system options for both chemical and electric propulsion systems, and their similarities/differences.
BAEB02.11	Demonstrate the salient features of solid propellants rockets and estimate the grain configuration designs suitable for different missions.
BAEB02.12	Identify the applications of standard and reverse hybrid systems with an overview of its limitations.
BAEB02.13	Discuss the various feed systems and injectors for liquid propellants rockets and associated heat transfer problems
BAEB02.14	Appreciate the different propellant feed system options for both chemical and electric propulsion systems, and their similarities/differences.
BAEB02.15	Discuss the various feed systems and injectors for liquid propellants rockets and associated heat transfer problems

MAPPING OF SEMESTER END EXAMINATION TO COURSE OUTCOMES

SEE Question No.		Course Outcomes		Course Outcomes	Blooms' Taxonomy Level
1	a	BAEB02.01	Demonstrate different type's aircraft engine operating principle.	CO1	Remember
	b	BAEB02.02	Understand steps involved in performance analysis of all aircraft engine.	CO1	Understand
2	a	BAEB02.03	Analyze the engine performance parameters and parameters influencing them.	CO1	Understand
	b	BAEB02.03	Analyze the engine performance parameters and parameters influencing them.	CO1	Understand
3	a	BAEB02.04	Describe operational modes of subsonic inlets and parameters influencing it.	CO2	Remember
	b	BAEB02.04	Describe operational modes of subsonic inlets and parameters influencing it.	CO2	Understand
4	a	BAEB02.05	Understand different types of combustion chamber and functions of all the components.	CO2	Understand
	a	BAEB02.06	Describe supersonic inlets, starting problem in it and their operating modes.	CO2	Remember
5	a	BAEB02.07	Understand different design of compressor and limitations of each method.	CO3	Understand
	b	BAEB02.09	Analyze performance characteristics of axial and centrifugal compressor.	CO3	Remember
6	a	BAEB02.08	Describe principle of operation of centrifugal and axial flow turbine.	CO3	Remember
	b	BAEB02.09	Analyze performance characteristics of axial and centrifugal compressor.	CO3	Understand
7	a	BAEB02.10	Appreciate the different propellant feed system options for both chemical and electric propulsion systems, and their similarities/differences.	CO4	Understand
	b	BAEB02.11	Demonstrate the salient features of solid propellants rockets and estimate the grain configuration designs suitable for different missions.	CO4	Remember
8	a	BAEB02.11	Demonstrate the salient features of solid propellants rockets and estimate the grain configuration designs suitable for different missions.	CO4	Understand
	b	BAEB02.12	Identify the applications of standard and reverse hybrid systems with an overview of its limitations.	CO4	Remember
9	a	BAEB02.13	Discuss the various feed systems and injectors for liquid propellants rockets and associated heat transfer problems.	CO5	Remember
	b	BAEB02.14	Appreciate the different propellant feed system options for both chemical and electric propulsion systems, and their similarities/differences.	CO5	Understand
10	a	BAEB02.15	Discuss the various feed systems and injectors for liquid propellants rockets and associated heat transfer problems.	CO5	Understand
	b	BAEB02.15	Discuss the various feed systems and injectors for liquid propellants rockets and associated heat transfer problems.	CO5	Remember

Signature of Course Coordinator **HOD,AE**