INSTITUTE OF AERONAUTICAL ENGINEERING
(Autonomous)
Dundigal, Hyderabad - 500 043

MODEL QUESTION PAPER-II

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)	Illustrate with proper label the scramjet engine and explain the functions of all the components.	**[7M]**
	b)	Write short notes on performance parameters of gas turbine engine and give an equation for any one performance parameter.	**[7M]**
2.	a)	Explain the need for an air breathing engine. Is an air-breathing engine different from a non-air-breathing engine? Explain.	**[7M]**
	b)	Derive isentropic efficiency of a simple turbojet engine. Explain with proper nomenclature for the same.	**[7M]**
UNIT – II			
3.	a)	What do you understand by characteristic Mach number, and favorable pressure gradient? Also explain correctly expanded condition.	**[7M]**
	b)	Derive area Mach number relation with clearly determining each nomenclature and its importance.	**[7M]**
4.	a)	Brief about the theory of flow through nozzle and derive an equation for the showing the flow through nozzle.	**[7M]**
	b)	Derive an equation for the flow through nozzle and explain its operating conditions with a diagram.	**[7M]**
UNIT – III			
5.	a)	Explain how over-expanded operating condition is possible for convergent nozzle.	**[7M]**
	b)	Will there be any wave formation in correctly expanded nozzle. Justify your answer.	**[7M]**
6.	a)	What is the condition for convergent-divergent nozzle to deliver supersonic Mach number?	**[7M]**
	b)	Explain in details about the methods used to control surge. Also differentiate between stall and surge in a compressor.	**[7M]**
UNIT – IV			
7.	a)	Describe about the selection criteria of solid propellant grains for various grain configurations.	**[7M]**
	b)	With the help of neat sketches compare the standard and reverse hybrid systems.	**[7M]**
8.	a)	What are the limitations of combustion mechanism theory in hybrid propulsion?	**[7M]**
	b)	Explain the process of initiating the combustion in a solid propellant rocket motor.	**[7M]**

		UNIT – V	
9.	a)	What are the common problems associated with liquid propellants? Discuss the desired properties of liquid propellants.	**[7M]**
	b)	What is meant by the Monopropellant Engines? Write the practical applications of the same.	**[7M]**
10	a)	Sketch and explain the working principles of the pulse detonation engine and the rotary rocket engine.	**[7M]**
	b)	List out the essential differences between liquid propellant rocket engines to solid propellant rocket. Discuss on which one is best for space travel.	**[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	BAEB02.02	Understand steps involved in performance analysis of all aircraft engine.	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	BAEB02.08	Describe principle of operation of centrifugal and axial flow turbine.	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	BAEB02.12	Identify the applications of standard and reverse hybrid systems with an overview of its limitations.	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	BAEB02.14	Appreciate the different propellant feed system options for both chemical and electric propulsion systems, and their similarities/differences.	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**