Model Question Paper-1 with effect from 2022-23 (CBCS Scheme)

USN | | | | | | | | | | |

Fourth Semester B.E. Degree Examination

Subject Title: Aircraft Propulsion

TIME: 03 Hours **Max. Marks: 100**

Note: 01. Answer any **FIVE** full questions, choosing at least **ONE** question from each **MODULE**.

		Module -1	*Bloom's Taxonomy Level	Marks
Q.01	a	Explain the working principle of 4-Stroke CI engine using P-V and T-S diagram.	L2	10
	b	Briefly discuss the principles of aircraft propulsion and Classify the different types of aircraft power plants.	L2	10
		OR		
Q.02	a	Write the comparison between gas turbine engines over reciprocating engine.	L2	10
	b	Explain Brayton cycle with PV and TS diagram.	L2	10
		Module-2		
Q. 03	a	Explain different types of propellers and write the propeller nomenclature with neat sketch.	L2	10
	b	An aircraft flies at 960 kmph. One of its turbojet engines takes in 40 kg/s of air and expands the gases to the ambient pressure. The air fuel ratio is 50 and the lower calorific value of the fuel is 43 MJ/kg. For maximum thrust power determine i) Jet velocity ii) Thrust iii) Specific thrust iv) Thrust power v)Propulsive thermal and overall efficiencies vi)TSFC.	L4	10
		OR		
Q.04	a	With a neat schematic diagram explain the working of a Turbo-Prop Engine. And list the advantages and disadvantages.	L2	10
	b	The diameter of the propeller of an aircraft is 2.5m.it flies at a speed of 500Kmph at an altitude of 8000m. for a flight to jet speed ratio of 0.75 determine i) the flow rate of air through the propeller ii) the thrust produced iii) Specific thrust iv)Specific impulse v) the thrust power. Take air density 0.525 kg/m^3	L4	10
		Module-3		
Q. 05	a	Explain the following: i) Subsonic inlets ii) Factors affecting diffuser performance	L2	10
	b	Derive a relation for minimum area ratio ($Amax/Ai$) in terms of external deceleration and co-efficient of pressure.	L3	10
		OR		
Q. 06	a	Elaborate the concept of shock swallowing by area variation in supersor Inlets.	L2	10
	b	What is thrust vectoring and explain the various thrust vectoring methods.	L3	10
		Module-4		
Q. 07	a	With a neat sketch, explain the Principle of operation of centrifugal compressor with h-s diagram.	L2	10
	b	Discuss the following for a centrifugal compressor. a)concept of pre-whirl and rotational stall	L2	10

		b)performance characteristics of centrifugal compressor		
		OR		
Q. 08	a	Define degree of reaction of an axial flow compressor and Derive an expression for the same.	L2	10
	b	A Centrifugal compressor under test gave the following data: Speed = 11,500 rev/min, Inlet Total head temperature = 21^0C, Outlet and Inlet Total head pressure is 4 bar and 1 bar respectively, Impeller dia = 75cm, If the slip factor is 0.92, what is the compressor efficiency?	L2	10
		Module-5		
Q. 09	a	Explain the different types of combustion chambers with relevant sketches, list their advantages and disadvantages.	L2	10
	b	Write short notes on a) Flame tube cooling b)Flame stabilization	L3	10
		OR		
Q. 10	a	Explain the important factors affecting the combustion chamber performance with relevant sketch.	L2	10
	b	Elaborate on the different methods used for Turbine blade cooling with relevant sketches.	L3	10

*Bloom's Taxonomy Level: Indicate as L1, L2, L3, L4, etc. It is also desirable to indicate the COs and POs to be attained by every bit of questions.

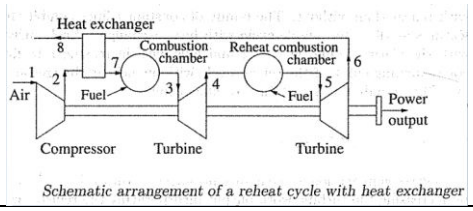
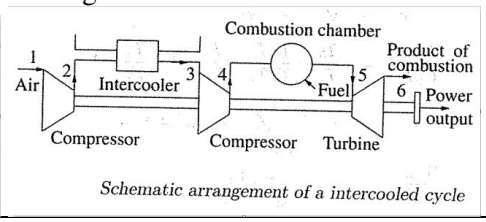
Model Question Paper-2 with effect from 2022-23 (CBCS Scheme)

USN | | | | | | | | | | |

Fourth Semester B.E. Degree Examination
AIRCRAFT PROPULSION

TIME: 03 Hours **Max. Marks: 100**

Note: 01. Answer any **FIVE** full questions, choosing at least **ONE** question from each **MODULE**.

		Module -1	*Bloom's Taxonomy Level	Marks
Q.01	a	Briefly explain the basic principles of Aircraft propulsion. Name the different types of reciprocating Engines	L3	10
	b	What are the difference between 2 stroke piston engine and gas turbine engine	L3	4
	c	Briefly explain the major components in a gas turbine engine	L3	6
		OR		
Q.02	a	Differentiate between any two gas turbine engines with a neat sketch	L3	6
	b	Define thrust. Explain how thrust differs from reciprocating engine and jet engine	L2	4
	c	Write the P-v & T-s Diagram for the below engines  *Schematic arrangement of a reheat cycle with heat exchanger*  *Schematic arrangement of a intercooled cycle*	L1	10
		Module-2		
Q. 03	a	Draw a neat sketch of propeller blade and briefly explain the terminologies related to propeller blade	L1	6
	b	With a neat sketch briefly explain the types of propeller blades	L5	4
	c	Name the three theories used in design of propellers. Briefly explain Blade Element theory	L3	10
		OR		
Q.04	a	Explain the working principle of a 'TURBOPROP' engine with the help of neat sketch and mention its advantages and disadvantages	L5	10
	b	Derive the equation for Thrust and what are the factors affecting thrust	L3	6
	c	List the methods of thrust augmentations. Explain any one in brief	L1	4
		Module-3		
Q. 05	a	Why stall happens in subsonic flow and how flow separates near boundary	L5	7
	b	Define Diffuser. Explain the working principle of supersonic inlets	L2	7
	c	Using a detailed diagram, explain the technique of shock swallowing with a variable area inlet.	L5	6
		OR		
Q. 06	a	Define Nozzle. List few functions of it and its classification	L2	7
	b	With the aid of a clear diagram, describe the concepts of over-expanded and under-expanded nozzles.	L5	7
	c	Briefly explain 1. Thrust reverser 2. Thrust Vectoring 3. Nozzle Chocking	L5	6
		Module-4		
Q. 07	a	Describe the principle of operation of a centrifugal compressor, supported by a schematic diagram.	L5	
	b	A centrifugal compressor compresses 30kg of air per second at a rotational speed of 15000 rpm. The air enters the compressor axially, and the conditions at the exit	L4	10

		sections are radius=0.3m, relative velocity of air at the tip = 100m/s at an angle of 80^0 C with respect to plane of rotation. Take p_{01} = 1bar and T_{01} =300k Find the Torque and power required to drive the compressor and also the heat developed		
		OR		
Q. 08	a	Describe the concept of the degree of reaction for an axial flow compressor and provide the derivation for its expression.	L5	10
	b	Air at 1.0132 bar and 288K enters an axial flow compressor stage with an axial velocity 150 m/s. There are no inlet guide vanes. The rotor stage has a tip diameter of 60 cm and a hub diameter of 50 cm and rotates at 100rps. The air enters the rotor and leaves the stator in the axial direction with no change in velocity or radius. The air is turned through 30.2^0 as it passes through rotor. Assume a stage pressure ratio of 1.2. Assuming the constant specific heats and that the air enters and leaves the blade at the blade angles, I. Construct the velocity diagram at mean dia for this stage II. Mass flow rate III. Power required, and IV. Degree of reaction	L4	10
		Module-5		
Q. 09	a	Explain the different combustion chamber designs and highlight their benefits and drawbacks.	L5	10
	b	Write some important factors affecting combustor design	L1	5
	c	Briefly explain the flame tube cooling with a neat sketch	L5	5
		OR		
Q. 10	a	Explain the different types of injectors and mention the advantages and disadvantages	L5	10
	b	A multi stage gas turbine is to be designed with impulse stages, and is to operate with an inlet pressure and temperature of 6 bar and 900 K and an outlet pressure of 1 bar. The isentropic efficiency of turbine is 85%. All the stages are to have a nozzle outlet angle of 75^0 and equal outlet and inlet blade angles. Mean blade speed of 250 m/s and equal inlet and outlet gas velocities. Estimate the maximum number stages required. Assume C_p = 1.15 kJ/kg K, γ= 1.333 and optimum blade speed ratio.	L4	

*Bloom's Taxonomy Level: Indicate as L1, L2, L3, L4, etc. It is also desirable to indicate the COs and POs to be attained by every bit of questions.