Model Question Paper-2 with effect from 2019-20 (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 principles of aircraft propulsion and Classify the different types of aircraft power plants.	L1	10
	b	Give the major difference between 4-Stroke and 2-Stroke Petrol engine.	L2	4
	c	A Piston- Cylinder arrangement contains 0.5 kg of air at a volume and pressure of 0.1 m^3 and 0.4 MPa respectively. Calculate the initial temperature and the amount of work done when the air is heated to 300°C at constant pressure.	L3	6
		OR		
Q.02	a	Define and Explain the following (i) Mach Number (ii) Reynolds Number (iii) Compressible flow (iv) Adiabatic Process (v)Specific heat	L1	10
	b	What is adiabatic process, derive an expression for work done in an adiabatic process.	L2	6
	c	If Work done in a constant pressure process is 4.5kJ and the change in volume is from 0.025m^3 to 0.05m^3, Find the constant pressure.	L3	4
		Module-2		
Q. 03	a	With a neat sketch explain blade element theory and the criteria for blade selection.	L2	10
	b	An internal combustion engine drives a propeller. The propeller has a diameter of 2.0 m and discharges air at a rate of 360 kg/s. The aircraft flight speed is 80.0 m/s. Determine the thrust, Froude efficiency and the pressure rise across the propeller. (Assume air density to be 1.225 kg/m3)	L3	10
		OR		
Q.04	a	With a neat sketch explain the working of a Turbo-Propeller Engine.	L1	10
	b	Derive Thrust equation for a Propulsive device and what are the factors affecting thrust.	L2	10
		Module-3		
Q. 05	a	Derive a relation for minimum area ratio $\left(\frac{A_{max}}{A_i}\right)$ in terms of external deceleration and co-efficient of pressure.	L2	12
	b	The pressure, temperature and Mach number at the entry of a flow passage are 2.45 bar, 26.5^{0}C and 1.4 respectively. If the exit Mach number is 2.5, determine for adiabatic flow of a perfect gas (γ=1.3, R=0.469 kJ/kg K) 1) Stagnation temperature 2) Temperature and velocity of gas at exit	L3	8
		OR		
Q. 06	a	Explain the concept of shock swallowing by area variation in supersonic inlets.	L2	8
	b	List and explain the various losses in Nozzles.	L1	6
	c	What is thrust vectoring and explain the various thrust vectoring methods.	L1	6

Module-4				
Q. 07	a	Write short notes on 1) Concept of Pre-Whirl 2) Rotating Stall	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?	L3	10
OR				
Q. 08	a	Define Degree of reaction of an axial flow compressor and obtain an expression for 50% degree of reaction.	L2	10
	b	An axial flow air compressor of 50% reaction design has blades with inlet and outlet angles of 45^0 and 10^0 respectively. The Compressor is to produce a pressure ratio of 6:1 with an overall isentropic efficiency of 0.85 when the inlet static temperature is out the compressor. Assuming the value of 200m/s for blade speed find the number of stages required if the work done factor is i) Unity ii) 0.87 for all stages	L3	10
Module-5				
Q. 09	a	List out the important factors affecting the combustion chamber design.	L1	8
	b	Write short notes on i) Flame tube cooling ii) Flame stabilization	L2	12
OR				
Q. 10	a	Elaborate on the different methods used for Turbine blade cooling with relevant sketches.	L2	10
	b	Gas at 7 bar and 300^0C expands to 3 bar in a impulse turbine stage. The nozzle angle is 70^0 with reference to the exit direction. The rotor blades have equal inlet and outlet angle and the stage operates with optimum blade speed ratio. Assuming that the isentropic efficiency of the nozzles is 0.9 and that the velocity at entry to the stage in negligible, deduce the blade angle used and the mass flow required for this stage to produce 75kW. Take Cp=1.15 kJ/kg K	L3	10