Model Question Paper-1 with effect from 2019-20 (CBCS Scheme)

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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	Explain the working principle of 4-Stroke Petrol engine using P-V and T-S diagram.	L1	10
	b	List out the major difference between Air breathing and Non- Air breathing engines.	L2	4
	c	What is an Isentropic process and show that $\frac{T_1}{T_2} = \left(\frac{P_1}{P_2}\right)^{\frac{\gamma-1}{\gamma}}$	L3	6
		OR		
Q.02	a	Write the advantages of gas turbine engine over reciprocating engine.	L1	10
	b	Define the following with an expression. Stagnation Enthalpy 2) Stagnation Pressure	L2	4
	c	For a polytropic process if the ratio of initial to final conditions of pressure and volume is given as 10 and 0.16 respectively, find the polytropic index of the process.	L3	6
		Module-2		
Q. 03	a	Explain Momentum theory and show that velocity at the Actuator disc is equal to the sum of velocities at entry and exit of the considered boundary.	L2	10
	b	Explain the different types of propellers	L1	6
	c	Elaborate on spacing to chord length of a propeller and how this ratio affects thrust.	L2	4
		OR		
Q.04	a	Compare Turbo Prop, Turbo – Fan and Turbo Jet engines	L2	10
	b	A turbojet engine uses aviation kerosene, if the mass flow rate of the fuel and mass flow rate of air is 0.45 kg/s and 32 kg/s respectively and the forward velocity is 500 m/s and thrust produced is 12 KN. Calculate the Jet velocity and Thrust power considering fuel-air ratio , also find the calorific value of the fuel, if the heat added is 20 MW.	L3	10
		Module-3		
Q. 05	a	Write short notes on different types of compression in a supersonic inlet.	L2	8
	b	With a neat sketch explain the method of shock swallowing using variable area inlet.	L2	8
	c	Air enters a straight axisymmetric duct at 300k, 3.45bar and 150m/s, leaves at 277k, 2.058bar and 260m/s. The area of cross section at entry is 500cm^2. If the flow is adiabatic, Determine: 1) Stagnation temperature 2) Mass flow rate and 3) Area of cross-section (γ=1.4, R=287.43 J/kg-K)	L3	4

		OR		
Q. 06	a	Write short notes on: 1) Nozzle Chocking 2) Nozzle Throat condition	L2	10
	b	A supersonic wind tunnel setting chamber expands air on Freon-21 through a nozzle from a pressure of 10bar to 4bar in the test section. Calculate the stagnation temperature to be maintained in the settling chamber to obtain a velocity of 500m/s in the test section for i) Air, Cp=1.025kJ/kg-K, Cv=0.735 kJ/kg K ii) Freon-21, Cp=0.785kJ/kg-K, Cv=0.67kJ/kg K What is the test section Mach number in each case?	L3	10
		Module-4		
Q. 07	a	With a neat sketch, explain the Principle of operation of centrifugal compressor.	L2	10
	b	A centrifugal compressor has to deliver 35kg /s. The impeller dia is 76cm revolving at 11,500 rpm with an adiabatic efficiency of 80%. If the pressure ratio is 4:2:1 estimate the probable axial width of the impeller, at the impeller tip if the radial velocity is 120m/s. The inlet conditions are 1 bar and 47^0C.	L3	10
		OR		
Q. 08	a	Derive and expression for degree of reaction of an axial flow compressor	L2	8
	b	Explain the process of surging and stalling in an axial flow compressor	L2	8
	c	Give the difference between centrifugal compressors and axial compressors.	L2	4
		Module-5		
Q. 09	a	Explain the different types of combustion chambers with relevant sketches, list their advantages and disadvantages.	L2	10
	b	Explain the effect of operating variables on combustion chamber performance.	L2	10
		OR		
Q. 10	a	With neat diagram explain the working of Single stage reaction turbine.	L2	8
	b	Briefly explain the various losses in a turbine.	L2	4
	c	A multistage gas turbine is to be designed with impulse stages and is to operate with an inlet pressure and temperature of 6 bar and 900k and an outlet pressure bar of 1 bar. The isentropic efficiency of the 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 250m/s and equal inlet and outlet gas velocities. Estimate the maximum number of stages. Take γ = 1.33 and Cp=1.15kJ/kg-K and optimum blade speed ratio.	L3	8