CBCS SCHEME

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BAE403

Fourth Semester B.E./B.Tech. Degree Examination, June/July 2025
Aircraft Propulsion

Time: 3 hrs. Max. Marks: 100

Note: 1. Answer any FIVE full questions, choosing ONE full question from each module.
2. M : Marks , L: Bloom's level , C: Course outcomes.

		Module – 1	M	L	C
Q.1	a.	Derive an expression for steady flow energy equation for compressible flow machines with usual notation.	10	L4	CO1
	b.	Define stagnation state and stagnation enthalpy. Derive an expression for stagnation temperature.	10	L4	CO1
		OR			
Q.2	a.	With the help of PV and TS diagram, explain the cycle analysis of jet engine.	12	L3	CO1
	b.	List the advantages and disadvantages of Turbo-Prop engine.	08	L2	CO1
		Module – 2			
Q.3	a.	Explain the operating principle of a turbofan engine with a neat diagram. Also give the advantage and disadvantage.	12	L2	CO1
	b.	A turbojet Power plant uses aviation kerosene having a colorific value of 43MJ/kg. The fuel consumption is 0.18 kg/hr – N when the thrust is 9KN. The aircraft velocity is 500m/s, the mass of air passing through the compressor is 27kg/s. Calculate the air-fuel ratio and overall efficiency.	08	L5	CO1
		OR			
Q.4	a.	Briefly explain different types of propeller.	10	L2	CO1
	b.	The diameter of the propeller of an aircraft is 2.5 m . It flies at a speed of 500 kmph 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 at z = 8000m, air density = 0.525kg/m^3)	10	L5	CO1
		Module – 3			
Q.5	a.	Derive a relation for minimum area ratio $\left(\frac{A_{max}}{A_i}\right)$ in terms of external declaration (v_i/v_a).	10	L4	CO3
	b.	List the major design consideration for the inlets.	05	L3	CO3
	c.	Differentiate subsonic and supersonic inlets.	05	L1	CO3
		OR			
Q.6	a.	Discuss the various types of thrust reversal system with suitable sketch.	10	L2	CO3
	b.	Derive an expression for diffuser efficiency.	05	L2	CO3
	c.	Explain Ejector nojstyle with a sketch.	05	L2	CO3

		Module – 4			
Q.7	**a.**	With a neat sketch, explain working principle of centrifugal compressor.	**10**	**L2**	**CO2**
	b.	An axial flow air compressor of 50% reaction design has blades with inlet and outlet angles of 45° and 10° respectively. The compressor is to produce a pressure ratio of 6:1 with an overall isentropic efficiency of 0.85 when inlet static temperature is 37°C. The blade speed and axial velocity are constant through compressor. Assuming a value of 200 m/s for blade speed, find the number of stages required if the work done factor is : i) Unity ii) 0.87 for all stages.	**10**	**L5**	**CO2**
		OR			
Q.8	**a.**	Explain performance characteristics of axial compressor with a graph.	**10**	**L3**	**CO3**
	b.	Differentiate axial flow compressor and centrifugal compressor.	**05**	**L2**	**CO2**
	c.	A centrifugal compressor has to deliver 35kg of air per second. The impeller is 76 cm diameter revolving at 11500rpm with an adiabatic efficiency of 80%. If the pressure ratio is 4.2:1, estimate the probable axial width of the impeller tip if the radial velocity is 120m/s. The inlet conditions are 1 bar and 47° C.	**05**	**L5**	**CO2**
		Module – 5			
Q.9	**a.**	With the help of a neat sketch, explain the working of radial turbine.	**10**	**L1**	**CO2**
	b.	Discuss the various important factors affecting combustion chamber design.	**10**	**L2**	**CO3**
		OR			
Q.10	**a.**	Explain the various methods used in turbine blade cooling.	**08**	**L2**	**CO3**
	b.	Describe various losses in turbine.	**08**	**L1**	**CO3**
	c.	Write a note on impact of pollutants in combustion chambers.	**04**	**L2**	**CO3**

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