U.S.N.										

B.M.S. College of Engineering, Bengaluru-560019

Autonomous Institute Affiliated to VTU

September / October 2024 Supplementary Examinations

Programme: B.E. **Semester: V**
Branch: Aerospace Engineering **Duration: 3 hrs.**
Course Code: 22AS5PCBPR **Max Marks: 100**
Course: Basic Propulsion

Instructions: 1. Answer any FIVE full questions, choosing one full question from each unit.
2. Missing data, if any, may be suitably assumed.

		UNIT - I	CO	PO	Marks
1	a)	What are the various aircraft performance parameters? Briefly explain them.	CO1	PO1	**8**
	b)	A turbojet is flying at a speed of 720 km/h in a surrounding atmosphere of 0.6 bar and 260 K. The air enters the diffuser first and then enters into the compressor. The pressure ratio of the compressor is 4.5. The maximum temperature entering into the turbine is limited to 977°C. The hot gases coming out of the turbine expands in the nozzle to pressure of 0.7 bar. Take the following data. Diffuser efficiency of 95%, C.V of fuel used = 40000 kJ/kg, air used = 1200 kg/min. Neglect the velocity of the air leaving the diffuser. Determine i) Power consumed by the compressor ii) A: F ratio used iii) thrust power of the engine. Take $C_{pa} = C_{pg} = 1.0$, $\gamma_a = \gamma_g = 1.4$; $\eta_d = 95\%$, $\eta_c = 82\%$, $\eta_t = 85\%$, $\eta_n = 94\%$.	CO2	PO2	**12**
		OR			
2	a)	Derive an expression for range of an aircraft by considering a steady level flight, relating lift, drag, specific impulse and mass of the aircraft. Highlight the significance for different applications like fighter aircraft, passenger aircraft etc.	CO3	PO2	**10**
	b)	Explain the working principle of Ramjet with the help of TS diagram. Highlight the comparison with turbojet.	CO1	PO1	**10**
		UNIT - II			
3	a)	What are the requirements of a combustor?	CO1	PO1	**4**
	b)	With the help of TS diagram, Explain the flow patterns in subsonic intake for take-off condition and for a steady level cruise condition.	CO1	PO1	**8**
	c)	What do you mean by starting of an intake? Explain.	CO1	PO1	**8**

			UNIT - III			
	4	a)	What are the various influencing factors in axial compressor? Explain them.	*CO4*	*PO2*	**10**
		b)	Air at a temperature of 290 K enters a ten stage of axial flow compressor at the rate of 3 kg/s. The pressure ratio is 6.5 and the isentropic efficiency is 90%, the compression process being adiabatic. The compressor has symmetrical blades. The axial velocity is 110 m/s is uniform across the stage and the mean blade speed of each stage is 180 m/s. Determine the directions of the air at entry to and exit from the rotor and stator blades and the power given to the air. Assume Cp = 1.005 kJ/kg K and $\gamma = 1.4$	*CO4*	*PO2*	**10**
			OR			
	5	a)	What do you mean by radial equilibrium? Derive an expression for radial equilibrium.	*CO4*	*PO2*	**10**
		b)	Define the following i) work done factor ii) flow coefficient iii) Pressure coefficient	*CO1*	*PO1*	**6**
		c)	What are the various losses in axial flow compressor? Briefly explain them.	*CO3*	*PO1*	**4**
			UNIT - IV			
	6	a)	With the help of TS diagram, explain the working principle of an axial turbine.	*CO1*	*PO1*	**6**
		b)	What are the various blade cooling techniques? Draw the necessary diagram.	*CO1*	*PO1*	**6**
		c)	In a single-stage gas turbine, gas enters and leaves in axial direction. The nozzle efflux angle is 68°, the stagnation temperature and stagnation pressure at stage inlet are 800°C and 4 bar, respectively. The exhaust static pressure is 1 bar, total-to-static efficiency is 0.85, and mean blade speed is 480 m/s, determine (i) the work done, (ii) the axial velocity which is constant through the stage, (iii) the total-to-total efficiency, and (iv) the degree of reaction. Assume $\gamma = 1.33$, and Cpg = 1.147 kJ/kg.K.	*CO4*	*PO2*	**8**
			UNIT - V			
	7	a)	Compare vane type and vaneless type compressor.	*CO3*	*PO1*	**4**
		b)	Explain the performance characteristics of a centrifugal compressor.	*CO3*	*PO1*	**6**
		c)	A centrifugal compressor runs at 15000 rpm and produces a stagnation pressure ratio of 4 between the impeller inlet and outlet. Stagnation conditions of air at the intake are 100 kPa and 300 K. The absolute velocity at the compressor intake is without any whirl component. At the exit of the impeller, the flow component of the velocity is 135 m/s and the blades are radial. The total-to-total efficiency of the compressor is 0.78. Draw the velocity triangles and find the blade angle at the inlet. Also compute the slip and slip coefficient. The rotor diameter at the exit is 0.58 m and that at the inlet is 0.25 m.	*CO4*	*PO2*	**10**

****