GUJARAT TECHNOLOGICAL UNIVERSITY
BE - SEMESTER–VIII (NEW) - EXAMINATION – SUMMER 2017

Subject Code: 2181928   **Date: 02/05/2017**
Subject Name: Steam and Gas Turbines
Time: 10:30 AM to 01:00 PM   **Total Marks: 70**

Instructions:
1. Attempt all questions.
2. Make suitable assumptions wherever necessary.
3. Figures to the right indicate full marks.

Q.1	**(a)**	What do you mean by governing of steam turbine? Explain nozzle control governing with neat sketch.	**07**
	(b)	Derive the expression of optimum pressure ratio for maximum work output in actual Brayton cycle.	**07**
Q.2	**(a)**	Derive an expression for maximum discharge through convergent-divergent nozzle.	**07**
	(b)	What is compounding of steam turbine? Explain with neat diagram pressure compounded impulse turbine.	**07**
		OR	
	(b)	Explain brief note on Pass-out turbine with neat sketch.	**07**
Q.3	**(a)**	Discuss briefly the methods employed for improvement of thermal efficiency of open cycle gas turbine.	**07**
	(b)	Steam is expanded in a set of nozzles from 10 bar and 200 ^{0}C to 5 bar. What type of nozzle is it? Neglecting the initial velocity find minimum area of the nozzle required to allow of 3 kg/sec under the given conditions. Assume that expansion of steam to be isentropic.	**07**
		OR	
Q.3	**(a)**	Explain with neat sketch working of steam and gas combined cycle power plant. Give advantages of combined cycle power plant.	**07**
	(b)	In a gas turbine plant working on Brayton cycle, the air at inlet is 27 ^{0}C, 0.1 MPa. The pressure ratio is 6.25 and the maximum temperature is 800 ^{0}C.The turbine and compressor efficiencies are each 80%. Find compressor work, heat supplied, cycle efficiency and turbine exhaust temperature. Mass of air may be considered as 1 kg. Draw T-S diagram.	**07**
Q.4	**(a)**	Explain Reheat factor. Why is its magnitude always greater than unity?	**07**
	(b)	Write short note on Labyrinth packing.	**07**
		OR	
Q.4	**(a)**	What is critical pressure? Derive the expression for critical pressure ratio in flow through the nozzles. Calculate its value for superheated steam.	**07**
	(b)	In a stage of an impulse turbine provided with a single row wheel, the mean diameter of the blade ring is 80 cm and the speed rotation is 3000 rpm The Steam issues from the nozzles with a velocity of 300 m/s and nozzle angle is 20^0 . The rotor blades are equiangular and due to friction in the blade channels	**07**

the relative velocity of steam at outlet from the blades is 0.86 times the relative velocity of steam entering the blades. What is the power developed in the blades when the axial thrust on the blades is 140 N?

Q.5 **(a)** What is the principle of jet-propulsion? Explain Thrust, Thrust power, Propulsive power and Propulsive Efficiency. **07**

(b) Air at temperature of 15 ^{0}C enters a gas turbine plant working at pressure ratio of 15. Turbine inlet temperature is 1250 ^{0}C. polytropic efficiency (i.e. small stage efficiency) of compressor and turbine is 0.91. Assume C_p=1.005 and 1.128 for air and gases respectively and calorific value of fuel used =42000 KJ/Kg of fuel, calculate (a) overall efficiency (b) specific output (c) fuel to air ratio and (d) specific fuel consumption. **07**

OR

Q.5 **(a)** Differentiate between (i) Turbojet engine and Turboprop engine **07**
(ii) Ramjet engine and Pulsejet engine

(b) Write short note on methods of attachment of blades to turbine rotors. **07**

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