Seat No.: _____ Enrolment No._____

GUJARAT TECHNOLOGICAL UNIVERSITY

BE - SEMESTER–VIII • EXAMINATION – WINTER • 2014

Subject Code: 181904 Date: 27-11-2014

Subject Name: Thermal Engineering

Time: 02:30 pm - 05:00 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)** Explain working principle of simple cycle gas turbine with schematic diagram. **07**

(b) Give the classification of gas turbines. **07**

Q.2 **(a)** What is compounding? Explain working principle of pressure compounding with neat sketch. **07**

(b) What is governing of steam turbine? Explain nozzle governing with neat sketch. **07**

OR

(b) Describe different types of nozzle with neat sketch. State the function of nozzle. **07**

Q.3 **(a)** What is the difference between impulse and reaction turbine? **07**

(b) Steam issues from the nozzles of De Laval turbine with velocity of 1000 m/sec. The nozzle angle is 20^0 C. Mean blade velocity is 400 m/sec. The blades are symmetrical. The mass flow rate is 1000 kg/hr. friction factor is 0.8, and η_{nozzle} =0.95. Determine **07**

1) Blade angle
2) Axial thrust on the rotor turbine
3) Work done
4) Power developed
5) Blade efficiency
6) Stage efficiency

OR

Q.3 **(a)** Explain open cycle gas turbine with regeneration using schematic diagram and T-s diagram. **07**

(b) In a closed cycle gas turbine the following data apply, **07**

Working substance is air, C_p = 1kJ/kg and γ =1.4

Ambient temperature = 27^0 C

Top temperature = 823^0 C

Pressure at compressor inlet = 1 bar

Pressure ratio = 4

Compressor efficiency = 80%

Turbine efficiency = 85%

Heating value of fuel = 41800 kJ/kg

Heater loss = 10% of heating value

Find the following

1) Compressor work
2) Heat supplied
3) Turbine work
4) Net work
5) Thermal efficiency
6) Work ratio

Q.4	**(a)**	Explain reheating of steam in steam turbine with neat sketch.	**07**
	(b)	Dry saturated steam at pressure of 6 bar flows through nozzles at the rate of 4.5 kg/sec and discharges at a pressure of 1.6 bar. The loss due to friction occurs only in the diverging portion of the nozzle and its magnitude is 12% of the total isentropic enthalpy drop. Assume the isentropic index of expansion n = 1.135, determine the cross-sectional are at the throat and exit of the nozzles.	**07**

OR

Q.4	**(a)**	Explain working of combustion chamber of gas turbine with neat sketch.	**07**
	(b)	A gas turbine set draws in atmospheric air at 1 bar and 15^0 C, there are two pressure stages with perfect intercooler and the total pressure ratio is 25:1. The maximum temperature of the cycle is 1300^0 C as there is one turbine for expansion. A regenerator is used and recovers 70% of the available heat. Determine the efficiency of plant and work ratio. The turbine and compressor efficiencies may be taken as 0.87 and 0.86 respectively. Assume mechanical efficiency of whole assembly equal to 0.96 and generator efficiency as 0.98.	**07**
Q.5	**(a)**	What is the principle of jet propulsion? Explain the working of the turbojet engine with neat sketch."	**07**
	(b)	Explain basic working principle of rocket engine with neat sketch.	**07**

OR

Q.5	**(a)**	State the various methods of attachment of blades to turbine rotor. Explain any one method of attachment with neat sketch.	**07**
	(b)	Discuss briefly various losses occurring in steam turbines.	**07**

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