Seat No.: _____ Enrolment No._____

GUJARAT TECHNOLOGICAL UNIVERSITY

ME - SEMESTER–I(New course)• EXAMINATION – WINTER- 2015

Subject Code: 2713902 **Date: 02/01/2016**

Subject Name: Energy Conversion Systems

Time:2:30 pm to 5:00 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)**	Enlist different Forms of Energy. Explain energy conversion process with neat sketch.	**07**
	(b)	State different types of gassifiers. Explain any one in brief with neat sketch.	**07**
Q.2	**(a)**	Explain with neat sketch construction and working of HTGR.	**07**
	(b)	Calculate the minimum volume of air required to burn 1 kg of coal having the following composition by volume: C-72.4%, H_2 – 5.3, N_2 – 1.81%, O_2 -8.5%, moisture – 7.2%, S_2 – 0.9% and ash – 3.9%.	**07**
		OR	
	(b)	Explain the Energy conversion process through fission and fusion.	**07**
Q.3	**(a)**	Explain with neat sketch the different method of increasing the efficiency of steam turbine power plant.	**07**
	(b)	Steam issues from the nozzle of a simple impulse turbine with a velocity of 900 m/sec. The nozzle angle is 20^0, the mean diameter of the blades is 0.25m and the speed of rotation is 20,000 rpm. The mass flow through the turbine nozzle and blading is 0.18 kg of steam per sec. Draw the velocity diagram and calculate: (i) Tangential forces on blades (ii) Axial force on blades (iii) power developed by the turbine wheel (iv) Efficiency of the blading (v) Inlet angles of blades for shockless inflow of steam. Assume outlet angle of blade is equal to the inlet angle and frictional losses are negligible.	**07**
		OR	
Q.3	**(a)**	Give the list of various methods used for governing steam turbine and explain throttle governing in detail.	**07**
	(b)	Two stages of feed heating are employed in a steam turbine installation, steam being bled for these at pressures of 3.4 bar and 0.6 bar respectively. The temperature of the feed water is raised to that of the bled steam and the condensate from each heater may be taken as being the same temperature as the feed water entering the heater. The steam is supplied to the turbine at 17 bar with 4.5^0 C superheat and condenser pressure is 0.06bar. The stage efficiency between pressures 17 bar and 3.4 bar is 0.7 and in other two stages is 0.65. Estimate (i) the mass of steam bled to each heater (ii) the total work done per kg of steam supplied to the turbine (iii) the overall thermal efficiency of the cycle.	**07**
Q.4	**(a)**	State the types of FBC boiler. Explain the mechanism of FBC boiler with sketch.	**07**
	(b)	A simple constant pressure open cycle gas turbine plant draws air at 1 bar and 17^0C and compresses it through a pressure ratio of 4. The air is then passes to the combustion chamber and after combustion of fuel; the gases enter the turbine at a temperature of 650^0C and expand to 100kPa. Assuming the isentropic efficiency of both the compressor and turbine as 85%, Calculate: (i) power required to drive the compressor if it has to handle 2 kg/sec of air (ii) power developed by turbine (iii) the net plant work output per kg of air (iv) thermal efficiency of the plant (v) work ratio of the plant. Assume Cp = 1.026 kJ/kgK, γ = 1.4 for both air and	**07**

gases. Neglect the mass of fuel burnt and the loss of pressure in the combustion chamber.

OR

Q.4	**(a)**	What do you mean by Boiler blow down? Explain the different types of blow down process in boiler.	**07**
	(b)	In a gas turbine installation the compressor takes in air at a temperature of 20^0C and compresses it to four times the initial pressure with an isentropic efficiency of 84%. The air is than passed through a heat exchanger and heated by the turbine exhaust before reaching the combustion chamber. In the next heat exchanger, 80% of the available heat is given to compressed air. The maximum temperature after constant pressure combustion is 580^0C and the isentropic efficiency of the turbine is 75%. Determine the overall efficiency of the plant. Take Cp = 1.005 kJ/kgK, γ = 1.4 for both air and gases.	**07**
Q.5	**(a)**	Classify the waste heat recovery methods. Explain any one in brief.	**07**
	(b)	Discuss about the saving potential in co-generation and tri-generation in context of energy.	**07**

OR

Q.5	**(a)**	Explain waste heat recovery system in case of (i) Heat pipes (ii) Shell and tube type heat exchangers.	**07**
	(b)	Explain the principles of co-generation system. Explain it with respect to Steam turbine.	**07**

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