Seat No.: _____ Enrolment No._____

GUJARAT TECHNOLOGICAL UNIVERSITY

ME - SEMESTER–I (New) EXAMINATION – WINTER 2016

Subject Code: 2713902 Date:05/01/2016

Subject Name: Energy Conversion System

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**
4. **Use of steam table is permitted.**

Q.1	**(a)**	Classify different forms of energy. Explain thermodynamics of energy conversion process.	**07**
	(b)	Write a short note on Fluidized bed gassifier.	**07**
Q.2	**(a)**	Explain with neat sketch construction and working of LMFBR.	**07**
	(b)	Calculate the minimum amount of air required to burn 1 kg of coal on weight and mole basis having the following composition by weight: C = 72.4%, H_2 5.3%, N_2 = 1.81%, O_2 = 8.5%, moisture = 7.2%, S = 0.9% and ash 3.9%	**07**
		OR	
	(b)	Enlist the principle components of nuclear reactor and explain their functions with neat sketch.	**07**
Q.3	**(a)**	Explain concept of boiler blow down. Enlist the benefits of it. Differentiate between continuous and intermittent blow down.	**07**
	(b)	A multi-stage steam turbine is provided with 2-stage regenerative feed heating. Steam is bled-off from the turbine stages at a pressure of 2 bar and 0.4 bar resp. Initial steam pressure is 25 bar and 300^0C and exhaust pressure is 0.1 bar. Assuming isentropic expansion, calculate: (i) steam quantities to be tapped at each stage (ii) thermal regenerative efficiency with feed heating and without feed heating	**07**
		OR	
Q.3	**(a)**	Explain Pressurized Fluidized Bed Combustion System in boiler.	**07**
	(b)	A Gas turbine takes air at 1 bar and 300K with mass flow rate of 10kg/s with pressure ratio is 6. The compression takes place in two stages with perfect intercooling. The maximum Temperature is limited to 1050K. The isentropic efficiencies of both compressor and turbine are 82% and 84% resp. The regenerator (effectiveness-0.65) is used to increase temperature of air before entering the combustion chamber. Calculate thermal efficiency of the plant. Cp = 1 kJ/kgK and γ =1.4. Neglect mass of fuel.	**07**
Q.4	**(a)**	Explain the methods of enhancing the efficiency of gas power plant cycle.	**07**
	(b)	A steam turbine is supplied with steam at 90 bar and 500^0C. The condenser pressure is maintained at 0.05 bar. The plant is equipped with reheat as well as regenerative arrangement. The steam is extracted at 8bar pressure for feed heating and remainder is reheated to 400^0C in a reheater and than expanded in LP turbine to condenser pressure. Determine: (i) amount of steam bleed off for feed heating (ii) amount of steam in LP turbine (iii) heat supplied in boiler and reheater (iv) output of boiler	**07**
		OR	
Q.4	**(a)**	Discuss the types of energy losses occur in steam turbines.	**07**

(b) In a gas turbine plant air at 18^0C and 1 bar is compressed to 8 bar. Air is than heated to max. temp. 1050^0C, first in the heat exchanger and than in the combustion chamber. It is than expanded in two stages, such that work output is equally divided between the stages. Gases are reheated to 1050^0C after HP turbine with perfect reheating. The compressor and turbine efficiencies are 82% and 84% resp. The thermal efficiency of plant is 30%, calculate effectiveness of heat exchanger. Assume Cp = 1.005 kJ/kgK and γ =1.4 for both air and gas. **07**

Q.5 **(a)** Discuss the various sources of waste and explain the methods of waste heat recovery. **07**

(b) Explain important technical parameters affecting the co-generation system. **07**

OR

Q.5 **(a)** Explain the operating principle of a waste heat recovery boiler with neat sketch. **07**

(b) Write a short note on: **07**

(1) Steam turbine co-generation system

(2) Features and benefits of Tri-generation system

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