Seat No.: _____ *Enrolment No._____*

GUJARAT TECHNOLOGICAL UNIVERSITY

M. E. - SEMESTER – I • EXAMINATION – WINTER • 2014

Subject code: 2713902 **Date: 09-01-2015**

Subject Name: Energy Conversion System

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)**	Enlist different Energy sources available on the earth. Explain energy conversion process with neat sketch.	**07**
	(b)	Explain coal gasification process.	**07**
Q.2	**(a)**	Explain with neat sketch construction and working of BWR.	**07**
	(b)	Methane (CH_4) is burned with atmospheric air. The analysis of the products on a dry basis is as follows: CO_2 = 10%, O_2 = 2.37%, CO = 0.53%, N_2 = 87.10%. Determine (i) Combustion equation (ii) air-fuel ratio (iii) % theoretical air	**07**
		OR	
	(b)	Enlist the principle components of nuclear reactor and explain their functions with neat sketch.	**07**
Q.3	**(a)**	Explain with neat sketch various circuits associate with modern steam power plant and explain at least two circuits in detail.	**07**
	(b)	Dry and saturated steam at pressure 11 bar is supplied to a turbine and expanded isentropically to pressure of 0.07 bar. Calculate the following :(i) heat supplied (ii) Total change of entropy (iii) heat rejected (iv) theoretical thermal efficiency	**07**
		OR	
Q.3	**(a)**	Give the list of various methods used for governing steam turbine and explain throttling governing in detail.	**07**
	(b)	A steam turbine receives steam at pressure 20 bar and 88.6^0C degree of superheat. The exhaust pressure is 0.07 bar and the expansion of steam takes place isentropically. Determine :(i) Net work done (ii) Thermal efficiency (iii) theoretical steam consumption.	**07**
Q.4	**(a)**	With neat sketch discuss the salient features of circulation fluidized bed (CFB) boilers along with its advantages and disadvantages.	**07**
	(b)	A gas turbine unit has a pressure ratio of 6 and max. cycle temp. is 900^0C. The isentropic efficiencies of the compressor and the turbine are 85% and 90% respectively. Air enters the compressor at 15^0C at the rate of 5 kg/s. Calorific value of the fuel used is 43000 kJ/kg, combustion efficiency is 95%, using C_{pa} = 1 kJ/kgK, C_{pg} = 1.07 kJ/kg and ɔ = 1.4 for air and gases. Find (i) thermal efficiency (ii) power output (iii) Air-fuel ratio	**07**
		OR	
Q.4	**(a)**	Discuss in detail the means of improving the specific output and thermal efficiency of simple open cycle gas turbine plant.	**07**
	(b)	Steam issues from the nozzles of a De laval turbine with a velocity of 1200 m/s. The nozzle angle is 20^0, the mean blade velocity is 400 m/s, and the inlet and outlet angle of blade are equal. The mass of steam flowing through turbine per hour is 900 kg. Calculate (i) the blade angles (ii) the relative velocity of steam entering the blades (iii) the tangential force on the blades (iv) the power developed (v) Blade efficiency. Assume that k = 0.8.	**07**

Q.5	**(a)**	Discuss the various methods used for waste heat recovery.	**07**
	(b)	State the need of co-generation and tri-generation in context of energy.	**07**

OR

Q.5	**(a)**	What do you understand by the term ówaste heat recoveryö? Give two examples of waste heat recovery. What are the direct and indirect benefits of waste heat recovery?	**07**
	(b)	Write a short note on: (1) Reciprocating engine co-generation system (2) Steam turbine co-generation system	**07**

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