

JK LAKSHMIPAT UNIVERSITY, JAIPUR

INSTITUTE OF ENGINEERING AND TECHNOLOGY

End Term Examination (Regular), April 2015
B. Tech in Mechanical Engineering, Semester VI



Roll No.....

COURSE CODE: ME-623: Waste heat recovery

Time: 3 hours

Max. Marks: 100

Instructions to students:

1. Do not write anything other than your roll number on question paper.
2. Assume suitable data wherever required and mention it clearly.
3. Writing appropriate units, nomenclature, and drawing neat sketches/schematics/ flow chart wherever, required are an integral part of the answer.

Q.1A Objective type questions (10 questions @ 1 mark) 10

1. What is the most common material used in making solar cells?
(a) Silver (b) Iron (c) Aluminum (d) Silicon
2. Hybrid recuperator is combination of designs
3. Which of the following solar cookers is the most efficient and has the shortest cooking time?
(a) Box cooker (b) Parabolic cooker. (c) Panel cooker (d) Cardboard type cooker
4. In a super heater:
a) pressure rises and temperature drops
b) temperature rises and pressure drops
c) temperature rises and pressure remains unchanged
d) pressure rises and temperature remains the same
5. A gas turbine works on which of the following cycles.
(a) Brayton (b) Rankine
(c) Stirling (d) Otto
6. Coal fired power plant boilers manufactured in India generally use
a) pulverized fuel combustion (b) Fluidised bed combustion
(c) circulating fluidized bed combustion (d) none of these
7. Solar energy travels through space by the process of
(a) Conduction (b) Convection (c) Radiation (d) Transportation
8. What kind of energy does a wind turbine use?
(a) Kinetic energy (b) Potential energy (c) Chemical Energy (d) Thermal energy
9. POF for base load plant is in range
10. Which of the following energy originate from the ocean?
(a) Tidal energy (b) Sea energy (c) Wind energy (d) Hydropower

Q.2 Short answer type questions (4 questions @ 2.5 marks) 10

- (a) What do you mean critical temperature and pressure of water.
- (b) Why binary vapor has greater efficiency.
- (c) What are superconductivity
- (d) Explain Economizer and its application.



Q.3A	. What are recuperators explain the hybrid recuperator. With diagram	05																					
Q.3B	Differentiate between peaking load and base load with diagram.	05																					
Q.4A	Differentiate between tub charging and gas generator	05																					
Q.4B	Draw the system diagram of Chemical storage system used in a power plant.	05																					
Q.5A	Why are combined cycles used, explain combined steam and gas turbine.	05																					
Q.5B	What are the advantages and disadvantages of mercury as working fluid?	05																					
Q.6A	Explain the need and basic classification for Energy storage.	05																					
Q.6B	What is cogeneration its significance and types.	05																					
OR																							
Q.6B	Explain the magnetic storage and its advantages and disadvantages.	05																					
Q.7A	A simple compressed air energy system supplies average air flow into a cavern of 65,000m ³ at the rate of 8400m ³ /h. air enters the compressor at 1 bar and 288K and leaves at 90 bar. The isentropic compressor efficiency is 75% and the peaking turbine is 60%. The air is stored in the cavern at 90 bar and 288K. calculate the following - (a) the compressed air temperature (b) the storage time (c) the total energy storage in MWh and (d) the total energy delivered by the peaking load in MWh.	05																					
Q.7B	Explain the pumped Hydroelectric energy storage with diagram	05																					
OR																							
Q.7B	Explain FBC its advantages and disadvantages. With Diagram.	05																					
Q.8A	Elaborate solar storage system. How parabolic solar storage system is advantageous over other storage system	6+4																					
Q.9A	Derive the expression for overall efficiency of binary vapour cycle .	10																					
Q.9B	Explain the thermal storage and its types its advantages and disadvantages.	10																					
OR																							
Q.9B	In a binary vapour cycle, mercury vapour dry and saturated enters the mercury turbine at 12.68 bar and exhausts at 0.07 bar into the mercury condenser steam boiler unit. Steam comes out from this unit uses a superheat temperature of 35 °C at 30 bar and expand to 0.07bar. compute the efficiency of the combined cycle assuming expansion in both cycle as isentropic and neglect the pump work and steam coming out from boiler as dry and saturated for mercury For mercury	10																					
<table><tr><td>P(bar)</td><td>Ts(°C)</td><td>Hf (kJ/kg)</td><td>Hg(kJ/kg)</td><td>Sf (KJ/kg k)</td><td>Sg KJ/kg k)</td></tr><tr><td>0.07</td><td>236.5</td><td>32.395</td><td>326.667</td><td>0.08548</td><td>0.662906</td></tr><tr><td>12.68</td><td>537.5</td><td>71.9796</td><td>360.704</td><td>0.145798</td><td>0.50185</td></tr></table>						P(bar)	Ts(°C)	Hf (kJ/kg)	Hg(kJ/kg)	Sf (KJ/kg k)	Sg KJ/kg k)	0.07	236.5	32.395	326.667	0.08548	0.662906	12.68	537.5	71.9796	360.704	0.145798	0.50185
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For steam

P(bar)	Ts(°C)	Hf (kJ/kg)	Hg(kJ/kg)	Sf (KJ/kg k)	Sg KJ/kg k)
0.07	39.025	163.38	2572.6	0.5591	8.2767
30	233.84	1008.35	2802.3	2.6455	6.1837

Property of superheated steam at 268.84 °C $h=2918.3$ $S=6.0124$

