

JK LAKSHMIPAT UNIVERSITY, JAIPUR

INSTITUTE OF ENGINEERING AND TECHNOLOGY

End Term Examination, November 2017

B. Tech. in Mechanical Engineering, Semester VII

Roll No.....

ME 737: Waste Heat Recovery and Management

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 multiple choice questions (10 questions @ 1 mark)	10
i.	The temperature of waste gases which is coming out from gas turbine exhausts are of the order of: (a) 370-540°C (b) 450-700°C (c) 700-800°C (d) 250-440°C	
ii.	Following statements are made regarding the first law efficiency η_I , Co-efficient of performance (COP) and second law efficiency η_{II} . Identify the correct statement(s): (a) For a given temperature limits, η_I , η_{II} or COP can never be more than 1 (b) There is no relationship between η_I and η_{II} (c) η_{II} depends on the temperature limits of the cycle (d) η_I depends on the temperature limits of the cycle	
iii.	Which one is correct: (a) For recovery, quantity of waste heat is important. (b) For recovery quality of waste heat is important. (c) For recovery apart from quality and quantity of waste heat, there may be other constraints related to plant (d) Quality of waste heat is not relevant for its recovery	
iv.	Recuperator will be more efficient if the flow path of hot and cold fluids is in: (a) co-current mode; (b) counter current mode; (c) cross current mode; (d) None of the above	
v.	Recovery of waste heat from cold fluid to hot fluid is called; (a) thermo compressor (b) waste heat recovery boiler (c) heat pump (d) economizer	
vi.	Latent heat of steam at critical point is (a) Infinite (b) 540 kcal (c) Zero (d) None of the above	
vii.	Identify the correct statement. In a utility steam power plant : (a) a combination of reheat and regeneration is used (b) combination of reheat and regeneration should be avoided (c) regeneration is not preferred as it reduces the work output (d) None of the above	
viii.	Recovery of waste heat from cold fluid to hot fluid is called; (a) thermo compressor (b) waste heat recovery boiler (c) heat pump (d) economizer	

ix.	A major advantage of waste heat recovery in industry is: (a) Reduction in pollution; (b) increase in efficiency; (c) both (a) and (b); (d) None of the above	
x.	For every 6°C rise in feed water temperature through an economizer the fuel savings in the boiler is of the order of: (a) 1% (b) 1.5% (c) 3% (d) 2%	
Q.2	Short answer type questions (2 questions @ 5 marks)	10
i.	Write a note on total energy approach.	
iii.	List at least five applications of 'heat pipe'.	
Q.3A	What is the principle of 'recuperators'?	05
Q.3B	List some of the medium and low temperature heat recovery sources.	05
Q.4	Explain cogeneration with a neat sketch.	10
Q.5	Explain the principle of heat pump with the line diagram of heat pump cycle.	10
Q.6	Explain the working principle of MHD generator with a neat sketch.	10
	OR	
Q.6	Explain the main areas of energy conservation in an apartment building.	10
Q.7	Classify the waste heat recovery heat exchangers according to the type of fluids.	10
	OR	
Q.7	Explain the construction and principle of operation of a heat pipe with a figure.	10
Q.8	Explain the operating principle of a waste heat recovery boiler.	10
Q.9	Steam enters the turbine at 7 MPa, 400°C and at a rate of 15 kg/s. Some steam is extracted from the turbine at 500 kPa for process heating. The remaining steam continues to expand to 5 kPa. Steam is then condensed at constant pressure and pumped to the boiler pressure of 7 MPa. The extracted steam leaves the process heater as a saturated liquid at 500 kPa. It is subsequently pumped to 7 MPa. Disregarding any pressure drops and heat losses in the piping and assuming the turbine and the pump to be isentropic, determine (a) the maximum rate at which process heat can be supplied, (b) the net power produced when no process heat is supplied.	20

-----ALL THE BEST-----