

JK LAKSHMIPAT UNIVERSITY, JAIPUR

INSTITUTE OF ENGINEERING AND TECHNOLOGY

End Term Examination (Regular/Backlog), Nov-Dec 2017

B. Tech Mechanical Engineering, Semester V

Roll No.....

ME 509: Applied Thermodynamics

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	(10 questions @ 1 mark)	10
i.	What is the function of nozzle?	
ii.	What is the function of diffuser?	
iii.	What is economizer?	
iv.	What is flash chamber?	
v.	What are the sources of nitrogen to generate NO_x in the operation of thermal power plant?	
vi.	What is condenser?	
vii.	What is reaction turbine?	
viii.	What is draught?	
ix.	What is DPT?	
x.	What is enthalpy?	
Q.2	Attempt Any Two	10
i.	Explain the effect of regeneration on steam cycle and efficiency.	
ii.	What is boiler blowdown? Why it is needed?	
iii.	Why are ID cooling towers preferred in utility plants?	
Q.3	Water at 35°C flows into a cooling tower at a rate of 1.2 kg per kg of air. Air enters the tower at a DBT of 22°C and a relative humidity of 60% and leaves it at a DBT of 30°C and 92% RH. Makeup water is supplied at 22°C . Determine (i) The temperature of the water leaving the tower (ii) The fraction of the water evaporated (iii) The approach and the range of the cooling tower	10
Q.4A	What is WBT and DBT? What is the advantage of using WBT and why is DBT measured with a shielded thermometer. Explain each question in detail.	10
Q.5A	An ideal steam power plant operates between 70 bar, 550°C and 0.075 bar. It has seven feed-water heaters. Find the optimum temperature and pressure at which the heaters operate?	07

Q.5B	A steam power plant operates between 150 bar, 550°C and 0.1 bar. Assuming ideal process find the steam quality at turbine exhaust.	03
Q.6A	Explain the performance parameters of vapour power cycle.	05
Q.6B	What are the principle components of a vapour power plant?	05
	OR	
Q.6B	Explain mean temperature of heat addition.	05
Q.7A	Compare water tube and fire tube boilers.	05
Q.7B	Give the construction details of Lancashire boiler.	05
	OR	
Q.7B	Give the construction details of babcock and wilcox boiler.	05
Q.8	A steam power plant with inlet steam to the h.p. turbine at 90 bar and 500°C, and condensation at 40°C produces 500 MW. It has one stage of reheat optimally placed which raises the steam temperature back to 500°C. one closed feed-water heater with drains cascaded back to the condenser receives bled steam at the reheat pressure, and the remaining steam is reheated and then expanded in l.p. turbine. The h.p. and l.p. turbines have isentropic efficiencies of 0.92 and 0.90, respectively. The isentropic efficiency of the pump is 75%. Calculate (a) The mass flow rate (b) The cycle efficiency Draw neat and clean schematics of the power plant.	20
Q.9	A forced draught fan supplies air at 10m/s against a draught of 20mm of water across the fuel bed. Estimate the power required to run the fan if 2500kg/h of coal is consumed and 16 kg of air is supplied per kg of fuel burned. The temperature of the flue gas and ambient air may be taken as 600K and 300K respectively. If the forced draught fan is replaced by an induced draught fan, what will be the power required to drive the fan?	10
	OR	
Q.9	Atmospheric air at 101kPa and 27°C is accelerated isentropically in a nozzle from 13.5 m/s to 223.8 m/s. find the changes in (a) temperature (b) pressure (c) density (d) stagnation temperature and pressure.	10