

JK LAKSHMIPAT UNIVERSITY, JAIPUR

INSTITUTE OF ENGINEERING AND TECHNOLOGY

End Term Examination November 2018
B. Tech in Mechanical Engineering, Semester V

Roll No.....

ME 509: Applied Thermodynamics-

Time: 3 hours

Max. Marks: 80

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.
4. Use of Steam table is permitted.

Q.1 ■ Objective type multiple choice questions (10 questions @ 1 mark)

10

- i. What is the purpose of reheat cycle? (a) to limit the pump work (b) to decrease heat input in Rankine cycle (c) to limit the quality of steam to 0.85 at the turbine exhaust (d) none of the above
- ii. Rankine cycle efficiency for a power plant is 29.6%. The Carnot cycle efficiency will be (a) Equal to Rankine cycle efficiency (b) More than Rankine cycle efficiency (c) Less than Rankine cycle efficiency (d) There is no comparison for the two.
- iii. The effect of friction in the nozzle _____ dryness fraction of steam. (a) Has no effect on (b) decreases (c) Increases (d) None of these
- iv. The diagram efficiency is the ratio of (a) Work done on the blades to the energy supplied to the blades (b) Work done on the blades per kg of steam to the total energy supplied per stage per kg of steam (c) Energy supplied to the blades per kg of steam to the total energy supplied per stage per kg of steam (d) None of the above
- v. Which one is true for pressure-compounded steam turbine? (a) pressure drop takes place in stages in various stages of nozzles (b) pressure remain constant throughout the stages (c) velocity goes on decreasing throughout the stages (d) none of the above
- vi. The isentropic efficiency of steam turbine ranges from (a) 40 to 60% (b) 50 to 60% (c) 50 to 70% (d) 70 to 90%
- vii. Pick up the wrong statement about critical condition of steam (a) Latent heat is zero (b) Liquid directly becomes steam (c) Specific volume of steam and liquid is same (d) This is the maximum pressure limit
- viii. The effect of bleeding is that (a) It increases the thermodynamic efficiency of the turbine (b) Boiler is supplied with hot water (c) It decreases the power developed by the turbine (d) All of the above
- ix. The ratio of the temperature rise of cooling water to the vacuum temperature minus inlet cooling water temperature is called (a) Condenser efficiency (b) Vacuum efficiency (c) Nozzle efficiency (d) Boiler efficiency
- x. Blow off cock in a boiler is used to (a) Control the flow of steam from the boiler

to the main pipe and to shut off the steam completely when required (b) Empty the boiler when required and to discharge the mud, scale or sediments which are accumulated at the bottom of the boiler (c) Put off fire in the furnace of the boiler when the level of water in the boiler falls to an unsafe limit (d) Increase the temperature of saturated steam without raising its pressure

Q.2	Short answer type questions (4 questions @ 2 marks)	8
i.	Describe Nozzle and diffuser.	
ii.	Define stagnation properties of fluid flowing in a duct.	
iii.	Write the draught losses in chimney.	
iv.	Write the advantages of forced draught over induced draught	
Q.3	Write the difference between Impulse and Reaction turbine.	8
	OR	
Q.3	Write the comparison between fire tube and water tube boilers.	8
Q.4	Write the comparison of jet and surface condenser.	8
	OR	
Q.4	Prove $T_0/T = 1 + ((k-1)/2) * M^2$	8
Q.5	A steam power plant operates on the actual Rankine cycle. Steam leaves the boiler at 15.2 MPa, 625°C, and enters in the turbine at 15MPa, 600°C, and expands to 10 kPa. It is then condensed to 9 kPa, 38°C before entering the pump, where it compresses to 16 MPa. This compressed water enters into the boiler at 15.9 MPa, 35°C. If the isentropic efficiency of the turbine is 87% and the isentropic efficiency of the pump 85%, determine (a) the thermal efficiency of the cycle and (b) the net power output of the plant for a mass flow rate of 15 kg/s.	16
Q.6	Steam enters a converging and diverging nozzle at 3 MPa and 500°C with a negligible velocity and a mass flow rate of 3 kg/s and exits at 400kPa. The flow is isentropic between the nozzle entrance and throat, and the overall nozzle efficiency is 93%. Determine (a) the throat and exit areas of the nozzle (b) the Mach number at the throat and the nozzle exit.	15
Q.7	In a condenser test, the following observations were made. Vacuum = 70.1 cm of Hg ; Barometer = 76.3 cm of Hg Mean temp. of condensation = 35°C ; Hot well temperature = 29°C Amount of cooling water = 46,270 kg/hr Inlet temperature of cooling water = 16.75°C Outlet temperature of cooling water = 31.15°C Amount of condensate = 1,188 kg/hr. Determine the following: (a) The amount of air present per cubic meter of condenser volume (b) The state of steam entering the condenser (c) The vacuum efficiency.	15

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