PVP 14

Code: ME4T2

II B.Tech - II Semester – Regular/Supplementary Examinations – April 2018

APPLIED THERMODYNAMICS
(MECHANICAL ENGINEERING)

Duration: 3 hours Max. Marks: 70

PART – A

Answer ***all*** the questions. All questions carry equal marks

11 x 2 = 22

1.

a) What is the purpose of reheating?
b) Explain the difference between gross calorific value and net calorific value.
c) What is the main purpose of high-pressure boilers?
d) Define nozzle efficiency.
e) What are the various types of nozzles and their functions?
f) Explain the purpose of compounding in steam turbines.
g) What are the turbine losses?
h) Define condenser efficiency.
i) Name any two types of condensers.
j) Define clearance ratio.
k) Define slip factor of a centrifugal compressor.

PART – B

Answer any ***THREE*** questions. All questions carry equal marks.
3 x 16 = 48 M

2. a) Sketch a typical layout of a modern thermal power plant with superheat, reheating regenerative feed heating. Show on T-S diagram. 8 M

   b) A steam power plant operates at a boiler pressure of 7MPa and steam enters turbine with a dry saturated condition & condenser pressure of 20kpa. Determine:
   1) Energy supplied/kg of stem produced in boiler.
   2) Quality of steam entering the condenser.
   3) Rankine cycle efficiency considering the pump work.
   4) Specific steam consumption. 8 M

3. a) What are the effects of super saturated flow on the performance of nozzle? 6 M

   b) Derive the expressions for maximum velocity and discharge through a convergent-divergent nozzle in terms of initial pressure, specific volume and polytropic index. 10 M

4. a) Derive an expression for maximum blade efficiency. 8 M

b) The following data refer to a particular stage of a Parson's reaction turbine

Speed of the turbine = 1500 rpm

Mean diameter of the rotor = 1 metre

Stage efficiency = 80%

Speed ratio = 0.7

Blade outlet angle = 20^0

Determine the available isentropic enthalpy drop in the stage. 8 M

5. a) Draw the schematic diagram of counter flow jet condenser and explain its working. 8 M

b) The surface condenser is designed to handle 16000kg of steam per hour. The steam enters the condenser at 0.09 bar abs. and 0.88 dryness fraction and condensate leaves the condenser at the corresponding saturation temperature. Determine the rise in cooling water temperature if the cooling water flow rate is 8.96×10^5 kg/hour. Assume that the pressure is constant throughout the condenser. 8 M

6. a) Differentiate between reciprocating and centrifugal compressors. 8 M

b) A two stage singe acting air compressor compresses $2m^3$ air from 1 bar and 20° C to 15 bar. The air from the low pressure compressor is cooled to 25° C in the intercooler. Calculate the minimum power required to run the compressor if the compression follows $PV^{1.25}=C$ and the compressor runs at 400rpm. 8 M