

Total No. of Questions: 09

B.Tech. (ME) (2010 Batch Only) (Sem. – 3)

APPLIED THERMODYNAMICS–I

M Code: 59005

Subject Code: ME-209

Paper ID: [A0805]

Time: 3 Hrs.

Max. Marks: 60

INSTRUCTIONS TO CANDIDATES:

1. **SECTION-A** is **COMPULSORY** consisting of **TEN** questions carrying **TWO** marks each.
2. **SECTION-B** contains **FIVE** questions carrying **FIVE** marks each and students have to attempt any **FOUR** questions.
3. **SECTION-C** contains **THREE** questions carrying **TEN** marks each and students have to attempt any **TWO** questions.

SECTION A

1. a) What is the difference between regenerator and economizer?
b) What is a pure substance? Name any five.
c) What is the difference between nozzle and diffuser?
d) What do you mean by supersaturated flow in nozzles?
e) What is the effect of friction on nozzles?
f) How we can minimize axial thrust in steam turbines.
g) What are the methods of controlling exit losses of impulse steam turbines?
h) What are the different types of condensers?
i) What is minimum air required for complete combustion of one kg of fuel.
j) What is best value of index of compression.

SECTION B

2. 3 kg. of steam at 10 bar and 250°C undergoes a constant pressure process. The resulting steam is wet having dryness fraction 0.6. Calculate (a) work done (b) change in enthalpy (c) heat transferred assuming non flow process.
3. How are Boilers classified? Explain Locomotive boiler with the help of neat diagram.
4. Determine throat area, exit area and exit velocity for a steam nozzle to pass 0.2 kg/s when the inlet conditions are 12 bars and 250°C and the final pressure is 2 bars. Expansion is isentropic and inlet velocity is negligible. Take $n = 1.3$ for superheated steam.
5. Explain with the help of neat diagram the working of a Binary vapour cycle.
6. How the compressors are classified, explain the working of single stage reciprocating compressor.

SECTION C

7. Steam is supplied to a turbine at 30 bar and 350°C. The turbine exhaust pressure is 0.08 bar. The main condensate is heated regenerative in two stages by steam bled from turbine at 5 bar and 1 bar respectively. Calculate the mass of the steam bled off at each pressure per kg of steam entering the turbine and the theoretical thermal efficiency of the cycle.
8. A surface condenser deals with 13625 kg of steam per hour at a pressure of 0.09 bars. The steam enters 0.85 dry and the temperature at the condensate and air extraction pipes is 36°C. The air leakage amounts to 7.26 kg/hour. Determine:
 - a) The surface required if the average heat transmission rate is $3.97 \text{ kJ/cm}^2/\text{s}$.
 - b) The cylinder diameter for dry air pump, if it is single acting at 60 r.p.m. with stroke bore ratio of 1.25 and volumetric efficiency of 0.85.
9. Write short note on;
 - a) Determination of flue gas analysis by mass and by volume.
 - b) Methods of steam turbine governing.