Roll No. | | | | | | | | | | | | **Total No. of Pages : 02**

Total No. of Questions : 09

B.Tech. (Marine Engineering) (2013 Onwards)

B.Tech.(ME) (2011 Onwards)

(Sem.–3)

APPLIED THERMODYNAMICS – I

Subject Code : BTME-304

Paper ID : [A1141]

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

Q1. Write briefly :

a) What do you mean by 'minimum air' and 'excess air' in combustion?

b) What is auto-ignition?

c) Why do the isobars on the Mollier diagram diverge from one another?

d) Explain the significance of critical pressure ratio for a nozzle.

e) Differentiate between fire tube and water tube boilers.

f) What are the limitations of Carnot vapour power cycle?

g) Define the term 'degree of superheat' in reference to steam.

h) How are the steam turbines classified?

i) Define 'reheat factor'. Why is its magnitude always greater than unity?

j) What is the function of a cooling tower?

SECTION-B

Q2. Explain the phenomenon of knocking in C.I engines. What are the factors that influence knocking?

Q3. Steam at 20 bar, 360°C is expanded in a steam turbine to 0.08 bar. It then enters a condenser, where it is condensed to saturated liquid water. The pump feeds back the water into the boiler. Assuming ideal processes, find per kg of the steam the net work and the cycle efficiency.

Q4. With the help of a neat sketch discuss the working of any one water tube boiler.

Q5. A surface condenser is designed to handle 10000 kg of steam per hour. The steam enters at 0.08 bar and 0.9 dryness and the condensate leaves at the corresponding saturation temperature. The pressure is constant throughout the condenser. Estimate the cooling water flow rate per hour, if the cooling water temperature rise limited to 10°C.

Q6. What do you mean by supersaturated flow through a nozzle? Explain with the help of h-s diagram.

SECTION-C

Q7. Steam initially at 0.3 MPa, 250°C is cooled at constant volume.

a) At what temperature will the steam become the saturated vapor?

b) What is the quality at 80°C.?

c) What is the heat transferred per kg of steam in cooling from 250°C to 80°C?

Q8. A 50% reaction turbine with symmetrical velocity triangles running at 400 r.p.n has the exit angle of the blades as 20° and the velocity of steam relative to blades at the exit is 1.35 times the mean blade speed .The steam flow rate is 8.33kg/s and at a particular stage the specific volume is 1.381m^3/kg. Calculate for this stage :

a) A suitable blade height assuming the rotor mean diameter 12 times the blade height

b) The diagram work.

Q9. Write short notes on **any two** of the following :

a) Compounding in steam turbines.

b) Supercharging of 1C engines.

c) Methods of analysis of products of combustion.