

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**

**INSTRUCTION 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 has to attempt any **FOUR** questions.
3. **SECTION-C** contains **THREE** questions carrying **TEN** marks each and students has to attempt any **TWO** questions.

**SECTION-A**

**1. Write briefly :**

- a) Define mean effective pressure and comment its application in internal combustion engines.
- b) List various factors that influence the flame speed.
- c) Explain the terms : degree of sub-coil and sensible heat used in case of steam.
- d) Explain the significance of mollier chart.
- e) List the factors which should be considered while selecting a boiler.
- f) Sketch Rankine cycle on T-S & h-s planes.
- g) Explain Dalton's law of partial pressure.
- h) What is the effect of friction on the flow through a steam nozzle?
- i) Explain reheat factor. Why is its magnitude always greater than unity?
- j) List the advantage of steam turbine over the steam engine.

## SECTION-B

2. Explain the combustion mechanism in C.I. engines. What is ignition delay? What are the factors which influence ignition delay?
3. A vessel of volume  $0.04 \text{ m}^3$  contains a mixture of saturated water & saturated steam at a temperature of  $250^\circ\text{C}$ . The mass of the liquid present is 9 kg. Find the pressure of the mass, the specific volume, enthalpy and entropy.
4. Draw the discharge versus ratio of pressure at outlet to inlet curve for a convergent steam nozzle. Discuss the physical significance of critical pressure ratio.
5. Explain the construction and working of Edward's air pump.
6. Describe the different operations of Rankine cycle. Derive also the expression for its efficiency.

## SECTION-C

7. A blast furnace gas has the following volumetric composition.

$\text{CO}_2 = 11\%$ ;  $\text{CO} = 27\%$ ,  $\text{H}_2 = 2\%$ ;  $\text{N}_2 = 60\%$ .

Find the theoretical volume of air required for the complete combustion of  $1 \text{ m}^3$  of the gas. Find also the percentage composition of dry flue gases by volume. Assume that air contains 21% of  $\text{O}_2$  and 79% of  $\text{N}_2$  by volume.

8. (a) Explain how the flow of steam of water is automatically stopped when the glass tube breaks.  
(b) Explain the functions of blow off cock.
9. The following data relate to a single stage impulse turbine :

Steam velocity = 600 m/s : Blade speed = 250 m/s

Nozzle angle =  $20^\circ$  : Blade angle at outlet =  $25^\circ$

Neglecting the effect of friction, calculate the work done by the turbine for the steam flow rate of 20 kg/s. Also calculate the axial thrust on the bearings.