

MAHARASHTRA AGRICULTURAL UNIVERSITIES EXAMINATION BOARD, PUNE
SEMESTER END EXAMINATION

B.Tech. (Agril. Engg.)

Semester : II (New)	Term : II	Academic Year : 2009-10
Course No. : APE 121	Title : Thermodynamics	
Credits : 3(2+1)	Time : 9.00 to 12.00	Total Marks : 80
Day & Date : Friday, 23.4.2010		

- Note :
1. Solve ANY FIVE questions from SECTION "A".
 2. All questions from SECTION "B" are compulsory.
 3. All questions carry equal marks.
 4. Draw neat diagrams wherever necessary.

SECTION "A"

- Q.1 a) In a condenser of a steam power plant, the vacuum is recorded as 700 mm of mercury. If the barometer reading is 760 mm of mercury, find the absolute pressure in the condenser in $N\ m^{-2}$, kPa, bar and $N\ mm^{-2}$.
- b) A gas occupies a volume of $0.1\ m^3$ at a temperature of $2.0^\circ\ C$ and a pressure of 1.5 bars. Find the final temperature of the gas, if it is compressed to a pressure of 7.5 bars and occupies a volume of $0.04\ m^3$.
- Q.2 a) Derive, $\Delta S = m [C_v \ln P_2/P_1 + C_p \ln V_2/V_1]$
- b) A system contains $0.15\ m^3$ of a gas at a pressure of 3.8 bar and $150^\circ\ C$. It is expanded adiabatically till the pressure falls to 1 bar. The gas is then heated at a constant pressure till its enthalpy increases by 70 kJ. Determine the total work done. Take $C_p = kJ\ kg^{-1}\ K^{-1}$ and $C_v = 0.714\ kJ\ kg^{-1}\ K^{-1}$.
- Q.3 a) State Kelvin-Planck statement and explain thermal efficiency.
- b) An engine works between the temperature limits of 1775 K and 373 K. What can be the maximum thermal efficiency of this engine?
- Q.4 a) State first law of thermodynamics and explain its limitations.
- b) Explain Polytropic process with diagram.
- Q.5 a) Determine the quantity of heat required to produce 1 kg of steam at a pressure of 6 bar and at a temperature of $25^\circ\ C$. When the steam is wet, having a dryness fraction 0.9.
- b) Determine the volume at 1 kg of superheated steam at a pressure of 20 bar and a temperature of $300^\circ\ C$.
- Q.6 a) Derive for constant pressure process, $dH = m \cdot C_p (T_2 - T_1)$.
- b) An ideal gas of mass 0.25 kg has a pressure of 3 bar, a temperature of $80^\circ\ C$ and a volume of $0.07\ m^3$. The gas undergoes an irreversible adiabatic process to a final pressure of 3 bar and a final volume of $0.10\ m^3$, during which the work done on the gas is 25 kJ. Evaluate C_p and C_v of the gas.
- Q.7 a) Explain the working of Lancashire boiler with neat sketch.
- b) Enlist the boiler mounting and accessories.

(P.T.O.)

Q.8 a) Give the classification of boilers in detail.

b) What are the differentiating features between a water tube and fire tube boiler.

Q.9 Derive general expression for the change of entropy of a perfect gas in terms of

a) Volume and absolute temperature.

b) Pressure and absolute temperature

Q.10 Write short notes on (Any Two)

1) Economizer

2) Quasi-static process

3) Locomotive Boiler

SECTION "B"

Q.11 Define the followings.

1) Dryness fraction of steam

mass wet steam / total steam

5) Water equivalent

2) Wet steam

6) Extensive property

3) Hyperbolic process

7) Enthalpy

4) Perfect gas

8) Thermal equilibrium

Q.12 Fill in the blanks.

1) In _____ boiler water is contained inside the tube.

2) ~~Dryness fraction~~ ^{Quality} is also called as quality of steam.

3) 1 bar = $1 \times 10^5 \text{ N/m}^2$

4) The heating of gas at constant press is governed by _____

5) Characteristic equation of gas is given by $PV = mRT$

6) The ratio of specific heats of gas at constant pressure and at constant volume always varies with γ

7) Most useful form of general gas equation is $PV = mRT$

8) Unit of enthalpy is _____ in S.I. units.

