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ET-201(B)

B.Tech. Civil (Construction Management) /
B.Tech. Civil (Water Resources Engineering) /
B.Tech. (Aerospace Engineering)

00143

Term-End Examination

December, 2016

ET-201(B) : ENGINEERING THERMODYNAMICS

Time : 3 hours *Maximum Marks : 70*

Note : *Answer any **seven** questions. All questions carry equal marks. Use of steam tables and scientific calculator is permitted.*

1. Define the following : *5×2=10*

(a) Internal Energy

(b) Triple Point of Water

(c) Entropy

(d) Availability

(e) Pure Substance

2. A fluid system undergoes a non-flow frictionless process following the pressure volume relation as $P = \frac{5}{V} + 1{\cdot}5$, where P is in bar and V is in m^3. During the process the volume changes from $0{\cdot}15\ m^3$ to $0{\cdot}05\ m^3$ and the system rejects 45 kJ of heat. Determine : *10*

(a) Change in internal energy

(b) Change in enthalpy

3. What is Clausius-Clapeyron equation and how is it useful ? Derive it, clearly mentioning the terms used in it. *10*

4. Determine the following when a gas obeys the Van der Waal's equation, $\left(P + \frac{a}{V^2}\right)(V - b) = RT$: *10*

(a) Change in internal energy

(b) Change in enthalpy

5. (a) A reversible heat pump is used to maintain a temperature of 0°C in a refrigerator when it rejects the heat to the surroundings at 25°C. If the heat removal rate from the refrigerator is 1440 kJ/minute, determine the C.O.P. of the machine and the work input required.

(b) If the required input to run the pump is developed by a reversible engine which receives heat at 380°C and rejects heat to the atmosphere, then determine the overall C.O.P. of the system. *10*

6. Show that the compression ratio for the maximum work to be done per kg of air in an Otto cycle between upper and lower limits of absolute temperatures T_3 and T_1 is given by

$$r = \left(\frac{T_3}{T_1}\right)^{1/2(\gamma-1)} .$$ *10*

7. Discuss the effect of pressure ratio, turbine inlet temperature and compressor inlet temperature on the efficiency of a gas turbine, with suitable sketches. *10*

8. Explain, in detail, the principle and working of a vapour absorption refrigeration system. *10*

9. Explain the following with respect to a liquid fuel : $4 \times 2\frac{1}{2} = 10$

(a) Viscosity

(b) Specific Heat

(c) Calorific Value

(d) Flash Point

10. Derive the Maxwell thermodynamic relations for a closed system undergoing a reversible process. *10*
