Student Exam No:_____

GANPAT UNIVERSITY
B.TECH SEM.III[RD] MECHANICAL ENGINEERING
REGULAR EXAMINATION NOV/ DEC -2012
2ME-305 ENGINEERING THERMODYNAMICS

TIME:- 3 HOURS **TOTAL MARKS :- 70**

1) Attempt all question.
2) Answer of two sections must be written in separate answer book.
3) Right figure indicates full marks.
4) Assume required data if necessary.
5) Allow steam table, mollier diagram.

SECTION – I

Q-1

(A) Explain phase of System and how it is classified? 3

(B) Explain types of thermodynamic equilibrium with examples. 3

(C) The characteristic constant for a gas is 0.29kJ/kgK. 0.9 kg of this gas receives heat at constant pressure at 8 bar. The increase in temperature is from 25 °C to 300 °C as a result of heat supplied .If C_V =0.72kJ/kgK, then calculate:(1) increase in internal energy (2) increase in work done (external energy) (3) increase in total energy (4) Specific heat at constant pressure. 6

OR

(A) Explain the perpetual motion machine of first kind. 3

(B) What is a throttling process? Point out its salient aspects. 3

(C) Steam enters a nozzle at a pressure of 7 bar & 20 °C (i.e. initial enthalpy 2850 kJ/kg) and leaves at a pressure of 1.5 bar. The initial velocity of steam at the entrance is 40 m/sec and the exit velocity from the nozzle is 700 m/sec. The mass flow rate through the nozzle is 1400kg/h. The heat loss from the nozzle is 11705 kJ/h. Determine the final enthalpy of steam & the nozzle area if the specific volume is 1.24 m^3/kg. 6

Q-2

(A) What is heat pump? How does it differ from a refrigerator by unity.. 3

(B) Explain the term reversibility as applied to a thermodynamic process. 3

(C) A reversible heat engine operates with in the higher and lower temperature limits 1500 K and 500 K respectively. The entire output of the engine is utilized to operate a heat pump. The pump works on reversed Carnot cycle , extracts heat from a reservoir at 400 K. and delivers it to the reservoir at 500 K .If 100 kJ/s of net heat is supplied to the reservoir at 500 K . calculate the heat supplied to the engine by the reservoir at 1500 K. 5

OR

(A) Derive the expression entropy change during constant Pressure process. 3

(B) Define entropy and show that for an irreversible process $\int ds > \int (\delta Q/T)$ 3

(C) For a particular power plant, the heat added and rejected both occurs at constant temperature and no other processes experience any heat transfer. The heat is added in the amount of 3150 kJ at 440°C and is rejected in the amount of 1950 kJ at 20°C. Is the Clausius inequality satisfied and is the cycle reversible or irreversible? Calculate the net work, cycle efficiency. 5

Q-3 **Attempt any Three** 12

(A) What are Helmholtz function and Gibb's function?

(B) Show that work is a path function and not the property of system.

(C) What do you mean by Dead state and Quality of Energy?

(D) Explain in brief Types of Irreversibilities.

SECTION – II

Q-4

(A) Explain the dual cycle and derive efficiency equation of dual cycle with P-V and T-S diagram. Why this cycle is also called limited pressure cycle? 6

(B) An air standard dual cycle has pressure and temperature at the beginning of compression as 1 bar and 38 °C, respectively. The compression ratio is 12, the pressure ratio during heat addition 1.7 and cut-off ratio 1.8. Calculate 6
(a) the % clearance (b) the pressure , temperature and volume at each point of the cycle, (c) heat added.

OR

(A) Derive Following Tds equations: 6
(a) $Tds = C_V dT + \beta T.dv/K$
(b) $Tds = C_P dT - v\,\beta T dp$

(B) Derived Maxwell equations. 6

Q-5

(A) Compare the Otto, Diesel and Dual cycle 5
I. For same compression ratio and same heat input.
II. For same maximum pressure and temperature.

(B) An air- standard Otto cycle has a compression ratio of 8. At the start of compression process, the temperature is 299 K and the pressure is 1 bar. If the maximum temperature of the cycle is 1353 K. calculate (a) the heat supplied per kg of air (b) the net work done per kg of air and thermal efficiency of the cycle. 6

OR

Q-5 (A) Define following terms: 5
(a) Pure substance
(b) Dryness fraction
(c) Critical point

(B) Steam is available at 8 bar and 0.9 dry. Make calculations for the final dryness fraction of steam in each of the following cases: 6
(a) There is a loss of 125 kJ from the steam at constant pressure.
(b) The temperature of steam falls to 160 °C
(c) The steam expands to 3 bar pressure in a turbine stage and work equivalent of 200kJ/kg is done.

Q-6 **Attempt any Three** 12

(A) What is Carnot cycle? Explain it in detail and derive the equation for thermal efficiency.

(B) Explain Co-efficient of volume expansion and Isothermal compressibility.

(C) Define Sensible heat and Latent heat.

(D) Derive an expression for thermal efficiency of Rankine cycle.

END OF PAPER