

Time allowed: 3 Hours

Max. Marks: 50

NOTE: Attempt five questions in all, including Question No. 1 which is compulsory and selecting two questions from each Part. Use of steam and gas tables is permitted.

x-x-x

Q-1)

- 1) What is Kay's Rule in real gas mixtures?
- 2) What is meant by compressor turbine?
- 3) What is Van't Hoff equation?
- 4) What is second law efficiency for an adiabatic compressor.
- 5) What is a cut off ratio in a diesel cycle?

(5x2=10)**PART A****Q-2)**

- 1) Determine ideal efficiency of a diesel engine having cylinder bore 250mm, stroke 375mm, clearance volume 1500cc, with fuel cut-off occurring at 5% of stroke.
- 2) How can irreversibility be equivalent to exergy destroyed?

(6,4)**Q-3)**

- 1) A 200m³ rigid tank initially contains atmospheric air at 100kPa and 300K, and is used as a storage vessel for compressed air at 1MPa and 300K. Compressed air is to be supplied by a compressor that takes in atmospheric air at $P_0 = 100\text{kPa}$ and $T_0 = 300\text{K}$. Determine minimum work required for this process.
- 2) Explain construction, working and advantages of a pulse jet engine.

(6,4)**Q-4)**

- 1) A gas turbine operates on a pressure ratio of 6. Inlet air temperature to the compressor is 300K and air entering the turbine is at 577°C, if volume rate entering the compressor is 240m³/sec then calculate Net Power Output of the cycle in MW and find its Efficiency, Inlet Pressure is 1 bar.

(2-)

- 2) Prove that in a Brayton cycle based turbine system, maximum work output is obtained when the exit compressor temperature is same as exit turbine temperature.

(5,5)

PART B

Q-5)

- 1) What are the conclusions of Henry's Law?
- 2) Give any five conclusions regarding equilibrium constant for ideal gas mixtures.

(5,5)

Q-6)

- 1) Derive the criterion expression for chemical equilibrium in terms of molar Gibbs function for a chemical reaction.
- 2) Differentiate between Dalton's and Amagat's laws for predicting P-V-T behavior of a gas mixture.

(5,5)

Q-7)

Write short notes on any 2 of the following:-

- 1) Entropy generation
- 2) Flow work and non-flow work
- 3) Gibbs phase rule

(5,5)

X-X-X