H.T.No. | | | | | | | | | | |

Code No: ME1510 **GEC-R14**

II B. Tech I Semester Regular Examinations, November 2016

ENGINEERING THERMODYNAMICS

(Mechanical Engineering)

Time: 3 Hours **Max. Marks: 60**

Note: All Questions from **PART-A** are to be answered at one place.
Answer any **FOUR** questions from **PART-B.** All Questions carry equal Marks.

PART-A

6 × 2 = 12M

1. Define homogeneous and heterogeneous systems.
2. a) Which of the following is the basis for temperature measurement?
   A) First law of thermodynamics B)Zeroth law of thermodynamics
   C) Law of Conservation of energy D) Second law of Thermodynamics
   b) The state at which ice, liquid water and water vapour co-exist in equilibrium is called …….
3. State Classius statement of second law of thermodynamics.
4. a) Mention the name of a device which is used for the measrment of dryness fraction of steam.
   b) Name the substance whose fusion curve has negative slope.
5. a) What is the work done in Free Expansion?
   b) What is Joule-Thompson coefficient?
6. Draw the Otto cycle on P-V and T-s planes

PART-B

4 × 12 = 48M

1. a) Differentiate open system, closed system and isolated system. Give examples for each. (6M)
   b) If a gas of volume 6000 cm^3 and at pressure of 100 kPa is compressed quasi-statically according to $pv^2 = constant$ until the volume becomes 2000 cm^3, determine the final pressure and the work transfer. (6M)
2. a) Derive the steady flow energy equation and also list the assumptions made in the analysis. (6M)
   b) A piston-cylinder device contains 0.1 kg of air at 300 K and 100 kPa. The air is now slowly compressed in an isothermal process to a final pressure of 250 kPa. Show the process in a P-V diagram and find both the work and heat transfer in the process. (6M)

3. a) Calculate the entropy change of the universe as a result of the following process: (6M)
   i) A copper block of 600 g mass and with Cp(Heat capacity) of 150J/K at 100^0C is placed in a lake at 8^0C.
   ii) The same block. at 8^0C, is dropped from a height of 100 m in to the lake.

   b) 3 kg of water at 80^0C is mixed with 4 kg of water at 15^0C in an isolated system. Calculate the change in entropy due to mixing process. (6M)

4. a) Explain the working of separating and throttling calorimeter with neat sketch. (6M)

   b) Steam expands isentropically in a nozzle from 1 MPa, 250°C to 10 kPa. The steam flow rate is 1 kg/s. Find the velocity of steam at the exit from the nozzle, and the exit area of the nozzle. Neglect the velocity of steam at the inlet to the nozzle. (6M)

5. Two vessels A and B, both containing nitrogen are connected by a valve which is opened to allow the contents to mix and achieve an equilibrium temperature of 27^0C. Before mixing the following Information is known about the gases in the two vessels.

Vessel A	Vessel B
P =1.5MPa	P = 0.6MPa
T = 50^0C	T = 20^0C
Contents = 0.5kg mol	Contents = 2.5kg

   Calculate the final equilibrium pressure, and the amount of heat transferred to the surroundings. If the vessel has been perfectly insulated, calculate the final temperature and pressure which would have been reached. Take γ=1.4 (12M)

6. a) Derive the expression for thermal efficiency of Brayton cycle. (6M)

   b) A diesel engine has a compression ratio of 14 and cut off takes place at 6% of the stroke. Find air standard efficiency. (6M)

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