

The LNM Institute of Information Technology
Department Name: Mechanical-Mechatronics Engineering
Engineering Thermodynamics MME?
Exam Type (Mid Term)

Time: 90 minutes

Date: 28/09/2017

Max. Marks: 30

Instruction: Answer must be brief and to the point. All questions carry equal weightage. Attempt all the questions. Suitable assumptions may be taken for any data required

Q1 (a) Define the second law efficiency and explain its physical significance.

(b) Explain the term exergy and exergy destruction. Derive the expression for the exergy of a fixed mass i.e. closed system exergy. [3+7]

Q2 (a) Differentiate between the Refrigerator and Heat Pump with neat sketches. Define the Coefficient of Performance (COP) of the refrigerator and Heat Pump

(b) A reversible heat engine receives heat from two thermal reservoirs maintained at constant temperatures of 750K and 500K. The engine develops 100 KW and rejects 60 kJ/s of heat to a sink at 250 K. Determine thermal efficiency of the engine and heat supply rate (kJ/s) by each thermal reservoirs. [4+6]

Q3 (a) What is the physical significance of the entropy? Prove that the entropy is a property.

(b) Derive the following equation

$$\left(\frac{\partial C_p}{\partial p}\right)_T = -T \left(\frac{\partial^2 V}{\partial T^2}\right)_p$$

and prove that C_p of an ideal gas is a function of Temperature (T) only. [4+6]

$$\frac{Q_{in}}{250} = \frac{Q_{in}}{750}$$