# UNIVERSITY OF RUHUNA

## Faculty of Engineering

End-Semester 1 Examination in Engineering: August 2014

**Module Number: ME 1202**

**Module Name: Fundamentals of Engineering Thermodynamics**

**[Three Hours]**

[This question paper has Part A and Part B. Answer all questions in Part A and Part B. Steam tables are provided]

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## Part B – 01 hour

Q 1. A well-insulated cylinder is fitted with a frictionless leak proof piston and kept in vertical position. The cylinder contains 2 kg of water at 30°C, and, the piston exerts 8bar pressure on water. Then the heat supply is started from the bottom of the cylinder using a 0.8 kW electric heater until the piston rises through a distance of 20 cm. If the cross sectional area of the cylinder is 0.2 $m^2$,

I. Find the final temperature of water.
II. Time taken to reach final position.
III. Draw the T-v Diagram relevant to this process.

Following data are given:

Specific volume of saturated liquid at 30°C is $1.0043 \times 10^{-3}$ $m^3/kg$.
Specific volume of saturated liquid at 2bar is $1.08 \times 10^{-3}$ $m^3/kg$.
*Use $y = y_{f@T}$ to find any property of u, v, h, s of compressed liquid.*

[10 marks]

Q2. A heat engine operating between two reservoirs at 1200 K and 400 K is used to drive a heat pump. This heat pump extracts heat from the reservoir at 400K at a rate twice that which the engine rejects heat to a reservoir at temperature T. The efficiency of heat engine is 50% of the efficiency of a Carnot heat engine operating between same reservoirs. The Coefficient of Performance (COP) of heat pump is 40% of the efficiency of a Carnot heat pump operating between same reservoirs. If the rate of supply of heat to the engine is 60kW, determine;

I. The temperature of the reservoir to which the heat pump rejects heat, T.
II. Rate of heat rejection from the heat pump.

[10 marks]

---------- **End of Part B** ---------