VIT

Vellore Institute of Technology

Continuous Assessment Test – II

Programme Name & Branch: B.Tech. (BME/BME/BMA)

Course Name & Code: Engineering Thermodynamics (MEE1003)

Class Number: VL2018195002690 Slot: A1+TA1+V3 Exam Duration: 90 Mins. Max. Marks: 50

General instruction(s):

1. *Missing data, if any, may be suitable assumed.*
2. *Use of steam tables and Mollier chart permitted*

Answer all the Questions

1 a. A Carnot engine operates on air with the cycle shown in Fig.1. Determine the thermal efficiency.

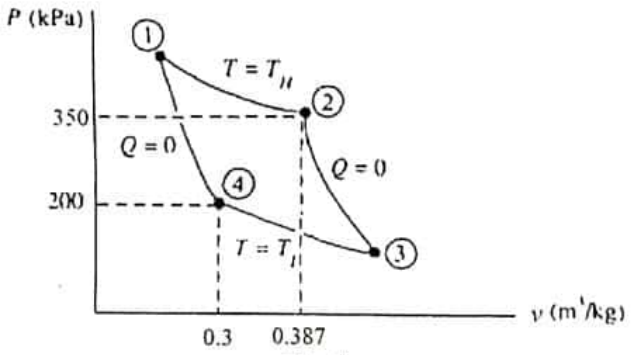


Fig.1

(6 marks)

1 b. What is the second law efficiency of the following system shown in Fig.2? Explain.

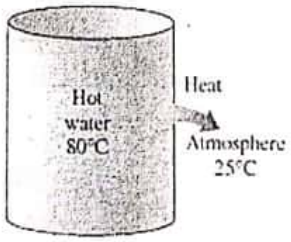


Fig. 2

(2 marks)

1c. Is it possible to maintain a pressure of 10 kPa in a condenser that is being cooled by river water entering at 20°C? Explain (2 marks)

2. A heat engine is supplied with 0.0025 kg/s fuel having calorific value of 37500 kJ/kg. The engine works between the temperature limits of 727°C and 27°C. It delivers 30 kW net work and rejects the remaining heat to a low temperature sink at 27°C. Explain clearly this heat engine obeys or violates the second law of thermodynamics on the basis of

   a. Carnot principle
   b. Clausius inequality (10 marks)

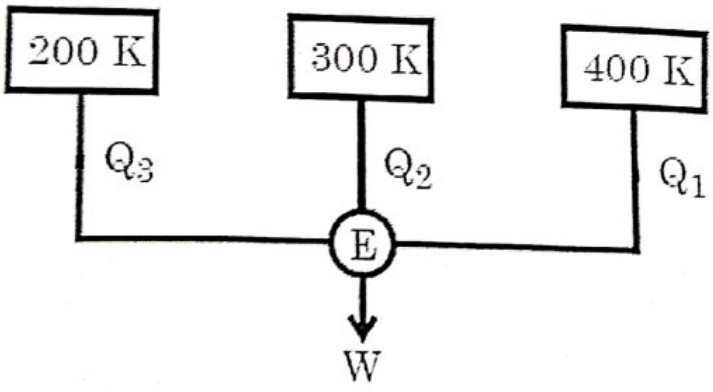
3. Steam enters the turbine of a Rankine cycle with a specific volume of 0.04839 m^3/kg and a saturation temperature of 295°C. Saturated liquid exits the condenser at a saturation temperature of 45.83°C. The net power output of the cycle is 10 MW. Determine (a) the boiler pressure (b) the condenser pressure (c) the turbine work (d) the pump work (e) the thermal efficiency, (f) the mass flow rate of steam, in kg/s

(10 marks)

4. Throttling calorimeter has steam entering to it at 100 bar and coming out of it at 0.5 bar and 100°C. Determine dryness fraction of steam, change of entropy and change in specific volume. (Use Mollier chart only) For throttling h = constant

(10 marks)

5. A reversible engine, as shown in Fig.3 during a cycle of operations draws 5 MJ from the 400 K reservoir and does 840 kJ of work. Find the amount and direction of heat interaction with other reservoirs.



(10 marks)

Fig.3