UNIT 61: ENGINEERING THERMODYNAMICS

Unit code: D/601/1410

QCF level: 5 Credit value: 15

ASSIGNMENT 1.2 OPEN THERMODYNAMIC SYSTEMS.

Assignment front sheet to be attached to assignment when submitted for assessment.

You are allowed a maximum of 4 weeks from the date of issue to complete this assignment.

Date Issued

Date submitted

I agree to the assessment as contained in this assignment. I confirm that the work submitted is my own work.

Signed

| Learning outcomes | Assessment criteria for pass | Achieved |
|--|--|----------|
| On successful completion of this unit a learner will: | The learner can: | |
| LOI Understand the parameters and characteristics of thermodynamic systems | 1.1 evaluate polytropic process parameters | Ass.1.1 |
| | 1.2 explain the operation thermodynamic systems and their properties | |
| | 1.3 apply the first law of thermodynamics to thermodynamic systems | |
| | 1.4 determine the relationships between system constants for an ideal gas | Ass.1.1 |
| Grade | Descriptor | Achieved |
| MERIT | use a range of methods and techniques to collect, analyse and process information/data. Apply and analyse detailed knowledge and skills, using relevant theories and techniques. Coherently present and communicate work using technical language correctly. | |
| DISTINCTION | Check validity when collecting, analysing and processing complex information/data. Evaluate and synthesise relevant theories and techniques to generate and justify valid conclusions. Show an individual approach in representing and communication work coherently, using technical language fluently. | |

| Feedback Comments | | |
|-------------------|-----------------|------|
| Brief I,V. by | Date | IV |
| Grade Awarded | Tutor Signature | Date |

PART 1 OPEN SYSTEM PROBLEM



A simple steam power plant works as follows. Water is pumped into the boiler at point (1) on the diagram. Superheated steam leaves the boiler and goes to the turbine at point (2). The steam leaving the turbine is wet with dryness fraction x and goes to a steam condenser at (3). The condenser turns the steam into saturated water and this goes to a pump at (4) and the cycle is repeated. Assume That 1 kg/s flows around the circuit.

You must assume that no heat is lost from the turbine or pump. Given the set of conditions for each point in the circuit you must determine the enthalpy at each point in the cycle and calculate the following.

- 1. The work transfer rate into the pump (Pin).
- 2. The heat transfer rate into the boiler (Φ_{in}).
- 3. The work transfer rate from the turbine (Pout).
- 4. The heat transfer rate from the condenser (Φ_{out}).
- 5. The thermal efficiency of the plant. (η th)

| Student | p1 /p2 | bar p3 /p4 bar | θ2 C | X3 |
|---------|--------|----------------|------|-------|
| 1 | 40 | 0.035 | 400 | 0.785 |
| 2 | 100 | 0.07 | 400 | 0.733 |
| 3 | 60 | 0.5 | 450 | 0.865 |
| 4 | 50 | 0.07 | 300 | 0.733 |
| 5 | 100 | 0.04 | 600 | 0.805 |
| 6 | 15 | 0.1 | 300 | 0.836 |
| 7 | 20 | 0.1 | 350 | 0.841 |
| 8 | 70 | 0.08 | 500 | 0.813 |
| 9 | 90 | 0.09 | 450 | 0.775 |

PART 2 RESEARCH

In order to have a better understanding of steam power plant, find out and explain the following items that are found in a large industrial boiler. State where you found the information. Include some diagrams and pictures.

Water drum Water walls Economiser Super-heater Re-heater Air pre-heater Once through evaporation.