

Prince of Songkla University
Faculty of Engineering

Final Examination

15 December 2014

215-231 ENGINEERING THERMODYNAMIC I

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Semester 1/2557

Time 09:00-12:00

Room: R200

Room: A401

Room : S 203

Directions

- A4 paper is allowed and can be written two sides of the A4 paper.
- All types of calculator and dictionary are permitted.
- Attempt all 6 questions.
- The exam paper has 15 pages.

Gampon Prateepchaikul (Section 01)
Juntakan Taweekun (Section 02)
Instructor

Problem	Marks	
1	15	
2	15	
3	15	
4	15	
5	15	
6	15	
Total	90	

Name _____

ID _____

Section _____

Name _____ ID _____

Question 1 (15 points)

Steam at 4 MPa and 400°C enters a nozzle steadily with a velocity of 60 m/s, and it leaves at 2 MPa and 300°C. The inlet area of the nozzle is 50 cm², and heat is being lost at a rate of 75 kJ/s. Determine

- (a) The mass flow rate of the steam
- (b) The exit velocity of the steam
- (c) The exit area of the nozzle

Name _____ ID _____

Question 2 (15 points)

Steam flows steadily into a turbine with a mass flow rate of 26 kg/s and negligible velocity at 6 MPa and 600°C. The steam leaves the turbine at 0.5 MPa and 200°C with a velocity of 180 m/s. The rate of work done by the steam in the turbine is measured to be 20 MW. If the elevation change between the turbine inlet and exit is negligible, determine the rate of heat transfer associated with this process.

Name _____ ID _____

Question 3 (15 points)

A heat engine receives heat from a heat source at 1200°C and has a thermal efficiency of 40 percent. The heat engine does maximum work equal to 500 kJ. Determine the heat supplied to the heat engine by the heat source, the heat rejected to the heat sink, and the temperature of the heat sink.

Name _____ ID _____

Question 4 (15 points)

A household refrigerator with a COP of 1.2 removes heat from the refrigerated space at a rate of 60 kJ/min. Determine

- (a) the electric power consumed by the refrigerator (in unit of kW)
- (b) the rate of heat transfer to the kitchen air (in unit of kJ/min)

Name _____ ID _____

Question 5 (15 points)

Water vapor enters a turbine at 6 MPa and 400°C, and leaves the turbine at 100 kPa with the same specific entropy as that at the inlet. Calculate the difference between the specific enthalpy of the water at the turbine inlet and exit.

Name _____ ID _____

Question 6 (15 points)

Steam is expanded in an isentropic turbine with a single inlet and outlet. At the inlet, the steam is at 2 MPa and 360°C. The steam pressure at the outlet is 100 kPa. Calculate the work produced by the turbine, in kJ/kg.