

Prince of Songkla University
Faculty of Engineering

Final Examination

22 February 2008

216-231 Engineering Thermodynamic I

Semester 2/2550

Time 13:30-16:30

Room: R300

Directions

- Books, note and dictionary are not allowed.
- All types of calculator are permitted.
- Attempt all 5 questions.

Juntakan Taweekun
Instructor

Problem	Marks	
1	20	
2	20	
3	20	
4	20	
5	20	
Total	100	

Name _____

ID _____

Name-Surname ID

Question 1 (20 points)

A car engine with a power output of 55 kW has a thermal efficiency of 22 percent. Determine the fuel consumption rate of this car (in unit of kg/hr) if the fuel has a heating value of 48,000 kJ/kg (that is, 48,000 kJ of energy is released for each kg of fuel burned).

Name-Surname ID

Question 2 (20 points)

A heat pump is used to meet the heating requirements of a house and maintain it at 22 °C. On a day when the outdoor air temperature drops to -3 °C, the house is estimated to lose heat at a rate of 85,000 kJ/hr. If the heat pump under these conditions has a COP of 2.5, determine

- 2.1) the power consumed by the heat pump (in unit of kW)
- 2.2) the rate at which heat is absorbed from the cold outside air (in unit of kW)

and transfers it to the same ambient air at 30 °C. Determine

- 5.1 The maximum rate of heat removal from the refrigerated space (in unit of kJ/min)
- 5.2 The total rate of heat rejection to the ambient air (in unit of kJ/min)

Name-Surname ID

Question 5 (20 points)

A Carnot heat engine receives heat from a reservoir at $927\text{ }^{\circ}\text{C}$ at a rate of 740 kJ/min and rejects the waste heat to the ambient air at $30\text{ }^{\circ}\text{C}$. The entire work output of the heat engine is used to drive a refrigerator that removes heat from the refrigerated space at $-5\text{ }^{\circ}\text{C}$ and transfers it to the same ambient air at $30\text{ }^{\circ}\text{C}$. Determine

- 5.1 The maximum rate of heat removal from the refrigerated space (in unit of kJ/min)
- 5.2 The total rate of heat rejection to the ambient air (in unit of kJ/min)

Name-Surname ID