Uva Wellassa University, Sri Lanka
End Semester Examination – Sep/Oct 2012
SCT 368-1 Applied Thermodynamics
Time: One (01) Hour

Total 03 Questions
Answer all questions

01)

I. In a brochure, you read that a car has a 2-liter engine. What does this mean?
(25 marks)

II. A car magazine says that your car's engine has more power when the ambient temperature is low. Do you agree?
(25 marks)

III. Why are the external surfaces of a lawn mower engine covered with fins?
(20 marks)

IV. The ideal Brayton and Rankine cycles are composed of the same four processes, yet look different when represented on a T-s diagram. Explain.
(30 marks)

02)

I. An air standard dual cycle has a compression ratio of 16 and a cutoff ratio of 1.15. At the beginning of compression, p_1 = 95 kPa and T_1 = 300 K. The pressure increases by a factor of 2.2 during the constant volume heat addition process. The mass of air is 0.04 kg.

a. Draw *p-v* and *T-s* diagrams for the above process and mark the given data.
(20 marks)

b. Define compression ratio.
(04 marks)

c. Define cutoff ratio.
(04 marks)

d. In which process/processes does the heat is added to the system?
(03 marks)

e. In which process does the heat rejected from the system?
(03 marks)

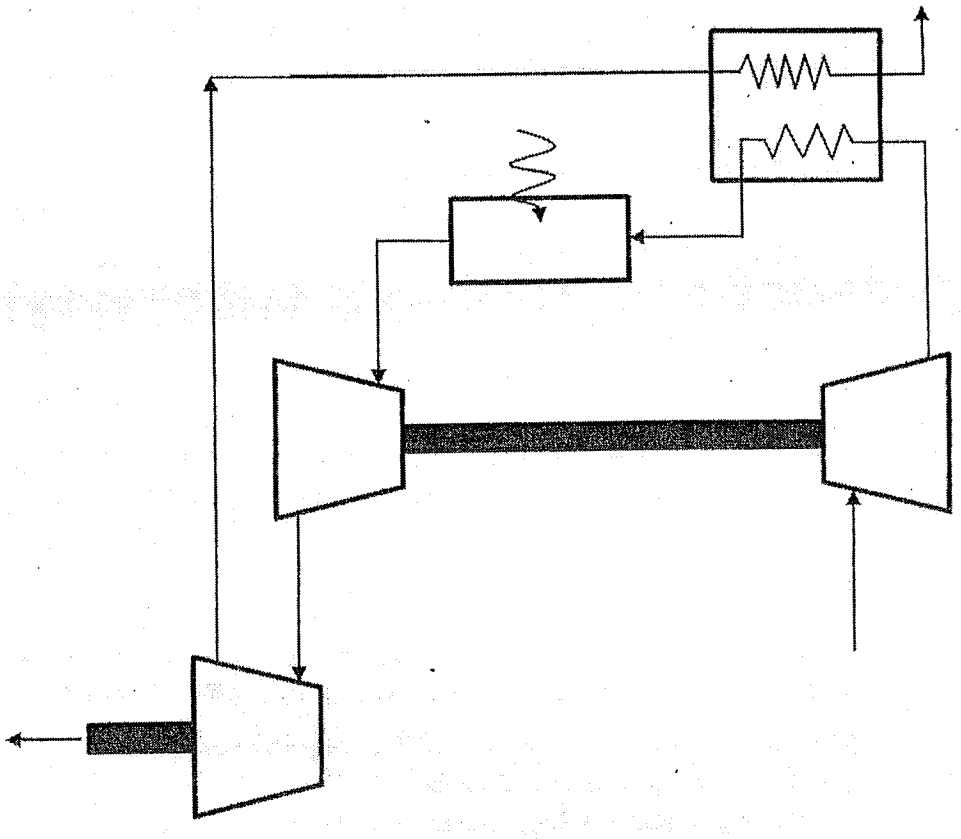
f. Which process is related to the work done by the system?
(03 marks)

g. What are the isentropic processes in the system?
(03 marks)

h. Define the thermal efficiency for the system and give the necessary equations to calculate it.
(10 marks)

12

II. A regenerative gas turbine power plant is shown in FigQ02. Air enters the compressor at 1 bar, 27°C with a mass flow rate of 0.562 kg/s and is compressed to 4 bar. The isentropic efficiency of the compressor is 80%, and the regenerator effectiveness is 90%. All the power developed by the high-pressure turbine is used to run the compressor. The low-pressure turbine provides the net power output. Each turbine has an isentropic efficiency of 87% and the temperature at the inlet to the high-pressure turbine is 1200 K.



FigQ02

a. Complete the above diagram inserting all the data given above.
(20 marks)

b. Draw *p-v* and *T-s* diagrams for this system.
(20 marks)

c. Define the thermal efficiency for this system using the common terms.
(10 marks)

03) Consider a 210-MW steam power plant that operates on a simple ideal Rankine cycle. Steam enters the turbine at 10 MPa and 500°C and is cooled in the condenser at a pressure of 10 kPa. Show the cycle on a *T-s* diagram with respect to saturation lines, and determine

I. the quality of the steam at the turbine exit
(40 marks)

II. the thermal efficiency of the cycle
(60 marks)