Menoufiya University

Subject: MEP 212 Thermodynamics

Production & Design Eng. Department

First Semester Final Exam

Minufiya University

Time Allowed: (3 hrs.) Three hours
Total Marks : 70 marks
Date of Exam.: 1 / 1/ 2014

Allowed Tables and Charts: Steam Table and Chart.

Solve the Following Questions

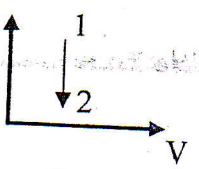
(Question Number-1) :(18 Marks)

(a) Select the correct answer and comment on your answer using illustrations:

1) What is the lowest temperature at which steam can exist?
a) -10°C b) 0°C c) 32°C d) 50°C e) 100°C f) 212°C

2) A heat engine is 80% efficient. What percent of energy is input at the engine as heat? a) 0 % b) 20 % c) 80% d) 100% e) 120%

3) In process AB above, Q is:
a) + ve b) – ve c) 0



4) If the gas is compressed in an adiabatic process, then Q is
(a) Positive (b) Negative (c) Zero

5) If the gas expands in an adiabatic process, Q is
(a) Positive (b) Negative (c) Zero (6 Marks)

(b) Show and Prove that for adiabatic process $PV^{\gamma} = Constant$ (4 Marks)

(c) Show that the ideal gas enthalpy depends only on the gas temperature and use that result to show that the gas constant (R) is equal to the difference between the gas specific heat at constant pressure, Cp and specific heat constant volume, Cv. (4 Marks)

(d) Show a comparison for the air standard cycles (Otto – Diesel – Dual) and their thermal efficiencies, if the maximum pressure and the heat rejected are constants. (4 Marks)

(Question Number-2) :(18Marks)

(a) Air is expanded on according to the relation $PV^{n} = Constant$, from initial state of 6.9 bar and 555 K to final state 1.38 bar with an entropy gain of 0.1675 kJ/kg.K. Find the index n and the work-done during this process. (10 Marks)

(b) Air flows into a convergent nozzle at 150 kPa, 300 K and very low velocity. It flows out of the nozzle at 80 kPa, 288 K. If the nozzle is insulated determine the air exit velocity. Sketch the nozzle, take Cp for air = 1.005 kJ.kg.K. Also, find the velocity exit velocity the inlet velocity is 25 m/sec and there is a heat losses of 0.5 kJ/kg. (8 Marks)

(Question Number-3) :(18 Marks)

(a) Two refrigerators, the first works between the upper and lower limits of temperatures of 40 °C and - 4 °C. The second works between 25 °C. and T °C., respectively. Determine T CO.P. for each refrigerators, if they have the same work done and ΔS. Also, find value of T, if each refrigerator has the same the CO.P. (8 Marks)

are 1 bar and 27 °C. The cycle produces 450 kJ/kg of work. If the cycle compression ratio is 10, determine the cycle thermal efficiency and the mean effective pressure. Take Cp = 1.005 kJ/kg.K and Cv = 0.718 kJ/kg.K. (10 Marks)

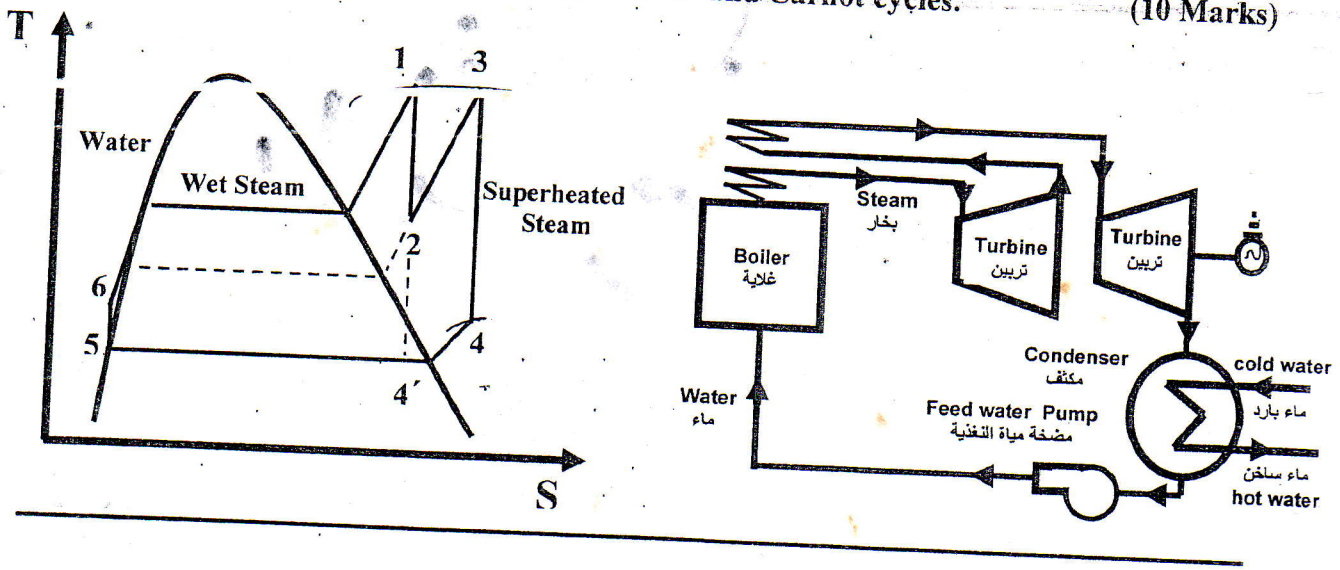
(Question Number-4) :(15 Marks)

(a) Define the 1st law of thermodynamics and show the energy balance for complete open gas turbine cycle and for each component separately and show how we can apply the second law of thermodynamics on that cycle. Draw the cycle on (P-V) and (T-S) diagrams and show how its efficiency can be improved. (8 Marks)

(b) In steam power station is working according to Rankine cycle and reheating cycle as can be shown in the figure below. If $T_1 = T_3 = 450$ °C, $T_2 = 250$ °C $P_c = P_4 = 0.5$ bar, $T_4 = 100$ °C, determine the inlet state of the steam inter to the turbine, P_1, P_2 and then find:

(i) The thermal efficiency of the cycle, neglecting the work of feed water pump.

(ii) Compare it with that of normal Rankine and Carnot cycles. (10 Marks)



With our best wishes *Dr./ Essam Wahba*

This exam contributes " by measuring in achieving Programme Academic Standards according to NARS

Question Number	Q1-(a-d)	Q2-a			Q2-d	Q3-a				Q3-b	Q4-a	Q4-b		
Skills	A1,A2	A1, A3			B4	B5				C4	C5	C5		..
	Knowledge & Understanding Skills				Intellectual Skills					Professional Skills				