1-17

Menoufiya University
Faculty of Engineering Shebin El-Kom
Production & Design Eng. Department
First Semester Final Exam

Subject: MEP 213 Thermodynamics.
Level : Second Year.
Time Allowed: (3 hrs.) Three hours
Total Maeks : 70 marks
Date of Exam.: 17 / 1/ 2016

Allowed Tables and Charts: Steam Table and Chart.

Solve the Following Questions " Assume the missing data use illustration if as possible)

(Question Number-1) :(18 Marks)

(a) Define the following terms:
(i) State. (ii) Process (iii) Process diagram. **(6 Marks)**

(b) Show and Prove that for adiabatic process PV^{γ} = Constant **(4 Marks)**

(c) Air is expanded according PV^{n} = constant, from initial state 8 bar and 527 °C to 2 bar with entropy gain of 0.2 kJ/kg.K. Find the index n and the workdone during the process and compare it with adiabatic process for the same limits. Take Cp = 1.005 kJ/kg°C and Cv = 10.718 kJ/kg°C **(8 Marks)**

(Question Number-2) :(14Marks)

(a) Write the statement of the second kaw of thermodynamics which can be applied for the refrigerator. Then describe the refrigerator cycle and show how the first law can be applied to its component. A show how the second law can be applied for the cycle. **(6 Marks)**

(b) Is the thermal efficiency can be 100 % of an heat engine? Why? **(2 Marks)**

(c) The C.O.P of a refrigerator is 8. The cycle rejected heat at room temperature 27 °C. If the heat rejected is 80 kJ/kg. What will power necessary to run the refrigerator and the lower temperature. The mass flow rate of the refrigerant is 5 kg/min. **(6 Marks)**

(Question Number-3) :(14 Marks)

(a) 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)**

(b) In an air Otto cycle, the pressure and temperature at the beginning of compression are 1 bar and 27 °C. The cycle produces 650 kJ/kg of work. If the cycle compression ratio is 12, 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) Describe how the mechanical efficiency can be estimated experimentally for a single cylinder internals combustion engine. **(4 Marks)**

(b) A Morse test is carried out to estimate the indicate power of six cylinders Internal combustion engine. The brake power is 40 kW for the engine. The measured brake power the engine when one cylinder is cut-off is given in the table blew. **(8 Marks)**

Cylinder number	1	2	3	4	5	6
Power in kW	20.5	20.2	22	21	21.5	20.8

(Question Number-5) :(15 Marks)

(a) Drive an expression for thermal efficiency of simple gas turbine as function of pressure ratio P2/P1. Compare that efficiency with that if we use heat exchanger. Draw a schematic figure and its diagrams of the cycle on P-V and T-S diagram.

(4 Marks)

(b) In steam Power station working at Rankine cycle. The steam enter the turbine at 10 bar and 400 oC and exit dry and saturated at Pc = 0.4 bar. Determine

(i) The turbine internal efficiency.

(ii) The thermal efficiency of the cycle with and without pump work.

(iii) Compare the thermal efficiency with that of Carnot cycle. **(8 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				