



Unit 15 - Week 12 :

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Assignment 12

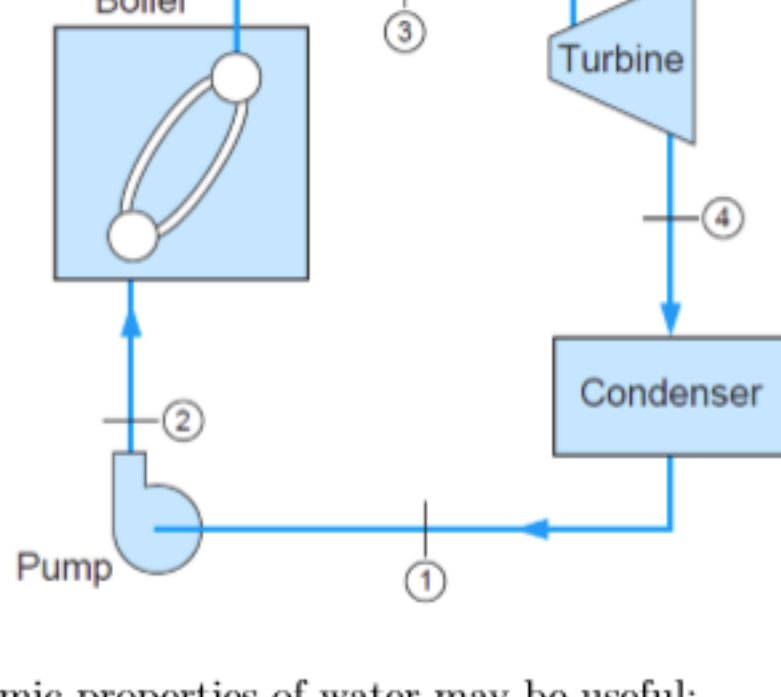
The due date for submitting this assignment has passed. As per our records you have not submitted this assignment.

Due on 2019-10-23, 23:59 IST.

1) 1 point

Common Data for Questions 1 to 7:

A steam power plant operating on a Rankine cycle with superheat has a high pressure of 5 MPa and a boiler exit of 600°C. The boiler receives heat from a heat source at 700°C. The ambient air at 20°C provides cooling in order to maintain the condenser at 45°C. All components are ideal except for the turbine, which has an actual exit state with a quality of 97%. The processes in all the four components are steady state steady flow processes with negligible changes in kinetic and potential energies. Assume that the pump handles an incompressible liquid of specific volume 0.00101 m³/kg.



The following thermodynamic properties of water may be useful:

Saturated water

p (kPa)	T_{sat} (°C)	u_f (kJ/kg)	u_g (kJ/kg)	h_f (kJ/kg)	h_g (kJ/kg)	s_f (kJ/kg-K)	s_g (kJ/kg-K)
9.593	45	188.41	2436.81	188.42	2583.19	0.6386	8.1647
5000	263.99	1147.78	2597.12	1154.21	2794.33	2.9201	5.9733

Superheated water

p (kPa)	T (°C)	u (kJ/kg)	h (kJ/kg)	s (kJ/kg-K)
5000	600	3273.01	3666.47	7.2588

The specific heat transfer to the boiler from the heat source is

- (A) 2473 kJ/kg (B) 3473 kJ/kg
(C) 1173 kJ/kg (D) 1643 kJ/kg

- a
 b
 c
 d

No, the answer is incorrect. Score: 0

Accepted Answers: b

2) The specific work output of the actual turbine is 1 point

- (A) 875 kJ/kg (B) 955 kJ/kg
(C) 1155 kJ/kg (D) 1371 kJ/kg

- a
 b
 c
 d

No, the answer is incorrect. Score: 0

Accepted Answers: c

3) If the actual turbine is replaced by an ideal isentropic turbine that operates between the same boiler exit state (state 3) and the same condenser pressure, the specific work output of the ideal turbine would be 1 point

- (A) 875 kJ/kg (B) 955 kJ/kg
(C) 1155 kJ/kg (D) 1371 kJ/kg

- a
 b
 c
 d

No, the answer is incorrect. Score: 0

Accepted Answers: d

4) The isentropic efficiency of the actual turbine is 1 point

- (A) 84.2 % (B) 75.2 %
(C) 68.2 % (D) 92.2 %

- a
 b
 c
 d

No, the answer is incorrect. Score: 0

Accepted Answers: a

5) The thermal efficiency of the cycle (with actual turbine) is 1 point

- (A) 61.2 % (B) 45.2 %
(C) 33.2 % (D) 26.2 %

- a
 b
 c
 d

No, the answer is incorrect. Score: 0

Accepted Answers: c

6) The specific heat rejection in the condenser (with actual turbine) is 1 point

- (A) 1922.9 kJ/kg (B) 2322.9 kJ/kg
(C) 2522.9 kJ/kg (D) 2922.9 kJ/kg

- a
 b
 c
 d

No, the answer is incorrect. Score: 0

Accepted Answers: b

7) The specific entropy generation in the boiler/heat source setup is 1 point

- (A) 3.051 kJ/kg-K (B) 3.591 kJ/kg-K
(C) 2.651 kJ/kg-K (D) 0.571 kJ/kg-K

- a
 b
 c
 d

No, the answer is incorrect. Score: 0

Accepted Answers: a

8) 1 point

Common Data for Question 8 to 12:

A refrigerator has a steady flow of R-22 as saturated vapour at -20°C into the adiabatic compressor that brings it to 1000 kPa. After the compressor, the temperature is measured to be 60°C. The following thermodynamic properties of R-22 may be useful:

Saturated R-22

p (kPa)	T_{sat} (°C)	h_f (kJ/kg)	h_g (kJ/kg)	s_f (kJ/kg-K)	s_g (kJ/kg-K)
244.8	-20	21.73	242.06	0.0890	0.9593
909.9	20	68.67	256.51	0.2590	0.8977
1043.9	25	74.91	257.88	0.2797	0.8934

Superheated R-22

p (kPa)	T (°C)	h (kJ/kg)	s (kJ/kg-K)
1000	40	271.04	0.9400
1000	50	279.05	0.9651
1000	60	286.97	0.9893

The specific work input to the actual compressor is

- (A) 35.14 kJ/kg (B) 44.91 kJ/kg
(C) 56.45 kJ/kg (D) 64.93 kJ/kg

- a
 b
 c
 d

No, the answer is incorrect. Score: 0

Accepted Answers: b

9) The specific heat transfer to the hot space is 1 point

- (A) 129.5 kJ/kg (B) 154.7 kJ/kg
(C) 169.2 kJ/kg (D) 214.1 kJ/kg

- a
 b
 c
 d

No, the answer is incorrect. Score: 0

Accepted Answers: d

10) The specific heat transfer from the cold space is 1 point

- (A) 129.5 kJ/kg (B) 154.7 kJ/kg
(C) 169.2 kJ/kg (D) 214.1 kJ/kg

- a
 b
 c
 d

No, the answer is incorrect. Score: 0

Accepted Answers: c

11) The coefficient of performance of the actual cycle is 1 point

- (A) 2.66 (B) 3.77
(C) 4.33 (D) 5.11

- a
 b
 c
 d

No, the answer is incorrect. Score: 0

Accepted Answers: b

12) The isentropic efficiency of the compressor is 1 point

- (A) 78.24 % (B) 84.26 %
(C) 89.12 % (D) 94.35 %

- a
 b
 c
 d

No, the answer is incorrect. Score: 0

Accepted Answers: a