Ministry of Higher Education
& Scientific Research
Tikrit University
College of Engineering
Mechanical Engineering Dept.

جامعة تكريت

Final Exam
2015-2016

Class : Fourth
Subject: Power Plants
Time: 3 hrs.
Date : 19 / 5 / 2016
Form: (A)

Q1. A small power plant produces steam at 3 MPa, 600 °C in the boiler. It keeps the condenser at 45 °C by transfer of 10 MW out as heat transfer. The first turbine section expands to 500 kPa and then flow is reheated followed by the expansion in the low- pressure turbine.
Find the reheat temperature so the turbine output is saturated vapor. For this reheat, find the total turbine power output and the boiler heat transfer.

Q2. A gas turbine with air as the working fluid has two ideal turbine sections, the first of which drives the ideal compressor, with the second producing the power output. The compressor input is at 290 K, 100 kPa, and the exit is at 450 kPa. A fraction of flow, x, bypasses the burner and the rest goes through the burner where 1200 kJ/kg added by combustion. The two flows then mix before entering the first turbine and continue through the second turbine, with exhaust at 100 kPa. If the mixing should result in a temperature of 1000 K into the first turbine find the fraction x. Find the required pressure and temperature into the second turbine and its specific power output. Assume cold air properties.

Q3. Water is the working fluid in an ideal Rankine cycle. Superheated vapor enters the turbine at 8 MPa, 480 °C. The condensate temperature is 41.5 °C. 1813.8 kg/s of cooling water enters the condenser at 15 °C and exits at 35 °C with negligible pressure change. Determine for the cycle:
(a) the output power, in kW.
(b) the thermal efficiency.

Q4. The following data refer to a boiler consisting of an economizer, boiler, and superheater:
Mass of water evaporated per hour=5940 kg, mass of coal burnt per hour=675 kg, L.H.V of coal=31600 kJ/kg, pressure of steam at boiler stop valve=14 bar, temperature of feed water entering the economizer=32 °C, temperature of feed water leaving the economizer=115 °C, dryness fraction of steam leaving the boiler and entering superheater is 0.96, temperature of steam leaving the superheater=260 °C, specific heat of superheater steam=2.3 kJ/kg.K, determine:
i : Percentage of heat in coal utilized in economizer, boiler, and superheater.
ii : Overall efficiency of boiler plant.

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