جامعة المنوفية
كلية الهندسة
قسم هندسة القوى الميكانيكية

الفرقة الثالثة قسم كهرباء
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الزمن : ثلاث ساعات

المادة : مقرر اختياري (محطات قوى ميكانيكية)
يسمح باستخدام جداول وخرائط البخار

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1) A) - Compare between steam power plant used regenerative, reheating cycle with backward feed water heater and power plant used regenerative, reheating cycle with closed feed water heater forward feeding.

B) A Pass-out two-stage turbine receives steam at 50bar and 350 °C. At 1.5 bar the high-pressure stage exhausts and 12000kg of steam per hour are taken at this stage for process purposes. The remainder is reheated at 1.5 bar to250 °C and then expanded through the low-pressure turbine to a condenser pressure of 0.05 bar. The power output from the turbine unit is to be 3750 KW. The relevant values should be taken from an h-s chart. Taken the isentropic efficiency of the high-pressure stage as 0.84, and that of the low-pressure stage as 0.81.

Determine:

1- Calculate the boiler capacity

2- Cycle efficiency.

2) Steam power station, steam inlet 30 bar and 350 C° and condenser pressure 0.0.04 bar if steam expanded in turbine to 10 bar where additional steam is extracted for closed forward heater and the remainder reheated to 300 C°. And is expanded to 5 bar where additional steam is extracted again for closed backward heater. If the turbines efficiencies is 80 % .

Determine:

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1. The cycle efficiency.
2. The output power developed by the turbine in H.P if the rate of steam is 10Ton/hr.(assume mech. &ele. efficiencies)

3-a) For an ideal simple gas turbine cycle, Prove that the pressure ratio at which the output power is maximum depends only on the lower and higher temperatures.

3-b) Find the maximum power could be developed from a simple gas turbine system works between minimum and maximum temperatures of 32 °C and 877 °C. Find also the corresponding thermal efficiency of the system in this case.

4-) A gas turbine system consists of two stages compressor, a combustion chamber, two stages turbine and a regenerative heat exchanger. The high stage turbine is used to derive the high stage compressor while the low stage turbine is connected together with the low stage compressor and the generator. Minimum and maximum pressures are 1 bar and 9 bar. Minimum and maximum temperatures are 32 °C and 850 °C. The pressure ratio is the same in each compression stage. Water inter-cooler effectiveness is 0.9. The temperature at each turbine stage is the same. Isentropic efficiency for each compressor stage is 0.85 and that of each turbine stage is 0.9. Air temperature at the regenerative heat exchanger outlet is 475 °C.

Find for 1 kg/s mass flow rate of air:

a) The power developed.
b) The thermal efficiency.
c) The heat exchanger effectiveness.
d) The temperature of gases leaving the heat exchanger.