คณะวิศวกรรมศาสตร์

มหาวิทยาลัยสงขลานครินทร์

การสอบกลางภาค ประจำภาคการศึกษาที่ 1 ประจำปีการศึกษา 2556

วันที่ 3 สิงหาคม 2556 เวลา 09.00-12.00 น.

วิชา 215-332 Engineering Thermodynamics II ห้อง

216-332

คำสั่ง

1. ข้อสอบมีทั้งหมด 5 ข้อ ทำทุกข้อกระดาษคำตอบ
2. นำกระดาษ A4 จด 2 หน้า เข้าห้องสอบได้
3. นำพจนานุกรมเข้าห้องสอบได้

รศ.กำพล ประทีปชัยกูร

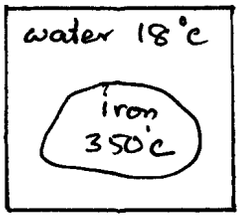
ผู้ออกข้อสอบ

รหัส..... ชื่อ-สกุล..... ตอน.....

รหัส..... ชื่อ-สกุล..... ตอน.....

1. A 25 kg iron block initially at 350°C is quenched in an insulated tank that contains 100 kg of water at 18°C. Assuming the water that vaporizes during the process condenses back in the tank, determine the total entropy change during this process.

Given: $c_{p,water} = 4.18 \frac{kJ}{kg.C}$, $c_{p,iron} = 0.45 \frac{kJ}{kg.C}$ (20 points)

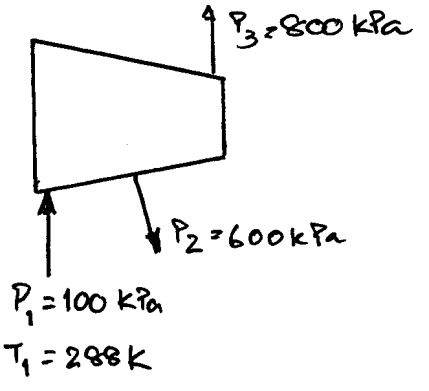


รหัส..... ชื่อ-สกุล..... ตอน.....

2. An ideal gas at 100 kPa, 15°C enters a steady flow compressor. The gas is compressed to 600 kPa, and 10 percent of the mass that entered the compressor is removed for some other use. The remaining 90 percent of the inlet gas is compressed to 800 kPa before leaving the compressor. The entire compression process is assumed to be reversible and adiabatic. The power supplied to the compressor is measured to be 32 kW. If the ideal gas has constant specific heat such that

$c_v = 0.8 \frac{kJ}{kg.K}$, $c_p = 1.1 \frac{kJ}{kg.K}$ (a) sketch the compression process on a T-s diagram (b) determine the temperature of the gas at the two compressor exits, in K (c) determine the mass flow rate of the gas into the compressor in kg/s.

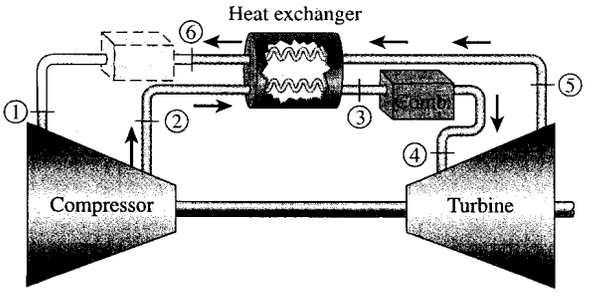
Given: for ideal gas $c_v = 0.8 \frac{kJ}{kg.K}$, $c_p = 1.1 \frac{kJ}{kg.K}$ (20 points)



รหัส..... ชื่อ-สกุล..... ตอน.....

3. A gas turbine for an automobile is designed with a regenerator. Air enters the compressor of this engine at 100 kPa 20°C. The compressor pressure ratio is 8; the maximum cycle temperature is 800°C; and the cold air stream leaves the regenerator 10°C cooler than the hot air stream at the inlet of the regerator. Assuming both the compressor and the turbine to be isentropic, determine the rates of heat addition and rejection for this cycle when it produces 150 kW. Use constant specific heata at room temperature and draw T-s diagram of the cycle.

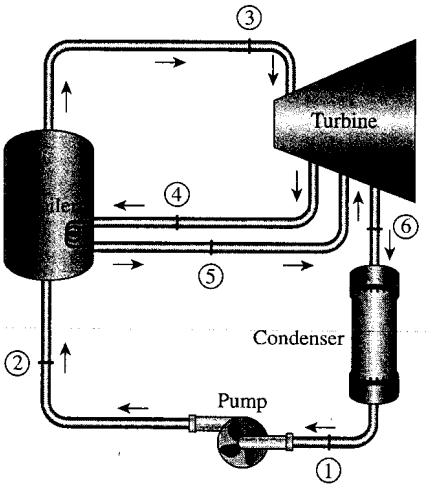
Given: $c_p = 1.005 \frac{kJ}{kg.K}$, $k = 1.4$ (25 points)



รหัส..... ชื่อ-สกุล..... ตอน.....

4. A steam power plant operates on the reheat Rankine cycle. Steam enters the high pressure turbine at 12.5 MPa and 550°C at a rate of 7.7 kg/s and leaves at 2 MPa. Steam is then reheated at constant pressure to 450°C before it expands in the low pressure turbine. The isentropic efficiencies of the turbine and the pump are 85 percent and 90 percent, respectively. Steam leaves the condenser as a saturated liquid at 10 kPa. Determine (a) the net power output and (b) the thermal efficiency.

(25 points)



รหัส..... ชื่อ-สกุล..... ตอน.....

5. Refrigerant-134a enters the condenser of a residential heat pump at 800 kPa and 55°C at a rate of 0.018 kg/s and leaves at 750 kPa subcooled by 3°C. The refrigerant enters the compressor at 200 kPa superheated by 4°C. Determine (a) the isentropic efficiency of the compressor (b) the rate of heat supplied to the heated room and (c) the COP of the heat pump. Also, determine (d) the COP and the rate of heat supplied to the heated room if this heat pump operated on the ideal vapor compression cycle between the pressure limits of 200 and 800 kPa. Draw T-s diagram of the cycle. (25 points)