

**คณะวิศวกรรมศาสตร์**  
**มหาวิทยาลัยสงขลานครินทร์**

การสอบกลางภาค ประจำปีการศึกษาที่ 1

ประจำปีการศึกษา 2557

วันที่ 18 ตุลาคม 2557

เวลา 09.00-12.00 น.

วิชา 216-332 Engineering Thermodynamics II

ห้อง S 817

วิชา 215-332 Engineering Thermodynamics II

ห้อง หัวหุ่น

**คำสั่ง**

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

รศ.กำพล ประทีปชัยกูร

ผู้ออกข้อสอบ

รหัส..... ชื่อ-สกุล..... ตอน.....

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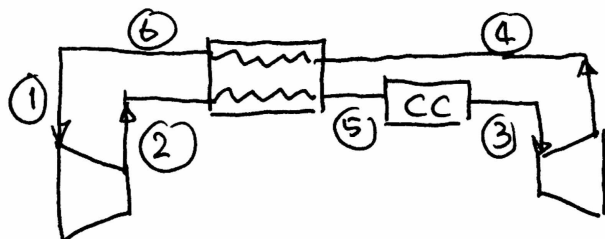
1. A 75-kg copper block initially at  $110^{\circ}\text{C}$  is dropped into an insulated tank that contains 160 L of water at  $15^{\circ}\text{C}$ . Determine the final equilibrium temperature and the total entropy change for this process. Given: the density and specific heat of water at  $25^{\circ}\text{C}$  are  $\rho = 997 \text{ kg/m}^3$   $c_p = 4.18 \text{ kJ/kg}\cdot^{\circ}\text{C}$  and the specific heat of air at  $27^{\circ}\text{C}$  is  $c_p = 0.386 \text{ kJ/kg}\cdot^{\circ}\text{C}$   
(20 marks)

รหัส..... ชื่อ-สกุล..... ตอน.....

2) An ideal gas Carnot cycle uses air as the working fluid, receives heat from a heat reservoir at  $1027^{\circ}\text{C}$ , is repeated 1500 times per minutes, and has a compression ratio of 12. The compression ratio is defined as the volume ratio during the compression process. Determine the maximum temperature of the low-temperature heat reservoir, the cycle's thermal efficiency, and the amount of heat that must be supplied per cycle if this device is to produce 500 kW of power. Draw the T-s diagram of this cycle Given: for air  $c_p = 1.005 \text{ kJ/kg.K}$ ,  $k = 1.4$  (15 marks)

รหัส..... ชื่อ-สกุล..... ตอน.....

3. Air enter the compressor of a regenerative gas turbine engine at 310 K and 100 kPa, where it is compressed to 900 kPa, 650 K. The regenerator has an effectiveness of 80%, and the air enters the turbine at 1400 K. For a turbine efficiency of 90%, determine (a) the amount of heat transfer in the regenerator and (b) the thermal efficiency. Assume variable specific heats for air. (20 marks)



รหัส..... ชื่อ-สกุล..... ตอน.....

4) A simple Rankine cycle uses water as the working fluid. The boiler operates at 6000 kPa and the condenser at 50 kPa. At the entrance to the turbine, the temperature is 450°C. The isentropic efficiency of the turbine is 94%, pressure and pump losses are negligible, and the water leaving the condenser is subcooled by 6.3°C. The boiler is sized for a mass flow rate of 20 kg/s. Determine the rate at which heat is added in the boiler, the power required to operate the pump, the net power produced by this cycle and the thermal efficiency. (25 marks)

รหัส..... ชื่อ-สกุล..... ตอน.....

5. A steam power plant operates on an ideal Rankine cycle with two stages of reheat and has a net power output of 75 MW. Steam enters all three stages of the turbine at  $550^{\circ}\text{C}$ . The maximum pressure in the cycle is 10 MPa, and the minimum pressure is 30 kPa. Steam is reheated at 4 MPa the first time and at 2 MPa the second time. Show the cycle on a T-s diagram with respect to the saturation line, and determine (a) the thermal efficiency of the cycle (b) the mass flow rate of the steam. (25 points)