# คณะวิศวกรรมศาสตร์
# มหาวิทยาลัยสงขลานครินทร์

การสอบกลางภาค ประจำภาคการศึกษาที่ 1 ประจำปีการศึกษา 2555

วันที่ 6 สิงหาคม 2555 เวลา 09.00-12.00 น.

วิชา 216-332 Engineering Thermodynamics 2 ห้อง S 201 , S101

---

**<u>คำสั่ง</u>**

1. ข้อสอบมีทั้งหมด 5 ข้อ ทำทุกข้อ, ให้ทำข้อสอบในตัวข้อสอบ
2. อนุญาตให้นำกระดาษ A4 เข้าห้องสอบได้
3. อนุญาตให้นำเครื่องคิดเลขเข้าห้องสอบได้
4. อนุญาตให้นำ Talking dictionary และพจนานุกรมเข้าห้องสอบได้

รศ.กำพล ประทีปชัยกูร

รศ.ดร.ชูเกียรติ คุปตานนท์

ผู้ออกข้อสอบ

รหัส..... ชื่อ-สกุล.....

รหัส..... ชื่อ-สกุล.....

1) Air is compressed in a piston-cylinder device from 90 kPa and 22°C to 900 kPa in a reversible adiabatic process. Determine the final temperature and the work done during this process, assuming a) constant specific heats b) variable specific heats for air. Given: for air

$R = 0.287 \frac{kJ}{kg.K}, \quad k = 1.393, \quad c_v = 0.730 \frac{kJ}{kg.K}$ (20 points)

รหัส..... ชื่อ-สกุล.....

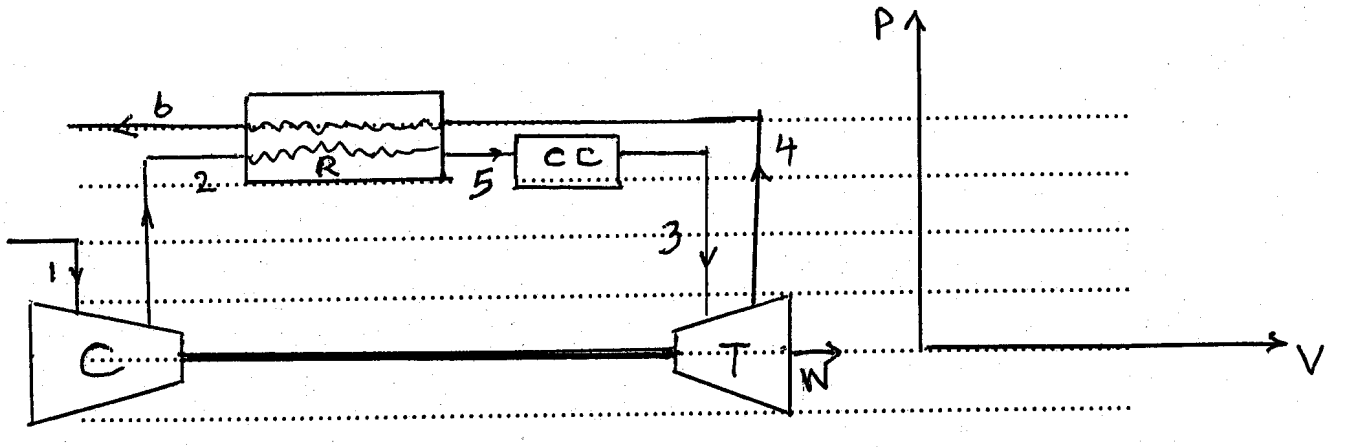
2) A Brayton cycle with regeneration using air as the working fluid has a pressure ratio of 8. The minimum and maximum temperatures in the cycle are 310 K and 1150 K. Assuming an adiabatic efficiency of 75 percent for the compressor and 82 percent for the turbine and an effectiveness of 65 percent for the regenerator. Assume variable specific heats for air. (20 points)

(a) show the cycle on a PV diagram, and determine ;

(b) the air temperature at the turbine exit,

(c) the net work output, and

(d) the thermal efficiency.



รหัส..... ชื่อ-สกุล.....

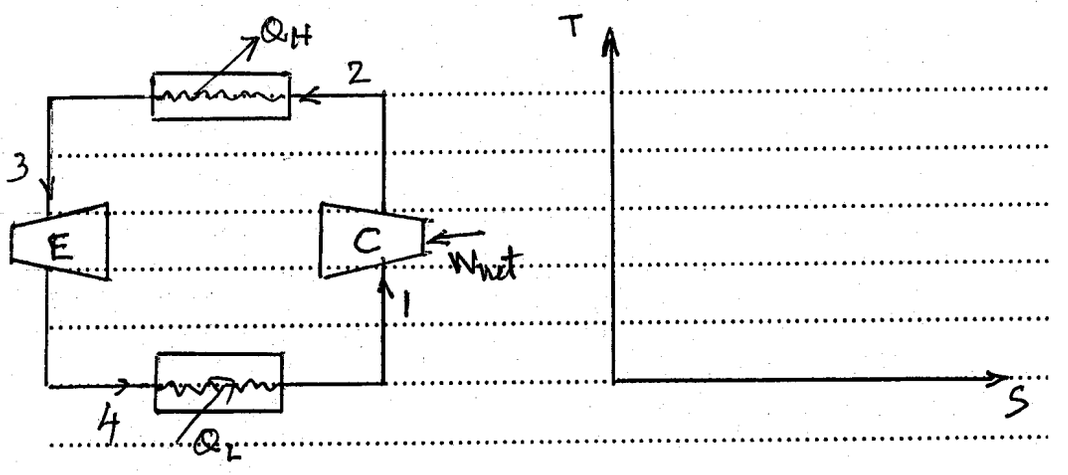
3) Air enters the compressor of an ideal-gas refrigeration cycle at 285 K and 50 kPa and the turbine at 320 K and 250 kPa. The mass flow rate of air through the cycle is 0.8 kg/s. Assume variable specific heats for air. (20 points)

(a) show the cycle on a T-s diagram, and determine;

(b) the rate of refrigeration,

(c) the coefficient of performance, and

(d) the net power input.



รหัส..... ชื่อ-สกุล.....

4)

a) Consider a simple ideal Rankine cycle with fixed turbine inlet condition. What is the effect of lowering the condenser pressure on (10 points)

| | | | |
|---|---|---|---|
| Pump work input | a) increase | b) decrease | c) remains the same |
| Turbine work output | a) increase | b) decrease | c) remains the same |
| Heat supplied | a) increase | b) decrease | c) remains the same |
| Heat rejected | a) increase | b) decrease | c) remains the same |
| Cycle efficiency | a) increase | b) decrease | c) remains the same |
| Moisture content at turbine exit | a) increase | b) decrease | c) remains the same |

b) Consider a simple ideal Rankine cycle with fixed boiler and condenser pressure. What is the effect of superheating the steam to a higher temperature on (10 points)

| | | | |
|---|---|---|---|
| Pump work input | a) increase | b) decrease | c) remains the same |
| Turbine work output | a) increase | b) decrease | c) remains the same |
| Heat supplied | a) increase | b) decrease | c) remains the same |
| Heat rejected | a) increase | b) decrease | c) remains the same |
| Cycle efficiency | a) increase | b) decrease | c) remains the same |
| Moisture content at turbine exit | a) increase | b) decrease | c) remains the same |

รหัส..... ชื่อ-สกุล.....

5) The schematic of a single flash geothermal power plant with state number is given. Geothermal resource exists as saturated liquid at 230°C. The geothermal liquid is withdrawn from the production well at a rate of 230 kg/s, and is flashed to a pressure of 500 kPa by an essentially isenthalpic flashing process where the resulting vapor is separated from the liquid in a separator and directed to the turbine. The steam leaves the turbine at 10 kPa with a moisture content of 10 % and enters the condenser where it is condensed and routed to a reinjection well along with the liquid coming of the separator. Determine a) the mass flow rate of steam through the turbine b) the isentropic efficiency of the turbine c) the power output of the turbine d) the thermal efficiency of the palnt (the ratio of this turbine work output to the energy of the geothermal fluid relative to standard ambient condition).

Given: standard ambient condition temperature at 25°C where saturated liquid state is used for dead state enthalpy. (20 points)

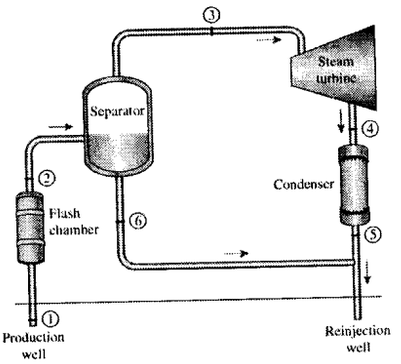



FIGURE P10–24