

ชื่อ.....นามสกุล.....รหัส.....

PRINCE OF SONGKLA UNIVERSITY  
FACULTY OF ENGINEERING

Final examination: Semester-I

Academic year: 2004

D/M/Y: 01/10/2004

Time: 13:30-16:30

Subject: 216-436 (Gas Turbine Theory)

Room: A 201

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Remark: (46 students)

1. Answer all (7) questions
2. Allow to bring handouts, books and all lecture notes (open examination)
3. Allow to bring a calculator
4. Cheater will be caught and investigated following the faculty rule for examination
5. Total score for this examination is 35%

ข้อที่	คะแนนเต็ม	คะแนนที่ได้
1	3	
2	4	
3	6	
4	4	
5	5	
6	7	
7	6	
รวม	35	

Wiriya Thongruang

Lecturer









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**ข้อ 3. (6 คะแนน)**

Give the brief discussion with the aid of sketches of the following:

- a) A tuboannular combustor
- b) A cross fire tube
- c) An impingement cooling
- d) A dilution zone

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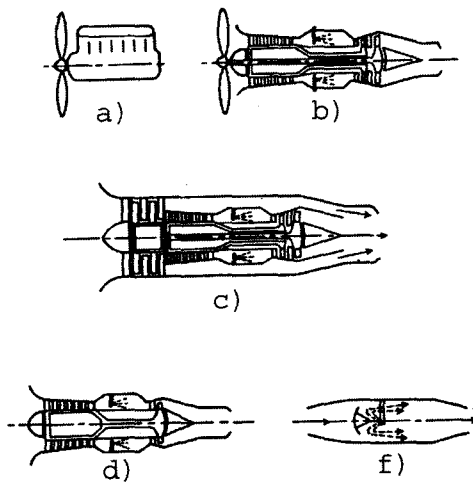
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ข้อ 4. (4 คะแนน)

4.1) Give the name of the following various types of engines



- a)..... b).....  
c)..... d).....  
e).....

4.2) Compare the characteristics of a turbojet engine and a turboprop engine.

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**ข้อ 5. (5 คะแนน)**

A gas turbine works at the optimum pressure ratio of an ideal cycle. Air enters a compressor at 300 K and hot gas enters a turbine at 1400 K. Heat exchanger has the efficiency of 75%. Given,  $c_p = 1.005$  kJ/kg-K and  $k = 1.4$ . Calculate the net work ( $W_n$ ) and the total efficiency ( $\eta_t$ ).

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**ข้อ 7. (6 คะแนน)**

The combined cycle power plant has the set of a gas turbine working at the pressure ratio of 6. Air enters a compressor at 30 °C and hot gas enters a gas turbine at 700 °C. Hot gas from a gas turbine is used to produce steam at 1.4 MPa and 250 °C in the heat recovery steam generator (HRSG) while the exhaust gas leaves the HRSG at 120 °C. A condenser works at 10 kPa and a pump power is neglected. If the electrical power from the gas turbine set is 75 MW, Calculate:

- 5.1 the total efficiency of the plant
- 5.2 the fuel consumption (kg/hr)
- 5.3 the rate of steam produced (Ton/hr)

Given:

The efficiency of a compressor ( $\eta_c$ ) = 0.85

The efficiency of a gas turbine ( $\eta_{GT}$ ) = 0.86

The efficiency of a combustion chamber ( $\eta_{CC}$ ) = 0.80

The transmission efficiency from GT to C ( $\eta_{GT-C}$ ) = 0.94

The efficiency of a generator of a gas turbine ( $\eta_{GG}$ ) = 0.92

The efficiency of the HRSG ( $\eta_{HRSG}$ ) = 0.82

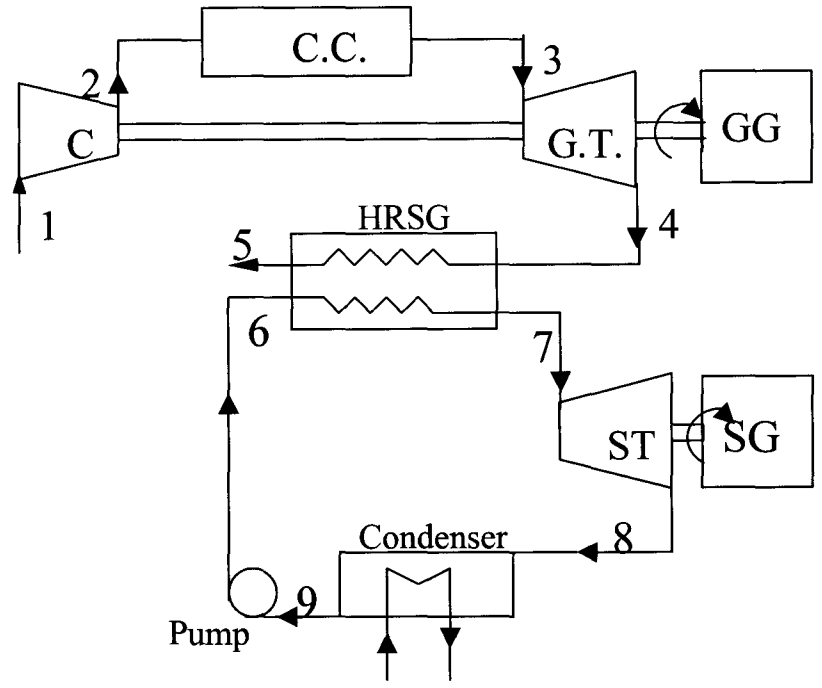
The efficiency of a steam turbine ( $\eta_{ST}$ ) = 0.88

The efficiency of a generator of a steam turbine ( $\eta_{SG}$ ) = 0.92

For compression process,  $c_p = 1.005$  kJ/kg-K,  $k = \gamma = 1.4$

For combustion and expansion process,  $c_p = 1.156$  kJ/kg-K,  $k = \gamma = 1.33$

Heating value of fuel used 44,400 kJ/kg



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