8E4051

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B. Tech. (Sem. VIII) (Back) Examination, February/March - 2011

8ME3 Gas Turbine & Gas Power Plant

Time : 3 Hours] [Total Marks : 80

[Min. Passing Marks : 24

*Attempt any **five** questions. Selecting one question from each unit. All Questions carry **equal** marks. (Schematic diagrams must be shown wherever necessary. Any data you feel missing suitably be assumed and stated clearly. Units of quantities used / calculated must be stated clearly.*

Use of following supporting material is permitted during examination. *(Mentioned in form No. 205)*

1. Nil 2. Nil

UNIT - I

1 (a) Draw T-S diagram and schematic diagram for a Heat Exchange Cycle and derive an expression for thermal efficiency of the cycle. Also discuss the effect of pressure ratio and temperature ratio on cycle efficiency.

(b) Discuss the advantages and disadvantages of Gas Turbines over Reciprocating engines.

OR

1 (a) What are the effects of reheating, intercooling and heat exchanger on performance of Simple Gas Turbine Cycle?

(b) Derive an expression for the optimum pressure ratio, giving maximum specific work output in a Simple Gas Turbine cycle. Discuss the effect of addition of a heat exchanger at optimum condition.

UNIT - II

2 Air at temperature of 15°C enters a gas turbine plant, working at pressure ratio of 15. Turbine Inlet Temperature is 1250°C. Polytropic efficiency of turbine and compressor is 0.91. Assume - C_{pair} = 1.005 kJ/kg-K C_{Pgas}= 1.128 kJ/kg-K for air and gases respectively. Calorific value of fuel used is 42000 kJ/kg, calculate (a) overall efficiency (b) specific output (c) fuel-air ratio (d) specific fuel consumption.

OR

2 (a) Explain all the factors, liable for deviation of actual cycle from ideal cycle in a gas turbine plant.

(b) Derive an expression for optimum pressure ratio giving maximum specific work output in an actual gas turbine cycle. Assume efficiencies of turbine and compressor as η_t and η_c respectively.

UNIT - III

3 (a) Describe with a sketch, working of turbojet engine and explain its thermodynamic cycle on T-S diagram.

(b) What are the various propulsive devices used for aircraft propulsion? Explain each of them in brief.

OR

3 (a) Define propulsive efficiency of a turbojet engine. Derive an expression for the same and prove that it cannot be 100%.

(b) Explain the working of turbofan engine with the help of neat diagram.

UNIT - IV

4 (a) What are the requirements of a good combustion chamber for a gas turbine engine. Explain it in detail.

(b) Describe with a sketch the Can Type gas turbine combustion chamber.

OR

4 A single stage impulse turbine is supplied with air at 27°C and a static pressure of 1.7 bar and exhausts at a static pressure of 1 bar. Find isentropic drop of enthalpy across the stage. The air enters the nozzles at 70 m/s and the nozzle velocity coefficient is 0.97. The ratio of mean blade speed to nozzle discharge velocity is 0.46. The nozzle discharge angle is 14°, the relative velocity coefficient for the rotor blade passage is 0.9, the rotor blades are equiangular and the air enters without shock. Calculate work done per kg of air and the exit temperature of air.

UNIT - V

5 (a) Describe with a sketch the construction and working of a free piston engine. Why is it called "free" piston engine?

(b) Write a note on materials used for making different parts of a gas turbine.

OR

5 (a) What are the advantages of gas turbine plant and compare it with hydel power plant.

(b) Write a note on performance of Gas Turbine power plant.
