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Roll No .....

MMTP-204

M.E./M.Tech., II Semester

Examination, December 2016

Steam and Gas Turbine

Time : Three Hours

Maximum Marks : 70

Note : i) Attempt any five questions.
ii) All questions carry equal marks.
iii) Draw neat diagrams wherever required.

1. Write the principle and working of steam turbines.

   Steam issues from the nozzles of a de Laval turbine with a velocity of 1200 m/s. The nozzle angle is 20°, the mean blade velocity is 400 m/s, and the inlet and outlet angle of blades are equal. The mass of steam flowing through the turbine per hour is 900 kg. Calculate : 14

   i) The blade angles ;
   ii) The relative velocity of steam entering the blades,
   iii) The tangential force on the blades,
   iv) The horse power developed and
   v) The blade efficiency.

   Assume that K = 0.8

2. What do you understand by impulse turbine? Explain : 14

   a) Pressure compounding;
   b) Velocity compounding; and
   c) Pressure and velocity compounding of impulse turbine with the help of suitable diagram.

3. Define most Ideal regenerative feed Heating cycle. Steam enters a turbine at 60 kgf/m^2 and 600°C. Steam is bled off at 7 kgf/cm^2 for regenerative feed heating and the remaining steam is condensed in condenser to condenser temperature 30°C. 14

   Calculate :

   a) The amount of bled steam

   b) Cycle net work and

   c) The ideal thermal efficiency of cycle

   For an ideal turbine and with same states, determine

   d) Ideal turbine work

   e) Ideal efficiency; and

   f) Steam rate in kg/kW-hr.

4. Draw and explain velocity diagram for dry steam and water particles. Also write advantages and disadvantages of reheating. 14

5. Explain Reheat-Regenerative cycle with the help of T-S and H-S diagram and Regenerative water extraction cycle. 14

6. A steam turbine plant operates between the pressure of 180 and 0.07 kgf/cm^2; the initial steam temperature being 430°C. During the expansion the steam is extracted at 26 kgf/cm^2. and reheated to 430°C. Due to friction there is a drop of pressure in the reheater. Find the reheater for which the gain in thermal efficiency due to reheating just vanishes. Assume isentropic expansion throughout. 14

7. What do you understand by Heat Accumulator? Air at temperature of 15°C enters a gas turbine plant working at pressure ratio of 5. Turbine inlet temperature is 800°C. Polytropic efficiency (i.e. small stage efficiency) of compressor and turbine is 0.87. Assume Cp = 0.24 for air and gases and calorific value of fuel used = 10,000 k.cal/kg of fuel. Calculate : 14

   a) Overall efficiency

   b) Specific output

   c) Fuel to air ratio; and

   d) Specific fuel consumption

8. Write short note on : 14

   a) Mixed-pressure turbine

   b) Open cycle gas turbine with Regeneration

   c) Propulsive power and propulsive efficiency

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