MMTP-204 M.E./M.Tech., II Semester Examination, July 2015

Steam and Gas Turbine

Time: Three Hours **Maximum Marks : 70**

Note: Attempt any five questions. All questions carry equal marks. Use of steam tables and Mollier chart is permitted.

1. a) Explain various losses that occur in a steam turbine, b) Find the optimum ratio of blade speed to steam speed
for the maximum blade efficiency in a single-stage impulse turbine. What is the maximum efficiency if nozzle angle is 20° and blade velocity coefficient is 0.83.
2. a) Explain various methods of governing a steam turbine,
b) Explain various methods of attachment of the blades to
the rotor of a steam turbine,
3. a) What is the mean temperature of heat addition? Explain the different methods by which the mean temperature of heat addition can be increased in case of a vapour power cycle.
b) Show that regenerative feedwater heating improves the cycle efficiency.
4. a) When does reheating of steam become necessary? Explain the effect of reheat on cycle output and efficiency. Why more than two-reheats not used in practice?
b) Draw a schematic diagram of a 200 MW turbine equipped with reheat-regenerative arrangement.
5. A steam power plant with inlet steam to h.p. turbine at 90 bar. 500°C and condensation at 40°C produces 500 MW. It has one stage of reheat optimally. Placed which raises the steam temperature back to 500°C. One closed feedwater heater with drains cascaded back to the condenser receives bled steam at the reheat pressure, and the remaining steam is reheated and then expanded in the l.p. turbine. The h.p. and l.p. turbines have isentropic efficiencies of 92% and 90%. respectively. The isentropic efficiency of the pump is 75%. Calculate

a) The mass flow rate of steam at turbine inlet in kg/s.
b) The cycle efficiency, and
c) The cycle work ratio,
Use Terminal Temperature Difference (TTD) as -1.6°C.

5. a) Explain briefly the pass-out turbine. When is it used?
b) Explain briefly the mixed pressure turbine. When is it used?

6. a) Derive the expression for specific work output and the efficiency of a gas turbine with a heat exchanger. Draw their trends as a function of pressure ratio.
b) Explain the working principle of turboprop engine with the help of a schematic diagram and thermodynamic cycle. Derive an expression for the thrust developed.

7. Write short notes on any three of the followings :
a) Deaerator
b) Heat accumulator
c) Closed cycle gas turbine
d) Ram jet