

**R09****Code: 9A03501**

B.Tech III Year I Semester (R09) Supplementary Examinations December 2015

**THERMAL ENGINEERING – II**

(Mechanical Engineering)

Time: 3 hours

Max Marks: 70

Answer any FIVE questions

All questions carry equal marks

(Steam tables are permitted in the examination hall)

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- 1 In a single heater regenerative cycle the steam enters the turbine at 30 bar, 400°C and the exhaust pressure is 0.10 bar. The feed water heater is a direct contact type which operates at 5 bar.  
Find: (i) The efficiency and steam rate of the cycle.  
(ii) The increase in mean temperature of heat addition, efficiency and steam rate as compared to the Rankine cycle (without regeneration)
- 2 (a) What is a boiler? Explain the classification of boilers.  
(b) What is the necessity for safety valves in a boiler?
- 3 (a) What do you mean by supersaturated flow? What are the effects of super saturation over steam?  
(b) Steam expands isentropically from the state of 8 bar and 250°C to 1.5 bar in a convergent-divergent nozzle. The steam flow rate is 0.75 kg/s. Find: (i) Velocity of steam at exit from the nozzle.  
(ii) Exit area of nozzle. Neglect the inlet velocity of steam.
- 4 Derive the expression for maximum blade efficiency in a single-stage impulse turbine.
- 5 A reaction turbine runs at 3000 rpm and the steam consumption is 20,000 kg/h. The pressure of steam at a certain pair is 2 bar, its dryness fraction is 0.93 and the power developed by the pair is 50 kW. The discharge blade angle is 20° for both the fixed and moving blades and the axial velocity of flow is 0.72 times the blade velocity. Find the drum diameter and the blade height. Find the drum diameter and the blade height. Take the tip leakage steam as 85. Neglect the blade thickness.
- 6 Explain briefly the following types of jet condensers:  
(a) Parallel-flow type.  
(b) Counter-flow type.  
(c) Ejector flow type.
- 7 The air enters the compressor of an open cycle constant pressure gas turbine at a pressure of 1 bar and temperature of 20°C. The pressure of the air after compression is 4 bar. The isentropic efficiencies of compressor and turbine are 80% and 85% respectively. The air-fuel ratio used is 90:1. If flow rate of air is 3 kg/s. Find: (i) Power developed. (ii) Thermal efficiency of the cycle.
- 8 Explain using a neat sketch, the principle of operation of turbo jet engine.

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