Roll No. | | | | | | | | | | |

B.E / B.Tech (FT) END SEMESTER EXAMINATIONS – APRIL / MAY 2019

MECHANICAL ENGINEERING

Fifth Semester

ME8503 Thermal Engineering II

(Regulation 2012)

(Use of Steam and Refrigeration Tables and Charts Are Permitted)

Time: 3 Hours | Answer ALL Questions | Max. Marks 100

PART-A (10 x 2 = 20 Marks)

1. Define the critical pressure ratio of a convergent nozzle.
2. What do you mean by supersaturated flow and mark on the h-s diagram?
3. How do boiler accessories differ from mountings?
4. List the advantages of high pressure boilers.
5. What do you mean by compounding of steam turbines?
6. When the blade efficiency of two stage turbine will be maximum?
7. Write the advantages of waste heat recovery.
8. How cogeneration is more helpful in improving the energy utilisation?
9. Define actual, theoretical and relative COP.
10. What is the function of ducts?

Part – B (5 x 16 = 80 marks)
(Question No.11 is Compulsory)

11. Explain with neat sketches the construction and working of any two types of waste heat recovery devices.

12. a) Derive the expression for critical pressure ratio of a nozzle and discuss why attainment of sonic velocity determines the maximum mass flow rate.

(OR)

b) Determine the throat area, exit area and exit velocity for a steam nozzle to pass a mass flow of 0.2 kg/s when inlet conditions are 10 bar and 250°C and the final pressure is 2 bar. Assume expansion is isentropic and that the inlet velocity is negligible. Use $pv^{1.3}$ = constant.

13. a) Explain with neat sketches the construction and working of LaMont and Velox boilers.

(OR)

b) Explain the construction and working of the following mountings used in a boiler (i) Water level indicator, (ii) Blow-off cock valve, (iii) fusible plug and (iv) safety valve.

14. a) The following data relate to a stage of an impulse reaction turbine:
Steam velocity coming out of nozzle = 245 m/s; nozzle angle = 20°; blade main speed = 145 m/s; speed of the rotor = 300 rev/min; blade height = 10 cm; specific volume of steam at nozzle outlet and blade outlet respectively = 3.45 m^3/kg and 3.95 m^3/kg; Power developed by the turbine = 287 kW; efficiency of nozzle and blades combinedly = 90%; carry-over coefficient = 0.82. Find (i) The heat drop in each stage, (ii) Degree of reaction and (iii) Stage efficiency

(OR)

b) A 50% reaction turbine (with symmetrical velocity triangles) running at 400 rev/min has the exit angle of blades as 20° and the velocity of steam relative to the blades at the exit is 1.35 times the mean blade speed. The steam flow rate is 8.33 kg/s and at a particular stage the specific volume is 1.381 m^3/kg. Calculate for this stage: (i) A suitable blade height, assuming the rotor mean diameter 12 times the blade height, and (ii) the diagram work.

15. a) Explain with the neat diagram the working of central system of air-conditioning.

(OR)

b) A refrigeration system of 10.5 tonnes capacity at an evaporator temperature of -12°C and a condenser temperature of 27°C is needed in a food storage locker. The refrigerant ammonia is sub-cooled by 6°C before entering the expansion valve. The vapor is 0.95 dry as it leaves the evaporator coil The compression in the compressor is of adiabatic type. Use P-H chart and find (i) Condition of volume at outlet of the compressor, (ii) Condition of vapor at entrance to evaporator, (iii) COP, (iv) Power required in kW. Neglect valve throttling and clearance effect.