

Fourth Semester B.E. Degree Examination, June/July 2017 Marine Heat Engine and Air Conditioning

Time: 3 hrs. Max. Marks: 100

Note: Answer FIVE full questions, selecting at least TWO questions from each part.

PART - A

- 1 a. With a neat sketch, explain the forces on the blades, work done, blade efficiency for impulse steam turbine. (10 Marks)
 - b. Write the advantages and disadvantages of velocity compounding of impulse turbine.

(06 Marks) (04 Marks)

- c. Define speed ratio and blade friction factor for stream turbine.
- a. What do you mean by reheat factor? Write the advantages of reheating. (10 Marks)
 - b. In a 50% reaction turbine, steam leaves the fixed blades at 140 m/s. The mean blade speed is 70 m/s and the exit angle from both fixed and moving blades is 20°. Determine:
 - i) The absolute velocity leaving the moving blades, and its direction.
 - ii) The blade work per kg.
 - iii) The diagram efficiency.

(10 Marks)

- 3 a. Explain briefly mean temperature of heat addition in a Rankine cycle and show that for a simple Rankine cycle the thermal efficiency is given by $\eta = 1 \frac{T_2}{T_{...}}$. (10 Marks)
 - b. Explain with the help of flow diagram and T-S diagram the basic Carnot cycle for steam power generation. (10 Marks)
- 4 a. With the help of flow diagram, T-S and h-s diagram, explain Rankine regenerating cycle.

(10 Marks)

b. Explain about combined steam and gas plant.

(10 Marks)

PART - B

5 a. Explain simple open cycle gas turbine plant.

(10 Marks)

- b. In a simple open cycle gas turbine plant, the overall pressure ratio is 5/1. The minimum temperature is 27°C, and the compressor and turbine each have an isentropic efficiency of 0.8. Determine the network output per kg of air and the thermal efficiency of the cycle if the maximum temperature is (i) 1000 K; (ii) 1300 K for gas $\gamma = 1.33$, for air $\gamma = 1.4$, $C_{P_{air}} = 1.005 \text{ kJ/kgK}$; $C_{P_g} = 1.1 \text{ kJ/kgK}$. (10 Marks)
- 6 a. With the help of sketch, write the important element of a centrifugal compressor. (10 Marks)
 - b. A centrifugal compressor has an inlet eye 15 cm diameter. The impeller revolves at 20000 rpm and the inlet air has an axial velocity of 107 m/s, inlet stagnation temperature and pressure are 294 K and 1.03 bar respectively. Determine:
 - i) The theoretical angle of the blade at this point and
 - ii) Mach number of the flow at the tip of the eye.

(10 Marks)

- 7 a. Explain with a neat sketch, vapour compression refrigeration system.
- (10 Marks)
- b. Write down the desirable properties of refrigerant with example.
- (10 Marks)

8 a. Define the following: i) DPT

- ii) WBT
- iii) Specific humidity
- iv) Relative humidity.

(08 Marks)

b. Write a brief note on the following:

i) Summer air conditioning system

ii) Winter air conditioning system

(12 Marks)

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