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10MR45

Fourth Semester B.E. Degree Examination, June/July 2016
Marine Heat Engine & 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. Why is compounding of steam turbine necessary? Describe with a neat sketch of the pressure compounding. **(10 Marks)**

b. Define the following as related to steam turbine.
i) Speed ratio ii) Blade velocity co-efficient iii) Diagram efficiency
iv) Stage efficiency v) Degree of Reaction. **(10 Marks)**

2 a. Show that the maximum blade efficiency of a parson's reaction turbine is $\frac{2\cos^2 \alpha_1}{1+\cos^2 \alpha_1}$ **(10 Marks)**

b. The mean diameter of the blades of a n impulse turbine is 85cm and the speed is 3200rpm. The nozzle angle is 20° and the ratio of blade speed to steam speed is 0.45. The blade velocity co-efficient is 0.85. The outlet angle of blade is 2° less than the blade angle at the inlet. The steam flow is 9kg/s. Draw the velocity triangles and determine the following :
i) Tangential and axial thrust on the blades
ii) Resultant thrust on the blades
iii) Power developed and blade efficiency. **(10 Marks)**

3 a. Sketch and explain with help of the P.V and T.S diagram of Carnot cycle with a steam as working substance. **(07 Marks)**

b. What are the limitations of Carnot cycle? **(03 Marks)**

c. A simple Rankine cycle works between the boiler pressure of 30bar and condenser pressure of 0.04 bar. The steam is dry saturated before the throttling in turbine. Determine :
i) Rankine cycle efficiency
ii) Work ratio
iii) Specific steam consumptions. **(10 Marks)**

4 a. Draw a neat sketch of a regenerative power cycle and with the help of a T.S diagram analyse the cycle if three feed water regenerators are used. **(10 Marks)**

b. A regenerative cycle has turbine inlet pressure of 40bar and dry saturated steam expands in the condenser to a pressure 0.04 bar. Steam is bled at optimum pressure from the turbine to heat the condensate water in the feed water heater, Neglecting pump work, determine the cycle efficiency. **(10 Marks)**

PART – B

5 a. With the help of neat sketch, explain open cycle and closed gas turbine plants. **(06 Marks)**

b. With the help of a neat sketch, explain the working of a Brayton cycle gas turbine plants. **(08 Marks)**

c. With a neat block diagram and T.S diagram explain how inter cooling increase thermal efficiency of gas turbine plant. **(06 Marks)**

6 a. Explain working principle of centrifugal compression. **(10 Marks)**

b. Free air delivered by a compression is 20kg/min. The inlet conditions are 1 bar and 20°C static. The velocity of air at the inlet is 60m/s. The isentropic efficiency of the compressor is 0.7. The total head pressure ratio is 3.

Find :

i) The total head temperature at the exit and

ii) The power required by the compressor

If the mechanical efficiency is 95%. **(10 Marks)**

7 a. Explain the working of ammonia vapour absorption refrigeration system. **(10 Marks)**

b. In an ideal vapour compression refrigerator of 15kW cooling capacity, the saturated refrigerant vapour leaves the evaporator with an enthalpy of 178kJ/kg. The enthalpies at exit of compressor and condenser are respectively 21kJ/kg and 65kJ/kg show the refrigeration cycle on T.S and P.h diagrams and calculate :

i) Cop of the cycle

ii) Refrigerant flow rate

iii) Power required to drive the compressor. **(10 Marks)**

8 a. Define the following:

i) D.P.T

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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