Reg. No. :

Question Paper Code : X10705

B.E./B.Tech. DEGREE EXAMINATIONS, NOVEMBER/DECEMBER 2020
Fifth/Seventh Semester
Mechanical Engineering
ME 8595 – THERMAL ENGINEERING – II
(Regulations 2017)
(Common to Mechanical Engineering (Sandwich))

Time : Three Hours   Maximum : 100 Marks

Answer ALL questions
(Use of steam tables, Refrigeration charts, psychrometric chart and mollier diagram is permitted)

PART – A   (10×2=20 Marks)

1. Define critical pressure ratio in steam nozzles.

2. What is degree of undercooling in nozzle ?

3. Distinguish between boiler mountings and accessories.

4. Classify the types of boiler according to circulation of gases and water respectively.

5. Define blade velocity coefficient in an impulse turbine.

6. What is the operating principle of a reaction turbine ?

7. Why regenerators are normally preferred for high pressure ratio gas turbine cycle ?

8. Write the advantages of cogeneration system.

9. Define refrigeration and air conditioning.

10. What is the function of the throttling valve in vapour compression refrigeration system ?

PART – B   (5×13=65 Marks)

11. a) Dry saturated steam at a pressure of 11 bar enters a steam nozzle and leaves at a pressure of 2 bar. If the flow is adiabatic and frictionless, determine :
(i) the exit velocity of steam (ii) ratio of cross-section at exit and that at throat.
Assume the index of adiabatic expansion to be 1.135

(OR)

b) Derive the following expression for nozzle flow : $\dfrac{dA}{A} = \dfrac{1}{\gamma} \dfrac{dp}{p} \left[\dfrac{1 - M^2}{M^2} \right]$ where, the symbols having usual meanings.

12. a) How are boilers classified ? Explain the unique features of the high pressure boilers.

(OR)

b) An oil fired package boiler was tested for 2 hours duration at steady state condition. The fuel and water consumption were 250 litres and 3500 litres respectively. The specific gravity of oil is 0.92. The saturated steam generation pressure is 7 kg/cm^2 (g). The boil feed water temperature is 30ºC. Determine the boiler efficiency and evaporation ratio

13. a) In a single stage impulse turbine, nozzle angle is 20º and blade angles are equal. The velocity coefficient for blade is 0.85. Find maximum blade efficiency possible. If the actual blade efficiency is 92% of the maximum blade efficiency, find the possible ratio of blade speed to steam speed.

(OR)

b) Explain various type of compounding in steam turbine.

14. a) With suitable circuit, explain the function wise differences between topping and bottoming cycle

(OR)

b) Explain about Recuperative and Regenerative heat exchangers with neat sketch.

15. a) The following data relates to the office air conditioning plant having maximum seating capacity of 25 occupants :

Outside design conditions	=	34ºC DBT, 28ºC WBT
Inside design conditions	=	24ºC DBT, 50% RH
Solar heat gain	=	9120 W
Latent heat gain per occupant	=	105 W
Sensible heat gain per occupant	=	90 W
Lightening load	=	2300 W
Sensible heat load from other sources	=	11630 W
Infiltration load	=	14 m^3/min

Assuming 40% fresh air and 60% of recirculated air passing through the evaporator coil and the by-pass factor of 0.15. Estimate the capacity of the plant and the dew point temperature of the coil.

(OR)

b) Explain any four psychometric processes with neat sketch.

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PART – C   (1×15=15 Marks)

16. a) A textile factory requires 10t/h of steam for process heating at 3 bar saturated and 1000 kW of power, for which a back pressure turbine of 70% internal efficiency is used. Find the steam condition required at inlet of the turbine.

(OR)

   b) An air conditioned auditorium is to be maintained at 27ºC dry bulb temperature and 60% relative humidity. The ambient condition is 40ºC dry bulb temperature and 30ºC wet bulb temperature. The total sensible heat load is 100000 kJ/h and the total latent heat load is 40000 kJ/h. 60% of the return air is recirculated and mixed with 40% of make-up air after the cooling coil. The condition of air leaving the cooling coil is at 18ºC.

   Determine the following :
   i)   Room sensible heat factor
   ii) The condition of air entering the auditorium
   iii) The amount of make-up air
   iv) Apparatus dew point

   Show the processes on the psychrometric chart.

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