B.E. Fourth Semester (Mechanical Engineering) (CGS)

10837 : Energy Conversion - I : 4 ME 03

P. Pages : 3 | **AU - 2570**

Time : Three Hours | Max. Marks : 80

Notes :
1. Due credit will be given to neatness and adequate dimensions.
2. Assume suitable data wherever necessary.
3. Illustrate your answer necessary with the help of neat sketches.
4. Use of steam tables, Moller's chart is permitted.
5. Use of pen Blue/Black ink/refill only for writing the answer book.

SECTION - A

1. a) Explain with neat sketch combined throttling & separating calorimeter ? **7**

b) 1000 kg of steam at a press of 16 bar & 0.9 dry is generated by a boiler per hour. The steam is passed through a superheater via boiler stop valve where its temp raised to 380°C. If the temp of feed water is 30°C. Determine : **7**
i) Total heat supplied to feed water per hour to produce wet steam.
ii) Heat absorbed in superheater.
(Take sp. Heat of superheated steam as 2.2 kJ/kg K)

OR

2. a) Explain the following term : **7**
i) Internal Latent heat
ii) External work of evaporation
iii) Different states of steam.

b) In combined separating & throttling calorimeter following observations were made **7**
Total quantity of steam = 23.4 kg
Water drained from separator = 1.2 kg
Steam press before throttling = 8.25 bar
Temp. of steam on leaving = 111.4°C
Steam press on leaving = 1.03 bar
Find the dryness fraction of steam on entry.
Take sp. heat of superheated steam = 2.1 kJ/kg K

3. a) What are the characteristics of high pressure boiler ? Explain Benson boiler with neat sketch. **6**

b) Find the mass flow rate of flue gases passing through chimney when the draught produced is equal to 20 mm of water column. The temp of flue gas & ambient air are 300°C & 30°C resp. The mass of air used is 19 kg per kg of fuel burnt. Assume dia. of chimney as 2 m & neglect losses. **7**

OR

4. a) Explain the difference between water tube & fire tube boiler. **6**

b) Establish the condition for maximum discharge of flue gases through a chimney. 7

5. a) How coal is pulverized ? Explain in brief about firing of pulverized coal in boiler ? 7

b) Sketch & explain cyclone burner. 6

OR

6. a) Draw the heat balance sheet of a boiler & explain. 7

b) Describe any one ash handling system with neat sketch. 6

SECTION - B

7. a) Explain the difference between jet & surface condenser. 6

b) Following observations were obtained on a trial on steam condenser. 8
Barometric reading = 760 mm of Hg
Vacuum reading = 700 mm of Hg
Inlet temp. of cooling water = 15°C
Outlet temp of cooling water = 30°C
Mean temp of condensate = 35°C
Hot well temp = 30°C
Mass of water circulating = 750 kg/min
Mass of steam = 20 kg/min
Find :
i) Mass of air
ii) Quantity of Steam
iii) Vacuum efficiency
iv) Condenser eff.

OR

8. a) Explain evaporative condenser with neat sketch. 7

b) What are the different types of cooling tower ? Discuss any one with neat sketch. 7

9. a) What are the effect of friction on nozzle performance ? Explain the effect with the help of h-s diagram. 6

b) What is compounding ? Explain pressure compounding with neat sketch. 7

OR

10. a) Derive an expression for maximum discharge through the nozzle. 6

b) Steam at a press of 10 bar & 0.98 dry is passed through a convergen & divergent nozzle to a back press of 0.1 bar. The mass flow rate is 0.55 kg/sec. 7
Find :
i) The press at throat
ii) No. of nozzle used if each nozzle has a area of 0.5 cm^2.
The enthalpy drop used for reheating the steam by friction in divergent part is 10% of the overall drop. Take index of expansion = 1.13.

11. a) Discuss losses in steam turbine. **6**

b) Define the term 'Degree of Reaction' as applied to steam turbine. **3**

c) Show that for Parson's reaction turbine the degree of reaction is 50%. **4**

OR

12. a) Discuss briefly the different methods of steam turbine governing. **6**

b) Prove that the optimum blade speed ratio for maximum blade efficiency is given by **7**
$\rho_{opt} = (\sin\alpha)/2$
Also show that maximum workdone per kg of steam is given by
$W_{max} = 2C_{bl}^2$
where,
ρ is speed ratio
α is nozzle angle
& C_{bl} is linear vel. of blade.

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