B.Tech. / B.E. Mechanical Engineering (Model Curriculum) Semester-IV

PCC-ME-202 - Applied Thermodynamics

P. Pages : 2 **GUG/W/24/14062**

Time : Three Hours * 5 5 7 9 * Max. Marks : 80

Notes :
1. All questions carry marks as indicated.
2. Due credit will be given to neatness and adequate dimensions.
3. Assume suitable data wherever necessary.
4. Diagrams and Chemical equation should be given wherever necessary.
5. Illustrate your answers wherever necessary with the help of neat sketches.
6. Use of slide rule, Steam tables, moist air is permitted.
7. Discuss the reaction, mechanism wherever necessary.
8. Attempt Q. 1 or Q. 2, Q. 3 or Q. 4, Q. 5 or Q. 6, Q. 7 or Q. 8, Q. 9 or Q. 10.

1. a) Explain the working of vapor compression refrigeration cycle with neat sketch. **8**

b) Calculate the ideal air standard cycle efficiency of a petrol engine operating on Otto cycle. **8**
The cylinder bore is 50mm, a stroke of 75mm and clearance volume is $21.3 cm^3$.

OR

2. a) Write short note on- **8**
i) Rankine cycle.
ii) Mean effective pressure.

b) In an air standard dual cycle, the pressure and temperature are 0.1 MPa and 27ºC. The compression ratio is 18. The pressure ratio for the control volume part of heating process is 1.5 and volume ratio for constant pressure part of heating is 1.2. **8**
Calculate
i) Thermal efficiency.
ii) Mean effective pressure in MPa.

3. a) What do you mean by boiler mountings and accessories? Discuss air preheater with neat sketch. **8**

b) Explain Benson boiler with neat sketch. **8**

OR

4. a) Discuss boiler classification in detail. **8**

b) Describe with neat sketch- **8**
i) Cochran boiler.
ii) Safety valve.

5. a) Derive the expression for mass flow rate of steam at nozzle exit assuming fluid flow to be isentropic. **8**

b) In a convergent divergent nozzle, steam enters at 15 bar and 300ºC and leaves at a pressure of 2 bar. The inlet velocity to the nozzle is 150 m/s. Find the required throat and exit area for the mass flow rate of 1 kg/s. Assume nozzle efficiency to be 90% and Cps = 2.4 kJ/kgK. **8**

OR

6. a) Differentiate between governing and compounding of turbine in detail. **8**

b) Describe throttle control governing in steam turbine. **8**

7. The steam is supplied to a de-Laval Turbine at a velocity of 1000 m/s at an angle of 20º. The blade velocity is 300 m/s and blades are symmetrical. The mass flow rate of the steam is 0.5 kg/s. Allowing a friction factor of 0.8 and by drawing velocity diagram, determine- **16**

a) Blade efficiency
b) Power developed
c) Stage efficiency if nozzle efficiency is 95%

OR

8. In a reaction turbine, the fixed blade and moving blade are of the same shape but reversed in direction. The angles of the receiving tips are 35º and of the discharging tips 20º. Find the power developed per pair of blades for a steam consumption of 2.5 kg/s, when the blade speed is 50 m/s. If the heat drop per pair is 10.04 kJ/kg, find the efficiency of pair. **16**

9. a) Discuss functions of condenser. Derive the expression to estimate cooling water requirement of condenser. **8**

b) Elaborate low level parallel flow jet condenser with neat sketch. **8**

OR

10. Write short notes on **any four**. **16**

a) Forced draught cooling tower.

b) Ejector condenser.

c) Cooling pond.

d) Effects of air leakage in condensers.

e) Comparison between jet and surface condensers.

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