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

PCCME202 / SE202 - Applied Thermodynamics

P. Pages : 2 **GUG/S/25/14062**

Time : Three Hours Max. Marks : 80

Notes : 1. All questions carry equal marks / marks as indicated
2. Due credit will be given to neatness and adequate dimensions.
3. Assume suitable data wherever necessary.
4. Illustrate your answers wherever necessary with the help of neat sketches.
5. Use of slide rule, Logarithmic tables, Steam tables, Mollier's chart, Drawing instruments, Thermodynamic tables for moist air, Psychrometric charts and Refrigeration charts is permitted. Non-Programmable Electronic Calculator is allowed.
6. Solve 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 Diesel cycle in detail. Derive the expression for air standard efficiency of Diesel cycle. **8**

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

OR

2. a) Write short notes on the following: **8**

a) Stirling cycle

b) 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 rating is 1.2
Calculate : l) Thermal Efficiency 2) Mean effective pressure in MPa. **8**

3. a) Discuss the classification of boiler in detail. **8**

b) Write short notes on the following: **8**

a) Cochran boiler

b) Lancashire boiler

OR

4. a) With neat sketch explain the working of economizer and superheater in boiler. **8**

b) Elaborate the boiler efficiency and equivalent evaporation in the boiler in detail. **8**

5. a) Discuss various types of nozzles. Derive the expression for velocity of steam at nozzle exit. **8**

b) Calculate the critical pressure and throat area per unit mass flow rate of steam expanding through a convergent-divergent nozzle from 10 bar, dry saturated down to atmospheric pressure of 1 bar. Assume that the inlet velocity is negligible and that the expansion is isentropic. **8**

OR

6. a) Compare impulse and reaction turbines with neat the sketch. State some examples of each. **8**

b) What do you mean by compounding of steam turbine? Explain pressure compounding in detail. **8**

7. The rotor of an impulse turbine is of 260 mm diameter and runs at 20500 rpm. The nozzle angle is 20^0 and issues a steam jet with a velocity of 910 m/s. The mass flow rate through the turbine nozzles blading is 2 kg of steam per second. Draw the velocity diagram and calculate; (a) tangential force in blades (b) axial force on blades (c) power developed by turbine (d) blading efficiency. **16**

OR

8. At a stage in a reaction turbine, the mean blade ring diameter is 1m. The turbine runs at 3000 rpm. The blades are designed for a degree of reaction of 50% with exit angles of 30^0 and inlet angles of 50^0. The turbine is supplied with a steam at 10000 kg/hr and stage efficiency is 85%. Determine. **16**

a) Power output of the stage
b) Specific enthalpy drop in kJ/kg
c) Percentage increase in relative velocity of steam over moving blades
d) Specific steam consumption.

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

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

OR

10. Write short notes on: **16**

a) Cooling tower

b) Cooling pond

c) Daltons law of partial pressures

d) Condenser efficiency and vacuum efficiency

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