B.E. Mechanical Engineering (Model Curriculum) Sem-IV

PCCME202 : Applied Thermodynamics

P. Pages : 2 **GUG/W/22/14062**

Time : Three Hours * 3 2 9 1 * 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, Logarithmic Tables, Steam Tables, Moldier's Chart, Drawing Instruments, Thermodynamic tables for moist air, Psychometric Charts and Refrigeration charts is permitted.
7. Discuss the reaction, Mechanism wherever necessary.
8. Solve Q1 or Q2 , Q3 or Q4, Q5 or Q6, Q7 or Q8, Q9 or Q10.

1. a) Explain Otto cycle and derive an expression for air standard efficiency. **8**

b) The minimum pressure and temperature in an Otto cycle are 100 kPa and 27ºC. The amount of heat added to the air per cycle is 1500 kJ/kg. **8**
i) Determine the pressures and temperatures at all points of the air standard Otto cycle.
ii) Also calculate the specific work and thermal efficiency of the cycle for a compression ratio of 8:1.
Take for air : Cv = 0.72 kJ/kg K & u = 1.4

OR

2. a) Write short notes on **any two.** **8**
i) Rankine cycle
ii) Stirling cycle
iii) Mean effective pressure.

b) A diesel engine has a compression ratio of 15 and heat addition at constant pressure takes place at 6% of stroke. Find the air standard efficiency of the engine. **8**
Take Y for air on 1.4.

3. a) Compare Fire tube boilers with water tube boilers in detail. Also explain working of fire tube boiler. **8**

b) Describe following terms in detail **8**
i) Boiler efficiency ii) Evaporation rate
iii) Equivalent evaporation iv) Energy balance in boiler.

OR

4. Write short notes on **any two:-** **16**
a) Locomotive boiler
b) Velox boiler
c) Lancashire boiler

5. a) Explain the phenomenon of super-saturated expansion of steam in nozzle and sketch the process on h-s diagram. **8**

b) With suitable sketch, describe the working of impulse and reaction turbine. Give examples of these turbines. **8**

OR

6. Steam enters the blade row of an impulse turbine with a velocity of 600 m/s at an angle of 25º to the plane of rotation of the blades. The mean blade speed is 255 m/s. The blade angle on the exit side is 30º. The blade friction coefficient is 10%. Determine **16**

i) The angle of the blade on the entry side
ii) The work done/kg of steam
iii) Diagram efficiency
iv) Axial thrust/kg/second.

7. a) Explain various causes of losses in steam turbine in detail. **8**

b) Describe throttle and nozzle control governing of steam turbine in detail. **8**

OR

8. A simple impulse turbine has one ring of moving blades running at 150 m/s The absolute velocity of the steam at exit from the stage is 85 m/s at an angle of 80º from the tangential direction Blade velocity coefficient is 0.82 and flow of steam through the stage is 2.5 kg/s. If the blades are equiangular, determine i) Blade angles ii) Nozzle angle iii) Absolute velocity of steam issuing from nozzle iv) Axial thrust. **16**

9. a) Describe elements of a steam condensing plant in thermal power plant. **8**

b) Explain air leakage and its effect on the performance of condenser. **8**

OR

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

i) Low level jet condenser.
ii) Dalton's law of partial pressures.
iii) Evaporative condensers.

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