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Reg. No. : .....

Name : .....

Fourth Semester B.Tech. Degree Examination, May 2014
(2008 Scheme)
Branch : MECHANICAL ENGINEERING
08.405 : Thermal Engineering (MU)

Time : 3 Hours Max. Marks : 100

Instruction *:* ***Use*** *of steam tables and Mollier chart is* ***permitted****.*

PART – A

Answer **all** questions. **Each** question carries **4** marks.

1. Explain the Mollier chart for steam.
2. Draw T-S diagrams for Rankine cycle and modified Rankine cycle and explain the difference between them.
3. What are the effects of super saturated flow in steam nozzles ?
4. List out any four main differences between the impulse and reaction turbines.
5. Explain adiabatic flame temperature in a reaction.
6. Define Octane number and cetane number. How is octane or cetane number determined ?
7. What are the requirements of a good combustion chamber for a gas turbine ?
8. What is the ideal compression process for combustion in a reciprocating compressor and why ?
9. Explain the phenomenon of choking in rotary compressors.
10. Write short notes on roots blower. **(10×4=40 Marks)**

P.T.O.

PART – B

Answer **one** question from **each** Module.

Module – I

11. a) Describe, with the help of schematic diagram and T-S diagram, binary vapour cycle. 10

    b) Dry saturated steam at 25 bar expands isentropically in a reciprocating steam engine to 2 bar. It is then released at constant volume to the condenser pressure of 1 bar. Find the work output and heat added per kg of steam during the cycle. Find also the modified Rankine cycle efficiency, neglecting feed pump work. 10

OR

12. a) With the help of a neat sketch, describe the working of a LaMont boiler. 8

    b) Steam at a velocity of 460 m/s enters an impulse turbine wheel having a nozzle angle of 25°C. The mean blade speed is 130 m/s and the exit angle of the moving blade is 20°C. Determine the moving blade angle at inlet, work done per kg of steam flow, and the energy lost at exit by using the velocity diagram. Also find the diagram efficiency. The velocity coefficient of the blade is 0.7. 12

Module – II

13. a) Define equivalence ratio.

    Methane (CH_4) is burnt with atmospheric air. The analysis of the dry products on molar basis is as follows. CO_2 10%, O_2 2.37%, CO 0.53%, N_2 87.10%. Calculate the A/F ratio and the equivalence ratio. 10

    b) Explain the phenomenon of knock in a CI engine and compare it with SI engine knock. 10

OR

14. a) Discuss the different methods for improvement of the performance of simple open cycle constant pressure gas turbine plant. 10

    b) Derive the expression for the theoretical efficiency of constant pressure closed cycle gas turbine. 10

Module – III

15. a) With suitable sketches, explain the working of an axial flow compressor. 8

b) A single acting compressor is required to deliver air at 70 bar from a suction pressure of 1 bar at the rate of 2.4 m^3/min measured at FAD of 1.013 bar and 15°C. The temperature at the end of the suction stroke is 32°C. Calculate the power required, if the compression is carried out in two stages with an ideal intermediate pressure and complete intercooling. The index of compression and expansion is 1.25. What is the saving in power over single-stage compression ? If the clearance volume is 3% of the swept volume in each cylinder, calculate the swept volumes of the cylinders. The speed of the compressor is 750 rpm. 12

OR

16. a) Define degree of reaction of an axial flow compressor and derive an expression for it, in terms of blade angles and the axial flow velocity. 10

b) Air at a temperature of 17°C flows into the centrifugal compressor running at 20000 rpm.

Given : Slip factor = 0.80

Work input factor = 1

Isentropic efficiency = 70%

Outer diameter of blade tip = 50 cm

Assuming the absolute velocities of air entering and leaving the compressor are same, find

i) the temperature rise of air passing through compressor and

ii) the static pressure ratio. 10