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Reg. No. : .....

Name : .....

Fourth Semester B.Tech. Degree Examination, May 2010
(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. Draw T-S diagram for steam and show on it constant pressure, constant volume and constant dryness fraction lines. Also show adiabatic, isothermal and throttling processes in it.
2. What are the advantages and limitations of binary vapour plants over single vapour plant ?
3. What are the effects of friction on nozzle performance ?
4. What is meant by governing ? List the important methods of governing steam turbines.
5. How fuels are classified ? Give three examples each of various types of fuels.
6. 'The factors that tend to reduce detonation on SI engines increase knocking in CI engines' justify the above statement.
7. Draw the schematic diagram of a gas turbine plant with regenerator and its T-S diagram.
8. What is multistage compression ? What are the reasons for multistaging ?
9. Explain the phenomenon of surging in rotary compressors.
10. What are the various losses occurring in a centrifugal compressor ?

(10×4=40 Marks)

P.T.O.

PART – B

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

Module – I

11. a) Explain the sequence of operations of the modified Rankine cycle used in steam engines and derive the expression for efficiency. **10**

b) A steam turbine consumes 139 kg of steam per kWh when steam is supplied at a pressure of 10 bar and at 400°C. The exhaust takes place at 0.1 bar. Compare the efficiency of the engine with the Rankine efficiency. **10**

OR

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

b) In a Parson's reaction turbine the fixed and moving blades are of the same shape, but in reverse direction. The mean blade speed is 200 m/s and the speed ratio is 0.64. If the angles of the discharging tips are 20°, draw the velocity diagram and determine the angles of receiving tips and the work done per kg of steam flowing through the turbine. Also find the diagram efficiency. **12**

Module – II

13. a) The gravimetric analysis of a fuel oil shows 86.2% Carbon and 13.8% Hydrogen. If 50% excess air is supplied, find the percentage analysis of the products i) by mass and ii) by volume. **8**

b) What is a F-head combustion chamber ? Sketch one design of F-head chamber. **6**

c) Explain about cetane number. **6**

OR

14. a) What are the basic requirements of a combustion chamber for a gas turbine system ? Describe with a sketch the can type of gas turbine combustion chamber. **10**

b) In an open cycle constant pressure gas turbine, air enters the compressor at 1 bar and 27°C. The pressure of air after the compression is 4 bar. The isentropic efficiencies of compressor and turbine are 80% and 85% respectively. The A/F is 80. Find the indicated power and thermal efficiency of the cycle of the flow rate of air is 2.5 kg/s. Take C_p = 16 J/kg-K and r = 1.4 for air and gases calorific value of fuel = 41720 kJ/kg. **10**

Module – III

15. a) With suitable sketches, explain the working of a single stage centrifugal compressor. 8

b) A single stage double acting air compressor delivers FAD of 15 m^3/min measured at 1.013 bar and 300K and delivers at 7 bar. The condition at the end of suction stroke are 0.98 bar and 313 K. The clearance volume is 4% of the swept volume and stroke/bore ratio is 1.3, compressor runs at 300 rpm. Calculate : a) Volumetric efficiency with respect to FAD b) Cylinder dimensions c) Indicated power and d) Isothermal efficiency. The index of compression and expansion is 1.3. 12

OR

16. a) Explain the terms isentropic efficiency, slip factor and pressure coefficient as applied to centrifugal compressors. How are these terms related ? 8

b) An axial flow compressor having 10 stages and with 50% reaction blade, compresses air in the pressure ratio of 5 : 1. The air enters the compressor at 25°C and flows through it with a constant speed of 100 m/s. The rotating blades of the compressor rotate with a mean speed of 200 m/s, isentropic efficiency of the compressor = 85%. Calculate the blade angles and work required by the compressor. 12