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Reg. No. : .....

Name : .....

Fourth Semester B.Tech. Degree Examination, September 2018.
(2008 Scheme)
Branch : MECHANICAL ENGINEERING
08.405 : Thermal Engineering (MU)

Time : 3 Hours Max. Marks : 100

***Instruction** : **Use** of steam table and Mollier chart are **permitted**.*

PART – A

Answer **all** questions.

1. What is Mollier diagram ? How it helps us to solve different thermodynamic problems ?

2. Represent modified Rankine cycle in P-V, T-S and H-S diagrams.

3. What are the effects of friction in expansion of steam through a nozzle ?

4. Why biodiesel is not considered as an alternate fuel for spark ignition engines ?

5. Explain the surging phenomena in rotary compressors.

6. What are homogeneous and heterogeneous mixtures ? In which engines these mixtures are used ?

7. Compare steam and gas turbine power plants.

8. State the differences between gas turbine and IC engine combustion chambers.

9. Derive the equation for shaft work for single stage air compressor without clearance when law of compression followed is isothermal.

10. Explain various methods of governing steam turbines. **(10×4=40 Marks)**

P.T.O.

PART – B

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

Module – I

11. a) Explain metastable flow through nozzle using h-s diagram.

    b) Dry saturated steam at 3 bar is expanded in a convergent nozzle to a pressure of 2 bar. The throat area is 3 cm^2. Neglecting the approach velocity, calculate the exit velocity and mass flow rate if :

    a) equilibrium flow is assumed and

    b) supersaturated flow is assumed.

OR

12. a) Explain the working of Velox boiler with a neat diagram.

    b) Derive an expression for optimum value of the ratio of blade speed to steam speed for maximum efficiency for a single stage impulse turbine.

Module – II

13. a) Write short notes about :

    a) auto ignition

    b) preignition

    c) Anti knocking agents.

    b) Bring out clearly the process of combustion in CI engines and also explain the various stages of combustion.

OR

14. The following data apply to gas turbine set employing a separate power turbine, regenerator and intercooler between two stage compression :

    Isentropic efficiency of compression each stage : 80%

    Isentropic efficiency of compressor turbine : 88%

    Isentropic efficiency of power turbine: 88%

    Turbine to compressor transmission efficiency : 98%

Pressure ratio in each stage of compression : 3:1

Temperature after intercooler : 297K

Air mass flow : 15 kg/s

Regenerator effectiveness : 80%

Regenerator gas side pressure loss : 0.1 bar

Maximum turbine temperature : 1000 K

Ambient temperature : 327 K

Ambient pressure : 1 bar

Calorific value of the fuel : 43.1 MJ/kg

Calculate the net power output, specific fuel consumption, and overall thermal efficiency. Assume that the pressure losses in the air side of the regenerator and combustion chamber are accounted for in the compressor efficiency. Assume C_{pa} = 1.005 kJ/kg K, γ_a = 1.4, C_{pg} = 1.147 kJ/kg K, γ_g = 1.33.

Module – III

15. a) What do you mean by multi stage compression ?

    b) Derive an expression for minimum work required for a two stage compressor with intercooling.

    c) What do you mean by positive displacement compressors ? Give examples.

OR

16. a) Explain the working of a centrifugal air compressor with the help of neat sketches, clearly explaining the pressure changes taking place in the passage of air.

    b) Write short note about the following with respect to compressors :

    i) Free air delivered

    ii) Slip factor and pressure coefficient

    iii) Degree of reaction

    iv) Axial flow compressor.

(3×20=60 Marks)