Reg. No. : ....

Name : ....

Fourth Semester B.Tech. Degree Examination, July 2015
(2008 Scheme)
Branch : Mechanical Engineering
08.405 : THERMAL ENGINEERING (M U)

Time : 3 Hours

Max. Marks : 100

Note : 1) *Use of steam tables and Mollier Chart is **permitted**.*
2) *Answer **all** questions from Part **A** and **one** question from each Module of Part **B**.*

PART – A

(10×4= 40 Marks)

1. What is modified Rankine cycle ? With the help of p-V diagram discuss briefly.
2. State the difference between sensible heat and latent heat.
3. Explain gas turbine with inter cooling and reheating.
4. What are the causes of knock in CI engines ?
5. Draw schematic diagrams of
   i) annular and
   ii) can-annular gas turbine combustion chambers.
6. What do you mean by super saturated flow in nozzles ?
7. What are the broad classifications of compressors ? Give the application of each type.
8. Define cetane number of a fuel. How is it related to knocking tendency in CI engines ?
9. Write short notes on roots blower.
10. What do you understand by stoichiometric air fuel ratio and mixture strength ? Explain briefly.

PART – B

(20×3= 60 Marks)

Module – I

11. a) What is the effect of friction on critical pressure ratio of a nozzle ?

    b) A nozzle is to be designed to expand dry saturated steam isentropically from 7.5 bar to 0.25 bar. The mass flow rate of steam is 3 kg/ sec. Calculate the throat and exit areas required. The isentropic index of expansion may be taken as 1.35.

12. a) Describe with neat sketch the working of La-Mont Boiler.

b) A steam power plant works between 40 bar and 0.05 bar. If the steam supplied is dry saturated and the cycle of operation is Rankine, find 1) cycle efficiency and 2) specific steam consumption.

Module – II

13. a) Explain the phenomenon of detonation in SI engines. What are the main factors which affect detonation ?

b) Dry exhaust gas from an oil engine has the following composition by volume

$CO_2 - 8.85\%$; $CO - 1.2\%$; $O_2 - 6.8\%$; $N_2 - 83.15\%$. The fuel composition by mass is $C - 84\%$; $H_2 - 14\%$ and $O_2 - 2\%$. Determine :

1) Mass of carbon per kg of dry flue gas and

2) A/F ratio

14. a) Describe the flame front propagation in SI engine.

b) What are the different methods used in CI engines to create turbulence in the mixture ? Explain the effect on power output and thermal efficiency of the engine.

Module – III

15. a) Derive the expression for work done per kg of air compressed in a reciprocating air compressor with clearance volume V_c.

b) A single stage single acting compressor delivers 15 m³ of free air per minute from 1 bar to 8 bar. The speed of compressor is 300 rpm. Assuming that compression and expansion follow the law $PV^{1.3} = C$, and the clearance is 1/16th of swept volume, find the diameter and the stroke of the compressor. Take L/D = 1.5.

16. a) What is centrifugal compressor ? How does it differ from an axial flow compressor ?

b) A single acting two stage compressor with complete inter cooling delivers 6 kg/min of air at 15 bar. Assuming an intake at 1 bar and 15°C and compression and expansion with the law $PV^{1.3} = C$; Calculate

1) Power required to run the compressor
2) Free air delivered per sec.
3) Isothermal efficiency
4) If clearance ratios for LP and HP cylinders are 0.04 and 0.06. Calculate volumetric efficiency and swept volume for each cylinder.
5) Net heat transferred in LP and HP cylinders during compression and also in the intercooler.