FACULTY OF ENGINEERING

B.E. 3/4 (Mechanical) I – Semester (New) (Main) Examination, Nov. / Dec. 2012

Subject : **Applied Thermodynamics**

<u>Time : 3 hours</u>   **Max. Marks : 75**

Note: Answer all questions from Part–A and answer any **FIVE** questions from Part–B.

PART – A (10 x 2.5 = 25 Marks)

1.   Why inter cooling is employed in multistage reciprocating air compressors?

2.   Write short notes on MPFI.

3.   How does knocking in C.I. Engine differ from knocking in S.I. Engine?

4.   List any three accessories used in boilers.

5.   What are practical limitations in the deployment of Carnot cycle in steam power plant operation?

6.   Draw 2 stage reciprocating compression processes on T-s plots with ideal intercooler.

7.   What is the effect of variable specific heats on an IC engine cycle?

8.   Define Octane number.

9.   How jet condensers differ from surface condensers?

10. Is critical point shown on Mollier diagram? Justify your answer.

PART – B (5 x 10 = 50 Marks)

11. A three stage compressor with perfect inter cooling takes in air at 1 bar pressure and 27^0C. The law of compression in all stages is $PV^{1.4}$ = Constant. The compressed air is delivered at 16 bar from H.P. cylinder to an air receiver. Calculate per kg of air :-
(Take Rair = 287J/ kg^0 K and $C_{p(air)}$ = 1005 J/ kg^0 K)
i) Intermediate pressures,
ii) The minimum work done and
iii) Heat rejected in inter coolers

12.a) Discuss the merits of battery ignition system over magneto ignition system in S.I. engines?   5

   b) Differentiate two stroke engines from four stroke engines.   5

13. Briefly explain the stages of combustion in S.I. engines with the help of pressure v/s crank angle diagram. Mention the factors influencing flame speed.   5

14.a) Explain the working principle of stirling boiler with a neat sketch.   5

   b) Draw a neat sketch of a Jet Condenser and explain its operation.   5

15.a) Draw plots of "Pressure and Velocity versus Length", plots for a convergent divergent nozzle if the back pressure is less than design exit pressure.   4

   b) For a Rankine cycle operating between boiler pressure of 60 bar and condenser pressure 0.06 bar, determine i) Thermal efficiency   ii) Work ratio and iii) Specific steam consumption. The steam entering the turbine has a degree of superheat of 30^0 C. Isentropic efficiency of turbine is 85% and that of feed water pump is 90%.   6

16.a) Prove that for minimizing the work input to a two stage reciprocating air compressor, the intermediate pressure should be a geometric mean of suction and delivery pressures.   5

   b) Briefly discuss about direct type regeneration Rankine cycle using T-s diagram.   5

17.   A four stroke cycle gas engine working on constant volume cycle develops 11 kW at 250 rpm. The following data refers to the engine.   10

   The diameter of the cylinder is 24 cm, stroke length is 40 cm, clearance volume is 4500 c.c. Average explosions per minute are 80. The average mean effective pressure during firing stroke is 7 bar. The gas fuel consumption rate is 15 cu. meter / hour at a pressure of 770 mm of Hg. and C.V. of gas fuel is 21 MJ/m^3.

   Find   i) Indicate power   ii) Mechanical efficiency
           iii) Brake thermal efficiency and   iv) Air standard efficiency

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