

## FACULTY OF ENGINEERING

B.E. 3/4 (Mech./Prod.) I-Semester (Main) Examination,  
November/December, 2009

Subject : APPLIED THERMODYNAMICS

Time : 3 Hours ]

[ Max. Marks : 75

- Note : (i) Answer *all* questions of *Part - A*.  
(ii) Answer *five* questions from *Part - B*.

## PART - A

(25 Marks)

1. What do "intercooler" and "aftercooler" do in a multi stage air compressor ? How does this cut down work of compression ? 3
2. Mention any four uses of compressed air in practice. 2
3. Define "brake thermal", "mechanical" and "indicated thermal" efficiencies of an IC engine. 3
4. What are the benefits of drawing a "heat balance sheet" on an IC engine ? Explain. 2
5. Define "Octane Number" of an IC engine running on Petrol. How can it be improved ? 3
6. How does "ignition delay" act as a "blessing" in SI engine operation, while it is a "disadvantage" in CI engine operation ? 2
7. How do water-tube boilers differ from smoke tube boilers ? Write any four differences. 3
8. Differentiate between "Jet condenser" and "surface condenser". Write any four differences. 2
9. Draw the T-S and P-V diagrams of a Carnot Vapor power cycle and explain. 3
10. Define "Nozzle efficiency" and give its significance ? 2

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11. A single - acting, single-stage reciprocating air-compressor is required to deliver 5.67 m<sup>3</sup>/min of free air at a mean piston speed of 152.5 m/min. The air is compressed from 1 atm. To 7 atm. The clearance is (1/15) of the stroke, while the stroke is 1.25 times the diameter. Assuming that the indices of compression of re-expansion are identical at 1.3 and further taking suction and ambient conditions to be the same, find : 10
- (a) Volumetric efficiency,
  - (b) speed and
  - (c) bore diameter and stroke length of the cylinder.
12. With neat pertinent sketches, explain the principle of working of : 10
- (a) Battery ignition system and
  - (b) Magneto ignition system. Bring out the "contrast" between the two.
13. Explain the combustion problems generally encountered in SI as well as CI engines. Suggest remedial measures in each case. 10
14. Draw a neat sketch of Cochran steam boiler and explain its principle of operation. 10
15. Starting from first principles, derive the expressions for : 10
- (a) Exit steam velocity and
  - (b) critical pressure ratio for maximum discharge as referred to a convergent - divergent steam nozzle.
16. Dry-saturated steam at 3.5 bar (abs) is supplied to a convergent-divergent steam nozzle of throat area 4.4 cm<sup>2</sup>. The exit pressure is 1.1 bar (abs). Determine the maximum possible discharge through the nozzle per minute and area of the nozzle at exit, when the flow is maximum. Assume the flow to be frictionless adiabatic. 10
17. (a) Explain the functions of : 5
- (i) Fusible plug,
  - (ii) Water-Level Indicator,
  - (iii) Feed-water heater and
  - (iv) Feed-check valve as referred to a steam boiler.
- (b) Write a note on the adverse effects of exhaust gases let off by an IC engine. How could they be circumvented ? 5