

Code No. : 5183/S

**FACULTY OF ENGINEERING**

**B.E. 3/4 (Mech.) I Semester (Suppl.) Examination, June 2012**

**APPLIED THERMODYNAMICS**

Time : 3 Hours]

[Max. Marks : 75

**Note : Answer all questions from Part A. Answer any five questions from Part B.**

**PART – A (25 Marks)**

1. Mention at least four practical applications of the compressed air. 3
2. How does clearance volume help in the working of a reciprocating air compressor ? 2
3. How are IC engines classified on the basis of i) basic cycle of operation and ii) mode of fuel ignition employed ? 3
4. Mention at least two prominent differences between simple and Zenith carburetors. 2
5. How do premixed and diffusion flames differ vis-a-vis combustion in an IC engine ? 3
6. Define "ignition delay" as referred to an SI engine and give its significance. 2
7. Distinguish between fire-tube and water-tube boilers. 3
8. Explain briefly, the "principle of evaporative cooling" vis-a-vis a cooling tower. 2
9. Mention three salient differences between Carnot steam power cycle and Rankine steam power cycle. 3
10. Briefly explain the significance of "Critical pressure ratio" as referred to a steam nozzle. 2

**PART – B (5×10=50 Marks)**

11. A single stage reciprocating air compressor is needed to handle  $30 \text{ m}^3$  of free air per hour at 1 bar. The delivery pressure at 450 rpm is 6.5 bar. Calculate i) clearance ratio, ii) indicated mean effective pressure, iii) brake power input needed, if the mechanical efficiency is 80%, isothermal efficiency is 76% and volumetric efficiency is 75%. Assume the compressor to be "single acting type". 10

(This paper contains 2 pages)



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12. With neat and relevant schematic diagram, P-V diagram and T-s diagram, explain the working of a 4-stroke cycle S.I. (petrol) engine. 10
13. A 4-cylinder 4-stroke petrol engine has been subjected to a laboratory test and the following information is available : Cylinder diameter = 6.4 cm, Cylinder stroke = 9 cm, Clearance volume = 50 cm<sup>3</sup>; Fuel consumption = 7.5 l/h; Speed = 2400 rpm; Calorific value of the fuel = 47700 KJ/kg; Specific gravity of fuel = 0.717; Brake drum diameter = 73.5 cm; Rope diameter = 2.5 cm; Load on brake drum running at  $\frac{1}{3}$  engine by belts speed spring balance read 60 kg and 8 kg; Mechanical efficiency = 80%.
- Determine :
- air-standard efficiency
  - brake thermal efficiency, and
  - indicated thermal efficiency.
- Also find the relative efficiency of the engine. Take  $\gamma = 1.4$ . 10
14. Explain clearly "normal combustion" and "abnormal combustion" in C.I. (Diesel) engines. Mention the "additives" that could bring down "knocking" here. 10
15. Draw a neat sketch of Babcock and Wilcox water-tube steam boiler and clearly explain the working of the same. How does it differ from a forced connection water tube boiler ? 10
16. Dry saturated steam at 10 bar (abs) is expanded in a steam nozzle to 0.4 bar (abs). The throat area is 7 cm<sup>2</sup>, while the inlet velocity is negligible. Calculate i) the mass rate of flow of steam and ii) the exit area, assuming isentropic flow. Take the index of expansion to be,  $n = 1.135$ , for dry saturated steam. 10
17. Draw the P-V and T-s diagrams and schematic diagram of a Rankine cycle and clearly explain its principle of operation. 10