Code No. 2183 / O

FACULTY OF ENGINEERING

B.E. 3/4 (Mech.) I-Semester (Old) Examination, May 2013

Subject : **Applied Thermodynamics**

Time : 3 Hours Max. Marks: 75

Note: Answer **all** questions of Part - A and answer any **five** questions from Part-B.

PART – A (25 Marks)

1. Briefly explain any three practical applications of compressed air in engineering. (3)

2. Define (i) clearance factor and (ii) volutmetric efficiency as referred to a reciprocating air-compressor. (2)

3. Mention at least three salient differences between 2-stroke cycle and 4-stroke cycle internal combustion Engines. (3)

4. Define (i) mechanical efficiency and (ii) brake thermal efficiency vis-à-vis an internal combustion engine. (2)

5. Mention at least three factors that help in mitigating the knocking tendency in a spark ignition (SI) engine. (3)

6. Define "Ignition Lag" as referred to a C.I. engine spell out as to how it affects "Combustion phenomenon" in this engine. (2)

7. Mention the functions of (i) Fusible plug, (ii) Pressure gauge and (iii) Water gauge as referred to steam boilers. (3)

8. Briefly explain the significance of "Boiler Draught". (2)

9. Mention the essential differences between "steam power Carnot cycle" and "steam power Rankine cycle". (3)

10. Define nozzle efficiency. Give its significance. (2)

PART – B (5x10=50 Marks)

11. A pingle-acting, single-stage, reciprocating air compressor has a bore of 200 mm and a stroke of 300 mm. It runs at a speed of 500 rpm, while the air is compressed in accordance with the law $PV^{1.3}$ = constant, from an initial pressure of 0.91 bar (abs) and the delivery pressure is 5.3955 bar (abs). The initial temperature is $20^{o}C$. Calculate (i) the air delivery temperature (ii) the amount of air delivered, and (iii) the power need to be expended in driving the compressor. (10)

12. How do the battery ignition and the magneto ignition systems as referred to a spark ignition (petrol) engine differ? Bring out the essential working principle of a "magneto ignition system" along with a pertinent neat diagram. (10)

13. A 6-cylinder, 4-stroke Diesel engine has a cylinder bore of 120 mm and a stroke of 150 mm. It develops a brake output of 95 kW, while it runs at 2000 rpm. It consumes 27.3 liters of Diesel fuel per hour. The fuel specific gravity is 0.83. The frictional loss is estimated to be 25 kW at the above speed. Calculate (i) bmep, (ii) imep, (iii) mechanical efficiency (iv) bsfc and isfc and (v) torque for the above engine. (10)

..2

14. With the help of neat and pertinent pressure-Crank angle diagrams, explain the process of "Normal combustion" and "Abnormal combustion" as applied to a spark ignition (SI) petrol engine . Explain the concept of "Octane number rating" as applied to the above engine fuels. (10)

15. With the pertinent neat sketch, explain the principle of working of a Babcock and Wilcox water-tube steam boiler. How does it differ from a Cochran steam boilers? (10)

16. A convergent-divergent steam nozzle is required to discharge 2 kg of steam per second. The nozzle is supplied with steam at 10 bar (abs) and temperature 200^{o}C, while the discharge takes place against a back pressure of 0.34 bar (abs). Calculate the throat and the exit areas of the nozzle. Assume the flow of steam through the nozzle to be isentropic and the pertinent index of expansion to be 1.3. If the nozzle efficiency is assumed to be 85%, calculate the exit area of the nozzle. (10)

17. Draw the neat schematic, P- v and T-s diagrams of a basic Rankine steam power cycle and explain its working principle. How does this cycle's efficiency be augmented using "regeneration". (10)

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