FACULTY OF ENGINEERING

B.E. 3/4 (Mech.) I-Semester (Old) Examination, November / December 2012 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. How does a single-acting reciprocating air-compressor differ from a double-acting reciprocating air-compressor? (3)
- 2. Mention the functions of (i) inter cooler and (ii) after-cooler as referred to a multi-stage reciprocating air compressor. (2)
- 3. How does a spark ignition (SI) petrol engine differ from a compressor ignition (CI) diesel engine? (3)
- 4. Define (i) bsfc and (ii) isfc as applied to an Internal Combustion Engine.
 What is their significance? (2)
- 5. How do premixed flames differ from diffusion flames as referred to IC engines? (3)
- 6. Mention the names of at least two additives each that help in controlling knocking phenomenon in SI and CI engines. (2)
- 7. How do fire (or smoke) tube boilers differ from water tube boilers? (3)
- 8. Mention two salient differences between Jet Condensers and Surface Condensers. (2)
- 9. Briefly describe the advantages of "reheating" between "successive expansion stages" vis-à-vis a Rankine vapor power cycle. (3)
- 10. Mention the different types of steam nozzles used in engineering practice. (2)

PART - B (5x10=50 Marks)

- 11. The cylinder bore diameter and the piston stroke length of a single-acting, single-cylinder, air-compressor are, respectively, measured to be 15 cm and 20 cm. Air is inhaled into the cylinder at a pressure of 1 bar (abs), while the temperature is 20°C. It is then compressed, according to the law pv 1.35 = constant, to a pressure of 6 bar (abs). Calculate the theoretical HP required to drive the compressor, while running at 110 rpm. Also, calculate the mass flow rate of air handled by the compressor. (10)
- Explain the principle of working of a 4-stroke cycle spark ignition petrol engine along with a neat pertinent schematic diagram for the same. How does it differ from a 4-stroke cycle compression ignition Diesel engine? (10)
- 13. A 4-cylinder, 4-stroke SI (petrol) engine gave the following results during trial on the same: Bore= 6.5 cm; stroke = 9.5 cm; speed = 3000 rpm; clearance volume provided = 65 cm³; relative efficiency based on brake thermal efficiency = 50%; heating value of fuel used = 46054.8 kJ/kg; torque developed =68.67 N-m; mechanical efficiency = 80%; T(adiabatic index) for air = 1.4 Calculate (i) sfc and (ii) bmc P for the above engine.
- 14. Define and explain 'ignition delay' as referred to a CI (Diesel) engine.

 How does this trigger the phenomenon of "knocking"? Explain the various measures available to avert the above tendency in the engines. (10)
- 15. Explain the basic principle of evaporative cooling that is used in cooling towers in steam power plants. With a neat pertinent diagram, explain the principle of operation of an atmospheric (or hyperbolic) cooling tower. (10)
- 16. Dry saturated steam at 10 bar (abs) is expanded in a steam nozzle to 0.4 bar (abs). The throat area is 7cm², while the inlet velocity is negligible. Calculate the mass flow rate of steam through the nozzle and also find the exit area. Assume isentropic flow and take the index (n)=1.135 for dry saturated steam.
- 17. Clearly explain the relevance of
 - (a) regeneration and
 - (b) Cogeneration in "augmentation of the thermodynamic performance" of a steam-power Rankine cycle.
