

FACULTY OF ENGINEERING**B.E. 3/4 (Mech. Engg.) I – Semester (Main) Examination, December 2015****Subject : Applied Thermodynamics****Time : 3 hours****Max. Marks : 75****Note: Answer all questions from Part-A. Answer any FIVE questions from Part-B.****PART – A (2.5 x 10 = 25 Marks)**

- 1 What is the advantage of fitting an after cooler in a reciprocating air compressor.
- 2 Plot on TS coordinates, ideal cycle of a two stage reciprocating air compressor with intercooler and aftercooler.
- 3 How is scavenging period determined from valve timing diagram?
- 4 Define brake specific fuel consumption for an IC engine.
- 5 Why is period of controlled combustion called so in CI engines?
- 6 List some demerits of anti knocking additives.
- 7 What is the utility of economizer used in power plant?
- 8 What is the working principle of super critical boilers?
- 9 What is the relation for exit velocity in a nozzle flow in terms of inlet properties?
- 10 How does reheating improve the performance of Rankine cycle?

PART – B (5 x 10 = 50 Marks)

- 11 A two stage, single acting, reciprocating air compressor takes in air at 1 bar and 300° K. The delivery pressure is 10 bar. The law of compression is $PV^{1.3} = \text{constant}$. The rate of discharge is 0.1 kg/s. Calculate (a) power required to drive the compressor (b) saving in work in comparison with single stage compression (c) isothermal efficiency and (d) heat transfer to intercooler. Take $R_{\text{air}} = 287 \text{ J/kg } ^\circ\text{K}$.
- 12 A four cylinder, two stroke petrol engine develops 30 kW at 2500 rpm. The mean effective pressure on each piston is 8 bar and mechanical efficiency is 80%. Calculate the diameter and stroke of each cylinder, if the stroke to bore ratio is 1.5. Also calculate the fuel consumption of the engine, if the brake thermal efficiency is 28%. The calorific value of the fuel is 43900 kJ/kg.
- 13 Discuss how knocking takes place in SI and CI engines. What are the geometrical design considerations to prevent knocking in SI engines?
- 14 a) Explain the working principle of a cooling tower.
b) Discuss about the classification of steam condensers.
- 15 Steam enters a convergent – divergent nozzle at 15 bar and 300°C and leaves at a pressure of 2 bar. The inlet velocity to the nozzle is 150 m/s. Find the required throat and exit areas for a mass flow rate of 1 kg/s. The nozzle efficiency is 90% and $C_p = 2.4 \text{ kJ/kg } ^\circ\text{K}$.
- 16 A steam power plant operates on an ideal Rankine cycle between a boiler pressure of 40 bar, 300°C and a condenser pressure of 0.035 bar. Calculate cycle efficiency, Work ratio, and specific steam consumption for
 - i) Ideal Rankine cycle
 - ii) Rankine cycle when expansion process has an isentropic efficiency of 80%.
- 17 a) Differentiate between Air and Water cooling systems used in IC engines.
b) Discuss briefly about the types of combustion chambers used in SI engines.
