

FACULTY OF ENGINEERING

B.E. 3/4 (Mech.) I-Semester (New) (Suppl.) Examination, May / June 2017

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 (10 x 2.5 = 25 Marks)

- 1 Define clearance factor in a reciprocating air compressor and its significance.
- 2 Determine the length of the stroke of the piston, if velocity of the piston 152.5 meters / min and speed of the compressor is 100 r.p.m..
- 3 Write the formula of indicated power and explain each term.
- 4 Define brake specific fuel consumption and indicated specific fuel consumption.
- 5 Define equivalent ratio.
- 6 Write importance of compression swirl in C.I. engines.
- 7 Write the importance of air preheater and economiser in steam boiler.
- 8 Define boiler efficiency.
- 9 Draw the Rankine cycle on T-S diagram.
- 10 Write importance of cooling tower in a condenser.

PART – B (5 x 10 = 50 Marks)

- 11 a) Define volumetric efficiency and obtain an expression for it in case of a reciprocating air compressor.
b) Derive an expression for isothermal efficiency in case reciprocating air compressor.
- 12 The following observations were made during a trial of a single cylinder four stroke cycle gas engine having a cylinder diameter of 18cm and stroke 24cm.
Duration of trial = 30 min, Total no. of revolutions = 9000, Total no. of explosions = 4450, Mean effective pr = 5 bar, net load on brake wheel = 40 kg, Effective dia of brake wheel = 1m, Total gas used at NTP = 2.4m^3 , CV of gas at NTP = 19 MJ/m^3 , Total air used = 36m^3 ; Pr of air = 720mm of Hg, Temp of air = 17°C , Density of air at NTP = 1.29 kg/m^3 , temp of exhaust gases = 350°C , Room temp = 17°C , Sp.heat of exhaust gases = $1\text{ kJ/kg}^\circ\text{C}$, cooling water circulated = 80kg, Rise in temp of cooling water = 30°C .
Draw a heat balance sheet and estimate mechanical and indicated thermal efficiencies of the engine ($R = 287\text{ k/kg k}$).
- 13 Explain the stages of combustion in S.I. engine with neat sketch using P- θ diagram.
- 14 Derive an expression for a boiler draught in terms water column in terms chimney height of a boiler.

- 2 -

- 15 A regenerative system is added to a 5-MW steam power plant that operates of a simple ideal Rankine cycle. Steam enters into the inlet of the turbine at 5MPa and 673K and subsequently gets cooled to a saturated liquid at 5 kPa in the condenser. A suitable portion of the steam is withdrawn from the turbine at 3MPa, and the remaining steam is expanded to the condenser pressure level. Then, the pressure of this steam is raised to 3MPa to get mixed with extracted steam from the turbine in an open feed water heater. Determine a) quality of steam at the exit of turbine b) net work out put per unit mass, and c) thermal efficiency.
- 16 Define critical pressure of nozzle and derive condition for critical pressure.
- 17 Write short notes on the following :
- a) Multi stage compression
 - b) Simple carburettor
 - c) Exhaust Emissions in C.I. engine
