Code No. 3138 / O / S

FACULTY OF ENGINEERING

B.E. 3/4 (Mech.) I-Semester (Old) 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 Write any three applications of compressed air.
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 Compare SI and CI engine with respect to introduction of fuel load control.
4 Explain the mist lubrication in few sentences.
5 Define equivalent ratio.
6 Explain the importance of ignition delay period in C.I. engine.
7 Write any twomountings and two accessories in steam boilers.
8 How the cooling towers are classified based on the type of draught?
9 What is fluidized bed combustion? Explain briefly.
10 Define steam rate in Rankine cycle.

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. 4

b) A single acting single cylinder reciprocating compressor has a cylinder diameter of 200 mm and a stroke of 300mm air enters the cylinder at 1 bar and 27^0c ; it is then compressed polytropically to 8 bar according to the law $PV^{1.3} = C$. If speed of compressor is 250 rpm calculate the mass of air compressed per min and power required in kw to drive the compressor. 6

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 = 5bar, Net load on brake wheel = 40kg, 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 = 720 mm of Hg, Temp of air = 17^0c, Density of air at NTP = 1.29 kg/m^3, Temp of exhaust gases = 350^0c,

Room Temp = 17^0c, Sp.heat of exhaust gases = 1 kj/kg^{0}c, cooling water circulated = 80kg, Rise in temp of cooling water = 30^0c.

Draw a heat balance sheet and estimate mechanical and indicated thermal efficiencies of the engine (R = 287 j/kg k). 10

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13 a) Explain in detail flame front propagation in S.I. engine? Discuss the factors influencing the flame speed. 5

b) Discuss the abnormal combustion in S.I. engine. 5

14 a) Compare jet type and surface type condensers. 5

b) Explain with neat sketch of double pass surface condenser. 5

15 a) Define the term critical pressure. Derive an expression for condition for maximum discharge. 7

b) In a convergent-divergent nozzle the steam enters at 15 bar, 300^0c and leaves it at a pressure of 2 bar. The inlet velocity to the nozzle is 150m/sec. Find the required throat and exit areas for mass flow rate of 1kg/sec. Assume, nozzle efficiency to be 90%. Assume C_p = 2.4 Kj/kg k. 3

16 a) Explain the concept of Reheat cycle with a neat sketch and its importance in the steam power plant. 4

b) A cycle steam power plant is to be designed for a steam temperature at turbine inlet of 360^0c and an exhaust pressure of 0.08 bar. After isentropic expansion of steam in the turbine, the moisture content at the turbine exhaust is not to exceed 15%. Determine the greatest allowable steam pressure at the turbine inlet and calculate the Rankine cycle efficiency for these steam conditions. Estimate also the mean temperature of heat addition. 6

17 Write short notes on the following : 10

a) Isothermal, Isentropic efficiencies in Reciprocating Air Compressors

b) Combustion phenomena in C.I. engine

c) Crank case dilusion

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