Total No. of Questions – [8] Total No. of Printed Pages – [2]

G.R. No.	

Paper Code - U218-155 (BE - FF)

MAY 2019/ENDSEM

S. Y. B. TECH. (MECHANICAL ENGINEERING) (SEMESTER - I)

COURSE NAME : THERMODYNAMICS

COURSE CODE : MEUA21175

(PATTERN 2017)

Time: [**2 Hours**] [Max. Marks: **50**]

(*) Instructions to candidates:

1) **Answer Q.1, Q.2, Q.3, Q.4, Q.5 OR Q.6, Q.7 OR Q.8**
2) **Figures to the right indicate full marks**
3) **Use of Steam Table, Mollier Diagram is allowed**
4) **Use of scientific calculator is allowed**
5) **Use suitable data where ever required**

Q.1 a) State: i. Boyle's law ii. Charle's law iii. Gay Lussac's law 6

OR

b) Steam flows steadily into a condenser and at entry it has an enthalpy of 2050KJ/kg and its velocity is 500m/s. The condensate (condensed steam) has an enthalpy of 200 KJ/Kg and it leaves with 10 m/s velocity. The exit from the condenser is in line with the inlet. Determine the heat transfer to cooling water per unit mass of steam condensed. 6

Q.2 a) Explain the working of Carnot cycle with P-v diagram. 6

OR

b) A domestic food refrigerator maintains a temperature of -10°C whilst the ambient air temperature is -30°C. The heat leakage into the freezer is estimated to be at the continuous rate of 2KJ/s, Determine the least power needed to pump out this heat continuously. 6

Q.3 a) Explain the concept of available and unavailable energy. 6

OR

b) 30 kg of copper block, Cp = 0.386 KJ/Kg at 95°C is dropped in 30 kg of water at 24°C. Assume perfect heat transfer, and no heat lost to the surrounding. Find the final equilibrium temperature reached for water and copper block, entropy change of copper block and entropy change of water. 6

Q.4 a) Define i.wet steam ii.Dry saturated steam iii.Superheated steam iv. Latent heat of vaporization 4

OR

b) Define dryness fraction of steam. Calculate the dryness fraction of steam which has 4.5 kg of water in suspension with 50 kg of steam. 4

Q.5 a) 5400 kg of steam is produced per hour at a pressure of 750kpa in a boiler when feed water is at 41.5^{0}C. The dryness fraction of the steam is 0.98. The amount of the coal burnt per hour is 670 kg with CV of 31000 KJ/Kg. Determine the boiler efficiency and equivalent evaporation. 6

b) Find the draught in mm of water column produces by a chimney 36 m high when the mean temperature of hot gases is 300°C, the temperature of outside air is 27 °C and 19 kg of air is supplied per kg of fuel burnt in furnace. 4

c) Explain functions of super-heater and economizer in boiler. 4

OR

Q.6 a) In a boiler, the following observations were made: pressure of steam = 10 bar, steam condensed = 540 kg/h, fuel used = 65 kg/h, Moisture in fuel = 2% by mass, Mass of dry flue gases = 9 kg/kg of fuel, lower calorific value of fuel = 32000 kJ/Kg, Temperature of the flue gases = 325°C, Temperature of boiler house = 28 °C, feed water temperature = 50°C, mean specific heat of flue gases = 1 kJ/kg K, dryness fraction of steam = 0.95. Draw up a heat balance sheet for the boiler. 6

b) A boiler uses 18 kg air per kg of fuel. Determine the minimum height of chimney required to produce a draught of 25 mm of water. The mean temperature of chimney gases is 315°C and that of outside air 27°C. 4

c) Compare water tube boiler and fire tube boiler. 4

Q.7 a) During an experiment on reciprocating air compressor the following observations are being taken:
Barometer reading = 75.6 cm of Hg, Manometer reading across orifice = 13 cm of Hg, Atmospheric temperature = 25^{0}C, Diameter of orifice = 15 mm, Coefficient of discharge across the orifice = 0.65, Take density of Hg = 0.0135951 Kg/ cm^3. Determine the volume of air handled by compressor in m^3/min. 6

b) Draw p-v and T-s diagram for a single stage reciprocating air compressor, without clearance. 4

c) Enlist advantages of multi-staging in reciprocating air compressor? 4

OR

Q.8 a) A single stage reciprocating air compressor is required to compress 1 kg of air from 1 bar to 4 bar. The initial temperature is 27°C. Compare the work requirement in the following cases: i. Isothermal compression ii. Compression with $Pv^{1.2}$= constant iii. isentropic compression 6

b) Explain the effect of intercooling in a multistage reciprocating compressor. 4

c) Explain the following terms: a. Isothermal efficiency b. Volumetric efficiency 4

**********Best of Luck**********