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Seat No.	

[5559]-112

SE (Mech./Auto./Sand.) (First Semester) EXAMINATION, 2019

THERMODYNAMICS

(2015 PATTERN)

Time : Two Hours   Maximum Marks : 50

1. Solve 4 questions Q 1 or Q 2, Q 3 or Q 4, Q 5 or Q 6, Q 7 or Q 8
2. Answer for all questions should be written in same answer book.
3. Neat Diagrams should be drawn wherever necessary.
4. Use of steam Tables and Pscychrometric chart, scientific calculator is allowed.
5. Assumes suitable marks wherever necessary.
6. Figures to the right indicate full marks.

Q 1 A Draw block diagram of Heat Engine, Heat Pump and Refrigerator, write the formula for their efficiency and COP respectively (4 marks) also state Kelvin Plancks and Clausius statements for second law of Thermodynamics (2 marks).   6

     B Experimental data of heat capacity of air at constant pressure is as follows, 1. Mass of air = 0.05 kg, Air heated from 287 K to 347 K, heat input = 3012 kJ, Adiabatic index = 1.4. Find a. Specific heat of air at constant pressure (2 marks), b. Specific heat of air at constant volume (2 marks), c. Characteristic gas constant (2 marks)

OR

Q 2 A Represent the constant volume process on P-v diagram for an ideal gas (1 mark) and write a real world example of constant volume process (1 mark). Derive the expression for following, for an ideal gas undergoing constant volume process (1 mark for each),   6
        a. Heat transferred.
        b. Work transferred.
        c. Change in enthalpy.
        d. Change in internal energy.

     B A reversible heat engine operates on Carnot Cycle between source and sink temperature of 225 deg. C and 25 deg. C. If the heat engine receives 40 kW from the source, find the net work done, heat rejected to sink and efficiency of the engine.   6

Q 3 A Derive the efficiency equation for Otto Cycle (4 marks) also show the cycle on P-v diagram (2 marks)   6

     B Determine superheated entropy (2 marks), enthalpy (2 marks) and Specific volume (2 marks) for a steam at 20 bar and 250 deg. C using steam table.   6

P.T.O.

Q 4 A With neat and labeled sketch (4 marks) explain the working of separating calorimeter for measuring dryness fraction of wet steam. **6**

B A gas engine working on Otto Cycle has a cylinder of diameter of 0.2 m and stroke of 0.25 m. The clearance volume of 0.00157 m^3. Find the air standard efficiency of Otto Cycle (assume adiabatic index gama = 1.4) **6**

Q 5 A Define Equivalent evaporation (3 marks) and Boiler efficiency (3 marks). **6**

B Steam generator produces 6000 kg/hr steam at pressure 10.5 bar with a dryness fraction of 0.9. The feed water temperature is 49 deg. C. The amount of coal burnt is 10.83 kg/min having CV of 30500 kJ/kg. Determine the following 1. Boiler efficiency, 2. Equivalent evaporation. **7**

OR

Q 6 A Draw the heat balance sheet for boiler considering following sub components (1 mark for each component), **6**
   a. Energy credited by burning of fuel.
   b. Heat transferred to boiler drum.
   c. Heat transferred to economizer.
   d. Heat transferred to super heater.
   e. Heat transferred to air preheater.
   f. Heat lost to surrounding by flue gases.

B Calculate the height of Chimney required for producing a draught equivalent to 17 mm of water. The flue gas temperature is 270 deg. C. The ambient temperature is 22 deg. C and amount of air required per kg of fuel burnt is 17 kg. **6**

Q 7 A Represent the following process on Pscychrometric chart (Draw in your answer book only) a. Sensible heating, b. Sensible cooling, c. Humidification, d. Dehumidification, e. Heating and Humidification f. Cooling and Humidification, g. Heating and Dehumidification and g. Cooling and Dehumidification. **6**

B For air having DBT of 35 C and humidity of 10 gm/kg of dry air. Find the following and mention correct units (1 mark each for following), **7**
   1. Enthalpy of air.
   2. WBT.
   3. DPT.
   4. Relative humidity.
   5. Specific humidity.
(Show the point on Pscychrometric chart (2 marks))

OR

Q 8 A Define the following terms related to Pscychrometry (any 6),
   1. DBT.
   2. WBT.
   3. DPT.
   4. Humidity.
   5. Degree of Saturation.
   6. Relative humidity.
   7. Specific humidity.

B Moist air of mass flow rate 200 m^3/min at 15 deg. C DBT and 75 % RH is sensibly heated until its temperature reaches 25 deg. C. Find a. Enthalpy of air at inlet (1 marks), b. Enthalpy of air at exit (1 marks), c. Mass flow rate of air (2 marks) and d. Heat added to the air in kW (1 marks). Show the process on Pscychrometric chart (2 marks). **7**