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Total Number of Pages: 03

B.TECH
15BE2103

2nd Semester Back Examination 2017-18

THERMODYNAMICS

BRANCH: AEIE, AERO, AUTO, BIOMED, BIOTECH, CHEM, CIVIL, CSE, ECE, EEE, EIE,
ELECTRICAL, ENV, ETC, FASHION, FAT, IEE, IT, ITE, MANUFAC, MANUTECH,
MARINE, MECH, METTA, METTAMIN, MINERAL, MINING, MME, PE, PLASTIC, TEXTILE

Time: 3 Hours

Max Marks: 100

Q.CODE: C1036

Answer Part-A which is compulsory and any four from Part-B.

The figures in the right hand margin indicate marks. Steam tables are allowed in the examination hall.

Part – A (Answer all the questions)

Q1 Answer the following questions: *multiple type or dash fill up type* (2 x 10)

- a) A paddle wheel is harnessed to agitate a mass of liquid in a tank. And in that process 5kJ of mechanical work is supplied and the system loses 1.5 kJ of heat to its surroundings. Therefore the change in internal energy associated with the process is _____.
- b) A reversible engine operating between two temperature reservoirs of heat , 600K and 300K absorbs 300 kW of heat and rejects Q2 the heat sink. The value of Q2 is _____.
- c) The pressure and temperature at the critical state point (water-steam) are _____, _____.
- d) The density of air at pressure of 1 bar and temperature of 298 K is _____.
- e) The saturation temperature at 2 bar pressure and 0.5 dryness fractions is _____.
- f) The manometer reads 200 mm of Hg. The atmospheric pressure is 760 mm Hg. The absolute pressure (in bar) of a fluid flowing in a pipe line is _____.
- g) Enthalpy, volume steam at 10 bar, 200°C are _____ and _____.
- h) Find the odd out from the following
- i) $p dv + v dp$ ii) ds (iii) dv (iv) $p dv + v^2 dp$
- i) Find the odd from the following
- (i) Volume (ii) Density (ii) Entropy (iv) Enthalpy
- j) Find the odd out of the following
- (i) economizer (ii) water level indicator (ii) pressure gauge (iv) fusible plug

Q2 Answer the following questions: Short answer type (2 x 10)

- a) Differentiate between nozzle and a diffuser.
- b) What do you mean by intensive property? Give two examples.
- c) What is throttling process?
- d) State & explain PMM1.
- e) State Clausius law of inequality.
- f) What is throttling process?
- g) What is point function? Give two examples of point function?
- h) What is thermal equilibrium?
- i) What do you mean by Reversed engine?
- j) Differentiate between wet and dry steam.

Part – B (Answer any four questions)

- Q3 a)** Two kg of a gas enclosed in a cylinder-piston assembly undergo three specific processes of volume expansion: $P_1= 6 \text{ bar}$, $V_1=0.2\text{m}^3 \rightarrow P_2=2 \text{ bar}$, $V_2=0.6\text{m}^3$ **(10)**

Determine the work done in each case,

(i) P varies as linear function of V (ii) $PV=\text{Constant}$ (iii) P remains constant till the volume reaches 0.3 m^3 and $PV^n=\text{constant}$ after that.

- b)** Define the following, (i) C_p (ii) C_v (iii) H **(5)**

- Q4 a)** A centrifugal air compressor delivers 900 kg/h of air. Compute 1. The motor power required to drive the compressor 2. The ratio of inlet to outlet pipe diameter. **(10)**

Given

Air velocity at inlet: 5m/s, Air velocity at the outlet: 7.5 m/s, Enthalpy of the compressed air: 20 kJ/kg, Specific volume of the inlet air: 0.5 m³/kg, Specific volume of the outlet air: 0.15 m³/kg, Heat lost: 75.6 kJ/s.

- b)** Derive mass continuity and SFEE equation for the flow systems. **(5)**

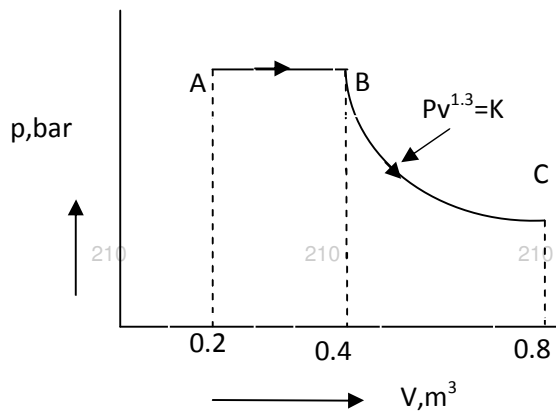
- Q5 a)** Two reversible heat engines A and B are arranged in such a manner that Engine A rejecting heat directly to Engine B. Engine A receives 300 kJ at a temperature of 620 C from a hot source while Engine B is in communication with sink at a temperature of 4 C. If the work output of A is twice that of B, find (a) the intermediate temperature between A and B (b) the efficiency of each engine (c) the heat rejected to the cold sink. **(10)**

- b)** Write down the 1st law and 2nd law of thermodynamics. Mention key differences. **(5)**

- Q6 a)** Water at 40C is continuously sprayed into a pipe carrying 6000 kg/hour of steam at 5 bar, 300 C. At a section downstream where the pressure of the steam is 3 bar and quality is 90%. Find the rate of water spray in kg/h. **(10)**

- b)** Draw the p-v, T-s and h-s plot of pure substance (water- steam). **(5)**

Q7 a) Determine the total work done by gas system following an expansion process as shown in the following process. **(8)**



b) Derive the expression for work done and heat transfer in polytropic process. **(7)**

Q8 a) Write short notes on Refrigerator and Heat pump **(10)**
b) Write short notes on air compressor **(5)**

Q9 a) State the first law of thermodynamics for closed cycle and a process. **(10)**
Explain the terms: (i) Energy (ii) Enthalpy (iii) Entropy
b) Draw the phase equilibrium diagram for water-steam on p-V, T-s plot with relevant property lines. **(5)**