QPC: RJ19BTECH149 AR 19 Reg. No

GIET UNIVERSITY, GUNUPUR – 765022

B. Tech (Fourth Semester – Regular) Examinations, June – 2021

BESAG4070 – Thermodynamics, Heat and Mass Transfer

(Agricultural Engineering)

Time: 2 hrs Maximum: 50 Marks

Answer ALL Questions

The figures in the right hand margin indicate marks.

PART – A: (Multiple Choice Questions) **(1 x 10 = 10 Marks)**

Q.1. Answer ***ALL*** questions [CO#] [PO#]

a. An open system is one in which CO1 PO1

(i) Mass does not cross boundaries of the system, through energy may do so

(ii) Neither mass nor energy crosses the boundaries of the system

(iii) Both energy and mass crosses the boundary of the system

(iv) Mass crosses the boundary the boundary but not energy

b. Properties of substances like pressure, temperature and density in thermodynamic coordinates are CO1 PO1

(i) Path function

(ii) Point function

(iii) Cyclic function

(iv) Real function

c. Zeroth law of thermodynamics CO1 PO1

(i) Deals with conversion of mass and energy

(ii) Deals with reversibility and irreversibility of process

(iii) States that if two systems are both in equilibrium with a third system, they are in thermal equilibrium with each other

(iv) Deals with heat engines

d. A heat exchange process in which the product of pressure and volume remains constant is known as CO1 PO1

(i) Heat exchange process

(ii) Throttling process

(iii) Isentropic process

(iv) Hyperbolic process

e. Kelvin Planck's law deals with CO2 PO1

(i) Conservation of heat

(ii) Conservation of work

(ii) Conversion of heat into work

(iii) Conversion of work into heat

f. The enthalpy of dry saturated steam _____with the increase of pressure CO3 PO1

(i) Decreases

(ii) Increases

(iii) Remains constant

(iv) All of the above

g. Superheated vapour behaves like CO3 PO1

(i) Exactly as gas

(ii) Liquid

(iii) Ordinary vapour

(iv) Approximately as a gas

h. In free convection heat transfer, Nusselt number is function of CO3 PO1

(i) Grashoff number and Reynold number

(ii) Prandtl number and Reynold number

(iii) Grashoff number and Prandtl number

(iv) Grashoff number, Reynold number and Prandtl number

i. The critical radius is the insulation radius at which the resistance to heat flow is CO3 PO1

(i) Maximum (ii) Minimum

(iii) Zero (iv) None of these

j. The ratio of emissive power and absorptive power of all bodies is the same and is equal to the emissive power of a perfectly black body. This statement is known as CO4 PO1

(i) Kirchoff's law (ii) Stefan's law

(iii) Wien's law (iv) Planck's law

PART – B: (Short Answer Questions) **(2 x 5 = 10 Marks)**

Q.2. Answer ***ALL*** questions [CO#] [PO#]

a. What is meant by thermodynamic system? How do you classify it? CO1 PO1

b. Define: Specific heat capacity at constant pressure. CO1 PO1

c. State the Kelvin – Plank statement of second law of thermodynamics CO2 PO1

d. Define triple point CO3 PO1

e. Distinguish between a black body and gray body. CO4 PO1

PART – C: (Long Answer Questions) **(6 x 5 = 30 Marks)**

Answer ***ANY FIVE*** questions Marks [CO#] [PO#]

3. Derive steady flow energy equation. (6) CO1 PO1

4. 10 kg of fluid per minute goes through a reversible steady flow process. The properties of fluid at the inlet are: p_1 = 1.5 bar, ρ_1 = 26 kg/m^3, C_1 = 110 m/s and u_1 = 910 kJ/kg and at the exit are p_2 = 5.5 bar, ρ_2= 5.5 kg/m^3, C_2 = 190 m/s and u_2 = 710 kJ/kg. During the passage, the fluid rejects 55 kJ/s and rises through 55 metres. Determine: (i) the change in enthalpy and (ii) Work done during the process. (6) CO1 PO2

5. Explain the working of Carnot cycle and derive the expression for its Thermal efficiency. (6) CO2 PO1

6. 3 kg of water at 80^0 C is mixed with 4 kg of water at 15^0 C in an isolated system. Calculate the change of entropy due to mixing process. (6) CO2 PO2

7. Explain the following terms relating to steam formation. (i) Sensible heat (ii) Latent heat of evaporation (iii) Dryness fraction of steam (iv) Enthalpy of wet steam. (6) CO3 PO1

8. An exterior wall of a house may be approximated by a 0.1 m layer of common brick (k = 0.7 W/m^{0}C) followed by a 0.04 layer of gypsum plaster (k = 0.48 W/m^{0}C). What thickness of loosely packed rock wool insulation (k = 0.065 W/m^{0}C) should be added to reduce the heat loss or gain through the wall by 80%? (6) CO3 PO2

9. Calculate the following for an industrial furnace in the form of black body and emitting radiation at 2500^{0}C. (6) CO4 PO2

   (i) Monochromatic emissive power at 1.2 µm length. (ii) Wavelength at which the emission is maximum. (iii) maximum emissive power (iv) Total emissive power (v) Total emissive power of the furnace if it is assumed as a real surface with emissivity equal to 0.9.

10. Derive an expression for Logarithmic Mean Temperature Difference for parallel flow heat exchanger. (6) CO4 PO1

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