QPC: RD19BTECH037 AR 19 Reg. No

GIET UNIVERSITY, GUNUPUR – 765022

B. Tech (Third Semester – Regular) Examinations, December – 2020

BPCME 3020 – ENGINEERING THERMODYNAMICS

(Mechanical Engineering)

Time: 2 hrs Maximum: 50 Marks

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 cross the boundaries of the system

(iv)Mass crosses the boundary but not the energy

b. Which of the following is the basic of temperature measurement CO1 PO1

(i) Zeroth law of thermodynamics (ii) First law of thermodynamics

(iii) Second law of thermodynamics (iv) Third law of thermodynamics

c. The General gas equation is CO2 PO2

(i) PV = nRT (ii) PV = mRT

(iii) $PV^n = C$ (iv)$C_p - C_v = R/J$

d. Kelvin Planck's law deals with CO2 PO1

(i) Conversation of energy (ii) Conservation of work

(iii) Conversion of heat into work (iv) Conservation of mass

e. Carnot cycle consists of CO2 PO1

(i) Two constant volume and two reversible adiabatic processes

(ii) Two isothermal and two reversible adiabatic processes

(iii) Two constant pressure and two reversible adiabatic processes

(v) One constant volume, one constant pressure and two reversible adiabatic processes

f. The enthalpy of dry saturated steam _____ with the increase in pressure CO3 PO1

(i) Decreases (ii) Increases

(iii) Remains constant (iv) All of the above

g. The amount of heat absorbed to evaporate 1 kg of water from its saturation temperature, without change of temperature, is called CO3 PO2

(vi) Sensible heat of water (ii) Latent heat of vaporisation

(vii) Enthalpy of steam (iv) Entropy of steam

h. In an irreversible process there is a CO4 PO1

(i) Loss of heat (ii) No loss of work

(iii) gain of heat (iv) no gain of heat

i. The entropy may be expressed as a function of CO4 PO1

(i) pressure and temperature (ii) temperature and volume

(iii) heat and work (iv) all the above

j Availability function is expressed as CO4 PO2

(i) $a = (u+P_0V - T_0S)$ (v) $a = (u+P_0V - T_0dS)$

(vi) $a = (du+P_0dV - T_0S)$ (vii) $a = (u+P_0V + T_0S)$

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

Q.2. Answer ***ALL*** questions	[CO#]	[PO#]
a. Explain Zeroth Law of thermodynamics?	CO1	PO1
b. Define Specific heat capacity at constant pressure and Specific heat capacity at constant volume.	CO2	PO2
c. State the Kelvin – Plank statement of second law of thermodynamics.	CO2	PO1
d. What are topping and bottoming cycles?	CO3	PO3
e. Define entropy.	CO4	PO3

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

Answer ***ANY FIVE*** questions	Marks	[CO#]	[PO#]
3. The properties of a closed system change following the relation between pressure and volume as pV = 3, where p is in bar V is in m^3. Calculate the work done when the pressure increases from 1.5 bar to 7.5 bar.	(6)	CO1	PO1 PO2
4. A fluid at a pressure of 3 bar and with specific volume of 0.18 m^3/kg, contained in a cylinder behind a piston expands reversibly to a pressure of 0.6 bar according to a law, $p = C/V^2$, where C is a constant. Calculate the work done by the fluid on the piston.	(6)	CO1	PO1 PO2
5. A fluid is confined in a cylinder by a spring loaded, frictionless piston so that the pressure in the fluid is a linear function of the volume (p=a + bV).The internal energy of the fluid is given by the following equation U=34+3.15pV where U is in KJ, p in up a, and V in cubic metre. If the fluid changes from an initial state of 170kPa, 0.03m3 to a final state of 400kPa, 0.06m3, with no work other than that done on the piston, find the direction and magnitude of the work.	(6)	CO2	PO2
6. Air flows steadily at the rate of 0.5mkg/s through an air compressor, entering at 7m/s velocity,100kPa pressure and 0.95 m^3/kg volume, and leaving at 5 m/s,700 kPa and 0.19 m^3/kg. The internal energy of the air leaving is 90 KJ/Kg greater than that of the air entering. Cooling water in the compressor jackets absorbs heat from the air at the rate of 58 KW. (a)Compute the rate of shaft work input to the air in KW.	(6)	CO2	PO1 PO3
7. A vessel of volume 0.04 m^3 contains a mixture of saturated water and saturated steam at a temperature of 250°C. The mass of the liquid present is 9 kg. Find the pressure, the mass, the specific volume and the enthalpy	(6)	CO3	PO1 PO2
8. Steam at 20 bar, 360^0 C is expanded in a steam turbine to 0.08bar. It then enters a condenser, where it is condensed to saturated liquid water. The pump feeds back the water into the boiler. Assuming ideal processes, find per kg of steams of the net work and the cycle efficiency.	(6)	CO3	PO1 PO2
9. One kg of water at 0^0 C is brought into contact with a heat reservoir at 90^0 C. When the water has reached 90^0 C, find (i) Entropy change of water (ii) Entropy change of heat reservoir (iii) Entropy change of the universe	(6)	CO4	PO1 PO3
10. 2.5 kg of air at 6 bar, 90^0Cexpands adiabatically in a closed system until its volume is doubled and its temperature becomes equal to that of the surroundings which is at 1 bar, 5^0C. For this process determine (i) The maximum work (ii) The change in availability. For air take Cv = 0.718 KJ/kg K, R = 0.287 KJ/kg K.	(6)	CO4	PO1 PO3

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