

**END SEMESTER EXAMINATION, JULY. – 2021-22**

Course Name: Chemical Engg. Thermodynamic I, Course Code: 201CH215

Seat No:

**Day and Date: Wednesday ,22/06/2022**

**Time: 9.30 am to 1.15 pm**

**Max. Marks- 100**

**Instructions:**

- i. Question No. 1 is compulsory.
- ii. Figure to the right indicate full marks.
- iii. Give suitable general Instructions
- iv. Any other Course Specific Instructions.
- v. No questions should repeat from MSE/ISE

BT	CO's	Q. No.		Marks	Weight age
		<b>Q.1</b>	<b>Attempt the following</b>	<b>40</b>	
<b>BT L-2</b>	<b>CO1</b>	<b>a</b>	i) Explain in brief scope & limitation of thermodynamics?	<b>4</b>	<b>40%</b>
<b>BT L-3</b>	<b>CO1</b>		ii) The reading on a mercury manometer at 25 <sup>0</sup> C (298.15K) (open to the atm. at one end) is 56. 38cm.The local acceleration of gravity is 9.832m/s <sup>2</sup> . Atmospheric pressure is 101.78KPa. What is the absolute pressure in KPa being measured? The density of mercury at 25 <sup>0</sup> C (298.15K) is 13.534 gm/cm <sup>3</sup>	<b>6</b>	
<b>BT L-1</b>	<b>CO1</b>	<b>b</b>	i) Define and Explain the following terms –i) Thermodynamic Processes ii)System and its classification iii)Boundary	<b>3</b>	
<b>BT L-1</b>	<b>CO1</b>		ii) State & Explain the Gibb's phase rule?	<b>3</b>	
<b>BT L-3</b>	<b>CO1</b>		ii) Heat in the amount of 5KJ is added to a system while its internal energy decreases by 10KJ. How much energy is transferred as work? For a process causing the same change of state but for which the work is zero, how much heat is transferred.	<b>4</b>	
<b>BT L-2</b>	<b>CO2</b>	<b>c</b>	i) Derive an expression for First law of thermodynamics for non flow process.	<b>5</b>	
<b>BT L-3</b>	<b>CO2</b>		ii) Liquid water at 180 (453.15k) and 1002.7 KPa has an internal energy (on an arbitrary scale) of 762.0 KJ/Kg. and a specific volume of 1.128 cm <sup>3</sup> /g. i) What is its enthalpy? ii) The water is brought to the vapor state at 300*C	<b>5</b>	

			(573.15) and 1500 KPa. Where its internal energy is 2784.4 KJ/Kg. and its sp. Volume is 169.7 cm <sup>3</sup> /g. Calculate $\Delta U$ and $\Delta H$ for the process.		
<b>BT L-2</b>	<b>CO3</b>	<b>d</b>	i) Drive expression for virial equation of state? Give its applications.		<b>5</b>
			ii) An ideal gas initially at 303.15K & 100KPa, undergoes the following the cyclic process in a closed system. i.e In mechanical reversible process, It is first compressed adiabatically to 500 KPa , Then cooled at a constant pressure 500KPa to 303.15K, & finally expanded isothermally to its original state. Calculate Q, W, $\Delta U$ & $\Delta H$ for each step of the process and for the cycle. Take $C_p = (7/2) R$ and $C_v = (5/2) R$ , $R = 8.314 J/K \text{ mol K}$ .		<b>5</b>
		<b>Q.2</b>	<b>Attempt</b>		<b>20</b>
<b>BT L-2</b>	<b>CO4</b>	<b>a</b>	Explain the concept of entropy and derive expression for entropy?	Unit: 4	<b>6</b>
<b>BT L-3</b>	<b>CO4</b>	<b>b</b>	Following heat engines produces power of 80,000 KW. Determine in each case the rates at which heat is absorbed from the hot reservoir and discarded to the cold reservoir. a) A carnot engine operates between heat reservoirs at 600 & 300 K. b) A practical engine operates between the same heat reservoirs but with a thermal efficiency $\eta = 0.3$		<b>7</b>
<b>BT L-2</b>	<b>CO4</b>	<b>c</b>	Derive an expression for thermal efficiency of Carnot engine? What is the specialty of Carnot engine?		<b>7</b>
		<b>Q.3</b>	<b>Attempt (any four questions)</b>		<b>20</b>
<b>BT L-2</b>	<b>CO5</b>	<b>a</b>	Discus in detail about the maxwell's equations and its applications.	Unit: 5	<b>5</b>
<b>BT L-3</b>	<b>CO5</b>	<b>b</b>	Show that, $dU = C_v.dT + [T(dP/dT)_v - P] dV$ and $dS = C_v.dT/T + (dP/dT)_v . dV$		<b>5</b>
<b>BT L-3</b>	<b>CO5</b>	<b>c</b>	Show that Gibb's energy is a generating function of all other thermodynamic properties.		<b>5</b>
<b>BT L-2</b>	<b>CO5</b>	<b>d</b>	Drive the fundamental property relations for homogenous constant mass, constant composition system.		<b>5</b>
<b>BT L-2</b>	<b>CO5</b>	<b>e</b>	Discus the thermodynamic diagrams with a neat sketch and also mention its importance.		<b>5</b>
		<b>Q.4</b>	<b>Attempt</b>		<b>20</b>
<b>BT L-1</b>	<b>CO6</b>	<b>a</b>	What are the practical limitations of carnot cycle for refrigeration?	Unit: 6	<b>4</b>

**60%**

<b>BT L-1</b>	<b>CO6</b>	<b>b</b>	Write note on internal combustion engine.		<b>4</b>	
<b>BT L-3</b>	<b>CO6</b>	<b>c</b>	A vapour cooperation refrigerator emptying Freon – 12 works between pressure limit of 182.5 kPa and 960.6 kPa. The heat transfer from the condenser is found to be 72 kJ/min. and the heat absorbed in the evaporator is 3200 kJ/hr. The refrigeration vapor leaves the evaporator in the saturated state. Calculate: i) The refrigerant flow rate through the system in kg/min. ii) The energy input to the compressor The enthalpy of saturated vapor at 182.5 kPa =181.2 kJ/kg and the enthalpy of saturated liquid at 960.6 kPa = 76.2 kJ/kg.		<b>6</b>	
<b>BT L-1</b>	<b>CO6</b>	<b>d</b>	Write a note on Heat Pump.		<b>6</b>	

**\*\*\*This is a Question Paper sample Template\*\*\***

**You are requested to ensure that,**

- a) The title block of the question paper is as per format
- b) The course name is correctly mentioned with correct course code as per S. Y. B. Tech syllabus structure.
- c) The name of the examination is correctly mentioned
- d) The instructions are appropriate and do not violate the present rules
- e) There can be variations in the Sub questions Marks, but the total of sub questions coming under main questions should not vary.
  - i) However internal options may be given to few sub questions with equal marks.
  - ii) Optional questions should be in the range of 20 to 30% of the total marks of the questions paper (100 marks).
- f) **Faculty should strictly follow the guidelines/instruction (attached with this format) while setting the question paper.**
- g) **Use Times New Roman, 12 Bold, for main question and Times New Roman, 12, for Sub question.**