Reg. No.



MANIPAL INSTITUTE OF TECHNOLOGY

(A constituent unit of MAHE, Manipal)

III SEMESTER B.TECH. (CHEMICAL ENGINEERING)

ENDSEM EXAMINATIONS, NOV 2018

SUBJECT: CHEMICAL ENGINEERING THERMODYNAMICS-I [CHE 2104]

REVISED CREDIT SYSTEM (22/11/2018)

Time: 3 Hours

MAX. MARKS: 50

Instructions to Candidates:

- ✤ Answer ALL the questions.
- ✤ Missing data may be suitably assumed.

1A.	Distinguish between the following terms: (i) Heat and work (ii) Classical and statistical thermodynamics (iii) Metastable and unstable equilibrium (iv) Enthalpy and internal energy	6
1B.	Starting from the Redlich-Kwong equation, calculate the molar volume for methanol vapour at 500 K and 10 bar. The values of critical temperature and critical pressure of methanol are 512.6 K and 81 bar. Use the iterative procedure.	4
2A.	Heat is not a substance, it is a form of energy. Justify the statement with the help of Joule's experiment.	3
2B.	Internal energy is a state function for a cyclic process. Discuss why?	2
2C.	With the help of P-V diagram, discuss the variation of molar volume with pressure at various temperature values.	5
3A.	An ideal gas is subjected to the following reversible processes (a) From an initial state of 50°C and 1 bar, it is compressed adiabatically to 130°C. (b) It is then cooled from 130°C to 40°C at constant pressure. Determine ΔU , ΔH , W and Q for each step and for the entire cycle. Assume $C_v = 1.5 R$ and $C_p = 2.5 R$.	5
3B.	Derive the van der Waal's equation of state in terms of compressibility factor.	3
3C.	It is not possible to have absolute zero thermodynamic temperature scale. Justify the statement.	2
4A.	With the help of all the simplified diagrams, state and prove second postulate of Carnot principle.	5
4B.	With the help of Mnemonics diagram, explain the rules for getting Maxwell's relations.	3

4C.	Explain the problems that will arise after completing vapour-compression refrigeration cycle.	2
5A.	Derive the expression $C_p - C_v = \frac{\beta^2 VT}{\kappa}$ for showing the relationship between heat capacity at constant pressure and constant volume.	4
5B.	Explain with a neat flow diagram, the reheat cycle of steam power plant. Discuss the TS diagram and obtain the equation for thermal efficiency.	6