Reg. No.										

MANIPAL INSTITUTE OF TECHNOLOGY

MANIPAL

(A constituent unit of MAHE, Manipal)

III SEMESTER B.TECH. (CHEMICAL ENGINEERING)

MAKEUP EXAMINATIONS, DEC 2018

SUBJECT: CHEMICAL ENGINEERING THERMODYNAMICS-I [CHE 2104]

REVISED CREDIT SYSTEM

Time: 3 Hours MAX. MARKS: 50

Instructions to Candidates:

- Answer **ALL** the questions.
- Missing data may be suitable assumed.

1A.	Explain the following terms with examples: (i) Homogeneous and heterogeneous system (ii) Reversible and free expansion (iii) State and path function (iv) Closed and open system	**6**
1B.	Derive the expression for first law of thermodynamics for non-flow process.	**4**
2A.	With the help of V-T diagram, discuss the variation of molar volume of a substance with temperature at various constant pressure values.	**5**
2B.	Determine the molar volume of ethylene vapour at 298.15 K and 8.25 MPa assuming that the ammonia follows the van der Waals equation of state. Given $a = 453.046 \times 10^{-3}\ Pa\ (m^3/mol)^2$ and $b = 0.057 \times 10^{-3}\ m^3/mol$	**5**
3A.	In a particular engine cylinder one mole of an ideal gas (γ =1.4) is compressed from 25^{o}C and 0.1 MPa till its volume is reduced to 1/12 of the original value. The process of compression can be approximated to follow the relation $PV^{1.25}$ = constant. Determine the work and heat interactions. Also calculate the final temperature and pressure of the gas.	**4**
3B.	Discuss the perpetual motion machine with respect to first law of thermodynamics.	**2**
3C.	With the help of all the diagrams, discuss the equivalence of Kelvin-Plank and Clausius statement with respect to second law of thermodynamics.	**4**
4A.	The vapour pressure of benzene is given by Antoine equation as $\log_{10} P = A - \frac{B}{t+C}$ Where P is in Torr and t is in ^{o}C. The values of Antoine constants A, B and C are given. Calculate the accentric factor. (Given A= 6.87987 B= 1196.76 C=219.161 Tc=562.1 K, Pc= 49.24 bar, 1 Torr = 0.0013332 bar).	**3**

4B.	Derive the expression for showing the effect of pressure and volume on heat capacity at constant pressure.	**3**
4C.	Get the modified expression for entropy in terms of heat capacity at constant volume, coefficient of expansion and isothermal compressibility.	**4**
5A.	Whenever heat is added to a body at lower temperature results in higher degradation of energy than the addition of heat to a body at higher temperature.	**2**
5B.	Explain with a neat flow diagram, the modified vapour compression refrigeration cycle. Discuss the TS diagram and obtain the equation for coefficient of performance.	**6**
5C.	Discuss any two properties of the refrigerant.	**2**