Reg. No.										

MANIPAL INSTITUTE OF TECHNOLOGY

MANIPAL

A Constituent Institution of Manipal University

III SEMESTER B.TECH. (CHEMICAL ENGINEERING)

END SEMESTER EXAMINATIONS, NOV/DEC 2016

SUBJECT: CHEMICAL ENGINEERING THERMODYNAMICS-I [CHE 2104]

REVISED CREDIT SYSTEM
(06/12/2016)

Time: 3 Hours MAX. MARKS: 100

Instructions to Candidates:

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

1A.	Distinguish between the following terms. (i) reversible and free expansion (ii) intensive and extensive properties (iii) Stable and metastable equilibrium (iv) temperature and heat	**12**
1B.	With the help of Joule's experiment prove that heat is not a substance, but it is a form of energy.	**05**
1C.	Internal energy is a state function. Justify the statement.	**03**
2A.	Discuss the significance of two correction factors that are added in van der Waals equation.	**07**
2B.	The saturation pressure of ammonia at 321.55 K is 1.95 MPa. Determine the molar volume of saturated vapour using the RK equation of state. Given the critical temperature and critical pressure of ammonia are 405.5 K and 112.77 bar. (Use iterative procedure)	**08**
2C.	Discuss the principle of corresponding states with respect to two parameter and three parameter correlation.	**05**
3A.	With a neat thermodynamic diagram, discuss the variation of molar volume of a substance with pressure at various constant temperatures.	**10**
3B.	State and prove Carnot principle first postulate with the help of all simplified diagrams.	**06**
3C.	An inventor claims to have designed a heat engine which absorbs 1000 kJ and 400 kJ as heat from a reservoir at 800 K and 400 K respectively and delivers 1000 kJ energy as work. He also claims that the engine uses a reservoir at 300 K as sink. Judge whether the engine is theoretically possible or not.	**04**

4A.	A rigid and insulated tank of 2 m^3 capacity is divided into two equal compartments by a partition. One compartment contains an ideal gas at 600 K and 1 MPa while the second compartment contains the same gas at 300 K and 0.1 MPa. Calculate the final temperature and pressure of the gas in the tank if the partition is removed. Assume γ=1.4 for the gas.	**06**
4B.	Obtain the expressions for showing the effect of pressure and volume on heat capacity at constant pressure and constant volume.	**09**
4C.	With the help of Mnemonic diagram, explain the rules for obtaining Maxwell's relations.	**05**
5A.	It is not possible to have absolute zero thermodynamic temperature scale. Justify the statement.	**03**
5B.	Discuss with a neat flow diagram, the Rankine cycle of steam power plant. Discuss the cycle by using a TS diagram and obtain the equation for thermal efficiency.	**11**
5C.	What are the disadvantages of vapour-compression refrigeration cycle? How do we come across these disadvantages?	**06**