Registration No: | | | | | | | | | | |

Total Number of Pages: 02 **B.Tech**

PCMT4202

3rd Semester Back Examination: 2017-18

METALLURGICAL THERMODYNAMICS AND KINETICS

BRANCH : METTA, MME

Time: 3 Hours

Max Marks: 70

Q.CODE: B726

Answer Question No.1 which is compulsory and any five from the rest.

The figures in the right hand margin indicate marks.

Q1 **Answer the following questions:** **(2 x 10)**

a) Differentiate between reversible and irreversible process.
b) What do you mean by degree of reduction of iron ore?
c) What is Hess's law of constant heat summation?
d) What is Dulong-Petit law?
e) What is Henry's law?
f) What is the relation between internal energy, heat and work?
g) What do you mean by temperature dependence of entropy?
h) How does thermodynamics differ from kinetics?
i) Define the term regular solutions.
j) State Gibbs's phase rule for metallurgical system for condensed phase.

Q2 **a)** (i) State Sievert's law. **(5)**

b) Prove that $C_p - C_v = R$ **(5)**

For an ideal gas under isothermal condition and constant pressure

Where,

C_p is heat capacity at constant pressure, C_V is heat capacity at constant volume, R is universal gas constant.

Q3 **a)** "The entropy of a system in isolation can never decrease." Give a mathematical explanation to above statement. **(5)**

b) Vapour pressure of liquid zinc above melting point of 420°C is given by: **(5)**

$$\log(P_{zn}) = \frac{6400}{T} + 5.5$$

The best of fusion Zn is 1600 cal/g atom for above the melting point and it is 1400 cal/g atom below its melting point. Derive a formula for vapour pressure over solid zinc below its melting point.

Q4 **a)** Prove that δq is not perfectly differentiable but $(\delta q/T)$ is perfectly differentiable. **(5)**

b) With the help of Ellingham diagram, comment on carbothermic reduction of metal oxide. **(5)**

Q5 **a)** Derive expression for entropy change of perfect gas. Discuss the important characteristics of entropy. **(5)**

b) What is chemical potential? Derive Gibb's Duhem relations. **(5)**

Q6 **a)** Assuming aluminothermic reduction of Cr_2O_3 is a first order reaction, the rate constant is found to be 7.0×10^{-4} at 57°C. Calculate the energy of activation and its specific reaction rate at 127°C. **(5)**

b) In an isothermal pocess enthalpy of an ideal gas is independent of pressure, justify from Maxwell's relation. **(5)**

Q7 **a)** Deduce equation for the combined statement of 1^{st} and 2^{nd} law of thermodynamics. **(5)**

b) State Henry law. Raoult's law appears to be a special case of Henry's law for pairs of closely related substance, justify. **(5)**

Q8 **Write short answer on any TWO:** **(5 x 2)**

a) Fugacity & Its Derivation

b) Partial molar quantities

c) Solid Electrolyte

d) Thermal analysis