SUBJECT NO-MT21105, SUBJECT NAME- METALLURGICAL THERMODYNAMICS AND KINETICS

LTP- 3-1-0,CRD- 4

SYLLABUS :-

Prerequisite Ã¢ÂÂ NilImportance of thermodynamics, definition of thermodynamic terms, concept of states, simple equilibrium. Equation of states, extensive and intensive properties, homogeneous and heterogeneous systems. Phase diagram of a single component system. Internal energy, First law of thermodynamics, heat capacity, enthalpy, isothermal, and adiabatic processes. Second law of thermodynamics, entropy, degree of reversibility and irreversibility, criteria of equilibrium, auxiliary functions, combined statements, Maxwells relations, transformation formula, Gibbs-Helmoltz equation.Concept of Third law, temperature dependence of entropy, statistical interpretation of entropy, Debye and Einstein concept of heat capacity, relation between Cp and Cv, consequences of third law, Fugacity, activity, equilibrium constant, use of S - functions, controlled atmospheres, homogeneous and heterogeneous equilibria. Ellingham-Richardson diagrams.Solutions, partial molal quantities, ideal and non-ideal solutions, Raoults law, Henrys law, Gibbs - Duhem equation, regular solution, quasi-chemical approach to solution, statistical treatment. Alternative standard states, interaction coefficients, chemical potential. Phase relations and phase rule-its applications. Free energy-composition diagrams for binary alloy systems, determination of liquidus, solidus and solvus lines. Effect of pressure on phase transformation and phase equilibria. Phase stability diagrams.Thermodynamics of electrochemical cells, solid electrolytes. Thermodynamics of point defects in solids.Introduction to metallurgical kinetics, Effect of concentration and temperature on the reaction rate, heterogeneous reaction kinetics-gas-solid, solid-liquid, liquid-liquid and solid-solid systems. Empirical and semi-empirical kinetics, concept of Johnson-Mehl equation, thermal analysis.Text Books:1.David R. Gaskell: Introduction to the Thermodynamics of Materials, Third Edition, Taylor and Francis, 2002.2.L.S. Darken and R.W. Gurry: Physical Chemistry of Metals, McGraw-Hill Book Company, Japan, 1953.