

## DEPARTMENT OF CHEMISTRY

NATIONAL INSTITUTE OF TECHNOLOGY: TIRUCHIRAPPALLI - 620 015

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### I B.Tech. syllabus

#### **II semester (3 credit theory + 1 credit practical = 4 credit course)**

#### **CHIR 12**

##### **Objectives**

To introduce the students to the fundamentals of chemical thermodynamics, chemical kinetics, electrochemistry, corrosion and solid state chemistry. To provide them a brief idea on the requirements of fuels and lubricants.

##### **Chemical Thermodynamics**

Second Law of Thermodynamics - Entropy change accompanying various processes (isothermal expansion, phase transition, heating, entropy of mixing of perfect gases); Absolute entropy and the Third Law of Thermodynamics; Spontaneity of a chemical reaction and Gibbs energy; Standard Gibbs energies of formation and reactions; Equilibrium constant through chemical potential (gas equilibria), relation between  $K_p$  &  $K_c$ .

##### **Kinetics and Catalysis**

Chemical Kinetics: The rate law: First order, second order, third order and pseudo order - The Arrhenius equation - Steady state approximation - Chain reactions (hydrogen-bromine reaction) - Enzyme catalysis (Michaelis-Menten Mechanism). Adsorption - types - adsorption of gases on solids - adsorption of solutes from solutions - role of adsorbents - activated carbon in pollution abatement of air and waste water.

##### **Electrochemistry and Corrosion**

Cell EMF, its measurement and applications - concentration cell - electrode (hydrogen gas electrode) and electrolyte concentration cell - concentration cell with and without transference - fuel cells - hydrox fuel cell.

Dry corrosion and wet corrosion, mechanisms, types of corrosion, Differential metal corrosion, differential aeration corrosion, inter granular, Passivity, Pitting, Polarization, over potential and its significance, Pourbiax diagrams, Potentiodynamic Polarization.

##### **Solid State Chemistry**

Brief introduction to solid state chemistry, Preparative methods: Solid state reaction, chemical precursor method, co-Precipitation, sol-gel, metathesis, self-propagating high temperature synthesis, ion exchange reactions, intercalation / deintercalation reactions; hydrothermal and template synthesis; High pressure synthesis.

##### **Fuels and Lubricants**

Fuels - Classification, examples, relative merits, types of coal, determination of calorific value of solid fuels, Bomb calorimeter, theoretical oxygen requirement for combustion,

proximate & ultimate analysis of coal, manufacture of metallurgical coke, flue gas analysis, problems. Lubricants - Definition, theories of lubrication, characteristics of lubricants, viscosity, viscosity index, oiliness, pour point, cloud point, flash point, fire point, additives to lubricants, Solid lubricants.

### **Outcome**

Students will learn the basic principles of chemical thermodynamics, chemical kinetics, electrochemistry, corrosion and solid state chemistry. They will familiarize with the theory and applications of fuels and lubricants.

### **Reference Books**

1. P. W. Atkins and J. de Paula, Physical chemistry by Oxford University Press
2. P. C. Jain & M. Jain, 'Engineering Chemistry', Dhanpat Rai Publishing Company, New Delhi, 2005.

### **Practicals (Laboratory Experiments):**

1. Corrosion rate by polarization technique
2. Conductometric titration
3. Potentiometric titration
4. pH metric titration
5. Determination of molecular weight of polymer by viscometry
6. Demonstration of sophisticated instruments and assignments on them

### **Outcome**

They will have in hand experience of different titration methods, use of viscometer to get the mol. weight of polymer. In addition, they will get to know about the sophisticated instruments that are present in the department.

### **Reference Books**

1. *Laboratory Manual, Department of Chemistry, NITT*
2. *S.K. Bhasin, S. Rani, 'Laboratory Manual on Engineering Chemistry', Dhanpat Rai Publishing Company, New Delhi, 2011.*