

Use of free energy in chemical

equilibria: Thermodynamic functions:
Definitions of free energy and entropy.
Cell potential, derivation of Nernst
equation for single electrode potential,
numerical problems on E, EO, and Ecell

Electrochemical energy systems:

Reference electrodes: Introduction,
construction, working and applications
of Calomel electrode. Ion-selective
electrode -Definition, construction and
principle of Glass electrode and
determination of pH using glass
electrode. Electrolyte concentration
cells, numerical problems

Energy storage systems: Introduction,
classification -primary, secondary and
reserve batteries. Construction, working
and applications of Ni-MH and Li-ion
batteries **(RBT Levels: L3)**

Module-2 Corrosion and Metal finishing

0 hours

Corrosion: Introduction, Electrochemical theory of corrosion, Factors affecting the rate of corrosion: ratio of anodic to cathodic areas, nature of corrosion product, nature of medium -pH, conductivity and temperature. Types of corrosion -Differential metal and differential aeration -pitting and water line). Corrosion control: Anodizing - Anodizing of aluminium, Cathodic protection -sacrificial anode and impressed current methods, Metal coatings -Galvanization

Metal finishing: Introduction, Technological importance. Electroplating: Introduction, principles governing electroplating-Polarization, decomposition potential and overvoltage. Electroplating of chromium (hard and decorative). Electroless plating: Introduction, electroless plating of nickel & copper, distinction between electroplating and electro less plating processes **(RBT Levels: L1 &LI)**

Chemical Fuels: Introduction, classification, definitions of CV, LCV, and HCV determination of calorific value of solid/liquid fuel using bomb calorimeter, numerical problems. Knocking of petrol engine -Definition, mechanism, ill effects and prevention. Power alcohol, unleaded petrol and biodiesel

Fuel Cells: Introduction, differences between conventional cell and fuel cell, limitations & advantages. Construction, working & applications of methanol-oxygen fuel cell with $\sim \text{SO}_4$ electrolyte, and solid oxide fuel cell (SOFCs)

Solar Energy: Photovoltaic cells- introduction, construction and working of a typical PV cell, Preparation of solar grade silicon by Union Carbide Process/Method. Advantages & disadvantages of FV cells

Module-4 Environmental Pollution and Water Chemistry

0 hours

Environmental Pollution: Air pollutants: Sources, effects and control of primary air pollutants: Carbon monoxide, Oxides of nitrogen and sulphur, hydrocarbons, Particulate matter, Carbon monoxide, Mercury and Lead. Secondary air pollutant: Ozone, Ozone depletion

Waste Management: Solid waste, e-waste & biomedical waste: Sources, characteristics & disposal methods (Scientific land filling, composting, recycling and reuse)

Water Chemistry: Introduction, sources and impurities of water; boiler feed water, boiler troubles with disadvantages -scale and sludge formation, boiler corrosion (due to dissolved O_2 , CO_2 and $MgCl_2$). Sources of water pollution, Sewage, Definitions of Biological oxygen demand (BOD) and Chemical Oxygen Demand (COD), determination of COD, numerical problems on COD.

Module-5 Instrumental methods of analysis and Nanomaterials 0 hours

Instrumental methods of analysis:

Theory, Instrumentation and applications of Colorimetry, Flame Photometry, Atomic Absorption Spectroscopy, Potentiometry, Conductometry (Strong acid with a strong base, weak acid with a strong base, mixture of strong acid and a weak acid with a strong base)

Nanomaterials: Introduction, size dependent properties (Surface area, Electrical, Optical, Catalytic and Thermal properties). Synthesis of nanomaterials: Top down and bottom up approaches, Synthesis by Sol-gel, precipitation and chemical vapour deposition, Nanoscale materials: Fullerenes, Carbon nanotubes and graphenes-properties and applications (**RBT Levels: L1 & LI**)