

CHY

ENGINEERING CHEMISTRY

Instruction 3 Periods per week
University Examination 75 Marks

Duration of University Examination 3 Hours
Sessional 25 Marks

UNIT –I: ELECTROCHEMISTRY

Electronic, electrolytic conductors. Specific, molecular, equivalent conductivities of an electrolyte. Conductivity cell, cell constant Measurement of conductivities Conductance of an Electrolytic Solution. Effect of dilution on conductivities.. Strong and weak electrolytes. Debye-

Huckel-Onsager equation (elementary treatment) ..Numerical problems. Electrochemical cells. electrolytic and galvanic (Voltaic) cell.. Types of electrodes.. Metal-metal ion, metal-metal insoluble salt (Calomel), gas-ion (SHE), metal-amalgam, redox (Quinhydrone), ion-selective, glass electrodes. Galvanic cell notation, cell reaction, cell emf, Weston Standard cell, emf determination by the Poggendorf's null method. Single, standard electrode potentials, electrochemical series, its applications, thermodynamics of electrode potential Nernst equation.. Derivation and applications, numerical problems..

Concept of activity and ionic activity

coefficients, calculation of mean ionic mean activity coefficient using the Debye-Huckellimiting law.. Determination of pH by glass electrode. Potentiometric acid-base titrations using calomel, quin hydrone electrodes. Battery Technology: Primary (Zn-MnO₂ dry cell) and Secondary (Lead

acid accumulators) cells. Over Voltage.. Hydrogen-Oxygen fuel cell. Cell description, cell reaction charging.. discharging.. Solar Cell.. solar energy conversion and storage.

UNIT –II: CHEMICAL THERMODYNAMICS

Thermodynamic functions of a system, P,V,T,E,H, Path functions q, W Heat capacities.

Processes: Isothermal, isochoric, isobaric, adiabatic, reversible, irreversible, cyclic work done by an ideal gas during expansion compression, in the above processes, Numerical problems. First law of thermodynamics. Different statements, mathematical formulation, numerical problems success and limitations of first law. Second law statements.. Carnot cycle, efficiency of a carnot engine. Derivation.. Entropy, concept, physical significance, entropy change and spontaneity of a process, numericals involving ideals gas as a system. Free energy.. Gibbs and Helmholtz free energy functions. significance. free energy change, criteria for spontaneity of a chemical process.

Gibbs, Helmholtz equations.. Clapeyron-Clausius equation, derivation. Application to liquid-vapour Solid-vapour and solid-liquid equilibria. numerical problems.

UNIT-III

i) WATER TECHNOLOGY ii) CORROSION AND ITS CONTROL WATER: Hardness of Water, types degree and units of hardness Determination of total temporary and permanent hardness by the EDTA method, Numericals based on the determination of hardness.

Drinking (Potable) Water. Specifications of potable water Treatment of for domestic purposes... Steps involved. coagulation, types of coagulants, filtration (rapid and gravity

filters); disinfection by chlorination, ozone treatment, U.V. irradiation, potassium permanganate treatment. concept of break point chlorination. Industrial water treatment: Water softening by ion-exchange (demineralization) methods. Desalination by reverse osmosis method. Waste water treatment: Sewage and industrial effluents. Physical, chemical and biochemical characteristics of waste waters. Biochemical Oxygen demand chemical oxygen demand. dissolved oxygen...physical, chemical and biological methods of water treatment. CORROSION AND ITS CONTROL Corrosion: Cause and effects. Electrochemical (Wet) theory of corrosion...formation of anodic areas through differential aeration (Oxygen concentration cell setup) i) Crevice corrosion ii) Water-line corrosion...galvanic corrosion. Factors affecting the rate of corrosion a) position of the metal in galvanic series, b) relative areas of anode and cathode, c) purity of the metal, d) Nature of the corrosion product. e) Nature of the environment i) temperature ii) humidity iii) pH iv) Oxidant. Corrosion Control: Cathodic protection-sacrificial anode and impressed current methods Surface Coatings: i) metallic coatings. Anodic and cathodic...application methods.

cladding, cementation hotdipping, electroplating, electroless plating. Organic Surface Coatings.. paints. constituents and their functions.

UNIT -IV MACROMOLECULES

Organic Polymers. Types of Polymerisation.. Addition, condensation and Co-polymerisation.. examples Structure-property relationships in polymers. Structure and i) Mechanical Properties, ii) Electrical Properties. iii) Chemical properties. crystallinity in polymers.. amorphous polymers.

structure and technological functions of polymers. Plastics, fibres, elastomers. Plastic Materials, Thermoplastics. thermosets..a comparison. preparation, properties and uses of (i) Bakelite ii) epoxy resins iii) PVC iv) Teflon. Fibres: Characteristics of fibres..polyamides (nylon 6,6) polyesters (Dacron). Elastomers. Natural rubber. Processing of latex. Crepe rubber.

smoked rubber. synthetic rubbers. Buna-S, butyl rubber. Silicone rubbers. Drawbacks of raw rubbers. Compounding of rubber with a special reference to vulcanisation. Chemistry of vulcanisation. Conducting Polymers: Mechanism of conduction in polymers. Intrinsic

conducting polymers. Poly-acetylenes. poly nitriles. Dependent conducting polymers. extrinsic conducting polymers. blended conducting polymers. photoconducting polymers.. applications of conducting polymers.

UNIT -V: CHEMICAL FUELS. REFRACTORIES

Fuel: Definition. Classification. Requirements of a good fuel. Combustion: ignition temperature of a fuel ..Calculation of air, quantities by weight and by volume. required for the combustion of a fuel, numerical problems. Calorific Value of a fuel ..HCV and LCV. theoretical calculation of

CV by Dulong formula. Determination of CV by bomb calorimeter. Numerical problems. Advantages, disadvantages of Solid, liquid and gaseous fuels. Solid fuels: Coal. Proximate and ultimate analyses. Significance. numerical problems. Liquid fuels:

Fractionation of crude oil... Fractions. Gasoline, Kerosene, Diesel Oil.. Cracking and its Significance... Catalytic cracking by fixed- bed method. knocking. fuel rating by octane number and cetane number..Unleaded petrol...(use of MTB ether). Catalytic converters. Gaseous fuels: LPG, CNG Rocket fuels: Principles of rocket propulsion. Solid propellants, liquid propellants. REFRACTORIES: Definition, classification, examples, Requirements of a good refractory.. Properties.. Refractoriness, measurement, PCE Test.. Refractoriness under load, measurement.. Porosity, thermal spalling, thermal conductivity, thermal expansion-compression.. chemical inertness, dimensional stability.

Suggested Reading:

1. P.L.SONI & O.P. DHARMARA : Text Book of Physical Chemistry Sultan Chand & Sons,
New Delhi.
2. K.K. SHARMA, L.K. SHARMA: Text Book of Physical Chemistry Vikas Publishing House
Pvt. Ltd. New Delhi.
3. J.C.KURIACOSE & J. RAJARAM: Chemistry in Engineering and Technology, Vol-I & II
Tata Mc. GrawHill Publishing Co. Ltd., New Delhi.
4. P.C. JAIN -MONIC JAIN : Engineering Chemistry, Dhanpat Rai Publishing Co. New Delhi.
5. SHASHI CHAWLA : A Text Book of Engineering Chemistry, Dhanpat Rai & Co (Pvt)
Ltd. First Edition 2002.
6. S.S. DARA : A Text Book of Engineering Chemistry, S. Chand & Co. Ltd. New Delhi.
7. B.K. SHARMA : Engineering Chemistry, Krishna Prakashan Media Pvt.Ltd., Meerut.