

## Syllabus of Screening Test for chemistry teaching post

**Note: Questions will be based on Basic Chemistry 20% weightage & on Applied Chemistry 80% weightage**

### Syllabus for Applied Chemistry- I & II

#### Module 01

**Water:** Impurities in water, Hardness of water, Determination of Hardness of water by EDTA method and problems, Softening of water by Hot and Cold lime Soda method and numerical problems. Zeolite process and numerical problems. Ion Exchange process and numerical problems. Potable water standard as per BIS w.r.t. i) pH, ii) Alkalinity, iii) TDS, iv) Hardness; Drinking water or Municipal water -Treatments removal of microorganisms by adding Bleaching powder, Chlorination (no breakpoint chlorination), Disinfection by Ozone, Electro dialysis, Reverse osmosis, and Ultra filtration. BOD, COD- definition & significance, sewage treatment (only activated sludge process), Numerical problems related to COD.

#### Module 02

**Polymers:** Introduction to polymers, Classification, Types of polymerization, Thermoplastic and Thermosetting plastic; Compounding of plastic, Fabrication of plastic by Compression, Injection, Transfer and Extrusion moulding. Preparation, properties and uses of Phenol formaldehyde, PMMA, Kevlar. Effect of heat on the polymers (Glass transition temperature), Viscoelasticity. Conducting polymers, Engineering Plastics, Polymers in medicine and surgery. Rubbers: Natural rubber- latex, Drawbacks of natural rubber, Vulcanization of rubber, Preparation, properties and uses of Buna-S, Silicone and Polyurethane rubber.

#### Module 03

**Lubricants:** Introduction, Definition, Mechanism of lubrication, Classification of lubricants, Solid lubricants (graphite & Molybdenum disulphide), Semisolid lubricants, Liquid lubricants, Additives in blended Oils. Important properties of lubricants - Definition and significance of - Viscosity, Viscosity index, Flash and fire points, Cloud and pour points, Oiliness, Emulsification, Acid value and numerical problems, Saponification value and numerical problems.

#### Module 04

**Phase Rule:** Gibb's Phase Rule, Terms involved with examples, One Component System (Water), Reduced Phase Rule, Two Component System (Pb- Ag), Advantages and Limitations of Phase Rule.

**Important Engineering Materials:** Cement – Manufacture of Portland Cement, Chemical Composition and Constitution of Portland Cement, Setting and Hardening of Portland Cement, Concrete, RCC and Decay. Nanomaterials, preparation (Laser and CVD) method, properties and uses of CNTS, Fullerene - properties and uses.

#### Module 05

**Corrosion:** Introduction: Types of Corrosion- (I) Dry or Chemical Corrosion-i) Due to oxygen ii) Due to other gases (II) Wet or Electrochemical corrosion- Mechanism i) Evolution of hydrogen type ii) Absorption of oxygen. Types of Electrochemical Corrosion- Galvanic cell corrosion, Concentration cell corrosion (differential aeration), Pitting corrosion, Intergranular corrosion, Stress corrosion. Factors affecting the rate of corrosion- Nature of metal, position of metal in galvanic series, potential difference, overvoltage, relative

area of anodic and cathodic parts, purity of metal, nature of the corrosion product, temperature, moisture, influence of pH, concentration of the electrolytes. Methods to decrease the rate of corrosion- Material selection, Proper designing, Use of inhibitors, Cathodic protection- i) Sacrificial anodic protection ii) Impressed current method, Anodic protection method, Metallic coatings- hot dipping- galvanizing and tinning, metal cladding, metal spraying, Electroplating, Cementation. Organic coatings – Paints (only constituents and their functions).

### **Module 06**

**Alloys:** Introduction, purpose of making alloys, Ferrous alloys, plain carbon steel, heat resisting steels, stainless steels (corrosion resistant steels), effect of the alloying element- Ni, Cr, Co, Mn, Mo, W and V; Non-Ferrous alloys- Composition, properties and uses of- Alloys of Aluminium- i) Duralumin ii) Magnalium. Alloys of Cu- (I) Brasses-i) Commercial brass ii) German silver, (II) Bronzes- i) Gun metal ii) High phosphorous bronze. Alloys of Pb- i) Wood's metal ii) Tinmann's solder. Powder Metallurgy- Introduction, (1) Methods of powder metal formation- i) Mechanical pulverization ii) Atomization iii) Chemical reduction iv) Electrolytic process v) Decomposition (2) Mixing and blending. (3) Sintering (4) Compacting- i) Cold pressing ii) Powder injection moulding (iii) Hot compaction. Applications of powder metallurgy. Shape Memory Alloys- Definition, properties and Uses.

### **Module 07**

**Fuels:** Definition, classification of fuels-solid, liquid and gaseous. Calorific value- Definition, Gross or Higher calorific value & Net or lower calorific value, units of heat (no conversions), Dulong's formula & numerical for calculations of Gross and Net calorific values. Characteristics of a good fuel. Solid fuels- Analysis of coal- Proximate and Ultimate Analysis with Significance and numericals. Liquid fuels- Crude petroleum oil, its composition and classification and mining (in brief). Refining of crude oil- i) Separation of water ii) Separation of 'S' & iii) Fractional Distillation with diagram and composition and uses table. Cracking- Definition, Types of cracking- I) Thermal cracking – (i) Liquid phase thermal cracking (ii) Vapour phase thermal cracking. II) Catalytic cracking- (i) Fixed-bed catalytic cracking (ii) Moving-bed catalytic cracking. Advantages of Catalytic cracking. Petrol- Refining of petrol, unleaded petrol (use of MTBE), Catalytic converter, Power alcohol, Knocking, Octane number, Cetane number, Antiknocking agents. Combustion- Calculations for requirement of only oxygen and air (by weight and by volume only) for given solid & gaseous fuels. Biodiesel- Method to obtain Biodiesel from vegetable oils (Trans-esterification), advantage and disadvantages of biodiesel. Fuel cell- Definition, types and applications.

### **Module 08**

**Composite Materials:** Introduction, Constitution- i) Matrix phase ii) Dispersed phase. Characteristic properties of composite materials. Classification- (A) Particle - reinforced composites- i) Large – particle reinforced composites ii) Dispersion – strengthened composites. (B) Fiber – reinforced composites- i) Continuous – aligned ii) Discontinuous – aligned (short)- (a) aligned (b) randomly oriented (C) Structural Composites- i) Laminates (ii) Sandwich Panels.

### **Module 09**

**Green Chemistry:** Introduction, Twelve Principles of Green chemistry, numerical on atom economy, Conventional and green synthesis of Adipic acid, Indigo, Ibuprofen and Carbaryl. Green solvents (water, supercritical CO<sub>2</sub>) and products from natural materials.