

## **Programme Outcomes (BSc Degree Course)**

**Academic year 2017-2018**

Name of the Programme : BSc Chemistry  
Academic Frame Work & : Following / Adhering to the Curriculum, syllabus and  
Content : evaluation system designed by Periyar University,  
Salem-7, Tamilnadu

### **Objectives**

1. To impart knowledge in fundamental aspects of all branches of Chemistry.
2. To acquire basic knowledge in the specialized areas like Polymer Chemistry, Environmental Chemistry, Dye Chemistry, Pharmaceutical Chemistry etc.
3. To create manpower in Chemical industries and help their growth.
4. To prepare candidates for a career in Chemical industries.
5. To prepare students for a hygienic and precautions in chemical laboratory.

### **Programme Outcomes**

- Students learn about the fundamentals particles of matter, periodic table of the elements and state of matter, inorganic, organic compounds.
- Students have understand functional groups of organic compounds.
- Students have got periodic properties, s, p, d, f block elements.
- Students have learnt organic and inorganic reaction mechanism and addition elimination reactions.
- They are understand basic knowledge of physical chemistry.
- Students have learnt laboratory methods of preparation of chemical compounds and what are principle involved in chemical reaction.

### **Programme specific outcomes**

- Students have learnt different types of electrostatic forces. Like ionic, covalent and Dative bonds.
- Students learn about the formation of carbocation, carbanion, and free radicals their stabilities and how it involves in organic reactions.
- Students have got the various types of organic and inorganic naming reactions.
- Students have learnt Thermodynamic laws and kinetics of the reaction in physical chemistry.
- Students have learnt handling of chemical, principle of volumetric, inorganic qualitative analysis, organic and Gravimetric estimations.
- Students have learnt preparation of organic and inorganic preparations and also known potentiometric and conductometric titrations.

## Learning Outcomes / Course Outcomes

### General Chemistry-I (17UCH01)

#### Chemical bond

- Student have learnt inert pair effect, fajan's rule, valence bond theory, molecular orbital theory, polarisation of ions, born Haber cycle, hetero nuclear diatomic molecules -CO, NO, HF.

#### Hydrides & Carbides

- Student have understood position in periodic table, ionic hydrides, covalent hydrides ,complex hydrides( $\text{NaBH}_4$ , $\text{LiBH}_4$ ), silane study.<https://meet.google.com/zkp-zpqb-opd>
- Students have learn Carbides-preparation, properties, uses,

#### Reaction mechanism intermediate

- Student have learn carbonation, carboanion, free radical formation of stability,  $\text{SN}_1$ , $\text{SN}_2$ , $\text{SN}_i$ ,  $\text{E}_1$ , $\text{E}_2$ reaction,relative reactivity of ethyl, isopropyl,tertiary, butylvinyl benyl halides.
- Students have learn Hofmann saytzeff rule, 1,2 and 1,4 addition to dienes.

#### Cycloalkanes and aromatic hydro carbons

- Student have understood nitration, halogenation,fridel crafts acylation.
- Student have learn naphthalene, anthracene properties, synthesis, wurtz reaction, dieckmann reaction, ring closure reaction.

#### The liquid state & liquid crystal

- Students have learn trouton's rule, surface tension, viscosity and chemical constitution, molar refraction, and chemical constitution.
- Students have understood smetic liquid crystal, nematic liquid crystal, cholesterol liquid crystal.

### SBEC-Food and Nutrition -17UCHS01

#### Food sources

- Students have learnt the sources of food, constituents of foods- carbohydrate, protein, fat, oils, colours, flavours, natural toxicants

#### Nutrition

- Students have understood the nutrition, nutrients, functions, nutritional status-definition, signs of good and poor nutritional status
- They have learnt the mall nutrition- definition ,forms, causes and remedy  
They have learnt the health- definition guidelines for good health

### Food poisoning and adulteration

- Students have understood , poisoning sources causes and remedy , causes and remedies for acidity gastritis, indigestion and constipation
- Students have learnt types of adulterants- intentional incidental effects and detection

### Food preservation and processing

- Students have learnt the food spoilage cause of food spoilage, types of food spoilage, preservation and processing by heating- sterilization, pasteurization

### Vitamins and minerals

- Students have understood sources requirements and deficiency diseases of A,C,K E1,B1,B2, minerals elements in food Na, K, Fe, S, P

## General Chemistry-II (17UCH02)

### Transition Elements and qualitative analysis

- Students have learnt Transition Elements – position in the Periodic Table-General characteristics of d-block elements – an objective study of the properties.

### Reaction mechanism II

- Students have understood the Mechanism of –Kolbe’s reaction,Reimer-Tiemann reaction, Gattermann, Lederer- Manasse and Houben-Hoesch reaction

### Carboxylic acids and Esters

- Students have learnt Unsaturated acids-preparation and properties of acrylic, crotonic, oleic and cinnamic acids, Dicarboxylic acids-preparation and properties of oxalic, malonic, succinic, glutaric and adipic acids.

### Solid State

- Students have understood The Solid State - Difference between crystalline and amorphous solids- isotropy and anisotropy-interfacial angles- symmetry in crystal systems-elements of symmetry-space lattice and unit cell-Bravis lattices- Law of rational indices-Miller indices-X ray diffraction-Bragg’s equation-Experimental methods structures of NaCl, CsCl and ZnS.

### Thermodynamics and thermochemistry

- Students have learn Terminology of Thermodynamics-Thermodynamic equilibrium-Nature of work and heatLaw of conservation of energy- first law of thermodynamics-Internal energy-Enthalpy of a system

## SBEC-Polymer Chemistry – 17UCHS02

### Structure of polymers

- Students have understood the linear, branched, crosslinked, homo, hetero copolymer, block copolymer, block copolymer
- They have learnt isotactic, syndiotactic, atactic.
- Students have understood crystalline melting point, the glass state, glass transition temperature.

### Molecular weight of polymers

- Students have learnt average molecular weight and weight average molecular weight, determination of molecular weight by viscosity and osmometry methods.
- They have understood the calendaring, die casting, and blow moulding, wet spinning.

### Poly olefins

- Students have understood polythene, PTFE, freons, pvc, polypropylene, polystyrene, natural rubber, butyl, buna-N, neoprene, thiocol, silicone rubber, polyurethane.

### Plastics and resins

- Students have learnt plastics and resins definition, thermoplastic and thermosetting resin, constituents of plastic, fillers, dyes, pigment, plasticizers, lubricant, catalyst, use of thermoplastic resins and thermosetting resins.

## General Chemistry –IV -17UCH04

### Nuclear chemistry

- Students have learnt Nuclear stability-n/p ratio-nuclear forces-Exchange theory and nuclear fluid theory and Natural radioactivity-modes of decay-Geiger Nuttal rule. Units of radioactivity-Kinetics of radioactive disintegration-Half life and average life-Radioactive equilibrium-Numerical problems.

### Heterocyclic compounds

- Students have understood the Molecular orbital picture and aromatic characteristics of pyrrole, furan, thiophene and pyridine and Preparation, properties and uses of furan, pyrrole & thiophene.
- Students have understood Synthesis and reactions of pyridine. Comparative study of basicity of pyrrole, pyridine with amines and preparation of indole, quinoline and isoquinoline.

### Amines and their derivatives

- Students have learnt Aliphatic amines-separation of amines by Hinsberg's & Hofmann methods - preparation and properties of dimethyl amine, trimethyl amine, (ethylene diamine and hexamethylene diamine).

## Second law of thermodynamics- I

- Students have understood . Limitations of the first law-need for second law- spontaneous processes- cyclic process-Carnot cycle –efficiency-Carnot theorem-Thermodynamic scale of temperature and Concept of entropy-Entropy-a state function-Entropy change in isothermal expansion of an ideal gas- entropy change in reversible and irreversible processes-Clausius inequality.

## Second law of thermodynamics- II

- Students have learn Work and free energy functions-Maxwell's relationships criteria for reversible and irreversible processes -Gibbs-Helmholtz equation- Partial molar free energy. Clapeyron equation- Clapeyron- Clausius equation-Applications of Clapeyron-Clausius equation.
- Students known the Third law of thermodynamics and Nernst heat theorem-statement of III law- Evaluation of absolute entropy from heat capacity measurements-Test for the validity of the law.

## Inorganic Chemistry I -17UCH05

### Concept of acids, bases, and non-aqueous solvents

- Student have learnt Arrhenius, bronsted, Lowery, Lewis concepts of acids and bases
- Students have learn Pearson's HSAB concept, non-aqueous solvents.

### Chemistry of f -block elements

- Student have lanthanide contraction and its consequences
- Students have learn lanthanide from monozite including the ion exchange resin method.
- Students have learn chemistry of thorium and uranium.

### Coordination chemistry

- Student have learn classification of ligands, chelate effect, sidgwick's theroy, isomerism, types, stereo isomerism, and geometrical isomerism.

### Valence bond theory, crystal field theory

- Student have understood valence bond theroy postulates, magnetic properties, outer orbital and inner orbital octahedral, Td complexes square planar complexes.
- They are learntCrystal field theroy postulates-d orbital spitting in octahedral,Td, square planar complexes, spectro chemical series, calculation of CFSE

### Reaction mechanism and application of complexes

- Students have learn Trans effect, polarisation theroy and pi bonding theroy, trans effect series.
- Students have understood separation of cu, cd co ions, identification of cu, Fe, Ni, hardness of water.

## Organic Chemistry – 17UCH06

### Optical isomerism

- Students have understood condition for optical isomerism and how to write projection formulas for molecules
- Students have understood Cahn-Ingold-Prelog rules to write R-S notation for optical isomers with 1 and 2 asymmetric carbon atoms
- Students have learned racemization, resolution and how to synthesize asymmetric compounds.
- Students to study about optical activity of allenes, spirans and biphenyls.

### Geometrical isomerism

- Students have understood to write cis, trans, syn-anti and E-Z notation for molecules
- They have learned conformational analysis, introduction of terms dihedral angle and torsional strain.
- Students have learned how to write conformational structures for molecules for example Ethane, ethylene glycol and n-butane.

### Amino acids

- Students have learned essential and non-essential amino acids and also preparation, properties of amino acids.
- They have learned about synthesis and properties of peptides, proteins.
- Students have learned structure of proteins.

### Ureides & Nucleic Acids

- Students have learned synthesis of pyrimidine and purine bases.
- Students have the knowledge about biological functions of DNA and RNA and also elementary ideas on replication.
- Students have understood how to synthesize for proteins.

### Chemistry of Natural products

- Students have learned structural elucidation of piperine, atropine and nicotine.
- Students have understood about structural elucidation of terpenes.

## Physical chemistry -17UCH07

- Students have learned about equilibrium constant, degree of advancement of chemical reactions and influence of temperature and pressure on equilibrium constant
- They have acquired knowledge about absorption isotherms
- Students learned about chemical reaction rates, rate constant -effect of temperature on reaction rates and various experimental methods of chemical kinetics
- They have acquired knowledge on theories of chemical kinetics and significance of energy and entropy of activation
- They can understand the concept of conductance and its applications

## Elective-Analytical Chemistry-I -17UCHE01

### Data analysis:

- Students learn the Idea of significant figures-its important-Accuracy-methods of e xpressing accuracy-Error analysis-Types of errors-minimizing errors,precision-methods of expressing presion,mean,median,mean deviation and confidance.Limits.
- Students have the precipitation,solvent extraction,ertitraction by chemically active solvents,continous extraction-soxhlent extraction.

### Gravimetric analysis:

- Students have learnt in solubility product and precipitation,factor affecting solubility,conditions of precipitation.
- Students have learnt in choice of precipitant and selective precipiant, crucibles uses of gravimetric analysis.

### U.V Visible spectroscopy:

- Students have the absorption and emission spectra,electromagnetic radiation ,differerent types of energies in molecules.
- Students have the types of electronic transitions, Beer lambert's law, chromophore, auxochrome, bathochromic shift, hypso chromic shifts, instrumentation, Application.

### I.R spectroscopy:

- Students learn the modes of vibration of diatomic,triatomic,linear [CO<sub>2</sub>] and non-linear triatomic molecules [H<sub>2</sub>O]stretching and bending vibiraction-selection rules-expression for vibrational frequency –instrumentation-samping techniques-Applications.

### Raman spectroscopy:

- Students have the Rayleigh and raman scattering, stokes and antistokes lines-Instrumentation,Differences between raman and I.R spectroscopy mutual exclusion principle[CO<sub>2</sub> and N<sub>2</sub>O ].
- Students have the SEM,TEM studies.

## SBEC-Agricultural Chemistry -17UCHS03

### Fertilizers

- Students have learnt Effect of Nitrogen, potassium and phosphorous on plant growth.
- Students have understood the Complex fertilizers and mixed fertilizers their manufacture and composition. Secondary nutrients micronutrients their function in plants.

### Manures

- Students have understood the Bulky organic manures Farm yard manure handling and storage oil cakes blood meal fish manures.

### Pesticides and Insecticides

- Students have learnt Pesticides – classification of Insecticides, fungicides, herbicides as organic and inorganic – general methods of application and toxicity. Safety measures when using pesticides.
- Students have know the Insecticides : Plant products – Nicotine, pyrethrin – Inorganic pesticides – borates. Organic pesticides – D.D.T. and BHC.

### Fungicides and Herbicides

- Students have understood Fungicide : Sulphur compounds, Copper compounds, Bordeaux mixture.
- Students have learn Herbicides : Acaricides – Rodenticides. Attractants – Repellants. Preservation of seeds.

### Soils

- Students have learn Classification and properties of soils –soil water,soil temperature,soil minerals, soil acidity and soil testing.

## SBEC-Dye Stuffs & Treatment of effluents 17UCHS04

### Unit 1

- Students have learn colour of the dyes.
- Students mast studied chromophore,auxochrome,bathochromic,hypsochromic effects.
- Students have learn acid,base vat and reactive dyes.
- Students to study what are the special characters of a good dyes.

### Unit 2

- Students have understood various methods of dyeing.
- They have learnt about synthesis and application of Alizarin.
- Students have learn Anthroquinone, Mordant dyes.

### Unit 3

- Students have learnt about synthesis and application of Auramine.
- They have learn some naming reactions of days like Malachite Green, Crystal Violet,Pararosanine dyes and their preparation , applications.
- Students must know about preparation and application of Indigo days and their derivatives.

## Unit 4

- Students have learn synthesis and application of Phenolphthalein.
- Students have the knowledge about Xanthein dyes and their derivatives.
- Students have understood using Acridine dyes-synthesis and application of Acridine orange NO.
- Students have learn reactive dyes under synthesis and application of Procion Blue HB.

## Unit 5

- Students to study about Textile effluent-degradability of wastes.
- Students have learn about Effluent treatment plants.
- Student have the knowledge about Aerated lagoon, photo oxidation process.

## Inorganic Chemistry-II -17UCH08

### Bioinorganic chemistry

- Student have learnt biological role of haemoglobin, chlorophyll, bonding in carbonyls - mono and binuclear carbonyls of Ni, Fe, cr,co,mn .
- Silicates-classification, properties, uses.

### Oregano metallic compounds

- Student have understood boron ferrocene preparation, properties, uses, structure, zeisel's salt, preparation, general properties of organometallic compounds.

### Nano science

- Student have learn definition of nano rods fullerences , carbon nano tubes, plasma arching, chemical vapour deposition, electro deposition.
- Students have learn use of natural nano particles, envionmental and biomedical applications.

### Some special compounds

- Student have understood classification and structure of carboranes, borazole metal bordides.
- Student have learn basic properties of iodine, uses of Icl, BrF3, IF5, IF7, pseudo halogens, cyanogens, hiocyanogen, preparation, properties, uses.

### Symmetry elements & magnetic properties of molecules

- Students have learn point group of simple molecules like H<sub>2</sub>, HCl, CO<sub>2</sub> H<sub>2</sub>O, NH<sub>3</sub>.
- Students have understood diamagnetism, paramagnetism,ferro magnetism,antiferro magnetism, using guoy balance.

## Elective Organic Chemistry -17UCHE02

### Carbohydrates

- Students how learn reactions of glucose and fructose and their ring and open chain structure.
- Students mast study how to interconverted pentose to hexose,aldose to ketose.
- Students have learn structural elucidation of sucrose and maltose.
- Students to study about polysaccharides like starch and cellulose and uses of their derivatives.

### Vitamins and antibiotics

- Students have understood to biological functions of vitamin A thiamine, Riboflavin, Ascorbic acid.
- They have learnt about synthesis and structural elucidation of ascorbic acid.
- Students have learn structural elucidation of penicillin G & chloromycetin.

### Molecular rearrangement

- Students have learnt about difference between inter and intramolecular rearrangement.
- They have learn some naming rearrangements like Pinnacle Pinnacle and Beckman, benzidine , Hofmann, Curtius, Lassen, Schmidt,benzilic acid,Fries&Cope rearrangements.
- Students have the knowledge to write the mechanisms.

### Important reagents

- Students have learn synthesis of reagents how to use in organic chemistry.
- Students have the knowledge about reducing reagents like Lithium aluminium hydride, sodium borohydride, sodium ethanol, hydrogen with Nickel, hydrogen with Palladium.
- Students have understood using oxidising reagent lead Tetra acetate Ocimum trioxide in organic compounds.

### Green Chemistry

- Students to study about need of Green chemistry and planning a green synthesis in a chemical laboratory solvent.
- Students have learn about fundamentals of closed vessel heating and sonication.
- Student have the knowledge about water as green solvent reactions in ionic liquid and a solid support organic synthesis.

### Physical chemistry -17UCH09

- Students learnt about distillation methods used for separation of binary liquid mixture. Nernst distribution law and its application.
- They have acquired knowledge on phase rule and its application to one, two and alloy systems, CST of phenol —water system.
- They have knowledge about different types of cells such as galvanic cell, concentration cell and storage cells, EMF and its significance.
- Students learnt about expression for (ljp) liquid junction potential and storage batteries.
- Acquired knowledge about the decay of electronically excited states, energy transfer photo chemical reactions and photochemical kinetics.

## Analytical Chemistry 17UCHE03

### Chromatographic techniques

- Student learn the column chromatography types of adsorbents, preparation of Column, elution, recovery of substances and applications
- Students learn the TLC principle, choice of the adsorbent, and solvents, preparation of chromatoplates, factors affected by Rf values, significance of Rf values
- Students have learn paper chromatography- principle, development of chromatogram, ascending, descending, and radial chromatography.

### Thermo analytical Methods

- Students have learn the principle TGA, DTA discussion of various component Block diagram  
 $\text{CuSO}_4 \cdot 5\text{H}_2\text{O}$ ,  $\text{MgC}_2\text{O}_4 \cdot \text{H}_2\text{O}$ ,  $\text{Ca}(\text{OOCCH}_3)_2 \cdot \text{H}_2\text{O}$
- DTA-TGA curves of  $\text{SrCO}_3$  in air and  $\text{CaC}_2\text{O}_4 \cdot \text{H}_2\text{O}$  in air and in  $\text{CO}_2$ , factors affecting TGA&DTA curve
- Students learn thermometric titration- principle, apparatus, and application.

### Electro analytical method

- Students learn the polarography principle-concentration, polarization, DME advantages, disadvantage, migration, residual, limiting, diffusion current, use of supporting electrolytes-Ilkovic, equation (derivation not required) oxygen wave, half wave potential.

### NMR – Spectroscopy

- Students have two NMR principle of NMR instrumentation number of signals -chemical shift, shielding, spin-spin coupling, coupling constants TMS as NMR
- Standard, deshielding
- Students have the NMR spectra acetone, anisole, Benzaldehyde, ethyl acetate, Toluene, Isopropyl phenyl ketone, Ethyl amine, ethyl bromide.

### Mass spectroscopy

- Students have understand the mass spectra principles, molecular ion peak, Metastable peak, Isotopic peak, nitrogen rule, ring rule, base peak.
- Students have understand the acetone, anisole, benzaldehyde, ethyl acetate, Toluene, Isopropyl phenyl ketone, ethyl amine.

## SBEC-Pharmaceutical Chemistry – 17UCHS05

### Unit 1

- Students have learnt definition of drugs.
- Students must studied pharmacophore, pharmacodynamic, Pharmacology.
- Students have the knowledge of bacteria, virus, fungus.
- Students to study what are the therapeutic uses of drugs.
- Students have learn difference between virus and fungus.

## Unit 2

- Students have understood various methods of preparation of sulpha drugs.
- They have learnt about uses of sulphadiazine and sulphapyridine.
- Students have learn classification as broad and narrow spectrum.
- Students must studied structure and mode of action antibiotics penicillin,ampicillin.

## Unit 3

- Students have learnt about narcotic and non narcotic analgesics.
- They have learn narcotic analgesics action of morphine heroine and their derivatives.
- Students must known about preparation and uses of salicylic acid derivatives methyl salicylate and aspirin.

## Unit 4

- Students have learn anaesthetic agents should have the characteristics
- Students have the knowledge about classification of anaesthetic
- students have understood which are general anaesthetic and local anaesthetic
- Students have learn general anaesthetic preparation and mode of action and advantages of ether, chloroform,nitrous oxide.
- Students have the knowledge about advantage of Folic acid vitamin B12 ferrous sulphate.

## Unit 5

- Students to studied about diabetes and hypoglycemic drugs.
- Students have learn how to control diabetes and advantage of oral hypoglycemic agent's sulphonyl urea, biguanides.
- Student have the knowledge about causes, prevention and control of AIDS.
- Students have studied about Indian medicinal plants and uses Thulasi keelanelli mango sembaruthi Adododai,Thoothuvalai.

### SBEC-Industrial Chemistry 17UCHS06

## Chemical Explosives

- Student have learnt Preparation and chemistry of lead azide, nitroglycerine, nitrocellulose, TNT, RDX,Dynamite, cordite, picric acid, gunpowder, introduction to rocket propellants.

## Leather Industry

- Student have understood Curing, preservation and tanning of hides and skins, process of dehairing and dyeing.Treatment of tannery effluents.

## Electrochemical Industries

- Student have lean Production of materials like chlorine, caustic soda, sodium chlorate, Batteries – primary and secondary cells, solar cells, fuel cells.

## Paints, Varnishes & Cleaning Agents

- Student have understood Paints & Varnishes: Primary constituents of paints, Dispersion medium (solvent), binder, Pigments, formulation of paints and varnishes. Requirements of a good paint, manufacture.
- Student have learn Cleansing Agents: Preparation of toilet and washing soaps, synthetic detergents-alkyl aryl sulphonate and cleansing action of soaps.

## Cement & Glass

- Students have learn Cement: Manufacture – Wet Process and Dry process, types, analysis of major constituents, setting of cement, reinforced concrete. Cement industries in India.
- Students have understood Glass: Composition and manufacture of glass .Types of glasses- optical glass, coloured glasses and lead glass.

## Allied Chemistry – I – 17UCHA01

### Chemical bonding:

- ★ Students have learnt types of bonding and molecular orbital theory.
- ★ They have understood molecular orbital diagrams of hydrogen, helium and nitrogen molecules.
- ★ Student have learn about hydrides borazole  $\text{NABH}_4$  and  $\text{LiAlH}_4$

### Nuclear chemistry:

- ★ Students learn about natural radioactivity radioactive series.
- ★ They have knowledge about nuclear binding energy and mass defects.
- ★ Students learn about the difference between nuclear fission and nuclear fusion.
- ★ Students learn about uses of radioisotopes

### Stereomerism:

- ★ Students learn about the geometry of organic methane, ethylene and acetylene.
- ★ Students have learned Electron displacement effect Inductive, Resonance Hyperconjugative.
- ★ Students have understood geometrical isomerism of maleic and fumaric acids.

### Aromatic compounds:

- ★ Students have understood Huckel's rule.
- ★ Students have learned about electrophilic substitution in benzene..
- ★ They have knowledge of naphthalene.
- ★ Students have learned about heterocyclic compounds furan, thiophene, pyrrole.

### Solutions of chromatography:

- ★ Students have learned about Raoult's law, fractional dilution and azeotropic distillation.
- ★ Students have knowledge about chromatography column paper and thin layer chromatography.

Coordination chemistry;

- ★ Students have learned about classification of ligands nomenclature chelation.
- ★ Students learnt werners theory, Sidgwick's theory and Poulings theory.
- ★ They have knowledge about haemoglobin and chlorophyll

Carbohydrates and Aminoacids;

- ★ Students have learnt classifications of carbohydrates, Glucose, Fructose, starch and cellulose.
- ★ They have understood inter conversion of glucose to fructose and fructose to glucose.
- ★ Students have learnt glucose and alanine preparation and properties.

Pharmaceutical chemical;

- ★ Students have acquired the skill of using sulphur drugs.
- ★ They have understood the usage of penicillin and chloramphenicol.
- ★ Students have knowledge about cancer and AIDS. Photochemistry;
- ★ Students learn about photochemical equivalence and quantum yield.
- ★ They have understood uses of phosphorescence and fluorescence.
- ★ Students have learnt Phase rule For water systems and lead silver systems.

Electro chemistry;

- ★ Students learn about Kohlrausch law, pH determinations and conductometric titration.
- ★ Students have Knowledge about galvanic cells reference electrodes.
- ★ Students have understood methods of prevention of corrosion

## Practical

### Volumetric estimations and inorganic Preparation. 17UCHP01

#### Acidimetry-alkalimetry&permanganometry&dichrometry

- Student have learnt estimation of NaOH- Std sodium carbonate, estimation of oxalic acid-std oxalic acid, estimation of ferrous ion Std Oxalic acid, estimation of ferrous iron using diphenylamine internal indicator Std  $\text{FeSO}_4$ .

#### Iodometry & iodometry & complexmetric titrations

- Students have learn estimation of potassium dichromate Std potassium dichromate, estimation of arsenious oxide Std Arsenious oxide, Estimation of hardness of water, estimation of Zn and mg Using EDTA.

#### Inorganic preparation

- Student have learn ferrous ammonium sulphate, microcosmic salt, tetra mine copper( II) sulphate, bis acetyl acetonato nickel ( II) or cu (II).

### Inorganic Qualitative Analysis 17UCHP02

- Students have learnt what are apparatus used and how to handle in inorganic semi microanalysis.
- Students have learnt Principles involved in  $\text{Na}_2\text{CO}_3$  extract preparation.
- Students have understood identification and confirmatory tests of given acid radical.
- Students have learnt Common ion effect, Solubility product and their applications in Qualitative analysis
- Students have learnt Separation of cations into Groups and what are cation present in each group.
- They are understood identification and confirmatory tests of given basic radical.

### Physical Chemistry Practical 17UCHP03

- Students have learnt titration for acid catalysed hydrolysis of ester, Iodination of acetone, reaction with persulphate -kl.
- Students have learnt cell constant, conductometric titration- acid base .titration. , Equivalent conductance strong electrolyte, potentiometric titration- acid base titration.
- Students have understood the CST of phenol water system determination of concentration of sodium chloride, determination of transition temperature.
- Students have learnt simple eutectic system-naphthalene- biphenyl, molecular weight of rast method.

### Organic Qualitative Analysis 17UCHP04

- Students have learnt which apparatus are used in organic analysis, preparation and how to handle it..
- Students must have the knowledge to clean silica and sintered crucibles using gravimetric estimations.
- Students have learn characterisation of organic compounds by their functional groups and confirmation by preparation of derivatives.
- Students have studied the functional groups aldehydes, ketones ,esters ,acids, primary amines ,amides,diamide, monosaccharides.
- Students have learnt about weight of inorganic compounds present in unknown solution by gravimetrically.
- They are understood what are the principles involved in organic reactions for example oxidation ,hydrolysis, bromination ,Nitration reactions.

### Allied Chemistry Practical 17UCHAP01

- ★ Students must know what is the apparatus used in volumetric estimation andorganic analysis and also how to handle it.
- ★ Students have learnt about unknown solution containing sodium hydroxide,hydrochloric acid,ferrous sulphate and oxalic acid by volumetrically.
- ★ They have learned principles involved in volumetric estimation.
- ★ Students have learnt organic compounds.
- ★ They are understood to identify special elements,nitrogen,sulphur and halogens,aliphatic or aromatic, saturated or unsaturated.
- ★ Student knowledge about functional groups phenol,acids,urea and amines etc.

## **Programme Outcomes (MSc Degree Course)**

**Academic year 2017-2018**

Name of the Programme : MSc Chemistry  
Academic Frame Work & Content : Following / Adhering to the Curriculum, syllabus and evaluation system designed by Periyar University, Salem-7, Tamilnadu.

### **Objectives**

1. To impart knowledge in advanced concepts and applications in various fields of Chemistry.
2. To provide wide choice of elective subjects with updated and new areas in various branches of Chemistry to meet the needs of all students.

### **Programme Outcomes**

- Students have learnt advanced level mechanism in the chemical reactions.
- Students have learnt various type of electrophilic and nucleophilic substitution reaction.
- Students have understood photo chemistry, Pericyclic reactions and important reagents.
- Students have learnt synthesis and structure elucidation
- Students have learnt inorganic reaction mechanism and inorganic cluster.
- They are understand quantum chemistry and group theory.
- Students are learnt about organic, inorganic estimations and double stage preparations.

### **Programme specific outcomes**

- Students have got knowledge about reaction intermediate and their relative name reactions. , Determination of kinetic and non kinetic mechanisms.
- They are understand reaction condition, reagents in chemical synthesis
- Students have learnt Structure and Bonding of organometallic compounds.
- Students have got knowledge about Hard and Soft acids and bases-classifications.
- Students have learnt Electronic Spectroscopy of transition metals and Inorganic Photochemistry.
- They are understood basic knowledge of Nano and Green chemistry.
- Students have learnt about semi micro analysis and less common radicals, photo colouric metric estimation.
- Students are learnt systematic procedure of detection of functional groups given organic compounds.
- They are understood isolation of metal from its ore and emf measurements.

## Course Outcomes / Learning Outcomes

### Organic chemistry –I -17PCH01

#### Stereochemistry

- Students have learnt R & S Notation, Axial chirality, planar chirality. And stereoselective, Stereospecific reactions.
- Students have understood Conformations and stereo chemistry of cis and trans Decaline.

#### Reaction intermediates, Structure and Reactivity

- Students have learnt formation, stability and structure of carbonium ions, carbanions, carbenes, nitrenes and free radicals
- Students have understood effect of structure on reactivity – resonance and field effects, steric effects, quantitative treatment
- Students have learnt thermodynamic and kinetic requirements for reactions, thermodynamically and kinetically controlled reactions

#### Aliphatic Nucleophilic Substitution Reactions

- Students are able to understand the neighbouring group mechanism, neighbouring group participation by  $\pi$  and  $\sigma$  bonds, anchimeric assistance.
- Students have got knowledge of reactivity effects of substrates structure, attacking nucleophile, leaving group and reaction medium, ambident nucleophile, regioselectivity.

#### Aromatic electrophilic and nucleophilic substitution reactions

- Students have understood the arenium ion mechanism, typical reactions like nitration, sulphonation, halogenation, Friedel – Crafts alkylation, acylation and diazonium coupling, electrophilic substitution on monosubstituted benzene.
- Students have learnt the  $S_NAr$  mechanism, the aryl cation mechanism, the benzyne intermediate mechanism

#### Alkaloids, Flavones and Isoflavones

- They have learnt about synthesis and Structural elucidation of Quinine, Papaverine, Morphine and Reserpine, flavones, isoflavones and anthocyanins.

## Inorganic chemistry –I -17PCH02

### Structure and Bonding

- Students have learnt Acid-Base strength, hardness, symbiosis, Theoretical basis of Hardness and Softness, applications of HSAB.
- Students have knowledge about Rings-Phosphazenes-Structure, Craig and Peddock model, Dewar model, polyorganophosphazenes, Polysulphur –nitrogen compounds.
- They have learnt Inorganic polymers-Silicates-structure, Pauling's rule, properties, correlation and application; Molecular sieves.

### Metal - Ligand Bonding

- Student have learnt Crystal field theory – splitting of d- orbitals under various geometries, factors affecting splitting, CFSE, evidences for CFSE
- They have the knowledge about Spectrochemical series, Jorgensen relation, site preferences, Jahn – Teller distortion – splitting pattern in trigonal pyramid, square pyramidal and cubic symmetries, Dynamic and Static J.T. effect, Jahn – Teller effect and Chelation.
- Students have understood Limitations of CFT Evidences for metal – ligand overlap; M.O. theory and energy level diagrams, concept of weak and strong fields, sigma and pi bonding in complexes.
- Students have learnt nephelauxetic effect, magnetic properties of complexes.

### Electronic Spectroscopy of transition metals and Inorganic Photochemistry

- Students have learnt Spectroscopic Term symbols for dn ions – derivation of term symbols and ground state term symbol, Hund's rule; Selection rules – break down of selection rules, spin-orbit coupling, band intensities, weak and strong field limits- correlation diagram.
- They have learnt Energy level diagrams; Orgel and Tanabe – Sugano diagrams; effect of distortion and spin orbit coupling on spectra.
- Student have learnt Evaluation of Dq and B values for octahedral complexes of Nickel Charge transfer spectra. Spectral properties of Lanthanides and Actinides.
- Students have learnt Inorganic photochemistry-Photosubstitution, Photoredox and isomerization processes application of metal complexes in solar energy conversion.

### Inorganic Reaction mechanism

- Students have understood Electron transfer reactions – Outer and inner sphere processes; atom transfer reaction, formation and rearrangement of precursor complexes.
- Students have Cross reactions and Marcus – Hush theory
- They have learnt about Reaction mechanism of coordination compounds – Substitution reactions, Labile and inert complexes. Substitution in square planar complexes – General mechanism reactivity of Platinum complexes influences of entering and leaving groups; the trans effect – theories, trans influence.

- Students have learnt Substitution in octahedral complexes – general mechanism, discussion of A, D, IA, ID and DCB mechanism, replacement of coordinated water; mechanism of acid hydrolysis and base hydrolysis – Conjugate base mechanism.

### Boron compounds and Clusters

- Students have learnt Boron hydrides – polyhedral boranes, hydroborate ions – a general study of preparation, properties and structure, styx numbers, Wade's rules.
- They have learnt Carboranes – types such as closo and nido – preparation, properties and structure. Metallo carboranes
- Students have learnt Metal clusters – Chemistry of low molecularity metal clusters only – structure of  $\text{Re}_2\text{Cl}_8$  multiple metal – metal bonds.

### Physical Chemistry-1- 17PCH03

#### Classical thermodynamics I&II

- Students have learnt the Maxwell relations pressure, volume, entropy & enthalpy, etc.
- Students have understood the thermodynamics of ideal and real gases.
- They are got some basic knowledge of standard States for solid, liquid, gases and component of solutions.
- Students have learnt the partial molar free energy and gibbs-buhem equation.
- Students have learnt the concept of ionic strength. Mean ionic activity and mean ionic activity coefficient.

#### Chemical kinetics-I

- Students have learnt the concept of arrhenius theory and activation energy of molecule.
- Student have got the knowledge of rate of the reaction, order and slope of molecules.
- Students have understood the theories of unimolecular reaction by lindemann and hinselwood methods.

#### Quantum chemistry-I

- Students have learnt the plans theory, photoelectric effort and de-broglie equations.
- Students have understood the schrodinger wave equation and harmonic oscillator.

#### Group theory-I

- Students have learnt the symmetry operation and elements.
- Students have understood how to calculate the point group of various molecules.

## Polymer Chemistry-1- 17PCHE01

### Basic Concepts:

- ★ Students have learnt monomers, repeat units branched and network Polymer.
- ★ They have Understood Free Radical, Cationic and anionic polymerization.
- ★ Students have learnt homogeneous and heterogeneous systems.

### Coordination polymerization:

- ★ Students are able to understand various types of Co-polymerization.
- ★ Students learn about kinetics, mono and bimetallic mechanisms of coordination polymers.

### Molecular Weight and Properties:

- ★ Students have studied average molecular weight concepts, number, weight and viscosity average molecular weight.
- ★ They have knowledge about Relationship between  $T_m$  and  $T_g$ .

### Polymer Processing:

- ★ Students have learnt plastic elastomers and fibers.
- ★ They have studied compounding and processing techniques.

### Properties of commercial polymers:

- ★ Students learnt about polyethylene polyvinyl chloride and polyester.
- ★ They have learnt how to use Biomedical polymers. artificial heart, kidney, skin and blood cells.
- ★ Students have gained enough knowledge in polymers.

## Organic Chemistry –II- 17PCH04

### Elimination Reactions

- Students have learnt Orientation of the double bond- Hofmann and Saytzeff rule, competition between elimination and substitution.
- Students have understood the stereochemistry of  $E_2$  eliminations in cyclohexane ring systems, mechanism of pyrolytic eliminations.

### Aromaticity

- Students have understood the Huckel's theory of aromaticity, concept of homoaromaticity and antiaromaticity.
- They have learnt how to use the NMR concept of aromaticity and antiaromaticity & Mobius aromaticity.

- Students have understood Bonding properties of systems with  $(4n+2)$   $\pi$ -electrons and  $4n\pi$  - electrons, alternant and non-alternant hydrocarbons.

#### Organic Photochemistry

- Students have learnt Fate of excited molecules, Jablonski diagram, Norrish Type I and Norrish Type II reactions & Paterno Buchi reaction.
- They have understood the Photooxidation, Photoisomerization, Photo addition of olefins Photo – Fries rearrangement and Photo rearrangement of 2, 5 – Cyclohexadienones.

#### Pericyclic Reactions

- Students have understood orbital symmetry, Woodward Hofmann rules, selection rules and stereochemistry of electrocyclic reactions.
- Students have learnt analysis by correlation diagram method and Frontier molecular orbital method and their related name reaction.

#### Reagents in Organic Synthesis

- Students have learn how to prepare the important reagents and their uses in organic synthesis like DCC, DDQ, DBU, DIBAL, 9BBN, NBS etc.,

### Physical chemistry-II – 17PCH05

#### Statistical and irreversible thermodynamics

- Students have learnt the consent of thermo dynamical and mathematical probabilities.
- Students have understood the heat capacity of solids.

#### Chemical kinetics-II

- Students have learnt to study the fast reactions of same methods.
- Students have learnt the kinetics of complex reaction.

#### Surface chemistry and catalysis

- Students have learnt the langmuir, freundlich and BET adsorption catalysis.

#### Quantum chemistry -II

- Students have learnt the origin of quantum numbers.
- They are understood the approximation method and its applications.

#### Group theory-II

- Students have learnt the vibrational modes of nonlinear molecules.
- They are understood the hybridization of non-linear molecules.

## Spectroscopy – 17PCHE02

### UV -Visible and IR Spectroscopy

- Students have learnt various types of absorption bands, factor affecting intensity and solvent effect of absorption.
- Students have understood the various mode of vibration, stretching frequencies such acid, Aldehyde, ketone, ester, and anhydride.

### NMR Spectroscopy-I

- Students have understood the principle, chemical shift, factors affecting the chemical shift, shielding and de shielding of different protons.
- They have learnt how to use the NMR concept of coupling constant, calculation and mechanism of coupling constant.
- Students have understood first order, non first order spectra and shift reagent.

### NMR Spectroscopy -II

- Students have learnt C-13 NMR, double resonance technique, Homo and heteronuclear coupling.
- They have understood the broadband decoupling, offresonance decoupling, Gauche effect.

### EPR and Mossbaeur spectroscopy

- Students have understood principle, hyperfine splitting, and instrumentation of EPR spectroscopy.
- Students have learnt principle of Mossbauer spectra, isomeric shift, quaterpole splitting of metal complexes.

### Photo acoustic Spectroscopy and Spectroscopic techniques

- Students have learnt to analysis various types of spectra UV, IR, NMR, EPR spectroscopy.
- Students have learnt the advantages, instrumentation, and application of PAS.

## Organic Chemistry -III -17PCH06

### Addition to Carbon – Carbon and Carbon – Hetero atom multiple bonds

- Students have understood Addition of halogen and nitrosyl chloride to olefins, hydration of olefins and acetylenes, hydroboration, hydroxylation – cishydroxylation.
- Students have understood Mechanism and applications of Mannich, Stobbe, Darzen Glycidic ester condensation. Benzoin condensation, Peterson olefination.

### Molecular Rearrangements

- Students have detailed understood of Wagner –Meerwin, Demjanov, Dienone- Phenol, Favorski, Baeyer – Villiger, Wolff, Stevens, Von– Richter Beckmann, Hydroperoxide, Smiles, Jacobsen, and Hofmann – Martius rearrangement.

### Oxidation and Reduction Reactions

- Students have understood Oxidation of alcohols by  $\text{CrO}_3$ , DMSO alone, DMSO in combination with DCC.
- They are understood Reduction of carbonyl compounds by complex metal hydrides (LAH,  $\text{NaBH}_4$ , and  $\text{NaBH}_3\text{CN}$ ), Clemmensen and Wolff Kishner reductions, Birch reduction, and MPV reduction.

### Steroids

- Students have learnt about the Structure and Stereochemistry of Cholesterol. Total synthesis of Cholesterol and Oestrone. Reactions of Oestrone, Conversion of cholesterol into progesterone, testosterone and Oestrone

### ORD - CD and Mass Spectrometry

- Students have learnt Definition, deduction of absolute configuration, octant rule for ketones, Cotton effect-axial haloketone rule.
- Students have understood about the Mass spectra – Basic principle, molecular ion peak, base peak, Meta stable ion peak, isotopic peaks, Nitrogen rule, ring rule, McLafferty rearrangement, rules for fragmentation pattern.

## Inorganic chemistry –II -17PCH07

### Crystal Systems and Structural Analysis

- Students have learnt the crystal systems and Bravais lattices – Miller indices and labelling of planes
- Students have knowledge about symmetry properties - crystallographic point groups and space groups - fundamentals of X-ray diffraction - powder and rotating crystal
- They have learnt systematic absences and determination of lattice types - analysis of X-ray data for cubic system
- They have also learnt structure factor and Fourier synthesis - electron and neutron diffraction and structure determination.

## Solid State - I

- Student have learnt close packing of atoms and ions - bcc , fcc and hcp voids -Goldschmidt radius ratio - derivation - its influence on structures
- They have the learnt about structures of rock salt - cesium chloride - wurtzite - zinc blende - rutile - fluorite - antiferite – diamond and graphite
- Students have understood spinel - normal and inverse spinels and perovskite
- Students have learnt lattice energy of ionic crystals - Madelung constant - Born-Haber cycle and its applications.

## Solid State - II

- Students have learnt Metallic state - free electron and band theories - non - stoichiometry - point defects in solids - Schottky and Frenkel defects - linear defects -
- They have learnt dislocations - effects due to dislocations - electrical properties of solids
- Student have learnt insulators - intrinsic semiconductors -impurity semiconductors (n and p- type) and superconductors
- Students have learnt elementary study of liquid crystals.

## Nuclear Chemistry - I

- Students have understood nuclear structure - stability of nuclei - packing fraction - even - odd nature of nucleons - n/p ratio - nuclear potential
- Students have binding energy and exchange forces – shell model and liquid drop model. Decay of radionuclei: rate of decay
- Students learnt about determination of half-life period - secular equilibrium and decay series. Modes of decay: alpha, beta,gamma and orbital electron capture - nuclear isomerism - internal conversions – Q value - nuclear cross section - threshold energy and excitation functions.
- Students have Particle acceleration and counting techniques: linear accelerator - cyclotron and synchrotron - betatron - G. M. counter - proportional and scintillation counters.

## Nuclear Chemistry - II

- Students have learnt Different type of nuclear reactions with natural and accelerated particles - transmutation - stripping and pick-up - spallation - fragmentation, etc.
- They have learnt fission -characteristics of fission reaction - product distribution and theories of fission – fissile and fertile isotopes – U235 , U238 , Th232 and Pu239 - atom bomb - nuclear fusion – stellar energy - synthesis of new elements
- Students have principles underlying the usage of radioisotopes in analysis - agriculture - industry and medicine - mechanism of chemical reactions -uses of radioisotopes in analytical chemistry - isotopic dilution analysis – neutron activation analysis and dating methods.

## Physical chemistry-II-17PCH08

### Statistical and irreversible thermodynamics

- Students have learnt the consent of thermo dynamical and mathematical probabilities.
- Students have understood the heat capacity of solids.

### Chemical kinetics-II

- Students have learnt to study the fast reactions of same methods.
- Students have learnt the kinetics of complex reaction.

### Surface chemistry and catalysis

- Students have learnt the langmuir, freundlich and BET adsorption catalysis.

### Quantum chemistry -II

- Students have learnt the origin of quantum numbers .
- They are understood the approximation method and it's applications.

### Group theory-II

- Students have learnt the vibrational modes of non linear molecules.
- They are understood the hybridisation of non-linear molecules.

## Experimental Methods in Chemistry -17PCHE03

### Surface Imaging

- Students have learnt about principle, instrumentation and applications of SEM, STM, SPM, SAM and TEM.
- Student's accures knowledge about technique involved in the modern instruments which is applicable for investigation of the surface characteristic of the materials.

### Chemical Analysis

- Students have understand the technique involve in X-ray Diffraction, Fluorescence Spectroscopy.
- Students have learnt about AA Spectroscopy, EMR and its important components in the instrumentation.

### Electro analytical Techniques

- Students have gained knowledge about the qualitative and quantitative analysis under Electro analytical methods like Polarography and rule of DME.
- Student's accures proper knowledge about estimation on various substance under Amperometric methods.

### Separation Methods – I

- Students have understand that How the components being separated by various Chromatographic technique.
- Students have learnt about various terms involved in Chromatographic methods particularly GC, Retention volume, resolution etc.,

### Separation Methods – II

- Students have learnt about the progress of GEL Chromatography like GEL Preparation Column packing and Detectors.

Students have understand that the function material used and applications of Ion exchange Chromatography

### Inorganic Chemistry – III - 17PCH09

#### Bonding in Organometallic Complexes and metal carbonyls

- Students have learnt 18 electron rule, EAN, classification of organometallic compounds.
- Students know that the synthesis - structure and reactions involved in metal carbonyls.

#### Metal alkyl, Alkylidene and Alkylidyne complexes

- Students have understand the structure – synthesis and stability alkylidene and alkylidyne complexes.
- Students have learnt that the nature of bond between M-C and C-O in organometallic compounds.

#### Metal Alkene and Alkyne complexes

- Students have understand how to synthesis metal alkene and alkyne complexes and know that its characteristics and structure, bonding it.
- Students have learnt about Wacker process hydrogenation – hydrosilation process.

#### Organometallic Sandwich complexes

- Students have achieve knowledge about synthesis metallocenes complexes and elaborate study about sandwich compounds.
- Students have understand that the synthesis and characterization arene and mutidecker complexes.

#### Organometallic Chemistry applications in catalysis

- Students knows about the application of the organometallic compounds in homogenous catalytic reactions.
- Students understand about isomerisation of alkenes, hydrogenation, hydroformylation and hydrosilation of alkenes and fluxional molecules.

### Nano Materials and Green Chemistry-17PCHE06

- Students will acquire knowledge about the basics, different types of synthetic method and application of nanomaterials in various fields.
- Students learnt about the tools for characterization of nanomaterial.
- Students have knowledge about the drastic change in properties when the size and shapes are changed.
- Students learnt about CNT synthesis and their applications.
- Knowledge about the concept of green synthesis, atom economy and atom efficiency.
- They learnt about the green solvent for the green synthesis and were able to follow different Synthesis methods of green synthesis.

## Practical

### Organic Qualitative Analysis-17PCHP01

- Students have learnt what are apparatus used and how to organic apparatus.
- Students have learnt Principles involved in separation of organic compounds.
- Students have understood 2-naphthyl methyl ether from 2-naphthol.
- Students have learnt preparation of resacetophenone from acetophenone.
- Students have preparation of methyl orange from sulphanilic acid.
- They are understood principle and preparation organic techniques.

### Inorganic Qualitative Analysis-17PCHP02

- Students can able to analysis the given sample mixture.
- They learnt about the preparation of complexes and colorimetric estimation of metal ions.

### Physical Chemistry Practical-I (17PCHP03)

- Students have learnt the definition molarity, molarity and normality.
- Students have learnt how to prepare the concentrated solution and weight calculation.
- Students have learnt the order of the chemical reaction in acid catalyst hydrolysis of an ester.
- They are understood the association factors of acids in organic solvents by distribution method.
- Students have learnt the conductance, specific conductance and equivalent conductance of strong electrolyte.
- Students have understood the acid-base titrations by conductometry methods.
- They are understood the identification of eutectic composition and eutectic temperature of the given compounds.

### Organic Qualitative Analysis- 17PCHP04

- Students have learnt organic estimation such as phenol, aniline, and glucose.
- Students have learnt preparation of organic compounds such as aspirin from methyl salicylate, benzanilide from benzophenone.
- Students have understood extraction of natural products such as caffeine from tea leaves.
- Students have learnt preparations of citric acid from lemon.
- Students have learnt the separation of mixture of orthodontist and para nitroaniline by chromatographic technique
- They are understood principle and preparation of paper and thin layer chromatography.

## Inorganic Chemistry Practical -II -17PCHP05

### Quantitative analysis of complex materials

- Students have learnt how to estimate quantitative materials like Fe and Mg, Fe and Ni, Cu and Ni, Cu and Zn Volumetrically as well as gravimetrically.

### Analysis of Ores

- Students have understand the procedure in determination of Percentage of martials present in the given Ores like Ca and Mg in Dolomite, Percentage of  $MnO_2$  in Pyrolusite and Lead in Galena.

### nalysis of Alloys

- Students have gained practical knowledge by determination of individual metal present in the metal alloys. Like Sn and Pb in Solder, Cu and Zn in Brass and Cr and Ni in stainless steel.

### Preparation of the complexes

- Students know how to prepare some inorganic complexes in laboratory scale, like Sodium hexanitro cobalt (III), Hexaammine cobalt (III) chloride, Prussian Blue.
- Students learnt about the laboratory conditions, safety hygienic and how to handle the laboratory chemical and instruments.

## Physical Chemistry Practical-II (17PCHP06)

- Students have learnt the electrode potential of Cu, Ag, and Zn.
- They have learnt stability constant of complexes.
- Students have understood solubility product of a sparingly soluble salt, Redox titrations.
- They are understood the titration of mixture of halides by emf measurements.