

## VIJAYANAGAR COLLEGE, HOSAPETE

### DEPARTMENT OF CHEMISTRY

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#### Program Outcome, Course Outcome and Program Specific outcome of B.Sc Degree for the Academic year -2020-21

##### Program Outcome:-

##### By the end of program students will be able to:-

1. **PO. 1:** To create enthusiasm among students for Chemistry and its application in various fields of life.
2. **PO. 2:** To provide students with broad and balanced knowledge and understanding of key concepts in Chemistry.
3. **PO. 3:** To develop in students a range of practical skills so that they can understand and assess risks and work safely measures to be followed in the laboratory.
4. **PO. 4:** To develop in students the ability to apply standard methodology to the solution of problems in chemistry.
5. **PO. 5:** To provide students with knowledge and skill towards employment or higher education in Chemistry or multi-disciplinary areas involving Chemistry.
6. **PO. 6:** To provide students with the ability to plan and carry out experiments independently and assess the significance of outcomes and to cater to the demands of chemical industries of well-trained graduates.
7. **PO. 7:** To develop the ability to adapt and apply methodology to the solution of unfamiliar types of problems.
8. **PO. 8:** To instil critical awareness of advances at the forefront of chemical sciences, to prepare students effectively for professional employment or research degrees in chemical sciences and to develop an independent and responsible work ethics.

At the end of the program students gain knowledge and skill in different areas of chemistry and are able to understand the importance of chemistry in day to day life. After completion of program they are well prepared to select the various fields of chemistry of their choice such as Teacher (B.Ed), Master's Degree, as Chemist in industries etc.

## Course Outcome:-

### B.Sc First Semester

#### PAPER-1:-

##### UNIT-I: INORGANIC CHEMISTRY-1 :-

After completing the course students are able to understand wave-mechanical model- application of Schrodinger wave equation to H-atom & physical significance of  $\psi$  &  $\psi^2$ . They get knowledge about quantum numbers n, l, m & s, probability distribution curves, and shapes of s, p & d orbitals. Students come to know various principles based on arrangement of electrons in an atom such as Pauli exclusion principle, Hund's rule of maximum multiplicity, Aufbau principle & (n+l) rule. In the Chapter Periodic properties students understand various properties of elements and trends in periodic table such as atomic & ionic radii, ionization energy, electron affinity and electronegativity etc. In the Chapter Chemical Bonding they learn different types of chemical bonds factors favouring the formation and structure of various ionic crystals.

##### UNIT-II:ORGANIC CHEMISTRY-1 :-

In this course students understand causes of bond formation, types of bonds with examples. They learn about various types of hybridization such as  $sp^3$ ,  $sp^2$ ,  $sp$  hybridizations. They understand the difference between sigma and pi bonds. In the Chapter Organic reactions and their mechanism students learn about various types of organic reactions types of bond cleavage. types of reagents, reactive intermediates and stability, free radicals and carbenes along with definition with examples. In the Chapter Stereochemistry of organic reactions students learn about concept of isomerism and types with definition and examples, and about elements of symmetry. Now students understand importance of chirality of carbon and its effect on structure of carbon and its compounds.

##### UNIT-III: PHYSICAL CHEMISTRY-1:-

In this course students understand about Critical phenomenon, PV-isotherms of real gases, the isotherms of carbon dioxide, relation between critical constants and Vanderwaal's constants, and importance of the law of corresponding states and reduced equation of states. In the Chapter Physical properties of liquids students gain knowledge about different properties of liquid such as surface tension, viscosity and refractive index and their practical applications in using instruments such as stalagnometer, viscometer and refractometer. Application of parachor and molar refractivity is also studied in elucidating the structure of benzene and quinine. In the Chapter Solid state students learn about differences between crystalline and amorphous solids. Laws of crystallography and Symmetry elements.

##### CHP-101: -LABORATORY COURSE-1:-

In this course students gain practical skills in handling apparatus such as burette, pipette, weighing of substance, preparation of solution, use of indicator and procedure in carrying out titration experiments. They learn about different types of expression of concentration of solution such as normality, molarity, ppm etc. They are now able to understand primary and secondary standard solution.

## B.Sc Second Semester

### PAPER-2:-

#### UNIT-I: INORGANIC CHEMISTRY-2:-

In this course students able to understand the physical properties of elements of s-block elements such as density, melting points & boiling points, flame coloration etc.They understand relation between lattice energy and hydration energy.In the Chapter p-block elements they gain knowledge about halides of boron, relative strength of  $\text{BF}_3$ ,  $\text{BCl}_3$  &  $\text{BBr}_3$  as Lewis acids, diborane and it's preparation, structure & bonding.Students are able to understand various properties with respect to halogens and types of interhalogen compounds their preparation and structure of  $\text{ICl}_3$ ,  $\text{IF}_5$  &  $\text{IF}_7$ .they develop knowledge about noble gases,structure & bonding in  $\text{XeF}_6$  and  $\text{XeO}_3$ , Clathrates. In the Chapter Chemical bonding -2 they develop the knowledge about concept of various theories on chemical bonding such as VBT,VSEPR,MOT(LCAO).

#### UNIT-II: ORGANIC CHEMISTRY-2:-

In this course they understand the preparation of alkanes and cycloalkanes and their reaction with mechanism.They get familiarize with Bayer's strain theory, Sachse-Mohr theory of strainless rings.In the Chapter Alkenes, Dienes and Alkynes, they understand the synthesis of alkenes,dienes and alkynes and their reactions with mechanism.In the Chapter Arenes and aromaticity students understand the concept of benzene and it's derivatives and effect of ortho,para and meta orientation in monosubstitued benzene.

#### UNIT-III: PHYSICAL CHEMISTRY-2:-

In the Chapter Liquid state students gain knowledge about inter molecular forces in liquids, structural differences between solids, liquids and gases, and differences between liquid crystals, solid and liquid structure,properties and applications of liquid crystals. In the Chapter Chemical kinetics students gain knowledge about basic concepts such as the rate, order and molecularity of reaction and methods of determination of order of a reaction.Various theories on unimolecular and bimolecular reactions are studied. Numerical problems on second order reactions are solved to develop the skill in understanding the concept.In the Chapter Colloids students develop understanding about origin of charge on colloidal particle and it's applications.

#### CHP-201:-LABORATORY COURSE-2:-

In this course students gain knowledge about organic qualitative analysis. They are able to analyse organic compounds and predict the type of compound by carrying out various tests. Students are made to understand to use of sodium fusion tube, capillary tube and Theil's tube in determining melting point of compound and it's derivative.

## B.Sc Third Semester

### PAPER-3:-

#### UNIT-I: INORGANIC CHEMISTRY-3:-

In this course students understand the various periodic trends of first, second and third transition series such as electron configuration, ionic radii, ionization energy, density, melting point, oxidation states & their stability, magnetic properties, color of compounds and catalytic properties.

In the chapter chemistry of lanthanides & actinides students continue to gain knowledge about various periodic trends of f-block elements. Concept of separation of lanthanides by ion exchange method is also studied. In the chapter acids & bases students are made to understand various concepts of acids and bases their applications and limitations.

#### UNIT-II: ORGANIC CHEMISTRY-3:-

In this course students understand the concept of various organic halogen compounds such as alkyl halides, alkenyl halides & acyl halides their definition, preparation, reactions, and bond breaking and bond breaking in the reaction mechanism. In the chapter alcohols students gain knowledge about types of alcohols, isomerism, preparation and are able to distinguish between primary, secondary and tertiary alcohols by Lucas test and dichromate test. In the chapter phenols students are made familiar with classification, manufacture and mechanism of named reactions of phenols. In the chapter Carboxylic acids and acid derivatives students continue to understand the classification, methods of preparation, reactions, effect of substituents in carboxylic acids and acid derivatives.

#### UNIT-III: PHYSICAL CHEMISTRY-3:-

In this course students gain knowledge about concept of quantum mechanics such as Black body radiation, Planck's radiation law, photoelectric effect, Compton effect, De-Broglie hypothesis, Heisenberg's uncertainty principle, Eigen values, postulates of quantum mechanics. In the chapter thermodynamics students gain knowledge about concept of thermodynamics, its laws, limitations and applications. In the chapter Adsorption students gain knowledge about concept of different theories of absorption and its application. In the chapter Distribution law students understand the concept of association and dissociation of solute with solvents.

#### CHP-301:- LABORATORY COURSE-3:-

In this course students understand the basic principles of scheme of qualitative analysis such as solubility, solubility product principle, common ion effect, complex formation etc. and various reaction equations for acidic radicals tests, basic radicals group precipitations, group analyses and cause of flame coloration. Students develop practical skill of separation, centrifugation, washing the precipitate and use of semi-micro apparatus in analyzing when a small amount of substance is provided.

## B.Sc Fourth Semester

### PAPER-4:-

#### UNIT-I:INORGANIC CHEMISTRY-4:-

In this course students gain knowledge about co-ordination compounds,Werner's theory of complexes,classification of ligands,geometry of complexes,Isomerism in coordination compounds

Stability of complexes and factors affecting the stability of complexes. In the chapter Metal-Ligand bonding in complexes they further study and understand various other theories applied to co-ordination compounds such as Sidgwick's electronic interpretation of coordination, Effective atomic number (EAN) rule,Valence bond theory (VBT), and Crystal field theory (CFT), their postulates,limitations and application to square planar,tetrahedral and octahedral complex.In the chapter Oxidation – Reduction students become familiar with Redox potentials, redox cycle,and redox stability.They understand interpretation of potential data by diagrammatic representation of potential data such as Latimer diagrams,Frost diagrams, Pourbaix diagrams.

#### UNIT-II: ORGANIC CHEMISTRY-4:-

In this course students understand the concept of organic compounds such as Ethers and Epoxides,their definition, nomenclature,synthesis and different methods of preparation. In the chapter Aldehydes and ketones students gain knowledge about preparation, mechanism of various named reactions with respect to aldehydes and ketones such as nucleophilic addition,condensation reactions,Cannizzaro and Perkin's reaction.Mannich reaction and Wolf-Kishner reduction are also studied. In the chapter Organic compounds of nitrogen students gain knowledge about different aliphatic and aromatic compounds of nitrogen such as amines,nitrobenzene,benzene diazonium chloride.Mainly students are able to understand the importance of basic character in amines.

#### UNIT-III: PHYSICAL CHEMISTRY-4:-

In this course students are able to understand and differentiate ideal and non-ideal solutions and effect of pressure, boiling point by construction of vapor pressure – composition and boiling point – composition diagrams. Students gain knowledge about principle of fractional distillation, azeotropic mixtures and partially miscible liquids such as phenolwater,triethylamine-water & nicotine-water systems.In the chapter phase equilibria students understand basic terms such as phase, component and degree of freedom,and application of phase equilibria for one component system (water), for two component system (Lead-silver). Solid-liquid equilibria, KI-water system.In the chapter colligative properties students understand the Concept of vapor pressure,Elevation in boiling point,Depression in freezing point and their relationship to the lowering of vapor pressure. Ebullioscopic constant of solventcryoscopic constant of the solvent, relation between depression in freezing point andmolecular mass of the solute are also studied.

#### CHP-401:LABORATORY COURSE-4:-

At the end of this course students gain knowledge and skill in use of instruments such as Ostwald's viscometer,Stalagnometer for determination of viscosity and surface tension by using different organic liquids.They understand use of specific gravity bottle in determination density of liquids.Experiments based on first order and second order reactions allow students to understand practical application of chemical kinetics.

**PAPER-5:- (PAPER-5.1)**

**UNIT-I:INORGANIC CHEMISTRY-5:-**

In this course students study and understand the concept of types of magnetic behavior of complexes such as diamagnetism, paramagnetism, ferromagnetism & antiferromagnetism, and magnetic moment of complex ions and magnetic properties of octahedral and tetrahedral complexes based on crystal field theory. Measurement of magnetic susceptibility and magnetic moment by Guoy method is also studied. In the chapter Electronic spectra of transition metal complexes students understand types of electronic transitions and selection rules for electronic transitions, which further allow them to draw Orgel energy level diagram for different energy states. In the chapter Inorganic chains, rings, cages and clusters students study and understand preparation, properties and structure of various inorganic sheet like structures such as Silicates, Sulfur nitrides, Borazines & cyclophosphazenes and Carboranes.

**UNIT-II: ORGANIC CHEMISTRY-5 :-**

In this course students are made aware of modern approach to organic chemistry by studying spectroscopic methods its advantages, general principles, basic components of spectrophotometer. Salient features, principle and applications of Infra red (IR) spectroscopy, Nuclear magnetic resonance (NMR) spectroscopy study gives student to upgrade level of thinking and approach in analyzing organic compounds and collection of data. In the chapter Organo-sulphur compounds students gain knowledge about behavior, preparation, chemical properties of aromatic compounds when different substituents like sulphur (Ethane thiol and Diethyl sulphide are attached). In the chapter amino acids students study and understand the behavior of long chain peptides, Classification, synthesis and structure of amino acids, acid-base behavior and isoelectric point of amino acid.

**UNIT-III: PHYSICAL CHEMISTRY-5:-**

In this course students understand the concept of effect of light on chemical reactions by studying different laws such as Grothus – Draper's law, Lambert's law, Beer's law, Einstein's law of photochemical equivalence. Quantum yield, Mechanism of photochemical processes, Chemiluminiscence, fluorescence, phosphorescence, photo inhibition & photo sensitization allow students to gain more knowledge of effect of light on chemical reactions. In the chapter Physical properties & molecular structure students understand the concept of Dipole moment, types of polarization, and use of bond polarity in deciding the shapes of  $\text{CO}_2$ ,  $\text{H}_2\text{O}$ ,  $\text{BF}_3$  and  $\text{CCl}_4$ .

**CHP-501:- LABORATORY COURSE-5:-**

At the end of this course students who already gained knowledge about organic qualitative analysis in second semester will apply the skill and separate given binary mixture by using scheme of separation and analyse the organic compound.

**PAPER-6:- (PAPER-5.2)**

**UNIT-I:INORGANIC CHEMISTRY-6 :-**

In this course students understand the concept of different analytical terms such as mean & median, precision, standard deviation, relative standard deviation. Accuracy, absolute error & relative error etc, and treatment of analytical data in statistics. Sampling of solids, liquids and gases is studied as a part of course. In the chapter Non-aqueous solvents students gain knowledge of solvent other than water such as liquid  $\text{NH}_3$  and liquid  $\text{SO}_2$  is also reliable to carry out many chemical reactions. In the chapter Nuclear chemistry students become familiar with structure of nucleus, nuclear models (shell model), nuclear stability, radioactivity and nuclear fission & nuclear fusion.

**UNIT-II: ORGANIC CHEMISTRY-6:-**

In this course students gain knowledge of reactive methylene compounds such as ethyl acetoacetate, its synthesis and synthetic applications of ethyl acetoacetate. In the chapter Carbohydrates students understand the concept of various ways of formation and representation of glucose and fructose. In the chapter Oils, fats, soaps and detergents students gain knowledge about use and function of long chain fatty acids in day to day life. In the chapter synthetic polymers synthesis and application of some of man made polymers such as teflon, nylon and terylene are made familiar to students. In the chapter Synthetic dyes students understand the synthesis and application of colour to fabrics such as methyl orange, bismarck brown & malachite green.

**UNIT-III: PHYSICAL CHEMISTRY-6:-**

In this course students understand the concept of cell, half cell and its representation, different types of conductance and its variation upon dilution and laws governing the conductance and its applications. In the chapter polymers students study the various basic terms of polymers, determination of molecular weight of polymers by viscosity method and its influence of molecular weight on mechanical properties of polymers.

**CHP-502:- LABORATORY COURSE – 6:-**

In this course students apply practical skills in determining concentration of solution by conductometric, potentiometric titration experiments. Students understand the use and practical application of colorimeter and refractometer.

**PAPER-7:- (PAPER-6.1)**

**UNIT-I:INORGANIC CHEMISTRY-7:-**

In this course students become familiar with some of the industrial materials such as cement, glass and paints and pigments, their composition, manufacture, physical and chemical properties, and mainly uses. In Chapter Environmental chemistry students are made aware of environment and its resources and pollutants causing harm to nature such as SO<sub>x</sub>, NO<sub>x</sub> & CO<sub>x</sub>, Water pollution etc. In the chapter Inorganic polymers students understand about general characteristics, preparation, properties, types and applications of Inorganic polymers such as Silicones and Polyphosphazenes.

**UNIT-II: ORGANIC CHEMISTRY-7 :-**

In this course students become familiar about natural products such as Alkaloids & Terpenes and their structural elucidation with synthesis and uses of some alkaloids such as nicotine, quinine, atropine, and terpenes such as citral, menthol and camphor. In the chapter Enzymes, hormones and vitamins students gain knowledge of characteristic properties of enzymes, mechanism of enzymatic action, synthesis and importance of hormones such as adrenaline, thyroxine and insulin and biological importance of vitamin A, B<sub>1</sub>, B<sub>2</sub>, C and D in daily balanced diet of human life. In the chapter Peptides and proteins students understand the importance of peptide linkage, which further leads to formation of proteins and its uses in good health and normal functioning of bodily functions in humans.

**UNIT-III:PHYSICAL CHEMISTRY-7:-**

In this course students understand the use and basic features of different spectrophotometer. In the chapter Rotational spectrum students understand the concept of determination of structure of polar molecules in gas phase by measurement of spectra of polar molecules in absorption or emission by microwave spectroscopy or by far infrared spectroscopy. In the chapter Vibrational spectrum students understand the measurement of interaction of Infra red radiation with matter through absorption, emission or reflection in gas, solid or liquid matter. In the chapter Raman spectrum students understand and differentiate between Raman Spectrum and IR spectrum and become familiar with the effect of scattering of light, which includes both scattering of light at the same wavelength as incident light and inelastic scattering at different wavelengths due to molecular vibrations.

**CHP-601: LABORATORY COURSE-7:-**

In this course students understand the gravimetric method of determination of element in given solution by precipitation method. Students develop practical skill of use of washing solution, air cone, Whatmann filter paper, heating and various other process involved in gravimetric analysis.



## B.Sc Sixth Semester

### PAPER-7:- (PAPER-6.2)

#### UNIT-I:INORGANIC CHEMISTRY-8 :-

In this course students gain knowledge about different organometallic compounds such as Organo-lithium & Organo-Aluminium compounds their preparation,properties,structure and bonding.In the chapter Bio-Inorganic chemistry students become familiar with some of biological elements such as myoglobin and haemoglobin and enzymes such as carbonic anhydrase, carboxy peptidase,peroxidase,and cytochrome, their structure,function in normal functioning of body.In the chapter Materials chemistry students understand the importance of some of multi-phase materials,composites and nano materials and their applications.

#### UNIT-II:ORGANIC CHEMISTRY-8:-

In this course students study the various organic compounds containing hetero atom in their structure such as furan, pyrrole, thiophene and pyridine and their molecular orbital picture, aromaticity and electrophilic substitution reactions.In the chapter Food analysis students gain knowledge about analysis of various parameters such as moisture,ash, and adulterants in food which lead them to know the difference between good food and adulterant food.In the chapter Medicinal chemistry students become familiar with various types of medicinal drugs such as aspirin, paracetamol and sulphanilamide.antipyrine and chloramine-T their synthesis and applications in curing various adverse effects in humans.

#### UNIT-III: PHYSICAL CHEMISTRY-8 :-

In this course students gain knowledge about Electrolytic and Galvanic cells, types of electrodes, and their use in determination of pH and EMF in potentiometric titrations.In the chapter Electrochemical energy sources students become familiar with Primary cell (dry cell), secondary cell (Ni-Cd cell), Fuel cells. Construction and working of hydrogen-oxygen fuel cell and its importance.

#### CHP-602 :-LABORATORY COURSE-8:-

In this course students apply practical skills in determining degree of dissociation, dissociation constant of solution by conductometric,EMF by potentiometric titration experiments. Students understand the use and practical application of colorimeter and refractometer.

### Program Specific Outcome:-

After learning chemistry UG program students acquired the knowledge to work in the field of chemistry:-

1. After handling the instruments like refractometer, potentiometer, colorimeter, conductometer and gravimetric techniques, volumetric analysis, separation and analysis of organic mixtures enables the students to work in various chemical industries.
2. After acquiring basic knowledge of chemistry they can pursue for higher education.
3. After learning food chemistry students can go for the Labs in which quality of food materials are assessed.
4. After learning drug chemistry students can go for the industries based on drug production.