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VIJAYANAGARA COLLEGE, HOSAPETE

DEPARTMENT OF P. G. STUDIES & RESEARCH IN CHEMISTRY

Program Outcome, course out Come and Program-specific outcome for the academic year-2020-21

Program Outcome:

1. They were able to understand the importance of chemistry in day-to-day life.
2. They were able to understand humankind's chemical and physiological actions and the environment.
3. They understood the fundamental aspect of chemistry and its effect and benefit to society.
4. They understood the instrumental techniques and skills for solving mysterious facts and figures.
5. They were able to skill up the laboratory techniques.
6. They understood the basic principles of analytical tools and studied their pharmaceutical and medicinal application.
7. They were able to understand the biochemical actions of organic and inorganic molecules.
8. They were able to understand every atom's physical and chemical properties in a periodic table.
9. They were able to provide hands-on experimental analysis and handling of reaction and understand its mechanism.
10. Students can function as members of the interdisciplinary problem-solving team, such as in medical, drug designing, pollution, adulterations, forensic science department, etc.

To provide critical knowledge on chemistry's theoretical and experimental aspects to prepare them for careers as proportional in chemistry. After learning the program, they may be able to go into various filed of chemistry such as Teacher, R & D, QC, QA, and entrepreneur. They can create social awareness of the benefit and disadvantages of chemistry.

Course outcome:

FIRST SEMESTER

CHI HCT: 1.1-Concepts and Models of Inorganic Chemistry

After completing these courses, the students can understand the basic concept of the atom. And they can understand the physical and chemical properties of atoms in atomic and molecular form. They will understand the various theories such as VBT, VSEPR, MO-LCAO by taking multiple examples. From the chemistry of transition metal, students understand the physical, chemical, and catalytic properties. The students can understand lanthanides and actinides' physical, chemical, magnetic, and spectral behavior. In unit-III, students understand the physical and chemical properties of s and p block elements. They can also understand the different properties such as interhalogen, noble gas compounds and silicate, and Zeolites, which have more incredible applications in the biomedical and industries. In Unit-IV, students can understand the HSAB and acid-base concepts. They were able to account for the factor which influences the change of properties in various media.

CHO HCT: 1.2- Theoretical Organic Chemistry

In this course, students can understand the bonding in organic molecules and aromaticity, H-bonding, etc. The students can understand the comprehensive studies of the basic concept of organic chemistry. In Unit-II, students understood how stereochemistry helps design stereospecific, chemospecific, and regiospecific organic molecules and how stereochemistry has a broad scope in biomedicines application. In Unit-III, students learned the reaction mechanisms, reactive intermediates & Named reactions. In Unit-IV, students understood how the pericyclic reaction undergoes at different reaction conditions and can understand the theoretical aspect of pericyclic reaction.

CHP HCT: 1.3- Chemical Thermodynamics and Chemical Kinetics.

In this course, students learned the chemical thermodynamics and application of thermodynamics so that they able laws of thermodynamics, Maxwell's relations, thermodynamic equations of state, limitations of Van't Hoff's equation, Nernst Heat theorem & its applications. To understand the deductions of laws of Raoult's ebullioscopy, cryoscopy, and osmotic pressure. Quantitative treatment of Le-Chatelier principle. In Unit-II, students learn the Theories of Reaction Rates, Chemical Kinetics, and Reactions in Solution.

Unit-III, students can understand the catalysis, acid-base catalysis, Kinetics of enzyme-catalyzed reactions-Michaelis- Menten equation. Effect of pH, temperature & inhibitors. In Unit-IV, students learned the electrochemistry theories and application of electrochemistry.

CSA SCT: 1.4- Analytical Chemistry – I

In this course, students learned the concept of errors and how the error can be minimized during experimental and the research field. They also learned the correlation and regression, linear regression, comparison of more than two means, Least square method, six sigma concept, etc. In Unit-II, students learned titrimetric and gravimetric analysis, which are very important to analyze the compounds quantitatively and qualitatively. Unit-III makes the students understand the separation and purification of organic and inorganic compounds by adopting various analytical techniques. In Unit-IV, students can study the theoretical aspect like work and principal of Conductometry, Potentiometry, Voltammetry, Amperometry, and Electrogravimetry.

Experiment: CHI HCP: 1.6- Inorganic Chemistry Laboratory-I

Students undergo the titration and separation techniques of inorganic and organic compounds in this course. This course is helpful to understand theoretical and laboratory skills. They will be experts in estimating inorganic salts using different titrant at different pH.

Experiment: CHO HCP: 1.7- Organic Chemistry Laboratory-I

In this course, students can synthesize organic molecules such as p-bromoaniline, p-nitroaniline, acetanilide, and 7-hydroxy-4-methyl coumarin. At the end of these courses, students can handle the independent reaction at the laboratory. They will adopt technical skills to handle any reaction.

Experiment: CHP HCP: 1.8 -Physical Chemistry Laboratory-I

This course taught students the independent handling of analytical instruments such as conductometer and potentiometers. The students are experts in determining the rate of constants, the energy of activation, rate constants at two different temperatures, and activation energy. They can perform the conductometric titration of the mixture of HCl and CH₃COOH against NaOH and a mixture of HCl and CH₃COOH and CuSO₄ against NaOH.

SECOND SEMESTER

CHI HCT: 2.1- Coordination Chemistry

In this course, students learn metal-ligand bonding through various theories such as Crystal Field Theory (CFT), crystal field stabilization energy(CFSE), effects of crystal field splitting, the energy of ligation, stabilities of oxidation states. The John-Teller distortion in metal complexes and metal chelates was studied. In Unit-II, students learned Metal Complexes' geometry, magnetic and spectral properties. These theoretical concepts will be beneficial to interpret the unknown or novel transition metal complexes (organometallic chemistry research). In Unit-III, they expected to learn the Metal-Ligand Equilibria in Solution and kinetics and mechanism of reactions of Coordination Compounds. In Unit-IV, students learn the classification & nomenclature of organometallic compounds. Same time, they understood the concept of 16 & 18 electron rules and the electron counting by neutral atom & oxidation state method. They will learn the synthesis, structure & bonding in metal olefins and metallocenes.

CHO HCT: 2.2- Heterocyclic Chemistry, Natural Products Reagents in Organic Synthesis

In this course, students learned synthesis and biological importance in heterocyclic chemistry. They are experts in name reaction and its mechanisms such as Scher indole synthesis, Skraup synthesis, Bischler-Napier Laski synthesis, mechanism of electrophilic substitution reaction of indole, quinoline, and benzofuran. Students will learn the phytochemical or chemistry of natural products, alkaloids, terpenoids, and steroids in Unit-II and their synthesis. In Unit-III, students are expected to know the carbohydrates, proteins, and nucleic acids. They understood how organic chemistry plays a vital role in biological activity in the living organism. In Unit-IV, students learned the reagent in organic synthesis and their mechanism. This unit helps the students to a deep understanding of reaction mechanisms using different reagents and conditions.

CHP HCT: 2.3- Electrochemistry, Quantum, and Photochemistry

In this course, students can understand the electrochemistry theories like Debye-Huckel, Debye Huckel-Onsager equation, Helmholtz-Perrin, Gouy-Champman, and Stern electrical double layer. They were able to comprehend EMF and Energetics of cell reactions and their

effect on temperature (T), pressure (P), and concentration (C). They have understood the principle and working of batteries. In Unit-II, they have studied the irreversible electrode process. The students can understand quantum mechanics superior than the classical mechanics. They know the various theories and mathematical derivations algebra of operators, commutative and non-commutative operators, linear operators, Laplacian operator, Hamiltonian operator, Eigen-value, Eigen-function, Hermitian operator, turn overrule, atomic units. They can learn the Application of the Schrodinger equation, wave equation for H-atom, Schrodinger equation to the rigid rotator, and the harmonic oscillator. In Unit-IV, students learned photochemistry and its application in the photodegradation of dyes(IC), pesticides (DDT), and industrial effluents. Effect of photodegradation on COD values.

CSA-SCT 2.4- Analytical Chemistry-II

In this course, students can understand the theoretical aspects of molecules and how molecular orientation and structure affect the electromagnetic spectrum change due to changing the structure. It will help interpret the unknown compound from analytical techniques. In unit-I, students learned the geometry of the molecules, symmetry operation and symmetry elements orthogonality theorem, character tables, and their construction (C_{2v} , C_{2h} , C_{3v})-Mullikan symbols, molecular models. In Unit-II, students learned electromagnetic radiation and UV-Visible spectroscopy principles and theories and their application. In Unit-III, they understood the working principles of Flame Photometry, Atomic Absorption Spectrometry, Atomic Emission Spectrometry, Inductively Coupled Plasma, Nephelometry, and Turbidometr, which are very useful in developing analytical skills. In unite-IV, students learned a set of analytical instrument techniques such as Thermo Gravimetric Analysis (TGA), Differential Thermal Analysis (DTA), and Differential Scanning Calorimetry (DSC), which are have more excellent application QA, QC, academic and industrial research.

CHI HCP: 2.6 -Inorganic Chemistry Laboratory-II

In this laboratory course, students learned hands-on practical skills. They identified the radical by experimental methods on semi-micro Inorganic qualitative analysis (minimum of eight mixtures with three cations, one rare element, and two anions).

(Li^+ , Mo^{++} , W^{4+} , Zr^{4+} , Ce^{4+} , Ti^{4+} , U^{6+} , Cations and CO_2^- , $CHCOO^-$, BO^- , PO_3^- , F^- Anions) .

CHO HCP: 2.7-Organic Chemistry Laboratory-II

In this laboratory course, they learned hands-on experimental skills of systematic qualitative analysis of organic binary mixture (solid+ solid) with derivative preparation. They will learn the skill of identification of unknown organic compounds by performing various chemical reactions and synthesizing the derivatives of any one of the compounds. After completing this course, students handle the reaction independently. These laboratory skills are crucial in research and development areas (academic and industrial research).

CHP HCP: 2.8 Physical Chemistry Laboratory-II

After learning of these courses, students possess the practical skill to determine absorption spectra of colored complexes and the Spectrophotometric titration of FeSO_4 against KMnO_4 . They can perform various experiments such as Adsorption of acetic acid on charcoal; Oxalic acid on activated charcoal.

THIRD SEMESTER

In this is semester, students learn the various aspect of chemistry.

CHS HCT: 3.1- Spectroscopy-I

In this course, students learned spectroscopic or analytical instrumentation such as Microwave Spectroscopy, Vibrational Spectroscopy, Raman Spectroscopy, Infrared Spectroscopy, H^1 , and C^{13} -NMR X-Ray Diffraction, and Photoelectron Spectroscopy. These instrumental techniques are essential to identifying unknown compounds by taking the spectrum of compounds. These instrumental skills are crucial for any person willing to take up research or R& D. After learning all these techniques, and students can solve different kinds of the spectrum and understand the application in various fields.

CHI HCT:3.2-Nuclear Chemistry and Materials Science

Nuclear chemistry and material science play a vital role in the current ear, so after learning these courses, students could deeply understand atoms, nuclear models, radioactivity, and its decay. They understood the principle and working of the nuclear reactor and its application. The students can understand what is induced by radioactivity and the reaction of nuclear fission; fusion and reprocessing of spend fuels. In unit-III, students will know about atomic packing, mechanical properties of crystals, phase diagrams, and Phase transitions. In Unit-IV, they learn the electronic properties, band Theory, and organic solid-state chemistry of organic charge-transfer complexes and new superconductors.

CHP HCT: 3.3-Advanced Physical Chemistry

In this paper, students learned the physical properties of molecules by applying various theories of thermodynamic probability and most probable distribution, Maxwell-Boltzmann distribution law. They can understand the calculation of thermodynamic properties and partition functions. In Unit-II, they understood the concepts of laws of thermodynamics, force energy, chemical potential, and entropies. In Unit-III, they studied the applications of Quantum Mechanics. In Unit-IV, students can understand solid-state chemistry. They understood the Semiconductors bonding and conductivity, mechanism of conductivity, energy bands in semiconductors, impurity conductors, p-n and n-p-n junctions. Same time they learn the importance of semiconductors and superconductors.

CSE SCT: 3.5-Environmental and biochemical analysis

In this paper, students learned the various aspects of environmental segments, air Pollution, and Soil Pollution. They can understand what are factors affect pollution and how to eradicate it. Unit-II makes students understand the hydrologic cycle, sources, criteria, and water quality standards (determination of BOD, COD, and TOC.). From Unit-III, students can realize soil analysis, such as types of soils, clays, and their swelling and adsorption properties. The primary soil constituents are organic matter, nitrogen, sulfur, potassium, and calcium. In Unit-IV, they can understand the food analysis, food adulteration, packing of food materials, and also estimation of food adulterants from HPLC methods.

CHI HCP: 3.6 -Inorganic Chemistry Laboratory-III.

In this course, students can handle the many chemical reactions and analytical statements. They can analyze i) hardness (temporary and permanent) and ii) alkalinity and TDS of the water sample. Secondly, they determined the chloride by precipitation titration-Mohar and Volhard methods. They have learned to handle spectrophotometric to determine Fe, V, and Ti.

CHO HCP: 3.8 Organic Chemistry Laboratory-III.

In this course, students can identify the organic functional group and estimate the functional group such as $-\text{COOH}$, NH_2 , ester, acetyl, amide, and nitro group in a given compound. In the second part of the experiments, they learned the separation of organic compounds by TLC. The combination of a) Acetanilide and Benzoic acid b) Benzamide and benzoic acid. During this experiment, students learned the principle and working of TLC.

CHP HCP: 3.8-Physical Chemistry Laboratory-III.

In this laboratory course, students are learned the partition Co-efficient for the distribution of I_2 between water and Chloroform, Phase rule-Acetic acid-water-benzene system, Potentiometric determination of equivalent weight, and K_a for a weak acid and simultaneous estimation of Co(II) and Cr(III) spectroscopically.

FOURTH SEMESTER

CHO HCT- 4.1 Advanced Organic Chemistry

In this course, students learned the hormones Introduction, classification, and the function of hormones, and also they learned how the hormones were synthesized by chemical reaction. Unit-II taught them the stereoselective reaction and its application in various syntheses. They have learned the retrosynthesis analysis, how it helps solve the synthetic route to macromolecules. They can design their synthetic method for the synthesis of organic compounds. In unit-III, students learned photochemistry, working and principle, and their application in various fields. In Unit-IV, students learn heterocyclic chemistry, synthesis, and their biological application. After learning these courses, students can understand the physical and chemical properties of organic synthesis.

CHI HCT: 4.2 Advanced Inorganic Chemistry

In this course, students understood organic chemistry and its biological importance. They can understand the mechanism of ionophores, metalloproteins as enzymes, chelation therapy, and metal complexes as drugs. In Unit-II, students learned the Heme and Non-heme Systems, and they could understand the biological importance of these systems. In Unit- III, they have learned the advanced organometallic chemistry and studied the mechanism and catalytic properties during the reaction. In Unit-IV, students can understand the synthesis of bulk materials, Chemical deposition, defects, ion transport, metal oxides, nitrides and fluorides, chalcogenides, chevrel phases, thermoelectric, and framework structures hydrides, hydrogen storage materials, Inorganic pigments, molecular materials, and fullerides.

CHS HCT: 4.3- Spectroscopy and Chromatography

Spectroscopy and Chromatography are essential topics in chemistry; in these courses, students learned HPLC, GC, and MS (mass spectroscopy). After learning this topic, they could interpret the spectrum of the unknown organic and inorganic sample. In Unit-II, they were known Molecular Luminescence, Chemiluminescence, Polarimetry, and Related Methods. In Unit–III, they understood the Electron Spin Resonance Spectroscopy, Mössbauer Spectroscopy, and Nuclear Quadruple Resonance Spectroscopy their working, principle, and applications. In Unit-IV, students understood and interpreted the electroporation techniques

such as Supercritical fluid chromatography, Electrophoresis, electroosmosis, and Field flow fractionation as their principle and working applications.

CSP SCT: 4.4 Polymer Science and Technology

In this course, students understood polymer science and its application in current years. After learning this unit, students can understand the importance of polymers, basic concepts, and the Polydispersion-average molecular weight concept. In Unit-II, they have learned theoretical concepts on morphology and order in crystalline polymers. In unit-III, they have learned the testing of polymers includes physical parameters such as tensile, flexural, impact, tear resistance, abrasion resistance, creep, fatigue conductivity, volume resistivity, surface, breakdown voltage, dielectric constant, loss factor, thermal coefficient of thermal expansion, heat distortion temperature, Vicat softening point, low temperature, properties, thermal conductivity and solution properties of polymers. In Unit-IV, they understood the processing of polymers which include Plastics, elastomers, and fibers, compounding. Processing techniques; calendaring, die casting, rotational casting, film casting, injection molding, blow molding extrusion molding, thermoforming, foaming reinforcing, fiber spinning, and commercial polymers' properties.

CHI HCP- 4.6 CHEMISTRY Practicals.

Students' expertise in preparing organic compounds and spectral analysis of a few complexes and organic compounds (UV-Visible, IR) in this course. And Interpretation of Spectral data (NMR,& Mass). They have given some spectrum that will interpret the exact structures of unknown compounds.

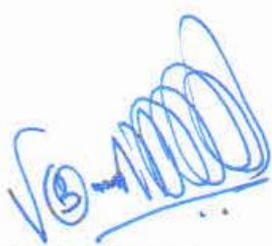
CHI HCP-4.7 PROJECT WORK

Project work for the partial fulfillment of master's degree will submit the project dissertation at the end of the semester. Later experts will evaluate them by taking a Viva voce examination.

Program-Specific outcome:

After learning the chemistry program students got the ability to work in various fields of chemistry.

1. After learning instrumental such as IR, NMR, MS. GC, HPLC, spectrophotometer, and UV-Visible they can be placed into QA, QC, and R & D in the industries as well as in research institutions.
2. Students were taken to USIC Dharawad where they have learned hand on experiments of instruments, this boosted up the students to take up in research activities.
3. After getting sound knowledge of chemistry they can teach in various institutions.
4. Natural product chemistry helps the students to take up research in phytochemistry which includes the identification, isolation, conformation, and biological assay.



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