FOUR YEAR UNDERGRADUATE PROGRAM (2024 – 28)
DEPARTMENT OF CHEMISTRY
COURSE CURRICULUM

PART-A: Introduction				
Program: Bachelor in Science *(Degree/Honors)*			**Semester -V**	Session: **2024-2025**
1	**Course Code**	**CHSC-05T**		
2	**Course Title**	**ORGANIC AND INORGANIC CHEMISTRY - I**		
3	**Course Type**	**DSC**		
4	**Pre-requisite(if,any)**	*As per Program*		
5	**Course Learning. Outcomes(CLO)**	➢ *Explore role of nitrogen in organic chemistry by studying N-containing compounds and heterocycles.* ➢ *Unravel molecular structures using techniques like rotational, vibrational, and Raman spectroscopy.* ➢ *Demystify bonding in transition metal complexes, including stability, lability, and magnetic properties.* ➢ *Understand the importance of organometallic and inorganic compounds in biological systems.*		
6	**Credit Value**	**3 Credits**	*Credit = 15 Hours -learning & Observation*	
7	**Total Marks**	**Max. Marks: 100**		**Min Passing Marks:40**

PART -B: Content oftheCourse		
TotalNo.of Teaching–learning Periods(01 Hr. per period) - 45 Periods (45 Hours)		
Unit	**Topics(Course contents)**	**No. of Periods**
I	**(A)Organic Compound of Nitrogen** Preparation of Nitroalkanes and Nitroarenes, Chemical properties of nitroalkanes, Mechanism of nucleophilic substitutions in nitroarenes, Reduction of nitroalkane in acidic, neutral, and alkaline medium.Picric acid Amines:- Nomenclature, Structure and stereochemistry. Basicity, Structural feature effecting basicity of amines. separation of primary, secondary and tertiary ammines. Amine salt as phase transfer catalyst. Preparation of alkyl and aryl amines:- reduction of nitro compound, reductive amination of aldehydic and ketonic compounds. Gabriel Phthalimide reaction, Hoffmann Bromamide reaction. Physical and chemical properties of amine: electrophilic aromatic substitution in aryl amines, reaction of amines with nitrous acid, synthetic transformation of aryl diazonium salts, Azo-coupling reaction.	**12**
II	**Spectroscopy:** General introduction, electromagnetic radiation, region of spectrum, representation of spectral width and intensity of spectral transition. (A)Rotational spectra of diatomic molecule as rigid rotor, selection rule, energy level, transition, spectra. Determination of bond length, Isotope effect, Qualitative description of non-rigid rotor. (B)Vibrational Spectra: Fundamental vibrational bands and their symmetry. Diatomic molecule as harmonic oscillator. Selection rule, pure vibrational spectrum, Determination of force constant Anharmonic oscillator. (C)Raman Spectra: introduction, concept of polarization, quantum theory, stoke and antistoke line, pure rotational and vibrational Raman spectra. Applications of Raman spectra.	**11**
III	**(A)Metal Ligand Bonding in Transition Metal Complex:** postulate of CFT. Splitting of d orbitals in octahedral, tetrahedral complex, Spectro-chemical series, Calculation of CFSE, Factors affecting CFSE, Applications of CFSE, Jahn-Teller Distortion, Limitations of CFT. **(B) Thermodynamic and Kinetic aspects of Metal Complexes:** A brief introduction of	**11**

	thermodynamic and kinetic stability of complex, Stepwise and overall stability constant. (C) Magnetic properties: Types of magnetic behavior, Methods of determining magnetic susceptibility, Spin Only formula, L-S Coupling, Calculation of effective magnetic moment, Orbital contribution to magnetic moment.	
IV	**(A)Organometallic Chemistry:** Definition, nomenclature, and Classification of organometallic compounds. Preparation, properties, bonding and application of alkyls and aryls of Li, Al. A brief account of metal ethylenic metal complexes special reference to Zeisse's salt. Mononuclear carbonyls and nature of bonding in metal carbonyls. 18 electron rules(Effective Atomic Number Rule). Ziegler-Nata Catalyst for polymerization of alkene, Wilkinson Catalyst and Hydrogenation , Hydroformylation. **(B)Bioinorganic Chemistry:** Essentials and trace elements in biological system, metalloporphyrins, with special reference to hemoglobin and myoglobin. Biological role of alkali and alkaline earth metals with special reference to Na^+ K^+ Ca^{2+} and Mg^{+2}, Nitrogen fixation.	**11**
Keywords	***Amines, Nitro compounds, Zeigler-Nata Catalyst, Wilkinson Catalyst, rigid rotor, harmonic oscillator, Hemoglobin, myoglobin.***	

SignatureofConvener&Members:

PART–C:Learning Resources

Text Books, Reference Books and Others

Text Books Recommended:

1. *Bahl, A., & Bahl, B. S. (2020). Organic chemistry (5th ed.). S. Chand & Company.*
2. *Madan, R. D. (2018). Advanced organic chemistry. S. Chand & Company.*
3. *Soni, P. L. (2019). A textbook of organic chemistry. S. Chand & Company.*
4. *Sharma, B. K. (2015). Spectroscopy. GOEL Publishing House.*
5. *Kaur, H. (2018). Spectroscopy. Pragati Prakashan.*
6. *Das, A. K. (2012). Bioinorganic Chemistry. Publisher.*

Reference Books Recommended:

1. *Skoog, D. A., Holler, F. J., & Crouch, S. R. (2017). Principles of Instrumental Analysis. Cengage Learning.*
2. *Mehrotra, R. C. (2010). Organometallic Chemistry. New Age International.*
3. *Carbtree, R. H. (2014). Organometallic Chemistry of the Transition Metal. University Science Books.*
4. *Housecroft, C. E., & Sharpe, A. G. (2012). Inorganic Chemistry. Pearson.*
5. *Miessler, G. L., Fischer, P. J., & Tarr, D. A. (2010). Inorganic Chemistry. Pearson.*

Online Resource:

- **e-Resources / e-books and e-learning portals**
- **https://onlinecourses.nptel.ac.in/noc23_cy01/preview**
- **https://pubs.rsc.org/en/content/articlelanding/1978/f2/f29787401203**
- **https://onlinecourses.swayam2.ac.in/cec23_cy03/preview**
- **https://onlinecourses.nptel.ac.in/noc22_cy12/preview**

PART-D: Assessment and Evaluation

Suggested Continuous Evaluation Methods:
Maximum Marks: 100 Marks
Continuous Internal Assessment(CIA):30 Marks
End Semester Exam(ESE):70 Marks

Continuous Internal Assessment(CIA): (By Course Teacher)	Internal Test / Quiz-(2): **20** ~~/20~~ Assignment/Seminar- **10** Total Marks -**30**	Better marks out of the two Test / Quiz+ obtained marks in Assignment shall be considered against **30** Marks
End Semester Exam (ESE):	**Two section – A & B** Section A: **Q1.** Objective – **10 x1= 10** Mark; **Q2.** Short answer type- **5x4 =20Marks** Section B: Descriptive answer type qts.,**1out of 2** from each unit-**4x10=40Marks**	

Name and Signature of Convener & Members of CBoS:

FOUR YEAR UNDERGRADUATE PROGRAM (2024 – 28)

DEPARTMENT OF CHEMISTRY
COURSE CURRICULUM

PART-A: Introduction				
Program: Bachelor in Science *(Degree/Honors)*			**Semester -V**	Session: **2024-2025**
1	**CourseCode**	**CHSC-05P**		
2	**CourseTitle**	**CHEMISTRY LAB COURSE -V**		
3	**CourseType**	**DSC**		
4	**Pre-requisite(if,any)**	***As per Program***		
5	**Course Learning. Outcomes(CLO)**	➢ *To apply the knowledge of qualitative and quantitative estimations in real sample analysis.* ➢ *To get 'Hands on Training' and develop skill for synthesis of various inorganic compounds.* ➢ *To learn the concept of gravimetric estimation.* ➢ *To learn use of conductometer and spectrophotometer for titration.*		
6	**CreditValue**	**1 Credits**	*Credit =30 Hours Laboratory or Field learning/Training*	
7	**Total Marks**	**Max.Marks:50**		**Min Passing Marks:20**

PART -B: Content oftheCourse		
TotalNo.of learning-Training/performancePeriods:30 Periods (30 Hours)		
Module	**Topics(Coursecontents)**	**No.ofPeriod**
Lab./Field Training/ Experiment Contents of Course	1)To verify Beer-Lambert Law for $KMnO_4$/ $K_2Cr_2O_7$ and determine the concentration of the given solution of the substrate from absorbance measurement. 2)To Determine the strength of the given acid conductometrically using standard alkali solution. 3)Gravimetric estimation of Ba as $BaSO_4$ from given solution of $BaCl_2$. 4)Inorganic compound synthesis: (i) Synthesis of sodium trioalato ferrate(III) $Na_2[Fe(C_2O_4)_3]$ and determination of its composition by permangnometry. (ii) Synthesis of Ni-dimethylglyoxime complex $[Ni(dmg)_2]$ (iii) Synthesis of Tetraaminecopper(II) sulphate $[Cu(NH_3)_4]SO_4$ (iv) Synthesis of Cis- and Trans-bisoxalateochromate(III)ion.	**30**
Keywords	***Spectrophotometer, Lambert beers law, Gravimetric estimation, synthesis of inorganic complexes***	

Signature of Convener &Members (CBoS):

PART–C:Learning Resources

Text Books, Reference Books and Others

Text Books:

1. Chatwal, G. R., & Sharma, A. (n.d.). *Instrumental methods of chemical analysis*. Himalaya Publishing House.
2. Raj, G. (2009). *Advanced Practical Inorganic Chemistry*. Krishna Prakashan.

Reference Books:

1. Svehla, G. (Ed.). (1978). *A textbook of quantitative inorganic analysis* (by A. I. Vogel). ELBS Publishers and Distributors. (Original work published 1968)
2. Henderson, W. A. (n.d.). *Inorganic synthesis*. Benjamin-Cummings Publishing Company.
3. Fernelius, W. G. (2009). *Experimental inorganic chemistry* (Adapted by R. K. Sharma & G. Panda). New Age International Publishers. (Original work published 1972)
4. Mendham, J., Denney, R. C., Barnes, J. D., & Thomas, M. (Eds.). (2000). *Vogels textbook of quantitative chemical analysis* (6th ed.). Pearson Education India. (Original work by A. I. Vogel)
5. Furniss, B. S., Hannaford, A. J., Smith, P. W. G., & Tatchell, A. R. (Eds.). (1989). *Vogel's textbook of practical organic chemistry* (5th ed.). Longman Scientific & Technical. (Original work by A. I. Vogel)

Online Resources:

- **e-Resources / e-books and e-learning portals**
- **https://www.youtube.com/watch?v=s7pXbV9dumI**
- **https://onlinelibrary.wiley.com/series/2146**
- **https://chem.libretexts.org/Ancillary_Materials/Laboratory_Experiments/Wet_Lab_Experiments/General_Chemistry_Labs/Online_Chemistry_Lab_Manual/Chem_11_Experiments/07%3A_Gravimetric_Analysis_(Experiment)**
- **https://mas-iiith.vlabs.ac.in/exp/beer-lambert-law/**

PART-D: Assessment and Evaluation

Suggested Continuous Evaluation Methods:
Maximum Marks: 50 Marks
Continuous Internal Assessment(CIA):15 Marks
End Semester Exam(ESE):35Marks

Continuous Internal Assessment(CIA): (By Course Teacher)	Internal Test / Quiz-(2): **10 &10** Assignment/Seminar +Attendance- **05** Total Marks **-15**	Better marks out of thetwo Test / Quiz +obtained marks in Assignment shall be considered against **15** Marks
End Semester Exam (ESE):	**Laboratory / Field Skill Performance: On spot Assessment** **M. Performed the Task based on lab. work - 20 Marks** **N. Spotting based on tools& technology (written) – 10 Marks** **O. Viva-voce (based on principle/technology) - 05 Marks**	**Managed by Course teacher as per lab. status**

Name and Signature of Convener & Members of CBoS:

FOUR YEAR UNDERGRADUATE PROGRAM(2024 – 28)
DEPARTMENT OF CHEMISTRY
COURSE CURRICULUM

PART-A: Introduction

Program: Bachelor in Science *(Degree/Honors)*		Semester -VI	Session: 2024-2025
1	Course Code	DSC-06T	
2	Course Title	ORGANIC AND PHYSICAL CHEMISTRY- II	
3	Course Type	DSC	
4	Pre-requisite(if,any)	*As per Program*	
5	Course Learning. Outcomes(CLO)	➢ *To understand role of quantum mechanics in chemistry.* ➢ *To know the organic compound in biological system* ➢ *To know the polymers in chemistry their preparation and application of polymer.* ➢ *To learn the techniques for studying the structure of chemical molecule.*	
6	Credit Value	3 Credits	*Credit = 15 Hours -learning & Observation*
7	Total Marks	Max.Marks: 100	Min Passing Marks:40

PART -B: Content of the Course

Total No.of Teaching–learning Periods(01 Hr. per period) - 45 Periods (45 Hours)

Unit	Topics(Course contents)	No. of Periods
I	**Quantum Chemistry I:**-Black body radiation ,plank's radiation law, photoelectric effect, Compton effect, de-Broglie's idea of matter and waves and its experimental verification. Heisenberg's uncertainty principle, operators: Hamiltonian operator, angular momentum operator, Laplacian operator, postulates of quantum mechanics, Eigen values, Eigen function, Schrodinger time independent wave equation, physical significance of Ψ and Ψ^2. Application of Schrodinger wave equation to Particle in one dimensional box. **Quantum Chemistry II:**-Quantum mechanical approach of molecular orbital theory basic idea, criteria of forming Molecular orbitals, LCAO(Linear combination of atomic orbital) approximation, formation of H_2^+ ion, calculation of energy of energy levels from wave functions, bonding and antibonding wave functions, concept of sigma bonding sigma antibonding, pi bonding and pi anti bonding M.Os. and their characteristics Comparison of M.O. theory and V.B. Model.	12
II	**(A)Carbohydrate:** Introduction and classification of carbohydrate, monosaccharide: open chain and cyclic structure of glucose and fructose, epimer and anomers of glucose. Relative and absolute configuration of carbohydrates, Specific rotation and mutarotation of glucose. Determination of ring size in glucose. Chemical properties of gluose: Osazone formation, oxidation, reduction, Reaction with HIO_4, Interconversion of Glucose and fructose, Chain lengthening and chain shortening. Structure of Disaccharide Sucrose, Lactose and Maltose. Structure of polysaccharide: Starch, Cellulose. **(B) Amino Acid & Protein:** amino acid types of amino acid, isoelectric point, structure of protein primary, secondary and tertiary structure. **(C) Nucleic Acid:** components of nucleic acid, types of nucleic acid, nucleoside, nucleotide, structure of nucleic acid.	11
III	**(A)Organometallic compound:** Preparation, Structure, and chemical reactions of organomagnesium(Grignard Reagent), Organozinc compound, Organolithium compound, Organosulphur compound **(B) Synthesis of organic compound via enolates :** Active methylene compound, Keto-enol tautomerism, Alkylation of diethyl malonate and acetoacetic ester. Claisen ester	11

	condensation and Robinson anealation. Synthesis of monoalkyl and dialkyl derivative, fatty acids, dibasic acid, α, β unsaturated acid, valeric acid, monoketone, diketone, heterocyclic compounds etc.	
IV	Spectroscopy II(Organic) (A) Infra red Spectroscopy: Basic principle and instrumentation, introduction, Modes of vibrations, fundamental band of different bond and functional groups, identification of band for compound and IR spectra of different compounds. Applications of IR spectroscopy. (B)Principle and instrumentation of UV-visible spectroscopy, Introduction, wavelength maxima, Beer Lambert's Law, Shifts in UV-visible spectra, Chromophore –Auxochrome theory, Effect of conjugation on wavelength maxima. Types of electronic transitions. Applications of UV-visible spectroscopy. Woodward Fischer rule for polyene wavelength maxima calculation. (C) NMR (Nuclear Magnetic Resonance): Introduction to NMR, Basic principle and instrumentation, No. of signal in PMR(proton Magnetic Resonance),Chemical shift, Sheilding and deshielding effect, Splitting of signal or spin-spin interaction, Intensity of Signal and peak height and peak ratio. Coupling Constant J. Proton NMR of some compound like ethanol, propanol, toluene, acetaldehyde, ketone,1,2-dibromoethylene etc.	**11**
Keywords	***Particle in one Dimensional Box, Hydrogen atom, Proton NMR, UV Visible, Vibrational Spectra. Woodward Fischer Rule.***	

SignatureofConvener&Members (CBoS):

PART–C:Learning Resources

Text Books, Reference Books and Others

Text Books Recommended:

1. *Tandon, M. M. N., & Agarwal, S. C. (2022). Unified chemistry. Shivalal and Company.*
2. *Sharma, B. K. (2010). Spectroscopy comprehension. Goel Publishing House.*
3. *Puri, B. R., Sharma, L. R., & Pathania, M. S. (2021). Principles of physical chemistry. Vishal Publications.*
4. *Gurtu, J. N., & Gurtu, R. (2015). Advanced physical chemistry. Pragati Prakashan.*

Reference Books Recommended:

5. *Atkins, P. W., de Paula, J., & Keeler, J. A. (2005). Atkins' physical chemistry Oxford University Press.*
6. *Pandya, A. J. (2010). A textbook of biochemistry: Nucleic acids, proteins and carbohydrates.*
7. *Korte, F., & Goto, M. (2009) Nucleic acids, proteins and carbohydrates, John Willy & Sons*

Online Resources:

- **https://onlinecourses.nptel.ac.in/noc23_cy09/preview**
- **https://www.udemy.com/course/ochemnmr/?couponCode=LEADERSALE24A**
- **https://en.wikipedia.org/wiki/Bioorganic_chemistry#:~:text=Biophysical%20organic%20chemistry%20is%20a,nature%20to%20determine%20their%20properties.**
- **https://onlinecourses.nptel.ac.in/noc21_cy38/preview**

PART-D: Assessment and Evaluation

Suggested Continuous Evaluation Methods:
Maximum Marks: 100 Marks
Continuous Internal Assessment(CIA):30 Marks
End Semester Exam(ESE):70 Marks

Continuous Internal Assessment(CIA): (By Course Teacher)	Internal Test / Quiz-(2): **20** ~~40~~ **20** Assignment/Seminar- **10** Total Marks -**30**	Better marks out of the two Test / Quiz+ obtained marks in Assignment shall be considered against **30** Marks
End Semester Exam (ESE):	**Two section – A & B** Section A: **Q1.** Objective – **10 x1= 10** Mark; **Q2.** Short answer type- **5x4 =20Marks** Section B: Descriptive answer type qts.,**1out of 2** from each unit-**4x10=40Marks**	

FOUR YEAR UNDERGRADUATE PROGRAM (2024 – 28)
DEPARTMENT OF CHEMISTRY
COURSE CURRICULUM

PART-A: Introduction				
Program:Bachelor in Science *(Diploma / Degree)*			**Semester VI**	Session: **2024-2025**
1	**CourseCode**	**CHSC-06P**		
2	**CourseTitle**	**CHEMISTRY LAB COURSE-VI**		
3	**CourseType**	**DSC**		
4	**Pre-requisite(if,any)**	*As per Program*		
5	**Course Learning. Outcomes(CLO)**	➢ *To understand the basic principles involved in separation and identification of organic compound.* ➢ *To apply the knowledge of qualitative and quantitative estimations in real sample analysis.* ➢ *To learn the synthesis of organic compounds* ➢ *To learn the use of conductometer and spectrophotometer in analysis.*		
6	**CreditValue**	**1 Credits**	*Credit =30 Hours Laboratory or Field learning/Training*	
7	**TotalMarks**	**Max.Marks:50**		**Min Passing Marks:20**

PART -B: Content oftheCourse

TotalNo.of learning-Training/performancePeriods:30 Periods (30 Hours)

Module	Topics(Coursecontents)	No.ofPeriod
Lab./Field Training/ Experiment Contents of Course	1)To determine the solubility and solubility product of Sparingly soluble salt using conductometer. 2)To titrate potentiometrically the given ferrous sulphate solution using KMnO4 / $K_2Cr_2O_7$ as titrant and calculate redox potential of Fe^{2+} /Fe^{3+} system on the hydrogen scale. **Organic mixture analysis** Separation and Identification of two solid organic compounds from given binary organic mixture by H_2O,$NaHCO_3$, NaOH for separation and preparation of suitable derivative. **Synthesis of one organic compound :-** (a)synthesis of m-dinitrobenzene from nitrobenzene. (b) synthesis of acetanilide from aniline (c)Preparation of iodoform from ethanol and acetone (d)Preparation of p-bromoacetanilide (e)Preparation of 2,4,6-tribromophenol. (f)Preparation of methyl orange and methyl red. (g)Preparation of benzoic acid from toluene. (h)Preparation of aniline from nitrobenzene.	**30**
Keywords	*Organic mixture analysis, synthesis of organic compound, solubility product, conductometer.*	

Signature of Convener & Members (CBoS):

PART–C:Learning Resources

Text Books, Reference Books and Others

Text Books Recommended:

1. *Tandon, M. M. N., & Shiva Lal Agarwal & Company. (2012). BSc. Practical Chemistry.*
2. *Pandey, O. P., BajPai, D. N., Giri, S., & S. Chand. (2013). Practical Chemistry.*

Reference Books Recommended:

1. *Bassett, J., Denney, R. C., Jeffery, G. H., & Mendham, J. (2000). Vogel's Text Book of Qualitative Analysis (revised). ELBS.*
2. *Das, R. C., & Behra, B. (2002). Experimental Physical Chemistry. Tata McGrawHill.*

Online Resources:

- **e-Resources / e-books and e-learning portals**
- **https://chem.libretexts.org/Courses/University_of_California_Davis/Chem_4C_Lab%3A_General_Chemistry_for_Majors/Chem_4C%3A_Laboratory_Manual/05%3A_Potentiometric_Titrations_(Experiment)**
- **https://vlab.amrita.edu/?sub=2&brch=191**
- **https://www.orgsyn.org/**

PART-D: Assessment and Evaluation

Suggested Continuous Evaluation Methods:
Maximum Marks: 50 Marks
Continuous Internal Assessment(CIA):15 Marks
End Semester Exam(ESE):35Marks

Continuous Internal Assessment(CIA): (By Course Teacher)	Internal Test / Quiz-(2): **10 &10** Assignment/Seminar +Attendance- **05** Total Marks -**15**	Better marks out of thetwo Test / Quiz +obtained marks in Assignment shall be considered against **15** Marks
End Semester Exam (ESE):	**Laboratory / Field Skill Performance: On spot Assessment** **P. Performed the Task based on lab. work - 20 Marks** **Q. Spotting based on tools& technology (written) – 10 Marks** **R. Viva-voce (based on principle/technology) - 05 Marks**	**Managed by Course teacher as per lab. status**

Name and Signature of Convener & Members of CBoS:

Indira