Shri Rawatpura Sarkar University, Raipur

Examination Scheme & Syllabus

for

Three Year Bachelor of Science (Hons.) in Chemistry Programme

B.Sc. (Hons.) Chemistry Semester-IV

(Effective from the session: 2022-23)

Shri Rawatpura Sarkar University

Raipur, Chhattisgarh

Department of Chemistry

Faculty of Science,

Three Year Bachelor of Science (Hons.) in Chemistry Programme

B.Sc. (Hons.) Chemistry Semester-IV

Scheme of Teaching and Examination

Outcome Based Education (OBC) and Choice Based Credit System (CBCS)

(Effective from the session: 2022-2023)

S. No.	Course Code	Course Title	Hours/ Week			Credit	Maximum Marks			Sem End Exam Duration (Hrs)
			L	T	P		Continuation Evaluation	Semester End Examination	Total	
1	SSH02401T	Inorganic Chemistry-III	4	-	-	4	30	70	100	3.0
2	SSH02402T	Physical Chemistry-III	4	-	-	4	30	70	100	3.0
3	SSH02403T	Organic Chemistry-III	4	-	-	4	30	70	100	3.0
4	SSH02454T	Generic Elective-IV	4	-	-	4	30	70	100	3.0
5	SSH02431T	Molecular Modelling & Drug Design	4	-	-	4	30	70	100	3.0
6	SSH02432T	Applications of Computers in Chemistry								
7	SSH02482P	Chemistry Lab Course: VII	-	-	4	2	15	35	50	5.0
8	SSH02482P	Chemistry Lab Course: VIII	-	-	4	2	15	35	50	5.0
9	SSH02483P	Generic Elective Lab Course:IV	-	-	4	2	15	35	50	5.0
	Total teaching hrs/week: 32		**Total Credits**			**26**	**Total Marks**		**650**	

Generic Electives (Semester I to IV): Zoology, Bioscience, Maths and Physics

Semester:	Semester I	Semester II	Semester III	Semester IV
Subject:	Zoology I	Zoology II	Bioscience I	Bioscience II
	Maths I	Maths II	Physics I	Physics II

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Course Title	**Inorganic Chemistry-III**				
Course Code	**SSH02401T**				
Course Credits	**L**	**T**	**P**	**TC**	
	4	**-**	**-**	**4**	
Prerequisites	**Inorganic Chemistry II**				
Course Objectives	• **To understand the basics of inorganic chemistry**				
Course Contents	**UNIT I** Werner's theory, valence bond theory (inner and outer orbital complexes), electroneutrality principle and back bonding. Crystal field theory, measurement of 10 Dq (Δo), CFSE in weak and strong fields, pairing energies, factors affecting the magnitude of 10 Dq (Δo, Δt). Octahedral vs. tetrahedral coordination, tetragonal distortions from octahedral geometry Jahn-Teller theorem, square planar geometry. **UNIT II** Qualitative aspect of Ligand field and MO Theory. IUPAC nomenclature of coordination compounds, isomerism in coordination compounds. Stereochemistry of complexes with 4 and 6 coordination numbers. Chelate effect, polynuclear complexes, Labile and inert complexes. **UNIT III** General group trends with special reference to electronic configuration, colour, variable valency, magnetic and catalytic properties, ability to form complexes. Stability of various oxidation states and e.m.f. (Latimer &Bsworthdiagrams). Difference between the first, second and third transition series. **UNIT IV** Lanthanoids and Actinoids:Electronic configuration, oxidation states, colour, spectral and magnetic properties, lanthanide contraction, separation of lanthanides (ion-exchange method only),Chemistry of Ti, V, Cr Mn, Fe and Co in various oxidation states (excluding their metallurgy) **UNIT V** Metal ions present in biological systems, classification of elements according to their action in biological system. Geochemical effect on the distribution of metals. Sodium / K-pump, carbonic anhydrase and carboxypeptidase. Excess and deficiency of some trace metals. Toxicity of metal ions (Hg, Pb, Cd and As), reasons for toxicity, Use of chelating agents in medicine,Iron and its application in bio-systems, Haemoglobin; Storage and transfer of iron.				
Course	On the completion of this course successfully student will be able to				

Outcomes	CO 1 : Learn about the Crystal field theory and measurement of 10 Dq (Δo) CO 2 : Study on Qualitative aspect of Ligand field and MO Theory. CO 3 : Understand the General group trends CO 4 : Gain knowledge on Lanthanoids and Actinoids CO 5 : Study on the Metal ions present in biological systems
Text Books	1. Purcell,K.F&Kotz,J.C.InorganicChemistryW.B.SaundersCo,1977. 2. Huheey, J.E., Inorganic Chemistry, Prentice Hall,1993. 3. Lippard,S.J.&Berg,J.M.PrinciplesofBioinorganicChemistryPanimaPublishing Company1994.
Reference Books	1. Cotton, F.A. & Wilkinson, G, Advanced Inorganic Chemistry Wiley-VCH,1999 2. Basolo, F, and Pearson, R.C. Mechanisms of Inorganic Chemistry, John Wiley & Sons, NY,1967. 3. Greenwood, N.N. &Earnshaw A. Chemistry of the Elements, Butterworth- Heinemann,1997.

Three year Bachelor of Science (Hons) in Chemistry programme
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Course Title	**Physical Chemistry III**				
Course Code	**SSH02402T**				
Course Credits	**L**	**T**	**P**	**TC**	
	4	**-**	**-**	**4**	
Prerequisites	**Physical Chemistry II**				
Course Objectives	• **To understand the importance of Phase Equilibria and Chemical Kinetics**				
Course Contents	**UNIT I** Concept of phases, components and degrees of freedom, derivation of Gibbs Phase Rule for nonreactive and reactive systems; Clausius-Clapeyron equation and its applications to solid- liquid, liquid-vapour and solid-vapourequilibria, phase diagram for one component systems, with applications,Phase diagrams for systems of solid-liquid equilibria involving eutectic, congruent and incongruent melting points, solid solutions,Three component systems, water-chloroform-acetic acid system, triangular plots. **UNIT II** Binary solutions: Gibbs-Duhem-Margules equation, its derivation and applications to fractional distillation of binary miscible liquids (ideal and nonideal), azeotropes, lever rule, partial miscibility of liquids, CST, miscible pairs, steam distillation,Nernst distribution law: its derivation and applications. **UNIT III** Order and molecularity of a reaction, rate laws in terms of the advancement of a reaction, differential and integrated form of rate expressions up to second order reactions, experimental methods of the determination of rate laws, kinetics of complex reactions (integrated rate expressions up to first order only): (i) Opposing reactions (ii) parallel reactions and (iii) consecutive reactions and their differential rate equations (steady-state approximation in reaction mechanisms) (iv) chain reactions. **UNIT IV** Temperature dependence of reaction rates; Arrhenius equation; activation energy. Collision theory of reaction rates, Lindemann mechanism, qualitative treatment of the theory of absolute reaction rates, Surface chemistry:Physical adsorption, chemisorption, adsorption isotherms. nature of adsorbed state. **UNIT V** Catalysis:Types of catalyst, specificity and selectivity, mechanisms of catalyzed reactions at solid surfaces; effect of particle size and efficiency of nanoparticles as catalysts. Enzyme catalysis, Michaelis-Menten mechanism, acid-base				

	catalysis.
Course Outcomes	On the completion of this course successfully student will be able to CO 1 : Learn about Clausius-Clapeyron equation and its applications CO 2 : Understand ther Nernst distribution law: its derivation and applications CO 3 : Understand the experimental methods of the determination of rate laws, kinetics of complex reactions CO 4 : Gain the knowledge on Arrhenius equation; activation energy. Collision theory of reaction rate CO 5 : Study on Michaelis-Menten mechanism
Text Books	1. Peter Atkins & Julio De Paula, Physical Chemistry 10th Ed., Oxford University Press (2014). 2. Castellan, G. W. Physical Chemistry, 4th Ed., Narosa(2004). 3. McQuarrie,D.A.&Simon,J.D.,MolecularThermodynamics,Viva BooksPvt.Ltd.: New Delhi(2004). 4. Engel,T.&Reid,P.PhysicalChemistry3rdEd.,Prentice-Hall(2012). 5. Assael,M.J.;Goodwin,A.R.H.;Stamatoudis,M.;Wakeham,W.A.&Will,S.Commonly Asked Questions in Thermodynamics. CRC Press: NY (2011). 6. Metz,C.R.PhysicalChemistry2ndEd.,TataMcGraw-Hill(2009).
Reference Books	1. Zundhal,S.S.ChemistryconceptsandapplicationsCengageIndia(2011). 2. Ball, D. W. Physical Chemistry Cengage India(2012). 3. Mortimer,R.G.PhysicalChemistry3rdEd.,Elsevier:NOIDA,UP(2009). 4. Levine, I. N. Physical Chemistry 6th Ed., Tata McGraw-Hill(2011).

Three year Bachelor of Science (Hons) in Chemistry programme
B.Sc. (Hons) Chemistry Semester-IV
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Course Title	**Organic Chemistry III**				
Course Code	**SSH02403T**				
Course Credits	**L**	**T**	**P**	**TC**	
	4	**-**	**-**	**4**	
Prerequisites	**Organic chemistry II**				
Course Objectives	• **To understand the importance of hetrocyclic compoundand alkoloids**				
Course Contents	**UNIT I** Preparation and important reactions of nitro compounds, nitriles and isonitriles,Amines: Effect of substituent and solvent on basicity; Preparation and properties: Gabriel phthalimide synthesis, Carbylamine reaction, Mannich reaction, Hoffmann's exhaustive methylation, Hofmann-elimination reaction; Distinction between 1°, 2° and 3° amines with Hinsberg reagent and nitrous acid. **UNIT II** Diazonium Salts: Preparation and their synthetic applications.Polynuclear Hydrocarbons:Reactions of naphthalene phenanthrene and anthracene Structure, Preparation and structure elucidation and important derivatives of naphthalene and anthracene; Polynuclear hydrocarbons. **UNIT III** Classification and nomenclature, Structure, aromaticity in 5-numbered and 6-membered rings containing one heteroatom; Synthesis, reactions and mechanism of substitution reactions of: Furan, Pyrrole (Paal-Knorr synthesis, Knorr pyrrole synthesis, Hantzsch synthesis), Thiophene, Pyridine (Hantzsch synthesis), Pyrimidine, Structure elucidation of indole, Fischer indole synthesis and Madelung synthesis). **UNIT IV** Structure elucidation of quinoline and isoquinoline, Skraup synthesis, Friedlander's synthesis, Knorr quinoline synthesis, Doebner- Miller synthesis, Bischler-Napieralski reaction, Pictet-Spengler reaction, Pomeranz-Fritsch reaction, Derivatives of furan: Furfural and furoic acid. **UNIT V** Alkaloids: Natural occurrence, General structural features, Isolation and their physiological action,Hoffmann's exhaustive methylation, Emde's modification,				

	Structure elucidation and synthesis of Hygrine and Nicotine. Medicinal importance of Nicotine, Hygrine, Quinine, Morphine, Cocaine, and Reserpine,Terpenes: Occurrence, classification, isoprene rule; Elucidation of stucture and synthesis of Citral, Neral and α-terpineol.
Course Outcomes	On the completion of this course successfully student will be able to CO 1 : Learn about the Preparation and reactions of nitro compounds CO 2 : Synthesis the Diazonium Salts and their synthetic applications CO 3 : Synthesis of5-numbered and 6-membered rings containing one heteroatom and its mechanism . CO 4 : Understand the Structure elucidation of quinoline and isoquinoline CO 5 : Study of the Isolation and their physiological action of alkoloids
Text Books	1. Morrison, R. T. & Boyd, R. N. Organic Chemistry, Dorling Kindersley (India) Pvt. Ltd. (PearsonEducation). 2. Finar, I. L. Organic Chemistry (Volume 1), Dorling Kindersley (India) Pvt. Ltd. (PearsonEducation). 3. Finar, I. L. Organic Chemistry (Volume 2: Stereochemistry and the Chemistry of NaturalProducts),DorlingKindersley(India)Pvt.Ltd.(PearsonEducation). 4. Acheson, R.M. Introduction to the Chemistry of Heterocyclic compounds, John Welly& Sons(1976).
Reference Books	1. GrahamSolomons,T.W.OrganicChemistry,JohnWiley&Sons,Inc. 2. McMurry, J.E. Fundamentals of Organic Chemistry, 7th Ed. Cengage Learning India Edition,2013. 3. Kalsi, P. S. Textbook of Organic Chemistry 1st Ed., New Age International (P) Ltd.Pub. 4. Clayden, J.; Greeves, N.; Warren, S.; Wothers, P.; Organic Chemistry, Oxford UniversityPress. 5. Singh, J.; Ali, S.M. & Singh, J. Natural Product Chemistry, PrajatiParakashan (2010).

Three year Bachelor of Science (Hons) in Chemistry programme
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Course Title	**Bioscience II: Plant breeding and Genetics.**				
Course Code	**SSH02454T**				
Course Credits	**L**	**T**	**P**	**TC**	
	4	**-**	**-**	**4**	
Prerequisites	Basic Knowledge of **Plant breeding and Genetics**.				
Course Objectives	• This **course** is aimed at understanding the basic concepts of genetics and Plant Breeding.				
Course Contents	**UNIT I:** **Heredity:** Laws of Inheritance, Modified Mandelian Ratios: Co- dominance, incomplete dominance, Pedigree Analysis; Male sterility, Multiple allelism, Pleiotropism, Chromosome theory of Inheritance, Sex-linked Inheritance. **UNIT II:** **Linkage and Crossing over:** Linkage: concept &history, complete & incomplete linkage, bridges experiment, coupling & repulsion, recombination frequency, linkage maps based on two and three factor crosses. Crossing over: concept and significance. **UNIT III:** **Mutations and Chromosomal Aberrations:**-Types of mutations, effects of physical & chemical mutagens. Numerical chromosomal changes: Euploidy, Polyploidy and Aneuploidy; Structural chromosomal changes: Deletions, Duplications, Inversions & Translocations. **UNIT IV:** **Plant Breeding:**-Introduction and objectives. Breeding systems: modes of reproduction in crop plants. Important achievements and undesirable consequences of plant breeding. **UNIT V:** **Methods of crop improvement:**-Introduction: Centres of origin and domestication of crop plants, plant genetic resources; acclimatization; Selection methods: For self pollinated, cross pollinated and vegetatively propagated plants; Hybridization: For self, cross and vegetatively propagated plants – Procedure, advantages and limitations.				
Course Outcomes	• Students will be able to understand the theories, types and examples of Heredity.				

	• They understand the "Concepts of Linkage and Crossing over". • Students will also realize the role of genes and factors in Mutations and Chromosomal Aberrations. • They will learn the systems and consequences of Plant Breeding. • Students will also learn and perform the different methods of crop improvement.
Text Books	1. Gardner EJ, Simmons MJ, Snustad DP (2008). Principles of Genetics. 8th Ed. Wiley-India. 2. Snustad, D.P. and Simmons, M.J. (2010). Principles of Genetics, John Wiley & Sons Inc., India. 5th edition. 3. Klug WS, Cummings MR, Spencer, C, Palladino, M (2011). Concepts of Genetics, 10th Ed., Benjamin Cummings 4. Griffiths, A.J.F., Wessler, S.R., Carroll, S.B., Doebley, J. (2010). Introduction to Genetic Analysis. W. H. Freeman and Co., U.S.A. 10th edition. 5. Pierce BA (2011) Genetics: A Conceptual Approach, 4th Ed., Macmillan Higher Education Learning 6. Singh, B.D. (2005). Plant Breeding: Principles and Methods. Kalyani Publishers. 7th edition.
References Books	1. Chaudhari, H.K. (1984). Elementary Principles of Plant Breeding. Oxford – IBH. 2nd edition. 2. Acquaah, G. (2007). Principles of Plant Genetics & Breeding. Blackwell Publishing.

Three year Bachelor of Science (Hons) in Chemistry programme
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Course Title	**PHYSICS II: WAVES, ACOUSTICS AND OPTICS**				
Course Code	**SSH02455T**				
Course Credits	**L**	**T**	**P**	**TC**	
	4	**0**	**0**	**4**	
Prerequisite	**Preliminary Knowledge of Physics.**				
Course Objective	• To study Physics in advance and establish foundation to research in the respective domain.				
Course Content	**UNIT-I** Waves in media: Speed of transverse waves on a uniform string, speed of longitudinal waves in a fluid, energy density and energy transmission in waves, typical measurements. Waves over liquid surface: gravity waves and ripples. Group velocity and phase velocity, their measurements. Harmonics and the quality of sound; examples. Reflection, refraction and diffraction of sound: Acoustic impedance of a medium, diffraction of sound, principle of a sonar system, sound ranging. **UNIT-II** Fermat's Principle of extremum path, the aplanatic points of a sphere and other applications. Cardinal points of an optical system, thick lens and lens combinations. Lagrange equation of magnification, telescopic combinations, telephoto lens. Monochromatic aberrations and their reductions; aspherical mirrors and Schmidt corrector plates, aplanatic points, oil immersion objectives, meniscus lens. Optical instruments: Entrance and exit pupils, need for a multiple lens eyepiece, common types of eyepieces. (Ramsden and Huygen's eyepieces) **UNIT-III** Interference of light: The principle of superpositions, two slit interferences, coherence requirement for the sources, optical path retardations, lateral shift of fringes, Rayleigh refractometer Localized fringes; thin films. Hai dinger fringes: fringes of equal indication. Michelson interferometer, its application for precision determination of wavelength, wavelength difference and the width of spectral lines, Twyman. Green interferometer and its uses, intensify distribution in multiple beam interference. Tolansky fringes, Fabry-Perot interferometer and etalon. **UNIT-IV**				

	Fresnel half-period zones, plates, straight edge, rectilinear propagation, Fraunhofer diffraction: Diffraction at a slit, half-period zones, Rayleigh criterion, resolving power of telescope and microscopic systems. Diffraction gratings: Diffraction at N parallel slits, intensity distribution, plane diffraction grating, reflection grating and blazed gratings, Concave grating and different mountings, resolving power of a grating and comparison with resolving powers of prism and of a Fabry-Perot etalon. **UNIT - V** Laser system: Purity of a spectral line, coherence length and coherence time, spatial coherence of a source, Einstein's A and B coefficients, Spontaneous and induced emissions, conditions for laser action, population inversion, Types of lasers: Ruby and, He-Ne and Semiconductor lasers. Application of lasers: Application in communication, Holography and nonlinear optics. (Polarization P including higher order terms in E and generation of harmonics).
Course Outcome	• On the completion of this course, successfully student will be able to understand the development of the Physics. 1. The purpose of the course is to introduce students to knowledge about Waves in media: Speed of transverse waves on a uniform string. 2. The purpose of the course is to introduce students to learning about Fermat's Principle of extremum path, the aplanatic points of a sphere and other applications. 3. The purpose of the course is to introduce students to introduction about Interference of light. 4. The purpose of the course is to introduce students to information about Fresnel half-period zones, plates, straight edge, rectilinear propagation. 5. The purpose of the course is to introduce students to knowledge about Laser system.
Text books	1. A.K. Ghatak: Physical Optics 2. D.P. Khandelwal, Optical and Atomic Physics' (Himalaya Publishing House) 3. K.D. Moltev ; 'Optics' (Oxford University Press) Sears : 'Optics' 4. Jenkins and White: 'Fundamental of Optics' (McGraw-Hill) 5. B.B. Laud: Lasers and Non-linear Optics (Wiley Eastern 1985) 6.. Smith and Thomson: 'Optics' (John Wiley and Sons)
References Books	1. Berkely Physics Courses: Vol.-III, 'Waves and Oscillations' 2. I.G. Main, 'Vibration's and Waves' (Cambridge University Press) 3. H.J. Pain: 'The Physics of Vibrations and Waves' (MacMillan 1975) 4. Text Book of Optics: B.K. Mathur 5. B.Sc. (Part III) Physics: B.P. Chandra, M.P. Hindi Granth Academy. 6. F. Smith and J.H. Thomson, Manchester Physics series: optics (English language book society and Jehu wiley, 1577)

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Course Title	**Molecular Modelling & Drug Design**				
Course Code	**SSH02431T**				
Course Credits	**L**	**T**	**P**	**TC**	
	4	**-**	**-**	**4**	
Prerequisites	**Basic knowledge of computer**				
Course Objectives	• **Upon completion of the course the student shall be able toMolecular Modelling and Drug Design**				
Course Contents	**UNIT I** **Introduction to Molecular Modelling:**Introduction. Useful Concepts in Molecular Modelling: Coordinate Systems. Potential Energy Surfaces. Molecular Graphics. Surfaces. Computer Hardware and Software. The Molecular Modelling Literature. **UNIT II** **Force Fields:**Fields. Bond Stretching.Angle Bending.Introduction to nonbonded interactions.Electrostatic interactions.van der Waals Interactions. Hydrogen bonding in Molecular Mechanics. Force Field Models for the Simulation of Liquid Water. **UNIT III** **Energy Minimization and Computer Simulation:**Minimization and related methods for exploring the energy surface. Non-derivative method, First and second order minimization methods. Computer simulation methods. Simple thermodynamic properties and Phase Space. Boundaries. Analyzing the results of a simulation and estimating Errors. **UNIT IV** **Molecular Dynamics & Monte Carlo Simulation:** Molecular Dynamics Simulation Methods. Molecular Dynamics using simple models. Molecular Dynamics with continuous potentials. Molecular Dynamics at constant temperature and pressure. Metropolis method. Monte Carlo simulation of molecules. Models used in Monte Carlo simulations of polymers. **UNIT V** **Structure Prediction and Drug Design:** Structure prediction - Introduction to comparative Modeling. Sequence alignment. Constructing and evaluating a comparative model. Predicting protein structures by 'Threading', Molecular docking. Structure based de novo ligand design, Drug Discovery – Chemoinformatics – QSAR.				

Course Outcomes	On the completion of this course successfully student will be able to CO 1 : Understand the Molecular Modelling CO 2 : Learn about the Hydrogen bonding in Molecular Mechanics CO 3 : Understand the Energy Minimization and Computer Simulation CO 4 : Study on Molecular Dynamics & Monte Carlo Simulation. CO 5 : Gain the knowledge about Structure Prediction and Drug Design
Text Books	1. A. R. Leach, Molecular Modelling Principles and Application, Longman, 2001. 2. J.M. Haile, Molecular Dynamics Simulation Elementary Methods, John Wiley and Sons, 1997.
Reference Book	1. Satya Prakash Gupta, QSAR and Molecular Modeling, Springer - Anamaya Publishers, 2008

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Course Title	**Applications of Computers in Chemistry**				
Course Code	**SSH02432T**				
Course Credits	**L**	**T**	**P**	**TC**	
	4	**-**	**-**	**4**	
Prerequisites	**Basic knowledge of computer**				
Course Objectives	• **Upon completion of the course the student shall be able toApplications of Computers in Chemistry**				
Course Contents	**UNIT I** Constants, variables, bits, bytes, binary and ASCII formats, arithmetic expressions, hierarchy of operations, inbuilt functions. Elements of the BASIC language. BASIC keywords and commands. Logical and relative operators. Strings and graphics. Compiled versus interpreted languages. Debugging. **UNIT II** Simple programs using these concepts. Matrix addition and multiplication. Statistical analysis, Roots of equations: Numerical methods for roots of equations: Quadratic formula, iterative method, Newton-Raphson method, Binary bisection and Regula-Falsi. **UNIT III** Differential calculus: Numerical differentiation, Simultaneous equations: Matrix manipulation: addition, multiplication. Gauss - Siedal method. **UNIT IV** Integral calculus: Numerical integration (Trapezoidal and Simpson's rule), probability distributions and mean values. **UNIT V** Interpolation, extrapolation and curve fitting: Handling of experimental data, Conceptual background of molecular modelling: Potential energy surfaces. Elementary ideas of molecular mechanics and practical MO methods.				
Course Outcomes	On the completion of this course successfully student will be able to CO 1 : Understand about the Elements of the BASIC language. CO 2 : Learn about the Statistical analysis CO 3 : Understand the concept of Differential calculus: CO 4 : Study about the Numerical integration				

	CO 5 : Study of the Interpolation, extrapolation and curve fitting
Text Books	1. Harris, D.C.Quantitative Chemical Analysis. 6th Ed., Freeman (2007) Chapters 3-5. 2. Levie,R.de,Howtouse Excelin analytical chemistry and in general scientificd at aanalysis, Cambridge Univ. Press (2001) 487pages.
Reference Books	1. Noggle, J. H. Physical chemistry on a Microcomputer. Little Brown & Co. (1985). 2. Venit, S.M. Programming in BASIC: Problem solving with structure and style. Jaico Publishing House: Delhi (1996).

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Course Title	**Chemistry Lab Course: VII**				
Course Code	**SSH02481P**				
Course Credits	**L**	**T**	**P**	**TC**	
	-	**-**	**2**	**2**	
Prerequisites	**Chemistry course lab V**				
Course Objectives	• **To enable the students to develop skills inorganic, physical and organic chemistry.**				
Course Contents	**Performed any 10 experiment** Qualitative semimicro analysis of mixtures containing 3 anions and 3 cations. Emphasis should be given to the understanding of the chemistry of different reactions. The following radicals are suggested: CO_3^{2-}, NO^-, S^{2-}, SO^{2-}, $S_2O_3^{2-}$, CH_3COO^-, F^-, Cl^-, Br^-, I^-, NO^-, BO^{3-}, C_2O^{2-}, PO^{3-}, NH^+, K^+, Pb^{2+}, Cu^{2+}, Cd^{2+}, Bi^{3+}, Sn^{2+}, Sb^{3+}, Fe^{3+}, Al^{3+}, Cr^{3+}, Zn^{2+}, Mn^{2+}, Co^{2+}, Ni^{2+}, Ba^{2+}, Sr^{2+}, Ca^{2+}, Mg2+ Mixtures should preferably contain one interfering anion, **or** insoluble component ($BaSO_4$, $SrSO_4$, $PbSO_4$, CaF_2 or Al_2O_3) **or** combination of anions e.g. $CO_3^{2-}$and SO_3^{2-}, NO_2^- and NO^-,Cl^- and Br^-, Cl^- and I^-, $Br^-$and I^-, NO^- and Br^-, NO^- and I^-. Spot tests should be done whenever possible. 1. Measurement of 10 Dq by spectrophotometric method 2. Verification of spectrochemical series. 3. Controlled synthesis of two copper oxalate hydrate complexes: kinetic vs thermodynamic factors. 4. Preparation of acetylacetanato complexes of Cu^{2+}/Fe^{3+}. Find the λ_{max} of the complex. 5. Synthesis of ammine complexes of Ni(II) and its ligand exchange reactions (e.g. bidentateligandslikeacetylacetone,DMG,glycine)bysubstitutionmethod. Conductometry I. Determination of cell constant II. Determination of equivalent conductance, degree of dissociation and dissociation constant of a weak acid. III. Perform the following conductometric titrations: 1. Strong acid vs. strong base					

	2. Weak acid vs. strong base 3. Mixture of strong acid and weak acid vs. strong base 4. Strong acid vs. weak base Any other experiment carried out related to inorganic chemistry and physical chemistry.
Course Outcomes	On the completion of this course successfully student will be able to CO 1 : Performed the Qualitative semimicro analysis of mixtures CO 2 : Measure the 10 Dq by spectrophotometric method CO 3 : synthesis of two copper oxalate hydrate complexes: CO 4 : Practically perform the conductometric titrations of Strong acid vs. strong base CO 5 : Find the λmax of the acetylacetanato complexes of Cu2+/Fe3+.
Text Books	1. Vogel, A.I., Tatchell, A.R., Furnis, B.S., Hannaford, A.J. & Smith, P.W.G., Textbook of Practical Organic Chemistry, Prentice-Hall, 5th edition, 1996. 2. Mann, F.G. & Saunders, B.C. Practical Organic Chemistry Orient-Longman, 1960. 3. Khosla, B. D.; Garg, V. C. & Gulati, A. Senior Practical Physical Chemistry,R. Chand & Co.: New Delhi (2011). 4. Ahluwalia, V.K. & Aggarwal, R. Comprehensive Practical Organic Chemistry, Universities Press.
Reference Books	1. Khosla, B. D.; Garg, V. C. & Gulati, A. Senior Practical Physical Chemistry, R. Chand & Co.: New Delhi(2011). 2. Garland, C.W.; Nibler, J.W. & Shoemaker, D. P. Experiments in Physical Chemistry 8th Ed.; McGraw-Hill: New York(2003). 3. Halpern, A. M. & Mc Bane, G.C. Experimental Physical Chemistry3rd Ed.; W.H. Freeman & Co.: New York(2003).

Course Title	**Chemistry Lab Course: VIII**				
Course Code	**SSH02482P**				
Course	**L**	**T**	**P**	**TC**	

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Credits	**-**	**-**	**2**	**2**	
Prerequisites	**Chemistry course lab VI**				
Course Objectives	• **To enable the students to develop practical skills on organic chemistry experiments**				
Course Contents	**Performed any 10 experiment** **Potentiometry** Perform the following potentiometric titrations: i. Strong acid vs. strong base ii. Weak acid vs. strong base iii. Dibasic acid vs. strong base iv. Potassium dichromate vs. Mohr's salt 1. Estimation of glycine by Sorenson's formalin method. 2. Study of the titration curve of glycine. 3. Estimation of proteins by Lowry's method. 4. Study of the action of salivary amylase on starch at optimum conditions. 5. Effect of temperature on the action of salivary amylase. 6. Saponification value of an oil or a fat. 7. Determination of Iodine number of an oil/fat. 8. Isolation and characterization of DNA from onion/cauliflower/peas. Any other experiment carried out related to organic chemistry and physical chemistry.				
Course Outcomes	On the completion of this course successfully student will be able to CO 1 : Study the titration curve of glycine. CO 2 : Measure the 10 Dq by spectrophotometric method CO 3 : To determine the Saponification value of an oil or a fat. CO 4 : Practically perform to Determine the Iodine number of an oil/fat. CO 5 : Isolate DNA from onion/cauliflower/peas.				
Text Books	1. Mann, F.G. & Saunders, B.C. Practical Organic Chemistry, Pearson Education (2009) 2. Manual of Biochemistry Workshop, 2012, Department of Chemistry, University of Delhi.				

Reference Book	1. Arthur, I. V. Quantitative Organic Analysis, Pearson.

Course Title	**Bioscience Lab Course: I**				
Course Code	**SSH02483P**				
Course Credits	**L**	**T**	**P**	**TC**	
	-	-	**4**	**2**	
Prerequisites	Practical Knowledge of **Plant breeding and Genetics**.				
Course Objectives	• To understand the practical and applied aspects of **Plant breeding and Genetics**				
Course Contents	**Plant breeding and Genetics** 1. Study of the structure of cell organelles through photomicrographs. 2. Study of structure of plant cell through temporary mounts. 3. Study of various stages of mitosis using cytological preparation of Onion root tips. 4. Study of DNA packing by micrographs. 20 5. Study of effect of temperature & organic solvent on permeability of cell membrane. 6. Numerical problems solving Mendel' Laws of inheritance 7. Chromosome mapping using 3 point test cross data. 8. Hybridization techniques – emasculation, bagging (for demonstration only). 9. Field visit to a plant breeding research station. 10. Calorimetric estimation of DNA by diphenylamine method.				

Course Outcomes	• Students will be able to perform exercise to make temporary mount of cell division. • Students will understand DNA packing by micrographs and they will be able to perform pedigree analysis for traits. • Students will be able to understand the concepts of Mendel's laws. • Students will able to demonstrate the Hybridization techniques • Students will able to perform the calorimetric estimation of DNA. They also learn the plant breeding techniques from field visit.
Text Books	1. Sharma, J.R. (1994)Principles and Practice of Plant Breeding, Tata McGraw- Hill Publishers, New Delhi 2. Singh,B.D. (2001)Plant Breeding : Principles and Methods ,Kalyani Publishers,¬ Ludhiana 3. Pundhan Singh (2015) Plant Breeding for Undergraduate Students, Kalyani¬ Publishers, Ludhiana 4. Gupta, S.K. (2010)Plant Breeding : Theory and Techniques,Agrobios (India),¬ Jodhpur 5. Hayes, H.K., F.R. Immer¬& D.C. Smith (2009) Methods of Plant Breeding,Biotech Books, Delhi

Course Title	**Physics Lab Course: II**				
Course Code	**SSH02484P**				
Course Credits	**L**	**T**	**P**	**TC**	
	-	**-**	**2**	**2**	
Prerequisites	• To enable the students to develop skills Physics Practical.				
Course Objectives	1. Measurement of sound intensities with different situation. 2. Characteristics of a microphone-loudspeaker system. 3. Designing an optical viewing system. 4. Study of monochromatic defects of images. 5. Determining the principal points of a combination of lenses.				

	6. Study of interference of light (biprism or wedge film) 7. Study of diffraction at a straight edge or a single slit. 8. Study of F-P etalon fringes. 9. Use of Diffraction grating and its resolving limit. 10. Resolving limit of a telescope system. 11. Polarization of light by reflection; also, cos-squared law. 12. Study of Optical rotation for any systems. 13. Study of laser as a monochromator coherent source. 14. Study of a divergence of a Laser beam.
Course Contents	On the completion of this course lab, successfully student will be able to understand the development of the Physics Practical.
Course Outcomes	1. D.P. Khandelwal: "Optics and Atomic Physics" (Himalaya Publishing House, Bombay 1988) 2. D.P. Khandelwal: "A Laboratory Manual for Undergraduate Classes" (Vani Publishing House, New Delhi)
Text Books	1. S. Lipschutz and A Poe: "Schaum's Outline of Theory and Problems of Programming with Fortran" (McGraw-Hill Book Company 1986)
Reference Book	• To enable the students to develop skills Physics Practical.