PROGRAMME GUIDE

MASTER OF SCIENCE

(M.Sc.)

CHEMISTRY

*Scheme of Examination (CBCS/ELECTIVE)

*Detailed Structure of Syllabus

DR. C.V.RAMAN UNIVERSITY

KARGI ROAD, KOTA, BILASPUR,CHATTISGARH(C.G.)
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w.e.f July.2020-21

DEPARTMENT OF CHEMISTRY

ABOUT THE DEPARTMENT OF CHEMISTRY:

INTRODUCTION:

The department of Chemistry was established in the year 2006 and thereafter moved on with its core chemistry branches successfully. The department consists of all its dedicated and well qualified energetic & skilled faculties as well as suitable strength of sincere students. The department offers all the regular degree programmes of chemistry like UG, PG, Certificate programmes & Research programmes viz. B.Sc, M.Sc, M.Phil & Ph.D. The programmes involve various professional job-oriented curriculum which fulfils the need for the complete development of the nation and the mission of new India. The department gives good academic results with positive trends & excellency. It also excels its Laboratory strength through various Instrumentation Techniques for chemical analysis through various instruments with a view to generate mission-oriented approach of chemical sciences for tackling the Research problems.

COMMITTMENT OF THE DEPARTMENT:

The Department of Chemistry is committed to:

1. Education: Provide the most comprehensive and highest quality education for Chemical sciences in a learning environment that embraces diversity, equity, integrity, ethics, moral courage and accountability.

2. Community service: Conduct health education programs to the community towards chemical aspects to prevent disease and improve public health and well-ness by fostering an environment that promotes the safe, efficacious, and cost-effective use of chemicals &substances preventing chemical hazards.

3. Research: Develop a passion for discovery and innovations with multidisciplinary collaborative research and engage in creative partnerships locally and globally to advance health education, research, practice& experiments related to chemistry.

LONG TERM GOALS:

- To develop center for excellence.
- To achieve International projects and Patents.
- To develop incubation center for global needs.
- To attain DST-FIST level.

SHORT TERM GOALS:

- To conduct International Conferences.
- To uplift all the laboratories so as to promote research and consultancy.
- To provide an excellent infrastructure facility to publish high indexed journals.
- To encourage teaching assistantship for the development of human values.
- To attract international students in UG, PG, M.Phil and Ph.D courses.
- To place students in core companies.

VISION

To lead the future of global chemical research for societal benefits and well being of the communities we serve. The department strives to contribute to a chemically literate society through chemical environment academically along with teaching, research and innovation for best human service.

MISSION

- To impart quality education in chemical Sciences and to undertake research and extension with emphasis on application and innovation that cater to the emerging societal needs through all around Development of students of all sections enabling them to be globally competitive and socially responsible citizens with intrinsic values.
- To ensure that Chemistry is the-international expert in providing excellence in education, initiating research and inspiring environment that ignites the young minds.

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- To maintain a Department that gives equal importance in terms of our significance of teaching and research by creating an environment that promotes independent thought, exchange of ideas, high ethical standards, development of innovative techniques & Use of modern educational tools & technology in lecture and laboratory courses.

ABOUT M.Sc. PROGRAMME

This programme is offered by the department of Chemistry as an effective program targeting the studentswho wish to pursue their higher studies in the field of chemistry. It offers in-depth knowledge about the various specific field of chemistry with an emphasis on fundamental understanding of chemical sciences atthe primary level and the core understanding of chemical sciences at the postgraduate level including the research component in the form of project.The structureof M.Sc.course scheme consist of courses of 84 credits in which the scheme includes the discipline specific electives (DSE), skill enhancement electives ,core courses and generic courses .

PROGRAMME EDUCATIONAL OBJECTIVES (PEO's):

The objective of the Master's programme in chemistry is to equip the students to apply the knowledge of mechanisms of chemical processes in living and non-living systems and higher order techniques to applied aspects.

- The laboratory training in addition to theory is included to prepare the students and learners for their careers in the industry and applied research where chemical sciences is increasingly elevated with an area of wisdom.

- The objective of the program is also to train the students and also sensitize them to the scope for research towards basics and current updates.

- The objective of the programme is also to address the increasing need for skilled scientific manpower with an understanding of research ethics involving chemistry for humans to contribute to the application, advancements and impartment of knowledge in the field of chemical sciences globally.

PROGRAM OUTCOMES (PO's)

[PO.1.] Critical Thinking: Take informed actions after identifying the assumptions that frame our thinking & actions.

[PO.2.] Effective communication: Speak, read, write & listen clearly in person and through electronic media in English and in one Indian Language, and make meaning of the world by connecting people, ideas, books, media and technology.

[PO.3.] Social interaction: Elicit views of others, mediate disagreements and help reach conclusions in group settings.

[PO.4.] Effective citizenship: Demonstrate empathetic social concern and the ability to act with an informed awareness of issues and participate in civic life through volunteering.

[PO.5.] Ethics: recognize different value systems including your own, understand the moral dimensions of decisions and accept the responsibility for them.

[PO.6.] Environment and sustainability: Understand the issues of environmental contents and sustainable development.

[PO.7.] Self-directed and long-life learning: Acquire the ability to engage in independent and lifelong learning in the broadest context of socio-economic and socio technological changes & develop an aptitude

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for continuous learning and professional development with ability to engage in chemistry practices and education program.

[PO.8.] Knowledge: Provide basic knowledge for understanding the principles and their applications in the area of Chemical Sciences, Instrumentation & Chemical Technology.
[PO.9.] Technical Skills: Develop an ability to use various instruments and equipment with an indepth knowledge on standard operating procedures for the same.

[PO.10.] Research & Development: To Demonstrate knowledge of identifying a problem, critical thinking, analysis and provide rational solutions in different disciplines of Chemistry & Chemical Sciences.

[PO.11.] Modern Tool Usage:Develop appropriate technique, resources and IT tools for prediction and modelling to complex chemical issues.

[PO.12.] The Society: Apply regional chemical reasoning informed by the contextual knowledge to comprehend and receive instructions on chemical safety and the consequent responsibilities relevant to the society as well as social well being.

[PO.13.] Problem analysis

[PO.14.] Conduct investigations of complex problems

[PO.15.] Design/Development of Solutions

[PO.16.] Individual and Teamwork

PROGRAM SPECIFIC OUTCOMES(PSO's)

[PSO.1.] Develop knowledge, understanding and expertise in their chosen field of chemical science.

[PSO.2.] Develop an understanding of eco-friendly chemical process and impact of chemistry on health and environment.

[PSO.3.] Understand the theoretical concepts of instruments that are commonly used in most chemistry fields as well as interpret and use data generated in the instrumental chemical analysis.

[PSO.4.] Provide opportunities to excel in academics, research or industry.

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W.E.F. July-2020-21

MASTEROF SCIENCE(CHEMISTRY)
Duration: 24 Months (2Years)
Eligibility: Graduation with Science Subjects

COURSE STRUCTURE M.SC CHEMISTRY SEMESTER Ist													
Course Details				External Assessment		Internal Assessment				Credit Distribution			Allotted Credits
Course Code	Course Type	Course Title	Total Marks	Major		Minor		Sessional ***		L	T	P	Subject wise Distribution
				Max Marks	Min Marks	Max Marks	Min Marks	Max Marks	Min Marks				
Theory Group													
6SMCH101	Core Course	Inorganic Chemistry - I	100	50	17	20	08	30	12	4	-	-	4
6SMCH102	Core Course	Organic Chemistry – I	100	50	17	20	08	30	12	4	-	-	4
6SMCH103	Core Course	Physical Chemistry – I	100	50	17	20	08	30	12	4	-	-	4
6SMCH104	Core Course	Analytical Chemistry - I	100	50	17	20	08	30	12	4	-	-	4
Practical Group				Term End Practical Exam		Lab Performance		Sessional					
6SMCH105	Practical	LAB – I	50	25	08	-	-	25	08	-	-	2	2
6SMCH106	Practical	LAB – II	50	25	08	-	-	25	08	-	-	2	2
	Grand Total		500							16	-	4	20

Minimum Passing Marks are equivalent toGradeD

L- Lectures T- Tutorials P- Practical

Major- Term End Theory / PracticalExam

Minor- Pre University Test

Sessional weightage – Attendance 50%, Three Class Tests/Lab Performance Assignment 50%

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COURSE STRUCTURE M.SC CHEMISTRY SEMESTER IInd														
Course Details				External Assessment		Internal Assessment				Credit Distribution			Allotted Credits
Course Code	Course Type	Course Title	Total Marks	Major		Minor		Sessional ***		L	T	P	Subject wise Distribution
				Max Marks	Min Marks	Max Marks	Min Marks	Max Marks	Min Marks				
Theory Group													
6SMCH201	Core Course	Inorganic Chemistry – II	100	50	17	20	08	30	12	4	-	-	4
6SMCH202	Core Course	Organic Chemistry – II	100	50	17	20	08	30	12	4	-	-	4
6SMCH203	Core Course	Physical Chemistry – II	100	50	17	20	08	30	12	4	-	-	4
6SMCH204	Core Course	Analytical Chemistry - II	100	50	17	20	08	30	12	4	-	-	4
Practical Group			-	Term End Practical Exam		Lab Performance		Sessional					
6SMCH205	Practical	Lab –I	50	25	08	-	-	25	08	-	-	2	2
6SMCH206	Practical	Lab-II	50	25	08	-	-	25	08	-	-	2	2
Skill Courses								Sessional					
	Skill Enhancement	Skill Enhancement Elective Course-1	50	-	-	-	-	50	20	1	-	1	2
	Grand Total		550							17		5	22

Minimum Passing Marks are equivalent to Grade D

L- Lectures T- Tutorials P- Practical

Major- Term End Theory / PracticalExam

Minor- Pre University Test

Sessional weightage – Attendance 50%, Three Class Tests/ Lab Performance Assignment 50%

Skill Elective I – Any other course being offered in this semester as per the list given at the end of course structure.

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Eligibility: Graduation with Science Subjects

COURSE STRUCTURE M.SC CHEMISTRY SEMESTER IIIrd														
Course Details				External Assessment		Internal Assessment				Credit Distribution			Allotted Credits
Course Code	Course Type	Course Title	Total Marks	Major		Minor		Sessional ***		L	T	P	Subject wise Distribution
				Max Marks	Min Marks	Max Marks	Min Marks	Max Marks	Min Marks				
Theory Group													
6SMCH301	Core Course	Application of Spectroscopy	100	50	17	20	08	30	12	4	-	-	4
6SMCH302	Core Course	Bio Organic& Inorganic chemistry	100	50	17	20	08	30	12	4	-	-	4
****	Discipline Specific Elective	Elective –I (Select any one from specialization opted)	100	50	17	20	08	30	12	4	-	-	4
****	Discipline Specific Elective	Elective –II (Select any one from specialization opted)	100	50	17	20	08	30	12	4	-	-	4
Practical Group				Term End Practical Exam		Lab Performance		Sessional					
****	Practical	Lab -I	50	25	08	-	-	25	08	-	-	2	2
****	Practical	Lab-II	50	25	08	-	-	25	08	-	-	2	2
Skill Courses								Sessional					
	Skill Enhancement	Skill Enhancement Elective Course-1	50	-	-	-	-	50	20	1	-	1	2
	Grand Total		550							17	-	5	22

Minimum Passing Marks are equivalent to Grade D

L- Lectures T- Tutorials P- Practical

Major- Term End Theory / Practical Exam

Minor- Pre University Test

Sessional weightage – Attendance 50%, Three Class Tests/ Lab Performance Assignment 50%

Skill Elective I – Any other course being offered in this semester as per the list given at the end of course structure.

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MASTEROF SCIENCE(CHEMISTRY)
Duration: 24 Months (2Years)
Eligibility: Graduation with Science Subjects

COURSE STRUCTURE M.SC CHEMISTRY SEMESTER IVth														
Course Details				External Assessment		Internal Assessment				Credit Distribution			Allotted Credits
Course Code	Course Type	Course Title	Total Marks	Major		Minor		Sessional ***		L	T	P	Subject wise Distribution
				Max Marks	Min Marks	Max Marks	Min Marks	Max Marks	Min Marks				
Theory Group													
****	Discipline Specific Elective	Elective –III (Select any one from specialization opted)	100	50	17	20	08	30	12	4	-	-	4
****	Discipline Specific Elective	Elective –IV (Select any one from specialization opted)	100	50	17	20	08	30	12	4	-	-	4
Practical Group				End Practical Exam		Lab Performance		Sessional					
****	Practical	LAB -I	50	25	08	-	-	25	08	-	-	2	2
****	Practical	LAB-II	50	25	08	-	-	25	08	-	-	2	2
	Research Component	Project/Internship & Viva Voce	200	100	33	-	-	100	40	-	-	8	8
	Grand Total		500							8	-	12	20

Minimum Passing Marks are equivalent toGradeD

L- Lectures T- Tutorials P- Practical

Major- Term End Theory / PracticalExam

Minor- Pre University Test

Sessional weightage – Attendance 50%, Three Class Tests/ Lab Performance Assignment 50%

Compulsory Project/Dissertation with choice in any Disciplinary specific elective. Compulsory one paper presentation certificate in related discipline. PROJECT

All the candidates of M.Sc. (Chemistry) are required to submit a project-report based on the work done by him/her during the project period. A detailed Viva shall be conducted by an external examiner based on the project report. Students are advised to see the detailed project related guidelines on the website of RNTU. (www.rntu.ac.in) under Project Guidelines for student section.

Outcome-The student will identify a problem on which he/she would be able to work, identify the scope of research on the chosen topic and will frame the objectives to be addressed in the project through a work plan.

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SPECILIZATION WITH ELECTIVE

***Note** - Students need to select any one group and choose any two subjects from selected group for Third and Fourth semester.

Electives for Third Semester			Electives for Fourth Semester		
Course Code	**Course Type**	**List of Electives**	**Course Code**	**Course Type**	**List of Electives**
GROUP ELECTIV-I & II Name – M.Sc (Chemistry)			**GROUP ELECTIVE-III & IV Name –M.Sc (Chemistry)**		
6SMCH303	Discipline Specific Organic Chemistry	Applied Organic Chemistry	6SMCH401	Discipline Specific Organic Chemistry	Chemistry of Natural Products
6SMCH304	Discipline Specific Organic Chemistry	Drug and Heterocyclic Compounds	6SMCH402	Discipline Specific Organic Chemistry	Stereochemistry
6SMCH305	Discipline Specific Inorganic Chemistry	Chemistry of Inorganic Materials	6SMCH403	Discipline Specific Inorganic Chemistry	Separation Science
6SMCH306	Discipline Specific Inorganic Chemistry	Co-ordination Chemistry	6SMCH404	Discipline Specific Inorganic Chemistry	Organo Metallic Chemistry
6SMCH307	Discipline Specific Physical Chemistry	Advanced Chemical Kinetics	6SMCH405	Discipline Specific Physical Chemistry	Surface Chemistry
6SMCH308	Discipline Specific Physical Chemistry	Electro- Chemistry	6SMCH406	Discipline Specific Physical Chemistry	Chemistry of Materials

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SKILL ENHANCEMENT ELECTIVE COURSES

Non-Technical			
Elective No.	**Department/ Faculty Name**		
	Faculty of Information Technology		
I	SCIT 201	Data Entry Operation	2(1+0+1)
II	SCIT 301	Multimedia	2(1+0+1)
III	SCIT 501	Web Designing with HTML	2(1+0+1)
IV	SCMIT 201	Web Development	2(1+0+1)
V	SCMIT 301	LINUX	2(1+0+1)
	Faculty of Management		
I	SMGT 201	Briefing and Presentation Skills	2(1+0+1)
II	SMGT 301	Resolving Conflicts and Negotiation Skills	2(1+0+1)
III	SMGT 802	Entrepreneurship Development	2(1+0+1)
	Faculty of Commerce		
I	SCOM 201	Tally ERP 9	2(1+0+1)
II	SCOM 302	Multimedia	2(1+0+1)
III	SCOM 803	Data Analyst	2(1+0+1)
	Faculty of Humanities		
I	SHBA 301	Pursuing Happiness	2(1+0+1)
II	SHBA302	Communication Skill and Personality Development	2(1+0+1)
III	SHMA301	Tourism in M.P	2(1+0+1)
	Faculty of Science		
I	SSBI 301	Mushroom Cultivation	2(1+0+1)
II	SSPH 301	House Hold Wiring	2(1+0+1)
III	SSPH 301	Basic Instrumentation	2(1+0+1)
IV	SSPH 301	DTP Operator	2(1+0+1)
V	SSCH 301	Graphic Designing	2(1+0+1)
	Faculty of Education		
I	SCBE 403	Understanding of ICTC (Information Communication Technology)	2(1+0+1)
II	SCPE 201	Yoga Education	2(1+0+1)

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SEMESTER- 1st
Course: M.Sc. Chemistry
SUBJECT:Inorganic Chemistry - I

Subject Code: 6SMCH101
Theory Max. Marks: 50
Theory Min. Marks: 17

Course objective: The student will be able to
1. Explain rules of periodicity
2. Identify s,p,d,f block elements
3.Provide brief descriptions of the transition elements
4. Understand Chemical Bonding and structure
5. Explain Bioinorganic Chemistry
6. Analyze Character of covalent bonds.

Unit	Unit wise course contents	Methodology Adopted
Unit – I	Chemical periodicity Periodic table, group trends and periodic trends in physical properties. Classification of elements on the basis of electronic, configuration. Modem IUPAC Periodic table. General characteristic of s, p, d and f block elements. Position of hydrogen and noble gases in the periodic table. Effective nuclear charges, screening effects, Slater's rules, atomic radii, ionic radii (Pauling's univalent), covalent radii. Ionization potential, electron affinity and electronegativity (Pauling's, Mulliken's and Allred-Rochow's scales) and factors influencing these properties. Inert pair effect. Group trends and periodic trends in these properties in respect of s-, p- and d-block elements.	Classroom teaching ICT tools and Google classroom,
Unit – II	Stereochemistry and Bonding in main group compounds VSEPR theory &drawbacks, Walsh diagram (tri and penta atomic molecules dπ-pπ bonds, Bent rule, and energetic of hybridization, some simple reactions of covalently bonded molecules.	Classroom teaching, ICT Based and individual presentation and Google classroom
Unit – III	Chemistry of transition elements General characteristic properties of transition elements, co-ordination chemistry Of transition metal ions, stereochemistry of coordination compounds, ligand field Theory, splitting of d orbital's in low symmetry environments, John- Teller effect, Interpretation of electronic spectra including charge transfer spectra, Spectrochemical series, nephelauxetic series, metal clusters, sandwich compounds, metal carbonyls.	Classroom teaching, ICT Based and individual presentation and Google classroom
Unit – IV	Bioinorganic Chemistry Role of metal ions in biological processes, structure and properties of metalloproteinase in electron transport processes, cytochromes, ferrodoxins and iornsulphur proteins, ion transport across membranes, Biological nitrogen fixation, PSI ,PS – II, Oxygen uptake proteins.	Classroom teaching, ICT Based and individual presentation and Google classroom, field visit
Unit - V	Chemical Bonding and structure Ionic bonding: Size effects, radius ratio rules and their limitations. Packing of ions in crystals, lattice energy, Bom-lande equation and its applications, Born-Haber cycle and its applications. Solvation energy, polarizing power and polarizability, ionic potential, Fazan's rules. Defects in solids (elememtary idea). Covalent bonding: Lewis structures, formal charge. Valence Bond Theory, directiqnal character of covalent bonds, hybridizations, equivalent and non-equivalent hybrid orbitals, Bent's rule, shapes of molecules and ions containing lone pairs and bond pairs (examples from main groups chemistry), Partial ionic Character of covalent bonds, bond moment, dipole moment and electro negativity differences. Concept of resonance, resonance energy, resonance structures	Classroom teaching, ICT Based and individual presentation and google classroom, model presentation.

Course outcomes:

After the completion of course learner should able to understand about
1.Be able to describe the electronic structure of atoms
2.Be able to know the properties of elements in the periodic table
3.Be able to differentiate between types of bonds& structures

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4.Be able to determine shapes of molecules
5.Knowledge of properties and behavior

Text Books

- J H, Huheey, Inorganic Chemistry – Principal, structure and reactivity, Hrper And Row Publisher, Inc. York (1992)
- J.D. Lee, Concise Inorganic Chemistry, Elba with Chapman and Hall, London
- F.A. Cotton, R.G. Wilkinson. Advanced Inorganic chemistry
- Chakrabury, Sold State Chemistry, New Age International Science e Books
- Inorganic chemistry vol 1&2 Gurdeep Raj, Goal publication.
- Inorganic chemistry- R. Sarkar (Vol.I-II), Newcentraj Book Agency.
- Basic Principales of Inorganic chemistry- Asim Kr. Das (Vol. I-II), CBS publishers, s Distributors, New Delhi.

Job opportunity	Employability skill developed	Local/National/UNDP Goal Achieved	Entrepreneurship Opportunity
Chemist, Scientist, Academic ,food industries	Analysis and organization. written and oral communication	Goal04(quality education) Goal13 (climate action), Goal 15(Life on land),Goal03 (Good health & well being)	Food, cosmetic & water purification expert , good academician etc.

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SEMESTER- 1st
Course: M.Sc. Chemistry
SUBJECT:Organic Chemistry - I

Subject Code: 6SMCH102
Theory Max. Marks: 50
Theory Min. Marks: 17

COURSE OBJECTIVE: The student will be able to
1. Explain rules of organic Reaction Mechanism
2.Identify Carbon–Carbon Multiple Bonds
3.Provide brief descriptions of the Elimination Reactions
4. Understand Stereochemistry & their rules
5. Explain Concept of Chirality
6. Analyze Characteristics of symmetry.

Unit	Unit wise course contents	Methodology Adopted
Unit – I	Reaction Mechanism: Structure and Reactivity (10+2) Types of reactions, potential energy diagrams, transition states and intermediates.Hard and soft acids and bases, strength of acids and bases. Generation, structure,stability and reactivity of carbocations and carbanions. b) Aliphatic Nucleophilic substitutions: The SN2, SN1 reactions with respects to mechanism and stereochemistry.Reactivity effect of substrate structure, effect of attacking nucleophiles, leaving groups and reaction medium, Neighbouring Group Participation. Nucleophilic aromatic substitutionreactions SN1, SN2.	Classroom teaching ICT tools and Google classroom,
Unit – II	Aromatic Electrophilic Substitutions: (10+2) Introduction, Concept of Aromaticity, the arenium ion mechanism, orientation and reactivity in Nitration, Sulphonation, Friedel-Crafts and Halogenation in aromatic systems, energy profile diagrams. The ortho/para ratio, ipso attack, orientation in their ring systems. Diazo-coupling, Vilsmeir reaction, Gatterman-Koch rection, Von Richter rearrangement .	Classroom teaching, ICT Based and individual presentation and Google classroom
Unit – III	Addition to Carbon–Carbon Multiple Bonds (10+2) Mechanism and steriochemical aspects of the addition reactions involving electrophiles and free radicals, regio and chemo-selectivity, orientation and reactivity. Hydrogenation of double and triple bonds, hydrogenation of aromatic rings. Michael reaction.	Classroom teaching, ICT Based and individual presentation and Google classroom
Unit – IV	Elimination Reactions: (10+2) The E1, E2 and E1cB mechanisms. Orientation in Elimination reactions. Reactivity: effects of substrate structures, attacking base the leaving group the nature of medium on elimination reactions. Pyrolytic elimination reactions.	Classroom teaching, ICT Based and individual presentation and Google classroom, field visit
Unit - V	Study of following reactions: (10+2) Beckman, Fries, Benzilic acid, Hoffman, Schmidt, Curtius, Lossen&Benzilic acid, Stereochemistry: Concept of Chirality and molecular dissymmetry, Recognition of symmetry elements and chiral centers, Prochiral relationship, homotopic, enantiotopic and disteriotopic groups and faces. Recemic modifications and their resolution, R and S nomenclature. Geometrical isomerism E and Z. Nomenclature. Conformational analysis : cyclohexane derivatives, stability and reactivity,	Classroom teaching, ICT Based and individual presentation and google classroom, model presentation.

Course Outcomes:1.Be able to describe the transition states and intermediates
2.Be able to know the properties of Aromatic Electrophilic Substitutions
3.Be able to differentiate organic reactions
4.Be able to determine molecular Chirality
5.Knowledge of properties of Carbon–Carbon Multiple Bonds.

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Text book:

- Mechanism and structure in Organic chemistry (Holt Reinh.) B.S. Gould.
- Organic reaction mechanism (McGraw-Hill) R.K. Bansal.
- Reaction mechanism in organic chemistry- S.M. Mukharji and S.P. Singh
- Stereochemistry by P.S. Kalsi (New Age International)

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- Reaction and Reagent O.P. Agrawal
- Organic chemistry – Jagdamba Singh Pragati Publication.
- Reaction mechanism inorganic chemistry, Mukharkee, Kaopoor., New Age International.

Job opportunity	Employability skill developed	Local/National/UNDP Goal Achieved	Entrepreneurship Opportunity
Chemist, scientist, Academic , various industries, explosive, organic solvents industries	Analysis and problem-solving. time management and organization. written and oral communication	Goal04(quality education) Goal13 (climate action), Goal 15(Life on land),Goal03 (Good health & well being)	Academician ,oganic chemical releted work

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SEMESTER- 1st
Course: M.Sc. Chemistry
SUBJECT:PHYSICAL CHEMISTRY-I

Subject Code: 6SMCH103
Theory Max. Marks: 50
Theory Min. Marks: 17

Course objective: The student will be able to
1. Explain rules of THERMODYNAMICS
2.Identify Ideal & Non ideal solutions
3.Provide brief descriptions of the KINETIC THEORY OF GASES
4. Understand Molecular statistics
5. Explain Concept of Molecular collision in gases
6. Analyze Characteristics COLLOIDS AND MACROMOLECULES
7. Define phase rules.

Unit	Unit wise course contents	Methodology Adopted
Unit – I	Thermodynamics-I Introduction, revision of basic concepts. 1.Second law of thermodynamics: Physical significance of entropy (Direction of spontaneous change and dispersal of energy), Carnot cycle, efficiency of heat engine, coefficient of performance of heat engine, refrigeration and problems. 2. Maxwell relations, thermodynamic equation of state, chemical potential, variation of chemical potential with temperature & pressure. Applications of chemical potential, phase rule, lowering of vapor pressure (Rault's law) and elevation in boiling point.	ICT based class room teaching, individual presentation
Unit – II	Thermodynamics-II (10+2) 1. Ideal solutions, Rault's law, Duhem-Margules equation and its applications to vaporpressurecurves(Binary liquid mixture), determination of activity coefficients fromvapor pressure measurements, Henry's law. 2. Nonideal solutions : deviations from ideal behaviour of liquid mixtures, liquidvapor compositions, conditions for maximum.	ICT based class room teaching, individual presentation
Unit – III	Kinetic Theory Of Gases (10+2) 1. Postulates of kinetic theory of gases, P-V-T relations for an ideal gas, non-idealbehavior of gases, equation of state, compressibility factor, virial equation, van derWaal's equation, excluded volume and molecular diameter, relations of van derWaal's constants with virial coefficients and Boyle temperature. 2. Molecular statistics, distribution of molecular states, deviations of Boltzmann law for molecular distribution, translational partition function, Maxwell-Boltzmann law for distribution of molecular velocities, physical significance of the distribution law, deviation of expressions for average, root mean square and most probable velocities, experimental verification of the distribution law. 3. Molecular collision in gases, mean free path, collision diameter and collision number in a gas and in a mixture of gases, kinetic theory of viscosity and diffusion.	ICT based class room teaching, individual presentation
Unit – IV	Colloids And Macromolecules(10+2) 1. Sols, Lyophilic and lyophobic sols, properties of sols, coagulation. Sols of surface active reagents, surface tension and surfactants, critical micelle concentration. Macromolecules: Mechanism of polymerization, molecular weight of a polymer (Number and mass average) viscosity average molecular weight, numerical problems. Degree of polymerization and molecular weight, methods of determining molecular weights(Osmometry, viscometry, light scattering, diffusion and ultracentrifugation) 05 3. Chemistry of polymerization: Free radical polymerization(Initiation, propagation and termination), kinetics of free radical polymerization, step growth polymerization(Polycondensation), kinetics of step polymerization, cationic and anionic polymerization. (More stress should be given to solving numerical problems)	ICT based class room teaching, individual presentation
Unit - V	Phase rule(10+2) Distribution Law: Partition of iodine between water and carbon tetrachloride.	ICT based class room teaching, individual

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	Equilibrium constant of $I^- + I_2 = I_3^-$. Concentration of unknown potassium iodide. Partition of ammonia between water and chloroform. Partition of aniline between benzene and water. Hydrolysis constant of aniline hydrochloride. Association of benzoic acid in Naphthalene. Solid-Liquid Equlibria: Construction of phase diagrams of simple eutectics, systems with congruent melting points and solid solutions. Determination of composition of unknown mixtures. Analytical and synthetic methods for the determination of solubilities	presentation

Course outcomes- After the completion of course learner should able to understand the following:

- 1.Be able to describe the Phase rule & Solid-Liquid Equlibria
- 2.Be able to know the properties of COLLOIDS AND MACROMOLECULES
- 3.Be able to differentiate polymerisation
- 4.Be able to determine Postulates of kinetic theory of gases
- 5.Knowledge of Chemistry of polymerization
- 6.Know methods of determining molecular weights.
- 7.Be able to understand kinetics of gases.

Text book:

- Text book of Physical Chemistry- S. Glasstone
- Physical Chemistry- G.M. Barrow, Tata-McGraw Hill, Vth edition, 2003
- Physical Chemistry- G.K. Vemulapalli, Prentice-Hall of India, 1997.
- A Text book of Physical Chemistry- A.S. Negi- New Age International
- A Text book of Physical Chemistry- K.L. Kaboor (Vol.I- IV) Mecmillan India Limited.
- Advanced Physical Chemistry- J.N. Gurtu R AGurta, PragatiPrakashan.
- Advanced Physical Chemistry – Gurdeep Raj Krishran Publication.
- Physical Chemistry- Puri, Sharma &Parhalia, Vikash

Job opportunity	Employability skill developed	Local/National/UNDP Goal Achieved	Entrepreneurship Opportunity
Chemist, Analyst, scientist, Academician, food industries	Analysis and problem-solving. time management in organization, written and oral communication	Goal 04(quality education) Goal 13 (climate action), Goal 15(Life on land), Goal 03 (Good health & well being)	Food, cosmetic pharmaceutical, academician

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SEMESTER- 1st
Course: M.Sc. Chemistry
SUBJECT: Analytical Chemistry - I

Subject Code: 6SMCH104
Max Marks theory. - 70
MinMarksTheory -28

Course Objective- The student will be able to
1. Determine Errors and treatment of Analytical Chemistry
2.Learn Chromatographic methods
3.Provide brief descriptions of Electro analytical Techniques
4. Understand Volumetric and Gravimetric Analysis
5. Explain Concept of TLC
6. Analyze Characteristics of Standard solutions Indicators
7. Define organic precipitation.

Unit	Unit wise course contents	Methodology Adopted
Unit – I	Errors and treatment of Analytical Chemistry (10+2) Errors, Determinant, constant and indeterminate. Accuracy and precision Distribution of random errors. Average derivation and standard derivation, variance and confidance limit. Significance figures and computation rules. Least square method. Methods of sampling: samples size. Techniques of sampling of gases, fluid, solids, and particulates.	ICT based classroom teaching measurement and calculation.
Unit – II	Chromatographic methods: (10+2) General principle, classification of chromatographic methods. Nature of partition forces. Chromatographic behavior of solutes. Column efficiency and resolution. Gas Chromatography: detector, optimization of experimental conditions. Ion exchanges chromatography. Thin layer chromatography: coating of materials, prepative TLC. Solvents used and methods of detection Column chromatography. Adsorption and partition methods. Nature of column materials.Preparation of the column. Solvent systems and detection methods.	ICT based classroom teaching and experimental significance. Analysis individual presentation
Unit – III	Electroanalytical Techniques(10+2) Polarography: Introduction, Instrumentation, Ilkovic equation and its verification. Derivation of wave equation, Determination of half wave potential, qualitative and quantitative applications. Amperometry: Basic principals, instrumentation, nature of titration curves and analytical applications.	ICT based classroom teaching, power point presentation.
Unit – IV	Theory of Volumetric and Gravimetric Analysis(10+2) Standard solutions Indicators, theory of indicators , types of titrations, Acid , base , precipitation, Redox and complexometric titrations, Acid–base titrations in nonaqueous media , solvent characterisation , living effect , applications of non – aqueous titrations , MnO_2 in pyrolusite, Na_2CO_3 + $NaHCO_3$ and NaOH + Na_2CO_3 Mixture analysis , Gravimetric Analysis purity of the precipitate – Co precipitation's and post precipitations from homogenous solution , organic precipitation.	ICT based classroom teaching, laboratory Analyzing and Group Discussions. ICT based classroom teaching, individual presentation
Unit - V	Computer Science: (10+2) Introduction: History etc. Hardware: Central processor unit. Input devices. Storage devices. Periferals, Software: Overview of the key elements of basic program structure, loops, arrays, mathematical function. User defined functions, conditional statements, string. Applications. Data representation, Computerized instruments system. Microcomputer interfacing.	ICT based classroom teaching, power point presentation.

Course outcomes-
1.Be able to describe use of Computer in analytical chemistry.
2.Be able to know the properties of Mixture and their analysis
3.Be able to differentiate Volumetric and Gravimetric Analysis
4.Be able to determine Solvent systems and their detection methods
5.Knowledge of Errors and their treatment
6.Know methods of sampling

Text Books

- Analytical Chemistry : (J.W) Gary Christain
- Instrumental Methods of analysis (CBS)- H.H. Willard, L.L. Mirrit, J.A. Dean

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- Instrumental Methods of Analysis : Chatwal and Anand
- Instrumental Methods of Inorganic Analysis (ELBS) : A.I. Vogel

Job opportunity	Employability skill developed	Local/National/UNDP Goal Achieved	Entrepreneurship Opportunity
Material and Quality Analyst, Research associate, Food Quality Control Chemist	Collect analyze and organize information, be open to new ideas and technique	Goal 3(Good Health and Well-Being, Goal 4(Quality Education),Goal 6(Clean Water and Sanitation), Goal10(Reduced Inequalities), Goal13(Climate Action)	Analytical Scientist, Chemist.

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SEMESTER- 1st
Course: M.Sc. Chemistry
SUBJECT:Lab-I Inorganic chemistry

Subject Code:SMCH 101
Max. Marks: 25
Min. Marks: 08

Course Objective:
To analyze the preparation, properties of inorganic compound. Estimation of inorganic salts mixture containing interfering radicals

Qualitative analysis of mixture containing.
Eight radical including some less common metal ions among the following by common method (preferably semi-micro method)
Basic radicals :- Ag, Pb, Hg, Cu, Cd,Bi, As, Sb, Sn, Fe, Al, Cr, Zn, Mn, Co, Ni, Ba, Sr, Ca, Mg, Na, K, NH_4, Ce, Th, Zr, w, Te, Ti, Mo, O, V, Be, Li, Au, Pt,
Acid Radicals: - CO_3^{2-}, SO_4^{2-}, SO_3^{2-}, NO_3^-, F^-, Cl^-, Br^-, I^-, NO_2^-, BO_3^{3-}, $C_2O_4^{2-}$, PO_4^{3-}, SiO_4^{2-}, Thiosulphate, Ferroeynide, Ferricyanide, Chromate, Arsenite, Arsenate, Permanganate,

Quantitative Analysis :-
Involving two of the following in ores, alloys or mixture in solution – one by volumetric and other by gravimetric method Ag, Cu, Fe, Cr, Mn, Ni, Zn, Ba, Ca, Mg, chloride, Sulphate.

Estimation of :-
Phosphoric acid in commercial orthophosphoric acid,
Boric acid in borax,
Ammonium lon in Ammonium salt,
MnO_2 in pyrolusite
Available chlorine in bleaching powder,
H_2O_2 in commercial sample,

Preparation of selected Inorganic compounds and study of their properties by various method including IR, Electronic Spectra, Mossbaur, ESR, Spectra magnetic susceptibility etc.
Vo(acac)2
Cis& Trans K $[Cr(C_2O_4)_2(H_2O)_2]. 2H_2O$
$Na[Cr(NH_3)_2(SCN)_4]$
Mn (acac)
$K3[Fe(C_2O_4)_3]$
Prussian BlueTurnbulls Blue
$[Co(NH_3)_6][Co(NO_2)_6]$
Hg $[Co(SCN)_4]$
$[Ni(NH_3)_4]Cl_2$
$Ni(DMG)_2$
$[Cu(NH_3)4]SO_4$
Mohr's salt
Nickel ammonium Sulphate

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Course Outcomes :
- Estimation of various ions by qualitative methods.
- Preparation of some inorganic complex compounds

Reeferences
- A text book of Quantitative Inorganic Analysis-A.I.Vogel.
- Experimental Inorganic Chemistry-W.G.Palmer.
- The analysis of minerals and ores of the rarer elements-W.R.Schoeller and A.R.Powell, Charles, Griffin and company Ltd.

Practical Inorganic Chemistry, Gurdeep Raj, Goal Publication.

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SEMESTER- 1st
Course: M.Sc. Chemistry
SUBJECT:Lab-II Physical Chemistry

Subject Code: SMCH 103
Max. Marks: 25
Min. Marks: 08

Course Objective:
To study about adsorption, chemical kinetics, conductometry, Polarimetry and colorimetry

Electrochemistry: Conductometry

1.Determination of solubility of sparingly soluble salt (e.g., $PbSO_4$, $BaSO_4$) conductometrically.
2.Determination of the strength of strong and weak acids in a given mixture conductometrically.
3.Determination of dissociation constant of weak electrolyte by conductometer.

pH metry/Potentiometry

4.Determination of the strength of strong and weak acid in a given mixture using pH **5.**meter/potentiometer.
6.Determination of dissociation constant of weak acid by pH meter.
7.Determination of concentration of acid in given buffer solution by pH meter.

Polarimetry

8.Determination of rate constant for hydrolysis/inversion of sugar using polarimeter Solubility and partition coefficient
9.Effect of temperature on solubility of electrolyte: Determination of partition coefficient of between carbon tetrachloride and water.
Find out atomic parachor of carbon and hydrogen.

Colorimety

10. Verification of beer's and lamberts law and find out the concentration of unknown solution

Course Outcomes:
Afterthe completion of course learner should able to understand the following:

- Verification of Freundlich's Adsorption Isotherm.
- Determination of order of a reaction.
- Determination of solubility, dissociation constant and ionic strength.
- Rate constant
- Partition co-efficient
- Verification of Lambert beer Law.

Text book:

- A text book of Quantitative Inorganic Analysis-A.I.Vogel.
- Experimental Inorganic Chemistry-W.G.Palmer.
- Practical physical chemistry, A.M.James and F.E.Prichard Longman
- Practical Physical Chemistry, Gurdeep Raj, Goal Publication.

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SEMESTER- 2nd
Course: M.Sc. Chemistry
SUBJECT:INORGANIC CHEMISTRY.-II

Subject Code: 6SMCH201
Theory Max. Marks: 50
Theory Min. Marks: 17

Course objectives-
The student will be able to
1. Explain Chemistry of non – Transition elements
2.Define Organometallic chemistry principles
3.Know Metal – ligand equilibria in solution
4. Define applications of Lanthanides and Actinides
5. Explain Non- aqueous solvents
6. Understand Nuclear and radiochemistry.

Unit	Unit wise course contents	Methodology Adopted
Unit – I	Chemistry of non – Transition elements (10+2) General discussion on the properties of the non – transition elements, special features of individual elements, synthesis, properties and structure of halides and oxides of the non – transition elements, Polymorphism in carbon, phosphorous and sulphur, Synthesis, properties and structure of boranes, carboranes, silicates, carbides, phosphazenes, sulphur – nitrogen compounds, peroxo compounds of boron, carbon,sulphur, structure and bonding in oxyacids of nitrogen,phosphorous, sulphur and halogens, interhalogens, pseudohalides.	Classroom teaching ICT tools and google classroom,
Unit – II	Organometallic Chemistry of transition elements (10+2) Ligand hapticity, electron count for different types of organometallic compounds, 18 and 16 electron rule ,synthesis, structure and bonding,organometallic reagents in organic synthesis and in homogeneous catalytic reactions (Hydrogenation, hydroformylation, isomerisation and polymerisation), pi metal complexes,) Metal – ligand equilibria in solution Stepwise and overall formation constants and their interaction, trends in stepwise constants, factors affecting the stability of metal complexes with reference to nature of metal ion and ligand, chelate effect.	Classroom teaching, ICT Based and individual presentation and google classroom
Unit – III	Studies and applications of Lanthanides and Actinides (10+2) Spectral and magnetic properties, use of lanthanide compounds as shift reagents, Modern methods of separation of lanthanides and actinides, Organometallic chemistry applications of lanthanide and actinide compounds in Industries.	Classroom teaching, ICT Based and individual presentation and google classroom
Unit – IV	Chemistry in Non- aqueous solvents (10+2) Classification of solvents, properties, leveling effect, type reactions in solvents, chemistry of liquid ammonia, liquid dinitrogen tetraoxide and anhydrous sulphuric acid with respect to properties, solubilities and reactions.	Classroom teaching, ICT Based and individual presentation and Google classroom, field visit
Unit - V	Nuclear and radiochemistry (10+2) Radioactive decay and equilibrium, nuclear reactions, Q value, cross-sections, types of reactions, chemical effects of nuclear transformation, fission and fusion, fission products and fission yield	Classroom teaching, ICT Based and individual presentation and google classroom, model presentation.

Course outcomes-After the completion of course learner should able to understand about
1. Be able to describe properties of the non – transition elements
2.Be able to know the properties of Metal – ligand bonding
3.Be able to Know Nuclear and radiochemistry
4.Be able to define fission and fusion
5.Knowledge of Synthesis, properties and structure of ligand complexes.

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TextBooks/Reference Books:
- J H, Huheey, Inorganic Chemistry – Principal, structure and reactivity, Harper And Row Publisher, Inc. York (1992)

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- J.D. Lee, Concise Inorganic Chemistry, Elba with Chapman and Hall, London
- F.A. Cotton, R.G. Wilkinson. Advanced Inorganic chemistry
- Chakrabury,Sold State Chemistry, New Age International Science e Books
- Inorganic chemistry vol 1&2 Gurdeep Raj. Goal publication.
- Inorganic chemistry- R. Sarkar (Vol.I-II), Newcentraj Book Agency.

Basic Principales of Inorganic chemistry- Asim Kr. Das (Vol. I-II), CBS publishers,s Distributors, New Delhi

Job opportunity	Employability skill developed	Local/National/UNDP Goal Achieved	Entrepreneurship Opportunity
Medicinal industry, cosmetic industry, water technology	Analysis and problem-solving. time management and organization. written and oral communication	Goal04(quality education) Goal13 (climate action), Goal 15(Life on land),Goal03 (Good health & well being)	Food ,cosmetic water purification , acamid ician

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SEMESTER- 2nd
Course: M.Sc. Chemistry
SUBJECT:ORGANIC CHEMISTRY.-II

Subject Code:6SMCH202
Theory Max. Marks: 50
Theory Min. Marks: 17

Course Objective- The student will be able to
1. Explain Mechanism of reactions
2.Define Alkylation and Acylation
3.Study of Organometallic compounds
4. Define Methodologies in organic synthesis
5. Explain carbonyl compounds

Unit	Unit wise course contents	Methodology Adopted
Unit – I	Study of following reactions: (10+2) Mechanism of condensation reaction involving enolates Mannich, Benzoin, Stobbe, Dieckmann, Diels-Alder, Robinson annulation Reimer-Tieman, Chichibabin, Baeyer Villiger oxidation	ICT based class room teaching Group presentation
Unit – II	a) Alkylation and Acylation(10+2) Introduction, Types of alkylation and alkylating agents: C-Alkylation and Acylation of active methylene compounds and Applications. b) .Hrdroboration and Enamines : Mechanism and Synthetic Applications.	ICT based class room teaching and discussion.
Unit – III	a) Reductions (10+2) Study of following reductions- Catalytic hydrogenation using homogeneous and heterogeneous catalysts. Study of following reactions: Wolff-Kishner, Birch, Clemmensen, Sodium borohydride, Lithium Aluminium hydride (LAH) and Sodium in alcohol, Fe in HCl. b) Oxidation Application of following oxidizing agents: $KMnO_4$, chromium trioxide, Manganese dioxide, Osmium tetraoxide, DDQ, Chloranil .	ICT based class room teaching and discussion.
Unit – IV	a) Study of Organometallic compounds(10+2) Organo-magnesium, Organo-zinc and Organo-lithium, Hg and Sn reagents; Use of lithium dialkylcuprate their addition to carbonyl and unsaturated carbonyl compounds.	ICT based class room with chemical society
Unit - V	Methodologies in organic synthesis –(10+2) ideas of synthones and retrones. Functional group transformations and interconversions of simple functionalities.	ICT based class room with group discussion

Course outcomes-
1. Be able to describe reaction involving enolates
2.Be able to know the properties ofAlkylation and Acylation reactions
3.Be able to Know Oxidation
4.Be able to define synthones and retrones
5.Be able to know carbonyl compounds.

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Text Books

- Modern synthetic reactions- (Benjamin) H.O. House.
- Principles of organic synthesis- (Methuen) R.O. C. Norman
- Organic Chemistry (Longman) Vol.I& Vol. II- Finar
- Advanced Organic chemistry 2nd Ed. R R. Carey and R.J. Sundburg.
- Some modern methods of Organic synthesi- (Cambridge) W.Carruthares

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Job opportunity	Employability skill developed	Local/National/UNDP Goal Achieved	Entrepreneurship Opportunity
Chemist Teacher lecturer	Able to solve the problem organic reaction mechanism, Action planning skill will be developed	Goal 1 (sustainable development and communities) Goal 2 Goal3 (Quality Education)	Yes, Industrial opportunity Quality controls

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SEMESTER- 2nd | **Subject Code: 6SMCH203**
Course: M.Sc. Chemistry | **Theory Max. Marks: 50**
SUBJECT:PHYSICAL CHEMISTRY-II | **Theory Min. Marks: 17**

Course objective:
The student will be able to
1. Explain principles of PHOTOCHEMISTRY
2.Define Photo physical phenomenaI
3.Understand Arrhenius theory of electrolytic dissociation
4. Define kinetics of a reaction
5. Explain Experimental methods of reactions
6. Calculate order of a reaction
7. Know Electrochemical cells.

Unit	Unit wise course content	Methodology Adopted
Unit-I	Photochemistry (10+2) Absorption of light and nature of electronic spectra, electronic transition, Frank-Condon principle, selection rules, photodissociation, predissociation, photochemical reactions: photoreduction, photooxidation, photodimerization, photochemical substitution, photoisomerization, photochemistry of environment: Green house effect.	ICT based class room teaching, individual presentation
Unit-II	Photo physical phenomenaI: (10+2) Electronic structure of molecules, molecular orbital, electronically excited singlet states, designation based on multiplicity rule, life time of electronically excited state, construction of Jablonski diagram, electronic transitions and intensity of absorption bands, photphysical pathways of excited molecular system(radiative and non-radiative).	ICT based class room teaching, individual presentation
Unit-III	Photo physical phenomena II(10+2) Fluorescence, delayed fluorescence, and phosphorescence, fluorescence quenching: concentration quenching, fluorescence resonance enrgy transfer between photexcited donor and acceptor systems. Stern-Volmer relation, The Grotthus- Draper and lambert –Beer Law Stake-Einstain Law of photochemical Equivalence. Quantum yield of photochemical reactions. bimolecular collisional V quenching and Stern-Volmer equation.	ICT based class room teaching, individual presentation
Unit-IV	Electrochemistry(10+2) Arrhenius theory of electrolytic dissociation (Evidences and limitations), revision of basic electrochemistry(Types of electrodes and cells). 2. Electrochemical cells with and without transference, determination of activity coefficients of an electrolyte, degree of dissociation of monobasic weak acid (approximate and accurate), instability constant of silver ammonia complex. Acid and alkaline storage batteries.	ICT based class room teaching, individual presentation
Unit-V	Chemical Kinetics(10+2) Experimental methods of following kinetics of a reaction, chemical and physical (measurement of pressure, volume, EMF, conductance, diffusion current and absorbance) methods and examples. Order and methods of determination(Initial rate, Integration, graphical and half life methods), rate determining step, steady state approximation and study of reaction between NO2 and F2, decomposition of ozone, and nitrogen pentoxide. 08 Kinetics of complex reactions, Simultaneous (first order opposed by first order), Parallel and Consecutive reactions. Examples and numericals.	ICT based class room teaching, individual presentation

Course outcomes-
1. Be able to describe photodissociation
2.Be able to know photphysical pathways of excited molecular system
3.Be able to Know Electrochemical cells with and without transference

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Text book:
- Photochemistry- J.G. CalvertsandJ.N. Pitts, John- Wiley & Sons
- Fundamentals of Photochemistry- K. K. Rohatgi-Mukharjii, Wiley Eastern
- Advanced Physical Chemistry- Gurdeep Raj, Goel Publishing House

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Job opportunity	Employability skill developed	Local/National/UNDP Goal Achieved	Entrepreneurship Opportunity
Chemist, Analyst, scientist, Academician, food industries	Analysis and problem-solving. time management in organization, written and oral communication	Goal 04(quality education) Goal 13 (climate action), Goal 15(Life on land), Goal 03 (Good health & well being)	Food, cosmetic pharmaceutical, academician

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DEAN
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W.E.F. July. 2020-21

Dr. C.V. RAMAN UNIVERSITY
Kargi Road, Kota, Bilaspur (C.G.)

SEMESTER-II
Course: M.Sc. Chemistry
SUBJECT: Analytical Chemistry-II

Subject Code: 6SMCH204
Theory Max. Marks: 50
Theory Min. Marks: 17

Course Objective: The student will be able to
1. Explain principles of Ultraviolet and visible spectrophotometry
2.Define Infrared Spectroscopy
3.Understand Nuclear Magnetic Resonance (NMR)
4. Define Mass spectroscopy and their applications
5. Explain difference between AAS and FES
6. Learn principles & applications of various spectrophotometers

Unit	Unit wise course content	Methodology Adopted
Unit-I	a) Ultraviolet and visible spectrophotometry (UV-VIS) (10+2) Introduction, Beer Lambert's law, instrumentation, calculation of absorption maxima of dienes, dienones and polyenes, applications. b) Infrared Spectroscopy (IR) Introduction, instrumentation, sampling technique, selection rules, types of bonds, absorption of common functional groups. Factors affecting frequencies, applications.	ICT based classroom teaching and experimental significance. Analysis individual presentation.
Unit-II	Nuclear Magnetic Resonance (NMR) (10+2) Magnetic and non magnetic nuclei, Larmor frequency, absorption of radio frequency. Instrumentation (FT-NMR). Sample preparation, chemical shift, anisotropic effect, spinspin coupling, coupling constant, applications to simple structural problems	ICT based classroom teaching, power point presentation.
Unit-III	Mass spectroscopy (10+2) Principle, working of mass spectrometer (double beam). Formation of different types of ions, Mclafferty rearrangements, fragmentation of alkanes, alkyl aromatics, alcohols and ketones, simple applications, simple structural problems based on IR, UV , NMR and MS	ICT based classroom teaching measurement and calculation.
Unit-IV	Nephlometry and Turbidometry (10+2) Introduction, Theory, Instruments, working and Applications b) Radiochemical Analysis, NAA: Scintillation counter and G.M. Counter (08)	ICT based classroom teaching and experimental significance. Analysis individual presentation.
Unit-V	Atomic Absorption Spectroscopy (10+2) a) Introduction, Principal, difference between AAS and FES, Advantages of AAS over FES, advantages and disadvantages of AAS. Instrumentation, Single and double beam AAS, detection limit and sensitivity, Interferences applications. b) Inductively coupled Plasma Spectroscopy Introduction, Nebulisation Torch, Plasmsa, Instrumentation, Interferences, Applications	ICT based classroom teaching, power point presentation.

Course outcomes-
1.Be able to describe Ultraviolet and visible spectrophotometry
2.Be able to know Infrared Spectroscopy
3.Be able to Know Nuclear Magnetic Resonance (NMR)
4.Be able to define Nephlometry and Turbidometry
5.Be able to know Inductively coupled Plasma Spectroscopy

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Text Books

- Analytical Chemistry : (J.W) G.D. Christain
- Instrumental Methods of analysis (CBS)- H.H. Willard, L.L. Mirrit, J.A. Dean
- Instrumental Methods of Analysis : Chatwal and Anand
- Instrumental Methods of Inorganic Analysis (ELBS) : A.I. Vogel

Job opportunity	Employability skill developed	Local/National/UNDP Goal Achieved	Entrepreneurship Opportunity
Chemist, Analyst, scientist, Academician, food industries	Analysis and problem-solving. time management in organization, written and oral communication	Goal 04(quality education) Goal 13 (climate action), Goal 15(Life on land), Goal 03 (Good health & well being)	Food, cosmetic pharmaceutical, academician

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W.E.F. JULY 2020-21

Dr. C.V. RAMAN UNIVERSITY
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SEMESTER- 2nd
Course: M.Sc. Chemistry
SUBJECT:Lab-I Organic Chemistry

Subject Code:
Max. Marks: 25
Min. Marks: 08

Course Objectives: The aim of this course is to provide the knowledge of basic and advanced laboratory procedures used in Qualitative and quantitative analysis in organic chemistry

Qualitative Analysis :-

1.Determination of the percentage number of hydroxyl groups by acetylation method.
2.Estimation of amine/phenols using Bromate Bromide method of Acetylation method.
3.Estimation of Carbonyl group by hydrazone method.
4.Estimation of Glycine by titration.
5.Determination of equivalent weight of carboxylic compounds.Estimation of carboxyl group by titration/Silver salt method.

Course Outcomes: Studentswill gain an understanding of analysis of binary mixture, estimation of functional group,organic synthesis including spectroscopic and analytical techniques for identification and characterization.

Text book:

- Volel's Textbook of Quantitative Analysis, revised, J. Basseell, R.C. Denney, G.H..Jaffery and J. Metham, ELBS.
- Experiments and Techniques in Organic Chemistry, D. Pasto, C. Johnson and M. Miller, Prentice. Hall
- Volgel's Textbook of Practical Chemistry, A.R. Tatchall, john Willey
- Experimental Physics Chemistry R.C. Das and Beher, Tata McGraw Hill.

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Dr. C.V. RAMAN UNIVERSITY
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SEMESTER- 2nd
Course: M.Sc. Chemistry
SUBJECT:Lab-II Analytical Chemistry

Subject Code:
Max. Marks: 25
Min. Marks: 08

Course Objective
To perform quantitative analysis of Ores/alloys along with the determination of complex composition and separation of different metal ions using ion-exchange method.

(Instrumentation and Computers)

Study and identification of various organic compounds through
1. UV spectrophotometry
2. Nuclear Magnetic Resonance
3.Mass spectroscopy
4.Nephlometry and Turbidometry
5.Atomic Absorption Spectroscopy

Course Outcome:

- Determination of complex composition and stability constant of a complex by Job's method spectro - photometrically
- Determination of DO, COD BOD Hardness of water sample.
- Determination of total cation concentration and separation of different metal ions using cation exchange resin.
- To separated cation and anion by Chromatography.
- Determination of half-cell potential of Cd(II) ion in KCl solution and estimation of Cd(II) ion in unknown solution by polarography.

Text book:

- Volel's Textbook of Quantitative Analysis, revised, J. Basseell, R.C. Denney, G.H..Jaffery and J. Metham, ELBS.
- Experiments and Techniques in Organic Chemistry, D. Pasto, C. Johnson and M. Miller, Prentice. Hall
- Volgel's Textbook of Practical Chemistry, A.R. Tatchall, john Willey
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Dr. C.V. RAMAN UNIVERSITY
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SEMESTER- 3rd
Course: M.Sc. Chemistry
SUBJECT:APPLICATION OF SPECTROSCOPY

Subject Code: 6SMCH301
Theory Max. Marks: 50
Theory Min. Marks: 17

Course objectives-

The student will be able to
1. Explain Symmetry and Group theory in Chemistry
2.Define Microwave Spectroscopy
3.Understand Infrared-Spectroscopy
4. Define Classical and quantum theories of Raman effect
5. Explain Basic principles of photo-electric effect
6. Learn principles & applications of various spectroscopies.

Unit	Unit wise course content	Methodology Adopted
Unit-I	Symmetry and Group theory in Chemistry: Symmetry elements and symmetry operation, definition of group, subgroup. Conjugacy relation and classes. Point symmetry group. Schonfilies symbols, representations of groups by matrices (representation for the Cn, Cnv, Cnh, Dnh group to be worked out explicity). Character of a representation. The great orthogonality theorem (without proof) and its importance. Character tables and their use; spectroscopy. Derivation of character table for C_2V and C_3V point group Symmetry aspects of molecular vibrations of H_2O molecule.	ICT based class room teaching, individual presentation
Unit-II	Microwave Spectroscopy: Classification of molecules, rigid rotor model, effect of isotopic substitution on the transition frequencies, intensities, non-rigid rotor. Stark effect, nuclear and electron spin interaction and effect of external field, applications.	ICT based class room teaching, individual presentation
Unit-III	Infrared-Spectroscopy: Review of linear harmonic oscillator, vibrational energies of diatomic molecules, zero point energy, force constant and bond strengths; anharmonicity, Morse potential energy diagram, vibration-rotation spectroscopy. P.Q.R. branches, Breakdown of Oppenheimer approximation; vibrations of polyatomic molecules. Selection rules, normal modes of vibration, group frequencies, overtones, hot bands, factors affecting the band positions and intensities, far IR region, metal ligand vibrations, normal co-ordinate analysis.	ICT based class room teaching, individual presentation
Unit-IV	Raman Spectroscopy: Classical and quantum theories of Raman effect. Pure rotational, vibrational and vibrational-rotational Raman spectra, selection rules, mutual exclusion principle, Resonance Raman spectroscopy, coherent anti stokes Raman spectroscopy (CARS).	ICT based class room teaching, individual presentation
Unit-V	Molecular Spectroscopy: Energy levels, molecular orbitals, vibronic transitions, vibrational progressions and geometry of the excited states, Franck-Condon principle, electronic spectra of polyatomic molecules. Emission spectra; radio-active and non-radioactive decay, internal conversion, spectra of transition metal complexes, charge-transfer spectra. Photoelectron Spectroscopy: Basic principles; photo-electric effect, ionization process, Koopman's theore	ICT based class room teaching, individual presentation

Course Outcome: After the completion of course learner should able to understand the following:
1.Be able to Calculate C2V and C3V point group
2.Be able to Draw representations of groups by matrices
3.Be able to Know rigid rotor models
4.Be able to define P.Q.R. branches
5.Be able to know Resonance Raman spectroscopy
6.Be able to define Emission spectra's

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SEMESTER- 3rd
Course: M.Sc. Chemistry
SUBJECT:APPLICATION OF SPECTROSCOPY

Subject Code: 6SMCH301
Theory Max. Marks: 50
Theory Min. Marks: 17

Course objectives-

The student will be able to

1. Explain Symmetry and Group theory in Chemistry
2. Define Microwave Spectroscopy
3. Understand Infrared-Spectroscopy
4. Define Classical and quantum theories of Raman effect
5. Explain Basic principles of photo-electric effect
6. Learn principles & applications of various spectroscopies.

Unit	Unit wise course content	Methodology Adopted
Unit-I	Symmetry and Group theory in Chemistry: Symmetry elements and symmetry operation, definition of group, subgroup. Conjugacy relation and classes. Point symmetry group. Schonfilies symbols, representations of groups by matrices (representation for the Cn, Cnv, Cnh, Dnh group to be worked out explicity). Character of a representation. The great orthogonality theorem (without proof) and its importance. Character tables and their use; spectroscopy. Derivation of character table for C_2V and C_3V point group Symmetry aspects of molecular vibrations of H_2O molecule.	ICT based class room teaching, individual presentation
Unit-II	Microwave Spectroscopy: Classification of molecules, rigid rotor model, effect of isotopic substitution on the transition frequencies, intensities, non-rigid rotor. Stark effect, nuclear and electron spin interaction and effect of external field, applications.	ICT based class room teaching, individual presentation
Unit-III	Infrared-Spectroscopy: Review of linear harmonic oscillator, vibrational energies of diatomic molecules, zero point energy, force constant and bond strengths; anharmonicity, Morse potential energy diagram, vibration-rotation spectroscopy. P.Q.R. branches, Breakdown of Oppenheimer approximation; vibrations of polyatomic molecules. Selection rules, normal modes of vibration, group frequencies, overtones, hot bands, factors affecting the band positions and intensities, far IR region, metal ligand vibrations, normal co-ordinate analysis.	ICT based class room teaching, individual presentation
Unit-IV	Raman Spectroscopy: Classical and quantum theories of Raman effect. Pure rotational, vibrational and vibrational-rotational Raman spectra, selection rules, mutual exclusion principle, Resonance Raman spectroscopy, coherent anti stokes Raman spectroscopy (CARS).	ICT based class room teaching, individual presentation
Unit-V	Molecular Spectroscopy: Energy levels, molecular orbitals, vibronic transitions, vibrational progressions and geometry of the excited states, Franck-Condon principle, electronic spectra of polyatomic molecules. Emission spectra; radio-active and non-radioactive decay, internal conversion, spectra of transition metal complexes, charge-transfer spectra. Photoelectron Spectroscopy: Basic principles; photo-electric effect, ionization process, Koopman's theore	ICT based class room teaching, individual presentation

Course Outcome: After the completion of course learner should able to understand the following:

1. Be able to Calculate C2V and C3V point group
2. Be able to Draw representations of groups by matrices
3. Be able to Know rigid rotor models
4. Be able to define P.Q.R. branches
5. Be able to know Resonance Raman spectroscopy
6. Be able to define Emission spectra's

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Text book:

- V.M. Parikh, Application spectroscopy of organic molecules. (Mehata)
- Silverstein and Basallar, Spectroscopic methods of organic compound.
- P.S. Kalsi Spectroscope of organic compounds (New age publisher)
- J.R. Dyer. Application of absorption spectroscopy of organic compounds.
- W. Kemp, Organic spectroscopy ELBS

Job opportunity	Employability skill developed	Local/National/UNDP Goal Achieved	Entrepreneurship Opportunity
Chemist, Analyst, scientist, Academician, food industries	Analysis and problem-solving. time management in organization, written and oral communication	Goal 04(quality education) Goal 13 (climate action), Goal 15(Life on land), Goal 03 (Good health & well being)	Food, cosmetic pharmaceutical, academician and water and soil analyst

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SEMESTER- 3rd
Course: M.Sc. Chemistry
SUBJECT:Bio Organic& Bio-Inorganic chemistry

Subject Code:6SMCH302
Theory Max. Marks: 50
Theory Min. Marks: 17

Course Objective-The student will be able to
1. Explain Cell Structure and Functions
2.Define Amino acids, Peptides and Proteins
3.Understand Nucleic Acids
4. Know Metals in Life Processes
5. Explain Basic principles of Trace Metals in Plant Life
6. Learn mechanism & applications of various enzymes

Unit	Unit wise course content	Methodology Adopted
Unit-I	a) Cell Structure and Functions(10+2) Structure of prokaryotic and eukaryotic cells, Intracellular organelles and their functions, comparison of plant and animal cells. Overview of metabolic processcatabolism and anabolism. ATP – the biological energy currency. Origin of life- unique properties of carbon, chemical evolution and rise of living system. Introduction to biomolecules, building blocks of bio- macromolecules. b) Enzymes Structure activity and reactions, catalyzed determination of active site, inhibition mechanism chemical transformations using enzyme.	Class room base Teaching
Unit-II	Amino acids, Peptides and Proteins (10+2) Chemical and enzymatic hydrolysis of proteins to peptides, amino acid sequencing. Secondary structure of protein, forces responsible for holding of secondary structures. _-helix, _-sheets, super secondary structure, triple helix structure of collagen. Tertiary structure of protein- folding and domain structure. Quaternary structure. Amino acid metabolism- degradation and biosynthesis of amino acids, sequence determination: chemical/ enzymatic/ mass spectral, racemisation/ detection. Chemistry of oxytocin and tryptophan releasing hormone (TRH).	Class room based Teaching
Unit-III	Nucleic Acids (10+2) [Purine and pyrimidine of nucleic acids, base pairing via H – bonding. Structure of ribonucleic acids (RNA) and deoxyribonucleic acid (DNA), double helix model of DNA and forces responsible for holding it. Chemical and enzymatic hydrolysis of nucleic acids. The chemical basis for heredity, an overview of replication of DNA, transcription, translation and genetic code. Chemical synthesis of mono and poly nucleosides.	Class room based Teaching
Unit-IV	Metals in Life Processes (10+2) Na+-K+-Pump charge carriers & osmotic pressure, relation to sensitivity of nerves and control on muscles, Mg-Ca complexes with nucleic acid, nerve impulse transmission, trigger reaction, Mn, Fe, Co, Cu, Mo, ferridoxins, Zn-super acid catalysis.	Class room based, ICT based Teaching
Unit-V	[A] Nitrogen Fixation (10+2) Nitrogen in biosphere, nitrogen cycle, nitrification role of microorganisms, nitrogen fixation in soils [B] Trace Metals in Plant Life Micronutrients in soil, role of micronutrients in plant life	Class room based, ICT based Teaching

Course outcomes- After the completion of course learner should able to understand the following:
1.Be able to understand Trace Metals in Plant Life
2.Be able to Know nitrogen cycle
3.Be able to Know Metals in Life Processes
4.Be able to define Nucleic Acids
5.Be able to know Amino acid metabolism
6.Be able to define Cell Structure and Functions

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Text Books

- Elements of Inorganic Photochemisty, G.J.Gerrandi Wiley.
- Environmental Pollution, A.K.De
- Environmental Pollution Control in Process Industries, S.P.Mahajan
- Introduction to Air Pollution P.K.Trivedi
- Environmental Pollution Analysis, S.M.Kharpkar
- Environmental Pollution Engineering and Control, C.S.Rao
- Environmental Chemistry, B.K. Sharma &H.Kaur.
- Bio-Inorganic chemistry : R.W. Hay.
- Principles of Biochemistry, A. L. Lehinger, Worth Publications.
- Biochemistry, Voet and Voet, John Wiley.
- . Basic Inorganic Chemistry (3rd ed) : Cotton ,Wilkinson &Gaus.
- . Inorganic chemistry (4th Ed) :Huheey, Keiter&Keiter.
- Bioinorganic and Suparmolecular Chemistry: Bhagi, G.R.Chatwal.
- Bio-Inorganic chemistry :E.Ochiai

Job opportunity	Employability skill developed	Local/National/UNDP Goal Achieved	Entrepreneurship Opportunity
Teaching, Chemist, Scientist	Able to solve Problem related Enzyme Peptide, Air and Water. Able to Understand Radiation Pollution	Goal 3: (UNDP) Good health and well-being Goal 6: (UNDP) Clean water and Sanitation Goal 15: Life on Land	Health & Environment Protection Service

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Dr. C.V. RAMAN UNIVERSITY
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SEMESTER- 3rd
Course: M.Sc. Chemistry
SUBJECT:Discipline Specific Elective -I
Applied Organic Chemistry

Subject Code: 6SMCH303
Theory Max. Marks: 50
Theory Min. Marks: 17

Course objectives-The student will be able to
1. Explain Agrochemicals and their syntheis
2.Define Manufacture of Phenylethanol, detergents, vanillin and other food flavours, synthetic musk
3.Understand Dyes and Intermediates
4. Know Mechanism of polymerization
5. Explain Basic principles of Soap and detergents
6. Learn Starch and cellulose

Unit	Unit wise course content	Methodology Adopted
Unit-I	Agrochemical(10+2) a. Carbamate pesticides: Introduction, carbaryl, Baygon, Aldicarb, Ziram, Zineb b. Organophosphorus pesticides: Malathion, monocrotophos, dimethoate, phorate, mevinphos c. Natural and synthetic pyrethroids : Isolation and structures of natural allethrin, fenvalerate, cypermethrin, d. Plant growth regulators: General survey synthesis of simple compounds e. Insect repellents: General survey and synthesis f. Jovenileharmone: introduction structures JHA importance synthesis g. Pheromones: introduction, examples, and importance in IPM synthesis of juvabionebombycol, grandisol, and disparure	Classroom teaching ICT tools and google classroom,
Unit-II	Manufacture of following(10+2) 2-Phenylethanol, detergents, vanillin and other food flavours, synthetic musk , Acetic acid and butenaldehyde from ethanol butyl acetate, furfural, from bagasse, citric acid from molasses, Application of oro and marker process. Nicotine from tobacco waste and citral from lemon grass, synthetic detergents, glycerol.	Classroom teaching, ICT Based and individual presentation and Google classroom
Unit-III	Dyes and Intermediates(10+2) Synthesis of important dye intermediates. Commercial processes for Azo dyes, reactive dyes, optical brighteners, thermal sensitive dyes, dispenses dyes.	Classroom teaching, ICT Based and individual presentation and Google classroom
Unit-IV	Polymers(10+2) Mechanism of polymerization. Study of polyesters, polyamides, PVC, polystyrene, polyvinyl acetate and polyvinylalcohol, polyethenes, viscose rayon, synthesis of polyethylene, polypropylene. Synthetic rubbers: Styrene-butadiene, butyl polyisoprene, phenol formation formaldehyde resin. Plastictisers and anti oxidants for polymers, Natural polymers: Starch and cellulose.	Classroom teaching, ICT Based and individual presentation and Google classroom, field visit
Unit-V	Soap and detergents(10+2) Soap -Introduction, method of preparation of soap, types of soap, cleaning mechanism, limitation of soap as cleaning agent. Detergents- Introduction , types of detergents, the mechanism of cleaning action of detergents,advantage of using detergent ,washing powder.	Classroom teaching, ICT Based and individual presentation and Google classroom, model presentation.

Course outcomes-After the completion of course learner should able to understand about
1.Be able to understand Soap and detergents
2.Be able to Know Polymers
3.Be able to Know Synthesis of dyes intermediates
4.Be able to define Manufacture of Acetic acid and butenaldehyde
5.Be able to know Plant growth regulators
6.Be able to define Jovenileharmones.
7.Be able to define azo dyes.

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Text Books:

- Apsimon: The total synthesis of natural products.
- P. D B. mayo: The chemistry of natural products
- P.W. Bently: Chemistry of Natural products,
- I. Final: Organic chemistry vol. II and I
- J.B. Hendrickson The molecules of nature.
- I. Final: Organic chemistry vol. II and I
- J. Sing and J. Sing: Organic Photochemistry

Job opportunity	Employability skill developed	Local/National/UNDP Goal Achieved	Entrepreneurship Opportunity
Chemist, scientist, Academician, food industries , textile industries and plastic industries	Analysis and problem-solving. time management in organization, written and oral communication	Goal 04(quality education) Goal 13 (climate action), Goal 15(Life on land), Goal 03 (Good health & well being)	Food, cosmetic pharmaceutical, academician ,drug formation and soap production

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SEMESTER- 3rd
Course: M.Sc. Chemistry
SUBJECT:Discipline Specific Elective-II
DRUG & HETEROCYCLIC COMPOUNDS

Subject Code: 6SMCH304
Theory Max. Marks: 50
Theory Min. Marks: 17

Course objectives- The student will be able to
1. Know mechanism of Drug design
2.Define History and development of QSAR
3.Understand Antimalerials
4. Know Anti AIDS drugs
5. Explain Small ring Heterocycles
6. Learn Antibiotics
7. Understand Six membered Heterocycles.

Unit	Unit wise course content	Methodology Adopted
Unit-I	a) Drug design (10+2) Development of new drugs, procedures followed in drug design, concepts of prodrugs and soft drugs. Theories of drug activity, Quantitative structure activity relationship. Theories of drug activity, Quantitative structure activity relationship. History and development of QSAR. Concepts of drug receptors b) Study of the Following types of drugs:I a) Antibiotics: Preparation of semi synthetic penicillin, conversion of penicillin into cephalosporin, general account of tetracycline & macrocyclic antibiotics(no synthesis) b) Antimalerials: Trimethoprim c) Analgesic & Antipyretics: Paracetamol, Meperidine, methadone, Aminopyrine.	ICT based class roo teaching, individu presentation
Unit-II	a) b) Study of the Following types of drugs:II (10+2) i) Anti- inflammatory: Ibuprofen, Oxyphenylbutazone, Diclophenac, Indomethacin. ii) Antitubercular &antileprotic : Ethambutol, Isoniazide& Dapsone iii) Anaesthetics : Lidocaine, Thiopental. iv) Antihistamines: Phenobarbital, Diphenylhydramine. v) Tranquilizers: Diazepam, Trimeprazine. vi) Anti AIDS: General study - vii) Cardiovascular: Synthesis of dilliazem, quinidine, methyldopa, atenolol, oxyprenol viii) Anti-neoplastic drugs: Cancer chemotherapy, Synthesis of mechloraethamine, cyclophosphamide, Mephalan, uracils, mustards. Recent development in cancer chemotherapy. Hormones and natural products.	ICT based class room teaching, individual presentation
Unit-III	a) Small ring Heterocycles (10+2) Three membered and four membered Heterocycles- synthesis and reactions of aziridines, oxiranes, thiranes, azetidines, oxitanes and thietanes. b) Benzo fused five membered Heterocycles. Synthesis and reactions of benzopyrroles, benzofurans and benzothiophenes.	ICT based class room teaching, individual presentation
Unit-IV	a) Six membered Heterocycles with one heteroatom (10+2) and reactions of pyrilium salts and pyrones and their comparison pyridinium and salts and pyridones. Synthesis and reactions of coumarins, chromones.	ICT based class room teaching, individual presentation
Unit-V	a) Six membered Heterocycles with two and more Heterocycles Synthes is and reactions of diazines & triazines. b) Seven membered Heterocycles [5] Synthesis and reactions of azepines, oxepines &thiepines	ICT based class room teaching, individual presentation

Course outcomes-After the completion of course learner should able to understand about
1 Be able to understand Six membered Heterocycles
2.Be able to Know Benzo fused five membered Heterocycles
3.Be able to Know Synthesis of Cardiovascular drugs
4.Be able to define Antihistamines, Anaesthetics, Anti- inflammatory drugs
5.Be able to know Drug design
6.Be able to define Anti AIDS Cardiovascular synthesis of drugs
7.Be able to understand oxepines &thiepines.

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Text book:

- Burger : Medicinal chemistry.
- A. Kar : Medicinal Chemistry (Wiley East)
- Wilson, Gisvold&Dorque: Text book of organic medical and pharmaceutical chemistry
- R. M. Acheson : An introduction to chemistry of heterocyclic compounds (Interscience).
- Joule & Smith: Heterocyclic chemistry (Van Nostrand).
- R.K. Bansal: Hetterocyclic chemistry (Wiley E).
- Finar : Organic chemistry (Vol.1& 2)
- Heterocyclic Chemistry, J.A. Joule, K Mills and G.F. Smith, Chapman and Hall
- Heterocyclic Chemistry, T.L. Gilchrist, Longman Scientific Technical
- An Introduction to Heterocyclic Compounds, R.M. Acheson, J. Willey

Job opportunity	Employability skill developed	Local/National/UNDP Goal Achieved	Entrepreneurship Opportunity
Chemist, Analyst, scientist, Academician, Pharmaceutical industries	Analysis and problem-solving. time management in organization, written and oral communication	Goal 04(quality education) Goal 13 (climate action), Goal 15(Life on land), Goal 03 (Good health & well being)	Food, cosmetic pharmaceutical, academician

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SEMESTER- 3rd | **Subject Code: 6SMCH303**
Course: M.Sc. Chemistry | **Theory Max. Marks: 50**
SUBJECT:Inorganic chemistry (Elective paper-I) | **Theory Min. Marks: 17**
Chemistry of Inorganic Materials

Course objectives-
The student will be able to
1. Know Lattice Defects : point defects, Line defect and plane defect
2.Define Synthesis of Inorganic materials
3.Understand Ionic Conductors, Organic semiconductors
4. Know order & disorder phenomena
5. Explain Magnetic properties of Materials
6. Learn Synthesis of Inorganic materials(
7. Understand Metal and Alloys.

Unit	Unit wise course contents	Methodology Adopted
Unit-I	**A] Lattice Defects** (10+2) Introduction to types of Solids, Perfect & imperfect crystals, point defects, Line defect and plane defect defect (definition & explanation of meaning) order & disorder phenomena, thermodynamics of Schottky &frenkel defect formation, Determination of defect, Nonstiochiometric defect (structural and thermodynamic aspects) incorporation of stiochometric excess of defects, thermodynamics of Nonstiochiometric phases.	Classroom teaching ICT tools and google classroom,
Unit-II	**B] Synthesis of Inorganic materials** (10+2) Synthesis of solid state materials using different techniques ceramic techniques, coprecipitation techniques, sol gel techniques, precursor techniques, high temperature & high pressure synthesis	Classroom teaching, ICT Based and individual presentation and Google classroom
Unit-III	A] Ionic Conductors(10+2) Types of ionic conductors, mechanism of ionic conduction, interstitial jumps, vacancy mechanism, diffusion, super ionic conductors, phase transition & mechanism of conduction in super ionic conductors, examples and applications of ionic conductors. B] Electronic properties of materials a) Organic semiconductors, examples, properties and application	Classroom teaching, ICT Based and individual presentation and Google classroom
Unit-IV	A] Magnetic properties of Materials(10+2) Introduction, Magnetization, Electron spin and magnetic moment, Theory of diamagnetism, langevins theory & paramagnetic susceptibility of solids, ferromagnetism, Domain theory. Hysteresis in magnetism, ferrimagnetisms (ferries) Applications of magnetic materials. B] Magnetic Materials I] Structure and Properties of i) Metal and Alloys ii) Transition metal Oxides Formation and characteristics.	Classroom teaching, ICT Based and individual presentation and Google classroom, field vi
Unit-V	A] Advanced Inorganic Materials (10+2) Nanotechnology and its business applications, Introduction to nanoscale, Potential applications of nanomaterials, Challenges and opportunities scope of nanotechnology, Commercialization scope Nanotechnology research in 21st century, Basic nanotechnology science and chemistry concepts, basic nanostructures , nanocomposites, Thin films, nanofoam, nanoclusters, smart nanostructures, manufacturing techniques of nanomaterials.	Classroom teaching, ICT Based and individual presentation and google classroom, model presentation.

Course outcomes-After the completion of course learner should able to understand about

1..Be able to understand Lattice defects.
2..Be able to Know synthesis inorganic material.
3..Be able to differentiate nanocomposites, Thin films, nanofoam, nanoclusters.
4..Be able to understand susceptibility ofisolids.
5..Be able to Define Organic semiconductors.
6..Be able to understand high pressure synthesis

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7..Be able to know Magnetic Materials.

Text book:

- N.N. Greenwood: lonic Crystals, Lattice Defects and Nonstionchiometry (Butterworth's)
- A. R. West, Solid State Chemistry
- H.V. K Keer, Principles of the Solid State Chemistry, Wiley Eastern..

Job opportunity	Employability skill developed	Local/National/UNDP Goal Achieved	Entrepreneurship Opportunity
Chemist, scientist, Academic , material synthesis and various industries , Nanomaterial synthesis	Analysis and problem-solving. time management and organization. written and oral communication	Goal04(quality education) Goal13 (climate action), Goal 15(Life on land),Goal03 (Good health & well being)	Academician ,electrical goods, insulator, inorganic material synthesis

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SEMESTER- 3rd
Course: M.Sc. Chemistry
SUBJECT: Discipline Specific Elective-II
Coordination chemistry

Subject Code:6SMCH304
Theory Max. Marks: 50
Theory Min. Marks: 17

Course Objective- The student will be able to
1. Know Mixed Ligand complexes
2.Define Transition metal complexes & catalysis.
3.Understand Magneto Chemistry
4. Know magnetic & thermal properties
5. Explain Theories of Metal-Ligand bonding

Unit	Class Room Based Teaching-	Methodology Adopted
Unit-I	**Theories of Metal-Ligand bonding** Molecular Orbital treatment, Octahedral (with and without pi bonding) tetrahedral and square planer complexes in a qualitative manner, comparison of theories of bonding, VBT, CFT, LFT and MOT.	ICT based class room teaching Group presentation
Unit-II	Structural studies of coordination compounds Compounds of first transition series elements, with respect to their electronic spectra, magnetic & thermal properties (DTA, TGA)	ICT based class room teaching and discussion.
Unit-III	Magneto Chemistry (10+2) Diamagnetic correction, single & multielectron system, types of the magnetic behaviour, Diamagnetism, Para magnetism, Ferro &Ferri, Antiferro and magnetic interaction, The origin of Para magnetism, Magnetic behavior of complexes, Simplification of Van Velck equation, magnitude of magnetic moments, Determination of magnetic susceptibility by Gouy and faraday method.	ICT based class room with presentation
Unit-IV	Transition metal complexes &catalysis(10+2) Introduction, General Principle, catalysis by transition metal complexes, Hydrocarbons Oxidation by Molecular oxygen, olefin Oxidation, olefin polymerization, olefin hydrogenation, Arene reactions catalyzed by metal complexes, catalysis of condensation polymerization reaction, Current and feature trend in catalysis.	ICT based class room with chemical society
Unit-V	Mixed Ligand complexes (10+2) Stabilities of ternary complexes, Dynamics of formation of ternary complexes reaction of Coordination ligand in ternary complexes, Mimicking reactions in biological systems, enzyme models, Amino acids ester hydrolysis, peptide synthesis & hydrolysis, Detarbodylation of B keto acids	ICT based class room with group discussion

Course outcomes-
1.Be able to understand Mixed Ligand complexes.
2.Be able to Know ternary complexes.
3.Be able to differentiate nanocomposites, Thin films, nanofoam, nanoclusters.
4.Be able to understand peptide synthesis & hydrolysis.
5.Be able to Define Magnetic behavior of complexes.
6.Be able to know theories of bonding, VBT, CFT, LFT and MOT.

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Text Books

- Jones: Elementary Coordination Chemistry J. Weily
- Graddon: Introduction to Coordination Chemistry J. Weily
- Drago: Physical methods of Inorganic Chemistry. J. Weily
- Datta&Shymla: Elements of Magneto Chemistry

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- James E. Huheey: Inorganic Chemistry Principles of Structure and reactivity, harber& Row, Publishers Inc. New York 1972.
- William L. Jolly: Modern Inorganic Chemistry Mecgrow Hill USA, 1984
- F.A. Cotton & R.G. Willkinson: Advanced Inorganic Chem.

Job opportunity	Employability skill developed	Local/National/UNDP Goal Achieved	Entrepreneurship Opportunity
Chemist Teacher lecturer	Able to solve the problem complex compound Action planning skill will be developed	Goal 1 (sustainable development and communities) Goal 2 Goal3 (Quality Education)	Yes, Industrial opportunity Quality controls

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SEMESTER- 3rd
Course: M.Sc. Chemistry
SUBJECT:Discipline Specific Elective-I
Advanced Chemical Kinetics

Subject Code 6SMCH304
Theory Max. Marks: 50
Theory Min. Marks: 17

Course Objective -The student will be able to
1. Know Steady State Approximation
2.Understand Electron transfer reaction
3. Know Catalysis
4. Explain cooperative and pseudo-phase ion exchange models
5. Learn Catalysis, Induced and cooxidations
6. Understand Mechanism of chromium(VI) oxidations

Unit	Unit wise course contents	Methodology Adopted
Unit-I	Chemical kinetics: (10+2) Steady State Approximation Collision theory of gas reaction , collision frequency. The rate constant , molecular diameters , collision theory vs. experiment Kinetics of Fast reactions: Relaxation techniques, pressure jump and temperature jump methods, NMR relaxation, flash photolysis and molecular beam methods.	Classroom teaching ICT tools and google classroom,
Unit-II	Hydrogen ion dependence of reaction rates: (10+2) Protonation and hydrolysis equilibria, determination of active reactant species form kinetic data, interpretation of hydrogen ion effect with example.	Classroom teaching, ICT Based and individual presentation and Google classroom
Unit-III	Electron transfer reaction: (10+2) Complimentary and non-complimentary reactions, outer and inner-sphere electron transfer reactions, proton transfer, hydride transfer and hydrogen, oxygen and chlorine atom transfer reactions.	Classroom teaching, ICT Based and individual presentation and Google classroom
Unit-IV	Catalysis(10+2) Trace metal ion catalysis and their mechanisms. Micellar catalysis, Berezini, Menger-Portonoy, cooperative and pseudo-phase ion exchange models and examples.	Classroom teaching, ICT Based and individual presentation and Google classroom, field visit
Unit-V	Mechanism of chromium(VI) oxidations: (10+2) One and two equivalent reductants oxidation, assumptions, limiting forms of rate laws, Westheimer mechanism and its validity. Catalysis, Induced and cooxidations. Mechanisms other than Westheimer mechanism.	Classroom teaching, ICT Based and individual presentation and google classroom, model presentation.

Course Outcomes- Course completion give rise to the following outcomes
1.Be able to understand collision frequency
2.Be able to Know interpretation of hydrogen ion effect
3.Be able to differentiate Mechanism of chromium(VI) oxidations
4.Be able to understand Induced and cooxidations
5.Be able to Define Micellar catalysis
6.Be able to understand Westheimer mechanism and its validity

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Text book:

- Text book of Physical Chemistry- S. Glasstone
- Physical Chemistry- G.M. Barrow, Tata-McGraw Hill, Vth edition, 2003
- Physical Chemistry- G.K. Vemulapalli, Prentice-Hall of India, 1997.
- A Text book of Physical Chemistry- A.S. Negi- New Age International
- A Text book of Physical Chemistry- K.L. Kaboor (Vol.I- IV) Mecmillan India Limited.
- Advanced Physical Chemistry- J.N. Gurtu R AGurta, PragatiPrakashan.

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- Advanced Physical Chemistry – Gurdeep Raj Krishran Publication.
- Physical Chemistry- Puri, Sharma &Parhalia, Vikash Publication.

Job opportunity	Employability skill developed	Local/National/UNDP Goal Achieved	Entrepreneurship Opportunity
Chemist, scientist, Academic , various industries	Analysis and problem-solving. time management and organization. written and oral communication	Goal04(quality education) Goal13 (climate action), Goal 15(Life on land),Goal03 (Good health & well being)	Academician ,electrical goods, synthesis

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SEMESTER SEMESTER- 3rd
Course: M.Sc. Chemistry
SUBJECT: Discipline Specific Elective-II
Electrochemistry

Subject Code: 6SMCH 304
Theory Max. Marks: 50
Theory Min. Marks: 17

Course objectives- The student will be able to

1. Know Electrolytic conductance
2. Define activity coefficients and their interrelationship
3. Understand Ion solvent interactions
4. Know Polarization
5. Explain Diffusion over potentials
6. Learn Electroanalytical Methods
7. Understand Colorimetric titrations

Unit	Unit wise course contents	Methodology Adopted
Unit-I	Electrolytic conductance(10+2) Debye - Huckel theory of inter-ionic attraction , ionic atmosphere, time of relaxation, relaxation and electro-phoretic effects, Debye-Huckel-Onsagar equation and its validity for dilute solutions and at appreciably concentrated solutions. Abnormal ionic conductance of hydroxyl and hydrogen ions. Activity coefficients: forms of activity coefficients and their interrelationship. Debye-Huckel limiting law its applications to concentrated solutions. DebyeHuckel	Classroom teaching ICT tools and Google classroom,
Unit-II	Ion solvent interactions and electrolysis(10+2) The Born Model and expression for the free energy of ion- solvent interactions. Thermodynamic parameters for the ion - solvent interactions. Calculations of heats of hydration of ions and the concept of hydration number . Electrolysis: Decomposition potentials: calculations and determinations. Polarization: types of polarization, over voltage and hydrogen and oxygen over voltage.	Classroom teaching, ICT Based and individual presentation and Google classroom
Unit-III	Electrode reactions. (10+2) Tafel equations, kinetics of discharge of hydrogen ions . Diffusion over potentials. Fuel cells: significance of fuel cells: hydrogen - oxygen, hydrocarbon - air, natural gas and carbon monoxide, air fuel cells. Corrosion: concept and importance, mechanism of corrosion and Pourbaix diagrams.	Classroom teaching, ICT Based and individual presentation and Google classroom
Unit-IV	Electrokinetic phenomena: (10+2) Electrical double lever, theories of double layer, electro-capillary phenomena, electro-capillary curve. Electro-osmosis, electrophoreses. Streaming and Sedimentation potentials. Zeta potentials and its determination by electrophoresis, influence of ions on Zeta potential.	Classroom teaching, ICT Based and individual presentation and Google classroom, field visit
Unit-V	Electroanalytical Methods - (10+2) Potentiometric methods: Reference electrodes and indicator electrodes. The hydrogen calomel, Ag-AgCl electrodes. The glass electrode – its structure, perofrmance and limitations. Measurement of pH.Petentiometric titrations. Redox and precipitation titrations. Electrogravimetry: Principle and method. Determination of Cu. Separation of metals. Conductometry: Principle and method. Conductance measurements. Conductometric titrations. Colorimetry: Principle and method. Colorimetric titrations.	Classroom teaching, ICT Based and individual presentation and google classroom, model presentation.

Course Outcomes- Course completion give rise to the following outcomes

1 Be able to understand Polarization
2.Be able to Know Electroanalytical Methods
3.Be able to differentiate Redox and precipitation titrations
4.Be able to understand electro-capillary
5.Be able to Define Electrode reactions
6.Be able to understand . Zeta potentials
7.Be able to know Debye-Huckel limiting law

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Text Books

- An introduction to Electrochemistry by S.Glasstone
- Modern Electrochemistry Vol. I & II by J.O.M. Bockris and A.K.N.Reddy.
- Physical Chemistry by S.Glasstone.
- Electrolytic Solutions by R.A.Robinson and R.H.Strokes
- Physical Chemistry by P.W.Atkins. ELBS

Job opportunity	Employability skill developed	Local/National/UNDP Goal Achieved	Entrepreneurship Opportunity
Chemist, scientist, Academic various industries	Analysis and problem-solving. time management and organization. written and oral communication	Goal04(quality education) Goal13 (climate action), Goal 15(Life on land),Goal03 (Good health & well being)	Electrical goods ,purification academician

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SEMESTER- 3rd
Course: M.Sc. Chemistry
SUBJECT: Lab I (Lab General)

Subject Code: 6SMCH301
Theory Max. Marks: 25
TheoryMin.Marks: 08

Course objectives- To perform Instrumental methods and Analytical Technique related to spectrophotometric determination

Qualitative Analysis :-

1.Spectrophotometric determination (Instrumental methods and Analytical Technique)
Manganese/Chromium/Vanadium in steel sample.Iron-salicylic acid complex by jobs method of continuous variation of concentration.Zirconium-Alizarin red complex; Mole ratio method.
Copper Ethylenediamine Complex; Slope ratio method.Separation & amp; determination of two metal ions: Cu^{2+} Ni^{2+}, Zn^{2+}, Ni^{2+}, Mg^{2+}, Ni^{2+} involving volumetric & gravimetric method.

2. Study and identification of various organic compounds .

Course outcomes

1. Studets will able to determine heavy metals spectrophotometrically.
2. Students will able to understand about Separation& determination of two metal ions: Cu- Ni, Zn-Ni,Mg-Ni involving volumetric & gravimetric method.

Text book:

- Volel's Textbook of Quantitative Analysis. revised, J. Basseell, R.C. Denney, G.H..Jaffery and J. Metham, ELBS.
- Experiments and Techniques in Organic Chemistry, D. Pasto, C. Johnson and M. Miller, Prentice. Hall
- Volgel's Textbook of Practical Chemistry, A.R. Tatchall, john Willey
- Experimental Physics Chemistry R.C. Das and Beher, Tata McGraw Hill.

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SEMESTER- 3rd
Course: M.Sc. Chemistry
SUBJECT:Lab II (Lab special organic chemistry)

Subject Code: 6SMCH303
Theory Max. Marks: 25
Theory Min. Marks: 08

Copurse Objectives- To prepare organic compounds which has its application in various industries

PRACTICALS:-

1. Manufacture of - 2-Phenylethanol, detergents, vanillin and other food flavours, synthetic musk
2. Dewtermination of agrochemicals in plants
3.synthesis of polyethylene, polypropylene
4.Synthetic rubbers: Styrene-butadiene, butyl polyisoprene, phenol formation formaldehyde resin
5.preparation of soaps

Course outcomes
1.Be able to understand Soap and detergents
2.Be able to Know Polymers
3.Be able to Know Synthesis of dyes intermediates
4.Be able to define Manufacture of Acetic acid and butenaldehyde
5.Be able to know Plant growth regulators
6.Be able to define Jovenile harmones.
7.Be able to define azo dyes.

Text books

1. COOK, J. A Text-Book of Practical Organic Chemistry. *Nature*
2. Vogel's Textbook of Practical Organic Chemistry, 5e Paperback

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SEMESTER- 3rd
Course: M.Sc. Chemistry
SUBJECT:Lab II (Lab Special Inorganic chemistry)

Subject Code: 6SMCH303
Theory Max. Marks: 25
Theory Min. Marks: 08

Copurse Objectives- To prepare inorganic compounds which has its application in various industries

PRACTICALS:-

1.Synthesis of Inorganic materials
2. Study of metal and alloy
3.Determination of magnaetic properties of inorganic materials.

Ourse Outcomes-

1. Studets will able to synthesize inorganic compounds.
2. Students will able to study metal in different alloy
3. Students will able to determine magnetism in different compounds

Text Book

1. A text book of Quantitative Inorganic Analysis-A.I.Vogel.
2. Experimental Inorganic Chemistry-W.G.Palmer.
3. The analysis of minerals and ores of the rarer elements-W.R.Schoeller and A.R.Powell, Charles, Griffin and company Ltd.
4. Practical Inorganic Chemistry, Gurdeep Raj, Goal Publication.

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SEMESTER- 3rd
Course: M.Sc. Chemistry
SUBJECT:Lab II (Lab Special Physical chemistry)

Subject Code 6SMCH304
Theory Max. Marks: 25
Theory Min. Marks: 08

Course Objectives - - To determination of sample by Conductometric, Colorimetric .pH metric and Potentiometric method

Chemical Kinetics

1.Verification of Freundlich's Adsorption Isotherm,
2.Determination of effect of Change of temperature, Change of concentrations of reactants and catalyst.
3.Ionic strength of the media on the velocity constant of hydrolysis of ester.
4.Determination of order of reaction for reaction between $K_2S_2O_8$ and KI.
5. Study of oxidation and reduction in chromium.

Course outcomes

1. Students will able to understand Conductometric Analysis.
2. Students will able to understand Colorimetric analysis
3. Students will able to understand pH metric and Potentiometric techniques

Text Books

1. Practical physical chemistry, A.M.James and F.E.Prichard Longman
2. Practical Physical Chemistry, Gurdeep Raj, Goal Publication.
3. A text book of Quantitative Inorganic Analysis-A.I.Vogel.

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SEMESTER- 4rth
Course: M.Sc. Chemistry
SUBJECT:Discipline Specific Elective-III
Chemistry of Natural Products

Subject Code: 6SMCH401
Theory Max. Marks: 50
Theory Min. Marks: 17

Course Objective-
1.Know Terpenoids
2.Define Alkaloids
3.Understand Prostaglandins
4. Explain carbohydrates and proteins
5. Learn Synthesis and structure of biotin and vitamin B2
6. Understand biological functions of B6

Unit	Unit wise course contents	Methodology Adopted
Unit-I	Terpenoids (10+2) Structure and synthesis of abietic acid, zingiberene, santonin, cuparenonne and caryophyllene.	Classroom teaching ICT tools and google classroom,
Unit-II	Alkaloids (10+2) Structure, stereochemistry, synthesis and biosynthesis of the following Structure of morphine, reserpine, ephedrine, (+) Conin.	Classroom teaching, ICT Based and individual presentation and google classroom
Unit-III	a) Steroids(10+2) Occurrence, nomenclature, basic skeleton, Diels hydrocarbon and study of the following hormones, Androsterone, Testosterone, Estrone, Progesterone, Aldosterone and cartisone. Biosynthesis of steroids. b) Prostaglandins Occurrence, nomenclature, classification, biogenesis and physiological effects, Synthesis of PGE_2 and PGF_2	Classroom teaching, ICT Based and individual presentation and google classroom
Unit-IV	Biogenesis (10+2) Alkaloids (pyridine, morphine and indole type) terpenoids of classes with examples, cholesterol, flavones, coumarins, carbohydrates and proteins.	Classroom teaching, ICT Based and individual presentation and Google classroom, field visit
Unit-V	Vitamins (10+2) Synthesis and structure of biotin and vitamin B2, synthesis of vitamin B1, biological functions of B6, B12, folic acid and thiamin.	Classroom teaching, ICT Based and individual presentation and Google classroom, model presentation.

Course outcomes-After the completion of course learner should able to understand about
1.Be able to understand synthesis of vitamin B_1
2.Be able to Know Terpenoids Structure and synthesis of abietic acid
3.Be able to differentiate Biogenesis
4.Be able to Define Occurrence, nomenclature, classification, biogenesis and physiological effects
5.Be able to understand Testosterone, Estrone, Progesterone.

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Text book:
- K. Venkataraman: Chemistry of Synthetic Dyes vol- 1to 7
- K. H. Buchel: Chemistry of Pesticides
- R. Cleymlin: Pesticides
- ShashiChawla, Engineering Chemistry, DhanpatRai and Co (P) Ltd.

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SEMESTER- 4rth
Course: M.Sc. Chemistry
SUBJECT:Discipline Specific Elective-III
Chemistry of Natural Products

Subject Code: 6SMCH401
Theory Max. Marks: 50
Theory Min. Marks: 17

Course Objective-
1.Know Terpenoids
2.Define Alkaloids
3.Understand Prostaglandins
4. Explain carbohydrates and proteins
5. Learn Synthesis and structure of biotin and vitamin B2
6. Understand biological functions of B6

Unit	Unit wise course contents	Methodology Adopted
Unit-I	Terpenoids (10+2) Structure and synthesis of abietic acid, zingiberene, santonin, cuparenonne and caryophyllene.	Classroom teaching ICT tools and google classroom,
Unit-II	Alkaloids (10+2) Structure, stereochemistry, synthesis and biosynthesis of the following Structure of morphine, reserpine, ephedrine, (+) Conin.	Classroom teaching, ICT Based and individual presentation and google classroom
Unit-III	a) Steroids(10+2) Occurrence, nomenclature, basic skeleton, Diels hydrocarbon and study of the following hormones, Androsterone, Testosterone, Estrone, Progesterone, Aldosterone and cartisone. Biosynthesis of steroids. b) Prostaglandins Occurrence, nomenclature, elassification, biogenesis and physiological effects, Synthesis of PGE_2 and PGF_2	Classroom teaching, ICT Based and individual presentation and google classroom
Unit-IV	Biogenesis (10+2) Alkaloids (pyridine, morphine and indole type) terpenoids of classes with examples, cholesterol, flavones, coumarins, carbohydrates and proteins.	Classroom teaching, ICT Based and individual presentation and Google classroom, field visit
Unit-V	Vitamins (10+2) Synthesis and strueture of biotin and vitamin B2, synthesis of vitamin B1, biological functions of B6, B12, folic acid and thiamin.	Classroom teaching, ICT Based and individual presentation and Google classroom, model presentation.

Course outcomes-After the completion of course learner should able to understand about
1.Be able to understand synthesis of vitamin B_1
2.Be able to Know Terpenoids Structure and synthesis of abietic acid
3.Be able to differentiate Biogenesis
4.Be able to Define Occurrence, nomenclature, classification, biogenesis and physiological effects
5.Be able to understand Testosterone, Estrone, Progesterone.

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Text book:
- K. Venkataraman: Chemistry of Synthetic Dyes vol- 1to 7
- K. H. Buchel: Chemistry of Pesticides
- R. Cleymlin: Pesticides
- ShashiChawla, Engineering Chemistry, DhanpatRai and Co (P) Ltd.

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Job opportunity	Employability skill developed	Local/National/UNDP Goal Achieved	Entrepreneurship Opportunity
Chemist in pharmaceutical and dye industry scientist, Academic ,food industries	Analysis and problem-solving. time management and organization. written and oral communication	Goal04(quality education) Goal13 (climate action), Goal 15(Life on land),Goal03 (Good health & well being)	Food , agrochemicals, dyes and academician flavorants

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SEMESTER- 4rth
Course: M.Sc. Chemistry
SUBJECT:Discipline Specific Elective-IV
Stereochemistry

Subject Code: 6SMCH402
Theory Max. Marks: 50
Theory Min. Marks: 17

Course Objective-
1.Know Stereochemistry of Organic Compounds
2.Define stereotopicity and enantiomeric excess
3.Understand stereoselective and stereospecific reactions
4. Know Diels Alder selective synthesis
5. Explain Fused and bridged rings: Fused bicyclic ring systems
6. Learn Bridged rings, Nomenclature stereoichemical restrictions

Unit	Unit wise course content	Methodology Adopted
Unit-I	**Stereochemistry of Organic Compounds** (10+2) Molecular chirality and stereoehemicalnomenclature.Molecules with chiral axes and planes.Molecular shape, topology and optical activity.Atropisomerism and its designation.Racemisation, resolution, prostereoisomerism, stereotopicity and enantiomeric excess.Non-carbon chiral centres.Introduction to chiroptical properties.	ICT based class roo teaching, individu presentation
Unit-II	**Newer methods of stereoselective synthesis** (10+2) Introduction and stereoselective and stereospecific reactions.Enantioselective synthesis (chiral approach) reactions with hydride donors, hydroboration, catalytic hydrogenation via chiral hydrazones and oxazolines.Sharplessepoxidation.Diels Alder selective synthesis, use of calculations of optical purity and enantiomeric excess..	ICT based class room teaching, individual presentation
Unit-III	a)Conformation and reactivity in acyclic compounds and of cyclohexanes(10+2) Stability and reactivity of diastereoisomers. Curtin- Hammett principle, b) Some aspects of the stereochemistry of ring systems Stereoisomerism and determination of configuration Stability of rings and ease of rings formation) c) The shapes of the rings other than six membered: Shapes of five, six, and seven membered rings	ICT based class room teaching, individual presentation
Unit-IV	a) Fused and bridged rings: Fused bicyclic ring systems :(10+2) Cis and transdecalins and perhydrophenanthrene. Bridged rings, Nomenclature stereoichemical restrictions, and The Bredt's rule, Reactivities. b) O.R.D. and C.D. : Types of curves, the axial haloketone rule. The Octant rule.Determination of conformation and configuration	ICT based class room teaching, individual presentation
Unit-V	a) Stereochemistry of Allenes, Spiranes and Biphenyls (10+2) Assignment of configuration b) Configuration of diastereomers based on physical and chemical methods.	ICT based class room teaching, individual presentation

Course outcomes-After the completion of course learner should able to understand about
1.Be able to understand Stereochemistry of Allenes
2.Be able to Know Configuration of diastereomers
3.Be able to differentiate O.R.D. and C.D
4.Be able to understand hydroboration, catalytic hydrogenation via chiral hydrazones
5.Be able to Define aspects of the stereochemistry of ring systems
6.Be able to explain use of calculations of optical purity and enantiomeric excess.

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Recommended Book

- E.L. Elil: Stereochemistry of carbon compounds
- D. Nasipuri : Stereochemistry of organic compounds
- P.S. Kalsi: Stereochemistry Conformation and Mechanism.
- Hallas: Organic stereochemistry

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- Mislow and Benjamin: Introduction to stereochemistry.

Job opportunity	Employability skill developed	Local/National/UNDP Goal Achieved	Entrepreneurship Opportunity
Chemist, scientist, Academic , various industries	Analysis and problem-solving. time management and organization. written and oral communication	Goal04(quality education) Goal13 (climate action), Goal 15(Life on land),Goal03 (Good health & well being)	Electrical goods ,purification academician

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SEMESTER- 4RTH
Course: M.Sc. Chemistry
SUBJECT:Discipline Specific Elective-III
Separation Science

SUBJECT CODE: SMCH401
Theory Max. Marks: 50
Theory Min. Marks: 17

Course Objective-
1. Know application of diketone
2.Define Solvent Extraction Separation
3.Understand chromatographic inert support
4. Know theory of break through curves
5. Explainapplication of diketone, hydroxyquinoline, oximes
6. Learn use of non aqueous solvents in one exchange separation
7. Define flow programming chromatography

Unit	Unit wise Course Content	Methodology Adopted
Unit-I	Solvent Extraction Separation(10+2) Principles of solvent extraction, formation of metal complexes, distribution of extractable species, quantitative treatment of extractable equillibria, Methods of extraction, techniques in extraction, application of diketone, hydroxyquinoline, oximes, dithiocarbamates, xanthets, thiols, macrocyclic polythenes and orgaophosphouous compounds in solvent extraction. Separation of nonmetals and metals.	Class room based
Unit-II	Chromatographic separation techniques(10+2) Extraction chromatography, theoretical aspects of extraction chromatography, correlation between solvent extraction and extraction chromatography, techniques in extraction chromatography, chromatographic inert support, stationary phases, use of extraction chromatography for separation of fission products.	Class room based
Unit-III	Ion exchange separation(10+2) Fundamental properties of ion exchangers, theories of ion exchange, exchange capacity, screening effect, penetration of electrolytes into the ion exchange resins, sorption of complex ions, ion exchanges equilibrium, column operation, theory of break through curves, elution steps, use of non aqueous solvents in one exchange separation, application of ion exchange separation in determination of total salt concentration, removal of interfering ions, separation of anions and metals.	Class room based
Unit-IV	Separation by electrolysis Basic principles, over potentials, electrogravimetry, constant current electrolysis,separation with controlled electrode potentials, constant voltage electrolysis, pofentialbuffers, and physical characteristics of metal deposits, internal electrolysis,electrography, electrophoresis, and electro chromatography.	Class room based, ICT based
Unit-IV	Gas Chromatography (10+2) Principles of gas chromatography, plate theory of gas chromatography, Instrumentation for gas chromatography, working gas chromatography, application of gas chromatography, programmed temperature chromatography, flow programming chromatography, gas-solid chromatography, and hyphenated techniques in chromatography Problems.	Class room based, ICT based

Course outcomes-After the completion of course learner should able to understand about
1.Be able to understand Principles of gas chromatography
2.Be able to Know internal electrolysis,electrography
3.Be able to differentiate programmed temperature chromatography, flow programming chromatography, gas-solid chromatography
4.Be able to understand use of non aqueous solvents in one exchange separation
5.Be able to Define application of gas chromatography

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Recommended Book

- Solvent extraction in analytical A chemistry by G.H. Morrison, F. Frieiser, john Wiley & Sons, NY.
- Sovent extraction Chemistry, Selkine and alegagawa.
- A.I. Vogel, A Text Book of quantitatice Inorganic Analysis. Longmann Green.
- D.A. Skoog& D.M. west, Fundamentals of Analytical Chemistry- holy Rinchart.
- S.M. Khopkar, Basic Concepts of Analytical Chemistry.

Job opportunity	Employability skill developed	Local/National/UNDP Goal Achieved	Entrepreneurship Opportunity
Teaching, Chemist, Scientist	Able to solve Problem related Chromatography	Goal4: (UNDP) Quality Education Goal 15(Life on land),Goal03 (Good health & well being)	Trainer , food processing

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SEMESTER- 4th
Course: M.Sc. Chemistry
SUBJECT: Discipline Specific Elective-IV
Organo Metallic Chemistry

Subject Code:6SMCH402
Theory Max. Marks: 50
Theory Min. Marks: 17

Course Objective
1.Know Methyl derivatives of metals
2.Define Catalytic processes of Carbonylation, hydrogenation
3.Understand reactions of bimetallic compounds and halides
4. Know organomettallic reactions with oxygen, carbonyls and others
5. Explain isomerisation of olefins
6. Learn ,3,4,5,6 and 7 electron donor carbametallic compounds

Unit	Unit wise course content	Methodology Adopted
Unit-I	A] Methyl derivatives of metals (10+2) Structures, bonding, classification of methyl derivatives of metals, cleavage of metal carbon bonds, thermochemical consideration. B] Catalytic processes Carbonylation, hydrogenation, isomerisation of olefins, olefin oxidation, oligomerization, polymerization.	ICT based class room teaching Group presentation
Unit-II	Organometallic synthesis(10+2) Radicals + metals, carbonyls, olefins complexes, addition of metal hydrides to unsaturated carbons,, addition of metal alkyls to unsaturated hydrocarbons, substitution reactions, Hydrocarbons + metal Organometallic + metal, mettalation, metal halogen exchange reactions, Mercuration& related covalent metallation reactions of Organometallic compounds with metal salts, reactions of bimetallic compounds and halides, ligand exchange reactions of diazoalkanes with metal hydrides and halides, addition of M-OR to C=C, electrolyte reduction using metal cathode, decarboxylation.	ICT based class room teaching and discussion.
Unit-III	Properties of reactions of Organometallic compounds (10+2) Complex formation, reactions with active oxygen compounds, reactions with halogen, reactions with alkyl halides, acid halides, reactions with oxygen, carbonyls and others.	ICT based class room with presentation
Unit-IV	Metal carbonyls, isocyanides and acetylides. (10+2) Preparation, structure, reactions of metal carbonyls with alkyl halides, reactions of metal carbonyls with metal alkyls, cyanides and isocyanides complexes, acetalynide complex adduct formation. Complexes: 2,3,4,5,6 and 7 electron donor carbametallic compounds, aromaticity of cyclopentadienyls.	ICT based class room with chemical society
Unit-V	Techniques of Organometallic Chemistry (10+2) Methods of synthetic chemistry, vacuum techniques, inert atmosphere, nonaqueous media, handling and hazards of organ metallic.	ICT based class room with group discussion

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Course outcomes-
1 Be able to understand cleavage of metal carbon bonds, thermochemical consideration
2.Be able to Know olefins complexes, addition of metal hydrides to unsaturated carbons
3.Be able to differentiate Methods of synthetic chemistry
4.Be able to understand aromaticity of cyclopentadienyls
5.Be able to Define Mercuration& related covalent metallation reactions of Organometallic compounds with metal salts.

Text Books

- James E. Huheey: Inorganic Chemistry-Principles of Structure and reactivity, Harber& Row, Publishers Inc. New York 1972.
- F.A. Cotton & R.G. Williamson: Advanced Inorganic Chem.

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SEMESTER- 4th **Subject Code:6SMCH402**
Course: M.Sc. Chemistry **Theory Max. Marks: 50**
SUBJECT:Discipline Specific Elective-IV **Theory Min. Marks: 17**
Organo Metallic Chemistry

Course Objective
1.Know Methyl derivatives of metals
2.Define Catalytic processes of Carbonylation, hydrogenation
3.Understand reactions of bimetallic compounds and halides
4. Know organomettallic reactions with oxygen, carbonyls and others
5. Explain isomerisation of olefins
6. Learn ,3,4,5,6 and 7 electron donor carbamefallic compounds

Unit	Unit wise course content	Methodology Adopted
Unit-I	A] Methyl derivatives of metals (10+2) Structures, bonding, classification of methyl derivatives of metals, cleavage of metal carbon bonds, thermochemical consideration. B] Catalytic processes Carbonylation, hydrogenation, isomerisation of olefins, olefin oxidation, oligomerization, polymerization.	ICT based class room teaching Group presentation
Unit-II	Organometallic synthesis(10+2) Radicals + metals, carbonyls, olefins complexes, addition of metal hydrides to unsaturated carbons,, addition of metal alkyls to unsaturated hydrocarbons, substitution reactions, Hydrocarbons + metal Organometallic + metal, mettalation, metal halogen exchange reactions, Mercuration& related covalent metallation reactions of Organometallic compounds with metal salts, reactions of bimetallic compounds and halides, ligand exchange reactions of diazoalkanes with metal hydrides and halides, addition of M-OR to C=C, electrolyte reduction using metal cathode, decarboxylation.	ICT based class room teaching and discussion.
Unit-III	Properties of reactions of Organometallic compounds (10+2) Complex formation, reactions with active oxygen compounds, reactions with halogen, reactions with alkyl halides, acid halides, reactions with oxygen, carbonyls and others.	ICT based class room with presentation
Unit-IV	Metal carbonyls, isocyanides and acetylides. (10+2) Preparation, structure, reactions of metal carbonyls with alkyl halides, reactions of metal carbonyls with metal alkyls, cyanides and isocyanides complexes, acetalynide complex adduct formation. Complexes: 2,3,4,5,6 and 7 electron donor carbametallic compounds, aromaticity of cyclopentadienyls.	ICT based class room with chemical society
Unit-V	Techniques of Organometallic Chemistry (10+2) Methods of synthetic chemistry, vacuum techniques, inert atmosphere, nonaqueous media, handling and hazards of organ metallic.	ICT based class room with group discussion

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Course outcomes-
1 Be able to understand cleavage of metal carbon bonds, thermochemical consideration
2.Be able to Know olefins complexes, addition of metal hydrides to unsaturated carbons
3.Be able to differentiate Methods of synthetic chemistry
4.Be able to understand aromaticity of cyclopentadienyls
5.Be able to Define Mercuration& related covalent metallation reactions of Organometallic compounds with metal salts.

Text Books
- James E. Huheey: Inorganic Chemistry Principles of Structure and reactivity, harber& Row, Publishers Inc. New York 1972.
- F.A. Cotton & R.G. Wilkinson: Advanced Inorganic Chem.

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- Jones: Elementary Coordination Chemistry J. Weily
- Graddon: Introduction to Coordination Chemistry J. Weily
- Drago: Physical methods of Inorganic Chemistry. J. Weily

Job opportunity	Employability skill developed	Local/National/UNDP Goal Achieved	Entrepreneurship Opportunity
Chemist Teacher lecturer	Able to solve the problem organo metallic complex compound Action planning skill will be developed	Goal 1 (sustainable development and communities) Goal 2 Goal3 (Quality Education)	Yes, Industrial opportunity Quality controls

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SEMESTER- 4rth
Course: M.Sc. Chemistry
SUBJECT: Discipline Specific Elective-III
Surface chemistry

Subject Code: 6SMCH401
Theory Max. Marks: 50
Theory Min. Marks: 17

Course Objective-

1.Know Adsorption and surface phenomenon.
2.Define Langmuir and B. E. T. equation and significance in surface area etermination.
3.Understand significance and experimental verification.
4. Know micellisation, critical micelle concentration (cmc) thermodynamics of micellisation.
5. Explain Types of emulsion, theories of emulsion and emulsion stability.
6. Learn Liquid gas and liquid interfaces.
7. Understand Solid - Solid interfaces, Surface energy of solids, adhesion and adsorption.

Unit	Unit wise course contents	Methodology Adopted
Unit-I	Adsorption and surface phenomenon (10+2) Physisorption and chemisorption , adsorption isotherms, Langmuir and B. E. T. equation and significance in surface area determination, surface films, states of insoluble films, L. B. films and their application, adsorption from solution, adsorption types, surface excess concentration , Gibb's adsorption equation : derivation , significance and experimental verification , catalytic activity of surfaces.	Classroom teaching ICT tools and google classroom,
Unit-II	Micelle (10+2) Surface activity, surface active agents and their classification, micellisation, critical micelle concentration (cmc) thermodynamics of micellisation , factors affecting cmc, methods of determination of cmc , reverse micelle , solubisation of water insoluble organic substances , use of surfactants in oil recovery ,	Classroom teaching, ICT Based and individual presentation and Google classroom
Unit-III	Emulsion(10+2) Types of emulsion, theories of emulsion and emulsion stability, identification of Emulsion types, inversion emulsion, micro emulsion: theory and application ,	Classroom teaching, ICT Based and individual presentation and Google classroom
Unit-IV	Liquid gas and liquid interfaces: (10+2) Surface tension, capillary action, methods of determination of surface tension, surface tension across curved surfaces, vapor pressure of droplet (Kelvin equation) , surface spreading , spreading coefficient, cohesion and adhesion energy,contact angle, constant angle hysteresis, wetting and detergency.	Classroom teaching, ICT Based and individual presentation and Google classroom, field visit
Unit-IV	Solid - Solid interfaces (10+2) Surface energy of solids, adhesion and adsorption, sintering and sintering mechanism, Tammann temperature and its importance, surface structure and Surface composition.	Classroom teaching, ICT Based and individual presentation and google classroom, model presentation.

Course outcomes-After the completion of course learner should able to understand about

1.Be able to understand Gibb's adsorption equation : derivation
2.Be able to Know Tammann temperature and its importance,
3.Be able to differentiate theories of emulsion and emulsion stability
4.Be able to understand sintering and sintering mechanism
5.Be able to Define factors affecting cmc, methods of determination of cmc
6.Be able to understand Effects of adhesion and adsorption, sintering and sintering mechanism

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Text Books

- Physical chemistry of surfaces: A.W. Adamson.
- Chemisorptions by B.m.W.Trapnell and H.O. Hayward.
- Introduction to colloids and surface chemistry by D.J. Shaw.
- Theories of chemical reaction rates by A.J.K. laidler
- Surface chemistry by E.J. Biltcroumin.

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Job opportunity	Employability skill developed	Local/National/UNDP Goal Achieved	Entrepreneurship Opportunity
Chemist, scientist, Academic , various industries	Analysis and problem-solving. time management and organization. written and oral communication	Goal04(quality education) Goal13 (climate action), Goal 15(Life on land),Goal03 (Good health & well being)	Electrical goods metallurgy ,,purification academician , water remediation

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SEMESTER- 4th
Course: M.Sc. Chemistry
SUBJECT:Discipline Specific Elective-IV
Chemistry of Materials

Subject Code: 6SMCH402
Theory Max. Marks: 50
Theory Min. Marks: 17

Course objectives-

1. Know Ceramic structures,mechanical properties, clay products Reformatories, characterizations
2. Define Tc superconductivity in cuprates, preparation and characterization of 1-2-3 and 2-1-4 materials
3. Understand stress- strain behavior,Thermalbehaviour of polymers.
4. Know conducting and ferro -Electric polymers
5. Explain Molecular shape , structure and configuration, crystallinity, stress- strain behavior,Thermal behavior, polymer types

Unit	Unit wise course contents	Methodology Adopted
Unit-I	**Glasses, Ceramics, Composite and Nanomaterials** (10+2)**:** Glassy state, glass formers and glass modifiers, applications, Ceramic structures,mechanical properties, clay products. Reformatories,characterizations, properties and applications.Microscopic composites; dispersion - strengthened and particle - reinforced, fibre-reinforced composites, macroscopic composites. Nanocrystline phase, preparationprocedures, special properties, and applications.	Classroom teaching ICT tools and google classroom,
Unit-II	**High Tc Materials** (10+2)**:** Defect perovskites, high Tc superconductivity in cuprates, preparation and characterization of 1-2-3 and 2-1-4 materials, and normal state properties; anisotropy; temperature dependence of electrical resistance; optical photon modes,superconducting state; heat capacity; coherence length, elastic constants, positionlifetimes, microwave absorption - pairing and multigap structure in highTc materials , applications of high Tc materials	Classroom teaching, ICT Based and individual presentation and Google classroom
Unit-III	**Polymeric Materials** (10+2)**:** Molecular shape , structure and configuration, crystallinity, stress- strain behavior,Thermal behavior, polymer types and their applications, conducting andferro -Electric polymers	Classroom teaching, ICT Based and individual presentation and Google classroom
Unit-IV	**a)Thin films and Langmuir- Blodgett Films** (10+2)**:** Preparation techniques; evaporation /sputtering, chemical processes, MOCVD, sol - gel etc. Langmuir- Blodgett (LB) film, growth techniques, photolithography, properties and application of thin and LB films	Classroom teaching, ICT Based and individual presentation and Google classroom, field visit
Unit-V	**Materials of Solid Devices** (10+2): Rectifiers, transistors, capacitors IV-V compounds, low dimensional quantum Structure; optical properties.	Classroom teaching, ICT Based and individual presentation and google classroom, model presentation.

Course outcomes-After the completion of course learner should able to understand about

1. Be able to understand Glassy state, glass formers and glass modifiers, applications
2. Be able to Know strengthened and particle - reinforced, fibre -reinforced composites
3. Be able to differentiate High Tc Materials, pairing and multigap structure in highTc materials
4. Be able to understand Thin films and Langmuir- Blodgett Films
5. Be able to Define conducting andferro -Electric polymers
6. Be able to understand Effects of optical photon modes,superconducting state
7. know applications of applications of high Tc materials.

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Text book:

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- N.N. Greenwood: Ionic Crystals, Lattice Defects and Nonstionchiometry (Butterworth's)
- A. R. West, Solid State Chemistry
- H.V. K Keer, Principles of the Solid State Chemistry, Wiley Eastern.

Job opportunity	Employability skill developed	Local/National/UNDP Goal Achieved	Entrepreneurship Opportunity
Chemist, scientist, Academic , material synthesis and various industries	Analysis and problem-solving. time management and organization. written and oral communication	Goal04(quality education) Goal13 (climate action), Goal 15(Life on land),Goal03 (Good health & well being)	Academician ,electrical goods, insulator, inorganic material synthesis

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SEMESTER- 4th
Course: M.Sc. Chemistry
SUBJECT: LAB GENERAL-II

Subject Code:
Max. Marks: 25
Min. Marks: 08

Course Objectives- Determination of various samples by chemical analysis using different methods of volumetric, instrumental, Spectroscopic, classical and Chromatographic techniques along with their applications.

1. CLASSICAL

- Determination of Organic Nitrogen.
- Determine the saponification value of given oil sample.
- Determination of Iodine Value in given oil sample.
- Determination of E_a of saponification of ester by conductometry method.
- Determination of Moisture content in given sample.
- Determination of adsorption isotherm of of the given sample from aqueous solution by using activated charcoal.
- Determination of dissociation constant of an acid - base indicator.

2. INSTRUMENTAL

a) Spectrophotometric/ Colorimetric determination
Determination of nitrate, sulphide, Phosphate, Chromium and copper
b) Determination of Manganese in steel
c) Flame photometry/ AAS:
   - Determination of sodium, potassium and calcium
   - Determination of potassium in combined fertilizer
   - Determination of calcium in wine
   - Simultaneous determination of sodium and potassium in soil samples
   - Determination of Arsenic in water samples

3. Chromatography: Advanced chromatographic separations of the given sample

4. Experiments based on: UV - Visible spectroscopy with application, Fluorescence Spectroscopy with application, Infrared Spectroscopy, Ion selective electrodes, Semiconductor materials, Optical materials.

5. Table work: Data Analysis, error analysis, least squares method, Characterization of sample using IR spectroscopy, Mass and NMR spectroscopy.

Course Outcomes-After the completion of course learner should able to understand about

1. Qualitative Analysis (Titriometric)
2. Colorimetric analysis
3. Chromatography techniques.
4. Modern Instrumental techniques.

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Text book:

1. Volel's Textbook of Quantitative Analysis, revised, J. Basseeh, R.C. Denney, G.H..Jaffery and J. Metham, ELBS.
2. Experiments and Techniques in Organic Chemistry, D. Pasto, C. Johnson and M. Miller, Prentice. Hall
3. Volgel's Textbook of Practical Chemistry, A.R. Tatchall, john Willey
4. Experimental Physical Chemistry R.C. Das and Beher, Tata McGraw Hill.
5. Analytical Chemistry, Alka L. Gupta, Pragati Publication, 5th ed.
6. Advanced Inorganic Chemistry, S.K. Agarwala and KeemtiLal, 12the

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Dr. C.V. RAMAN UNIVERSITY
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SEMESTER- 4th **Subject Code: 6SMCH402**
Course: M.Sc. Chemistry **Max. Marks: 25**
SUBJECT: Lab.II (Discipline Specific-Organic Chemistry) **Min. Marks: 08**

Course Objectives – To synthesize organic copounds via multistep synthesis, and its chacterization techniqes.

Multi-step Synthesis of Organic Compounds
The exercises should illustrate the use of organic reagents and may involve purification of the products by chromatographictechniques.
Benzophenone→ Benzpinacol→Benzpinacolone Beckmann rearrangement: Benzanilide from benzene
Benzene→ Benzophenone→Benzophenoneoxime→Benzanilide Benzilic acid rearrangement: Benzilic acid from benzoin
Benzoin→ Benzil→Benzilic acid Synthesis of heterocyclic compounds
Skraup synthesis: Preparation of quinoline from aniline. Fisher-Indole synthesis: Preparation of 2-phenylindole fromphenylhydrazine.
Enzymatic synthesis
Enzymatic reduction: Reduction of ethyl acetoacetate using Bakersyeast to yield enantiomeric excess of S (+) ethyl-3-hydroxybutanoate and determine its optical purity. Biosynthesis of ethanol from sucrose.
Synthesis using microwaves
Alkylation of diethyl malonate with benzyl chloride.
Synthesis using phase transfer catalyst.
Alkylation of diethyl malonate or ethyl acetoacetate with an alkyl halide.
Paper Chromatography
Sepration and identification of the sugars present in the given mixture of glucose, fructose and sucrose bypaperchromatographyanddeterminationof R_f values.
Spectroscopy
Identification of organic compounds by the analysis of their spectral data (UV, IR, PMR, CMR & MS).

Course Outcomes

1. Student will able to synthesize organic compounds .
2. Students will able to separate organic compounds using chromatographic technique.
3. Student will able to perform Synthesis using microwaves
4. Student will able to perform Synthesis using phase tyransfer catalysis

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Text books

1. Volel's Textbook of Quantitative Analysis, revised, J. Basseell, R.C. Denney, G.H..Jaffery and J. Metham, ELBS.
2. Experiments and Techniques in Organic Chemistry, D. Pasto, C. Johnson and M. Miller, Prentice. Hall
3. Practical organic chemistry, O P Agrawal .

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Dr. C.V. RAMAN UNIVERSITY
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SEMESTER- 4th
Course: M.Sc. Chemistry
SUBJECT: Lab.II (Discipline Specific-Inorganic Chemistry)

Subject Code: 6SMCH402
Max. Marks: 25
Min. Marks: 08

Course Objectives –To perform instrumental, Spectroscopic, classical and Chromatographic techniques along with their applications related to inorganic samples

Instrumentation : Spectrophotometry

Mn/Cr/V in steel sample ; Ni/Mo/W/V/U by extractive spectrophotometric method.; Fluoride / nitrite / phosphate.; Iron-phenanthroline complex: Job's method. ; Zirconium-Alizarin Red-S complexes: Mole-ratio method.; Copper-Ethylene diamine complexes: Slope-ratio method.
(II) Flame photometric determinations
Naand K when present together. Li/Cd/Ba/Sc. Cd and Mg in tap water.
(III) Nephelometric determination. Sulphate, Phosphate, Silver
(IV) pH-metric and Conductometric study of metal-complexes.
Chromatographic separation
Paper Chromatography: Mixture of cations/ anions viz. Cd and Zn, Zn and Mg etc., Thin-layer chromatographic-separation of Ni, Mn, Co, Zn etc.. Determination of
R_f values. Separation and identification of the amino acids/sugars present in the given mixture by paperchromatography and determination of R_f values.
Course Outcomes

1. Student will able to understand operation and application of spectrosphotometer, flame photometer, pH meter and conductivity meter.
2. Students will able to separate mixter cataio/anion using chromatographic techniques.

Text books

1. Volel's Textbook of Quantitative Analysis, revised, J. Basseell, R.C. Denney, G.H..Jaffery and J. Metham, ELBS.
2. Practical Inorganic chemistry , Gurdeep Raj.

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W.E.F. July-2020-21

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SEMESTER- 4th
Course: M.Sc. Chemistry
SUBJECT: Lab.II (Discipline Specific-Physical Chemistry)

Subject Code: 6SMCH402
Max. Marks: 25
Min. Marks: 08

Course Objectives –To perform instrumental determination related to Polarography and DO meter.

Polarography:
Estimation of Pb^{2+} and Cd^{2+} /Zn^{2+} and Ni^{2+} ions in mixtureof $Pb^{2+}$and Cd^{2+} /Zn^{2+} and Ni polarography.
Quantitative determination of electroactive species by Polarography
Determination of dissolved oxygen in aqueous solution of organic solvent.
Determination of the amount of Pb^{2+} by standard $K_2Cr_2O_7$ solution amperometrically..

Course Outcomes:
Afterthe completion of course learner should able to understand the following:

- Estimation in polarography
- Dermination of DO in organic solvents

Text book:

- A text book of Quantitative Inorganic Analysis-A.I.Vogel.
- Experimental Inorganic Chemistry-W.G.Palmer.
- Practical physical chemistry, A.M.James and F.E.Prichard Longman
- Practical Physical Chemistry, Gurdeep Raj, Goal Publication.

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W.E.F. JULY - 2020-21

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SEMESTER- 4rth
Course: M.Sc. Chemistry
SUBJECT: Project Work

Subject Code: 2010433101
Max. Marks: 100
Max. Marks: 33

PROJECT

All the candidates of M.Sc.(Chemistry) are required to submit a project-report based on the work done by him/her during the project period. A detailed Viva shall be conducted by an external examiner based on the project report. Students are advised to see the detailed project related guidelines on the website of CVRU. (www.cvru.ac.in) under Project Guidelines for student section.

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