UNIVERSITY OF LUCKNOW
MASTERS OF CHEMISTRY PROGRAMME
REGULATION 2020

1. APPLICABILITY

These regulations shall apply to the Masters in Chemistry programme from the session 2020-21.

2. Minimum eligibility for admission

A three/four years Bachelor's degree or equivalent with chemistry as one of the subject in final year awarded by University or Institute established as per law and recognized as equivalent by university with minimum 45% marks for general and OBC (SC/ST 40%) or equivalent grade shall constitute the minimum requirement for admission to the Masters in Chemistry Programme.

3. Programme Objectives

I. To enable the students to learn about the Periodic Table, Coordination Chemistry and Structure of Molecules, Properties of Compounds, Structural Determination of Complexes using theories and instruments.
II. To make the students to learn about the physical aspects of Atomic Structure, Dual Behaviour, Reaction Pathways with respect to time, various Energy Transformations, Molecular assembly at Nanolevel, Significance of Electrochemistry, Molecular Segregation using their symmetry.
III. To learn about the potential uses of Analytical, Industrial and Medicinal chemistry.
IV. To understand and apply principles of Organic Chemistry for understanding the Reaction mechanisms, Stereochemistry, Organic Synthesis, complex chemical structures, instrumental method of chemical analysis, Molecular rearrangements and separation techniques. To carry out laboratory experiments taught in Core Theory papers and to learn the principles of good laboratory practices.
V. To help the studentsôdevelop ability to make mathematical models for physical systems.
VI. To inculcate interest in research and provide to exposure to various research methodologies.

1. Programme Outcomes

PO-1. Demonstrate, solve and an understanding of major concepts in all disciplines of Chemistry independently and in group as well as draw logical conclusions through Project and Seminar Presentation.
PO-2. Employ critical thinking and the scientific knowledge to design, carry out, record and analyze the results of Chemistry experiments
PO-3. Equip students to face the employment challenges and instil confidence to turn into entrepreneur and also step into research career.
PO-4. Generation of new scientific insights or to the innovation of new applications of chemical research
PO-5. Present scientific and technical information resulting from laboratory experimentation in both written and oral formats.
PO-6. Apply modern methods of analysis to chemical systems in a laboratory setting.
PO-7. The students will become well versed in the mechanisms of all types of high level and complicated chemical reactions.
PO-8. The students will improve their competencies on par with their counterparts in premier institutions across the nation.

4. Programme Specific Outcomes

PSO-1. Appreciates the importance of various elements present in the periodic table, coordination chemistry and structure of molecules, properties of compounds, structural determination of complexes using theories and instruments.
PSO-2. Gathers attention about the physical aspects of atomic structure, dual behaviour, reaction pathways with respect to time, various energy transformations, molecular assembly in nanolevel, significance of electrochemistry, molecular segregation using their symmetry.
PSO-3. Learns about the potential uses of analytical, industrial chemistry and medicinal chemistry.
PSO-4. Understand and apply principles of Organic Chemistry for understanding the scientific phenomenon in Reaction mechanisms, Stereochemistry, Organic Synthesis, complex chemical structures, instrumental method of chemical analysis, molecular rearrangements and separation techniques.
PSO-5. Study of organometallic reactions.
PSO-6. Study of biological mechanisms using amino acids.
PSO-7. Learn the classical status of thermodynamics.
PSO-8. Carry out laboratory experiments taught in Core Theory papers and to understand good laboratory practices with safety.

PSO-9. Enhance studentsôability to develop mathematical models for physical systems.
PSO-10. Global level research opportunities to pursue Ph.D. programme targeted approach of CSIR/UGC ï NET examination
PSO-11. Discipline specific competitive exams conducted by service commission

5. Course Structure

The course structure of the Masters in Chemistry programme shall be as under.

No.	Name of the Couse	Credit	Remark
	Semester I		
CHCC-101	Inorganic Chemistry	**04**	Core Course
CHCC-102	Organic Chemistry	**04**	Core Course
CHCC-103	Physical Chemistry	**04**	Core Course
CHCC-104A CHCC-104B CHCC-104C	Inorganic Chemistry Practical Organic Chemistry Practical Physical Chemistry Practical	**04** **04** **04**	Core Course
CHVNC-101	* Separation Techniques Or * Chemistry of Analgesics and Antipyretics	**00**	Value Added (Non Credited)
	Semester Total	**24**	
	Semester II		
CHCC-201	Inorganic Chemistry	**04**	Core Course
CHCC-202	Organic Chemistry	**04**	Core Course
CHCC-203	Physical Chemistry	**04**	Core Course
CHCC-204A CHCC-204B CHCC-204C	Inorganic Chemistry Practical Organic Chemistry Practical Physical Chemistry Practical	**04** **04** **04**	Core Course
CHVNC-201	* Science of Technology of Cosmetics Or * Bioethanol as Fuel	**00**	Value Added (Non Credited)
	Semester Total	**24**	
	Semester III		
CHCC-301	Inorganic Chemistry	**04**	Core Course/MOOC
CHCC-302	Organic Chemistry	**04**	Core Course
CHCC-303	Physical Chemistry	**04**	Core Course
CHCC-304	Advance Chemistry Practical-I	**04**	Core Course
CHEL-301A	Environmental Chemistry	**00**	Elective (Non Credited)
CHEL-301B	Chemistry of Natural Products		
CHIN-301	Summer Internship	**04**	Summer Internship
CHIER-301	Concepts of Chemistry	**04**	Interdepartmental
	Semester Total	**24**	
	Semester IV		
CHCC-401	Advanced Chemistry Practical-II	**04**	Core Course
Any one papers from each CHEL-402A, CHEL-402B and CHEL-402C			
CHEL-402A	Bioinorganic and Supramolecular Chemistry Or Organotransition Metal Chemistry	**04**	Elective/ Intradepartmental Course
CHEL-402B	Organic Synthesis Or Medicinal Chemistry	**04**	
CHEL-402C	Polymer Chemistry Or	**04**	Elective/ Intradepartmental

No.	Name of the Couse	Credit	Remark
	Electrochemistry		Course
CHMT-401	Project and Dissertation, Evaluation and Viva-voce on submitted Dissertation (Internal)	**08**	Master Thesis
	Semester Total	**24**	
	GRAND TOTAL	**96**	

* The offered courses shall be announced by the Head, Chemistry Department in the beginning of session every year.

CH – Subject; CHCC – Core Course; CHVNC –Value Added (Non-credited); CHEL – Elective; CHIER – Interdepartmental Course; CHIRA – Intradepartmental Course

Course Outlines

PROGRAMME STRUCTURE

The Master of Science in Chemistry is a Two Year Full Time Course consisting of Four Semesters.
Semester I
Semester II
Semester III
Semester IV

Sem	Core Course			Elective Course			Open elective Course			Value Added		Total Credits
	No. of Papers	Credits (L+T/P	Total Credit	No. of Paper	Credits (L+T/P)	Total Credit	No. of Paper	Credits (L+T/P	Total Credit	No. of Papers	Credits	
I	4	12+12	24	0	0+0	0	0	0+0	0	1	0	24
II	4	12+12	24	0	0+0	0	0	0+0	0	1	0	24
III	5	12+8	20	0	0+0	0	1	4+0	4	0	0	24
IV	2	4+8	12	3	4+4+4	12	0	0+0	0	0	0	24
Total Credits			80			12			4		0	96

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Semester I

Paper Code	Title of the paper	Credits	Int. Ass.	End Sem. Exam.	Marks
CHCC-101	Inorganic Chemistry	**4**			
CHCC-102	Organic Chemistry	**4**			
CHCC-103	Physical Chemistry	**4**			
CHCC-104A **CHCC-104B** **CHCC-104C**	Inorganic Chemistry Practical Organic Chemistry Practical Physical Chemistry Practical	**4** **4** **4**			
CHVNC-101	* Separation Techniques **Or** * Chemistry of Analgesics and Antipyretics	**0**	00		
	Total	**24**			

Semester I Syllabus
Core Course
Paper Code CHCC-101 Inorganic Chemistry

Credits 04 **Hours 60**

Course Objective:
The objective of this course is to provide students coming in the first year of Masters programme new and advance understanding into the bonding properties of normal compounds and coordination complexes and their concomitant optoelectronic and magnetic applications.

Course Outcome:
CO-1. Students gain newer insight regarding the symmetry, bonding, electronic and magnetic properties of inorganic compounds and coordination complexes.
CO-2. This forms the basis of the development of newer molecule based materials which can offer attractive electronic properties at the molecular level, supermolecular and supramolecular level.
CO-3. Also, the content dealing with the magnetic properties may create zeal amongst the students to design and develop new single molecule magnets which now a day are getting attraction as the contrast agents in magnetic resonance imaging (MRI).

Unit I

Symmetry and group Theory in chemistry:

Symmetry element and operation, definition of mathematical group, sub group, cyclic group, conjugacy relation and classes, point symmetry group (Schonflies symbols), use of point group symmetry: optical activity, dipole moment, representation of group by matrices, character of representation, the great orthogonality theorem (without proof) and its importance, irreducible representation, character table and their use.

Unit II

Stereochemistry and Bonding: Among main group compounds:

VSEPR, Walsh diagrams (tri-and penta-atomic molecules), $d\pi$ $p\pi$ bonds, Bent rule and energetics of Hybridization, some simple reaction of covalently bonded molecules

Unit III

Among Transition Metal complexes:

Limitation of crystal field theory, Molecular orbital theory, Octahedral, tetrahedral and square planar complexes, π-bonding and molecular orbital theory.

Unit IV

Electronic Spectra of transition metal complexes:

Spectroscopic ground states, correlation, Orgel and Tanabe-Sugano diagram for transition metal complexes (d^1 ï d^9), calculation for Dq, and ß parameter, charge transfer spectra, spectroscopic method for assignment of absolute configuration in optically active metal chelates and their stereochemical information.

Unit V

Magnetic properties of transition metal complexes and Isopoly and Heteropoly acid:

Anomalous magnetic moments, magnetic exchange coupling and spin crossover.Isopoly and Heteropoly acid and salts of V, Mo, W.

Recommended Books:

1. Advanced Inorganic Chemistry, F. A. Cotton and G. Wilkinson, John Wiley
2. Inorganic Chemistry, J. E. Huheey, Ellen A. Keiter, Richard L. Keiter, Addison Wesley Longman (Singapore) Pvt. Ltd.
3. Chemistry of the Elements, N. N. Greenwood and A. Earnshow, Pergamon.
4. Inorganic Electronic Spectroscopy, A. B. P. Lever, Elsevier
5. Magnetochemistry, R. L. Carlin, Springer Verlag
6. Modern Spectroscopy, J. M. Hollas, John Wiley.
7. Chemical Applications of Group Theory, F. A. Cotton.
8. Symmetry and Group theory: Some chemical applications, Ramashankar and Suresh Ameta, Himanshu Publications, Udaipur, Delhi.
9. K. Veera Reddy, Symmetry and Spectroscopy of Molecules, New Age
10. Inorganic Chemistry, D. E. Shriver, P. W. Atkins and C. H. L. Langford, Oxford

Semester I Syllabus

Core Course
Paper Code CHCC-102: Organic Chemistry

Credits 04 **Hours 60**

Course Objective:

The objective of this course is to provide students coming in the first year of Masters programme new and advance understanding about bonding, varied mechanistic approaches and some important reaction mechanism which they had not encountered in their degree programme.

Course Outcome:

After the completion of the course the students will acquire knowledge of:

CO-1: aromaticity, nonaromaticity and antiaromaticity in carbocyclic and heterocyclic compounds.
CO-2: mechanism and outcome of aliphatic electrophilic substitution reactions.
CO-3: properties and reactivity of stereoisomers and stability of an organic molecule based on structure, including conformation and stereochemistry, Conformational analysis and its effect on organic reactivity, stereoselective and stereospecific synthesis.
CO-4: the various types of aliphatic nucleophilic substitution reactions and will give them a better understanding of the processes involved.
CO-5: mechanisms for various organic reactions and how to use their understanding of organic mechanisms to predict the outcome of reactions.
CO-6: molecular orbital symmetry and possibility of thermal and photochemical pericyclic reactions.

Unit I

Nature of bonding in organic molecules

Bonding in fullerenes, Aromaticity in benzenoid and non-benzenoid compound, alternate and nonalternate hydrocarbons, energy of p-molecular orbitals, annulenes, antiaromaticity,

Qī aromaticity homoaromaticity. Crown ether complexes and cryptands, cyclodextrins, catenanes and rotaxane.

Aliphatic electrophilic substitution

Biomolecular mechanism ï S_E2 and S_E1. The S_E1 mechanism, electrophilic substitution accompanied by doubled bond shifts. Effect of substrates, leaving group and solvent polarity

Unit II

Stereochemistry

Conformational analysis of mono and di substituted cycloalkanes, decalines, effect of conformation on reactivity, steric strain due to unavoidable crowding.

Enantiotopic and diastereotopic atoms, group of faces, stereospesific and stereoselective synthesis, asymmetric synthesis, optical activity in absence of chiral carbon (biphenyls, allenes and spiranes), chirality due to helical shape.

Stereochemistry of compound containing nitrogen, sulphur and phosphorous.

Unit III

Aliphatic nucleophilic substitution

The S_N2, $S_N1$and SET mechanism.

The neighboring group mechanism, neighboring group participation by ´ and bond, anchimeric assistance. Nonclassicalcarbocations, phenonium ions, norboryl system.

The S_Ni mechanism

Nucleophilic substitution at an allylic, aliphatic trigonal and vinylic carbon. Reactivity effect of substrate structure, attacking nucleophile, leaving group and reaction medium, phase transfer catalysis, regioselectivity.

Unit IV

Reaction Mechanism: structure and reactivity

Hammonds postulate, Curtin-Hammett principle.

Potential energy diagram, transition state and intermediates, methods of determining mechanism, isotope effect. Hard and soft acids and bases. Effect of structure on reactivity ï resonance and field effect, steric effect, quantitative treatment. The Hammett equation and linear free energy relationship, substituent and reaction constants, Taft equation.

Unit V

Pericyclic Reactions

Molecular orbital Symmetry, Frontier orbital of ethylene, 1,3-butadiene, 1,3,5-hexatriene and allyl system. Classification of pericyclic reactions. Woodward Halfmann correlation diagram, FMO and PMO approach, electrocyclic reaction ï conrotatory and disrotatory motion, 4n, 4n+2 and allyl systems. Cycloaddition ï antarafacial and suprafacial addition, 4n and 4n+2 systems, 2+2 addition of ketenes, 1,3 dipolar cycloaddition and chelotropic reactions. Sigmatropic rearrangement ï Suprafacial and antarafacial shift of H, sigmatropic shift involving corban moieties, 3,3 and 5,5-sigmatropic rearrangement. Claisen, cope and aza-cope rearrangements. Fluxional tautomerism. Ene reaction

Recommended books

1. Stereochemistry of Organic Compounds, Nasipuri, New Age International (P) Limited.
2. Stereochemistry of Carbon Compounds, E. L. Eliel and S. H. Wilen
3. Organic Chemistry, J. Clayden, N. Greeves, S. Warren and P. Wothers (Oxford Press.)
4. Advanced Organic Chemistry, A. F. A. Carey and R. J. Sundberg, 5th Ed. Springer (2007)
5. Advanced Organic Chemistry, J. March, 6th Ed.
6. Mechanism and structure in Organic Chemistry ï E. S. Gould (Holt, Rinehart and Winston)
7. Textbook of Pericyclic Reaction, Concept and Application, K.C. Majumdar and P. Biswas, Scientific International Pvt. Ltd.
8. Photochemistry and Pericyclic Reactions, Jagdamba Singh and Jaya Singh, New Age International (P) Limited.
9. Guidebook to Mechanism in Organic Chemistry, Orient Longman, Sykes, P. A New Delhi.

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Semester I Syllabus
Core Course
Paper Code CHCC-103: Physical Chemistry

Credits 04 **Hours 60**

Course Objective:
The objective of this course is to provide students coming in the first year of Masters program new and advance understanding into the applications of kinetics and thermodynamics of reaction rates, surface chemistry, macromolecules, electrochemistry and their application.

Course outcome:
Students will gain an understanding of:

CO-1. the application of mathematical tools to calculate thermodynamic and kinetic properties.
CO-2. the theories of kinetics and thermodynamics of reaction rate with special reference to kinetic salt effect.
CO-3. the knowledge of basics of surface chemistry, macromolecules, micelles, electro chemistry and electro diffraction giving firm foundation in the fundamentals and applications.

Unit I

Chemical Dynamics
Theory of reaction rate: collision, activated complex and unimolecular reaction i.e. Lindeman and preliminary ideas (Hinshelwood, Rice Ramsperger and RKKM theories), thermodynamics of reaction rate.
The ideas of reaction kinetics in solution with special reference to kinetic salt effects. The fast reaction kinetics, fundamental aspects of NMR, Relaxation methods, flow and flesh photolysis. Preliminary ideas of molecular reaction dynamics. Simple ideas of Oscillatory chemical reaction, Belousov-Zhabotinsky reaction.
Photochemical reactions involving pyrolysis of molecules and kinetics of enzyme reaction

Unit II

Surface chemistry
A. Adsorption
Surface tension, capillary action, pressure difference across curved surface (Laplace equation), vapor pressure of droplets (Kelvin equation), Gibbs adsorption isotherm, estimation surface area (BET equation), and surface film of liquids (electro ï kinetic phenomenon) catalytic activity at surface.
B. Micelle
Surface active agent, classification of surface active agent, micellization, hydrophobic interaction, critical micellar concentration (CMC), factors affecting the CMC of surfactant, counter ion binding to micelles, thermodynamics of micellization ï phase separation and moss action models, solubilization, micro emulsion, reverse micelles.

Unit III

C. Macromolecules
Polymer ï definition, classification of polymer, electrically conducting fire resistant, liquid crystal polymer, kinetics and mechanism of polymerization (Chain reaction and step growth), molecular mass, number and mass average molecular mass, molecular mass determination (osmometry, diffusion and light scattering methods), sedimentation and end group analysis method, chain configuration of macromolecules, calculation of average dimensions of various chain structures.

Unit IV

Electrochemistry
Electrolytic conductance of strong electrolytes, Activity, activity coefficient, Debye-Huckel theory for electrolytic solution, determination of activity and activity coefficient, ionic strength. Electrochemistry of solution, Debye-Huckel ï Onsager treatment and its extension, ion solvent interaction, Debye Huckel, Bjerrum mode.

Electrical phenomenon at interfaces and electrode processes

Thermodynamics of electrified interface equation, deviation of electro-capillary, Lippmann equation (surface excess), methods of determination, structure of electrified interfaces. Guoy Chapman, Stern, Bockris, Devanathan method.

Mechanism of electrode reaction, overpotential current, current potential relation, Tafel equation, over-voltage and decomposition potential, Butler Volmer equation

Introduction to corrosion, homogenous theory, form of corrosion, corrosion monitoring and prevention methodism.

Unit V

X-ray and electron diffraction

Bragg condition, miller indices, Laue method, Bragg method, Debye-Scherrer method of X-ray structural analysis of crystals, index reflection, identification of unit cell from systematic absences in diffraction pattern. Structure of simple lattices and X-ray intensities, structure factor and its relation to intensity and electron density, phase problem. Description of the procedure for an X-ray structure analysis, absolute configuration of molecules, Ramachandran diagram. Scattering intensity vs. scattering angle, Wierl equation, measurement technique. Low energy electron diffraction.

Recommended Books:

1. P.W. Atkins, Physical Chemistry, Oxford University Press, New York.
2. S. Glasston, Physical Chemistry, Nostrand.
3. Advance Physical Chemistry (Vol-1,2,3,4), K.L. Kapoor, MacMillan, India
4. Puri Sharma Pathania, Advance Physical Chemistry.
5. J.O.M. Bockris and A.K.N. Reddy, Modern Electrochemistry, Vol.2, Plenum Press, New York.
6. Statistical Thermodynamics, Second Edition, New Age International Limited Publisher, India by M.C. Gupta.
7. Introductory Quantum chemistry by A.K Chandra, Second Edition,Tata McGraw-Hill publishing company Limited, India.
8. Quantum chemistry Through problems and solution by R.K Prasad, New age International PvtLmtd, Publishers.
9. Molecular quantum Mechanics By P.W. Atkins Oxford University Press, Oxford New York
10. Physical Chemistry, Ira N. Levine.

Semester I Syllabus

Core Course
Paper Code CHCC-104A Inorganic Chemistry Practical
Paper Code CHCC-104B Organic Chemistry Practical
Paper Code CHCC-104C Physical Chemistry Practical

Credits 12 (4+4+4)

Course Objective:

To provide students coming in the first year of Masters program advance understanding analysis and separation of inorganic and organic mixtures. Also, to provide advance insight about the electrochemical aspects of chemistry, about preparation of solutions standardization of secondary solution, conductance, e.m.f, pH, kinetics and partition coefficient.

Course Outcome:

In order to make students understand the theories taught to them in M.Sc. Sem I in different branches of chemistry e.g. Inorganic, Organic, Physical, the following practical are introduced. Students will learn:

CO-1. Qualitative analysis of inorganic mixtures and insolubles.
CO-2. Separation techniques of cations and anions by chromatography.
CO-3. Qualitative analysis of three component organic mixture.

CO-4. The basic knowledge like preparation of solutions standardization of secondarysolution, dilution, calibration and handling of some sophisticated electronic relatedto the practical syllabus.
CO-5. The basic knowledge of conductance, e.m.f, pH, kinetics and partition coefficient.
CO-6. To focus their aim for future prospects of Ph.D programme and Pharmaceutical industry.

INORGANIC CHEMISTRY (CH-104A)

Qualitative analysis

a. Qualitative analysis of inorganic mixture of 8 radicals containing not more than two of the following less common metals: Tl, Mo, W, Zr, Th, V, U.
b. Insoluble ï oxides, sulfates and halides.

Chromatography

Separation of cations and anions by

a. Paper chromatography
b. Column chromatography- Ion exchange.

ORGANIC CHEMISTRY (CH-104B)

Qualitative analysis

Separation, purification, characterization and identification by making suitable derivatives of the three component Organic mixture (three solids or two solids and one liquid or two liquids and one solid) involving all the functional groups. Use TLC for checking the purity of the separated compounds and their derivatives and report their R_f values.

PHYSICAL CHEMISTRY (CH-104C)

Conductance measurement

1. Determination of cell constant of a given conductivity cell and also find out the equivalent conductance of a strong electrolyte at different concentrations at room temperature and the test the validity of Onsager equation.
2. Study hydrolysis of aniline hydrochloride by conductance method.
3. Determination of basicity of a given salt by conductance method.

Electrochemistry (EMF – Measurements) – Potentiometry / pH-metry

4. Determination of EMF of Daniel Cell by Potentiometric method
   $Zn/ZnSO_4$ (C_1) I I $CuSO_4$ (C_2)/Cu
   Where C_1 and C_2 (i) same concentration (ii) different concentration and hence to see the effect of dilution.
5. Determination of the solubility of a sparingly soluble salt in water by EMF method.
6. Determination of the strength of strong acid using pH ï metric method.

Chemical kinetics

7. Determination of the rate constant and order of reaction for the hydrolysis of an ester catalyzed by an acid at a given temp.

Partition coefficient

8. To study the distribution of I_2 between CCl_4 and calculate the partition coefficient.
9. Determination of the partition coefficient of benzoic acid between water and benzene and comment on the molecular state of benzoic acid in benzene.

Recommended Book:

1. Vogels Text book of Quantitative Analysis revised, J. Bessett, R.C. Denney, G.H. Jellery and J. Mendhan ELBS
2. Experimental Inorganic Chemistry by Mounir A, Malati, Horwood series in Chemical Science (Horwood publishing Chichester) 1999.
3. Inorganic Experiments, J. Derexwoolings VCH
4. Microscale Inorganic Chemistry, Z. Scafran, R.M. Pike and M.M. Singh Wiley.
5. Practical Inorganic Chemistry, G. Marrand, B.W. Rockett, Van Nostrand.
6. The systematic Indentification of Organic Compounds, R.L. Shringer and D.Y. Curlin.
7. Qualitative Analysis, R.A. Day, Jr. and A.L. Underwood, Prentice Hall.
8. Basic concept of Analysis chemistry, S.M. Chopkar, Wiley Bastern.
9. Synthesis and characterization of Inorganic compounds, W.L. Jolly, Prentice Hall.
10. Systematic Qualitative Organic Analysis, H. Middeton, AdwardArnoid.
11. Handbook of Organic Analysis Qualitative and Quantitative, H. Clark, Adward Ar.
12. Vogel's Textbook of Practical Organic Chemistry, A.R. Tatchell, John Wiley.
13. Practical Physical Chemistry, A.M. James and F.E. Prichand, Longman.

14. Findleyôs Practical Physical Chemistry revised, B.P. Levitt, Longman.
15. Experimental Physical Chemistry, R.C. Das and Bebera, Tata Mc Grawhill.
16. Senior Practical Physical Chemistry, B.D. Khosla and V.S. Barg (R. Chand and Co., Delhi)
17. Experimental Physical Chemistry by D.P. Shoemaker Mc Grawhill, 7th Edition 2003.
18. Experiments in Chemistry, D.V. Jahagirdar, Himalaya Publishing House.
19. Practical Physical Chemistry, B. Vishwanathan and P.S. Raghwan, Viva Books.
20. General Chemistry Experiments, Anil J Elias, University Press (2002)
21. Experimental Physical Chemistry, V.D. Athawale, ParulMathur, New Age International (P) Limited.
22. Systematic Experiment in chemistry, ArunSethi, New Age International (P) Limited.
23. Experiments in Physical chemistry, J.C. Ghosh, BharatiBhavan.
24. Advanced Practical Physical Chemistry, JB Yadav.
25. Practical Organic Chemistry, Mann and Saunders.

Semester I Syllabus

Value Added (Non-Credited)
Paper Code CHVNC-101A: Separation Techniques

Credits 00 **Hours 60**

Course Objective:
The objective of this course is to provide students coming in the first year of Masters program new insight into the separation and filtration technique which in turn pave the pathway for the purification and isolation of targeted compounds after rational synthesis.

Course Outcome:

CO-1. Students will learn the methods of separating a mixture or solution of chemical substances to obtain the pure constituents.
CO-2. Students will learn the tradition methods of purification such as crystallization, extraction and distillation.
CO-3. Students will know the Celite filtration, a useful technique used to remove fine solids such as metal salt from the reaction mixture.
CO-4. Students will learn the centrifugation techniques useful in the microanalysis and is based on density difference.
CO-5. They also learn the chromatographic techniques as they give accurate and complete separation and purification of the compounds.
CO-6. The students will also learn the modern techniques of chromatography such as flash chromatography, LPLC, HPLC and GC-MS etc.

Unit – I

1. Distillation
2. Crystallization
3. Membrane Processes
4. Filtration

Unit – II

1. Evaporation
2. Extraction
3. Celite Filtration
4. Gel Filtration

Unit – III

1. Demister (Vapour)
2. Adsorption & Stripping
3. Centrifugation

Unit – IV

1. TLC
2. Sephadex Chromatography
3. Flash Chromatography
4. LPLC

5. HPLC
6. Paper Chromatography

Unit – V

1. Counter current chromatography (CCC & DCCC)
2. Ion exchange chromatography
3. GC ï MS (Gas Chromatography)
4. Column chromatography (Silica gel)
5. Molecular Sieve chromatography or size exclusion chromatography

Recommended Books:

1. Lloyd R. Snyder LC Resoures, Inc walnut Greek, California
2. Colin F. Poole, Department of Chemistry, Wayne State University Detroit MI 48202, USA 2003 Elsevier.
3. J. D. Seader, and Ernest J. Henley, Separation Process Principles, Wiley, 2nd edition (2013).

Semester I Syllabus
Value Added (Non-Credited)
Paper Code CHVNC-101B:Chemistry of Analgesics and Antipyretics

Credits 4 **Hours 60**

Course Objective:

The objective of this course is to provide students coming in the first year of Masters program to learn about the recent development in the area of antipyretics and analgesics and also about the structure activity relationship which play pivotal role in drug development.

Course Outcome:

After completing the course, students shall be able to learn:

CO-1. the structural activity relationship of different class of drugs.
CO-2. the synthesis of drug molecules using the reactions of synthetic organic chemistry.
CO-3. well acquainted with the synthesis of some important class of drugs.
CO-4. the mechanism pathways of certain class of medicinal compounds and their modes of action with receptors.
CO-5. the chemistry of drugs with respect to their pharmacological activity.

Unit I

Introduction, classification, mode of action, structural activity relationship of narcotic analgesics and applications of the following:

1. Derivatives of morphin
2. Morphinan
3. phenylpiperidine
4. benzazocine
5. diphenylpropylamine and isosters.

Unit II

Introduction, classification, mode of action, structural activity relationship of narcotic antagonists and applications of the following:

1. n-allyl-nor morphine
2. Levellorphan
3. Naloxone

Unit III

Synthesis of the following narcotic analgesics and antagonists:

1. Phenylpiperidine
2. Benzazocine
3. Diphenyl propylamine
4. n-allyl-nor morphine
4. Levellorphan
5. Naloxone

Unit IV

Introduction, classification, mode of action, structural activity relationship of antipyretic analgesics and applications of the following:

1. Paracetamol
2. Asprin
3. Indomethacin
4. Diclophenac sodium
5. Ibuprofen
6. Piroxicam

Unit V

Synthesis of the following antipyretics:

1. Paracetamol
2. Asprin
3. Indomethacin
4. diclophenac sodium
5. ibuprofen
6. piroxicam

Recommended Books:

1. Thomas L. Lemke, David A. Williams, Victoria F. Roche, S. William Zito, Foye's Principles of Medicinal Chemistry, 7th Ed.,Lippincott Williams & Wilkins, 2012.
2. Graham L. Patrick, "An Introduction to Medicinal Chemistry", 5th Ed. Oxford University Press 2013.
3. D. Sriram, P. Yogeeswari, Medicinal Chemistry, Pearson Education India, 2009.
4. AshutoshKar, Medicinal Chemistry, 4th Edition, New Age Publicational Publishers.