DEPARTMENT OF CHEMISTRY

PREAMBLE

UG: Programme Profile and the Syllabi of Courses Offered in Semester III and IV Along with I and II Evaluation Components (With Effect from 2021-2024 Batch onwards).

PG: Syllabi of Programme Offered in Semester III and IV along with III and IV Evaluation Components (With effect from 2021-2023 Batch Onwards).

PROGRAMME PROFILE B.Sc., Chemistry Programme Specific Outcome (PSO)

Upon completion of the programme, the students will be able to

- Development of the Skills in handling various Chemicals, Apparatus and Instruments.
- Application of the Principles of Thermodynamics and Chemical Kinetics in Chemical Reactions.
- Acquiring the Knowledge on Heterocyclic Compounds and Natural Products.
- Ability to apply the basic Principles of various Spectroscopic, Electro and Thermo Analytical Methods to Characterize the Compounds.

					Pervious	Conta ct	Credit
Semester	Part	Category	Course code	Course Title	course code	Hrs/ Wee k	Min/Ma x
	Ι	Languages / AECC-IITamil / Hindi / French	UTAL107/ UTAL108/ UHIL101/ UFRL101	Basic Tamil-I/ Advanced Tamil-I/ Hindi-I/ French-I	UTAL103/ UTAL104	5	3/4
	П	English/AECC-I	UENL109/ UENL110	English for Communication (Stream – I)/ English for Communication (Stream – II)		5	3/4
Ι	III	Core I/ DSC-I	UCHM109	Inorganic Chemistry-I	-	5	5
		Core II/ DSC-II	UCHM110	Analytical Chemistry	-	4	4
		Core Practical I/ DSC Practical-I	UCHR101	Volumetric Practical	-	3	2
		Allied I/GE	UPHA102	Allied Physics - I	-	3	2
		Allied Practical I/ GE Practical-I	UPHR103	Allied Physics Practical-I	-	3	2
		Core III/ DSC-III	UPEM101	Professional English I		6	4
	IV	Value Education				2	1
				Total		36	26/28
П	I	Languages/ AECC-II Tamil/ Hindi/French	UTAL207/ UTAL208/ UHIL201/ UFRL201	Basic Tamil-II/ Advanced Tamil-II/ Hindi-II/ French-II	UTAL203/ UTAL204	5	3/4

	Π	English/AECC-I	UENL209/ UENL210	English for Communication (Stream – I)/ English for Communication (Stream – II)		5	3/4
		Core IV/ DSC-IV	UCHM203	Organic Chemistry-I		5	5
	III	Core V/ DSC-V	UCHM204	Nuclear & Radiation Chemistry	-	3	3
		Core Practical II/DSC Practical II	UCHR206	Organic Practical	-	3	2
		Allied II/GE	UPHA201	Allied Physics II	-	3	2
		Allied Practical II /GE Practical II	UPHR202	Allied Physics Practical-II	-	3	2
11		Core VI/ DSC-VI	UPEM201	Professional English II		6	4
		Internship	UPSI201	Internship/Field work/Field Project (30 Hours)	-		/1 (Extra Credit)
	IV	NME			-	3	2
	V	Extension Programme/ Physical Education/NCC			-	-	-/2
		·		Total		36	27/31
	Ι	Languages/ AECC-II Tamil/Hindi/French	UTAL307/ UTAL308/ UHIL301/ UFRL301	Basic Tamil-III/ Advanced Tamil-III/ Hindi-III/ French-III	UTAL303/ UTAL304	5	3/4
				English for			
	П	English/AECC-I	UENL309/ UENL310	Communication (Stream – I) / English for Communication (Stream – II)	UENL306	5	3/4
ш	Ш	English/AECC-I Core VII/ DSC-VII	UENL309/ UENL310 UCHM307	Communication (Stream – I) / English for Communication (Stream – II) Physical Chemistry - I	UENL306	5	3/4
III	П	English/AECC-I Core VII/ DSC-VII Core VIII/ DSC- VIII	UENL309/ UENL310 UCHM307 UCHM308	Communication (Stream – I) / English for Communication (Stream – II) Physical Chemistry - I Electrochemistry	UENL306 - -	5	3/4
III	Ш	English/AECC-I Core VII/ DSC-VII Core VIII/ DSC- VIII Core Practical III /DSC Practical III	UENL309/ UENL310 UCHM307 UCHM308 UCHR404/ UCHR405	Communication (Stream – I) / English for Communication (Stream – II) Physical Chemistry - I Electrochemistry Semi Micro Qualitative Inorganic Analysis	UENL306 - -	5	3/4 4 2 -
III	Ш	English/AECC-I Core VII/ DSC-VII Core VIII/ DSC- VIII Core Practical III /DSC Practical III Allied/GE	UENL309/ UENL310 UCHM307 UCHM308 UCHR404/ UCHR405 UMAA304	Communication (Stream – I) / English for Communication (Stream – II) Physical Chemistry - I Electrochemistry Semi Micro Qualitative Inorganic Analysis Algebra, Differential Calculus and Trigonometry	UENL306 - -	5 4 3 3 5	3/4 4 - 4
III	II III IV	English/AECC-I Core VII/ DSC-VII Core VIII/ DSC- VIII Core Practical III /DSC Practical III Allied/GE Online Course	UENL309/ UENL310 UCHM307 UCHM308 UCHR404/ UCHR405 UMAA304	Communication (Stream – I) / English for Communication (Stream – II) Physical Chemistry - I Electrochemistry Semi Micro Qualitative Inorganic Analysis Algebra, Differential Calculus and Trigonometry Online Course (NPTEL/ST)	UENL306 - -	5 4 3 5 3	3/4 4 2 - 4 1/2
III	II III IV	English/AECC-I Core VII/ DSC-VII Core VIII/ DSC- VIII Core Practical III /DSC Practical III Allied/GE Online Course Value Education	UENL309/ UENL310 UCHM307 UCHM308 UCHR404/ UCHR405 UMAA304	Communication (Stream – I) / English for Communication (Stream – II) Physical Chemistry - I Electrochemistry Semi Micro Qualitative Inorganic Analysis Algebra, Differential Calculus and Trigonometry Online Course (NPTEL/ST)	UENL306 - - -	5 4 3 5 3 2	3/4 4 2 - 4 1/2 1

	1	1		Total		30	27
	IV	XIV Value education	UCHP501			2	1
		/DSC Practical IV /DSC Practical IV Core XIV/ DSC-	UCHR501	Gravimetric Analysis Project	-	3	25
		DSE-I	UCH0502 UCH0503	Chemistry Organic Spectroscopy			
		Major Elective /	UCHO501	Organometallics and Bioinorganic chemistry	-	5	4
		Core XIII/ DSC- XIII	UCHM512	Physical Chemistry –II	-	5	5
V	III	Core XII/ DSC-XII	UCHM511	Organic Chemistry – II	-	5	5
		Core XI/ DSC-XI	UCHM510	Inorganic Chemistry – II	-	5	5
				Total		30	23/28
	v	Extension Programme/ Physical Education/NCC				-	-/2
	IV	Soft skill	USKS401			2	1
	11.7	NME				3	2
		Internship	UPSI201	Internship/Field work/Field Project (30 Hours)	-		/1 (Extra Credit)
		Allied/GE	UMAA406	Integral Calculus, Laplace Transform & Ordinary Differential Equation	-	5	4
IV	III	Core Practical III /DSC Practical III	UCHR404/ UCHR405	Semi micro Qualitative Inorganic Analysis	-	3	4
		Core X/ DSC-X	UCHM408	Research Methodology	-	3	2
		Core IX/ DSC-IX	UCHM407	Molecular Spectroscopy & Photochemistry	-	4	4
	Π	English/AECC-I	UENL409/ UENL410	English for Communication (Stream – I)/ English for Communication (Stream – II)	-/ UENL406	5	3/4
	Ι	Languages/ AECC-II Tamil/Hindi/French	UTAL407/ UTAL408/ UHIL401/ UFRL401	Basic Tamil-IV/ Advanced Tamil-IV/ Hindi-IV/ French-IV	UTAL403/ UTAL404	5	3/4

		Core XV/ DSC-XV	UCHM614	Inorganic Chemistry III	-	5	5
		Core XVI/ DSC- XVI	UCHM615	Organic Chemistry III	-	5	5
		Core XVII/ DSC- XVII	UCHM616	Physical Chemistry III	-	5	5
		Core XVIII/ DSCXVIII	UCHM617	Advanced Material Chemistry		2	2
	III	Major Elective/ DSE-II	UCHO602 UCHO603 UCHO604	Polymer Chemistry Medicinal Chemistry Forensic Chemistry	-	5	4
		Core Practical V /DSC Practical V	UCHR605	Physical Chemistry Practical	-	3	2
VI		Core Practical VI /DSC Practical VI	UCHR606	Organic Analysis and Preparation	-	3	2
		Viva –Voce	UCHM605	Comprehensive Viva- Voce	-	-	1
		Internship	UPSI201	Internship/Field work/Field Project (30 Hours)	-		/1 (Extra Credit)
	IV	Soft Skill	USKS601		-	2	1
	v	Extension Programme/ Physical Education			-	-	-/2
		Extension Programme	UROX601	Rural Outreach Programme			- / 1 (Extra Credit)
				Total		30	27/31
Grand Total						192	148/166

LIST OF COURSES OFFERED TO OTHER DEPARTMENTS ALLIED AND ALLIED OPTIONAL COURSES

			Course		Pervious	Contact	Credits
Semester	Part	Category	Category code Course title course code code code code		course code	hrs per week	Min/Max
Ι	III	Allied- I/GE	UCHA103	Chemistry for Biochemist		3	2
IV	III	Allied- I/GE	UCHA402	Chemistry for physics		3	2
Ι	III	Allied Practical- I/ GE Practical-I	UCHR104	Organic Analysis	-	3	2
IV	III	Allied Practical- II/ GE Practical- II	UCHR404	Volumetric Analysis		3	2
V	III	Allied Optional	UCHA502 UCHA504 UCHA505 UCHA506	Industrial Chemistry Dairy Chemistry Agricultural Chemistry Environmental Chemistry	-	5	4

NON- MAJOR ELECTIVE COURSES

	_	~	Course	~	Pervious	Contact	Credits
Semester	Part	Category	code	Course title	course code	hrs per week	Min/Max
П	IV	Non major Elective	UCHE204 UCHE205 UCHE206	Food Chemistry Health and Hygiene Cosmetics and Detergents	-	3 3 3	2 2 2
IV	IV	Non major Elective	UCHE401 UCHE402 UCHE403	Agricultural Chemistry Environmental Chemistry Industrial Chemistry		3 3 3	2 2 2

EXTRA CREDIT EARNING PROVISION

		Course		Pervious	Hrs	Credits
Semester	Category	Code	Course Title	Course Code	per Week	Min/Max
II	Core	UCHI201	Internship	-	-	1
IV	Core	UCHI401	Internship	-	-	1
		UCHS601/	Green Chemistry	-		
VI	Core	UCHP601	(Self Study Paper)/		-	1/2
			Project			

EXPERIENTIAL LEARNING (MANDATORY/ONLY FOR INTERESTED STUDENTS)

Dalada J	Wo Nature of the	rk experience Proposed Duration	Proposed period	Callaharatira	Mada af
Paper	Course/Institution	(No.of.Days/Weeks/Months)	(Sem.	Agency	Evaluation
_			Break/May/ Any Other)		
UCHM509	Organic Farming	2 days	August	MSME	To get Certificate

SKILL ORIENTATION PROGRAMME (MANDATORY/ONLY FOR INTERESTED STUDENTS)

Semester	Category	Course code	Course title	Collaborating Agency	Hours/Da ys/Month	Mode of Evaluation
V	Core	UCHT501	Industrial Lab safety	TCIL	4 days	To get Certificate

PHYSICAL CHEMISTRY-I UCHM307

Semester: III Category: Core VII/DSC-VII Class & Major: II B.Sc., Chemistry

COURSE OBJECTIVES:

CO	To enable the students
No.	
CO-1	To study the behavior of molecules in gaseous states
CO-2	To understand the concepts of thermodynamics
CO-3	To understand the physical and chemical properties of systems.
CO-4	To understand the Carnot's Theorem
CO-5	To Understand the Maxwell Relationship

Unit-I GASEOUS STATE

Types of Molecular Velocities and their Inter Relations-Mean, Rms, Most Probable Velocities - Calculation of Most Probable Velocity, Average Velocity and Root Mean Square Velocity Maxwell's Distribution of Molecular Velocities, Statement of Equation and Explanation (No Derivation)-Graphic Representation-Effect of Temperature on Velocity Distribution. Collision Diameter-Collision Number-Collision Frequency-Mean free Path Degrees of Freedom of Gaseous Molecules-Principle of Equipartition of Energy-Heat Capacity and Molecular Basis. Viscosity of Gases and Effect of Temperature and Pressure on Coefficient of Viscosity

Unit-II THERMODYNAMICS-I

Introduction: Scope and Importance of Thermodynamics-Energy and its Units-Mechanical Work and Heat and their Relation-thermodynamic Systems and their Characteristics -State of a System-State Function and Path Function and their Characteristics Thermodynamic Functions-Exact and Inexact Differentials. First Law-Statement Mathematical Formulation -Change In Constant Pressure-Cp-Cv Relationship-Work Done in Isothermal, Reversible Expansion and Compression of an ideal Gas-Calculation of E, H and W for Adiabatic Reversible Expansion. Reversible Isothermal Expansion of a Rea Gas Calculation of E, Q, W And H for a Vander Waal's Gas-Joule thomson Effect ($\Delta E/\Delta V$)T Value for Ideal Gas-Temperature, Calculation and Significance.

Unit-III THERMODYNAMICS-II

Variation of Enthalpies with temperature-Kirchoff's equation-Hess's law of constant heat summation-statement and applications. Bond enthalpies-definition-calculation from the Thermo chemical data and applications. Zeroth law of thermodynamics and its significance. Second law of thermodynamics-object of the II law-different ways of stating II law and its significance. Conversion of heat into work-Carnot's theorem and cycle-Thermodynamic efficiency-thermodynamic scale of temperature.

Unit-IV THERMODYNAMICS-III

Entropy-definition and significance the concept of entropy-entropy changes in isolated systems -entropy as a thermodynamic function dependence of entropy on variables of the system. Entropy changes in ideal gas, in mixing of gases, physical transformations and in chemical reactions. Entropy and probability Free energy functions: Helmholtz free energy (A)-definition and temperature dependence-Gibb's free energy with temperature and pressure-Gibb's-Helmholtz equation and its applications -Maxwell's relations.

11 Hour

11 Hour

Credit : 4 Hours / Week: 4 Total hours : 52

ne. 10 Hour

Unit-V PARTIAL MOLAR QUANTITIES

10 Hour

Chemical potential-relationship between partial molar quantities-Gibb's Duhem equation- chemical potential in case of a system of ideal gases-application of the concept of chemical potential-Clausius-Claypeyron equation-derivation and its applications. Nernst heat theorem and its application-Third law of thermodynamics-a simple treatment of the law. Temperature dependence of heat capacity and its use in the determination of absolute entropy. Exceptions to III law-residual entropy of CO, N₂O, H₂O, NO and H₂.

Text Books

- Puri, B.R. Sharma, L.R. and Pathania, M.S. (2019). "*Principles of Physical Chemistry*", Vishal Publishing Co. 48th ed.,
- Soni P.L. Dharmarha O.P. Dash U.N. (2011). "*Text Book of Physical Chemistry*". Sultan Chand and Sons.

Reference Books

- Atkins, P. de Paula, J and Keeler. J (2006) "Atkins' Physical Chemistry", 8th ed.,
- Barrow G.M. (2006) Physical Chemistry, Tata McGraw Hill. 5th ed.,

E-Resources

- https://www.nios.ac.in/media/documents/313courseE/L6.pdf
- https://www.cpp.edu/~pbsiegel/supnotes/nts1323.pdf
- https://uou.ac.in/sites/default/files/slm/BSCPH-201.pdf

COURSE OUTCOMES:

CO No.	On completion of the course the student will be able to	Bloom's Level
CO-1	Define an expression for rate constant K for third order reaction	K1
CO-2	Solve the numerical problems based on Rate constant	K3
CO-3	Understand the term specific volume, molar volume and molar refraction	K2
CO-4	Know the meaning of phase, component and degree of freedom	K2
CO-5	Describe the expression Maxwell's relations	K1&K2

ELECTROCHEMISTRY UCHM308

Semester	: III	Credit : 2
Category	: Core VIII/ DSC-VIII	Hours/ week : 3
Class & Major	: II B.Sc. Chemistry	Total Hours : 39

COURSE OBJECTIVES:

CO No.	To enable the students
CO-1	To study the electrolytic conductance and transport number
CO-2	To understand the concepts of Debye-Huckel theory of strong electrolytes
CO-3	To understand the Electromotive force of Galvanic cells
CO-4	To understand the concept of electrolyte concentration cells
CO-5	To Understand the concept of transport numbers

UNIT-I ELECTROLYTIC CONDUCTANCE AND TRANSFERENCE-I 8 Hour Electrolytic conductance-specific conductance-equivalent conductance-molar conductance-variation of molar conductance with dilution-ionic mobility-Hittorf's

conductance-variation of molar conductance with dilution-ionic mobility-Hittorf's theoretical device, transport number-determination of transport number- Hittorf's method and moving boundary method.

UNIT-II ELECTROLYTIC CONDUCTANCE AND TRANSFERENCE-II 9 Hour

Kohlrausch's law-calculation of molar conductance-relation between molar ionic conductance and ionic mobility-determination of ionic mobility-applications of Kohlrausch's law-diffusion and ionic mobility-applications of conductance measurements-conductometric titrations-precipitation titrations-Ostwald's dilution law-Debye-Huckel theory of strong electrolytes-activity coefficients of electrolytes-ionic strength-Debye-Huckel theory of mean activity coefficients of strong electrolytes- Debye-Huckel limiting law.

UNIT-III ELECTROMOTIVE FORCE OF GALVANIC CELLS-I 8 Hour

Galvanic cells-reversible electrodes-single electrode potential-thermodynamics of reversible electrodes and cells-Nernst equation-standard electrode potential-the electrochemical series-electromotive force of galvanic cells-activity and mean ionic activity of electrolytes-concentration cells-electrode concentration cells-electrolyte concentration cells

UNIT-IV ELECTROMOTIVE FORCE OF GALVANIC CELLS-II 7 Hour

Types of Electrolyte Concentration cells-concentration cells without transference concentration cells with transference-liquid junction potential-fuel cells-applications of emf measurements-determination of activity coefficients of electrolytes

UNIT-V ELECTROMOTIVE FORCE OF GALVANIC CELLS-III 7 Hour

Determination of transport numbers-determination of valency of ions in doubtful cases- determination of solubility product constants- determination of pH-potentiometric titrations-acid-base titrations-redox titrations-precipitation titrations-oxidation-reduction indicators.

Text books

- Puri, B.R., Sharma L.R. and M. S. Pathania. (2019). "*Principles of Physical Chemistry*", Jalandhar: Vishal Publishing Co. 48th ed.,
- Arun Bahl, B.S. Bahl and G.D. Tuli, (2014). "*Essentials of Physical Chemistry*", S. Chand and company private limited. revised ed.,

Reference book

- Peter Atkins and Julio de Paula, (2016). "*Atkin's Physical Chemistry*", New Delhi: Oxford University Press, 10th ed.,
- Glasstone, S. (1974) "An Introduction to Electrochemistry" Affiliated East West Press Private, Limited, 4th reprint.

E-Resourses

- http://www.freebookcentre.net/chemistry-books-download/Text-bookofelectrochemistry-(PDF-364P).html
- https://ceramrtr.ceramika.agh.edu.pl/~szyszkin/eis/Modern%20Electrochemistry% 20 Vol%202B%20Electrodics%20in%20Chemistry,%20Engineering.pdf

COURSE OUTCOMES:

CO No.	On completion of the course the student will be able to	Bloom's Level
CO-1	Apply Nernst equation and the Tafel equation to different	K3
	electrochemical systems	
CO-2	Define the term overpotential, explain its origin and the	K1
	relationship between current and potential for some types of	
	electrochemical cells	
CO-3	Examine the conductivity of an electrolyte depends on the	K4
	electrolyte concentration	
CO-4	Evaluate some common electrochemical methods to	K5
	electrochemical systems and explain which type of	
	information that can be obtained with these techniques	
CO-5	Estimate an unknown solution concentration using	K6
	potentiometric titrations	

SEMI MICRO QUALITATIVE INORGANIC ANALYSIS UCHR404/UCHR405

Semester	: III & IV	•	Credit	:4
Category	: Core Practical III/DSC Practical	III	Hours/ week	x: 3+3
Class & Major	: II B.Sc., Chemistry		Total Hours	s:78

COURSE OBJECTIVES:

CO No.	To enable the students
CO-1	Define practical skills in semi micro qualitative inorganic analysis
CO-2	Identify the basic and acid radicals
CO-3	Develop analytical skills in qualitative inorganic analysis
CO-4	Demonstrate principle and working of various instruments
CO-5	To analysis on various methods of group identification

Unit– I Lab Safety rules, Principles and Analysis of simple acid radicals in Semimicro Qualitative Analysis 15 Hour

General Chemistry Laboratory safety rules-General Principles of Qualitative Analysis Analysis of simple acid radicals: a) Carbonate b) Sulphide c) Sulphate d) Chloride e) Bromide f) Iodide g) Nitrate Analysis of interfering acid radicals: a) Fluoride b) Oxalate c) Borate d) Phosphate e) Chromate f) Arsenite

Unit – II Semi-micro Qualitative Analysis – I

Elimination of interfering acid radicals:

a) Fluoride b) Oxalate c) Borate d) Phosphate e) Chromate f) Arsenite. Identifying the groups of basic radicals-Group I : Ag^+ , Hg^{2+} , Pb^{2+}

Unit – III Semi–micro Qualitative Analysis – II

Identifying the groups of basic radicals-Group II :

IIA- Cu^{2+} , Cd^{2+} , Hg^{2+} , Pb^{2+} , Bi^{3+} . IIB- Sn^{2+} , Sn^{4+} , Sb^{3+} , Sb^{5+} , As^{3+} , As^{5+} Group III : Fe^{3+} , Al^{3+} , Cr^{3+} . Group IV: Co^{2+} , Ni^{2+} , Mn^{2+} , Zn^{2+} Group V: Ca^{2+} , Ba^{2+} , Sr^{2+} . Group VI: Mg^{2+} , NH₄₊.

15 Hour

Unit –IV Semi–micro Qualitative Analysis – III

Analysis of basic radicals (group-wise): Lead, Copper, Bismuth, Cadmium, Antimony, Iron, Aluminium, Chromium, Zinc, Manganese, Nickel, Calcium, Strontium, Barium, Magnesium, Ammonium.

Unit –V Semi–micro Qualitative Analysis – IV

Analysis of a mixtures containing two cations and two anions (of which one is interfering type) (max. 15 Mixtures).

Text Books

- V.V. Ramanujam, (1974) "*Inorganic Semi Micro Qualitative Analysis*", The National Publishing Company, Chennai, 3rd ed.,
- V. Venkateswaran, R. Veeraswamy, A. R. Kulandaivelu (2004) "Basic Principles of Practical Chemistry", Sultan Chand & Sons, New Delhi, 2nd ed.,

Reference books

- Svehla. G, Sivasankar. B, (2012) "Vogel's Qualitative Inorganic Analysis", Pearson Education, 7th ed.,
- A.O. Thomas, (2003) "*Practical Chemistry*", Scientific Book Centre, Cannanore.

E-Resources

- https://id.scribd.com/document/311336414/SEMI-MICRO-QUALITATIVEANALYSIS-OF-SIMPLE-INORGANIC-SALT-docx
- <u>http://www.rbmcollege.ac.in/sites/default/files/files/reading%20material/inorga</u> <u>nicqualitative-analysis.pdf</u>

COURSE OUTCOMES:

СО	On completion of the course the student will be able to	Bloom's Level
No.		
CO-1	Describe the organic and inorganic salts	K1&K2
CO-2	Understand the basic concepts behind in the chemical compounds	K1&K2
CO-3	Apply and analyze the sample using various techniques	K3
CO-4	Select the exact method for particular compounds	K5
CO-5	Design new methods to analyze the chemical compounds	K6

MOLECULAR SPECTROSCOPY & PHOTOCHEMISTRY UCHM407

Semester	: IV	Credit	:4
Category	: Core IX/DSC-IX	Hours/ week	:4
Class & Major	: II B.Sc Chemistry	Total Hours	: 52

COURSE OBJECTIVES:

CO No.	To enable the students
CO-1	To recall the fundamental concept of Rotational, Vibrational and Raman
	spectroscopy
CO-2	To understand the fundamental concept of NMR and ESR spectroscopy
CO-3	To know the photochemical processes
CO-4	To comprehend the Franck-Condon principle
CO-5	To cognize the PMR spectra of organic molecules

16 Hour

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UNIT-I ROTATIONAL AND VIBRATIONAL SPECTROSCOPY 11 Hour

Rotation spectroscopy: Selection rules, intensities of spectral lines, determination of bond lengths of diatomic and linear triatomic molecules, isotopic substitution.

Vibrational spectroscopy: Classical equation of vibration, computation of force constant, amplitude of diatomic molecular vibrations, anharmonicity, Morse potential, dissociation energies, fundamental frequencies, overtones, hot bands, degrees of freedom for polyatomic molecules, modes of vibration, concept of group frequencies. Vibration-rotation spectroscopy: diatomic vibrating rotator, P, Q, R branches.

UNIT-II RAMAN SPECTROSCOPY

Raman spectroscopy: Qualitative treatment of Rotational Raman effect; Effect of nuclear spin, Vibrational Raman spectra, Stokes and anti-Stokes lines; their intensity difference, rule of mutual exclusion.

UNIT-III ELECTRONIC SPECTROSCOPY

Electronic spectroscopy: Franck-Condon principle, electronic transitions, singlet and triplet states, fluorescence and phosphorescence, dissociation and predissociation, calculation of electronic transitions of polyenes using free electron model.

UNIT-IV NMR AND ESR SPECTROSCOPY

Nuclear Magnetic Resonance (NMR) spectroscopy: Principles of NMR spectroscopy, Larmor precession, chemical shift and low resolution spectra, different scales, spin-spin coupling and high resolution spectra, interpretation of PMR spectra of organic molecules.

Electron Spin Resonance (ESR) spectroscopy: Its principle, hyperfine structure, ESR of simple radicals.

UNIT-V PHOTO CHEMISTRY

Difference between thermal and photochemical processes. Laws of photochemistry Grothus-Draper's law and Stark-Einstein's law of photochemical equivalence. Quantum yield photochemical reaction mechanism- hydrogen- chlorine, hydrogen- bromine reaction. Qualitative description of fluorescence, phosphorescence, and Photosensitized reactions- energy transfer processes (simple example).

Text books

- Banwell, C. N. & McCash, E. M. (2006) "Fundamentals of Molecular Spectroscopy", Tata McGraw-Hill, New Delhi, 4th ed.,
- Puri B.R, Sharma L.R & Pathania M.S, (2016) "*Principles of Physical Chemistry*", Vishal publishing & Co, 47th Ed.,

Reference books

- Gordon M. Barrow, (1962) "Introduction to Molecular Spectroscopy", McGraw-Hill
- Inc.
- Nicholas J. Turro, (1991) "Modern Molecular Photochemistry", University Science Books.
- K. K. Rohatgi-Mukherjee, (1978) "Fundamentals of Photochemistry", New Age
- International.

11 Hour

10 Hour

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10 Hour

E-Resources

- http://cires1.colorado.edu/jimenez/AtmChem/CHEM-5151_S05_L5.pdf
- https://chem.libretexts.org/Bookshelves/General_Chemistry/Map%3A_Principles_ of_

Modern_Chemistry_(Oxtoby_et_al.)/Unit_5%3A_Rates_of_Chemical_and_Physic al_Process es/20%3A_Molecular_Spectroscopy_and_Photochemistry

COURSE OUTCOMES:

CO	On completion of the course the student will be able to	Bloom's Level
No.		
CO-1	Recognize characteristics of organic molecules	K1&K2
CO-2	Understand the structures of newly synthesized compounds	K1&K2
CO-3	Apply their knowledge to characterize the chemical compounds	K3
CO-4	Analyze the coupling reaction between hydrogen	K4
CO-5	Evaluate and apply knowledge of modern techniques for organic samples.	K5

RESEARCH METHODOLOGY UCHM408

Semester	: IV	Credit	:2
Category	: Core X/DSC-X	Hours/ week	:3
Class & Major	: II B.Sc Chemistry	Total Hours	: 39

COURSE OBJECTIVES:

CO No.	To enable the students
CO-1	To impart knowledge about the basic concepts of research
CO-2	To provide a road map for conducting research
CO-3	Students are expected to identify, explain and apply basic concepts of research
CO-4	Acquire information, recognize various issues related to research and to learn
	instrumental methods required for research in chemistry
CO-5	Have some idea about writing literature survey report, review and scientific
	article

UNIT - I LITERATURE SURVEY

Nature and importance of research - aims, objective, principles and problems - selection of research problem - survey of scientific literature - primary and secondary sources -citation index for scientific papers and journals - patents.

UNIT - II RESOURCES AND WRITING SCIENTIFIC PAPERS

Information Technology and Library Resources: The Internet and World Wide Web. Internet resources for chemistry. Finding and citing published information. Methods of Scientific Research and Writing Scientific Papers: Reporting practical and project work. Writing literature surveys and reviews. Organizing a poster display.

UNIT - III EXPERIMENTATION

Experimentation - Design of an experiment, data collection – types of data - interpretation and deduction –repeatability and replication- Accuracy and precision, Revision or modification of scientific theories and laws

7 Hour

8 Hour

UNIT-IV EDUCATIONAL SOFTWARES

INFLIBNET, NICNET, BRNET, NPTEL, VIRTUAL LABS OF MHRD academic services Chemistry related softwares- Chem sketch and Chem Draw for structure drawing, Chemical Databases-Pubchem, ZINC, Cambridge Structural Database (CSD), Molecular visualization tools –Avogadro, Molden, Molekel, File format-PDB and CIF, Graphical tools- Excel and Origin (elementary idea only with computer assistance).

UNIT – V PROPOSAL WRITING AND PLAGIARISM

7 Hour

Patent and project proposal – writing – knowledge of various funding agencies. Plagiarism – definition, classification and their limitations

Text Books

- Kothari, C. K.; Garg, G. Research Methodology-Methods and Techniques, 3rd Ed., New Age International, New Delhi (2014).
- Kumar, R. Research Methodology–A Step-By-Step Guide for Beginners; 2nd Ed., Pearson Education: New Delhi (2005).

Reference Books

- Montgomery, D. C. Design & Analysis of Experiments; 8th Ed., Wiley India: Noida (2013). 4.
- Dean, J. R.; Jones, A. M.; Holmes, D.; Reed, R.; Weyers, J.; Jones, A. Practical Skills in Chemistry, 2nd Ed. Prentice-Hall, Harlow (2011).
- Hibbert, D. B.; Gooding, J. J., Data Analysis for Chemistry. Oxford University Press (2006).

COURSE OUTCOMES:

CO No.	On completion of the course the student will be able to	Bloom's Level
CO-1	Demonstrate the ability to choose methods appropriate to research aims and objectives	K1
CO-2	Understand the limitations of particular research methods	K2
CO-3	Develop skills in qualitative and quantitative data analysis and presentation	К3
CO-4	Develop advanced critical thinking skills	K6
CO-5	Demonstrate enhanced writing skills	K2

SEMI MICRO QUALITATIVE INORGANIC ANALYSIS UCHR404/UCHR405

Semester	: III & IV	•	Credit	:4
Category	: Core Practical III/DSC Practical	III	Hours/ weel	k: 3+3
Class & Major	: II B.Sc., Chemistry		Total Hours	s : 78

COURSE OBJECTIVES:

CO No.	To enable the students
CO-1	Define practical skills in semi micro qualitative inorganic analysis
CO-2	Identify the basic and acid radicals
CO-3	Develop analytical skills in qualitative inorganic analysis
CO-4	Demonstrate principle and working of various instruments
CO-5	To analysis on various methods of group identification

Unit– I Lab Safety rules, Principles and Analysis of simple acid radicals in Semimicro Qualitative Analysis 15 Hour

General Chemistry Laboratory safety rules-General Principles of Qualitative Analysis Analysis of simple acid radicals: a) Carbonate b) Sulphide c) Sulphate d) Chloride e) Bromide f) Iodide g) Nitrate Analysis of interfering acid radicals: a) Fluoride b) Oxalate c) Borate d) Phosphate e) Chromate f) Arsenite

Unit – II Semi–micro Qualitative Analysis – I

Elimination of interfering acid radicals:

a) Fluoride b) Oxalate c) Borate d) Phosphate e) Chromate f) Arsenite. Identifying the groups of basic radicals-Group I : Ag^+ , Hg^{2+} , Pb^{2+}

Unit – III Semi–micro Qualitative Analysis – II

Identifying the groups of basic radicals-Group II:

$$\begin{split} &IIA-Cu^{2+},\ Cd^{2+},\ Hg^{2+},\ Pb^{2+},\ Bi^{3+}\ .\ IIB-Sn^{2+},\ Sn^{4+},\ Sb^{3+},\ Sb^{5+},\ As^{3+},\ As^{5+}\ Group\ III:\ Fe^{3+},\\ &Al^{3+},\ Cr^{3+}.\ Group\ IV:\ Co^{2+},\ Ni^{2+},\ Mn^{2+},\ Zn^{2+}\ Group\ V:\ Ca^{2+},\ Ba^{2+},\ Sr^{2+}\ .\ Group\ VI:\ Mg^{2+},\\ &NH_{4+}. \end{split}$$

Unit –IV Semi–micro Qualitative Analysis – III

Analysis of basic radicals (group-wise): Lead, Copper, Bismuth, Cadmium, Antimony, Iron, Aluminium, Chromium, Zinc, Manganese, Nickel, Calcium, Strontium, Barium, Magnesium, Ammonium.

Unit –V Semi–micro Qualitative Analysis – IV

Analysis of a mixtures containing two cations and two anions (of which one is interfering type) (max. 15 Mixtures).

Text Books

- V.V. Ramanujam, (1974) "*Inorganic Semi Micro Qualitative Analysis*", The National Publishing Company, Chennai, 3rd ed.,
- V. Venkateswaran, R. Veeraswamy, A. R. Kulandaivelu (2004) "*Basic Principles of Practical Chemistry*", Sultan Chand & Sons, New Delhi, 2nd ed.,

Reference books

- Svehla. G, Sivasankar. B, (2012) "Vogel's Qualitative Inorganic Analysis", Pearson Education, 7th ed.,
- A.O. Thomas, (2003) "Practical Chemistry", Scientific Book Centre, Cannanore.

E-Resources

- https://id.scribd.com/document/311336414/SEMI-MICRO-QUALITATIVEANALYSIS-OF-SIMPLE-INORGANIC-SALT-docx
- http://www.rbmcollege.ac.in/sites/default/files/files/reading%20material/inorga nicqualitative-analysis.pdf

COURSE OUTCOMES:

CO	On completion of the course the student will be able to	Bloom's Level
No.		
CO-1	Describe the organic and inorganic salts	K1&K2
CO-2	Understand the basic concepts behind in the chemical compounds	K1&K2
CO-3	Apply and analyze the sample using various techniques	K3
CO-4	Select the exact method for particular compounds	K5
CO-5	Design new methods to analyze the chemical compounds	K6

16 Hour

16 Hour

15 Hour

Semester	Course Code	Course Title	Component-III	Component-IV
III	UCHM307	Physical Chemistry - I	Assignment	Seminar
	UCHM308	Electrochemistry	Assignment	Seminar
IV	UCHM407 UCHM408	Molecular Spectroscopy & Photochemistry Research Methodology	Assignment Assignment	Seminar Seminar
	UCHR404/ UCHR405	Semi micro Qualitative Inorganic Analysis	Practice of analyzing cations and anions	Practice of analyzing mixtures containing two cations and two anions

UG Evaluation Component – III and IV

PROGRAMME PROFILE M.Sc., Chemistry

Programme Specific Outcome (PSO)

Upon completion of the programme, the students will be able to

- Development of the Skills in Handling Various Chemicals, Apparatus and Instruments.
- Application of the Principles of Thermodynamics and Chemical Kinetics in Chemical Reactions
- Acquiring the Knowledge on Heterocyclic Compounds and Natural Products
- Ability to Apply the Basic Principles of Various Spectroscopic, Electro and Thermo Analytical Methods to Characterize the Compounds

Semester	Category	Course	Course Title		Contact	Cr	edits
Semester	Code		course mile		Hrs/Week	Min	Max
	Core-I/DSC-I	PCHM113	Organic Chemistry-I		5	4	4
	Core-II/DSC-II	PCHM114	Inorganic Chemistry-I		5	4	4
	Core-III/ DSC-III	PCHM115	Physical Chemistry-I		5	4	4
Ι	Core-IV/DSC-IV	PCHM116	Analytical Chemistry		5	4	4
	Core Practical-I/ DSC Practical-I	PCHR203	Organic Practical		5	-	-
	Core Practical-1I/ DSC Practical-II	PCHR204	Inorganic Practical		5	-	-
			Т	otal	30	16	16
	Core-V/DSC-V	PCHM207	Organic Chemistry-II		5	4	4
	Core-VI/DSC-VI	PCHM208	Inorganic Chemistry-II		5	4	4
	Core-VII/DSC-VII	PCHM209	Physical Chemistry-II		5	4	4
П	Core Practical-I/ DSC Practical-I	PCHR203	Organic Practical		5	5	5
	Core Practical-II/ DSC Practical-II	PCHR204	Inorganic Practical		5	5	5
	NME				5	4	4
	Service Learning	PCHX201	Vermicomposting		-	1	1

	Internship	UPSI201	Internship/Field work/Field Project	-	-	-/1 (Extra Credit)
			Total	30	27	28
	Core-VIII/DSC- VIII	PCHM309	Organic Chemistry-III	5	4	4
	Core-IX/DSC-IX	PCHM310	Inorganic Chemistry-III	4	4	4
	Core –X/DSC-X	PCHM311	Physical Chemistry-III	4	4	4
	AECC		Research Methodology	5	4	4
III	Core-XI/GE	PCHI301	Sustainable Materials and Technologies	5	4	4
	Core Practical –III/ DSC Practical-III	PCHR401	Physical Chemistry Practical	5	-	-
	Core XVII/ DSCXVII	PCHP401	Project	2	-	-
			Total	30	20	20
IV	Core-XIII/DSC- XIII	PCHM412	Organic Chemistry-IV	6	4	4
	Core-XIV/DSC-	PCHM413	Inorganic Chemistry-IV	5	4	4
	XIV					
	Core-XV/DSC-XV	PCHM414	Physical Chemistry-IV	5	4	4
	Core-XVI/DSC-VI	PCHM411	Natural Products	5	4	4
	Core Practical –III/ DSC Practical	PCHR401	Physical Chemistry Practical	5	5	5
	Core XVII/ DSCXVII	PCHP401	Project	4	6	6
	Internship	UPSI201	Internship/Field work/Field Project	-		-/1 (Extra Credit)
	Total					28
Grand Total					90	92

EXTRA CREDIT EARNING PROVISION

	Category	Category Course Course T		YitlePerviousCourseCode	Hrs per	Credits
Semester			Course Title		Week	Min/Max
II	-	-	Online Course	-	-	1

ORGANIC CHEMISTRY- III PCHM309

Semester	: III	Credits	:4
Category	: Core-VIII/DSC-VIII	Hours/Week	x : 5
Class&Major	: II-M.Sc., Chemistry	Total Hours	: 65

COURSE OBJECTIVES:

CO No.	To enable the students
CO-1	Understand the preparation and properties of heterocyclic compound
CO-2	Discuss fundamentals of concept of UV and IR spectroscopy
CO-3	Apply the gained knowledge from Mass spectroscopy to identify the structure
CO-4	Understand the NMR spectroscopy for ¹ H and ¹³ C
CO-5	Describe organic structure by various spectroscopy method

UNIT-I HETEROCYCLIC COMPOUNDS

Nomenclature of heterocyclic compounds. Preparation, Properties and uses -Pyrazole, Oxazole, Pyridazine, Pyrimidine, Pyrazines and Thiozole. **Alkaloids:** Classification and isolation of alkaloids-General methods of Structural elucidation. Structural elucidation of Papaverine, Cocaine, Morphine.

UNIT-II UV-Vis AND IR SPECTROSCOPY

UV-Visible spectroscopy: Frank-condon principle, Types of electronic transitions, Chromophores & Auxochromes, absorption and intensity shifts, Factors influencing positions & intensity of absorption bands, Absorption spectra of dienes, polyenes & unsaturated carbonyl compounds, Woodward- Fieser rules for conjugated dienes and carbonyl compounds.

IR SPECTROSCOPY: Principle, vibrational frequencies & factors affecting them, IR absorption frequencies of functional groups, identification of functional groups, Finger Print Region, Significance of Far IR region.

UNIT-III MASS SPECTROMETRY

Principle - EI, CI& FAB-Base peak, isotopic peaks, metastable peak, parent peak, Fragmentation–Nitrogen, even electron rule and pattern, McLafferty rearrangement, Retro -Diel's Alder reaction fragmentation pattern of hydrocarbons, alcohols, aldehydes and ketones, Quantitative and qualitative analysis with GC-MS.

UNIT-IV1D NMR SPECTROSCOPY

Basic principles of NMR experiments-CW & FT NMR-¹H NMR-Chemical Shift & Coupling constant-Factors influencing Proton Chemical Shift & Proton-Proton Coupling constant, AX & AB spin system-Spin decoupling-Nuclear Over hauser effect-Chemical exchange.¹³C NMR chemical shift& factor affecting ¹³C Chemical shift.

UNIT-VIDENTIFICATION OF ORGANIC COMPOUNDS

Applications of organic spectroscopy: Structure determination of organic compounds by using UV-Vis, IR, ¹H &¹³C-NMR and Mass spectroscopic techniques (simple molecules only-restricted to 12 carbon systems with/without one hetero atom).

Text Books

- Finar.I.L, (2006)"Organic Chemistry, Vol-I&II", ELBS Publication, 5th ed.,
- Sharma. Y.R, (2013) "*Elementary Organic Spectroscopy*", S. Chand Publication, 5th ed.,

Reference Books

- Dyer. J, (1980) "Applications of Organic Spectroscopy", Prentice & Hall of India Pvt Ltd., New Delhi.
- Mukerjee. S.M & Singh. S.P, (1990) "Organic Reaction Mechanism", McMillan India Ltd., Chennai.
- Gurdeep R. Chatwal, (2009) "Organic chemistry of Natural products", Volume I & II Himalaya Publishing House, New Delhi.
- Kemp. W, (2001) Organic Spectroscopy, Mcmillan Ltd.
- Silverstein. R.M, Bassler, G.D. & Monsu, (2004) "Spectrometric Identification of Organic Compounds", John Wiley & Sons, New York.
- Jag mohan, (2007) "*Organic Spectroscopy: Principles and Applications*", Alpha Science International Ltd., Harrow, U.K. 2nd ed.,
- V.K. Ahluwalia, Rakesh K. Parashar, (2015) "*Organic Reaction Mechanisms*", Narosa Publishing House Pvt. Ltd. 8th Reprint.

13 Hour

12 Hour

14 Hour

12 Hour

E-Resources

- https://www.k-state.edu/bmb/labs/jc/teaching/bioch590/bioch590-6-NMR.pdf https://www.weizmann.ac.il/plants/aharoni/sites/plants.aharoni/files/uploads/june 192007.pdf
- http://chemistry.syr.edu/totah/che575/support/3a1/3-1.MS.pdf

COURSE OUTCOMES:

CO No.	On completion of the course the student will be able to	Bloom's Level
CO-1	Explain the nomenclature of heterocyclic compound	K1 &K2
CO-2	Predict and characteristics of functional groups using UV and IR spectroscopy.	K2
CO-3	Apply the Mass spectroscopy to identify the structure from Fragmentation pattern, effect of isotopes.	К3
CO-4	Differentiate nuclear magnetic resonance spectroscopy of 1 H and 13 C	K4
CO-5	Determine the given molecular structure using NMR, IR, UV-Vis and MS spectra from a	K5

INORGANIC CHEMISTRY- III PCHM310

Semester	: III	Credit : 4
Category	: Core-IX/DSC-IX	Hours/week : 4
Class & Major	: II-M.Sc., Chemistry	Total hours : 52

COURSE OBJECTIVES:

CO No.	To enable the students
CO-1	Understand the properties & applications of f-block elements
CO-2	Know about the application of Nuclear Chemistry in various fields
CO-3	Get the knowledge of various Inorganic reactions.
CO-4	To impart knowledge of chemistry of organometallic compounds
CO-5	To know about various catalyst application

UNIT-I CHEMISTRY OF LANTHANIDES AND ACTINIDES

Lanthanides and actinides-Occurrence, isolation, Position in the periodic table, lanthanide contraction, oxidation state, color, spectral, magnetic characteristics, coordination numbers, and stereochemistry, nuclear and non-nuclear applications. Separation of lanthanides by (i) Ion exchange method and (ii) Solvent extraction method (Principles and technique).

UNIT-II NUCLEAR CHEMISTRY-I

Subatomic particle, isotope, isotone, isobar, nuclear forces, Meason theory of nuclear forces, stability of the nucleons-N/P ratio and stability belt, liquid drop model, shell and combined model of the nucleus. Mass defects and Binding energy. Natural and artificial radioactivity. Radioactivity disintegration, Group displacement law, radioactive series, Trans uranium element.

UNIT-III NUCLEAR CHEMISTRY-II

Nuclear transmutation, classification of nuclear reactions- elastic, inelastic, spallation, capture, fission and fusion reaction, Q-value of nuclear fission, mechanism and fission bomb. Nuclear fusion-Mechanism, stellar energy and Hydrogen bomb. Modes of

11 Hour

11 Hour

radioactive decay detection and determination of activity by Cloud Chamber and Geiger Muller Counter. Nuclear reactors-Fast Breeder reactors, particle accelerators, Cyclotron and Synchrotron.

UNIT-IV ORGANO METALLIC CHEMISTRY-I

Carbon donors: Alkyls and aryls metallation, Chain and cyclic donors, olefines, acetylene, and allyl system.

Reactions: Association, substitution, addition and elimination reactions, ligand protonation, electrophilic and nucleophilic attack on ligands. Carbonylation, decarboxylation, oxidative addition.

10 Hour **UNIT-V ORGANO METALLIC CHEMISTRY-II**

Catalysis: Hydrogenation of olefins (Wilkinson's catalyst), hydroformylation of olefins using cobalt or rhodium catalysts (Oxo process), oxidation of olefins to aldehydes and ketones (Wacker process) polymerization (Zeigler-Natta catalyst): cyclo oligomerisation of acetylene using Nickel catalyst (Reppe's catalyst).

Text books:

- Arniker .H.J, (2000) "Nuclear chemistry", Wiley Eastern Co, 2nd ed.,
- Wahid U.Malik, G.D.Tuli&R.D.Madan, (2010) "Selected Topics in Inorganic Chemistry", S.Chand& Company Ltd., New Delhi.

Reference books:

- Maheshwar Sharma & Madhuri Sharma, (2009) "Nuclear chemistry", Ane Books • Pvt. Ltd
- Singh. G, (2008) "Chemistry of Lanthanides and Actinides", Discovery publishing.
- Huheey, J.E. Keiter, E.A. and Keiter, R.L.(2006) "Inorganic Chemistry", Harper and Row, New York, 4t ed.,

E-Resources

- https://www.alchemyst.co.uk/pdf/Inorganic/lanthanides_and_actinides.pdf •
- http://chemistry.bd.psu.edu/jircitano/Wilkinsons13.pdf
- https://nptel.ac.in/courses/104101006/downloads/lecture-notes/mod3/lec4.pdf

CO No.	On completion of the course the student will be able to	Bloom's
		Level
CO-1	Remember the lanthanide and actinide series.	K1
CO-2	Explain the characteristics of radioactive decays, knows the	K2
	basics of measurement of radioactivity and has the knowledge	
	of the main applications of nuclear chemistry	
CO-3	Prepare various types of nuclear changes or	K3
	processes including fission, fusion and decay reactions.	
CO-4	Describe and explain catalytic processes using an organometallic	K4
	compound as a catalyst	
CO-5	Determine organometallic compounds are used as catalysts in	K5
	organic synthesis	

COURSE OUTCOMES:

PHYSICAL CHEMISTRY-III PCHM311

Semester	: III	Credit	:4
Category	: Core –X/DSC-X	Hours/Week	:4
Class & Major	: II M.Sc., Chemistry	Total Hours	: 52

COURSE OBJECTIVES:

CO No.	To enable the students
CO-1	Apply the fundamental knowledge in the colloidal system
CO-2	Analysis of adsorption isotherm
CO-3	Know about the function of the catalysts and its surface action and apply it for
	research work
CO-4	To get the knowledge kinetic reaction in solution and fast reaction type
CO-5	Understand the chemistry of corrosion

UNIT-I COLLOIDAL STATE

Colloidal system-classification, Preparation of lyophobic colloidal solutions Dispersion methods and Condensation methods-Purification of colloidal solutions-general properties of colloidal systems. Properties of hydrophobic colloidal systems-Electrical properties and electro kinetics properties. Determination of size of colloidal particles.

UNIT-II SURFACE CHEMISTRY

Kinetics of surface reactions: Physical and chemical adsorption-adsorption isotherms types of adsorption isotherms - Langmuir adsorption isotherm. B.E.T theory for multilayer adsorption, measurement of surface area-Mechanism of heterogeneous catalytic unimolecular and bimolecular reactions.

UNIT-III CATALYSIS

Acid Base catalysis-mechanism of Langmuir-Hinshelwood and Eley Rideal– Bronsted catalytic law - Catalysis by enzymes-effects of substrate concentration, pH and temperature on enzyme catalyzed reactions-reversible and irreversible enzyme inhibition mechanism.

UNIT-IV KINETICS OF REACTIONS IN SOLUTION AND FAST REACTION

10 Hour

Kinetics of reaction in solution-Diffusion controlled reactions in solutionsinfluence of ionic strength on rates of reactions-primary and secondary salt effect, dielectric constant.

Kinetics of fast reaction-relaxation method-temperature and pressure jump methods flash photolysis

UNIT-V CORROSION

Corrosion-definition-costs of corrosion-economic losses-human life and safetytypes of corrosion-dry corrosion-wet corrosion-mechanisms-galvanic corrosionconcentration cell corrosion-atmospheric corrosion-soil corrosion-pitting corrosion-intergranular corrosion water line corrosion-stress corrosion-microbial corrosion. Corrosion and passivation of metals-Pourbiax and Evan's diagrams. Corrosion control methods. Inhibitor-types and theory.

10 Hour

11 Hour

11 Hour

Text books

- Crow, D. R. (2014) "Principles and applications of electrochemistry", Chapman & Hall/CRC, 4th ed.,
- Atkins .P and de Paula. J, (2006) *"Atkins' Physical Chemistry"*, Oxford University Press, Oxford. 8th ed.,

Reference Books

- Somorjai, G.A, Yimin Li, (2010) "Introduction to Surface chemistry and *Catalysis*", John Wiley & Sons, 2nd ed.,
- Puri, Sharma and Pathania, (2013) "Principle of Physical chemistry", Vishal Publication, 46th ed.,
- Laidler, K.J. "Chemical Kinetics", (2008)Pearson Education India, 3rd ed.,

E-Resources

- https://nptel.ac.in/courses/113108051/module1/lecture1.pdf
- http://www.uobabylon.edu.iq/eprints/publication_12_18276_228.pdf
- https://chem.libretexts.org/Courses/University_of_California_Davis/UCD_Chem_ 107B%3A_Physical_Chemistry_for_Life_Scientists/Chapters/2%3A_Chemical_K ineti cs/2.10%3A_Fast_Reactions_in_Solution

COURSE OUTCOMES:

CO No.	On completion of the course the student will be able to	Bloom's Level
CO-1	Recognize concentration and mechanism of catalysis	K1
CO-2	Describe and understand the Colloidal system	K1& K2
CO-3	Apply the knowledge to adsorption isotherm	K3
CO-4	Differentiate the Kinetics of reaction in solution and fast reaction	K4
CO-5	Criticize and Understand and analyze the application corrosion.	K5 & K2

SUSTAINABLE MATERIALS AND TECHNOLOGIES PPHI301/PCHI301

Semester	: III	Credit : 4
Category	: Core XI	Hours/week : 5
Class & Majo	or: II - M.Sc Chemistry & Physics	Total Hours : 65

COURSE OBJECTIVES:

CO No.	To enable the students		
CO-1	Understand the concept of sustainable materials		
CO-2	Learn about green chemistry strategies for designing the chemical synthesis		
CO-3	Explore the theoretical understanding of various physical and chemical		
	properties of nanomaterials		
CO-4	Acquire the knowledge of various techniques to nanomaterials		
CO-5	Get knowledge nanomaterials properties and their application		

UNIT-I INTRODUCTION TO MATERIALS

13 Hour

Concept of Sustainable materials, Classification of materials: Crystalline & amorphous materials, high Tc superconductors, alloys & composites, semiconductors,

solar energy materials, luminescent and optoelectronic materials, Polymer, Liquid crystals and quasi crystals, Ceramics.

UNIT- II GREEN CHEMISTRY

Introduction: Prospects and future of Green Chemistry - Twelve guiding principles of green chemistry - Concept of atom economy - Green starting materials, Green reagents, Green solvents and reaction conditions, Green synthesis - Real world cases (Traditional Vs. Green processes) Synthesis of Ibuprofen, Adipic acid - Biomimetic, multifunctional reagents; Combinatorial green chemistry; Non-covalent derivatization.

UNIT-III GREEN TECHNOLOGIES

Green Solvents: Enhancement of selectivity, efficiency, and industrial applicability - Ionic liquids-Supercritical fluids - Solvent free neat reactions in liquid phase - Flourous phase reactions Green Catalysis: Heterogeneous catalysis: Use of zeolites, silica, alumina, clay, polymers, cyclodextrins, and biocatalysts.

UNIT - IV CHARACTERIZATION TECHNIQUES RELATED TO NANOMATERIALS 13 Hour

Electron Microscopy techniques: Scanning Electron Microscope, Transmission Electron Microscope, Field emission scanning electron microscopy, Atomic Force Microscopy, X-ray photoelectron spectroscopy, (XPS), Energy Dispersive X-Ray Analysis (EDX).

UNIT- V APPLICATION OF NANOMATERIALS

12 Hour

Overview of nanomaterials properties and their applications, Molecular Electronics and Nanoelectronics – Nanobots- Biological Applications – Quantum Devices – Nanomechanics – Photovoltaic cells- Nano structures as single electron transistor.

Reference Books

- K. Barriham, D.D. Vvedensky, *Low Dimensional Semiconductor Structures: Fundamental and Device Applications*, Cambridge University Press, 2001.
- V.K. Ahluwalia, *Methods and Reagents of Green Chemistry: An Introduction by Green Chemistry*, Ane Books India, 2006.
- Bontempi, Elza, *Raw Materials Substitution Sustainability*, Springer International Publishing, 2017.
- G. Cao, *Nanostructures & Nanomaterials: Synthesis, Properties & Applications,* Imperial College Press, 2004.

Text Books

- J.George, Marcel Dekker, Preparation of Thin Films, Inc., New York. 2005.
- Rashmi Sanghi & M. M. Srivastava, *Green Chemistry Environment Friendly Alternatives*, Narora Publishing House, 2003.
- Elson Longo, Felipe de Almeida La Porta, *Recent Advances in Complex Functional Materials*, Springer, 2017.

e-Books

- https://asdlib.org/onlineArticles/ecourseware/Bullen/SPMModule_BasicTheoryAF M.pdf
- http://etsf.ehu.es/files/nanorobots_work.pdf
- http://www.me.nchu.edu.tw/lab/CIM/www/courses/Manufacturing%20Processes/ Ch07- Ceramics-Wiley.pdf

14 Hour

COURSE OUTCOMES:

CO	On completion of the course the student will be able to	
N0.		Level
CO-1	Remember the sustainable materials	K1
CO-2	Explain processes and products that are safe and hazard free	K2
CO-3	Apply knowledge of green chemistry in alignment with sustainability principles realizing benefits for society.	K3
CO-4	Analyse mechanistic problems and develop new functional materials.	K4
CO-5	Select new materials for various applications	K5

PHYSICAL CHEMISTRY PRACTICAL PCHR401

Semester	: III & IV	Credit	: 5
Category	:Core Practical -III	Hours/	Week: 5+5
Class & Major	: II M.Sc Chemistry	Total H	lours : 130

COURSE OBJECTIVES

CO No.	To enable the students
CO-1	To understand the phase rule of binary system
CO-2	To know the kinetics of acid hydrolysis of ester
CO-3	To understand the concept of partition co-efficient
CO-4	To understand the basic concepts of conductometric and potentiometric titrations
CO-5	To understand the concepts polarimeter

Phase rule

- Binary system of Naphthalene & Biphenyl
- Binary system of Naphthalene & M-dinitrobenzene
- Three component System(CH₃COOH, H₂O & CHCl₃)

Kinetics

- Hydrlolysis of Ester
- KI Vs K₂S₂O₈
- I₂ Vs CH₃COCH₃ (By Calorimetric method)
- Comparision of Strength of two Acids.

Partition Co-efficient

• Instability constant $(KI_3 = KI + I_2)$ - Strength of KI

Potentiometry

- Mixture of acids Vs Strong base
- FAS Vs $K_2Cr_2O_7$
- Determination of dissociation constant of week acid
- Sparingly soluble salts BaSO₄ (concentration cell)

Conductometric

- Mixture of acids Vs NaOH
- Verification of Onsager's theory
- Degree of dissociation & dissociation constant of a week electrolyte Determination of solubility of a sparingly soluble salts

Polarimeter

- Inversion of Sucrose

Text book

• Alexander Findlay and Kitcher. J.A, "Practical physical chemistry", Longmans, Green, 2010.

Reference book

• Shoemaker .D.P and Garland .C.W, "Experiment physical chemistry", 8th ed., Mc Graw- Hill, New York, 2009.

COURSE OUTCOMES:

CO	On completion of the course the student will be able to	Bloom's Level
No.		
CO-1	Define the practical knowledge about the chemical kinetics	K1
CO-2	Understand the conductivity experiments	K2
CO-3	Apply potentiometric titrations in identification of acids	K3
CO-4	Analyze the experimental data	K4
CO-5	Develop the partition co-efficient of new compounds in a	K6
	mixture of two immiscible solvents	

ORGANIC CHEMISTRY- IV PCHM412

Semester	: IV	Credits : 4
Category	: Core-XIII/DSC-XIII	Hours/Week: 6
Class & Major	: II-M. Sc., Chemistry	Total Hours : 78

COURSE OBJECTIVES:

CO No.	To enable the students
CO-1	To introduce the students regarding the fundamentals of photochemistry and
	various photochemical reactions in detail.
CO-2	To classify pericyclic reactions into cyclo-addition reactions, electrocyclic
	reactions and sigmatropic rearrangements
CO-3	The students will be able to familiar with various types of rearrangement
	reactions.
CO-4	The use of important reagents in organic synthesis
CO-5	The concept of retrosynthesis and the terms involved

UNIT - I PHOTOCHEMISTRY

Absorption of Electromagnetic Radiation-Excited state, Types - Quantum yield - jablonski diagram : Phosphorescence & Fluorescence - Energy transfer and Photo sensitization- Inter system crossing - photochemical reactions - photoreduction, photo enolisation, cis - trans isomerisation, photo oxidation, photo addition, photoreactions of ketones - Norrish type I & II reactions and Di-Pi methane rearrangement.

UNIT - II PERICYCLIC CHEMISTRY

Introduction of pericyclic reactions - Conservation of molecular orbital Symmetry - Methods to explain Pericyclic reactions - Electrocyclic reactions (FMO Approach) -Cycloaddition - Cheleotropic reactions - Sigmatropic Rearrangement - Correlation Diagram method

18 Hour

UNIT - III MOLECULAR REARRANGEMENT

Introductory concept of rearrangements, migrating aptitude, memory effect. Pinacol - Pinacolone, Wager- Meerwein, , Favorski, Baeyer - Villiger, Wolf, Stevens (in cyclic systems) Von Richter rearrangements, Hoffman, Curtius, Lossen, Schmidt, Beckman, Benzil Benzilic, Benzidine , Fries and cope rearrangement.

UNIT - IV MORDERN REAGENTS FOR ORGANIC SYNTHESIS 12 Hour

CrO₃, peracids, Osmiumtetroxide, DDQ, Seleniumdioxide, DCC, DMSO, aluminium triisopropoxide, Diazomethane, LAH, NaBH₄, organoboranes, NBS, LTA, Wittig reagent. Pd compounds- heck & Suzuki coupling.

UNIT - V RETROSYNTHESIS

18 Hour

An introduction to retero synthesis - Synthon, Synthetic equivalent, Umpolung-Target molecule, Functional group interconversion, Disconnection approach - One group disconnection - Disconnection of alcohols, olefins and ketones - Logical and illogical disconnection, Two group disconnection- 1,2 - 1,3 - 1,4 - 1,5 and - Deoxygenated skeletons and dicarbonyls. Retero Diels Alder reaction, Reterosynthesis.

Text books

- Jonathan clayden, Nick Greeves and Warrner Stuart, Organic Chemistry, Oxford University Press, Oxford, UK, 2012.
- Jerry March, *Advanced Organic Chemistry*, 6th edition, John Wiley & Sons. NewYork, 2007.
- Ahluwalia .V.K, *Organic Reaction Mechanism*, 4th edition, Narosa Publishers, 2011.

Reference books

- Coyle .J.D, Organic Photo Chemistry-Wiley,2004
- Aggarwal. O.P, "Reaction *and Reagents in organic chemistry*", 4th edition, Goyle publications, 2004.
- Gaikwad .N.J, Chaudari R.Y, Patil V.R., *Retrosynthetic analysis and synthesis of drugs*, Nirali prakashan Publication, 2006.

e-Books

- https://www.massey.ac.nz/~gjrowlan/chem312/lct1.pdf
- http://diposit.ub.edu/dspace/bitstream/2445/61063/25/5.%20Organic%20Synth esis.%20Int roduction%20to%20Retrosynthetic%20Analysis.pdf
- https://www.massey.ac.nz/~gjrowlan/chem312/tutorial.pdf

COURSE OUTCOMES:

CO	On completion of the course the student will be able to	Bloom's
No.		Level
CO-1	Remember the photochemical transformations in photochemistry	K1
CO-2	explain type of pericyclic mechanism is operative in a reaction	K2
CO-3	Carry out various types of rearrangement reactions and their mechanism.	K3
CO-4	explain role of reagents in organic synthesis	K4
CO-5	Evaluate and Create synthetic routes to complex organic molecules through cycloaddition reactions	K5&K6

INORGANIC CHEMISTRY-IV

Semester	: IV	Credit	:4
Category	: Core-XIV/DSC-XIV	Hours/week	:5
Class & Major	: II-M.Sc., Chemistry	Total hours	: 65

COURSE OBJECTIVES:

CO	To enable the students
No.	
CO-1	To understand the basic concept of Inorganic Chains, Rings, Cages And Clusters
CO-2	To obtain theoretical understanding of how inorganic reactions take place
CO-3	To know the fundamental principles of synthesis of alkene complexes by ligand
	and C-H activation of alkenes – alkyne
CO-4	To able to use knowledge about structure and bonding issues to understand the
	stability and reactivity of Cyclopentadienyl complexes
CO-5	To study organometallic catalytic and alkene reaction

UNIT-I INORGANIC CHAINS, RINGS, CAGES AND CLUSTERS 15 Hour

Silicate minerals – ortho-, pyro-, and meta-silicates – pyroxene, amphiboles– two dimensional silicates – talc, mica and three dimensional aluminosilicates, feldspar, ultramarine –Polymeric sulphur nitride, phosphonitrilic compounds-trimers and tetramers - homocyclic inorganic ring systems – Concept of multi-centered bond – structure of B₂H₆, B₄H₁₀, [B₁₂H₁₂]^{2–}, B₆H₁₀, B₈H₁₂, B₁₀H₁₄ – Wade's rules, closo, nido, arachno boranes and carboranes – The "styx" code. Silicones -preparation, properties and uses.

UNIT-II EPR AND PHOTOELECTRON SPECTROSCOPY

Electron spin resonance: theory, g value– factors affecting the magnitude of gvalues, hyperfine structure, ESR of organic free radicals, ESR of inorganic ions, ESR of simple free radicals in solutions, zero field splitting and Krammer's degeneracy. Photoelectron spectra koopmam's theorem, fine structure in PES and Application of UPS

UNIT-III ORGANOMETALLIC CHEMISTRY-III

Alkene complexes - synthesis of alkene complexes by ligand substitution - by reduction and by metal atom synthesis - bonding of alkenes to transition metals - bonding in diene complexes - reactivity of alkene complexes - ligand substitution - reactions with nucleophiles - olefin hydrogenation - hydrosilation - Wacker process - C-H activation of alkenes - alkyne complexes - bonding in alkyne complexes - reactivity of alkynes - alkyne complexes in synthesis - cobalt catalysed alkyne cycloaddition

UNIT-IV ORGANOMETALLIC CHEMISTRY-IV

Cyclopentadienyl complexes - metallocenes - synthesis of metallocenes - bonding in metallocenes - reactions of metallocenes - Cp2Fe/Cp2Fe+ couples in biosensors - bent sandwich complexes - bonding in bent sandwich complexes - metallocene halides and hydrides - metallocene and stereospecific polymerization of 1-alkenes - cyclopentadiene as a non-spectator ligand – monocyclo pentadienyl (half-sandwich) complexes - synthesis and structures of allyl complexes - arene complexes - synthesis - structure and reactivity of arene complexes - multidecker complexes.

UNIT-V ORGANOMETALLIC CHEMISTRY-V

Organometallic compounds in homogeneous catalytic reactions - coordinative unsaturation - acid-base behaviour reaction - migration of atoms or groups from metal to ligand - insertion reactions of coordinated ligands - catalytic reactions of alkenes

12 Hour

14 Hour

12 Hour

- isomerisation of alkenes - hydrogenation - hydroformylation and hydrosilation of alkenes - alkene polymerisation and oligomerisation - fluxional molecules.

Text Books

- F. Albert Cotton, Geoffrey Wilkinson, Carlos A. Murillo, Manfred Bochmann, (1999) "Advanced Inorganic Chemistry", 6th ed.,
- Parish.R. V, (1990) "NMR, NQR, EPR and Mossbauer Spectroscopy in Inorganic Chemistry," EllisHorwood, New York.

Reference Books

- Huheey, J. E. Keiter, E. A. and Keiter, R. L. Medhi, O.K. (2009) "Inorganic Chemistry-Principles of structure and reactivity", Pearson Education, 4th ed.,
- Manfred Bochmann, (1994) "Organometallics 1, Complexes with transition metalcarbon σ -bonds", Oxford science publications, Oxford.
- Manfred Bochmann, (1994) "Organometallics 2, Complexes with transition metalcarbon π -bonds", Oxford science publications, Oxford.

E-Resources

- https://www.rsc.org/Education/Teachers/Resources/Inspirational/resources/6.4.4.p df
- https://nptel.ac.in/courses/104108062/module6.pdf
- http://www.anilmishra.name/notes/nqr1.pdf

COURSE OUTCOMES:

CO	On completion of the course the student will be able to	Bloom's
INO.		Level
CO-1	Describe cluster, ring ,cages and chain of main group elements	K1
CO-2	Acquire skill to interpret the spectra of EPR and Photoelectron	K2
	Spectroscopy for inorganic compounds.	
CO-3	Prepare various alkene and alkyne complex	K3
CO-4	Analyze Cyclopentadienyl metalloccene- sandwich and half-	K4
	sandwich complexes	
CO-5	Determine the Organometallic reaction	K5

PHYSICAL CHEMISTRY-IV PCHM414

Semester	: IV	Credit :	4
Category	: Core-XV/DSC-XV	Hours/Week :	: 5
Class &Major	: II M.Sc. chemistry	Total Hours	: 65

COURSE OBJECTIVES:

CO No.	To enable the students		
CO-1	Study of Vibrating diatomic molecule, energy levels of a diatomic molecule,		
	simple harmonic and anharmonic oscillator, Scattering of light and Raman		
	Spectrum. rotational and vibrational Raman Spectra		
CO-2	To analyse the samples using different analytical techniques like SEM, TEM,		
	AFM, and STM.		
CO-3	To study the kinetics of polymerization		
CO-4	Understand concepts of photo and Radiation Chemistry.		
CO-5	To know about the electro analytical techniques		

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UNIT- I ROTATIONAL AND VIBRATIONAL SPECTROSCOPY 15 Hour

The rotation of molecules, rotational spectra-rigid diatomic molecule, intensity of spectral lines, selection rules, effect of isotopic substitution. Diatomic molecules as non-rigid rotors. Polyatomic molecules-linear, symmetric and asymmetric top molecule. Stark effect.

Vibrating diatomic molecule: energy of diatomic molecules as simple harmonic oscillator- energy levels, vibrational transitions, selection rules; anharmonic oscillator- energy levels, selection rules, vibrational transitions. - Diatomic vibrating rotator: Born-Oppenheimer approximation, vibration of polyatomic molecules-fundamental vibrations, linear molecules, symmetric top and asymmetric top molecules.

UNIT - II MICROSCOPY TECHNIQUES

Principle, theory, Instrumentation and Application of Optical microscopy -Scanning electron microscope (SEM) - Transmission electron microscope (TEM)- Atomic force microscope(AFM) - Surface Tunneling microscope (STM) - Energy dispersive Xray spectroscopy (EDX).

UNIT – III MACROMOLECULES

Polymerization in homogeneous and heterogeneous phases - Kinetics of polymerization (Ionic and Addition)-kinetics of copolymerization - Mechanism of Polymerization - Chain Initiation- Propagation - Termination-Transfer -Inhibition and Retardation. Properties of polymers: Molecular weight of polymers - Mw, Mn determination - Light Scattering, Ultra centrifuge - Gel Permeation Chromatography.

UNIT- IV PHOTO and Radiation Chemistry

Photovoltaic and photogalvanic cells, photoelectrochemical cells, photo assisted electrolytes of water, aspects of solar energy conversion. Radiation chemistry-Interaction of high energy radiation with matter-primary and secondary processes-G value- radialysis of waterhydrated electron.

UNIT - V ELECTRO ANALYTICAL TECHNIQUES

Polarography – theory, DME, diffusion, Kinetic and catalytic currents, currentvoltage curves for reversible and irreversible systems, Qualitative and quantitative application to inorganic systems. Amperometric titrations- theory, types of titration curves, Cyclic Voltammetry - theory, instrumentation, differential pulse Voltammetry - principle and instrumentation.

Text Books

- Banwell .C. N and McCash .E. M, *Fundamentals of Molecular Spectroscopy*, 4th ed., Tata McGraw Hill, New Delhi, 2007.
- Drago. R. S, Physical Methods in Chemistry; Saunders: Philadelphia, 2008.
- Allen J. Bard and Israel Rubinstein, *Electroanalytical chemistry*, vol.22, Marcel Dekker, 2004.

Reference Books

- Atkins. P and J. de Paula, *Physical Chemistry*, 7th ed., Oxford University Press, Oxford, 2002.
- Raman .K. V, Gopalan .R and Raghavan .P. S, *Molecular Spectroscopy*, Thomson and Vijay Nicole, Singapore, 2004.
- Weil J. A, Bolton J. R and Wertz J. E, *Electron Paramagnetic Resonance*; Wiley Interscience, 2005.

13 Hour

12 Hour

15 Hour

e-Books

- https://pubweb.eng.utah.edu/~lzang/images/Lecture 6 STM.pdf
- https://gcep.stanford.edu/pdfs/assessments/solar assessment.pdf •
- https://shodhganga.inflibnet.ac.in/bitstream/10603/88264/10/10 chapter%201.pdf •

COURSE OUTCOMES:

CO No.	On completion of the course the student will be able to	Bloom's Level
CO-1	Recognize diatomic molecule	K1
CO-2	Predict the samples using different analytical techniques like SEM, TEM, AFM, STM.	K2
CO-3	Illustrate the polymerization and its types	К3
CO-4	Analyse the photo and radiation Chemistry	K4
CO-5	Evaluate the electrochemical processes.	K5

NATURAL PRODUCTS

PCHM411

Semester	: IV	Credit	: 04
Category	: Core-XVI/DSC-VI	Hour/Week	: 05
Class & Major	: II M.Sc., Chemistry	Total Hour	: 65

COURSE OBJECTIVES:

CO No.	To enable the students
CO-1	Explain Basic Knowledge in Chemistry involved in Natural Products
CO-2	To understand the pathway involved in biosynthesis of aromatic amino acids
CO-3	To understand the isolation and structural elucidation of alkaloids
CO-4	Implications of chemistry in traditional drugs
CO-5	Various techniques that are involved in the separation methods

Unit-I STRUCTURAL BASIS OF NATURAL PRODUCTS

Chemical and spectral approaches to simple molecules of natural origin. Identification of natural products by chromatographic and spectroscopic methods and application of I.R., N.M.R. and Mass spectroscopy in the structural elucidation of organic compounds. Concept of stereoisomerism taking examples of natural products Eg.citral, menthol, camphor, ephedrine, atropine etc.; standardization of traditional drug formulations, chromatographic study of some herbal constituents

Unit-II SEPARATION TECHNIQUES

Need for learning separation techniques, separation techniques in natural product research and drug discovery, extraction techniques. Chromatography: General principles, classification of chromatographic techniques, normal and reversed phase, bonded phase chromatography, stationary phases, activity of stationary phases, elutropic series, and separation mechanisms. Column Chromatography, Flash and Vacuum Liquid Chromatography, High Pressure Liquid Chromatography (HPLC)-Planar Chromatography TLC/HPTLC/OPLC.

Unit-III AROMATIC AMINO ACIDS & PHENYL PROPANOIDS 13 Hour

Introduction: The Shikimate Pathway, The Sulfa drugs, Siderophores, Cinnamic Acid derivatives, Coumarins, Lignans-Lignins, The Condensed Tannins, Lignans, Coumarins, Flavanoids, & Terpenoid Quinones.

13 Hour

Unit-IV ALKALOIDS

Classification, biosynthetic studies and basic metabolic pathways, introduction to biogenesis of secondary metabolites, chemistry, general methods of extraction, isolation, chemical tests, isolation and structural elucidation of Pyridine alkaloids, Tropane alkaloids, Quinoline and Isoquinoline alkaloids, Phenanthrene alkaloids, Indole alkaloids, Imidazole alkaloids, Alkaloid amines, Glycoalkaloid, Xanthine alkaloid.

Unit-V STUDY OF TRADITIONAL DRUGS

Classification of indigenous drugs traditional drugs, common vernacular names, botanical source, chemical constituents, uses and marketed formulations with ingredients like -Amla, Shatavari, Bhilwua, bael, bach, rasna, punarnava, gokhru, shankhapushpi, brahmi adusa, arjuna, lahsun, guggul, gymnema, neem ,tulsi, Shilajit and Spirulina.

Text Books:

- I.L. Finar, (2002) "Organic Chemistry: Stereochemistry and the Chemistry Natural Products", Volume II, 5th ed.,
- Gurdeep R. Chatwal, (2014) "Organic Chemistry of Natural Products: volume I and II", edited by Arora M, Himalaya publishing house.

References Books:

- James E Robbers, Varro E Tyler and Lynn R Brady, (2011)"Pharmacognosy", Wolters Kluwer India Pvt. Ltd. 9th ed.,
- William C. Evans (2009) "Trease and Evans Pharmacognosy", Elsevier Health, UK, 16th ed.,
- e -books
 - https://www.uou.ac.in/lecturenotes/science/MSCCH-• 17/CHEMISTRY%20LN%208%20NATURAL%20PRODUCTS-converted.pdf
 - https://www.researchgate.net/publication/313163260 Natural Products Chemistry The Emerging Trends and Prospective Goals

COURSE OUTCOMES:

СО	On completion of the course the student will be able to	Bloom's Level
No.		
CO-1	Describe the structure of Natural products by spectroscopic methods	K1
CO-2	Understand the Separation techniques involved in the separation of natural products	K2
CO-3	Prepare the aromatic amino acids using biosynthetic approach	K3
CO-4	Compare the biosynthesis of alkaloids	K4
CO-5	Create traditional drugs from various plants	K6

PG Evaluation Component-III and IV

Semester	Course Code	Course Title	Component-III	Component-IV
	PCHM309	Organic Chemistry-III	Assignment	Seminar
III	PCHM310	Inorganic Chemistry-III	Assignment	Seminar
	PCHM311	Physical Chemistry-III	Assignment	Seminar
IV			Preparation of	Experimental
	PCHM413	Inorganic Chemistry - IV	Coordination	procedure and
			complexes	its discussion
			Isolation of	Experimental
	PCHM411	Natural Products	Natural product	procedure and
				its discussion

14 Hour