RAJEEV GANDHI GOVT. POST GRADUATE COLLEGEAMBIKAPUR

POST GRADUATE COURSE IN CHEMISTRY (UNDER SEMESTER SYSTEM)

BASED ON UGC MODEL CURRICULUM

MASTER OF SCIENCE CHEMISTRY

2023- 2024

SEMESTER – I,II,III & IV

RAJEEV GANDHI GOVT. P.G. COLLEGE AMBIKAPUR C.G.

POST GRAUATE COURSE IN CHEMISTRY
(CBCS)
2023-2024

SCHEME FOR THE THEORY /LABORATORY COURSE

The Postgraduate course in chemistry shall extend over a period of two academic years comprising of four semesters. The syllabi and schemes of examination of these are detailed herewith.

The **four semesters** M.Sc. course shall consist of **twenty** theory and **six** practical courses. In each semester there shall be **four** theory courses each of 70 marks and 30 marks for internal Assessment Test. In internal assessment there will be
10 marks for two written test, and 10 marks for a seminar and 10 marks for assignment in each paper. Thus there shall be T/I =100 marks for each Paper. Minimum Passing/ Qualifying marks shall be 36% in each theory Paper and in internal assessment of each paper. Candidate will be required to pass separately in each theory courses and each practical courses.

In First and Second Semester there will be two practical /Laboratory courses each of 100 marks. In Third and Fourth Semester there will be two Practical/Laboratory course of 200 marks each .

M.Sc. CHEMISTRY
First Semester (CBCS)

Paper	Course Code	Course Type	Course (Paper/Subject)	Credits	Contact Hours Per Week			EoSE Duration (Hrs.)		Marks	
					L	T	P	Thy	P	SEE	IA
I	MSC 101	PD2	INORGANIC CHEMISTRY -1	6	4	3	0	3	0	70	30
II	MSC 102	PD2	ORGANIC CHEMISTRY-1	6	4	3	0	3	0	70	30
III	MSC 103	PD2	ANALYTICAL CHEMISTRY	6	4	3	0	3	0	70	30
	MSC 111	PD2	INORGANIC CHEMISTRY - 1LAB	6	0	0	9	0		100	
	MSC 112		ANALYTICAL CHEMISTRY-1LAB							100	
IV	MSC 104	PD2	SOCIAL OUTREACH, ENTERPRENEURSHIP &INTERNSHIP	6	4	3	0	3	0	100	
V	MSC 105	PD2	CONSTITUTIONALISM & INDIAN POLITICAL SYSTEM	6	4	3	0	3	0	70	30
	MSC 106	PD2	GROUP THEORY, SPECTROSCOPY AND DIGGRACTION METHODS								
	MSC 107	PD2	COMPUTER PROGRAMMING IN CHEMISTRY								
	MSC 108	PD2	**MEDICINAL CHEMISTRY**								
	MINIMUM CREDITS IN INDIVIDUAL SUBJECT IS 6 AND IN COMPLETE SEMESTER IN WOULD BE 30			Total Credit =36							

M.Sc. CHEMISTRY
Second Semester (CBCS)

Paper	Course Code	Course Type	Course (Paper/Subject)	Credits	Contact Hours Per Week			EoSE Duration (Hrs.)		Marks	
					L	T	P	Thy	P	SEE	IA
I	MSC 201	PD2	INORGANIC CHEMISTRY -2	6	4	3	0	3	0	70	30
II	MSC 202	PD2	ORGANIC CHEMISTRY-2	6	4	3	0	3	0	70	30
III	MSC 203	PD2	PHYSICAL CHEMISTRY	6	4	3	0	3	0	70	30
	MSC 211	PD2	CHEMISTRY LAB ORGANIC	6	0	0	9	0		100	
	MSC 212		PHYSICAL CHEMISTRY LAB							100	
IV	MSC 204	PD2	RESEARCH METHODOLOGY & COMPUTER APPLICATION:BASICS	6	4	3	0	3	0	100	
V	MSC 205	PD2	INVIRONMENTAL AND FOREST LAWS	6	4	3	0	3	0	70	30
	MSC 206	PD2	POLYMER CHEMISTRY								
	MSC 207	PD2	ORGANIC SYNTHESIS -1								
	MSC 208	PD2	**APPLIED CHEMISTRY**								
	MINIMUM CREDITS IN INDIVIDUAL SUBJECT IS 6 AND IN COMPLETE SEMESTER IN WOULD BE 30			Total Credit =36							

M.Sc. CHEMISTRY
Third Semester (CBCS)

Paper	Course Code	Course Type	Course (Paper/Subject)	Credits	Contact Hours Per Week			EoSE Duration (Hrs.)		Marks	
					L	T	P	Thy	P	SEE	IA
I	MSC 301	PD2	APPLICATIONS OF SPECTROSCOPY-INORGANIC CHEMISTRY	6	4	3	0	3	0	70	30
II	MSC 302	PD2	APPLICATIONS OF SPECTROSCOPY-ORGANIC CHEMISTRY	6	4	3	0	3	0	70	30
III	MSC 303	PD2	PERICYCLIC REACTIONS AND PHOTOCHEMISTRY	6	4	3	0	3	0	70	30
	MSC 311	PD2	GENERAL CHEMISTRY LAB	6	0	0	9	0		200	
IV	MSC 304	PD2	INTELLECTUAL PROPERTY, RIGHT	6	4	3	0	3	0	70	30
V	MSC 305	PD2	TRIBAL STUDIES	6	4	3	0	3	0	70	30
	MSC 306	PD2	GREEN CHEMISTRY								
	MSC 307	PD2	ORGANIC SYNTHESIS II								
	MSC 308	PD2	**HETROCYCLIC CHEMISTRY**								
	MINIMUM CREDITS IN INDIVIDUAL SUBJECT IS 6 AND IN COMPLETE SEMESTER IN WOULD BE 30			Total Credit =36							

M.Sc. CHEMISTRY
Fourth Semester (CBCS)

Paper	Course Code	Course Type	Course (Paper/Subject)	Credits	Contact Hours Per Week			EoSE Duration (Hrs.)		Marks	
					L	T	P	Thy	P	SEE	IA
I	MSC 401	PD2	BIOINORGANIC CHEMISTRY	6	4	3	0	3	0	70	30
II	MSC 402	PD2	ENVIRONMENTAL CHEMISTRY	6	4	3	0	3	0	70	30
III	MSC 403	PD2	SOLID STATE CHEMISTRY	6	4	3	0	3	0	70	30
	MSC 411	PD2	ORGANIC CHEMISTRY LAB.	6	0	0	9	0		200	
IV	MSC 404	PD2	DISSERTATION	6	4	3	0	3	0	100	
V	MSC 505	PD2	PHOTOINORGANIC CHEMISTRY	6	4	3	0	3	0	70	30
	MSC 406	PD2	MATERIAL SCIENCE								
	MSC 407	PD2	**CHEMISTRY OF NATURAL PRODUCT**								
	MINIMUM CREDITS IN INDIVIDUAL SUBJECT IS 6 AND IN COMPLETE SEMESTER IN WOULD BE 30			Total Credit =36							

Attributes of a Chemistry Graduate

Attributes of chemistry graduate under the outcome –based teaching – learning framework may encompass the following :

- **Core competency** : The chemistry graduates are expected to know the fundamental concepts of chemistry and applied chemistry. These fundamental concepts would reflect the latest understanding of the field, and therefore , are dynamic in nature and require frequent and time- bound revisions.
- **Communication Skills** : Chemistry graduates are expected to possess minimum standards of communication skill expected of a science graduate in the country. They are expected to read and understand documents with in-depth analyses and logical arguments. Graduates are expected to be well-versed in speaking and communicating their idea/ finding/concepts to wider audience.
- **Psychological Skills** : Graduates are expected to possess basic psychological skill required to face the world at large, as well as the skill to deal with individuals and students of various sociocultural , economic and educational level. Psychological skill may include feedback loops, self – compassion , Self reflection, goal –setting, interpersonal relationship and emotional management.
- **Problem -Solving** : Graduates are expected to be equipped with problem – solving philosophical approaches that are pertinent across the disciplines.
- **Analytical Reasoning** : Graduates are expected to acquire formulate cogent arguments and spot logical flaws, inconsistencies, circular reasoning etc.
- **Research –Skill :** Graduates are expected to be keenly abservant about what is going on in the natural surroundings to awake their curiosity. Graduates are expected to design a scientific experiment though statistical hypothesis testing and other a priori reasoning including logical deduction.
- **Teamwork :** Graduates are expected to be team players, with productive co-operations involving members from diverse socio- cultural backgrounds.
- **Digital Literacy :**Graduates are expected to be digitally literate for them to enroll and increase their core competency via e-learning resources such as **MOOC** and other digital tools for lifelong. Graduates should be able tosspot data fabrication and fake news by applying rational skepticism and analytical reasoning.
- **Moral and ethical awareness:** Graduates are expected to be responsible citizen of India and be aware of moral and ethical baseline of the country and the world. They are expected to define their core ethical virtues good enough to distinguish what construes as illegal and crime in Indian constitution. Emphasis be given on academic and research ethics, including fair Benefit Sharing ,Plagiarism, Scientific Misconduct and so on.
- **Leadership readiness:** Graduates are expected to be familiar with deciding making process and basic manarical skill to become a better leader .Skill include defining objective vision and mission, how to become charing inspiring leader and so on.

Programme Outcomes for PG

PO 1 : Critical Thinking : Inculcate critical thinking to carry out scientific investigation objectively Formulate coherent arguments : Critically evaluate practices, policies and theories by following scientific approach to knowledge development .Critically evaluate ideas ,evidence from an open –minded and reasoned perspective.

PO 2: Knowledges Skill : Equip the student with skill to analyse problems, formulate an hypothesis, evaluate and validate results, and draw reasonable conclusions thereof .Capacity to extrapolate from what one has learned and apply their competencies to solve different kinds of non- familiar problems ,rather than replicate curriculum content knowledge.

PO 3: Scientific Communication Skill : Imbibe effective scientific and /or technical communication in both oral and writing .Ability to show the importance of the subject as precursor to various scientific development since the beginning of the civilization.

PO 4: Ethics : Continue to acquire relevant knowledge and skill appropriate to professional activities and demonstrate highest standards of ethical issues in the subject concerned .Ability to identify unethical behavior such as fabrication .falsification or misrepresentation of data and adoptive objective , unbiased and truthful action in all aspects.

PO 5 : Enlightened Citizenship: Create awareness in become an enlightened citizen with commitment to deliver one`s responsibilities within the scope of bestowed right and privileges.

PO 6: Analytical Reasoning : Ability to evaluate the reliability and relevance of evidence ,identify logical flaws and holes in the arguments of others ,analyse and synthesise data from a variety of sources : draw valid conclusions and support them with evidence and examples, and addressing opposing viewpoints.

PO 7: Multicultural Competence : Development of asset of competencies in other to enhance and promote the growth of multicultural sensitivity within universities , Integrating multicultural awareness such as race, gender ,physical ability, age income and other social variables , and by creating an environment that is , ‘”welcoming for all students”.

PO 8 : Lifelong Learning : Ability to think , acquire knowledge and skill though logical reasoning and to inculcate the habit of self – learning though out life, thorough self –paced and self – directed learning aimed at personal development and adapting to changing academic demands of work place through knowledge skill development / reskilling.

PO 9: Leadership Qualities : Capability for mapping out the tasks of a learn or an organization ,and setting direction, formulating an inspiring vision ,building a team who can help achieve the vision, motivating and inspiring team members to engage with that vision ,and using management skill to guide people to the right destination in a smooth and efficient way.

PO 10 : Research Skill : Prepare student for pursuing research or in industry in concerned subject and allied fields, Capability to use appropriate software to solve various problems.

COURSE OUTCOME

M.Sc. I SEMESTER

COURSE CODE : D2

PAPER CODE :101

PAPER : I (INORGANIC CHEMISTRY -1)

After completion of course, the students will able to:-

CO 1. Recall the principles of electronic structure bonding & reactivity of coordination complexes.

CO 2. Understand the concepts of reactions .Through the mechanism in transition Metal complexes.

CO 3. Develop the understanding of structure and bonding of metal carbonyls.

CO4. Apply the different theories of coordination chemistry to elucidate the structureof different complexes.

CO5. Interpret the structure of cryptands inclusion compounds,isopoly & heteropoly acids.

	CO-1	CO-2	CO-3	CO-4	CO-5
PO- 1	✓				
PO-2		✓		✓	
PO-3	✓				
PO-4					
PO-5					
PO-6	✓		✓		
PO-7					
PO-8			✓		
PO-9					
PO-10	✓	✓	✓	✓	✓

M.Sc. CHEMISTRY FIRST SEMESTER			
COURSE CODE: MSC 101 PAPER-I			**COURSE TYPE: CCC**
COURSE TITLE: **INORGANIC CHEMISTRY-1**			
CREDIT: **THEORY: 6**	**PRACTICAL:**	**HOURS:** **THEORY: 90**	**PRACTICAL: 00**
MARKS: **THEORY: 70+30**	**PRACTICAL:**	**MARKS** **THEORY:**	**PRACTICAL:**

SCHEME OF MARKS :

i. Short answer type questions: three questions carrying 5 marks each to be asked two to be attempted (Word limit 100 words).

ii. Middle answer type questions: three questions carrying 9 marks each to be set two to be attempted (Word limit 250 words).

iii Long answer type questions: three questions carrying 14 marks each to be set two to be attempted (Word limit 750 words).

22 Hours	**STEREOCHEMISTRY AND BONDING IN MAIN GROUP COMPOUNDS** VSEPR, Walsh Diagram (Tri and Penta atomic molecules), dibonds. Bent rule and energetic of hybridization. Some simple reactions of covalently bonded molecules.Metal ligand Equilibria in Solution .Stepwise and overall formation constants and their interaction, trends in step-wise formation constants, factors affecting the stability of metal complexes with reference to nature of metal ion ligand, chelate effect and it's thermodynamic origin,.
24 Hours	**REACTION MECHANISM OF TRANSITION METAL COMPLEXES** Energy profile of a reaction, reactivity of metal complexes, inert and labile complexes, kinetic application of valence bond and crystal field theories, Kinetic s of octahedral substitution, acid hydrolysis, factors affecting acid hydrolysis, conjugate base mechanism, direct and indirect evidences in favour of conjugate mechanism, anation reactions, reactions without metal ligand cleavage, substitution reactions without metal ligand cleavage, substitution reaction in square planar complexes, the trans effect, mechanism of substitution reaction, Redox reactions, electron transfer reactions, Mechanism of one electron transfer reaction, outer sphere type reactions, cross reactions and Marcus- Hush Theory, inner sphere type reactions.
16 Hours	**METAL LIGAND BONDING** Limitation of Crystal Field Theory, molecular, orbital theory, octahedral, and square planar complexes, bonding and molecular orbital theory.
20 Hours	**METAL COMPLEXES** Metal carbonyls, structure and bonding, vibrational spectra of metal carbonyls for bonding and structural elucidation, important reactions of metal carbonyls, preparation, bonding and structure and important reactions of transition metal nitrosyl, dinitrogen and dioxygen complexes, tertiary phospine as ligand.
08 Hou	(A) CROWN ETHER COMPLEXES NAD CRYPTANDS, INCLUSION COMPOUNDS (B) ISOPOLY AND HETROPOLY ACIDS AND SALTS
RECOMENDE READINGS:	1. J.E. Huheey, Inorganic Chemistry - Principles, Structure and Reactivity, Harper Collins, New York, IV Edition (1993) 2. F.A. Cotton and G. Wilkinson, Advanced Inorganic Chemistry - A Comprehensive Text, John Wiley and Sons, V Edition (1988) 3. K.F. Purcell and J.C. Kotz, Inorganic Chemistry - WB Saunders Co., USA (1977) 4. M.C. Day and J. Selbin, Theoretical Inorganic Chemistry, Van Nostrand Co., New York (1974) 5. J.E. Huheey, Inorganic Chemistry, Harper Collins NY IV Edition, (1993) 6. G.S. Manku, Inorganic Chemistry (1984)

COURSE OUTCOME

M.Sc. I SEMESTER

COURSE CODE : PD2

PAPER CODE : 102

PAPER : II (ORGANIC CHEMISTRY -1)

After completion of course the students will able to:-

CO1. Recall the fundamental principles of stereochemistry applied to differentorganic reactions.

CO2. Understand the concepts related to synthesis, mechanism of functions of various organic reactions.

CO 3. Analyse the product distribution of stereochemistry of various products through spectroscopic data.

CO 4. Evaluate the organic reactions based on the influence of the substituents on substrate molecules and nature of solvent & the parametric conditions.

CO 5. Design new organic reactions in order to achieve the required products.

	CO-1	CO-2	CO-3	CO-4	CO-5
PO- 1	✓				
PO-2		✓			
PO-3					
PO-4					
PO-5					
PO-6			✓		✓
PO-7					
PO-8	✓				
PO-9					
PO-10	✓	✓	✓	✓	✓

M.Sc. CHEMISTRY FIRST SEMESTER

COURSE CODE: MSC 102 PAPER-II COURSE TYPE: CCC

COURSE TITLE:

ORGANIC CHEMISTRY-I

CREDIT: **THEORY: 6 PRACTICAL:**	**HOURS:** **THEORY: 90 PRACTICAL:00**
MARKS: **THEORY: PRACTICAL:** **70+30**	**MARKS** **THEORY: PRACTICAL:**

SCHEME OF MARKS :

i. Short answer type questions: three questions carrying 5 marks each to be asked two to be attempted (Word limit 100 words).Middle answer type questions: three questions carrying 9 marks each to be set two to be attempted (Word limit250 words).

ii. Long answer type questions: Five questions carrying 14 marks each to be set three to be attempted (Word limit750 words).

Hours 20	**STEREOCHEMISTRY** Optical activity and chirality, Classification of chiral molecules as asymmetric and dissymmetric. A brief Study of dissymmetry of allenes, biphenyls, spiro compounds, trans cyclo octane and cyclononene and molecules with helical structures absolute configuration - R, S notation of biphenyls and allenes. Fischer projection. Inter conversion of Sawhorse, Newman and Fischer projections. Molecules with more than one asymmetric center (restricted to five carbons). e.g. Erythro and threo compounds. Asymmetric synthesis. Cram's rule. Geometrical isomerism, E, Z - nomenclature of olefins, Geometrical and optical isomerism (if shown) of disubstituted cyclopropane, cyclobutane and cyclopentanes. Stereo specific and stereo selective reactions.
Hours 18	**CONFORMATIONAL ANALYSIS** Conformation of some simple 1, 2 - disubstituted ethane derivatives. Conformational analysis of disubstituted cyclohexane and their stereo chemical features (geometric and optical isomerism (if shown) by these derivatives). Conformation and reactivity of substituted cyclohexanol (oxidation and acylation), cyclohexanone. (reduction) and cycloehexane carboxylic acid derivatives (esterification and hydrolysis). Conformation and stereochemistry of cis and trans decalin and 9 - methyldecalin.
Hours 19	**ALIPHATIC NUCLEOPHILIC SUBSTITUTION REACTION AND ALIPHATIC ELECTROPHILIC SUBSTITUTION** SN1, SN2 and SNi mechanisms - Neighboring group participation - reactivity, structural and solvent effects - substitution in norbornyl and bridgehead systems - substitution at allylic and vinylic carbons - substitution by ambident nucleophiles - substitution at carbon doubly bonded to oxygen and nitrogen - alkylation and acylation of amines, halogen exchange, Von-Braun reaction, alkylation and acylation of active methylene carbon compounds, hydrolysis of esters, Claisen and Dieckmann condensation. SE1, SE2 and SEi mechanism, double bond shift - Reactivity. Migration of double bond, keto-enol interconversion, HVZ reaction, Stark-Enamine reaction, halogenation of aldehydes and ketones and decarboxylation of aliphatic acids.

Hours 17	**AROMATIC ELECTROPHILIC SUBSTITUTION REACTIONS** The arenium ion mechanism. Orientation and reactivity (ortho, meta and para directing groups). Typical reactions - nitration, halogenation, alkylation, acylation and diazonium coupling, Formylation ,Reimer - Tieman reaction, Vilsmeyer - Hack, Gattermann, Gattermann - Koch ,Kolbe reaction, Synthesis of di and tri substituted benzene (symmetrical tribromo benzene, 2-amino 5-methylphenol, 3 nitro, 4-bromobenzoic acid, 3, 4-dibromonitrobenzene, 1,2,3 - trimethylbenzene) starting form benzene or any monosubstituted benzene. Electrophilic susbstitution of furan, pyrole, thiophene and pyridine-N-oxide.
Hours 16	**AROMATIC NUCLEOPHLILIC SUBSTITUTIONS AND DETERMINATION OF REACTION MECHANISM** The SNAr,SN1 Benzye and SRN1 mechanism and Reactivty effect of substrate structure , leaving group and attacking nucleophile.The Von Richter, Sommelet – Hauser and Smiles rearrangement. Aromatic Nucleophilic substitution of activated halides. Ziegler alkylaiton. Chichibabin reaction.
RECOMENDE READINGS:	1. Organic Synthesis by R.O.C. Norman, Chapman and Hall, NY, (1980) 2. Physical Organic Chemistry by Niel Isaacs, ELBS Publications (1987) 3. Organic Reaction Mechanism by S.M. Mukherji and S.P. Singh, MacMillan India Ltd., Chennai (1990) 4. Organic Chemistry IV Edition by Stanley Pines 5. Structures and Mechanism by E.S. Gould 6. Advanced Organic Chemistry, Part A and B, by Francis A. Carey and Richard J. Sundberg, 3rd Edition (1990), Plenum Press. 7. Aromatic Nucleophilic Substitution by J. Miller 8. Advanced Organic Chemistry III Edition by J. Miller 9. Reactive Molecules, C. Wentrup, John Wiley and Sons, New York (1984) 10. Advanced organic reaction mechanism and structure by J. March, Tata McGraw Hill. 11. Organic Chemistry, Marc London 12. Organic Chemistry, Mc Murray 13. Organic Chemistry, Graham Solomons 14. Carbenes, Nitrenes and Arynes by T.L. Gilchrist and C.W. Rees, Thomas Nelson and Sons Ltd., London. 15. Stereochemistry, Conformation analysis and Mechanism by P.S. Kalsi, 2nd Edition (1993), Wiley Eastern Limited, Chennai. 16. Stereochemistry of carbon compounds by Ernest Eliel 17. Stereochemistry and Mechanism through solved problems by P.S. Kalsi. Wiley Eastern Ltd., (1994) 18. Basic principles of Organic Stereochemistry by P. Ramesh - Madurai Kamaraj University. 19. Organic Reaction Mechanism by R.K. Bansal. 20. A Guide book to mechanism in organic chemistry by Longman. 21. Structure and mechanism in organic chemistry by C.K. Ingold, cornell University press.

COURSE OUTCOME

M.Sc. I SEMESTER

COURSE CODE : PD2

PAPER CODE : 103

PAPER : III (ANALYTICAL CHEMISTRY)

After completion of course the students will able to:-

CO 1. Understand fundamentals of chemical analysis.

CO 2. Analyse different errors using statistical methods in chemical analysis.

CO3. Evaluate errors in chemical analysis through statistical treatment of data throughF- Test. T-Test & Q- Test.

CO4. Analyse thermal behaviour of different organic and inorganic materials usin TGA,DTA& DAC.

CO5. Adopt different chromatographic techniques for isolation of important organiccompounds.

CO 6. Apply absorption and emission techniques for traced elements analysis from different matrices.

	CO-1	CO-2	CO-3	CO-4	CO-5	CO-6
PO- 1	✓		✓		✓	
PO-2						
PO-3		✓				
PO-4						
PO-5						
PO-6	✓	✓	✓	✓	✓	✓
PO-7						
PO-8						
PO-9						
PO-10			✓	✓	✓	✓

M.Sc. CHEMISTRY FIRST SEMESTER

COURSE CODE: MSC 103	**PAPER-III**		**COURSE TYPE: PD2**
COURSE TITLE:	**ANALYTICAL CHEMISTRY**		
CREDIT:		**HOURS:**	
THEORY: 6	**PRACTICAL:**	**THEORY: 90**	**PRACTICAL: 00**
MARKS:		**MARKS**	
THEORY: 70+30	**PRACTICAL:**	**THEORY:**	**PRACTICAL:**

SCHEME OF MARKS :

i. Short answer type questions: three questions carrying 5 marks each to be asked two to be attempted (Word limit 100 words).

ii Middle answer type questions: three questions carrying 9 marks each tobe set two to be attempted (Word limit 250 words).

iii Long answer type questions: Five questions carrying 14 marks each tobe set three to be attempted (Word limit 750 words).

18 Hours	**FUNDAMENTALS OF CHEMICAL ANALYSIS**: Quantitative and Qualitative analysis; Sensitivity and Selectivity of Analytical methods; Sampling; Accuracy & precision; Standard Deviation; Calibration curve and Correlation Coefficient; linear regression;, student 't' test, Analysis of Variance (ANOVA).
18 Hours	**CHROMATOGRAPHY :** Theory of Chromatography , Retenation time. Capacity factor . Number of tneoretical plate and plate height. Band broadening .Van Deemater equatin . Column resolution. Gas Chromatography . Instrumentation Columns .Detection . flame ionization detector, thermal conductivity detector and mass spectrometric detector. High Performance Liquid Chromatography. Instrumentation .Pumping Systems. Sample injection system Columns. Detection .UV-Vis detector, Photodiode array detector, fluorescence detector , refractive index detector and mass spectrometric detection. Capillary Electrophoresis. Principle , mode of operation , and instrumentation.
18 Hours	**ION EXCHANGE :** Basic features of ion exchange reactions; Ion exchange resins and their classification; action of ion exchange resins; Factors affecting the selectivity of ion exchange resin ;Strongly and weakly basic anion exchanger .Liquide ion exhangers, Ion chromatography.Conductivity detection using suppressor column .
18 Hours	**SOLVENT EXTRACTION :** The Distribution Coefficient . Factors favouring solvent extraction .Extraction reagents . Synergetic effects. Ion –pair exchange. Extraction and stripping .Solvent extraction with crown ethers and factors influencing it .
18 Hours	**SPECTROSCOPIC TECNIQUES :** Principle, General layout of instrument and applications of: Flame Photometry; Atomic Absorption Spectroscopy (AAS); Fluorescence Spectroscopy; Nephelometry &Turbidometry.
RECOMENDE READINGS:	1. Vogel's Textbook of Quantitative Chemical Analysis, G.H.Jeffery, J.Bassett, J. Mendham and R.C. Denney, Publ ELBS, Longman, UK 2. Basic Concepts of Analytical Chemistry, S. M. Khopkar, Wiely Eastern. 3. Fundamentals of Analytical Chemistry, D.A. Skoog, D.M. West and F.J. Holler. Publ. W B Saunders. 4. Analytical Chemistry, G.D. Christian, John Willy & Sons.

COURSE OUTCOME

M.Sc. I SEMESTER

COURSE CODE : PD2

PAPER CODE : 111

PAPER : (INORGANIC CHEMISTRY-1 LAB.)

After completion of course the students will able to :-

CO 1. Prepare the solutions for quantitative analysis .

CO 2. Apply the knowledge of quantitative analysis for the determination of metal ions.

CO 3. Understand the principle for qualitative analysis of acid. basic radicals in inorganic mixture.

	CO-1	CO-2	CO-3
PO- 1			
PO-2	✓		
PO-3		✓	
PO-4			
PO-5			
PO-6	✓	✓	
PO-7			
PO-8	✓		
PO-9			
PO-10	✓	✓	✓

M.Sc. CHEMISTRY FIRST SEMESTER			
COURSE CODE: MSC 111		**COURSE TYPE:PD2**	
COURSE TITLE: **INORGANIC CHEMISTRY LAB**			
CREDIT: **THEORY:**	**PRACTICAL:06**	**HOURS:** **THEORY:**	**PRACTICAL:**
MARKS: **THEORY:**	**PRACTICAL:50**	**MARKS** **THEORY:**	**PRACTICAL:**

LABORATORY COURSE -1(INORGANIC CHEMISTRY)

Qualitative analysis of mixture containing eight radicals including some less common metal ion from among the following by common methods (preferably semi –micro)

Basic Radicals Ag, Pb, Hg,Cu, Cd, Bi, As, Sb, Sn, Fe, Al, Cr, Zn, Mn, Co, Ni, Ba, Sr, Ca, Mg, Na, K, NH_4, Ce, Th, Zr, W, Te, Ti, Mo, U, V, Be, Li, Au, Pt

Acid Radicals

Carbonate, Sulphate, Sulphide, Nitrite, Acetate, Fluoride, Chloride, Bromide, Nitrate, Sulphate, Borate, Oxalate, Phosphate, Silicate, Thiosulphate, Ferrocynide, Ferricynide, Chomate, Arsenite, Arsenate, Paramagnate.

Quantitative analysis:- Involving two of the following in ores, alloys or mixture in solution – one by Volumetric and other by Gravimetric method Ag, Cu, Fe, Mn, Zn, Ba, Ca, Wg, chloride, sulphate.

Estimation of :-

(a) Phosphoric acid in commercial orthophosphoric acid.
(b) Boric acid in Borax.
(c) Ammoniun ion in ammonium salt.
(d) MnO_2, in pyrolusite preparation of selected inorganic compounds and study of their properties by various methods including IR, Electronic spectra, Mossbauer, ERS spectra and magnetic susceptibility etc.

(1) $VO(acac)_2$ (2) Cis – K $[Cr(C_2O_4)(H_2O_2)]$

(3) $Na[Cr(NH_3)(SCN)_4]$ (4) $Mn(acac)_3$

(5) $K_3[Fe(C2O4)_3]$ (6) Prussian Blue, Turnbull's Blue

(7) $[Co\ (NH_3)_6][Co(No_2)_6]$ (8) $Hg[Co(SCN)_4]$

(9) $[Ni(NH_3)_6]Cl_2$ (10) $[Cu(NH_3)_4]SO_4H_2O$

(11) $Ni(dmg)_2$ (12) $[Co(Py)_2Cl_2]$

(13) Potassium trioxalato chromate (III) trihydrate

(14) Potassium dioxalato diaqueous chromate (III)

COURSE OUTCOME

M.Sc. I SEMESTER

COURSE CODE : PD-2

PAPER CODE : 112

PAPER: (ANALYTICAL CHEMISTRY -1 LAB.)

After completion of course the students will able to:-

CO 1. Understand various methods for volumetric and gravimetric analysis of various Chemical constituents.

CO2. Evaluate different contaminants I material using Nephelometry, Colorimetry,Flamephotometry.

CO 3. Analyse the errors obtained by estimations.

CO 4. Design chromatographic and titrimetric methods for identification of species

	CO-1	CO-2	CO-3	CO-4
PO- 1				
PO-2	✓			
PO-3		✓	✓	✓
PO-4				
PO-5				
PO-6			✓	
PO-7				
PO-8				
PO-9				
PO-10	✓	✓		✓

M.Sc. CHEMISTRY FIRST SEMESTER

COURSE CODE: PD 112	**COURSE TYPE: PD2**
COURSE TITLE: **ANALYTICAL CHEMISTRY LAB**	
CREDIT: **THEORY: 00 PRACTICAL:06**	**HOURS:** **THEORY: 00 PRACTICAL:**
MARKS: **THEORY: PRACTICAL: 50**	

(1) Error analysis & Statistical data analysis
Error, type of error, minimization of errors, statistical for error analysis-Standard deviation, relative standard deviation, Linear Least Square. Calibration of volumetric apparatus flask, weight box etc.

(2) Volumetric analysis
Basic principles. Determination of iodine, Acid, and saponification values of oil sample. Determination of DO, COD, BOD, Hardness of water samples.

(3) Gravimetric analysis;
Determination of metal ions eg.Ni Cu., etc.by gravimetric methods using organic precipitants such as dimethylglyoxime dithizoe, 8-hydroxyguinoline, etc

(4) Chromatography
Separation of cations and anions by- (a) Paper chromatography (b) Column chromatography.

(5) **pH metry/potentiometry :** Determination of strength of acids etc.

(6) Flame photometry/AA/FIA/Colorimetry
Determination of cations/anions and metal: eg.Na, Fe, Mo, Ni, Cu, Zn, K+, $Ca^{+}{}_{2,}$ $SO_4{}^{2-}$, $NO^{-}{}_{2,}$

(7) **Spectrophotometry** :
Verification of Beer-Lambert Law. Molar absoptivity Calculation,
plotting graph to obtain λ_{max} etc. Effect of pH in aqueous coloured system. Determination of metal ions eg. Fe, Cu, Zn, Pb etc. using inorganic reagent like SCN and organic chelating agent like dithiozone, cuferron, 8-hydroxyquinoline etc. in aqueous/organic phase in the presence of surface active agents.

(8) Nephelometry/ Turbidimetry
Determination of chloride,sulphate,phosphate, turbidity etc.

(9) Application of computer in chemistry
As specified in theory paper in sect II (a)

Polarimetry

(1) Determination of rate constant for hydrolysis/inversion of sugar using a polarimeter.

(2) Enzyme kinetics- inversion of sucrose.

Books suggested

1. Vogel's textbook of Quantitative Analysis ,Bassett, R, C. Denny, G.H. Jeffer and J. Mentham, ELBS
2. Synthesis and Characterization of inorganic compounds, N. L. Jolly, Prentice Hall.
3. Experiments and techniques in organic chemistry, D. Pasto,C. Johnson and M. Miller, Prentice Hall.
4. Macroscale and microscale organic experiments, K.L.Williamson D.C.Health.
5. Systematic qualitative organic analysis ,H. Middleton, Edward Arnold.
6. Handbook of organic analysis-Qualitative and Quantitative, H.Clarke Edward Arnold.
7. Vogel's Textbook of practical organic chemistry, A.R.Tatchel, John Wiley.
8. Practical Physical Chemistry, A.M. James and F.E.Prechard Longman.
9. Findley's Practical Physical Chemistry, B/P Levitt, Longmann.
10. Experimental Physical Chemistry, R.C.Das And B. Behher, Tata Mc Graw Hill.

COURSE OUTCOME
M.Sc. I SEMESTER

COURSE CODE : PD2

PAPER CODE : 104

PAPER : SOCIAL OUTREACH,ENTERPRENEURSHIP &INTERNSHIP

After completion of course the students will able to:-

The course will help students to enhanced the academic skill and responsibilitiestowords society.

M.Sc. CHEMISTRY FIRST SEMESTER	
COURSE CODE: MSC104 PAPER -IV COURSE TYPE: PD2	
SOCIAL OUTRECH SOCIAL OUTREACH, ENTERPRENEURSHIP &INTERNSHIP :- MUSHROOMS CULTIVATION	
CREDIT: 06	**HOURS : 90**
DISTRIBUTION OF MARKS :- **SOCIAL OUTREACH REPORT:-** 40 MARKS, PRESENTATION :-10 MARKS , ENTERPRENEURSHIP &INTERNSHIP –THEORY :-30 MARKS , PRACTICAL:- 20 MARKS	
MUSHROOM CULTIVATION	
18 Hrs	Introduction of Mushroom, Nutritive Value of Mushroom Brief Description of Cultivated Mushrooms in India. Poisonous and Non-Edible Mushroom and about their Misconception.
18 Hrs	Technical Description of Mushroom. Isolation of Mushroom Culture, Mushroom Spawn and Master or Mother Spawn
18 **H rs**	Oyster Mushroom Production: Problems and Solution in Oyster Mushroom production and methods of obtaining higher production. Diseases and Insect of Oyster Mushroom and their control
18 **Hrs**	Method of Marketing of Oyster Mushroom, Commercial production of Oyster Mushroom. Oyster Mushroom preservation method
18 **H rs**	Recipies of Oyster Mushroom, Self Training for becoming Oyster Mushroom Grower, Scope of Oyster Mushroom industry in India , White Button Mushroom production.
SUGGESTED READINGS	1. Bahl,N. 1998 Handbook on Mushroom,4Th Edition oxford and IBH, New Delhi. 2. Bhowmik K.L., Santra S.K. and Nilendri Bhowmik 1994,Mushroom Cultivator Manual, Action Research publication , Kolkata 150p. 3. Chandha, K.L. and Sharma.S.R. 1995 advances in Harticulture Vol.13, Mushroom,Methotra Publishing House, New Delhi 649p. 4. Garcha, H.S. 1984, A Manual of Mushroom Growing PAU publication,Ludhiana, 54p. 5. Kanniayan, S. and Ramaswami K. 1980. A Handbook of Edible Mushroom today and tomorrow. S. Printers and publishers, New Delhi. 6. Kapoor,J.N. 1989, Mushroom Cultivation .ICAR publication, New Delhi 89p. 7. Purkastha, R>P. and ChandraA.1985. Manual of India Edible Mushroom .Today and Tomorrows Printers and publishers , New Delhi 266p.

	8. Quimio S.T. Chang S.T. and royse,D.J. 1995 Technical Guidelines for Mushroom growing in tropics F.A.O. plant production and plant protection paper 106, 155p. 9. Sharma ,S.R. and Mohta, K.B. 1991 Bibliography of Mushroom Research in India MCMRT publication , Solam , 214p. 10. Tewari,S.C. and P.Kapoor, 1988, Mushroom Cultivation.An Economic analysisOxford & IBH publication New Delhi 28p. 11. Kumar,S., T.R. Shandilya and R.S. Choudhary 1989, Khumb Ki Kheti Directorate of Extension Education , U.H.F. Solam ,72p. 12. Gupta, Yash and B.Vijay 1992, Shwet Button Khumb ka Utpadan, NCMRTSolam publication, 72p. 13. Shandilya, T.R. Kumar and P.K. Seth Khumbi ki Kheti ICAR publicationNew Delhi, 153p. 14. Singh, S.K. and K.L. Ozha 2002. Mushroom Utpadan avam Prabandhan Kalyanipublishers, Ludhiyana,174p. 15. Tripathi,D.P. and H.P. Shukla, 2003. Mushroom Ki Kheti, Rama Publishing House , Meerut. 223p.

COURSE OUTCOME

M.Sc. I SEMESTER
COURSE CODE : PD2
PAPER CODE : 105

PAPER : V- CONSTITUTIONALISM &INDIAN POLITICAL SYSTEM

After completion of course the students will able to:-

CO 1. Understand the making of Indian constitution along with the debates of constituent assembly.

CO 2. Acquire the knowledge of various constitution statutory bodies.

CO 3. Describe the working of election commission and election rocess.

CO 4. Analyse the division of power between various organs of the governmentat different level .

	CO-1	CO-2	CO-3	CO-4
PO- 1	✓			
PO-2		✓		
PO-3		✓		
PO-4	✓			
PO-5	✓			
PO-6				✓
PO-7				
PO-8			✓	
PO-9		✓		✓
PO-10				

M.Sc. CHEMISTRY FIRST SEMESTER

COURSE CODE: MSC105 COURSE TYPE: PD2

COURSE TITLE:CONSTITUTIONALISM & INDIAN POLITICAL SYSTEM

CREDIT: 06	**HOURS : 90**
THEORY: 06	**THEORY: 90**

MARKS : 100
THEORY: 70 CCA : 30

Scheme of marks:

i.Short answer type questions: three questions carrying 5 marks each to be asked two to be attempted (Word limit 100 words).
ii. Middle answer type questions: three questions carrying 9 marks each to beset two to be attempted (Word limit 250words).
iii.Long answer type questions: Five questions carrying 14 marks each to be set three to be attempted (Word limit 750 words).

12 Hrs	**Unit- I:** Meaning: Constitution, Constitutional government & constitutionalism; Difference between Constitution & Constitutionalism; Constitutionalism: Basis, Elements, Features & future. Forms of Government: Democracy & Dictatorship, Unitary & Federal, Parliamentary & Presidential form. Ideals of the Indian Constitution incorporated in the Preamble. Special Features of the Indian Constitution.
24 Hrs	Unit-II: Concept of State and Citizenship, Judicial Review and Fundamental Rights, Directive Principles of the State Policy, Fundamental Duties, Procedure to Amend the Indian Constitution, Judiciary: Supreme Court and High Court, Judicial Activism and Public Interest Litigation and Provisions relating to Emergency.
10 **Hrs**	**Unit-III:** Union Executive- President, Prime Minister, Council of Ministers. State Executive- Governor, Chief Minister and Council of Ministers. Local Bodies &Panchayati Raj
24 **Hrs**	Unit-IV: Parliament of India, State Legislatures, Legislative Bills: Ordinary, Money and Financial, Union State Relations, Principles of the 'Separation of Power and the 'Principles of Check & Balance'. Political Parties and Pressure Groups. Challenges before Indian Democracy: Terrorism, Regionalism, Communalism, *Linguistics* and National Integration.
20 **Hrs**	**Unit-V:** Controller & Accountant General of India, Solicitor General, Advocate General, Election Commission, Union and State(s) Public Service Commission, Finance Commission.
SUGGESTED READINGS	HOBBES, Thomas, The Leviathan, Chapters XIII & XVII [entry] LOCKE, John, The Second Treatise of Civil Government, Chapter IX [entry] ROUSSEAU, Jean-Jacques, The Social Contract or Principles of Political Right MONTESQUIEU, The spirit of the laws, RAZ, Joseph, "The rule of law and its virtue", in The authority of law, Oxford University Press, 1979 Dicey on British constitution P. Ishwara Bhat Inter-relationship between Fundamental Rights M P Jain Indian Constitutional Law H M Seervai Constitutional Law of India V N Shukla Constitution of India D DBasu Shorter Constitution of India B Sivarao Constitutional Assembly Debates J. V R Krishna Iyer Fundamental Rights and Directive Principles Paras Diwan Human Rights and the Law P K Tripathi Some Insight into Fundamental Rights S P Sathe Fundamental Rights and Amendment to the Constitution P B Gajendragadkar Law, Liberty and Social Justice David Karrys Politics of Law

COURSE OUTCOME
M.Sc. I SEMESTER
COURSE CODE : PD2
PAPER CODE : 106

PAPER : V GROUP THEORY,SPECTROSCOPY AND DIFFRACTION METHODS

After completion of course the students will able to:-

CO 1. Understand diffraction techniques to elucidate the structure of solids.

CO 2. Acquire depth knowledge in group theory and molecular spectroscopy .

CO 3.Understand concepts of NMR & ESR spectroscopy & apply the concept forstructural elucidation.

CO 4. Apply the concepts of photoelectron spectroscopy to simple molecules.

	CO-1	CO-2	CO-3	CO-4
PO- 1		✓		
PO-2				✓
PO-3	✓			
PO-4				
PO-5				
PO-6		✓	✓	
PO-7				
PO-8	✓			
PO-9				
PO-10	✓	✓	✓	✓

M.Sc. CHEMISTRY FIRST SEMESTER		
COURSE CODE: MSC 106	**COURSE TYPE: PD2**	
COURSE TITLE: **GROUP THEORY, SPECTROSCOPY AND DIFFRACTION METHODS**		
CREDIT: **THEORY: 6**	**PRACTICAL:**	**HOURS:** **THEORY: 90** **PRACTICAL: 00**
MARKS: **THEORY: 70+30**	**PRACTICAL:**	**MARKS** **THEORY:** **PRACTICAL:**

Scheme of marks:

i. Short answer type questions: three questions carrying 5 marks each to beasked two to be attempted (Word limit 100 words).

ii Middle answer type questions: three questions carrying 9 marks each to beset two to be attempted (Word limit 250 words).

iii Long answer type questions: Five questions carrying 14 marks each to beset three to be attempted (Word limit 750 words).

18 Hours	**Diffraction Techniques :** Miller indices; X-ray diffraction – Bragg Law, Laue method; Debye-Scherrer method of X-ray structural analysis of crystals; Index reflections; Identification of unit cells from systematic absences in diffration pattern; X-ray diffration method for Identification of crystalline compound.
18 Hours	***Group Theory:*** Symmetry elements and symmetry operation, definitions of group,subgroup, Group and subgroup. Schonflies symbols, representations of groups bymatrices (representation for the Cn, Cnv, Cnh, Dnh etc. groups to be worked outexplicitly.). Character of a representation. The great orthogonality theorem (withoutproof) and its importance. Character tables and their use in spectroscopy
17 Hours	**Photoelectron Spectroscopy :** Photo-electric effect, ionizagtion process, Koopman's theorem. Photoelectron spectra of simple molecules. Electronically excited states: Fluorescence, phosphorescence and Chemiluminscence; Fluorescence Spectroscopy: Principle, basic instrumentation and Applications.
19 Hours	**Nuclear Magnetic Resonance Spectroscopy (NMR**): Theory of NMR: Nuclear spin, nuclear resonance, saturation, shielding of magnetic nuclei, deshielding; Chemical Shift and its measurements, factors influencing chemical shift; Spin-spin interactions, factors influencing coupling constant 'J' Spin decoupling; Instrument –basic ideas; Applications of NMR; Basic idea of 13C NMR and FT NMR, advantages of FT NMR.
18 Hours	**Electron Spin Resonance Spectroscopy(ESR):** Basic principle: zero field splitting, factors affecting the 'g' value. Isotropic and anisotropic hyperfine coupling constants, spin Hamiltonian, spin densities, Measurement techniques, ESR instrumentation and applications.
RECOMENDE READINGS:	1. Modern Spectroscopy, J.M.Hollas, John Wiley. 2. Applied Electron Spectroscopy for Chemical Analysis Ed. H. Windawi and F.L.Ho, Wiley Interscience. 3. NMR, NQR, EPR and Mossbauer Spectroscopy in Inorganic Chemistry, R.V.Parish, Ellis Harwood. 4. Physical Methods in Chemistry, R.S.Drago, Saunders College. 5. Chemical Applications of Group Theory. F.A. Cotton 6. Indroduction to Molecular Spectroscopy, G.M.Barrow, McGraw Hill 7. Basic Principles of Spectroscopy. R. Chang, McGraw Hill 8. Theory and Applications of UV Spectroscopy, H.H.jaffe and M. Orchin, IBHOxford. 9. Introduction to Photoelectron Spectroscopy, P.K.Ghosh, John Wiley 10. Introduction to Magnetic Resonance, A. Carrington and A.D.Maclachalan, Harper & Row. 11. Principles of Instrumentation Analysis, D.A. Skoog and J.J.LearyPubl Saunders, USA

COURSE OUTCOME
M.Sc. I SEMESTER
COURSE CODE : PD2
PAPER CODE : 107
PAPER : V COMPUTER PROGRAMMING IN CHEMISTRY

After completion of course the students will able to :-

CO 1. Understand fundamentals of programming .

CO 2. Critically assess the applicability of computational methods to specificproblems in chemistry.

CO 3. Successfully apply appropriate computational techniques in their academic & scientific careers.

CO 4. Hands on training in context of currently available computational chemistry software & high Performance computer hardware.

CO 5. Develop computational thinking (ability to translate vast data in to abstract concepts and to understand data based reasoning).

	CO-1	CO-2	CO-3	CO-4	CO-5
PO- 1					
PO-2					
PO-3	✓		✓	✓	
PO-4					
PO-5		✓			
PO-6				✓	
PO-7		✓			✓
PO-8					
PO-9					
PO-10	✓	✓	✓	✓	✓

M.Sc. CHEMISTRY FIRST SEMESTER			
COURSE CODE: MSC 107		**COURSE TYPE: PD2**	
COURSE TITLE: **COMPUTER PROGRAMMING IN CHEMISTRY**			
CREDIT: **THEORY: 6**	**PRACTICAL:**	**HOURS:** **THEORY: 90**	**PRACTICAL: 00**
MARKS: **THEORY: 70+30**	**PRACTICAL:**	**MARKS** **THEORY:**	**PRACTICAL:**

Scheme of marks:

i. Short answer type questions: three questions carrying 5 marks each to beasked two to be a

Middle answer type questions: three questions carrying 9 marks each to beset two to be attempted (Word limit 250 words).

ii Long answer type questions: Five questions carrying 14 marks each to beset three to be attempted (Word limit 750 words).

18 Hours	**Fundamentals of Programming** Generation for Computer Languages, Principles of Programming : Algorithm, Pseudo code and flowchart
18 Hours	**Introduction to C and Programming:**Constants, variables, operators and expressions, data input and output, format specifications,control statements, nesting of loops, arrays and subscripted variables, functions and subroutines.
19 Hours	**Numerical Analysis*:*** Data fitting by least square, Newton–Raphson and iterative methods for solving non-linearequations; Linear simultaneous equations - Cramer's rule, Gauss elimination method and Gauss-Seidel method; Numerical integration – interpolation, Gauss's quadrature formula; trapezoidalmethod, Simpson's 1/3rule.
20 Hours	**Development of small computer codes:** Involving simple formula in Chemistry such as vender Wall equation, pH titrations, Kinetics radioactive decay, evaluation of lattice energy and ionic radii, Secular equation (within Huckel theory), Elementary structural features such as bond length, bond angles, di-hedral angles etc. of molecule extracted from a data base such as Cambridge data base.
15 Hours	**Introduction and use of computer packages:** MS Word and Excel, preparation of graphs and charts
RECOMENDE READINGS:	1. W. E. Mayo & M. Chiakala. Programming with FORTRAN 77, chaum's Outline Series, New Delhi (1995). 2. E. Balagurusamy. Computer Oriented Statistical and Numerical Methods, Macmillan India Ltd. (1988). 3. A. C. Norris. Computational Chemistry: An Introduction to Numerical Methods, John Wiley, New York (1981).

COURSE OUTCOME

M.Sc. I SEMESTER

COURSE CODE : PD2

PAPER CODE : 108

PAPER : V (MEDICINAL CHEMISTRY)

After completion of course the students will able to:-

CO 1. Recall the basics of drug receptor interactions & types of receptors.

CO 2. Understand the mechanism of action of drugs based on physic chemical factors& mode of synthesis of selected drugs.

CO 3. Analyse mechanism pathways of different class of medicinal compounds to learn indepth about the clinical application & current trends of antibiotics and macrolides.

CO 4. Apply their knowledge in proper usage of drugs based on their mechanism ofaction& SAR.

CO 5. Evaluate correlation between pharmacology of a disease & its mitigation of cure.

CO 6. Design & synthesis new drugs based on the knowledge acquired on the existing drugs .

	CO-1	CO-2	CO-3	CO-4	CO-5	CO-6
PO- 1					✓	
PO-2	✓					
PO-3						✓
PO-4						
PO-5				✓		
PO-6			✓			
PO-7						
PO-8		✓				
PO-9						
PO-10	✓	✓	✓	✓	✓	✓

M.Sc. CHEMISTRY FIRST SEMESTER

COURSE CODE: MSC 108 PAPER-V COURSE TYPE: PD2

COURSE TITLE:

MEDICINAL CHEMISTRY

CREDIT: **THEORY: PRACTICAL:** **6**	**HOURS:** **THEORY: PRACTICAL:** **90 00**
MARKS: **THEORY: PRACTICAL:** **70+30**	**MARKS** **THEORY: PRACTICAL:**

SCHEME OF MARKS:

i. Short answer type questions: three questions carrying 5 marks each to be asked two to be attempted (Word limit 100 words).

ii. Middle answer type questions: three questions carrying 9 marks each to be set two to be attempted (Word limit 250 words).

Iii Long answer type questions: Five questions carrying 14 marks each tobe set three to be attempted (Word limit 750 words).

16 Hours	**DRUG DESIGN** Development of new drugs, Procedures followed in drug design. Structure Activity Relationship (SAR) of morphines and Penicillins. Physico – chemical parameters: Lipophilicity, partition coefficient, electronic ionization constants, Quantitative Structure Activity Relationship. Free – Wilson analysis, Hansch analysis, relationships between – Wilson and Hansch analysis – case study. Cocepts of drug receptors. Elementary treatment of Drug receptor interactions.
16 Hours	**PHARMACOKINETICS :** Introduction to drug absorption, disposition,elimination using pharmacokinetics, important pharmacokinetic parameters in defining drug disposition and in therapeutics. Mention of uses of pharmacokinetics in drug development process.
18 Hours	**ANTINEOPLASTIC AGENT :** Introduction, cancer chemotherapy, special problems, role of Alkylating agents and antimetabolites in treatment of cancer. Mention of carcinolytic antibiotics and mitotic inhibitors. Synthesis of mechlorethamine, cyclophosphamide. melphalan, uracil, mustards, and 6-mercaptopurine. Recent development in cancer chemotherapy. Hormone and natural Products.
22 Hours	**DRUG SYNTHESIS :** Synthesis of the following drugs a. Anxiolytics – Benzodiazepines , b. Neuroleptics – Phenothiazines, c. Hypnotics and Sedatives – Piperidinediones, d. Local anesthetics – Aminobenzoic acid and its derivatives, e. Anti – coagulants – 1,3 – Indanedione derivatives, f. Hypoglycemic agents – Sulfonyl ureas, g. Antihistaminic agents – Ethylenediamine derivatives, h. Antimalarials – Aminoquinolines, i. Analgesics and Antipyretic Paracetamol, Phenylbutazone., j. Anti – inflammatory – Diclofanac
18 Hours	**CARDIOVASCULAR DRUGS :** Introduction, cardiovascular diseases, drug inhibitors of peripheral Sympathetic function, central intervention of cardiovascular output. Direct acting arteriolar dilators. Synthesis of anyl nitrate, sorbitrate, diltiazem, quinidine, verapamil, methyldopa , atenolol, oxyprenonol.
RECOMENDE READINGS:	1. Balsam and Sargarin, Cosmetics Science and Technology 2. Wilson and Gisvold's, Text Book of Organic Medicinal and Pharmaceutical Chemistry, Ed Robert F.DOrge 3. RashmiSanghi and MM, Green Chemistry – Environment Friendly Alternatives, Srivastavasa, Narosa Publishers, New Delhi 4. Hougen, O.A., K.M. Watsen, and R.A. Ragartz, Chemical Process Principles, Part – I, John Wiley and Asia Publishing Co.,1975 5. Graham L. Patrick, An introduction to Medicinal Chemistry, Oxford, Edition II 6. Ilango, K and P. Valentina, Text Book of Medicinal Chemistry, Volume-I, Kreethi Publishers 7. AshutoshKar, Medicinal Chemistry, Edition III, New Age International Publishers. 8. Ishar, M.P.S and Abdul Faruk, Syntheses of Organic Medicinal Compounds, Narosa Publishing House 9. A Gringuage, Introduction to Medicinal Chemistry, Wiley – VCH 10. Wolff, M.E., Burger's Medicinal Chemistry and Drug Discovery, Vol-I (Chap 9 & 14), Ed., John Wiley 11. Goodmann and Gilman's Pharmacological Basis of Therapeutics, McGraw Hill. 12. Wilson and Gisvold's Text book of Organic Medicinal and Pharmaceutical Chemistry, Ed Robert F. Dorge

SECOND SEMESTER

COURSE OUTCOME

M.Sc. II SEMESTER

COURSE CODE : PD2

PAPER CODE : 201

PAPER : I (INORGANIC CHEMISTRY -2)

After completion of course, the students will have :-

CO1. A comprehensive knowledge of electronic spectra and magnetic properties of transition metal complexes.

CO2. A critical understanding of spectroscopic ground states, Orgel and Tanabe-Sugano diagrams, optical activity, magnetic exchange coupling , spin crossover, electron transfer and how spectral bands obtained from metal complexes..

CO3. An ability to compare and contrast metal clusters such as higher boranes , carboranes, metalloboranes , as well as homogeneous and heterogenous catalysis by organometallic compounds.

CO4. A critical inclination of bioorganic chemistry in biological systems as transport proteins, oxygen carriers, metalloenzymes, iron –sulphur protein and role of metals ions in functioning of biological processes.

CO5. Analysis of complexes and its stability thermodynamic aspects of complex formation and factors. HSABprovide information about nature of metal ligand complex formation and various stereochemical aspects.

CO6. To apply inorganic complexes which have major application in industrial processes, chemical synthesis and anticancerous drugs.

	CO-1	CO-2	CO-3	CO-4	CO-5	CO-6
PO- 1				✓		
PO-2				✓		
PO-3	✓				✓	
PO-4						
PO-5						
PO-6			✓		✓	✓
PO-7						
PO-8		✓				
PO-9						
PO-10	✓	✓	✓	✓	✓	✓

M.Sc. CHEMISTRY SECOND SEMESTER			
COURSE CODE: MSC 201	**PAPER-I**	**COURSE TYPE:PD2**	
COURSE TITLE:	**INORGANIC CHEMISTRY-2**		
CREDIT:		**HOURS:**	
THEORY:	**PRACTICAL:**	**THEORY:**	**PRACTICAL:**
6		**90**	**00**
MARKS:		**MARKS**	
THEORY:	**PRACTICAL:**	**THEORY:**	**PRACTICAL:**
70+30			

Scheme of marks:

i. Short answer type questions: three questions carrying 5 marks each to be asked two to be attempted (Wordlimit 100 words).

ii. Middle answer type questions: three questions carrying 9 marks each to be set two to be attempted (Word limit 250 words).

iii. Long answer type questions: Five questions carrying 14 marks each to be set three to be attempted (Word limit 750 words).

24 Hours	**ELECTRONIC SPECTRA AND MAGNETIC PROPERTIES OF TRANSITION METAL COMPLEXES** Spectroscopic ground states, correlation,Orgel and Tauble-Sugano diagrams for transition metal complexes(d1 to d9 states), calculation of Dq B and P parameters, charge transfer spectra, spectroscopic method of assignment of absolute configuration in Optically active metal chelates and their stereochemical information, anomalous magnetic moments, magnetic exchange coupling and spin crossover.
15 Hours	**METAL CLUSTURES** Higher Boranes, Carboranes, Metalloboranes and Metallocarboranes,Metal Carbonyl and halide clusters, compounds with metal metal multiple bonds.
18 Hours	**Homogenous and Heterogenous Catalysis By Organometallic Compounds :** Properties, types of reactions, isomerisation Wacker oxidation, Hydroformylation water gas shift reaction, Template synthesis Zeigler Natta polymerization of olefins Fischer Tropsch Process.Transition metal Compouds with bonds to hydrogen , silicon, broron C-60 or Buckminsterfullerene
15 Hours	**BIOINORGANIC CHEMISTRY** Transport proteins: Oxygen carriers, metalloenzymes, carboxy peptidase, carbonic anhydrase, redox process, iron-sulphur proteins, chlorophyll, salient features of the photo synthetic process, vitamin B12 role of sodium, potassium, calcium, zinc and copper; fixation of nitrogen, nitrogen cycle. Anti-cancer drugs and their mechanism of action, Natural and man made radio isotopes and their application.
18 Hours	**COORDINATION CHEMMISTRY** Stability of complexes, thermodynamic aspects of complex formation, factors affecting stability. HSAB APPROACH.Detarmination of stability constant by spectrometric, polarografic, potentiometric methods. Stereochemical aspects – Stereoisomerism in inorganic complexes, isomerism arising out of ligand and ligand confirmation, chirality and nomenclature of chiral complexes, optical rotator dispersion and circular dichroism.

RECOMENDE READINGS:	1. A.R. West, Basic solid state chemistry, John Wiley, (1991). 2. S. Glasstone, Source Book on Atomic Energy, Van Nostrand Co., (1969). 3. G. Frielander, J.w. Kennedy and J.M. Miller, Nuclear and Radiochemistry, John Wiley and Sons, (1981). 4. Hari JeevanArnikar , Essentials of nuclear chemistry, New Age International (P) Ltd., (2005). 5. Hari JeevanArnikar,Nuclear Chemistry Through Problems, New Age International (P) Ltd., (2007). 6. G.T. Seaborg, Transuranium elements, Dowden Hitchinson and Ross, (1978). 7. NishitMathur, Nanochemistry, RBSA publishers (2010). 8. Patric Salomon, A hand book on Nano Chemistry, Dominant publishers and distributors (2008). 9. G.B. Sergeev ,Nanochemistry ,Elsevier Science and Technology (2007). 10. U. Saityanarayana, Essentials of Biochemistry, Books and Allied (P) Ltd.,

COURSE OUTCOME

M.Sc. II SEMESTER

COURSE CODE: PD2
PAPER CODE : 202
PAPER : II (ORGANIC CHEMISTRY -2)

After completion of course, the students will able to :-

CO1. Understand the concept of various addition to C-C, hetero-multiple bonds, electrophilic and nucleophili reactions which are important part of organic synthesis.

CO2. Explain the mechanisms of different redox reactions which play key role in conversion of various organic compounds.

CO3. Compare and contrast oxidation, reduction, rearrangement reactions and rank the organic compounds in order to their oxidation level and structural isomer to form new compound.

CO4.Analyze molecular rearrangements and another aspects to form different scaffolds through mechanism, generate divers heterocyclic compounds through chemical transformation.

CO5. Evaluate the various aspects of content studying the growth and development of organic compounds and to appraise identification analysis with their structural mechanism.

CO6.Develop possible thermodynamic and kinetic approach in determination of energy states, intermediate, steric and isotope effects.

CO7. Create mechanisms to synthesize all kinds of natural products, heterocyclic compounds, vitamins steroids and drugs.

	CO-1	CO-2	CO-3	CO-4	CO-5	CO-6	CO-7
PO- 1		✓					
PO-2	✓				✓		
PO-3							✓
PO-4							
PO-5							
PO-6			✓	✓			
PO-7		✓					
PO-8	✓					✓	
PO-9							
PO-10					✓	✓	✓

M.Sc. CHEMISTRY SECOND SEMESTER			
COURSE CODE: MSC 202 PAPER-II		**COURSE TYPE: PD2**	
COURSE TITLE: **ORGANIC CHEMISTRY-2**			
CREDIT: **THEORY: 6**	**PRACTICAL:**	**HOURS:** **THEORY: 90**	**PRACTICAL: 00**
MARKS: **THEORY: 70+30**	**PRACTICAL:**	**MARKS** **THEORY:**	**PRACTICAL:**

Scheme of marks:

i. Short answer type questions: three questions carrying 5 marks each to be asked two to be attempted (Wordlimit 100 words).

ii. Middle answer type questions: three questions carrying 9 marks each to be set two to be attempted (Word limit 250 words).

iii. Long answer type questions:Five questions carrying 14 marks each to be set three to be attempted (Word limit 750 words).

19 Hours	**ADDITION TO CARBON - CARBON AND CARBON – HETERO MULTIPLE BONDS** Electrophilic, nucleophilic and neighbouring group participation mechanisms - addition of halogen and nitrosyl chloride to olefins. Hydration ofolefins and acetylenes.Hydroboration, hydroxylation, Michael addition, 1, 3 - dipolar additions, Carbenes and their additions to double bonds -Simon - Smith reaction. Mannich, Stobbe, Darzen, Wittig, Wittig - Horner and Benzoin reactions. Stereochemical aspects to be studied wherever applicable. Carbenes and nitrenes : Methods of generation , structure, addition reactions with alkenes - insertion reactions.
19 Hours	**OXIDATIONS AND REDUCTIONS** Mechanism - study of the following oxidation reactions - oxidation of alcohols - use of DMSO in combination with DCC or acetic anhydride in oxidising alcohols - oxidation of methylene to carbonyl, oxidation of aryl methenes - allylic oxidation of olefins. Ozonolysis - oxidation of Olefinic double bonds and unsaturated carbonyl compounds-oxidative cleavage of C-C bond. Reduction: Selectivity in reduction of 4-t-butylcyclohexanone using selected hyrides.Hydride reductions - reduction with LiAlH4, NaBH4, tritertiarybutyloxy aluminium hydride, sodium Cyanoborohydride, trialkyltin hydride, hydrazines.
16 Hours	**MOLECULAR REARRANGEMENTS** A detailed study with suitable examples of the mechanism of the following rearrangements: Pinacol - Pinacolone (examples other than tetramethylethylene glycol) - Wagner - Meerwein, Demjanov, Dienone - phenol, Favorski, Baeyer - Villiger, Wolf, Stevens (in cyclic systems) and Von Richter rearrangements.

20 Hours	**NATURE OF BONDING AND REACTION MECHANISM** Aromaticity in benzenoid and non-benezoid compounds, alternant and non-alternant hydrocarbons, Huckel's rule, energy level of molecular orbitals, anulenes, antiaromacity and aromaticity, homoaromaticity. PMO approachTypes of mechanisms, types of reactions, Thermodynamic and kinetic requirements, kinetic and thermodynamic control, Harmond's postulate, Cutin Hammet Principle, Potential energy diagram, transition energy states and intermediates, methods of determining mechanism, isotope effects. Effect of structure on reactivity- resonance and field effects, steric effects, Hammet equation, substituent and reaction constants.
16 Hours	**REACTION INTERMEDIATES** Generation,structure,stability and reactivity of carbocation carbanion free redicals , carbens nitrens nitrenes benzynes. Application of NMR in detection of carbocations

RECOMENDE READINGS:	1. E.S. Gould,Structure and Mechanism, 2. Francis A. Carey and Richard J, Sundberg, Advanced Organic Chemistry - Part B,3rdEdition (1990). 3. H.O. House, Modern Synthetic Reactions,The Benjamin Cummings Publishing Company, London (1972). 4. I.L.Finar, Organic chemistry, Vol.I and II, 5th Edition, ELBS Publication. 5. J. March,Advanced organic reaction mechanism and structure, Tata McGraw Hill. 6. Mc Murry,Advanced organic chemistry, Thomas Pvt. Ltd., 7. Michael B. Smith, Organic Synthesis, McGraw Hill, International Edition(1994). 8. Michael Smith,Organic synthesis. 9. Michael Smith,Organic synthesis. 10. Parmer and Chawla, Organic reaction mechanisms, S. Chand and Co., 11. Paul de Mayo,Molecular Rearrangements, Vol. I and II. 12. R.E. Ireland, Organic synthesis,Prentice Hall of India 13. R.O.C. Norman, Principles of organic synthesis, Chapman and Hall, London. 1980. 14. Raymond K. Mackie and David M. Smith,Guide book to Organic synthesis, ELBS Publication. 15. S.M. Mukherji and S.P. Singh,Organic Reaction Mechanism, MacMillan India Ltd., Chennai (1990). 16. Stuart Warren, Work book for organic synthesis, The Disconnection Approach,John Wiley & Sons (Asia) Pvt. Ltd., 17. W. Carruther, Jain Coldham, Modern Methods of organic synthesis, IV Edition. 18. W.Carruthers,Some Modern Methods of Organic Synthesis,IIIEdition,Cambridge University Press, (1993).

COURSE OUTCOME
M.Sc. II SEMESTER
COURSE CODE : PD2
PAPER CODE : 203

PAPER : III (PHYSICAL CHEMISTRY)

After completion of course, the students will able to :-

CO1. Critical understanding the concept of recapitulation, width, intensity of spectral lines, rotational and Raman spectra of di- and poly-atomic molecules.

CO2. Discuss the fourier transform signal processing , image processing , heat distribution , mapping wave simplification differaction and radiation measurement.

CO3. Explain Raman and electronic spectroscopy which gives information about rotation, vibration polarization, coarse, fine and electronic structure of molecules.

CO4. Compare and contrast neutron and electron diffraction which elaborate scattering of neutrons,magnetic scattering, scattering angles structure determination of solid and liquid and gas phase molecules .

CO5 .Analyse the quantum chemistry which continues to show its value in supporting and interpretation experimental spectroscopic data predict arrangement of electron, rates of chemical reaction and physical properties of molecules.

CO6. Evaluate selected technological application of surface chemistry that plays an indispensable role in adsorption, capillary action estimation of surface area, micellization and catalytic activity.

CO7. Apply these spectroscopic techniques in structure determination, elucidation and identification of compounds which is useful in science, engineering and throughout modern industrialization.

	CO-1	CO-2	CO-3	CO-4	CO-5	CO-6	CO-7
PO- 1	✓	✓					
PO-2	✓		✓		✓		
PO-3							
PO-4							
PO-5							
PO-6	✓	✓	✓				
PO-7						✓	
PO-8			✓				
PO-9							✓
PO-10	✓	✓		✓	✓		✓

M.Sc. CHEMISTRY SECOND SEMESTER			
COURSE CODE: MSC 203		**COURSE TYPE: PD2**	
COURSE TITLE:		**PHYSICAL CHEMISTRY**	
CREDIT:		**HOURS:**	
THEORY:	**PRACTICAL:**	**THEORY:**	**PRACTICAL:**
6		**90**	**00**
MARKS:		**MARKS**	
THEORY:	**PRACTICAL:**	**THEORY:**	**PRACTICAL:**
70+30			

Scheme of marks:

i. Short answer type questions: three questions carrying 5 marks each to be asked two to be attempted (Word limit 100 words).

ii. Middle answer type questions: three questions carrying 9 marks each to be set two to be attempted (Word limit 250 words).

iii. Long answer type questions :Five questions carrying 14 marks each to beset three to be attempted (Word limit 750 words).

16 Hours	**Recapitulation** : Width and intensity of spectral transitions, Forier transform,microwave spectroscopy, rotation spectra of di – and poly- atomic molecules,Stark effect. Infra red spectroscopy : Harmonic and an harmonic oscillator, vibrational spectra of di – and poly- atomic molecules, coarse and fine structure, Nuclear spin effect, application
18 Hours	**Raman Spectroscopy** : Introduction, Rotational Raman spectra, Vibrational Raman Spectra, polarization of light and Raman effect, structure elucidation from combined Raman and IR spectroscopy, applications in structure elucidation. **Electronic Spectroscopy of Molecules :** Born – Oppenheimer approximation,electronic spectra of diatomic molecules, vibrational coarse structure, rotational fine structure dissociation energy and dissociation products, electronic structure of Diatomic molecules, molecular photoelectron spectroscopy, application.
16 Hours	**Neutron Diffraction** Scattering of neutrons by solid and liquids, magnetic scattering, measurement techniques. Elucidation of structure of magnetically ordered unit cell. **Electron Differaction** Scattering intensity vs. Scattering angle, Wierl equation, measurement technique, Elucidation of structure of simple gas phase molecules. Low energy electron diffraction and structure of surfaces.
18 Hours	**QUANTUM CHEMISTRY** **a. Introduction to Exact Quantum Mechanical Results** The Schrodinger equation and the postulates of Quantum mechanics.Discussion of solution of the Schrodinger equation to some model system viz. particle in a box, the harmonic oscillator, the rigid rotor, the hydrogen atom **b.Approximate Methods** The variation theorem, linear variation principle. Perturbation theory (first order and non degenerate). Applications of variation method and Perturbation theory to the Helium atom. **b. Angular momentum** Ordinary angular momentum, generalized angular momentum, eigen unction for angular momentum, eigenfuvalues of angular momentum, operator using ladder operators, addition of angular momenta, spin, antisymmetry
22 Hours	**SURFACE CHEMISTRY** **a. Adsorption** Surface tension , capillary action , Pressure difference across curved surface (Laplace equation), vapour pressure of droplets (Kelvin equation), Gibbs adsorption isotherm, estimation of surface area (BET equation), surface films on liquids (Electro Kinetic phenomenon), catalytic activity at surface. **b. Micelles** Surface active agents, classification of surface active agents, micellization, hydrophobic interaction, critical micellar concentration (CMC),factors affecting the CMC of surfactants, counter ion binding to micelles, thermodynamics of micellization – phase separation and mass action models, Solubilization, micro emulsion, reverse micelles.
RECOMENDE READINGS:	1. Fundamentals of molecular spectroscopy : C.N. Banewell and E.Mc. Cash(Fourth edition). 2. Physical chemistry, P. W. Atkins, ELBS 3. Introductions to quantum chemistry – A.K. Chandra, Tata McGraw Hill 4. Quantum chemistry – Ira N. Levine, prentice hall. 5. Micelles, Theoretical and applied Aspects - V. Moroi, Plenum. 6. Chemical applications of radioisotopes – H.J. M. Brown Buffer & JammerLtd.

COURSE OUTCOME
M.Sc. II SEMESTER
COURSE CODE : PD2
PAPER CODE : 211

PAPER : (ORGANIC CHEMISTRY LAB)

After completion of course, the students will able to :-

CO1. Learn qualitative analysis, purification and identification using TLC,chromatography, chemical test and IR spectra.

CO2. Synthesize organic compounds via different steps and procedures such asacetylation, oxidation, Aldol condensation and Sandmeyer reaction.

CO3. Analyze quantitatively by estimation and measurement through classical andadvanced techniques.

	CO-1	CO-2	CO-3
PO- 1	✓	✓	
PO-2	✓		✓
PO-3			
PO-4			
PO-5			
PO-6	✓	✓	✓
PO-7			
PO-8		✓	
PO-9			
PO-10	✓	✓	

M.Sc. CHEMISTRY SECOND SEMESTER			
COURSE CODE:	**MSC21 1**	**COURSE TYPE: PD2**	
COURSE TITLE:	**ORGANIC CHEMISTRY LAB**		
CREDIT: **THEORY:**	**PRACTICAL: 03**	**HOURS:** **THEORY:**	**PRACTICAL:**
MARKS: **THEORY:**	**PRACTICAL:** **50**		

1. Qualitative Analysis :-

Separation purification and identification of binary (one liquid and one solid/both solid) using TCL and column chromatography/ chemical test/IR spectra may be used for function group identification.

Organic synthesis :-

Acetylation : of cholesterol and separation of cholesteryl acetate by column chromatography.

Oxidation : Adipic acid by chromic acid, oxidation of cyclohexanol.

Grignard's reaction : Triphenyl methanol from Benzoic acid.

Aldol condensation : Dibenzalacetone from Benzaldehyde.

Sandmeyer reaction : O-Chloro Toluene from O Toludine, O–chlorobenzoic acid from Anthranilic acid.

Friedic Craft's reaction : p-Benzoylpropanoic acid from succinic anhydride and Benzene.

Aromatic electrophilic substitution : p-nitro aniline from p-bromo aniline.

Two Stage Preparation : p-Bromoacetanilide from aniline via acetanilide, P-nitro acetanalide from aniline via acetanilide Benzoic acid. Product may be characterized by spectral techniques.

2. Quantitative analysis

Determination of the percentage number of hydroxyl groups by acetylation method.

Estimation of amine/phenols using Bromide method or Acetylation method.

Estimation of Carbonyl group by hydrazone method.

Estimation of lycine by titration.

Determination of equivalent weight of carboxyl compounds.

Estimation of carbonyl Group by titration/silver salt method.

COURSE OUTCOME

M.Sc. II SEMESTER

COURSE CODE : PD2

PAPER CODE : 212

PAPER: (PHYSICAL CHEMISTRY LAB)

After completion of course, the students will able to :-

CO1. Give the concept of adsorption by studying surface chemistry and phaseequilibrium of different component system.

CO2. Determine the effect of temperature, concentration, ionic strength, catalyst andrate of reaction.

CO3. Perform conductometry to determine velocity constant, order of reaction, activitycoefficient, weak and strong electrolytes.

CO4. Apply potetiometric and pH metric titrations to determine strength, valency,dissociation and thermodynamic constant.

	CO-1	CO-2	CO-3	CO-4
PO- 1			✓	✓
PO-2	✓			
PO-3		✓		
PO-4				
PO-5				
PO-6	✓	✓	✓	
PO-7				
PO-8	✓		✓	
PO-9				
PO-10				✓

M.Sc. CHEMISTRY SECOND SEMESTER			
COURSE CODE:	**MSC212**	**COURSE TYPE: PD2**	
COURSE TITLE:	**PHYSICAL CHEMISTRY LAB**		
CREDIT: **THEORY:**	**PRACTICAL: 03**	**HOURS:** **THEORY:**	**PRACTICAL:**
MARKS: **THEORY:**	**PRACTICAL:**		

Adsorption :

To study surface tension – concentration Relationship for solution (Gibbs equation)

Phase Equilibria :

(1) Determination of congruent composition and temperature of a binary system (e.g. diphenylamin – benzophenone system)

(2) Determination of glass titration temperature of a given salt (e.g. $CaCl_2$)conductometrically.

(3) To construct the phase diagram for three component system (e.g. chloroform–acetic acid – water).

Chemical Kinetics :

(1) Determination of the effect of (a) change of temperature (b)change of concentration of reaction and catalyst and (c) Ionic strength of the media on the velocity , constant of hydrolysis of an ester / ionic reaction .

(2) Determination of the velocity constant of hydrolysis of an ester/ ionic reaction in miceller media.

(3) Determination of the rate constant for the oxidation of iodide ions by hydrogen peroxide studying the kinetics as an iodine clock reaction.

(4) Determination of the Rate constant of decomposition of hydrogen peroxide by ferric ion.

(5) Determination of the primary salt effect on the kinetics of ionic reaction and testing of the Bronsted relationship (iodide ion is oxidized by persulphate ion .

Solutions

(1) Determination of molecular weight of non-volatile and non-electrolyte/electrolyte by crysoscopic methods and to determine the activity coefficient of an electrolyte.

(2) Determination of the degree of dissociation on of weak electrolyte and study the deviation from ideal behaviour that occurs with a strong electrolyte.

Conductometry

(1) Determination of the velocity constant , order of the reaction and energy of activation for saponification of ethyl acetate by sodium hydroxide conductometrically.

(2) Determination of solubility and solubility product of sparingly soluble salt(eg. $PbSO_4$,$BaSo_4$) conductometrically .

(3) Determination of the strength of strong and weak acids in a given mixture

conductometrically.

(4) Determination of the activity coefficient of zinc ions in the solution of 0.002 M zinc sulphate using Debye Huckel limiting law.

Potentiometers /pH metry;

(1) Determination of Determination of the the strength of halides in a mixture potentiometrically.
(2) Determination of the valency of mercurous ion potentiometrically.
(3) Determination of the strength of strong and weak acid in given mixture using a potentiometer/ pH meter
(4) Determination of temperature dependence of EMF of a cell.
(5) Determination of the formation constant of silver-ammonia complex and stoichiometry of the complex potentiometrically.
(6) Acid-baae titration using a pH meter.
(7) Determination of activity and activity coefficient of electrolyte**.**
(8) Determination of the dissociation constant of acetic acid pH metrically
(9) Determination of the dissociation constant of monobasic/dibasic acids by Albert-Serjeant method.
(10) De termination of thermodynamic constant. G. and S, H for the reaction by e.m.f. method. $Zn+H_2SO_4=ZnSO_4+2H$

COURSE OUTCOME

M.Sc. II SEMESTER

COURSE CODE : PD2

PAPER CODE : 204

PAPER : IV (RESEARCH METHODOLOGY & COMPUTER APPLICATION : BASICS)

After completion of course, the students will able to :-

CO1. Acquire critical understanding the conceptual engagement with research, enables people to see a problem in new area of research, tools of research and sampling techniques.

CO2. Have a Comprehensive knowledge of procedures such as historical, survey, case, comparative experimental etc. that followed in research methodology.

CO3. Give a brief account of the writing research report helpful in documentation of the report with format and style.

CO4. Analyse the data that will help in measurement, editing, coding, classification, tabulation and interpretation of results.

CO5. Apply principles and applications of computer fundamentals such as MS word,MS excel and MS powerpoint etc. in various branches of sciences.

	CO-1	CO-2	CO-3	CO-4	CO-5
PO- 1	✓				
PO-2	✓				
PO-3		✓		✓	✓
PO-4					
PO-5					
PO-6		✓	✓		
PO-7				✓	
PO-8	✓				
PO-9					
PO-10	✓	✓	✓	✓	✓

M.Sc. CHEMISTRY SECOND SEMESTER

COURSE CODE: MSC 204 PAPER-IV COURSE TYPE: PD2

COURSE TITLE:RESEARCH METHODOLOGY & COMPUTER APPLICATION: BASICS

CREDIT: 06	**HOURS : 90**
THEORY: 06	**THEORY: 90**

MARKS : 100
THEORY: 70 CCA : 30

Scheme of marks:

i. Short answer type questions: three questions carrying 5 marks each to be asked two to attempted (Word limit 100 words).

ii Middle answer type questions: three questions carrying 9 marks each to be set two to be attempted (Word limit 250 words).

iii Long answer type questions: five questions carrying 14 marks each tobe set three to be attempted (Word limit 750 words).

UNIT-I 15 Hrs	**CONCEPT OF RESEARCH :** Meaning and characteristics of research , Steps in research process , Types of research i) Basic, applied and action research ii) Quantitative and qualitative research , Areas of research in concern discipline **SELECTION OF PROBLEM FOR RESEARCH :** Sources of the selection of the problem , Criteria of the selection of the problem ,Drafting a research proposal , Meaning and types of variables ,Meaning and types of hypotheses.
UNIT-II 15 Hrs	**TOOLS OF RESEARCH :** Meaning and general information about construction procedure of (i) Questionnaire, (ii) Interview, (iii) Psychological test, (iv) observation (v) Rating scale (vi) Attitute scale and (vii) check list , Advantages and disadvantages of above tools **SAMPLING :** Meaning of population and sample , Importance and characteristics of sample , Sampling techniques - i) Probability sampling : random sampling, stratified random sampling, systematic sampling, cluster sampling ii) Non-probability sampling: incidental sampling, purposive sampling, quata sampling
UNIT-III 15 H	**METHODS OF RESEARCH** Meaning and conducting procedure of following methods of research : Historical method , Survey method , Case study , Causal comparative method , Developmental methods , Experimental methods
UNIT-IV	**TREATMENT OF DATA :** Level of measurements of data , Steps in treatment of data: editing, coding, classification, tabulation, analysis and interpretation of results **WRITING RESEARCH REPORT :**Abstract, Synopsis, Summary, Research paper, Project, Citation and Referencing.

UNIT-V 15 Hrs	**Computer Fundamentals** **Computer System :** Features, Basic Applications of Computer, Generations of computers. **Parts of Computer System :** Block Diagram of Computer System ; Central Processing Unit (CPU) ; Concepts and types of Hardware and Software, Input Devices - Mouse, Keyboard, Scanner, Bar Code Reader, track ball ; Output Devices - Monitor, Printer, Plotter, Speaker ; Computer Memory - primary and secondary memory, magnetic and optical storage devices. **Operating Systems - MS Windows :** Basics of Windows OS ; Components of Windows - icons, taskbar, activating windows, using desktop, title bar, running applications, exploring computer, managing files and folders, copying and moving files and folders ; **Control panel :** display properties, adding and removing software and hardware, setting date and time, screensaver and appearance ; **Windows Accessories :** Calculator, Notepad, WordPad, Paint Brush, Command Prompt, Windows Explorer.
UNIT-VI 15 Hrs	**Office Software Package** **Word Processing - MS Word :** Creating, Saving, Opening, Editing, Formatting, Page Setup and printing Documents ; Using tables, pictures, and charts in Documents ; Using Mail Merge sending a document to a group of people and creating form, letters and label. **Spreadsheet - MS Excel :** Opening a Blank or New Workbook, entering data/Function/ Formula into worksheet cell, Saving, Editing, Formatting, Page Setup and printing Workbooks. **Presentation Software - MS Power Point :** Creating and enhancing a presentation, modifying a presentation, working with visual elements, adding Animations & Transitions and delivering a presentation.
SUGGESTED READINGS	*Agrawal, Y. P. (1988).* ***Better sampling : Concepts, Techniques and Evaluation.*** *New Delhi : sterling Publishers Private Ltd. Best, J. W. (1993).* ***Research in Education*** *(6th ed.) New Delhi : Prentice-Hall of India Pvt. Ltd.* *Broota, K. D. (1992)* ***Experimental design in Behavioral Research*** *(2nd ed.)* *New Delhi : Wiley Eastern Limited.* *Dasgupta, A. K. (1968).* ***Methodology of Economic Research****. Bombay: Asia Publishing House. Edwards, A. L. (1957).* ***Techniques of Attitude Scale construction.*** *New York : Appleton-Contury* *Gall, M. D., Gall, J. P. and Borg, W. R. (2007).* ***Educational Research : An introduction*** *(8th ed.) Coston : Allyn and Bacon.* *Garrett, H. E. & Woodworth, R. S. (1969).* ***Statistics in Psychology and Education****. Bombay : Vakils, Fecffer & Simons Pvt. Ltd.* *Goode, W. J. & Hatt, Paul K. (1952).* ***Methods in Social Research.*** *New York : McGraw-Hill.* *Gopal, M. H. (1964).* ***An Introduction to research Procedure in Social Sciences.*** *Bombay : Asia Publishing House.* *Hillway, T. (1964)* ***Introduction to Research (2nd ed.)*** *Noston : Houghton Miffin.* *Hyman, H. H., et al. (1975****). Interviewing in Social Research.*** *Chicago : University of Chicago Press.* *Kerlinger, F. N. (1983)* ***Foundation of Behavioural Research. (2nd Indian Reprint)*** *New York : Holt, Rinehart and Winston.* *Kothari, C. R. (2007)* ***Research Methodology: Methods & Techniques*** *(3rd ed.)* *New Delhi : Wishwa Prakashan. Fundamentals Of Computers, Dr. P. Mohan, Himalaya Publishing House.* *Microsoft First Look Office 2010, K. Murray, Microsoft Press.* *Fundamental Of Research Methodology And Statistics, Y.K. Singh, New Age International (P) Limited, Publishers.Practical Research Methods, Dr Catherine Dawson, The Essence Of Research Methodology, Jan Jonker & Bartjan Pennink, Springer.*

COURSE OUTCOME

M.Sc. II SEMESTER
COURSE CODE : PD2
PAPER CODE : 205

PAPER : V (ENVIRONMENTAL AND FOREST LAWS)

After completion of course, the students will able to :-

CO1. Understand evolution of forest and wild life laws, importance of forest policy during British Regime, after independence and methods of conservation.
CO2. Explain forest protection act, laws and policies that give information about various acts and rules updated in different years.
CO3. Give the concept of multidisciplinary nature of environment, ecosystem, ecology and factors of degradation.
CO4. Introduce the acts, rules, policies, constitutional provision on environment protection, writ petitions and judicial activism.
CO5. Analyze legislative framework for pollution control laws to control air, water andnoise pollution and waste management.
CO6. Review environmental constitutionalism about fundamental rights to equality, information, life through different articles and acts.

	CO-1	CO-2	CO-3	CO-4	CO-5	CO-6
PO- 1	✓		✓		✓	
PO-2						✓
PO-3	✓	✓	✓	✓	✓	✓
PO-4	✓	✓	✓	✓	✓	✓
PO-5					✓	
PO-6						
PO-7			✓			
PO-8						
PO-9		✓		✓		
PO-10						

M.Sc. CHEMISTRY SECOND SEMESTER

COURSE CODE: MSC205 PAPER-V COURSE TYPE : PD2

COURSE TITLE: ENVIRONMENTAL AND FOREST LAWS

CREDIT: 06	**HOURS : 90**
THEORY: 06	**THEORY: 90**

MARKS : 100
THEORY: 70 CCA : 30

Scheme of marks:

i. Short answer type questions: three questions carrying 5 marks each to be asked two to be attempted (Word limit 100 words).
ii. Middle answer type questions: three questions carrying 9 marks each to be set two to be attempted (Word limit 250 words).
iii. Long answer type questions: Five questions carrying 14 marks each to be set three to be attempted (Word limit 750 words).

18 Hrs	**EVOLUTION OF FOREST AND WILD LIFE LAWS** a) Importance of Forest and Wildlife b) Evolution of Forest and Wild Life Laws c) Forest Policy during British Regime d) Forest Policies after Independence. e) Methods of Forest and Wildlife Conservation.
18 Hrs	**FOREST PROTECTION AND LAW** a) Indian Forest Act, 1927 b) Forest Conservation Act, 1980 & Rules therein c) Rights of Forest Dwellers and Tribal c) The Forest Rights Act, 2006 d) National Forest Policy 1988
18 H rs	**WILDLIFE PROTECTION AND LAW** a) Wild Life Protection Act, 1972 b) Wild Life Conservation strategy and Projects c) The National Zoo Policy
18 Hrs	**CHAPTER – BASIC CONCEPTS** a. Meaning and definition of environment. b. Multidisciplinary nature of environment c. Concept of ecology and ecosystem d. Importance of environment e. Meaning and types of environmental pollution. f Factors responsible for environmental degradation. **CHAPTER– INTRODUCTION TO LEGAL SYSTEM** a. Acts, Rules, Policies, Notification, circulars etc b. Constitutional provisions on Environment Protection c. Judicial review, precedents d. Writ petitions, PIL and Judicial Activism **CHAPTER – LEGISLATIVE FRAMEWORK FOR POLLUTION CONTROL LAWS** a) Air Pollution and Law. b) Water Pollution and Law.

	c) Noise Pollution and Law.
18 Hrs	**CHAPTER- LEGISLATIVE FRAMEWORK FOR ENVIRONMENT PROTECTION** a) Environment Protection Act & rules there under b) Hazardous Waste and Law c) Principles of Strict and absolute Liability. d) Public Liability Insurance Act e) Environment Impact Assessment Regulations in India **CHAPTER – ENVIRONMENTAL CONSTITUTIONALISM** a. Fundamental Rights and Environment i) Right to Equality .....Article 14 ii) Right to Information..... Article 19 iii) Right to Life ..... Article 21 iv) Freedom of Trade vis-à-vis Environment Protection b. The Forty-Second Amendment Act c. Directive Principles of State Policy & Fundamental Duties d. Judicial Activism and PIL
SUGGESTED READINGS	Bharucha, Erach. Text Book of Environmental Studies. Hyderabad : University Press (India) Private limited, 2005. Doabia, T. S. Environmental and Pollution Laws in India. New Delhi: Wadhwa and Company, 2005. Joseph, Benny. Environmental Studies, New Delhi: Tata McGraw-Hill Publishing Company Limited, 2006. Khan. I. A, Text Book of Environmental Laws. Allahabad: Central Law Agency, 2002. Leelakrishnan, P. Environmental Law Case Book. 2nd Edition. New Delhi: LexisNexis Butterworths, 2006. Leelakrishnan, P. Environmental Law in India. 2nd Edition. New Delhi: LexisNexis Butterworths, 2005. Shastri, S. C (ed). Human Rights, Development and Environmental Law, An Anthology. Jaipur: Bharat law Publications, 2006. Environmental Pollution by Asthana and Asthana, S,Chand Publication Environmental Science by Dr. S.R.Myneni, Asia law House Gurdip Singh, Environmental Law in India (2005) Macmillan. Shyam Diwan and Armin Rosencranz, Environmental Law and Policy in India – Cases, Materials and Statutes (2nd ed., 2001) Oxford University Press. **JOURNALS :-** Journal of Indian Law Institute, ILI New Delhi. Journal of Environmental Law, NLSIU, Bangalore. **MAGAZINES :-** Economical and Political Weekly Down to Earth.

COURSE OUTCOME

M.Sc. II SEMESTER

COURSE CODE : PD2

PAPER CODE : 206

PAPER : V (POLYMER CHEMISTRY)

After completion of course, the students will able to :-

CO1. Understand basics of polymer chemistry and different techniques of polymerization.

CO2. Describe kinetics and mechanisms of free radicals, cationic, anionic, co- ordination and degree of polymerization.

CO3. Give the concept of structure and properties such as mechanical, thermal, crystallinity and various spectroscopic techniques and methods for molecularweight determination.

CO4.Analyze industrial, natural or biopolymers and various electroluminescent, fire retardant, nanocomposite polymers that give information about degradable and non degradable nature of polymers

CO5. To impart knowledge in the theory and application of various instrumental techniques which are very important characterization techniques for different industrial polymers.

	CO-1	CO-2	CO-3	CO-4	CO-5
PO- 1		✓			✓
PO-2	✓			✓	
PO-3		✓			
PO-4					
PO-5					
PO-6				✓	
PO-7					
PO-8	✓		✓		✓
PO-9					
PO-10				✓	✓

M.Sc. CHEMISTRY SECOND SEMESTER			
COURSE CODE: MSC 206		**COURSE TYPE: PD2**	
COURSE TITLE: **POLYMER CHEMISTRY**			
CREDIT: **THEORY: 6**	**PRACTICAL:**	**HOURS:** **THEORY: 90**	**PRACTICAL: 00**
MARKS: **THEORY: 70+30**	**PRACTICAL:**	**MARKS** **THEORY:**	**PRACTICAL:**

Scheme of marks:

i. Short answer type questions: three questions carrying 5 marks each to be asked two to be attempted (Word limit 100 words).

ii. Middle answer type questions: three questions carrying 9 marks each to be set two to be attempted (Word limit 250 words).

iii. Long answer type questions: Five questions carrying 14 marks each tobe set three to be attempted (Word limit 750 words).

16 Hours	**Basic Concepts** Classification – Nomenclature and isomerism – functionality – Molecular forces and chemical bonding in polymers – Molecular weight – Linear, branched and cross linked polymers.Thermoplastic and thermosetting polymers – Elastomers, Fibers and resins.Techniques of polymerization–emulsion, bulk, solution and suspension.
16 Hours	**Kinetics and Mechanism** Kinetics and Mechanism of polymerization – free radical, cationic, anionic and co-ordination polymerization (Ziegler - Natta Catalyst).Copolymerisation – Kinetics (Detailed Study).General characterization–Kinetic chain length–degree of polymerization, chain transfer -initiators – inhibitors – retarders.

22 Hours	**Structure and Properties** Structure - property relationship – Mechanical properties, Thermal properties – Glass transitiontemperature – Factors affecting Glass transition temperature – crystallinity and melting point –related to structure.Nitrogenaseenzyme : Introduction, Types of nitrogen fixing microorganism,metal clusters in nitrogenase. Nitrogen fixation pathway.Transition metal complexes : Dinitrogen complexes. Biological redox reactions. Photosynthesis and chlorophyll.Polymer characterization and analysis Crystalline nature – X-Ray diffraction – Differential Scanning Calorimetry (DSC) – ThermoGravimetric Analysis – molecular weight determination – Osmometry (membrane), Viscosity,Ultra centrifuge and Gel Permeation Chromatography.
18 Hours	**INDUSTRIAL NATURAL POLYMERS** Important industrial polymers – preparation and application of polyethylene, poly vinyl chloride, poly urethanes, polytetrafluro ethylene (TEFLON), Nafion and ion – exchange resins.Importance of natural polymers – application and structures of starch, cellulose and chitosin derivatives.
18 Hours	**SPECIALITY POLYMERS** Bio polymers – biodegradable polymers – biomedical polymers – poly electrolytes – conducting polymers – high temperature and fire retardant polymers - polymer blend – polymer composites – polymer nanocomposites – IPN inter penetrating networkpolymers –Electroluminescent polymers.
RECOMENDE READINGS:	F. W. Bill Meyer. Text book of polymer science, III Edition, John Wiley and sons, New York. P. J. Flory. Principles of Polymer Chemistry, Cornell Press (recent edition). V. R. Gowarikar, B. Viswanathan, J. Sridhar, Polymer Science – Wiley Eastern, 1986. G. S. Misra – Introduction to Polymer Chemistry, Wiley Eastern Ltd., P. Bahadur, N. V. Sastry, Principles of Polymer Science, Narosa Publishing House. G. Odian, Principles of Polymerization, McGraw Hill Book Company, New York, 1973. A. Rudin, The Elements of Polymer Science and Engineering. Academic Press, New York, 1973. I. C. E. H. Brawn, The Chemistry of High Polymers, Butter worth & Co., London, 1948. G. S. Krishenbaum, Polymer Science Study Guide, Gordon Breach Science publishing, New York,1973. E. A. Coolins, J. Bares and E. W. Billmeyer, Experiments in Polymer Science, Wiley Interscience,NewYork, 1973.

COURSE OUTCOME

M.Sc. II SEMESTER

COURSE CODE : PD2

PAPER CODE : 207

PAPER : V (ORGANIC SYNTHESIS-I)

After completion of course, the students will able to :-

CO1. Learn modern synthetic methods, reactions and reagents for the synthesis of organic molecules using standard reactions like acetylation, alkylation, Grignard and deprotonation of functional groups.

CO2. Give information about C-C bond formation through various reaction like Henry, Wittig, Wordwoth Emmons and chemistry of enolates.

CO3. Explain electrophilic reactions such as Prins, Vilsmeier-Hack reaction, Suzuki coupling and other miscellaneous reactions that gives information about its mechanism.

CO4. Apply reagents such as K-selecteride, super hydrides, Fetizon, ceric ammonium nitrate, Gilman, lithium which are very important in synthesis of various organic compounds.

CO5. Create mechanisms to synthesize all kinds of organic compounds, natural products, heterocyclic compounds, vitamins, steroids and drugs.

	CO-1	CO-2	CO-3	CO-4	CO-5
PO- 1	✓			✓	✓
PO-2		✓	✓		
PO-3	✓				
PO-4					
PO-5					
PO-6			✓		
PO-7					
PO-8	✓			✓	
PO-9					
PO-10	✓	✓	✓	✓	✓

M.Sc. CHEMISTRY SECOND SEMESTER

COURSE CODE: MSC 207	**COURSE TYPE: PD2**
COURSE TITLE: **ORGANIC SYNTHESIS - I**	
CREDIT: **THEORY: 6** **PRACTICAL:**	**HOURS:** **THEORY: 90** **PRACTICAL: 00**
MARKS: **THEORY: 70+30** **PRACTICAL:**	**MARKS** **THEORY:** **PRACTICAL:**

Scheme of marks:

i. Short answer type questions: three questions carrying 5 marks each to be asked two to be attempted (Word limit 100 words).

ii. Middle answer type questions: three questions carrying 9 marks each to be set two to be attempted (Word limit 250 words).

iii. Long answer type questions:Five questions carrying 14 marks each to be set three to be attempted(Word limit 750 words).

18 Hours	**MODERN SYNTHETIC METHODS, REACTIONS AND REAGENTS** Synthesis of simple organic molecules using standard reaction like acetylation alkylation of enamines and active methylene compounds, Grignard reaction, Phosphorus and sulphurylides Robinson annulations, Diels Alder reactions, protection and deprotection of functional groups (R-OH, R-CHO, RCO, R-NH2 and R-COOH).
18 Hours	Nucleophilic C-C bond formation: Henry reaction, Wittig reaction and Horner-WordwothEmmons reaction and their selectivities; Chemistry of enolates – E, Z geometry of enolates, kinetic vs thermodynamic control of enolates, stereoselectiveenolate reactions, alkylation, aldol condensation (Zimmerman and Evans models), Mukaiyama reaction.
18 Hours	Electrophilic C-C bond formation: Prins reaction, Vilsmeier-Hack reaction, Pictet-Sprengler reaction, Heck reaction, Stille coupling, Suzuki coupling, Neigishii reaction, reactions of allylsilane, Acylation of carbonyl carbon; Carbonyl cyclizations and cleavages.
18 Hours	Miscellaneous reactions: Biginelli reaction, Hantzsch reaction, Passerini reaction, Ugi reaction, McMurry olefination, Ring closing metathesis (RCM) - Grubb's reaction, Mitsonobu reaction, Nef reaction, Sharpless asymmetric epoxidation and asymmetric dihydroxylation. Carboxylic acids and derivatives, decarboxylation reactions, 1,3-dithiane reactivity: Umpolung effect, Peterson's synthesis.
18 Hours	Reagents in organic synthesis: K-selecteride and L-selecteride, sodium cyanoborohydride, super hydrides, 9-BBN, IBX, Dess-Martin periodinane, manganese dioxide, Fetizon reagent, dioxiranes, ceric ammonium nitrate, Gilman's reagent, lithium disopropylamide, dicyclohexylcarbodimide, trimethysilyl iodide, tri-n-butyltin hydride, Tebbe reagent, CoreyNicolaou reagent, baker's yeast, lipase, Mosher's reagent, use of Os, Ru, and Tl reagents and DDQ.
RECOMENDE READING	1. F. A. Carey & R. J. Sundberg. Advanced Organic Chemistry Part B, Plenum Press (2007). 2. M. B Smith. Organic Synthesis (2 nd end.), McGraw-Hill, Inc. (2001). 3. J. March. Advanced Organic Chemistry: Reactions, Mechanism and Structure (4th edn.), John Wiley & Sons (2005).

COURSE OUTCOME

M.Sc. II SEMESTER

COURSE CODE : PD2

PAPER CODE : 208

PAPER : V (APPLIED CHEMISTRY)

After completion of course, the students will able to :-

CO1. Recall the chemistry of water quality parameters TDS, hardness, Dissolved oxygen and treatment of water through different techniques.

CO2. Explain the pharmacokinetics and pharmacodynamics of drugs such as administration, absorption, elimination, different kinds of antibiotics and misuse of drugs.

CO3. Compare and contrast between different kinds of polymers such as addition, condensation, thermoplastic, thermosetting and industrial application of polymers.

CO4. Analyze chemistry of environmental pollutants that give the information about hazardous effect of pollutants on human health, control methods, removal and management techniques.

CO5. Apply the concept of material chemistry in manufacturing of cement, setting of cement, paint, varnishes, adhesives, soaps and detergents .

	CO-1	CO-2	CO-3	CO-4	CO-5
PO- 1	✓		✓		✓
PO-2	✓	✓		✓	
PO-3					
PO-4					
PO-5		✓			
PO-6			✓	✓	
PO-7					
PO-8	✓				
PO-9					
PO-10			✓	✓	✓

M.Sc. CHEMISTRY SECOND SEMESTER

COURSE CODE: MSC 208 PAPER-V **COURSE TYPE: PD2**

COURSE TITLE:

APPLIED CHEMISTRY

CREDIT: **THEORY:** **PRACTICAL:** **6**	**HOURS:** **THEORY:** **PRACTICAL:** **90** **00**
MARKS: **THEORY:** **PRACTICAL:** **70+30**	**MARKS** **THEORY:** **PRACTICAL:**

SCHEME OF MARKS :

i. Short answer type questions: three questions carrying 5 marks each to be asked two to beattempted (Word limit 100 words).

ii. Middle answer type questions: three questions carrying 9 marks each to be set two to be attempted (Word limit 250 words).

iii. Long answer type questions :Five questions carrying 14 marks each to beset three to be attempted (Word limit 750 words).

18 Hours	**CHEMISTRY OF WATER**: Water quality parameters - Total dissolved solids - hardness - dissolved oxygen - Physical, Chemical, Biological contaminants in water - Municipal water treatment - sterilization - Chlorination - Ozonisation - Conversion of seal water into drinking water - Reverse Osmosis - Deionization.
18 Hours	**CHEMISTRY OF DRUGS**: Classification of drugs - Administration of Drug - Absorption of drugs - Elimination of drug by Kidney - Some important drugs - Antibiotics, Anti malarials, anti asthmatic drugs - Anti bacterial drugs, anti septics, anesthetics, analgestics and anti pyretic drugs. (Role and examples in each type) - Misuse of drugs.
18 Hours	**CHEMISTRY OF POLYMERS** Classification of polymers - Addition and condensation polymers - Polymerisation reaction - co-polymers - homopolymers - Thermoplastics and thermosetts - Molecular weight of polymers - Rubbers - Inorganic polymers - Biopolymers - Domestic and industrial application of polymers.
18 Hours	**CHEMISTRY OF MATERIALS**: Cement - Manufacture of cement - Setting of cement - Paint - Varnishes - Enamel and Lacquers - Refractories - Properties - Manufacturing methods - adhesives - types - Adhesive action - Preparation of adhesives - Soaps and Detergents.
18 Hours	**CHEMISTRY OF ENVIRONMENTAL POLLUTANTS**: Gaseous pollutants - Effect of gaseous pollutants on human health - Method of Control - Water pollutants - types - Removal methods - Soil pollutants - types - Control methods - nuclear wastes - Adverse effects - Control methods.
RECOMENDEREADIN	1. Engineering chemistry, Jain and Jain, Dhanpat Rai Publishing company. 2. Fundamental concepts of applied chemistry by Jayashree Ghosh, S. Chand & Company Ltd. 3. Introductory polymer chemistry, G.S. Mistra - New age international Pvt. Ltd. 4. Environmental science - Koushik and AmbauKoushik. New age international Publishers.

THIRD SEMESTER

COURSE OUTCOME
M.Sc. III SEMESTER
COURSE CODE : PD2
PAPER CODE : 301
PAPER : I (APPLICATION OF SPECTROSCOPY – INORGANICCHEMISTRY)

After completion of course the students will able to :-

CO1. Acquire comprehensive knowledge of atomic absorption emission, flameemission and Raman Spectroscopy in inorganic chemistry.

CO2. Develop a critical understanding of Vibrational Spectroscopy and determination of various shapes of molecules and their mode of bonding.

CO3. Describe inclination of spectroscopy such as electron spin resonance andidentification of transition metal complexes including biological system and inorganic free radicals.

CO4. Compare and contrast atomic spectroscopy and molecular Spectroscopy in identifying energies of atomic orbital, molecular orbital and various vibranictransitions and progression .

CO5. Apply Mossbauer spectroscopy in studies of iron complexes including different metal ions In determination of oxidation state, structure, metal ligand bonding and in equivalent Mossbauer atom.

	CO-1	CO-2	CO-3	CO-4	CO-5
PO- 1					
PO-2	✓	✓			
PO-3			✓		✓
PO-4					
PO-5					
PO-6	✓			✓	✓
PO-7					
PO-8			✓	✓	
PO-9					
PO-10	✓	✓			✓

M.Sc. CHEMISTRY THIRD SEMESTER			
COURSE CODE: MSC 301		**COURSE TYPE: PD2**	
COURSE TITLE: **APPLICATIONS OF SPECTROSCOPY-INORGANIC CHEMISTRY**			
CREDIT: **THEORY: 6**	**PRACTICAL:**	**HOURS:** **THEORY: 90**	**PRACTICAL: 00**
MARKS: **THEORY: 70+30**	**PRACTICAL:**	**MARKS** **THEORY:**	**PRACTICAL:**

Scheme of marks:

i. Short answer type questions: three questions carrying 5 marks each to beasked two to be attempted (Word limit 100words).
ii. Middle answer type questions: three questions carrying 9 marks each to be set two to be attempted (Word limit 250 words).
iii. Long answer type questions: Five questions carrying 14 marks each to beset three to be attempted (Word limit 750 words).

16 Hours	Applications of Atomic Absorption Spectroscopy, Atomic Emission Spectroscopy, Flame Emission Spectroscopy and raman spectroscopy in inorganic chemistry.
18 Hours	Vibrational Spectroscopy Symmetry and shapes of AB2, AB3, AB4, AB5 and AB6, mode of bonding of ambidentate ligands, ethylenediamine and diketonato complexes, application of resonance Raman spectroscopy particularly for the study of active sites of metalloproteins.
20 Hours	Electron Spin Resonance Spectroscopy Hyperfine coupling, spin polarization for atoms and transition metal ions, spinorbit coupling and significance of g-tensors, application to transition metal complexes (having one unpaired electron) including biological systems and to inorganic free radicals such as PH4, F2 and [BH3].
17 Hours	**Electronic Spectroscopy** **a. Atomic Spectroscopy** Energies of atomic orbitals, vector representation of momenta and vector coupling, spectra of hydrogen atom and alkali metal atoms. **b. Molecular spectroscopy** Energy levels, molecular orbitals, vibronic transitions, vibrational progressions and geometry of the excited states, Franck-Condon principle, electronic spectra of polyatomic molecules. Emission spectra; radioactive and non-radioactive decay, internal conversion,spectra of transition metal complexes, charge-transfer spectra.
19 Hours	Mossbauer Spectroscopy Basic principles, spectral parameters and spectrum display. Application of the technique to the studies of (1) bonding and structures of Fe+2 and Fe+3 compounds including those of intermediate spin, (2) Sn+2 and Sn+4 compounds – nature of ML bond, coordination number, structure and (3) detection of oxidation state and inequivalent MB atoms.
RECOMENDE READINGS:	1. Structural Methods in Inorganic Chemistry, E.A.V. Ebsworth, D.W.H. Rankin and S. Cradock, ELBS. 2. Infrared and Raman Spectra: Inorganic and Coordination Compounds, K. Nakamoto, Wiley. 3. Progress in Inorganic Chemistry vol., 8 ed., F.A. Cotton, vol., 15, ed. S.J. Lippard, Wiley. 4. Inorganic Electronic Spectroscopy., A.P.B. Lever, Elsevier. 5. NMR, NQR, EPR and Mossbauer Spectroscopy in Inorganic Chemistry, R.V. Parish, Ellis Horwood. 6. Practical NMR Spectroscopy, M.L. Martin, J.J. Delpeuch and G.J. Martin, Heyden.

COURSE OUTCOME

M.Sc. III SEMESTER

COURSE CODE : PD2

PAPER CODE : 302

PAPER : II(APPLICATION OF SPECTROSCOPY-ORGANIC CHEMISTRY)

After completion of course the students will able to :-

CO1. Skilled in interpreting one ,two dimensional NMR spectroscopy, EPR & Massspectroscopy to derive the information regarding the structure & stereochemistry of the molecules.

CO2. Understaand the instrumental set up involved in different organic spectroscopictechniques.

CO3. Acquire knowledge of TR spectroscopy & related vibrational frequencydata of different organic functional groups.

CO4. Apply the concepts to characterize different organic molecules by using givenspectroscopic data .

CO5. Analyse the organic compound and structure determination using different spectroscopic tools and techniques.

	CO-1	CO-2	CO-3	CO-4	CO-5
PO- 1	✓			✓	
PO-2		✓	✓		
PO-3	✓				
PO-4					
PO-5					
PO-6	✓		✓		✓
PO-7					
PO-8		✓			
PO-9					
PO-10	✓		✓	✓	✓

M.Sc. CHEMISTRY THIRD SEMESTER			
COURSE CODE: MSC 302		**COURSE TYPE: PD2**	
COURSE TITLE: **APPLICATIONS OF SPECTROSCOPY-ORGANIC CHEMISTRY**			
CREDIT: **THEORY: 6**	**PRACTICAL:**	**HOURS:** **THEORY: 90**	**PRACTICAL: 00**
MARKS: **THEORY: 70+30**	**PRACTICAL:**	**MARKS** **THEORY:**	**PRACTICAL:**

Scheme of marks:

i. Short answer type questions: three questions carrying 5 marks each to be asked two to beattempted (Word limit 100 words).

ii. Middle answer type questions: three questions carrying 9 marks each to be set two to be attempted (Word limit 250 words).

iii. Long answer type questions: three questions carrying 14 marks each to beset two to be attempted (Word limit 750 words).

20 Hours	Ultraviolet and Visible Spectroscopy Various electronic transitions (185-800 nm), Beer-Lambert law, effect of solvent on electronic transitions, ultraviolet bands for carbonyl compounds, unsaturated carbonyl compounds, dienes, conjugated polyenes. Fieser-Woodward rules for conjugated dienes and carbonyl compounds, ultraviolet spectra of aromatic and heterocyclic compounds. Steric effect in biphenyls. . Optical Rotatory Dispersion (ORD) and Circular Dichroism (CD) Definition, deduction of absolute configuration, octant rule for ketones.
19 Hours	**Mass Spectroscopy** ı, ion production, EI,Cl, FD, and FAB factors affecting fragmentation, ion analysis, ion abundance. Mass spectral fragmentation of organic compounds, Common functional groups, molecular ion peak, metastable peak,. McLafferty rearrangement. Nitrogen rule, High resolution mass spectrometry. Examples of mass spectral fragmentation of organic compounds with respect to their structure determination.
18 Hours	20 Infrared Spectroscopy Instrumentation and sample handling. Characteristic vibrational frequencies of alkanes, alkenes, alkynes, aromatic compounds, alcohols, ethers, phenols and amines. Detailed study of vibrational frequencies of carbonyl compounds (ketones, aldehydes, esters, amides, acids, anhydrides, lactones, lalctams and conjugated carbonyl compounds). Effect of hydrogen bonding and solvent effect on vibrational frequencies, overtones, combination bands and Fermi resonance. FT IR. IR of gaseous, solids and polymeric materials
17 Hours	Nuclear Magnetic Resonance Spectroscopy General introduction and definition, chemical shift, spin-spin interaction, shielding mechanism, mechanism of measurement, chemical shift values and correlation for protons bonded to carbon (aliphatic, olefinic, aldehydic and aromatic) and other nuclei (alcohols, phenols, enols, carboxylic acids, amines, amides &mercapto), chemical exchange, effect of deuteration, complex spin-spin interaction between two, three, four and five nuclei (first order spectra), virtual coupling. Stereochemistry, hindered rotation, Karplus curve-variation of coupling constant with dihedral angle.
16 Hours	Simplification of complex spectra-nuclear magnetic double resonance, contact shift reagents, solvent effects. Fourier transform technique, nuclear Overhauser effect (NOE). Resonance of other nuclei-F, P. Carbon-13 NMR Spectroscopy General considerations, chemical shift (aliphatic, olefinic, alkyne, aromatic, heteroaromatic and carbonyl carbon), coupling constants. Two dimension NMR spectroscopy – COSY, NOESY, DEPT, INEPT, APT and INADEQUATE techniques.
RECOMENDE READINGS:	1. Spectrometric Identification of Organic Compounds, R.M. Silverstein, G.C. Bassler and T.C. Morrill, John Wiley. 2. Introduction to NMR Spectyroscopy, R.J. Abraham, J. Fisher and P. Loftus, Wiley. 21 3. Application of Spectroscopy of Organic Compounds, J.R. dyer, Prentice Hall. 4. Spectroscopic Methods in Organic Chemistry, D.H. Williams, I. Fleming, Tata McGraw-Hill.

COURSE OUTCOME

M.Sc. III SEMESTER
COURSE CODE : PD2
PAPER CODE : 303
PAPER: III (PERICYCLIC REACTIONS AND PHOTOCHEMISTRY)

After completion of course the students will able to :-

CO1. Recall the fundamental principles of photochemical reaction.

CO2. Understanding the concepts related to light induced organicsynthesis , mechanism &the functions of various reagents .

CO3. Apply their understanding about the photochemical reaction of industrialsignificance.

CO4. Analyze the product distribution and the stereochemistry of variousorganic products derived from photochemistry.

CO5. Evaluate the photochemistry reactions based on the influence of thesubstituents on substrate molecules.

CO6. Design new photochemical reactions in order to achieve the required products.

	CO-1	CO-2	CO-3	CO-4	CO-5	CO-6
PO- 1	✓		✓			
PO-2		✓			✓	✓
PO-3			✓			
PO-4						
PO-5						
PO-6				✓		
PO-7			✓			
PO-8	✓					✓
PO-9						
PO-10	✓	✓		✓	✓	✓

M.Sc. CHEMISTRY THIRD SEMESTER

COURSE CODE: MSC 303 PAPER-III **COURSE TYPE: PD2**

COURSE TITLE:
PERICYCLIC REACTIONS AND PHOTOCHEMISTRY

CREDIT:		**HOURS:**	
THEORY:	**PRACTICAL:**	**THEORY:**	**PRACTICAL:**
6		**90**	**00**
MARKS:		**MARKS**	
THEORY:	**PRACTICAL:**	**THEORY:**	**PRACTICAL:**
70+30			

SCHEME OF MARKS :

i. Short answer type questions: three questions carrying 5 marks each to be asked twoto be attempted (Word limit 100 words).
ii. Middle answer type questions: three questions carrying 9 marks each to be set two to be attempted (Word limit 250 words).
iii. Long answer type questions: Five questions carrying 14 marks each to beset three to be attempted (Word limit 750 words).

19 Hours	**PHOTOCHEMISTRY :** Role of Photochemistry, Laws of Photochemistry,first Law of Photochemistry, Lambeer-Beer Law.Second Law of Photochemistry. Relationship between Photochemistry and spectroscopy.Units and Dimensions used inPhotochemistry.Relation between orbitals and organic chemistry with pericyclic Reaction .Pericyclic Reaction.Bonding and Antibonding Molecular orbitals Forntier orbitals (HOMOandLUMO).Stereochemistry of Thermal Electrocyclic Reactions.Photochemistry cyclization by conratatory path.Stereochemistry of Cycloaddition Reactions.Stereochemistry of Sigmaatropic Rearrangements.Some Exsmples of Sigmatropic Rearrangments.Suprafacial [3,3]cope and claisen Rearrangments.
18 Hours	**INTERACTION OF ELECTROMAGNETIC RADIATION WITH MATTER :** Spectrum of Electromagnetic Radiation. Particle nature of radiation. Particle nature of radiation.Wave nature of radiation.Dual Nature of Matter.Types of Excitation Fate of the Excited Molecule.Enargy Transfr or Photosensitization. Quantum Yield. Transfer of Excitation Energy.Actinometry.
17 Hours	**DERERMINATION OF REACTION MECHANISM:** Classification.Adiabatic Reaction.Intermediate case.adiabatic Reaction. Rate Constants and life times of reactive energy states . Determination of Rate constants reaction.Effect of light intensity on the rate of photochemical reactions .Type of Photochemical reactions.Photo reduction.Photo isomerization.Photooxidation .PhotodissociationGas –phase Photolysis
16 Hours	**PHOTOCHEMISTRY OF ALKENES ;** Geometrical Isomerism.cis-trans isomerisation by irradiation.cis-trans isomerisation by the use of photosensitizer .cyclisation Reactions.Inter Molecular cyclization between two double bonds (1,5-diene,1,6-di,ene,1,9-diene). Rearrangement of 1,4-diene. Rearrangement of 1,5-diene rearrangement.
20 Hours	**PHOTOCHEMISTRY OF CARBONYL COMPOUNDS:** Cyclisation Reactions. Intra molecular reaction in cyclic carbonyl compounds.Reaction in Bicyclic compounds. Reaction in tricyclic compounds. Intermolecular Reactions of Acyclic Carbonyl compounds.Interamolecular Photoreaction of Saturated carbonyl compounds.Intermolecular Photoreaction in β,Y – unsaturated carbonyl compounds.Intermolecular Reaction of cyclohexadienones. Through diradical intermediate.Intermolecular cycloaddition Reactions of carbonyl compounds.Oxetane Formatiom. Intermolecular Photocyclo dimerisation of carbonyl compounds.

RECOMENDE READINGS:	1. C.H.J. Well, Introduction to Molecular Photochemistry: London Champman & Hall, 1972. 2. 2. R.P. Wayne, Photochemistry, London; Butterworth,1970. 3. R.P. Cundall and A. Gilbert, Photochemistry ;London; Thomas Nelson,1970. 4. N.J.Turro, Molecular Photochemistry. New York: W.A. Benjamin,1966. 5. J.G. Calvert and J.N. Pitts,Jr.Photochemistry .New York .Wiley,1966.

COURSE OUTCOME

M.Sc. III SEMESTER

COURSE CODE : PD2
PAPER CODE : 311

PAPER : (GENERAL CHEMISTRY LAB)

After completion of course the students will able to :-

CO1. Understand principles and techniques for identification of metalion using pH mete, spectrophotometer ,flame photometer and nephelometer.

CO2. Analyse the metal ion mixture by paper chromatography andthin layer chromatography.

CO3. Apply concept of physical analysis and organic chemistry through experiments. .

CO4 .Design experiments in physical chemistry, analytical chemistryusing conductometry, colorimeter ,pH meter potentiometer .

	CO-1	CO-2	CO-3	CO-4
PO- 1	✓	✓		
PO-2	✓		✓	✓
PO-3				
PO-4				
PO-5				
PO-6		✓		
PO-7	✓			
PO-8				✓
PO-9				
PO-10	✓	✓	✓	✓

M.Sc. CHEMISTRY THIRD SEMESTER

COURSE CODE: MSC 311 **COURSE TYPE:PD2**

COURSE TITLE:

GENERAL CHEMISTRY LAB

CREDIT: **THEORY:** **PRACTICAL:06**	**HOURS:** **THEORY:** **PRACTICAL:135**

MARKS:

THEORY: **PRACTICAL:**

200

10 Hrs. (Spread over two days) M. M. 200

Note: The laboratory course (General) will be of 10 hrs. duration. The examinee will have to perform three experiments (one each from Section A, B and C). These experiments will be of 40 marks each. 40 marks each will be allotted for viva –voce and sessional work.

SECTION - A [INORGANIC CHEMISTRY]

INSTRUMENTAL METHODS AND ANALYTICAL TECHNIQUES :

A. Spectrophotometric Determinations

i. Manganese/Chromium / Vanadium in steel sample
ii. Nickel /Molybdenum /Tungston /Vanadium /Uranium by extractive spectrophotometric method.
iii. Fluoride /Nitrite /Phosphate /Nitrate
iv. Iron phenanthroline complex : Job's method of continuousvariations.
v. Zirconium Alizarin Red-S complex _ Mole- Ratio method.
vi. Copper Ethylene diamine complex: Slope- Ratio method
vii. Iron thiocyanate complex.

B. pH metry

Stepwise proton-ligand and metal ligand stability constant of complexes by Irving – Rossoti method.

C. Polarography

Composition and stability constants of complexes

D. Flame Photometric Determinations

i. Sodium And potassium when present together
ii. Lithium / Calcium /Barium /Strontium
iii. Cadmium and magnesium in tap water

E. Nephelometric Determinations

i. Sulphate
ii. Phosphate
iii. Silver

F. Separation and Quantitative Estimation of Binary and Ternary Mixturesby the use of the following Separation Techniques

i. Paper chromatography –Cadmium and zinc, Zinc and Magnesium
ii.Thin Layer Chromatography –Separation of nickel,manganese and cobalt.

SECTION -B [ORGANIC CHEMISTRY]

A. Quantitative organic Analysis

i. Estimation of sulphur by Messenger's method
ii. Estimation of nitrogen by Kjeldahl method.
iii. Estimation of halogen by Fusion method.

B. Functional Group Estimation

i. Estimation of Aniline
ii. Estimation of amino gp. of by acetylation method
iii. Estimation of hydroxyl gp. of by acetylation method
iv. Estimation of carbonyl gp. of by hydrazone formation method

Separ

ation and identification of the sugars present in the given mixture of Glucose, fructose, and sucrose by paper chromatography anddetermination of Rf values.

SECTION- C [PHYSICAL AND ANALYTICAL CHEMISTRY]

PHYSICAL CHEMISTRY:

E. Conductometry

i. To verify Debye Huckel and Onsager law for strong electrolyte .
ii. To derermine the degree of hydrolysis and hydrolysis constant of NH_4Cl/Aniline hydrochloride at room temperature .
iii. To determine the basicity of an organic acid.
vi. To determine the equivalent conductance of an electrolyte at infinite dilution and determine the dissociation constant.

F. Colorimetry

i. To determine the indicator constant pK_{in} of methyl red spectro-photometrically .
ii. To verify additivities of absorbances of a mixture of a coloured substance in a Solution using $KMnO_4$ and $K_2Cr_2O_7$ solution.

G. PH metry

i. To determine pK of given disbasic and tribasic acid .
ii. To determine the pH of various mixtures of acetic acid and Na–acetate in aqueous solution and hence determine the dissociation constant of the acid.

H. Potentiometry

i. Titrate ferrous ammonium sulphate against $KMnO_4$ /$K_2Cr_2O_7$ and determine Redox potential of ferric system.
iii. To determine ionization constant of polybasic acid .

E. Distribution Coefficient

iii. To determine the formula of the complex formed between cupric ion and Ammonia by distribution method.

iv. To Determine the equilibrium constant of the following reaction :

$$Kl + I_2 \rightarrow KI_3$$

F. Partial Molar Volume

Determine the partial molar volume of NaCl in aq. Solution at room temperature.

ANALYTICAL CHEMISTRY:

ii. Preparation of homo and hetero- poly acids of Sb, V, Nb, Ta, Cr, Mo, W etc. and their properties.

ii. Determination of pKa of weak acids by pH metric and spectrophotometric methods
iii. Determination of distribution ratio and distribution coefficient of organic and inorganic compounds.
iv. Separation of organic compounds by chromatographic techniques i. e. TLC, paper Chromatography, column chromatography electrophoresis etc.
v. Analysis of carbohydrates, amino acids,proteins, alkaloids etc.
vi. Analysis of pharmaceutical materials, preservatives, flavour, additives etc.
vii. Application of redox titration for analysis of Sn (IV), Fe (III), Cr (VI) and Mn (VII)
viii. Analysis of ore, mineral, alloy.
ix. Determination of equilibrium constant and composition of complexes.
x. Determination of dimerisation /polymerization constant.

Books suggested

1. Text book of quantitative analysis by A. I. Vogel.
2. Experimental physical chemistry by Das & Behra
3. Practical physical chemistry by Alexander Findlay.

COURSE OUTCOME
M.Sc. III SEMESTER
COURSE CODE : PD2
PAPER CODE : 304

PAPER : IV(INTELLECTUAL PROPERTY,HUMAN RIGHT & ENVIRONMENT : BASICS)

After completion of course the students will able to :-

CO 1. Understand implication of patent, copyright ,trademark to an inventor & business organizations .

CO2. Identify different types of intellectual properties (IPs),the right of ownership, scope of protection as well as the ways to create and to create and to extract value from IP.

CO3. Recognize the crucial role of IP in organizations of different industrial sectors for the purposes of product &technology development.

CO4. Identify activities & constitute IP infringements &the remedies available to the IP owner and describe the precautions steps to be taken to prevent infringement of proprietary development.

CO5. Be familiar with the processes of intellectual property management (IPM) and variousapproaches for IPM and conducting IP & IPM auditing & explain how IPcan be managed as a strategic resource of suggest IPM strategy .

CO 6. Be able to anticipate & subject to critical analysis arguments relating to the development &reform of intellectual property right institutions and their likelyimpact on creativity & innovation.

	CO-1	CO-2	CO-3	CO-4	CO-5	CO-6
PO- 1		✓	✓			
PO-2						
PO-3	✓	✓			✓	
PO-4	✓	✓	✓			
PO-5				✓	✓	✓
PO-6						
PO-7						
PO-8						
PO-9	✓	✓	✓	✓		
PO-10						

M.Sc. CHEMISTRY THIRD SEMESTER

COURSE CODE: MSC304 PAPER-IV COURSE TYPE PD2

COURSE TITLE:INTELLECTUAL PROPERTY RIGHTS

CREDIT: 06	**HOURS : 90**
THEORY: 06	**THEORY: 90**

MARKS : 100
THEORY: 70 CCA : 30

SCHEME OF MARK :

xii. Short answer type questions: three questions carrying 5 marks each to be asked two to be attempted (Word limit 100 words).

xiii. Middle answer type questions: three questions carrying 9 marks each to be set two to be attempted (Word limit 250 words).

Iii Long answer type questions: three questions carrying 14 marks each to be set two to be attempted (Word limit 750 words).

12 Hrs	• Patents :- Introduction & concepts, Historical Overview. • Subject matter of patent. • Kinds of Patents. • Development of Law of Patents through international treaties and conventions including TRIPS Agreement. • Procedure for grant of patents & term of Patent. • Surrender, revocation and restoration of patent. • Rights and obligations of Patentee • Grant of compulsory licenses • Infringement of Patent and legal remedies • Offences and penalties • Discussion on leading cases.
24 Hrs	• Meaning of Copyright, Historical Evolution, • Subject matter of copyright. • Literary works • Dramatic Works & Musical Works • Computer Programme • Cinematographic films • Registration of Copyrights • Term of Copyright and Ownership of Copyrights • Neighboring Rights • Rights of Performers & Broadcasters • Assignment of Copyright. • Author's Special Rights (Moral Rights) • Infringement of Copyrights and defenses • Remedies against infringement (Jurisdiction of Courts and penalties) • International Conventions including TRIPS Agreement WIPO, UCC, Paris Union, Berne Convention, UNESCO. • Discussion on leading cases.
10 H rs	• Rights: Meaning • Human Rights- Meaning & Essentials • Human Rights Kinds • Rights related to Life, Liberty, Equals & Disable
24 Hrs	• National Human Rights Commission • State Human Rights Commission • High Court • Regional Court • Procedure & Functions of High & Regional Court.

20 Hrs	• Right to Environment asHuman Right • International HumanitarianLaw and Environment • Environment and ConflictManagement • Nature and Origin ofInternational EnvironmentalOrganisations (IEOs) • Introduction to SustainableDevelopment and Environment • Sustainable Development and Environmental Governance
SUGGESTED READINGS	1. G.B.Reddy, *Intellectual Property Rights and Law,* Gogia Law Agency, Hyderabad. 2. S.R.Myneni, *Intellectual Property Law*, Eastern Law House, Calcutta 3. P Narayanan *Intellectual Property Rights and Law (1999)*, Eastern Law House, Calcutta, India 4. VikasVashistha, *Law and Practice of Intellectual Property*,(1999) Bharat Law House, New Delhi. 5. Comish W.R *Intellectual Property,3rd ed, (1996),* Sweet and Maxwell *6.* P.S. Sangal and Kishor Singh, *Indian Patent System and Paris Convention,* *7.* Comish W.R *Intellectual Property, Patents, Copyrights and Allied Rights, (2005)* 8. BibeckDebroy, *Intellectual Property Rights, (1998),* Rajiv Gandhi Foundation.

COURSE OUTCOME
M.Sc. III SEMESTER

COURSE CODE : PD2

PAPER CODE : 305

PAPER : V (TRIBAL STUDIES)

After completion of course the students will able to :-

CO1. Know about the tribal development in India fram pre-independene to present day.

CO 2. Understand the tribal culture ,life and their situation in India.
CO3. Classifiy the tribals based on,Racial Lingnal Geographical & Cultural .
CO4. Develop Zeal to work for tribal people and their development in different department, Government and non govermental organizations.
CO5. Analyse the problem of tribals like prostitution, culture decay due to assimilation replacement & rehabilitation etc.

	CO-1	CO-2	CO-3	CO-4	CO-5
PO- 1			✓	✓	✓
PO-2					
PO-3	✓	✓			
PO-4					
PO-5					
PO-6		✓			
PO-7					
PO-8					✓
PO-9	✓	✓		✓	✓
PO-10				✓	

M.Sc. CHEMISTRY THIRD SEMESTER		
COURSE CODE: MSC305 PAPET-V		**COURSE TYPE : PD2**
COURSE TITLE: TRIBAL STUDIES		
CREDIT: 06 **THEORY: 06**		**HOURS : 90** **THEORY: 90**
MARKS : 100 **THEORY: 70 CCA : 30**		
SCHEME OF MARKS : i. Short answer type questions: three questions carrying 5 marks each to be asked two to be attempted (Word limit 100 words). ii. Middle answer type questions: three questions carrying 9 marks each to be set two to be attempted (Word limit250 words). iii. Long answer type questions: Five questions carrying 14 marks each to beset three to be attempted (Word limit 750 words).		
12 Hrs	**Tribal Studies :** Meaning, Nature, Scope, Need & importance of tribal studies. Meaning, Definition & characteristics of Tribe, Caste & Race.	
24 Hrs	**Scheduled Tribe in India :** Population Composition of tribal, classification of Indian Tribe – Racial, Lingual, Geographical, Cultural. **Some Major Tribes in India :** Santhal, Khasi, Munda, Bhils. **Some Major Tribes in Central India :** Gond, Baiga, Bharia, Korkus.	
10 H rs	**Iliteracy :**Poverty, Indebness, Unemployment, migration & Exploitation Environmental & Degradation. **Problem of Health and sanitation :** Prostitution, Culture Decay due to assimilation. Replacement & Rehabilitation of Tribal population.	
24 Hrs	**Welfare-Concept, Characteristics:** Tribal Welfare in post independence period. Constitutional provision & safe guard after independence, Legislation & Reservation Policy.	
20 Hrs	**Tribal Development Programs for Scheduled Tribes :** Medical, Education, Economy, Employment & Agriculture Evaluation of Programs **Tribal Welfare & Advisory Agencies in India :** Role of NGO's in tribal development, Role of Christian missionaries in tribal welfare & development. Tribal Welfare Administration.	
SUGGESTED READINGS	1. *Tribal Development In India (Orissa)* by Dr. Taradutt 2. *Books on Tribal studies* by PK Bhowmik 3. *Books on 'Tribal Studies'* by W.G. Archer	

COURSE OUTCOME
M.Sc. III SEMESTER
COURSE CODE : PD2
PAPER CODE : 306

PAPER : V (GREEN CHEMISTRY)

After completion of course the students will able to :-

CO1. To provide various methodologies used in organic synthesis, which enable the student to think different possible ways to synthesis an organic compound in anecofriendly way.
CO2. To get an idea of greener methodologies using ultrasound and microwavemethodologies.
CO3. To Know the solvent less & aquatic phase reactions.
CO4. Students will be able to understand the application of bio catalysts in organic synthesis.
CO5. To understand the design of chemical or eliminate the use and generation ofhazardous substance.

	CO-1	CO-2	CO-3	CO-4	CO-5
PO- 1	✓		✓		
PO-2		✓		✓	
PO-3					
PO-4		✓			✓
PO-5					
PO-6					
PO-7	✓	✓			
PO-8	✓			✓	
PO-9					
PO-10			✓	✓	✓

M.Sc. CHEMISTRY THIRD SEMESTER

COURSE CODE: MSC306 PAPER-V COURSE TYPE: PD2

COURSE TITLE:

GREEN CHEMISTRY

CREDIT:		**HOURS:**	
THEORY:	**PRACTICAL:**	**THEORY:**	**PRACTICAL:**
6		**90**	**00**
MARKS:		**MARKS**	
THEORY:	**PRACTICAL:**	**THEORY:**	**PRACTICAL:**
70+30			

SCHEMEOF MARKS :

i. Short answer type questions: three questions carrying 5 marks each to be asked two to be attempted (Word limit 100 words)

.ii. Middle answer type questions: three questions carrying 9 marks each to be set two to be attempted (Word limit250 words).

iii Long answer type questions: Five questions carrying 14 marks each to beset three to be attempted (Word limit 750 words).

18 Hours	**PRINCIPLES & CONCEPT OF GREEN CHEMISTRY** Introduction –Concept and Principles-development of Green Chemistry- Atom economy reactions – rearrangement reactions , addition reactions- atom uneconomic-sublimation-elimination-Wittig reactions-toxicity measures- Need of Green Chemistry in our day to day life.
18 Hours	**MEASURING AND CONTROLLING ENVIRONMENTAL PERFORMANCE** Importance of measurement – lactic acid production-safer Gasoline – introduction to life cycle assessment-four stages of Life Cycle Assessment (LCA) –Carbon foot printing-green process Matrics-eco labels -Integrated Pollution and Prevention and Control(IPPC)-REACH (Registration, Evaluation, Authorization of Chemicals)
18 Hours	**EMERGING GREEN TECHNOLOGY AND ALTERNATIVE ENERGY SOURCES** Design for Energy efficiency-Photochemical reactions- Advantages-Challenge faced by photochemical process. Microwave technology on Chemistry- Microwave heating –Microwave assisted reactions-Sono chemistry and Green Chemistry –Electrochemical Synthesis-Examples of Electrochemical synthesis.
18 Hours	**RENEWABLE RESOURCES** Biomass –Renewable energy – Fossil fuels-Energy from Biomass-Solar Power- Other forms of renewable energy-Fuel Cells-Alternative economics-Syngas economy- hydrogen economy-Bio refinery chemicals from fatty acids-Polymer from Renewable Resources –Some other natural chemical resources
18 Hours	**INDUSTRIAL CASE STUDIES** Methyl Methacrylate (MMA)-Greening of Acetic acid manufacture-Vitamin C-Leather manufacture –Types of Leather –Difference between Hide and Skin-Tanning –Reverse tanning –Vegetable tanning –Chrome tanning-Fat liquoring –Dyeing –Application-Polyethylene- Ziegler Natta Catalysis-Metallocene Catalysis-Eco friendly Pesticides-Insecticides.

RECOMENDE READINGS:	1. Mike Lancaster , Green Chemistry and Introductory text, II Edition 2. P.T.Anastas and J.C Warner,Green Chemistry theory and Practice, Oxford University press, Oxford (1988). 3. P.Tundoet. al., Green Chemistry, Wiley –Blackwell, London (2007). 4. ProttiD.Dondiet.al.,Green Chemistry 5. T.E Graedel, Streamlined Life cycle Assessment, Prentice Hall, NewJersey (1998). 6. V.K. Ahluwalia,Methods and Reagents of Green Chemistry: An Introduction by Green Chemistry. 7. www.clri.org

COURSE OUTCOME
M.Sc. III SEMESTER
COURSE CODE : PD2
PAPER CODE : 307

PAPER : V (ORGANIC SYNTHESIS -II)

After completion of course the students will able to:-

CO1. Recollect the fundamental principles of organic reactions.
CO2.Understand the concept related to synthesis, mechanisms &thefunction of various reagents.
CO3.Apply Their understanding about the retrosynthetic approaches involved in organic reaction of industrial significance.
CO4. Analyze the product distribution & the stereochemistry of variousorganic products though spectroscope data.
CO5. Evaluate the organic reactions & methodologies based on the influence of the substituents on substrate molecules & nature of solvent & the parametric conditions.
CO6. Design new organic reactions in order to achieve the required retro-synthesisProducts.
.

	CO-1	CO-2	CO-3	CO-4	CO-5	CO-6
PO- 1	✓					✓
PO-2			✓	✓	✓	
PO-3		✓				
PO-4						
PO-5						
PO-6				✓		
PO-7						
PO-8	✓					
PO-9						
PO-10		✓	✓	✓	✓	✓

M.Sc. CHEMISTRY THIRD SEMESTER

COURSE CODE: MSC 307 PAPER-V **COURSE TYPE: PD2**

COURSE TITLE:

ORGANIC SYNTHESIS II

CREDIT:		**HOURS:**	
THEORY:	**PRACTICAL:**	**THEORY:**	**PRACTICAL:**
6		**90**	**00**
MARKS:		**MARKS**	
THEORY:	**PRACTICAL:**	**THEORY:**	**PRACTICAL:**
70+30			

SCHEME OF MARKS :

i. Short answer type questions: three questions carrying 5 marks each to be asked two to beattempted (Word limit 100 words).

ii. Middle answer type questions: three questions carrying 9 marks each to be set two to be attempted (Word limit 250 words).

iii. Long answer type questions: Five questions carrying 14 marks each to beset three to be attempted (Word limit 750 words).

20 Hours	**Disconnection Approach** An introduction to synthons and synthetic equivalents, disconnection approach, functional group inter-conversions, the importance of the order of events in organic synthesis, one group C-X and two group C-X disconnections, ch_emoselectivity, reversal of polarity, cyclisation reactions, amine synthesis
19 Hours	Protecting Groups Principle of protection of alcohol, amine, carbonyl and carboxyl groups. one Group C-C Disconnections Alcohols and carbonyl compounds, regioselectiviity. Alkene synthesis, use of acetylenes and aliphatic nitro compounds in organic synthesis
18 Hours	**Two Group C-C Disconnections** Diels-Aider reaction, 1,3-difunctionalised compounds, cx,j3-unsaturated carbonyl compounds, control in carbonyl condensations, 1,5-difunctionalised compounds. Micheal addition and Robinson annelation.
16 Hours	**Ring Synthesis** Saturated heterocycles, synthesis of 3-, 4-, 5- and 6-membered rings, aromatic heterocycles in organic synthesis.
17 Hours	**Synthesis of Some Complex Molecules** Application of the above in the synthesis of following compounds: Camphor, Longifoline, Cortisone, Reserpine, Vitamin 0, Juvabione, Aphidicolin and Fredericamycin A.
RECOMENDE READINGS:	1. DesigningOrganicSynthesis,S.Warren,Wiley. 2. OrganicSynthesis·Concept,Methods andStartingMaterials,J.FuhrhopandG.Penzillin,VerlageVCH. 3.SomeModernMethodsofOrganicSynthesis.W.Carruthers,CambridgeUniv.Press. 4.ModernSyntheticReactions,H.O.House,W.A.Benjamin, 5.AdvancedOrganicCht!1nistry:Reactions,MechanismsandStructure,J.March,Wiley. 6.PrinciplesofOrganicSynthesis,R.NormanandJ.M.Coxon,BlackieAcademic&Professional. 7.AdvancedOrganicChemistryPartB,F.A.CareyandR.J.Sundberg,PlenumPress.

COURSE OUTCOME
M.Sc. III SEMESTER

COURSE CODE : PD2

PAPER CODE : 308

PAPER : V (HETEROCYCLIC CHEMISTRY)

After completion of course the students will able to:-

CO1. Recall the significance of fundamental aspect of heterocyclic compounds.

CO2. Understand the concepts related to the nomenclature, structural aspects, synthesis reactions mechanism of three, four, five, six and seven membered heterocyclic.

CO3. Apply their understanding about heterocyclic reaction of industrial and medicinal uses .

CO4. Analyse the stereochemistry of products of various heterocyclic reaction.

CO5. Evaluate the heterocyclic reaction based on influence of the substituents on substrate molecule and nature of solvent and the parametric condition.

CO6. Create new heterocyclic reaction in on order to achieve the required products.

	CO-1	CO-2	CO-3	CO-4	CO-5	CO-6
PO- 1	✓	✓	✓			
PO-2				✓		✓
PO-3	✓					
PO-4						
PO-5	✓					
PO-6		✓			✓	
PO-7		✓	✓	✓		
PO-8						✓
PO-9						
PO-10			✓	✓	✓	✓

M.Sc. CHEMISTRY THIRD SEMESTER

COURSE CODE: MSC 308 PAPER-V COURSE TYPE: PD2

COURSE TITLE:

HETEROCYCLICCHEMISTRY

CREDIT: **THEORY: PRACTICAL:** **6**	**HOURS:** **THEORY: PRACTICAL:** **90 00**
MARKS: **THEORY: PRACTICAL:** **70+30**	**MARKS** **THEORY: PRACTICAL:**

SCHEME OF MARKS :

i. Short answer type questions: three questions carrying 5 marks each to b asked two to be attempted (Word limit 100 words).

ii. Middle answer type questions: three questions carrying 9 marks each to be set two to be attempted (Word limit 250words).

iii. Long answer type questions:Five questions carrying 14 marks each to beset three to be attempted (Word limit 750 words).

20 Hours	**NOMENCLATURE OF HETEROCYCLES** Replacement and systematic nomenclature (Hantzsch-Widman system) for monocyclic fused and bridged heterocycles.Aromatic Heterocycles General chemical behaviour of aromatic heterocycles, classification (structural type), criteria of aromaticity (bond lengths, ring current and chemical shifts in 1H NMR-spectra. Empirical resonance energy, delocalization energy and Dewar resonance energy, diamagnetic susceptibility exaltations).Heteroaromatic reactivity and tautomerism in aromatic heterocycles.
18 Hours	**NON-AROMATIC HETEROCYCLES** Strain-bond angle and torsional strains and their consequences in small ring heterocycles. Conformation of six-membered heterocycles with reference to molecular geometry, barrier to ring inversion, pyramidal inversino and 1,3-diaxial interaction. Stereo-electronic effects anomeric and related effects, Attractive interactions-hydrogen bonding and intermolecular nucleophilic, ectrophilic interactions. Heterocyclic Synthesis. Principles of heterocyclic synthesis involing cyclization reactions and cycloaddition reactions.
18 Hours	**SMALL RING HETEROCYCLES** Three-membered and four-membered heterocycles-synthesis and reactions of azirodines, oxiranes, thiranes, azetidines, oxetanes and thietanes.Benzo-Fused Five-Membered HeterocyclesSynthesis and reactions including medicinal applications of benzopyrroles, bezofurans and benzothiophenes.
18 Hours	**MESO-IONIC HETEROCYCLES** General classification, chemistry of some important meso-ionic heterocycles of type-A and B and their applications. Six-membered Heterocycles with one Heteroatom. Synthesis and reactions of pyrylium salts and pyrones and their comparison with pyridinium&thiopyrylium salts and phridones. Synthesis and reactions of quionlizinium and benzopyrylium salts, coumarins and chromones.
16 Hours	**HIGHER HETEROCYCLES** Six membered Heterocycles with two or more Heteroatoms. Synthesis and reactions of diazones, triazines, tetrazines and thiazines. Seven-and Large-membered Heterocycles. Synthesis and reactions of azepines, oxepines, thiepines, diazepinesthiazepines, azocines, diazocines, dioxocines and dithiocines.
RECOMENDE READINGS:	1. Heterocyclic Chemistry Vol. 1-3, R.R. Gupta, M. Kumar and V.Gupta, Springer Verlag. 2. The Chemistry of Heterocycles, T. Eicher and S. Hauptmann, Thieme. 3. Heterocyclic chemistry J.A. Joule, K. Mills and g.F. Smith, Chapman and Hall. 4. Heterocyclic Chemistry, T.L. Gilchrist, Longman ScietificTechinal. 5. Contemporary Hetrocyclic Chemistry, G,.R. Newkome and W.W. Paudler, Wiley-Inter Science. 6. An Introductiion to the Heterocyclic Compounds, R.M. Acheson, Johnwiely. 7. Comprehensive Heterocyclic Chemistry, A.R. Katrizky and C.W. Rees, eds. Pergamon Press

FOURTH SEMESTER
COURSE OUTCOME
M.Sc. IV SEMESTER
COURSE CODE : PD2
PAPER CODE : 401

PAPER : I (BIOINORGANIC CHEMISTRY)

After completion of course the students will able to :-

CO1. Understand the importance of metal ions in living organism.
CO2. Gaon knowledge of different type of enzymes in animals and plants.
CO3. Explain Identify the medicinal applications of inorganic compound of variousdisease.
CO4. select and integrate the Chemistry of metalloenzym and the mechanical aspects of Organometallic compound.

	CO-1	CO-2	CO-3	CO-4
PO- 1	✓			✓
PO-2				
PO-3		✓		✓
PO-4		✓		
PO-5				
PO-6				
PO-7			✓	
PO-8	✓			✓
PO-9				
PO-10			✓	✓

M.Sc. CHEMISTRY FOURTH SEMESTER			
COURSE CODE: MSC 401 PAPER-I		**COURSE TYPE: PD2**	
COURSE TITLE: **BIOINORGANIC CHEMISTRY**			
CREDIT: **THEORY: 6**	**PRACTICAL:**	**HOURS:** **THEORY: 90**	**PRACTICAL: 00**
MARKS: **THEORY: 70+30**	**PRACTICAL:**	**MARKS** **THEORY:**	**PRACTICAL:**

SCHEME OF MARKS :

i. Short answer type questions: three questions carrying 5 marks each to be asked two to be attempted(Word limit 100 words).

ii. Middle answer type questions: three questions carrying 9 marks each to be set two to be attempted (Word limit 250 words).

iii. Long answer type questions: Five questions carrying 14 marks each to beset three to be attempted (Word limit 750 words).

18 Hours	**METAL IONS IN BIOLOGICAL SYSTEM :** **Essential and Trace Metal ions** . Alkali and alkaline earth and transitionmetal cations. Crown ethers, Na & K ion transport, **Calcium in Biology** Calcium In living cells, transport and regulation, molecular. Aspects of intermolecular process,extracellular binding proteins. Metal ion toxicity in biochemical system. Bio membranes and calcium carriers.
18 Hours	**RESPIRATORY PROTEINS** Heme-oxygen carrier: Introduction, Models for transports Heme iron proteins, porphyrin system, substituent effects. Oxygen carriers- Haemoglobin, Myoglobin- structural characteristics and Bohr effect. Non-heme oxygen carriers: Hemerythrin and hemocyanin, Model compounds for oxygen carriers- Cobalt Schiff base, Vaska's complexes.
18 Hours	**METALLOENZYMES (REDOX AND NON REDOX) / METAL ION TRANSPORT AND STORAGE** **Hydrolases:** Carboxypeptidase, carbonic anhydrase, alkaline phosphatase and other dinuclear phosphatases and hydrolases. Electron Transfer Proteins: Blue copper, Iron-Sulphur proteins – Ferridoxins&Rubredoxin, and cytochromes.Redoxenzymes : Cu, Zn SOD and Cytochrome P450, Manganese enzyme and xanthine oxidase. Haem enzymes- peroxidase and catalase.
17 Hours	**Nitrogenase enzyme** : Introduction, Types of nitrogen fixing microorganism,metal clusters in nitrogenase. Nitrogen fixation pathway.Transition metal complexes : Dinitrogen complexes. Biological redox reactions. Photosynthesis and chlorophyll.
19 Hours	**MEDICINAL BIO-INORGANIC CHEMISTRY/CHELATION THERAPY:** Pt complexes in cancer therapy: Cisplatin and its mode of action, cytotoxic compounds of other metals. Gold containing drugs as antirheumatic agents and their mode of action, Lithium in psychopharmacological drugs. Metal complexes as probes of nucleic acid: Function of metal ions in enetic regulation, Metal DNA and RNA interactions – potential binding sites. Chelation Therapy in heavy metal poisoning.
RECOMENDE READINGS:	1. Advanced Inorganic Chemistry, F.A. Cotton and G. W. Wilkinson. John Wiley &Sons, 5th Ed.1988. 2. Inorganic Chemistry, Principles of Structure and Reactivity, J. E. Huheey,E.A. Keiter 4th Ed.Harper Collins, 1993. 3. Bioinorganic chemistry, R. W. Hay, Halsted Press, 1984. 4. Principles of Bioinorganic Chemistry, S. J. Lippard and J.M. Berg, Panima Publishing Corporation, 2nd Ed., 1995. 5. Inorganic Chemistry of Biological Processes, M.N. Hughes, John Wiley &Sons, 2nd Edition, 1985.

COURSE OUTCOME
M.Sc. IV SEMESTER
COURSE CODE :PD2
PAPER CODE : 402

PAPER : II(ENVIRONMENTAL CHEMISTRY)

After completion of course the students will able to :-

CO1. Explain the course, consequence and cure of various type of pollution.

CO2. Describe the methods to analyse and control our and water pollution.

CO3. Classify and understand various analytical techniques for analysis of pollutants.

CO4. Asses the implication of climate change.

CO5. Acquire knowledge of pesticides and their effects on agriculture.

	CO-1	CO-2	CO-3	CO-4	CO-5
PO- 1	✓			✓	
PO-2		✓	✓		
PO-3					
PO-4				✓	
PO-5	✓	✓	✓		✓
PO-6				✓	
PO-7					
PO-8	✓				
PO-9	✓			✓	
PO-10					

M.Sc. CHEMISTRY FOURTH SEMESTER

COURSE CODE: MSC 402 PAPER –II COURSE TYPE: PD2

COURSE TITLE:

ENVIRONMENTAL CHEMISTRY

CREDIT:	**HOURS:**
THEORY: PRACTICAL:	**THEORY: PRACTICAL:**
6	**90 00**
MARKS:	**MARKS**
THEORY: PRACTICAL:	**THEORY: PRACTICAL:**
70+30	

SCHEME OF MARKS :

i. Short answer type questions: three questions carrying 5 marks each to be asked two to beattempted (Word limit 100 words).

ii. Middle answer type questions: three questions carrying 9 marks each to be set two to be attempted (Word limit 250 words).

iii. Long answer type questions: Five questions carrying 14 marks each to beset three to be attempted (Word limit 750 words).

17 Hours	**ATMOSPHERIC CHEMISTRY** The structure of the earth's atmosphere- chemistry of the lower and upper atmosphere.The chemistry of air pollution- oxides of nitrogen- hydrogen sulphide and oxides of sulphur- Aerosols – ozone depletion and consequences- dioxins burning plastics- other atmospheric chemicals- smog- radio activity and fallout- air pollution abatement.Green house effect- Global warming, oxides of carbon.
20 Hours	**THE EARTH ;**The lithosphere- The chemical composition of earth- the structure and composition of inner earth- the mantle, and the crust.The exploitation of mineral resources and the abuse of earth – earth resources – changing the face of the land- the earth as a dump- recycle- earth resource conservation steps. The hydrosphere : The fresh water chemistry – the structure and properties of liquid water – lakes, rivers, ponds and stream – river chemistry, pollution and aeration – water additives- isotopes- mercury pollution. The chemical constituents of sea water- organic matter and suspended material- ocean dumping- oil pollution. The role of water in our total environment- the hydrologic cycle- snow and ice – nucleation and precipitation – the chemical composition of rain water- phase changes and isotopic fractionation.
17 Hours	**THE BIOSPHERE** The structure of the biosphere, Man's perturbation of the biosphere – Man as a chemical factory – material use and waste – energy use and thermal pollution – ecological disruption – chemical sensation, hormonal imbalance and mutagens- internal pollution. Hydrosphere - lithosphere interaction: The structure of water at an interface – chemical composition of mineral water- weathering and the changing face of the land- the origin of the oceans- sedimentation and the deposition of materials from the hydrosphere – chemical exchange between sediments and the water column.
19 Hours	**INTERACTIONS** Lithosphere- biosphere interaction: soil chemistry – the prospects of agriculture- agricultural pollution – pesticides and other persistent pollutants – the deposition of coal and petroleum – theories of origin of petroleum. Atmosphere – biosphere interaction and atmosphere – hydrosphere interaction: history of earth's atmosphere – the nitrogen cycle – the carbon cycle – air – sea interactions. Biosphere – hydrosphere interaction: The chemistry of water pollution – sewage treatment, primary, secondary- and tertiary – activated sledge – trickling filters- denitrification –biology and energy chain – reactor design theory – anaerobic digestion –eutrophication.
17 Hours	**POLLUTION CONTROL** Pollution control in the following: Fertiliser, petroleum, pulp and paper, tanning, sugar, alcohol, electroplating and nuclear reactors. Analysis of pollutants: Sum, specific and group parameters BOD, COD, specific oxygen demand, DOC, DOCl, DOS, Fe, Cr, Cu, Pb, and Ni- So2, NOx, H2S, O3 and CO.
REC OM	1. Chemistry of our environment R.A.Horne 2. Environmental chemistry A.K.De 3. Environmental chemical analysis Iain L, Marr and Malcom S. Cresser 4. Pollution control in process industries S.P.Mahajan.

COURSE OUTCOME

M.Sc. IV SEMESTER

COURSE CODE : PD2

PAPER CODE : 403

PAPER : III (SOLID STATE CHEMISTRY)

After completion of course the students will able to :-

CO1. Recall basic concepts of bonding in solids

CO2. Analyse bonding in solid state chemistry electronegativity, radii and packing ofatoms Band theory.

CO3. Analyse information from various structure charactevisation methods and utilizepowder X-ray diffraction data from phase identification.

CO4. Explain basic structures-crystal defects.

	CO-1	CO-2	CO-3	CO-4
PO- 1	✓		✓	
PO-2		✓		✓
PO-3				
PO-4				
PO-5				
PO-6		✓	✓	
PO-7				
PO-8	✓			✓
PO-9				
PO-10		✓	✓	✓

M.Sc. CHEMISTRY FOURTH SEMESTER

COURSE CODE: MSC403 PAPER-III **COURSE TYPE: PD2**

COURSE TITLE:

SOLID STATE CHEMISTRY

CREDIT: **THEORY:** **PRACTICAL:** **6**	**HOURS:** **THEORY:** **PRACTICAL:** **90** **00**
MARKS: **THEORY:** **PRACTICAL:** **70+30**	**MARKS** **THEORY:** **PRACTICAL:**

SCHEME OF MARKS :

i. Short answer type questions: three questions carrying 5 marks each to be asked two to beattempted (Word limit 100 words).

ii. Middle answer type questions: three questions carrying 9 marks each to be set two to be attempted (Word limit 250 words).

iii. Long answer type questions: Five questions carrying 14 marks each to beset three to be attempted (Word limit 750 words).

18 Hours	**SOLID STATE REACTION**: General principle Experimental procedure , co precipitation as a precursory to solid state reaction ,kinetics of solid state reaction.Crystal Defect and Non – Stoichiometry .perfect and imperfect crystats ,intrinsic and extrinsic defects –point defects .line and plane defects . vacancies-schottky defects and Frenkel defects. Thermodynamics of Schottky and Frenkel defect formation , colour centres non- stoichiometry and defects.
20 Hours	**ELECTRONIC PROPERTIES AND BAND THEORY :** Metal`s insulators and semiconductors , electronic structureof solidsband theory band structure of metals, insulators and semiconductors,Intrinsic and extrinsic semiconductors , doping semiconductors,p-n junction , super conductors . Optical properties- application of optical and electron microscopy. Magnetic properties-Classification of materials. Effect of temperature calculation of magnetic moment, mechanism of ferro and anti ferromagnetic ordering super exchange.
16 Hours	**ORGANIC SOLID:** Electricallyconducting solids ,organic charge transfer complex , organic metals,new super conductors **.** **LIQUID CRYSTALS:** Types of liquid crystals,Nematic ,Smectic ,Ferroelectric ,Antiferroelectric ,various theory of LC .Liquid crystal display,new materials
18 Hours	**THE CRYSTAL LATTICE :** Introduction , Unit cells,crystal planes and Miller Indicies ,diffraction of x-raysby crystels-Bragg`s Law of diffraction ,reciprocal lattice- The Ewald construction, powder method – Debye-Scherrer method ,powder diffractometer, Indexing powder patterns, Determination of density
18 Hours	**BONDING IN SOLIDS :** The Vander Waals forces ,forces of co valency ,bonding in ionic solids –Born –Haber cycle .Extended lattice energy equation ,effect of polarisation, empirical lattice energy equations. Ionic radii, bonding in metals.
RECOMENDE READINGS:	1. J.H. de Boer,The Dynamic Character of Adsorption,Oxford University press Oxford, 1953. 2. S.Brunauer , The Adsorption of gases and Vapours, Princeton, 1945. 3. A. Clark Theory of Adsorption and Catalysis , Academic Press , New York 1970. 4. D.K. Chakrabarty , adsorption and Catalysis by Solids, Wiley Eastern, New Delhi, 1990. 5. G.C. Bond, Heterogeneous Catalysis , Oxford , 1980.

COURSE OUTCOME
M.Sc. IV SEMESTER

COURSE CODE : PD2

PAPER CODE : 411

PAPER : (ORGANIC CHEMISTRY LAB.)

After completion of course the students will able to :-

CO1. Isolation and identification of nature products .

CO2. Different type of reactions involved in synthesis of organic compounds.

CO3. Spectroscopic identification and estimations of organic compounds.

	CO-1	CO-2	CO-3
PO- 1		✓	
PO-2	✓		✓
PO-3			
PO-4			
PO-5			
PO-6		✓	
PO-7		✓	
PO-8			✓
PO-9			
PO-10	✓	✓	✓

M.Sc. CHEMISTRY FOURTH SEMESTER			
COURSE CODE:	**MSC411**	**COURSE TYPE: PD2**	
COURSE TITLE:	**ORGANIC CHEMISTRY LAB**		
CREDIT:		**HOURS:**	
THEORY:	**PRACTICAL:6**	**THEORY:**	**PRACTICAL:**
MARKS:		**MARKS**	
THEORY:	**PRACTICAL:200**	**THEORY:**	**PRACTICAL:**

NOTE : Laboratory course for course will be of 12 hrs duration. The examinee will have to perform three experiments (one each from Section A,B. and C). These experiments will be of 40 marks each will be allotted for viva–voce and sessional work.

SECTION- A

A. Multi-step Synthesis of Organic Compounds :

i. Beckmann Rearrangement: Benzanilide from benzene (Benzene u enzophenone u Benzophenone oxme u Benzanilide.)
ii. Benzilic Acid Rearrangement: Benzilic acid from Benzoin (Benzoin u Benzil u Benzilic acid)
i. Skraup's synthesis (Synthesis of heterocyclic compounds) Quinoline from o-amino Phenol
iv. p-Bromo aniline from aniline (Aniline u Acetanilide u p-bromoacetanilide u p-bromoaniline)
v. p-Nitroacetanilide from Acetanilide(Aniline u Acetanilide u p- Nitroacetanilide u -Nitroaniline)
vi. m-Nitroaniline from Benzene (Benzene u Nitrobenzene u m-Dinitrobenzene u m-Nitroaniline)

SECTION –B

B. Extraction of Organic Compound From Natural Source:

i. Isolation of caffeine from leaves.
ii. Isolation of Casein from milk.
iii. Isolation of lactose from milk.
iv. Isolation of nicotine dipicrate from tobacco.
v. Isolation of Cinchonine from cinchona bark.
vi. Isolation of piperine from black pepper.
viii. Isolation of Lycopene from tomatoes.
ix. Isolation of β-carotene from carrots.
ix. Isolation of oleic acid from olive oil (involving the preparation of complex with urea and separation of Linoleic acid).
x. Isolation of eugenol from cloves.
xi. Isolation of (+) limonine from citrus rinds.

C. Spectroscopy

Indentification of organic compounds by the analysis of their spectral data. (UV, IR, PMR, CMR and MS)

D. Spectrophotometeric Estimations:

(i) Amino acids (ii) Carbohydrate (iii) Ascorbic acid
(iv) Aspirin (v) Caffeine (vi) Cholesterol
(vii) Protein

E. Problem solving-Interpretation of prerecorded spectra of high molecular wt. compound.

SECTION-C

1. Estimatios : Any one of the following estimation –

(i) Halogen (ref.2,p.416) (ii) Hydrogen group (ref.2,p.450)
(iii) Amino group (ref.2,p.463) (iv) Carboxy group (ref.2,p.445)
(v) Methoxyl group (ref.2,p.497) (vi) Sugars (ref.2,p.460)

2. Preparation of dyes -

i. Indigo (ref.1,p.980)
ii. Alizarin (ref.1,p.929)
iii. Malachite green(ref.3,p.344)
iv. Methyl orange (ref.1,p.624 ref.2,p.214 ref.3,p.243)
v. Phenyl azo b-naphthol (ref.1,p.622)
vi. Other dyes of industrial importance.
vii. Identification of a dye on textile fibers (ref.6,p.391,402)
viii. Quantitative estimation of a dye in textile fibers (ref.5,p.519)

Ref. Books

1. A.I. Vogel, Practical Organic Chemistry 3rd Ed. Longman Group Ltd. 1956.
2. F.G. Mann and B.G. Saunders , Practical Organic Chemistry 4th ed. Longman Group Ltd. 1974.
3. R.D. Brewster, C.A.Vannerwert, W.E. McQuwan United Experiments in Organic chemistry, 2ndEd. D.Van Noster and Co. Inc, 1954.

COURSE OUTCOME
M.Sc. IV SEMESTER

COURSE CODE : PD2

PAPER CODE : 404

PAPER : IV (DISSERTATION)

After completion of course the students will able to :-

CO1. Designing of research work.
CO2. Formulation of research methodology.

M.Sc. CHEMISTRY FOURTH SEMESTER			
COURSE CODE:	**MSC404**	**PAPER-IV**	**COURSE TYPE:PD2**
COURSE TITLE:	**DESSERTATION**		
CREDIT:6 **THEORY:**	**PRACTICAL:**	**HOURS:** **THEORY:**	**PRACTICAL:**
MARKS:100 **THEORY:**	**PRACTICAL:**	**MARKS** **THEORY:**	**PRACTICAL:**

COURSE OUTCOME

M.Sc. IV SEMESTER

COURSE CODE : PD2

PAPER CODE : 405

PAPER : V (PHOTOINORGANIC CHEMISTRY)

After completion of course the students will able to :-

CO1. Discribe type of photochemical & photosensitization reactions.

CO2.Explain the fundamental concept of photochemistry.

CO3.Acquire the knowledge of excited states of metal complex and semiconductors.

CO4.Understand the application of photochemical electron transfer in redox reactions.

CO5.Analyse and interpret photoeffects in coordination chemistry.

CO6.Explain physical and photochemical process for the excitation of the molecule.

	CO-1	CO-2	CO-3	CO-4	CO-5	CO-6
PO- 1		✓			✓	
PO-2	✓		✓	✓		
PO-3			✓	✓		
PO-4						
PO-5						
PO-6						
PO-7						
PO-8	✓	✓			✓	✓
PO-9						
PO-10						✓

M.Sc. CHEMISTRY FOURTH SEMESTER

COURSE CODE: MSC 405 PAPER-V COURSE TYPE: PD2

COURSE TITLE:

PHOTO INORGANIC CHEMISTRY

CREDIT:	**HOURS:**
THEORY: PRACTICAL:	**THEORY: PRACTICAL:**
6	**90 00**
MARKS:	**MARKS**
THEORY: PRACTICAL:	**THEORY: PRACTICAL:**
70+30	

SCHEME OF MARKS

i. Short answer type questions: three questions carrying 5 marks each to be asked two to beattempted (Word limit 100 words).

ii. Middle answer type questions: three questions carrying 9 marks each to be set two to be attempted (Word limit 250 words).

iii. Long answer type questions: Five questions carrying 14 marks each to be set three to be attempted (Word limit 750 words).

18 Hours	**BASICS OF PHOTOCHEMISTRY** Absorption, excitation, photochemical laws, quantum yield, electronically excited states• life times-measurements of the times. Flash photolysis, stopped flow techniques. Energy dissipation by radiative and non-radiative processes, absorption spectra, Franck-Condon principle, photochemical stages- primary and secondary processes
18 Hours	**II PROPERTIES OF EXCITED STATES**: Structure, dipole moment, acid-base strengths, reactivity. Photochemical calculation of rates of radiative processes. Bimolecular deactivation - quenching kinetics• **Ill EXCITED STATES OF METAL COMPLEXES**: Excited states of metal complexes: comparison with organic compounds, electronically excited states of metal complexes, charge-transfer spectra, charge transfer excitations, methods for obtaining charge-transfer spectra.
18 Hours	**LIGAND FIELD PHOTOCHEMISTRY** Photosubstitution, photooxidation and photoreduction, lability and selectivity, zero vibrational levels of ground state and excited state, energy content of excited state, zero• zero spectroscopic energy, development of the equations for redox potentials of the excited states.
20 Hours	**REDOX REACTIONS BY EXCITED METAL COMPLEXES** Energy transfer under conditions of weak interaction and strong interaction-exciplex formation; conditions of the excited states to be useful as redox reactants, excited electron transfer, metal complexes as attractive candidates (2,2'-bipyridine and 1,10- phenonthroline complexes), illustration of reducing and oxidising character of Ruthenium2+(bipyridal complex, comparision with Fe(bipy)s; role of spin-orbit coupling-life time of these complexes. Application of redox processes of electronically excited states for catalytic purposes, transformation of low energy reactants into high energy products, chemical energy into light
16 Hours	**Metal Complex Sensitizers** Metal complex sensitizer, electron relay, metal colloid systems, semiconductor supported metal or oxide systems, water photolysis, nitrogen fixation and carbon dioxide reduction

RECOMENDE READINGS:	8. Concepts of Inorganic Photochemistry, A.W. Adamson and P.O. Fleischauer, Wiley. 9. Inorganic Photochemistry, J. Chern. Educ., vol. 60, no. 10, 1983. 10. Progress in Inorganic Chemistry, vol. 30, ed. S.J. Lippard, Wiley. 11. Coordination Chern. Revs., 1981, vol. 39, 121, 131; 1975, 15, 321; 1990,97,313. 12. Photochemistry of Coordination Compounds, V. Balzari and V. Carassiti, Academic Press. 13. Elements of Inorganic Photochemistry, G. J. Ferraudi, Wiley.

COURSE OUTCOME
M.Sc. IV SEMESTER
COURSE CODE : PD2
PAPER CODE : 406

PAPER : V (MATERIAL SCIENCE)

After completion of course the students will able to :-

CO1. Classify materials (crystals) according to their types .

CO2. Understand the theories if metallic state.
CO3. Describe crystal geometry technique of structure determination.
CO4. Acquire knowledge of ionic conductors and organic semiconductors.
CO5 Compare different liquid crystals.

	CO-1	CO-2	CO-3	CO-4	CO-5
PO- 1				✓	
PO-2		✓	✓		✓
PO-3	✓				
PO-4					
PO-5					
PO-6	✓		✓		✓
PO-7	✓				
PO-8		✓			✓
PO-9					
PO-10		✓		✓	

M.Sc. CHEMISTRY FOURTH SEMESTER

COURSE CODE: MSC 406 PAPER-V COURSE TYPE: PD2

COURSE TITLE:

MATERIAL SCIENCE

CREDIT:		**HOURS:**	
THEORY:	**PRACTICAL:**	**THEORY:**	**PRACTICAL:**
6		**90**	**00**
MARKS:		**MARKS**	
THEORY:	**PRACTICAL:**	**THEORY:**	**PRACTICAL:**
70+30			

SCHEME OF MARKS :

i. Short answer type questions: three questions carrying 5 marks each to be asked two to beattempted (Word limit 100 words).

ii. Middle answer type questions: three questions carrying 9 marks each to be set two to be attempted (Word limit 250 words).

iii. Long answer type questions: Five questions carrying 14 marks each to be set three to be attempted (Wordlimit 750 words).

18 Hours	**CLASSIFFICATION OF CRYSTALS** Seven crystal systems and fourteen Bravaislattices.Structure and bonding in solids- Cohesive force in crystals, van der waal'sinteractions,Ionic bonding, covalent bonding and hydrogen bonding in solids.Structure aspects os rock salt, rutile, fluorite, antifluorite, diamond, zinc blende, wurtzite,Crystobalite, spinels, inverse spinels and silicates.
18 Hours	**CRYSTAL GEOMETRY** Symmetry elements for solids (including glide planes and screw axis).Introduction to space groups with examples.Techniques of structure determination in solid state – X-ray diffraction, electron and neutron diffractions and electron microscopy – principle, instrumentation and applications; Calculation of structure factor.
17 Hours	**THEORIES OF METALLIC STATE** Free electron theory,(Brillouin) and Band models.Defects in crystals – Frenkel and Schotky defects, F-centres, effect of defects on the electrical, optical, magnetic, thermal and mechanical properties of crystals.Smart metals- binary and ternary – examples and applications.
17 Hours	**IONIC CONDUCTORS** Optimised ionic conductors-silver ion, copper ion, alumina and related electrolytes, alkali metalion, fluoride ion and proton conductors; super conductors – principle and applications.Models of ionic motion-simple hopping motion – cooperative motion models.Photo conducting materials – principle, examples and applications.
20 Hours	**ORGANIC SEMICONDUCTORS** Organic semiconductors – photo physical processes, thermal and photo generation of carriers;Aromatic hydrocarbons, phthalocynins- anthracene mechanisms; excitons and polarons.Change transfer complexes – characterization and their electrical properties.Conduction polymers- polyacetylenes, polyanilines and polyvinylidenes- preparation and Applications.Carbon Nano particles- fullerenes- preparation and potential applications. liquid crystals- classification- thermotropic and lyptropic- nemetic, smectic and cholestric and their applications.

RECOMENDE READINGS:	1. Materials science Raghavan 2. Materials Science Vol I and II by ManasChanda 3. Structural Inorganic chemistry A.F . Wells 4. Introduction to solid state physics McCrey et al. 5. Solid state chemistry and applications Antony West 6. Solid state chemistry Hannay 7. Chemistry of Nanomaterials,Vol.I&II, C.N.R. Rao, Muller and A. K. Cheetham, 8. Wiley VCH Verlag GmbH KGaA, 2002.

COURSE OUTCOME
M.Sc. IV SEMESTER
COURSE CODE : PD2
PAPER CODE : 407

PAPER : V (CHEMISTRY OF NATURAL PRODUCT)

After completion of course the students will able to :-

CO1. Knowledge of structure of nature product like tapenoids, alkaloids, steoids ,plantpigment.

CO2. Able to describe various type of degradations reaction and synthesis of naturalproducts.

CO3. Classify the terpenoids, alkaloids flavonoids and its application .

CO4. Evaluate the importance of alkaloids in medicinal field.

CO5. Analyse the methods applied in determination of different natural product.

CO6. A research tendency to go for innovative study of organic chemistry in the lightof latest research insight.

	CO-1	CO-2	CO-3	CO-4	CO-5	
PO- 1				✓		✓
PO-2	✓	✓				
PO-3			✓			
PO-4		✓				
PO-5						
PO-6					✓	
PO-7						
PO-8	✓		✓			✓
PO-9						
PO-10				✓	✓	

M.Sc. CHEMISTRY FOURTH SEMESTER

COURSE CODE: MSC407 **PAPER-V** **COURSE TYPE: PD2**

COURSE TITLE:

CHEMISTRY OF NATURAL PRODUCTS

CREDIT: **THEORY:** **PRACTICAL:** **6**	**HOURS:** **THEORY:** **PRACTICAL:** **90** **00**
MARKS: **THEORY:** **PRACTICAL:** **70+30**	**MARKS** **THEORY:** **PRACTICAL:**

SCHEME OF MARKS :

i. Short answer type questions: three questions carrying 5 marks each to be asked two to be attempted (Word limit 100 words).

ii. Middle answer type questions: three questions carrying 9 marks each to be set two to be attempted (Word limit 250 words).

iii Long answer type questions: Five questions carrying 14 marks each to be set three to be attempted (Word limit 750 words).

UNIT-1/ 20 Hours	**TERPENOID AND CAROTENOIDS** Classification,nomenclature, isolation ,general methods of structure determination, isoprene rule .Structuredetermination ,stereochemistry, biosynthesis and synthesis of the following representative molecules : Citral,Gerniol, a-Terpeneol, Methol Farnesol ,Zingiberene, Santonin , Abietic acid and B-carotene.
UNIT-2/ 20 Hours	**STEROIDS** Occurrence, nomenclature ,basic skeleton,Diel`s hydrocarbon and stereochemistry,Isolation,structure determination and synthesis of cholesterol, Bile acids,Androsterone, Testosterone ,Estrone, Progestrone, aldosterone,Biosynthesis of steroids.
UNIT-3/ 11 Hours	**PLANT PIGMENTS** Occurrence, nomenclature and general methods ,of structure determination,Isolationand synthesis of Apigenin, Quercetin,3-glucoside,Vitexin,Diadzein,Buttein,Aureusin,Cyanidin-7arabinoside, Cyanidin,Hirsutidin, Biosynthesis of flavonoids : Acetate pathway and Shikimic acid pathway.
UNIT-4/ 25 Hours	**PORPHYRINS** Structure and synthesis of Haemoglobin and Chlorphyll. Alkaloids:Definition , Nomenclature and physiological action, occurrence,,isolation generalmethods of structure elucidation, Classification based on nitrogen heterocyclic ring,role of alkaloids in plants.Structure , stereochemistry, synthesis and biosynthesis of the following ephedrine,(+)-Coniine, Atropine,quinine and Morphine .
UNIT-5/ 14 Hours	**PROSTGLANDIS** Occurrence, nomenclature, classification,biogenesis and physiological effects.Synthesis of PGE2 and PGF2 a.Pyrethroids and Rotennones; Synthesis and reactions of Pyrethroids and Rotenones . (For Structure educidation, emphasis is to be placed on the use of spectral parameters wherever possible).

RECOMENDE READINGS:	1. Natural Products : Chemistry and Biological Significance, J.Mann,R.S.Davidson.J.B.Hoobbs,D.v.Banthropeadn J.B. Harbomen,Essex. 2. Organic Chemistry :Vil.2,I.L. Finar ELBS. 3. Stereoselective Synthesis: A Practical Approach, M.Norgradi, VCH. 4. Rodd`s Chemistry of Carbon Conpounds Ed.S.Coffey,Elsevier. 5. Chemistry,Biological and Pharmacological Properties of Medicinal Plants from the Americas,Ed.Kurt Hostettmann, M.P. Gupta and A. Marston.Harwood Academic Publishers. 6. Introduction to Flavonoids, B.A. Bohm.Harwood Academic Publishers. 7. New Trends in natural product Chemistry, Ata-ur-Rahman and M.L. Choudhary,HarwoodAcademic Publishrs. 8. Insecteides of Natural Organic, Sukh Dev, Harwood Academic Publishers.