

S. K. E. Society's
Govindram Seksaria Science College (Autonomous)
Belagavi



P. G. DEPARTMENT OF CHEMISTRY

BOARD OF STUDIES (BoS) MEETING

13 SEPTEMBER 2025

MEMBERS OF BoS

Sl. No.	Name and Address	Designation	Signature
1	Prof. C. V. Balikai Co-ordinator PG Department of Chemistry G.S.Sc College, Belagavi Mob: 9035635337	Chairman	
2	Dr. Gurubasavaraj Department of Chemistry RCU ,Belagavi Mob:9538083102	University Nominee	
3	Dr.Vinayak S. Hegde Assistant Professor, Basveshwar Science College ,Bagalkote Mob:8884206315	Subject expert outside the parent University	
4	Dr. M. M. Mane Associate Professor, Madkholkar College of Arts, Science and Commerce.Chandgad,Dist- Kolhapur. Mob:7709093866	Subject expert outside the parent University	
5	Shri. Niranjan Dadkar Dadson Industries, Udyambag, Belagavi. Mob:9243222100	Industry Representative	
6	Shri Ajit Birje Alumnus of GSS, Works at Industry Mob:9740825262	College Alumnus	

7	Prof. A. K. Samant Associate Professor, Principal, G.S.Sc College, Belagavi Mob: 9845982499	Member	
8	Dr. S. M. Deshpande Associate Professor, G.S.Sc College, Belagavi Mob: 9403600796	Member	
9	Prof. R. T. Katamble Assistant Professor, Head Department of Chemistry G.S.Sc College, Belagavi Mob: 9902130098	Member	
10	Prof. A. R. Chitnis Assistant Professor Department of Chemistry G.S.Sc College, Belagavi Mob: 9242153537	Member	
11	Dr. V. A. Sungar Associate Professor Department of Chemistry G. S. Sc College, Belagavi Mob: 9448112593	Member	
12	Dr. S. G. Adoor Assistant Professor Department of Chemistry G.S.Sc College, Belagavi Mob: 9886335372	Member	

**S. K. E. Society's
Govindram Seksaria Science College (Autonomous)
Belagavi**

P. G. DEPARTMENT OF CHEMISTRY
Regulations
Scheme of Examination & Syllabus
for
M.Sc. Degree in Chemistry
as per
Choice Based Credit System
(Effective from the Academic Year 2024-25)

**S. K. E. Society's
Govindram Seksaria Science College (Autonomous)
Belagavi**



P. G. DEPARTMENT OF CHEMISTRY

**Regulations
Scheme of Examination & Syllabus**

for
M.Sc. Degree in Chemistry
as per
Choice Based Credit System
(Effective from the Academic Year 2024-25)

1.0 Title of the Course

The course shall be called **M.Sc. in CHEMISTRY** (Organic)

1.1 Duration of the course: The M.Sc. degree course is of two years duration, spread over four semesters each of four months duration.

1.2 Eligibility for Admission: The Bachelor's degree in science or equivalent degree with Chemistry as one of the subject. The candidate should have obtained at least 40% of marks in optional subjects as rules of the university.

1.3 1.3. Admission & Seat Matrix: The rules for admission and seat matrix as per management G. S. Sc. autonomous college notification from time to time.

1.4 1.4. Admission to other semesters: students are allowed to take admissions to successive semesters under carry over benefit (COB) facility

2.0 Attendance: Every student must have at least 75% attendance in each paper (Theory & Practical) in each semester. Shortage of attendance will be dealt with as per the G. S. Sc. autonomous college rules from time to time.

3.0 Medium of instruction: The medium of instruction shall be English.

4.0 Course Structure:

There shall be *three* categories of papers namely, core subject (Theory & Practical's), soft core (50 marks paper), project dissertation and open elective (Theory) papers for M.Sc. in Chemistry.

In the 1st semester, there shall be 4 core theory papers of 4 credits in each paper and 4 core subject practical papers of 2 credits each.

In 2nd semester, there shall be 3 core theory papers of 4 credits in each paper and 3 core subject practical's of each 2 credits, 1 soft core paper of 2 credits and one open elective paper with 4 credits.

In 3rd semester, there shall be 3 core theory papers of 4 credits in each paper and 3 core subject practical's each of 2 credits, 1 soft core paper of 2 credits and one open elective paper with 4 credits.

In the 4th semester, there shall be 3 core theory papers of 4 credits in each paper and 3 core subjects of practical's each of 2 credits, 1 soft core paper of 2 credits & one project with 4 credits.

Syllabus for each paper of 4 credits shall have four units of 16 h each & each paper of 2 credits shall have two units of 16 h each.

Project work of 4th semester shall be allocated during the 1st semester itself so that it can be planned well in advance for effective execution under the supervision of guide.

5.0 Scheme of Evaluation:

5.1 There shall be an examination at the end of each Semester.

5.2 The duration of examination of theory paper carrying 80 marks is 3h & duration of examination of theory paper carrying 40 marks is 2h.

Duration of Exam for practical's (Lab) is 4h and number of students per batch should not exceed 15.

The IA marks of theory papers are based on best of two out of three per paper per semester as well as attendance, seminar and assignments (if any). The weightage of marks for these components may be distributed accordingly.

The IA marks of practical paper are based on one IA Tests per paper per semester.

5.3 The theory and practical examinations of all the semesters shall be evaluated through single / double valuation by an internal / external examiner as per the guidelines of G. S. Sc. Autonomous, College.

5.4 Project: The project report shall be evaluated for 80 marks by one internal and one external examiner based on the *dissertation* & oral presentation.

IA marks of 20 allocated for project work must be earned from ***Industrial visit / Technical / Study tour*** of minimum 2 days to be undertaken during the 2nd year M.Sc. course. Such a visit/ tour (within India) must be endorsed by the Chairman, Dept. of Chemistry (Principal of affiliated college).

In case the student cannot undertake ***Industrial visit / Technical / Study tour*** due to health issues or unavoidable circumstances, IA marks shall be based on the presentation of the work in a seminar. However, students should produce the medical certificate approved by coordinator.

6.0 Pattern of question paper: 80 (Exam) + 20 (IA)

Question paper contains five questions. Question 1 is compulsory. It shall contain 10 questions carrying 2 marks each, drawn from all the four units. Questions 2, 3, 4 and 5 should be drawn from each unit for 15 marks each (sub questions a, b and c or d carry 5, 5 and 5 marks).

20+60, Total marks = 80 (20+60)

7.0 Maximum period for the completion of M.Sc. Degree in Chemistry: There shall be fully carry over system from first to fourth semesters. Maximum number of years for a student to complete the degree is as specified by the university from time to time.

8.0 The general regulations governing post graduate programs under CBCS and regulation governing post graduate programs in the school of basic sciences under CBCS of G. S. Sc. Autonomous College, Belagavi are applicable to this course for all the matters not covered under this.

Course structure of M.Sc. degree in Chemistry @ GSS College, Belagavi

Subjects	Paper	Instruction hrs / week	Duration of exam, hr	Marks			Credits
				IA	Exam	Total	
a) 1 st semester of the PG Programme							
Core Subject	4 T	4 X 4 = 16	4 X 3	4 X 20	4 X 80	4 X 100	4 X 4 = 16
	4 P	4 X 4 = 16	4 X 4	4 X 10	4 X 40	4 X 50	4 X 2 = 8
Per semester total of credits							24
b) 2 nd and 3 rd semester							
Core Subject	3 T	3 X 4 = 12	3 X 3	3 X 20	3 X 80	3 X 100	3 X 4 = 12
	3 P	3 X 4 = 12	3 X 4	3 X 10	3 X 40	3 X 50	3 X 2 = 6
Soft core	1T	1 X 2 = 2	1 X 2	1X 10	1 X 40	1 X 50	1 X 2 = 2
OEC	1T	1 X 4 = 4	1 X 3	1X 20	1 X 80	1 X 100	1 X 4 = 4
Semester total of credits							24X2= 48
c) 4 th semester							
Core Subject	3 T	3 X 4 = 12	3 X 3	3 X 20	3 X 80	3 X 100	3 X 4 = 12
	3 P	3 X 4 = 12	3 X 4	3 X 10	3 X 40	3 X 50	3 X 2 = 6
Soft core	1T	1 X 2 = 2	1 X 2	1X 10	1 X 40	1 X 50	1 X 2 = 2
Project	1Pr	1 X 4 = 4	Report Evaluation	1X 20	1 X 80	1 X 100	1 X 4 = 4
Semester total of credits							24
Programme grand total of credits							96

T - Theory, P- Practical, Pr-Project, OEC- Open Elective

* For earning IA marks of Project work, please refer to Section 5.4 in the regulation.

Course structure of M. Sc. degree in Chemistry @ GSS College, Belagavi

Paper Details		Teaching h / week	Duration of exam, h	Marks			Credits
				Exam	IA	Total	
1 st Semester							
Core Sub	CHIT 1.1 : Inorganic Chemistry – I	4	3	80	20	100	4
	CHOT 1.2 : Organic Chemistry - I	4	3	80	20	100	4
	CHPT 1.3 : Physical Chemistry - I	4	3	80	20	100	4
	CHAC 1.4: Analytical Chemistry	4	3	80	20	100	4
	CHIPr 1.5: Inorganic Chemistry Practical – I	4	4	40	10	50	2
	CHOPr 1.6:Organic Chemistry Practical – I	4	4	40	10	50	2
	CHPPr 1.7 : Physical Chemistry Practical – I	4	4	40	10	50	2
	CHACPr 1.8: Analytical Chemistry Practical - I	4	4	40	10	50	2
Total		32	28	480	120	600	24
2 nd Semester							
Core Sub	CHIT 2.1 : Inorganic Chemistry – II	4	3	80	20	100	4
	CHOT 2.2 : Organic Chemistry - II	4	3	80	20	100	4
	CHPT 2.3 : Physical Chemistry - II	4	3	80	20	100	4
	CHIPr 2.5: Inorganic Chemistry Practical – II	4	4	40	10	50	2
	CHOPr 2.6:Organic Chemistry Practical – II	4	4	40	10	50	2
	CHPPr 2.7 : Physical Chemistry Practical – II	4	4	40	10	50	2
Soft core	CHORT 2.2.1: Spectroscopy-I	2	2	40	10	50	2
OEC	CHEG – 2.4: Open Elective	4	3	80	20	100	4
Total		30	26	480	120	600	24

Course structure of M. Sc. degree in Chemistry (ORGANIC CHEMISTRY) @ GSS College, Belagavi

Paper Details		Teaching h / week	Duration of exam, h	Marks			Credits
				Exam	IA	Total	
3 rd Semester							
Core Sub	CHORT - 3.1 : Organic Chemistry – III A	4	3	80	20	100	4
	CHORT - 3.2 : Organic Chemistry – III B	4	3	80	20	100	4
	CHORT - 3.3 : Organic Chemistry – III C	4	3	80	20	100	4
	CHORPr 3.6: Organic Chemistry Practical - IIIA	4	4	40	10	50	2
	CHORPr 3.7 Organic Chemistry Practical - IIIB	4	4	40	10	50	2
	CHORPr 3.8: Organic Chemistry Practical - IIIC	4	4	40	10	50	2
Soft core	CHORT 3.4: Spectroscopy - II	2	2	40	10	50	2
OEC	CHEG – 3.5: Open Elective	4	3	80	20	100	4
Total		30	26	480	120	600	24
4 th Semester							
Core Sub	CHORT - 4.1 : Organic Chemistry – IV A	4	3	80	20	100	4
	CHORT - 4.2 : Organic Chemistry – IV B	4	3	80	20	100	4
	CHORT - 4.3 : Organic Chemistry – IV C	4	3	80	20	100	4
	CHORPr 4.5: Organic Chemistry Practical - IVA	4	4	40	10	50	2
	CHORPr 4.6 Organic Chemistry Practical – IVB	4	4	40	10	50	2
	CHORPr 4.7: Organic Chemistry Practical - IVC	4	4	40	10	50	2
Soft core	CHORT 4.4: Advanced Techniques in Organic Compounds	2	2	40	10	50	2
Projec t	CHOP – 4.8: Project / Dissertation	4	-	80	20	100	4
Total		30	23	480	120	600	24
Grand Total		122	103	1920	480	2400	96

**S.K.E. Society's
G.S.S. COLLEGE BELAGAVI
P.G DEPARTMENT OF CHEMISTRY
Syllabus for Autonomous Status
Syllabus of M.Sc. degree in CHEMISTRY**

M.Sc. in CHEMISTRY (Organic Chemistry) @ GSS

III SEMESTER

CHORT-3.1: ORGANIC CHEMISTRY-III A

Teaching: 4 h/ week & Total: 64 h

Credits: 4

UNIT-I

16hr

AROMATICITY

Aromaticity and Huckel's rule: HMO theory, energy level diagrams, Huckel's rule, benzenoid and non-benzenoid aromatic compounds, alternant and non-alternant hydrocarbons, annulenes. Antiaromaticity, homo aromaticity.

Aromaticity of charged rings (3-8 membered): Aromatic character and chemistry of Cyclopropynyl cyclopentadienyl anion, tropylium cation, tropone and tropolone

Heterocyclic Systems: Systems of the type pyrrole, pyridines, pyrilium cation, ferrocene.

Physical methods to study aromaticity: X-ray, UV and ^1H -NMR methods. Ring current as criteria for aromaticity. Annulenes and hetero annulenes [10-18]

Self-Study: Review fundamental concepts of bonding and molecular orbital theory. study the application of Hückel's Rule to various complex cyclic systems and charged rings (e.g., annulenes, ferrocene).

Skill Component: Practice predicting the aromaticity, anti-aromaticity, or non-aromaticity of novel cyclic compounds using Hückel's rule. Develop the ability to interpret spectroscopic data (NMR, UV-Vis) to determine aromatic character and ring current effects.

UNIT –II
REAGENTS IN ORGANIC SYNTHESIS

16hr

Use of the following reagents in organic synthesis and functional group transformation:

- | | |
|-----------------------------------|---------------------------------------|
| 1. Gilmann reagent | 2. Lithium diisopropyl amide (LDA) |
| 3. Dicyclohexyl carbodimide (DCC) | 4. 1,3-Dithiane (reactivity umpolung) |
| 5. Trimethylsilyl iodide | 6. Tri-n-butyl tin hydride (TNBH) |
| 7. DDQ | 8. Woodward-Prevost hydroxylation |
| 9. Baker's Yeast | 10. Phase transfer catalysts |
| 11. Crown ethers | 12. Peterson synthesis |

Self-study: Basics of reagents, storage, handling, expire date. Basic of Crown ethers and Phase transfer catalyst.

Skill components: Students need to list out hazardous and nonhazardous reagents in the above 12 synthesis. Give model for storing safe and handling during reaction (gaggle, Fume hood and other safety measures)

UNIT –III
PHOTOCHEMISTRY

16hr

Interaction of radiation with matter, types of excitations, rate of excited molecules, quenching, quantum efficiency, quantum yield, transfer of excitation energy, actinometry, singlet and triplet states, experimental methods in photochemistry of carbonyl compounds, and transition, Norrish type I and Norrish type II reactions Paterno–Buchi reaction, photoreduction, photochemistry of enones, hydrogen abstraction rearrangement of unsaturated ketones and cyclohexadienones,

photochemistry of parabenzoquinones, photochemistry of aromatic compounds with reference to isomerization, addition and substitution, photochemical isomerization of cis and trans alkenes, photo-Fries rearrangement, Barton reaction, Hoffmann- Loeffler-Freytag reaction, photochemistry of vision.

Self-study: Basics of photochemistry (PC), principle of PC, effect of photon on organic molecules. **Skill components:** Students select at least FOUR photoreaction products and analyse

using different spectroscopic data (UV-Vis, FT-IR, NMR and mass spectrometry from online source).

UNIT –IV

PERICYCLIC REACTIONS

16hr

Pericyclic Reactions: Classification of pericyclic reactions, molecular orbital symmetry, frontier orbitals of ethylene, 1,3-butadiene, 1, 3, 5-hexatriene, allyl system, Woodward-Hoffman correlation diagram method and Perturbation of molecular orbital (PMO) approach of pericyclic reaction under thermal and photochemical conditions, FMO and PMO approach to the following reactions.

Electrocyclic reactions- Con rotatory and dis rotatory ring closure $4n$ and $4n+2$ and allylic systems, Woodward and Hoffmann selection rules for pericyclic reactions.

Cycloadditions reactions - Antarafacial and suprafacial additions, more emphasis on [2+2] and [4+2] Cycloadditions, Diels-Alder reaction, 1,3-dipolar cycloaddition reactions.

Sigmatropic rearrangements: Antarafacial and suprafacial shift involving carbon moieties, retention and inversion of configuration, Ene, Claisen and Cope reaction.

Self-study: Basics of pericyclic, electrocyclic and cycloaddition reactions. Orbital shape, conrotation and dis-rotation, stereochemistry.

Skill components: Students need to prepare some models (ball & Stick) to show some of the selected reactions.

REFERENCE BOOKS:

1. Fundamentals of photochemistry, K.K. Rohatgi Mukherjee, Wiley Eastern Limited, (1986)
2. Organic Photochemistry, J. M. Cozen and B. Halton, Cambridge University Press (I Edition) 1974
3. Molecular Reactions and Photochemistry, C H Deputy and D S Chapman, Prentice Hall India, New Delhi (1st Edition) , 1972.
4. Understanding organic reaction mechanisms, A. Jacob, Cambridge Univ. Press, 1997.
5. Introduction to organic chemistry A. Streitweiser, Jr and C. H. Heathcock, Macmillan, 1985.
6. Physical and mechanistic organic chemistry, R.A.Y. Jones, 1st Edn. Cambridge Univ. Press, 1979.
7. Mechanisms of molecular migrations, Vols I and II, B. S. Thiagarajan, 1st Edn. Pergamon Press, Oxford, 1979.
8. Radicals in organic synthesis, B. Giese, Pergamon Press, 1986.
9. Stereoelectronic effects in organic chemistry, P. Deslongchamps, 1st Edn. Pergamon Press, 1983.

10. Organic photochemistry, J. M. Coxon and B. Halton, 1st Edn, Cambridge Univ. Press, London, 1974.
11. Molecular reactions and photochemistry, C. H. Deputy and D. S. Chapman, 1st Edn. Prenticehall India, New Delhi, 1972.

CHORT-3.2: ORGANIC CHEMISTRY-IIIB

Teaching: 4 h/ week & Total: 64 h

Credits: 4

UNIT-I

16hr

METALS AND NON-METALS IN ORGANIC SYNTHESIS

Organomagnesium compounds (Grignard reagents):

Preparation and structure.

Reactions:

Nucleophilic addition reaction:

With aldehydes and ketones, with imines and nitriles,

Nucleophilic substitution reaction:

At sp² hybrid carbon- reaction with acid chloride, esters, amides, and lactones at sp³ hybrid carbon- reaction with organic halide, oxiranes,

Synthetic uses: For the preparation of hydrocarbons, alcohols, aldehydes, and ketones.

Organo Boron and Silicon compounds: Preparation and applications, hydroboration, hydroboration-oxidation, rearrangements, nucleophilic substitution at silicon. Silyl ethers as protecting groups, ipso substitution with electrophilic reactions, Brook rearrangement.

Self study: Recent advances in organometallic compounds.

Skill components: Preparation of any organozinc compound.

UNIT-II

16 hr

DYNAMIC STEREOCHEMISTRY

Prochirality: Homotopic, heterotopic, enantiotopic and diastereotopic ligands and faces, identification using addition, substitution and symmetry criteria, nomenclature of stereoheterotopic ligands and faces, symbols for stereoheterotopic ligands in molecules with one

or more prochiral centres, chiral and prochiral centre; prochiral plane, symbols for enantiotopic and diastereotopic faces.

Dynamic Stereochemistry: Stereoselectivity in organic synthesis: stereospecific and stereoselective reactions, principle of stereoselectivity-enantioselectivity and diastereoselectivity, use of chiral auxiliaries, Cram's and Prelog's rules. Stereoselectivity in addition, elimination, substitution reactions.

Asymmetric synthesis: using optically active reagents, optically active substrates and optically active catalysts with suitable examples.

Self study: Basic of stereochemistry, enantiomers, diastereomers, R&S configurations, threo
Skill components: Analyse benzenoid (Naphthalene, Anthracene) and non-benzenoid.

UNIT-III DYES AND PIGMENTS

16 hr

Colour and Constitution (electronic concept). Classification of dyes. Methods of applying dyes to the fibres. A general study of the following dyes (Principle involved and synthesis of typical dyes).

Azo dyes: Orange – II, Mordant brown, Congo red, Methyl orange and Methyl red.

Triphenyl methane dyes: Malachite green, Rosaniline, Crystal violet and Phenolphthalein.

Cyanine dyes: Ethyl red, Cyanine blue and Quinaldine.

Reactive dyes and Optical brighteners: Tinopal and Blankophorppp.

Pigments: Fast violet, Lake red and Orange R.

Self study: Basics of dyes, their classification, and synthesis of typical dyes and pigments. principles involved in the

Skill components: Students need to prepare some derivatives using azo dyes by laboratory method.

UNIT-IV OILS, FATS AND LIPIDS

16 hr

Oils, fats and waxes: Definition, chemical composition, chemical properties-hydrogenation, hydrogenolysis, hydrolysis, drying oils, rancidity, analysis of oils and fats- saponification value, iodine and acid value. Soaps-Manufacture of soaps by hot process, cleansing action.

Synthetic detergents, comparison of soaps and detergents, types of detergents (cationic, anionic and nonionic). Animal and plant waxes-composition, examples.

Lipids: Sphingolipids, phospholipids and glycolipids, naturally occurring fatty acids and their triglycerides, essential fatty acids, unusual fatty acids, methods of isolation: Gunstone's partition method, reactions of fatty acids-Fischer and trans esterification, oxidation and acyl group transfer reactions, analytical values-cetane number, emulsions and biodiesel.

Self study: Basics of hydrogenation, hydrogenolysis, hydrolysis, drying, oils, fats, saponification, soaps, detergents, waxes, esterification, and fatty acidification, soaps, detergents, waxes, esterification, emulsion, biodiesels, and fatty acids.

Skill components: students need to carry out some small experiments of soap and detergents with oil and compare the difference between them.

REFERENCE BOOKS:

01. F. A. Carey and Sundberg, Advanced Organic Chemistry – Part A & B, 3rd edition, Plenum Press, New York, 1990.
02. F. A. Carey and Sundberg, Advanced Organic Chemistry – Part A & B, 3rd edition, Plenum Press, New York, 1990.
03. Comprehensive Organic Synthesis – B. M. Trost and I. Fleming series, Pergamon Press, New York, 1991.
04. S. K. Ghosh, Advanced General Organic Chemistry, Book and Allied (P) Ltd, 1998
05. Principles of organic synthesis, Richard Norman and J. M. Coxon
06. Disconnection approach, by Stuart Warren.
07. Natural products: Their chemistry and biological significance-J. Mann,
08. R. S. Davidson, J. B. Hobbs, D. V. Banthorpe & J. B. Harborne, Longman, UK, 1994.
09. Terpenes, J. Verghese, Tata McGraw-Hill, New Delhi, 1982.
10. Chemistry of terpenes and terpenoids, A. Newman, Academic Press, London, 1975.
11. Handbook of naturally occurring compounds Vol. II: Terpenes, T. K. Davon, I. Scott, Academic Press, NY, 1972.
12. Natural products chemistry Vol. I & II, K. Nakanishi, T. Goso, S. Ito, S. Natori & S. Nozoe, Academic Press, NY, 1974.
13. Total synthesis of natural products Vol. I & VI, Apsimon, John Wiley, NY, 1973-1981.
14. Organic chemistry Vol. II, I. L. Finar, 6th Edn. Longman, 1992.
15. Chemistry of natural products Vol. I & II, O. P. Aggarwal, Goel Publishing House, 6th Edn. 1982.
16. Total synthesis of natural products: The chiral approach Vol. III, S. Hanessian Pergamon Press, 1983.
17. Total synthesis of steroids, Akhaun & Titov, Jerusalem, 1969.
18. Medicinal natural products: A biosynthetic approach, P. M. Dewick. John Wiley, Chichester, 1997.

19. The colours of life: An introduction to the chemistry of porphyrins and related compounds, L. R. Milgrom, Wiley Chichester, 1995.
20. Spectral data of natural products Vol. I- K.Yamaguchi, Elsevier Publishing Co, London,1970.
23. Chemistry of natural products: A unified approach, N. R. Krishnaswamy, University Press, India, 1999.

CHORT-3.3: ORGANIC CHEMISTRY-IIIC

Teaching: 4 h/ week & Total: 64 h

Credits: 4

UNIT-I

16 hr

ORGANIC POLYMER CHEMISTRY-I

Preparation and Significance: Preparation of polymers based on different types of monomers. Industrial applications. Nylon, Urea formaldehyde, phenol-formaldehyde and melamine resin. polycarbonates and its applications.

Rubbers: Natural and synthetic rubbers. Structural elucidation of natural rubber. Polymers degradation reactions. Thermal, oxidative and radiative processes.

Synthesis and properties of Buna-S and butyl rubber.

Biodegradable Polymers: Polymer degradation mechanisms, types, synthetic methods and applications of specific polymers like PLA, Polyurethane and Poly-lactico glycolic acid and factors affecting their biodegradability.

Self study: Basics of polymers, rubbers, thermal, oxidative and radiative processes, and analytical chemistry (Electrophoresis, thermal methods of analysis and chromatography)

Skill components: Students need to do the characterization of the given polymers by

Thermogravimetric (TG), Differential thermal analysis (DTA) and Differential scanning calorimetry (DSC) methods.

UNIT-II

16hr

ORGANIC POLYMER CHEMISTRY-II

(BIOPOLYMER CHEMISTRY)

Carbohydrates: Introduction, ring size determination of monosaccharides-glucose and fructose, configuration and conformations of monosaccharides, anomeric effect, epimerization and mutarotation. Configuration of aldoses and ketoses, osazone formation, chain elongation, chain shortening, reducing and non-reducing sugars, redox reactions of monosaccharides.

Polysaccharides: Structural elucidation of starch, structure of cellulose, glycogen, industrial importance starch, cellulose.

Polypeptides and Proteins: Introduction, Bruce-Merrifield synthesis of polypeptides.

Structure of proteins- End group analysis (Edman's and Sanger's methods).

Nucleic acids: Introduction, classification, components of nucleic acids, structures and synthesis of nucleosides and nucleotides, Watson-Crick model of DNA, role of DNA and RNAs in protein synthesis, genetic code-salient features.

Self-study(SS): Basics of carbohydrates, origin, types, examples, stereo isomers of D Glucose, Basic chemistry of amino acids, types of amino acids, history of nucleic acids.

Skill components: Students need to analyse spectral data of D- Glucose and D Fructose (open source/record). Pentapeptide sequence ($\text{H}_2\text{N}-\text{Leu}-\text{Ala}-\text{Phe}-\text{Pro}-\text{Gly}-\text{OH}$) analyzed mass spectrometry fragmentation pattern and confirm the sequence. DNA and RNA mass determination techniques may be model/analyzed (open source).

UNIT-III

16 hr

PETROCHEMICALS

Petroleum refining, constituents of petroleum and their separation. Conversion process (Cracking, reforming, alkylation etc.) for precursors of petrochemicals. Brief description of the chemistry and applications of ethylene, propylene, butylenes, acetylene, benzene and some of their derivatives and conversion into useful products.

Synthetic fibres, rubbers and plastics.

Newer Reactions: Japp-Klingaman reaction, Meerwein arylation, Nef reaction, Raush asymmetric allylation, Sharpless asymmetric dihydroxylation, Ugi-multicomponent reaction and Williamson ether synthesis.

Self study: Basics of petroleum refining, constituents of petroleum their separation, Synthetic fibres, rubbers and plastics.

Skill components: By using the application of the given alkenes (ethylene, propylene butylenes, acetylene, benzene) and their derivatives, covert them into useful products by laboratory methods.

CARBON NANOMATERIALS

Introduction : carbon molecules, nature of carbon bond, carbon structure. Small carbon clusters- C₆₀: Discovery, structure and bonding in Fullerenes and other bulky balls. (, crown ether complexes and cryptands, inclusion compounds, cyclodextrins, catenanes and rotaxanes)

Carbon nano-tubes: Fabrication structure, mechanical properties of Graphene and CNT

Drug delivery using nanomaterials: Targeted and controlled drug release through covalent, non-covalent and defect functionalization (conjugation) of carbon nanotubes (CNTs). Conjugation of biomolecules to other nanomaterials (noble metals, metal oxides, fullerenes and graphene) for targeted drug / gene delivery.

Bio-sensors: An overview, types, design and applications.

Self study: Basics of drugs, Nanomaterials (CNTs), biomolecules, enzymes, hormones, DNA and RNA.

Skill components: Students need to prepare a model on Bio- sensors.

REFERENCES

1. Polymer chemistry – An introduction by Malcolm P.Stevens, 3rd edition, Oxford university press, 1998.
2. Organic polymer chemistry by K.J.Saunders 2nd edition, Chapman and Hall publishers, 1973.
3. Polymer science and technology : Plastics, rubbers, blends and composites by Dr. Premamoy Ghosh 3rd edition . McGraw Hill Education (India) Pvt.Ltd. 2011.
4. Amino acids peptides synthesis , structures and applications . Edited by Bernd Gutte
5. Amino acids peptides and proteins in organic chemistry volume 5 by Andrew B. Hughes, Wiley publications, 2013.43
6. Amino acids and peptides by G.C.Barrett, D.T.Elmore, Cambridge university press, 1998.
7. Amino acids peptides and proteins volume 31, by G.C.Barrett, Don T. Elmore, Jenny A. Littlechild, Anand S.Dutta, Imer sovago, Etelka Farkas. Royal society of chemistry, 2007.
8. Nanotubes and Nanowires- C.N.R. Rao and A. Govindaraj. Editor: Paul O Brien. 2nd illustrated edition. Royal society of chemistry publishing, 2011.
9. Nanoscale materials, edited by Kenneth J. Klabunde, Ryan M.Richards 2nd edition, Wiley publishers, 2009.
10. Synthesis, functionalization and surface treatment of nanoparticles , edited by Marie Isabelle Baraton. Amer scientific publications, 2002.
11. BioMEMS (Microsystems) edited by Gerald A. Urban, 1st edition,
12. Introduction to Nanoscale Science and Technology (Nanostructure Science and Technology volume 6) , edited by -Massimiliano Di Ventra, Stephane Evoy and James R.Heflin, Jr. Springer science and business media, 2004.
13. Nanomaterials for drug delivery and therapy by Alexandru Mihai Grumezescu
14. Introduction to RNA/DNA cleavage by James K.Bashkin , ACS publication , 1998.

Soft-core: CHORT-3.4
SPECTROSCOPY-II

Teaching: 2 h/ week & Total: 32 h

Credits: 2

UNIT-I

16 hr

NUCLEAR MAGNETIC RESONANCE SPECTROSCOPY

Magnetic properties of Nuclei – Nuclear spin, magnetic moment, g factor. Effect of External Magnetic field on the spinning nuclei, Larmor frequency, Resonance condition. Magnetic Energy levels, Relaxation processes – Mechanism & Relaxation time. Line width and factors affecting line width.

Instrumentation: continuous wave methods, sample handling, reference and solvents. (D₂O exchange).

Chemical shift – Factors affecting chemical shift, Electronegativity, Shielding & deshielding mechanisms. Ring current and anisotropic effects, to be illustrated with Alkanes, Alkenes, Alkynes, Alkyl halides, Aromatic and carbonyl compounds. Chemical shifts of different types of organic compounds. NMR of Annulenes

Nature of protons attached to carbon: Integrals, Equivalence of protons – chemical and Magnetic Equivalence. Spin–Spin coupling. Geminal and Vicinal coupling constants, Karplus equation – curve.

First order spectra – High order spectral Analysis. Simplification of spectra – effect of increasing magnetic field strength.

Long range coupling, NOE, Lanthanide shift reagents, Temperature effect, Nuclear double resonance. Study of H-bonding in OH, SH, NH – compounds.

Self-study (SS): Basic of spectroscopy, Electromagnetic radiation, nuclear spin, NMR solvent, theory of NMR.

Skill component (SC): Download simple molecules NMR spectra of C₂H₅OH, CH₃-CO-CH₃, C₆H₆, CH₃OH and CH₃CH₂CH₂OH, analyze ¹H, ¹³C

UNIT-II

MASS SPECTROMETRY

16 hr

Ionisation and Mass analysis.

Instrumentation, methods of ionization, EI, CI, DI, SI - Methods.

Fragmentation : principles, odd and even ions, molecular ion and base peak, Nitrogen rule, metastable ions. Isotope effects in chloro and bromo compounds. Stevenson rule.

Fragmentation of :

i) Normal and Branched Alkanes. ii) Alkenes. iii) benzene and its derivatives.

iv) Alcohols. v) Aldehydes. vi) Ketones. vii) Acids. viii) Esters. ix) Ethers. x) Amines.

xi) Nitro compounds. xii) Halo compounds. xiii) Peptides

McLafferty and McLafferty + 1 rearrangement. Calculation of molecular formula. Composite problems:

Calculation of H- deficiency Index..

Combined applications of spectroscopic techniques

Combined applications of IR, UV-Visible, ^1H NMR, ^{13}C NMR and Mass spectrometry in the structural elucidation of organic compounds.

01. Structure analysis when spectral data of the organic compound is given

02. Structure analysis when spectra of organic compound are given

Self-study (SS): Origin of mass spectrometry, ionization, principle, types of detector.

Skill component (SC): Download some six simple different functional group containing compounds and analyse fragmentation pattern and justify how this helps for structure elucidation of new compounds.

REFERENCE BOOKS:

01. Introduction to Spectroscopy. Pavia, Lampman and Kriz, 3rd edition, Thomson.
02. Spectroscopy, B. P. Straughan and S. Walker, John Wiley & Sons Inc., New York, Vol. 1 & 2, 1976.
03. Vibration Spectroscopy Theory and Applications, D. N. Satyanarayana, New age International, New Delhi.
04. Organic Spectroscopy, William Kemp, 3rd edition, Palgrave, 1991.
05. Optical Method of Analysis, E. D. Olsen, McGraw Hill Inc, 1975.
06. Spectroscopy of organic compounds – P. S. Kalasi, Wiley Eastern Ltd, India 1993.
07. Introduction to instrumental analysis – R. D. Braun, McGraw Hill Book company 1982.
08. Physical methods in inorganic chemistry – R. Drago, East West Pvt. Ltd, 1968.
09. Instrumental methods of chemical analysis – Gurdeep Chatwal and Anand.

10. Organic Spectroscopy, 2nd edition– Jag Mohan, Narosa Publishing House New Delhi.
11. Spectroscopy by H. Kaur, Pragati prakashan, 2017

3.6: ORGANIC CHEMISTRY PRACTICALS-III A

Duration: 4 h/ week & Total: 64h

Credits: 2

ORGANIC ESTIMATIONS

1. Estimation of phenol.
2. Estimation of aniline
3. Determination of saponification value of oils.
4. Estimation of sugars by Fehling's method
5. Estimation of amino acids.
6. Determination of iodine value of oils.

Determination of unsaturation by bromination method

Scheme of Examination:

- i. Duration of examination: 04 hours
- ii. Experiment: 30 marks
- iii. Viva-Voce: 05 marks
- iv. Journal : 05 marks
- v. Internal assessment: 10 marks

Total: 50 marks

REFERENCES

01. Manual of Organic Chemistry Dey and Seetharaman.
02. Modern experimental Organic Chemistry John H. Miller and E. F. Neugil
03. An introduction to practical Organic Chemistry Robert, Wingrove etc.
04. A Text book of practical Organic Chemistry A I. Vogel Vol.III
05. Practical Organic Chemistry Mann & Saunders
06. An Introduction to Practical Organic Chemistry Robert, Wingrove etc.
07. Semimicro qualitative Organic Analysis Cheronis, Entrikin and Hodnet
08. Laboratory Manual of Organic Chemistry R. K. Bansal New PAGE International (P) Ltd. London, 3rd edition, 1996.

3.7: ORGANIC CHEMISTRY PRACTICALS-IIIB

Duration: 4 h/ week & Total: 64 h

Credits : 2

Synthesis via Name Reactions

1. Benzoic acid and benzyl alcohol from benzaldehyde (Cannizarro reaction).
2. Preparation of o-hydroxy benzophenone from phenyl benzoate via Fries rearrangement
3. Esterification: Preparation of benzocaine from p-nitrotoluene
4. Molecular rearrangement: Preparation of o-chlorobenzoic acid from phthalic anhydride
5. Biginelli Reaction: Synthesis of Dihydropyrimidinone from Benzaldehyde and Urea
6. Preparation benzilic acid from benzaldehyde

Scheme of Examination:

- i. Duration of examination: 04 hours
- ii. Experiment: 30 marks
- iii. Viva-Voce: 05 marks
- iv. Journal : 05 marks
- v. Internal assessment: 10 marks

Total: 50 marks

REFERENCES

01. Manual of Organic Chemistry Dey and Seetharaman.
02. Modern experimental Organic Chemistry John H. Miller and E. F. Neugil
03. An introduction to practical Organic Chemistry Robert, Wingrove etc.
04. A Text book of practical Organic Chemistry A I. Vogel Vol.III
05. Practical Organic Chemistry Mann & Saunders
06. An Introduction to Practical Organic Chemistry Robert, Wingrove etc.
07. Semimicro qualitative Organic Analysis Cheronis, Entrikin and Hodnet

08. Laboratory Manual of Organic Chemistry R. K. Bansal New PAGE International (P) Ltd. London, 3rd edition, 1996.
09. Practical Organic Chemistry N. K. Visno, New PAGE International(P) Ltd. London, 3rd edition, 1996

3.8: ORGANIC CHEMISTRY PRACTICALS-IIIIC

Duration: 4 h/ week & Total: 64 h

Credits :2

MULTISTEP ORGANIC PREPARATION

1. Preparation of anthralinic acid from phthalimide.
2. Preparation of p-chlorotoluene from p-toluidine.
3. Preparation of benzophenone oxime and its rearrangement to benzanilide.
4. Preparation of methyl red from anthralinic acid.
5. Preparation of benzopinacolone from benzophenone.
6. Preparation of 6,8-nitro-4-methyl-7-hydroxycoumarine from resorcinol.
7. Preparation of β -anilino- β -phenyl propiophenone from acetophenone and benzaldehyde

Scheme of Examination:

- i. Duration of examination: 04 hours
- ii. Experiment: 30 marks
- iii. Viva-Voce:05 marks
- iv. Journal :05 marks
- v. Internal assessment: 10 marks

Total: 50 marks

REFERENCES

01. Manual of Organic Chemistry Dey and Seetharaman.
02. Modern experimental Organic Chemistry John H. Miller and E. F. Neugil
03. An introduction to practical Organic Chemistry Robert, Wingrove etc.
04. A Text book of practical Organic Chemistry A I. Vogel Vol.III
05. Practical Organic Chemistry Mann & Saunders
06. An Introduction to Practical Organic Chemistry Robert, Wingrove etc.
07. Semimicro qualitative Organic Analysis Cheronis, Entrikin and Hodnet

08. Laboratory Manual of Organic Chemistry R. K. Bansal New AGE International (P) Ltd. London, 3rd edition, 1996.
09. Practical Organic Chemistry N. K. Visno, New AGE International(P) Ltd. London, 3rd edition, 1996.

[OPEN ELECTIVE]
CHEG-3.5: ENVIRONMENTAL CHEMISTRY

Teaching: 4 h/ week & Total: 64 h

Credits : 4

**UNIT-I
POLLUTION**

16 hr

Environmental segments, evolution of earth's atmosphere.

Air pollution: Air pollutants, prevention and control, greenhouse gases and acid rain, carbon monoxide, industrial sources and transportation sources.

SO_x- sources, ambient concentration, test methods, control techniques - scrubbing, limestone injection process. Ozone hole and CFC's, photochemical smog and PAN.

NO_x- sources, ambient concentration, test methods, thermodynamics and NO_x, control techniques. **Particulates:** Size distribution, particulate collection - settling chambers, centrifugal separators, wet scrubbers, electrostatic precipitators & fabric filters, catalytic converters for mobile sources, Bhopal gas tragedy.

**UNIT-II
WATER POLLUTION**

16 hr

Hydrologic cycle, sources, chemistry of sea water, criteria and standards of water quality- safe drinking water, maximum contamination levels of inorganic and organic chemicals, radiological contaminants, turbidity, microbial contaminants, public health significance and measurement of colour, turbidity, total solids, acidity, alkalinity, hardness, chloride, residual chlorine, sulphate, fluoride, phosphate and different forms of nitrogen in natural and polluted water, chemical sources of taste and odour, treatment for their removal, sampling and monitoring techniques.

WATER ANALYSIS

Determination and significance of DO, BOD, COD and TOC, water purification for drinking and industrial purposes, disinfection techniques, demineralization, desalination processes and reverse osmosis.

Radioactive waste management, radionuclides in soil, effects of ionizing radiations effect on ecosystem, accidents at atomic power plants-Chernobyl disaster, disposal of radioactive liquid wastes, methods of radiation protection.

UNIT-IV**16 hr****DETERGENTS, PESTICIDES and SOIL ANALYSIS**

Toxic chemicals in the environment, impact of toxic chemicals on enzymes.

Detergents- pollution aspects, eutrophication.

Pesticides-pollution of surface water. Sewage and industrial effluent treatment, heavy metal pollution. Chemical speciation- biochemical effects of pesticides, insecticides, particulates, heavy metals (Hg, As, Pb, Se), carbon monoxide, nitrogen oxides, sulphur oxides, hydrocarbon, particulates, ozone, cyanide and PAN. Solid pollutants and its treatment and disposal.

Composition of soil - Inorganic and organic components in soil, micro and macro nutrients, nitrogen and sulphur pathways, soil pollution: classification of pollutants and their characteristics, sources, prevention and control, sampling and monitoring techniques.

REFERENCES BOOKS:

01. A.K. De : Environmental Chemistry (Wiley Eastern).
02. S.K. Banerji : Environmental Chemistry (Prentice Hall India), 1993.
03. S.D. Faust and O.M. Aly : Chemistry of Water Treatment, (Butterworths), 1983.
04. G.D. Christian : Analytical Chemistry, (4th Ed.), (John Wiley)
05. Sawyer and McCarty, Chemistry for Environmental Engineering (McGraw Hill) 1978
06. I. Williams, Environmental Chemistry, John Wiley, 2001
07. S. M. Khopkar, Environmental Pollution Analysis, (Wiley Eastern).
08. J.W. Moore: Heavy Metals in Water, (Springer-Verlag), 1984.
09. C. Malcolm, K.Killham and Edwards: Soil Chemistry and its Applications, Cambridge (1993)
10. M. Raymond and J.C. Shickluna: Soils, 5th Ed. (Prentice Hall, India),

Teaching: 4 h/ week & Total: 64h

Credits :

4

UNIT –I

16 hr

RETROSYNTHESIS

Designing the synthesis based on retrosynthetic analysis

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, chemoselectivity, reversal of polarity, cyclization reactions, amine synthesis.

One Group C-C Disconnections: Alcohols and carbonyl compounds, regioselectivity, alkene synthesis, use of acetylenes in organic synthesis.

Two Group C-C Disconnections: Diels-Alder reaction, 1,3-difunctionalised compounds, α,β unsaturated carbonyl compounds, Michael addition and Robinson annulations.

Retrosynthesis: Retrosynthesis of benzocaine, 4-methoxy acetophenone, saccharin and bisavalone.

Protecting Groups: Illustration of protecting and deprotecting groups in organic synthesis. Protection of hydroxyl, carboxyl, carbonyl, thiol and amino groups.

Self study(SS): Basic of retrosynthetic analysis, synthons, synthetic equivalents, chemoselectivity, reversal of polarity, cyclization reactions, basic of protecting group.

Skill Components (SC): Student need to analyze retrosynthetic pathways of saccharin and acetophenone product and intermediate analysis using several spectral data. How carbonyl group is protection monitored by FT-IR spectra need to be explained by taking (acetal and cyclic acetal formation one reaction)

UNIT–II

16 h

AMINO ACIDS AND SOLUTION PHASE PEPTIDE SYNTHESIS

Amino acids, classification, stereochemistry, acid and base properties, biologically active amino acids, peptides and proteins—enzymatic hydrolysis, N-terminus protection, protecting reagents both acid and base labile, C-terminus protection,

Amide bond formation: methods and strategies, Acyl chlorides synthesis, Coupling reactions with acyl chlorides, Limitations of acyl chlorides, Acyl fluorides, fluorinating agents, Acyl azides, Acyl imidazoles using CDI, Anhydrides: Symmetric anhydrides, Mixed anhydrides, N-carboxy anhydrides or Leuch's anhydrides Esters, Active esters of penta fluorophenol and Succinimidyl esters synthesis and applications, Phosphonium salts and Uronium salts reagents in peptide formation.

Self study: Basic of Amino acid classification, polypeptides, proteins and nucleic acids. Definition classification, characteristics and examples.

Skill components: Analyze and interpret with some suitable data for DNA and RNA in protein synthesis

UNIT –III

16 hr

ALKALOIDS ,TERPENOIDS AND STEROIDS

Alkaloids: Introduction, classification, methods of isolation, general methods of isolation from plants, general methods of structural elucidation, structural elucidation and synthesis of ephedrine and quinine. Structure and biological importance of cocaine, codeine, thebaine and morphine. **Terpenoids:** Introduction, classification, isoprene rule, structural elucidation and synthesis of menthol and zingiberene.

Steroids: Introduction, classification; Diels hydrocarbon- its importance and synthesis, stereochemistry of cholesterol. Structural elucidation of cholesterol-Blanc's rule, location of double bond, hydroxyl group, angular methyl groups and side chain in cholesterol, total synthesis.

Self-study (SS): Basics of alkaloids, terpenoids and antibiotics, isolation and nomenclature.

Skill components (SC): Analyze each one compound of the above class using various spectra.

UNIT –IV

16 hr

PROSTAGLANDINS, HORMONES AND VITAMINS

Prostaglandins: Introduction, classification and biological importance, constitution of PGE₁, synthesis of PGE₁ by Corey's and Upjohn's approach.

Hormones : Classification of hormones into steroid, peptide/protein, and amino acid-derived types; general structural features of steroid hormones and their simple biosynthesis from cholesterol; overview of peptide hormones such as insulin and oxytocin; amino acid-derived hormones including adrenaline, noradrenaline, and thyroxine and physiological importance

Vitamins: Definition, Classification and biological importance, synthesis of vitamin C from D(+)-Glucose, synthesis of vitamin A.

Self-study(SS): Basics of steroids, Prostaglandins, Vitamins, occurrence, nomenclature and isolation.

Skill components (SC): Students can make model of cholesterol. Students need to perform a small group project on water soluble & fat soluble vitamins, and analyze Vit- A UV-vis and FT-IR data (record/open source).

REFERENCE BOOKS:

01. F. A. Carey and Sundberg, Advanced Organic Chemistry – Part A & B, 3rd edition, Plenum Press, New York, 1990.
02. F. A. Carey and Sundberg, Advanced Organic Chemistry – Part A & B, 3rd edition, Plenum Press, New York, 1990.
03. Comprehensive Organic Synthesis – B. M. Trost and I. Fleming series, Pergamon Press, New York, 1991.
04. S. K. Ghosh, Advanced General Organic Chemistry, Book and Allied (P) Ltd, 1998
05. Principles of organic synthesis, Richard Norman and J. M. Coxon
06. Disconnection approach, by Stuart Warren.
07. Natural products: Their chemistry and biological significance-J. Mann,
08. R. S. Davidson, J. B. Hobbs, D. V. Banthorpe & J. B. Harborne, Longman, UK, 1994.
09. Chemistry of natural products: A unified approach, N. R. Krishnaswamy, University Press, India, 1999.
10. Terpenes, J. Verghese, Tata McGraw-Hill, New Delhi, 1982.
11. Chemistry of terpenes and terpenoids, A. Newman, Academic Press, London, 1975.
12. 4. Handbook of naturally occurring compounds Vol. II: Terpenes, T. K. Davon, I. Scott, Academic Press, NY, 1972.
13. Natural products chemistry Vol. I & II, K. Nakanishi, T. Goto, S. Ito, S. Natori & S. Nozoe, Academic Press, NY, 1974.
14. Total synthesis of natural products Vol. I & VI, ApSimon, John Wiley, NY, 1973-1981.
15. Organic chemistry Vol. II, I. L. Finar, 6th Edn. Longman, 1992.
16. Chemistry of natural products Vol. I & II, O. P. Aggarwal, Goel Publishing House, 6th Edn. 1982.
17. Total synthesis of natural products: The chiral approach Vol. III, S. Hanessian Pergamon Press, 1983.
18. Spectral data of natural products Vol. I- K. Yamaguchi, Elsevier Publishing Co, London, 1970.
19. Total synthesis of steroids, Akhavan & Titov, Jerusalem, 1969.
20. Medicinal natural products: A biosynthetic approach, P. M. Dewick. John Wiley, Chichester, 1997.
21. The colours of life: An introduction to the chemistry of porphyrins and related compounds, L. R. Milgrom, Wiley Chichester, 1995.

CHORT-4.2: ORGANIC CHEMISTRY-IVB

Teaching: 4 h/ week & Total: 64 h

Credits:

4

UNIT-I

16hr

STEREOCHEMISTRY OF COMPOUNDS OTHER THAN CARBON

Stereochemistry of nitrogen compounds: Quaternary ammonium salts, amines, tertiary amine oxides, oximes, determination of configuration of aldoximes and ketoximes, pyramidal inversion and configurational stability.

Phosphorus – chirality in phosphines, phosphine oxides, phosphonium salts; stability and inversion barrier.

Sulphur – stereochemistry of sulfoxides, sulfones, sulfonium salts; configurational stability and resolution.

Silicon – stereogenic silicon in organosilanes and silanols.

Other heteroatoms – brief introduction to chirality in arsenic, selenium, and related compounds.

UNIT-II

16 hr

ANTHOCYANINS CAROTENOIDS AND PORPHYRINS

Anthocyanins: Classification, method of isolation, basic structural features of anthocyanins, structural elucidation of cyanin chloride, pelargonin chloride, delphinidin chloride. Structural elucidation of quercetin and wickstroemia (synthesis not included).

Carotenoids: Methods of isolation. Structural relationship of α -, β - and γ -carotenes. Structure elucidation and synthesis of β -carotene.

Porphyrins: Structure elucidation and synthesis of haemin, chlorophyll-a.

Self study: Carotenoids biosynthesis and its pathway, MEP pathway, Structure and its functions. **Skill components:** Physiological effects of carotenoids, Anthocyanins, porphyrins & List of aroma chemicals.

UNIT III

16hr

INSECTICIDES, FUNGICIDES AND HERBICIDES

Insecticides: Introduction, classification, mode of action and synthesis of chlorinated insecticides (DDT, chlordane, heptachlor and hexachlorocyclohexane), Naturally occurring insecticides-pyrethroids-natural pyrethrins-isolation and structures, synthetic pyrethroids, allethrin, cypermethrin, phenvalerate. Organophosphorous insecticides: Malathion, parathion, DDVP, diazenon. Carbamate insecticides: Sevin, carbofluron, aldicab, beygon.

Fungicides: Introduction, Inorganic & organic fungicides, Systemic fungicides-types & examples.

Herbicides: Introduction, study of sulfonyl ureas, heterocyclic sulfonamides, heterocyclic amines, dihydropyrano[2,3-b]pyridylimidazolinones, pyrrolopyridylimidazolinones, 1,2,4-triazine-3,5-diones, hydroxyoxazolidinones & hydroxypyrrolidinones, pyridine herbicides & 1,3,4-oxadiazoles. Mechanism of action and toxicities of insecticides, fungicides and herbicides.

Self study(SS): Background and Approach to the Study of Insecticides, fungicides and herbicides, and their types.

Skill components(SC): Applications and effects of Insecticides, fungicides and herbicides.

UNIT-IV

16 hr

GREEN CHEMISTRY

Modern Technology: Modern techniques in organic synthesis. Brief outline of microwave. Ultrasound, clay catalyzed techniques and uses of ionic liquids and polymer supports in organic synthesis. Phase-transfer catalysts & Crown-ethers. Super critical fluid extractions

Microwave synthesis: Introduction, reaction vessel, reaction medium, concept, specific effects, atom efficiency, percentage atom utilization, advantage and limitation. N-alkylation and alkylation of active methylene compounds. Condensation of active methylene compounds with

aldehydes. Synthesis of Ibuprofen by BHC and BOOTS approach. Diels- Alder reaction, Leuckarts reductive amination of lactones. Oxidation of alcohols and sulphides. Supramolecules

Self study: Basics of chemistry in daily life, green chemistry, choosing of starting materials, reagents, catalysts, solvents, and green synthesis.

Skill components: Real time analysis for pollution prevention, Use of renewable feedstocks, design for energy efficiency.

REFERENCE BOOKS:

01. Natural products: Their chemistry and biological significance-J. Mann,
02. R. S. Davidson, J. B. Hobbs, D. V. Banthorpe & J. B. Harborne, Longman, UK, 1994.
03. Terpenes, J. Verghese, Tata McGraw-Hill, New Delhi, 1982.
04. Chemistry of terpenes and terpenoids, A. Newman, Academic Press, London, 1975.
05. Handbook of naturally occurring compounds Vol. II: Terpenes, T. K. Davon, I. Scott, Academic Press, NY, 1972.
06. Natural products chemistry Vol. I & II, K. Nakanishi, T. Goso, S. Ito, S. Natori & S. Nozoe, Academic Press, NY, 1974.
07. Total synthesis of natural products Vol. I & VI, Apsimon, John Wiley, NY, 1973-1981.
08. Organic chemistry Vol.II, I. L. Finar, 6th Edn. Longman,1992.
09. Chemistry of natural products Vol. I & II, O. P. Aggarwal, Goel Publishing House, 6th Edn. 1982.
10. Total synthesis of natural products: The chiral approach Vol.III, S. Hanessian Pergamon Press, 1983.
11. Total synthesis of steroids, Akhaun & Titov, Jerusalem, 1969.
12. Medicinal natural products: A biosynthetic approach, P. M. Dewick. John Wiley, Chichester, 1997.
13. The colours of life: An introduction to the chemistry of porphyrins and related compounds, L. R. Milgrom, Wiley Chichester, 1995.
14. Spectral data of natural products Vol. I- K.Yamaguchi, Elsevier Publishing Co, London,1970.
15. Chemistry of natural products: A unified approach, N. R. Krishnaswamy, University Press, India, 1999.
16. R. K. Bansal, Organic Reaction Mechanism, Wiley Eastern Limited, New Delhi, 1993 31. Green Chemistry-Environment friendly alternatives, R.Sanghi & M.M.Srivatsava, Narosa, 2003.
17. Green Chemistry-Environment benign reactions, V.K. Ahluwalia, Ane Books, India, 2006.

Medicinal Chemistry

Teaching: 4 h/ week & Total: 64 h

Credits : 4

UNIT-I

16hr

CHEMOTHERAPEUTIC AGENTS

Introduction, definition of drug, requirements of drugs, chemotherapy, pharmacokinetics, pharmacodynamics, metabolites and anti-metabolites, prodrug and soft drugs, agonists and antagonist, concept of drug receptor, elementary treatment of drug receptor interactions, theories of drug activity-occupancy theory, rate theory, induced fit theory, classification of drugs.

Sulphonamides: Introduction, classification, synthesis and SAR studies of sulphathiazole, sulphanilamide, sulphadiazine.

Antimalarials: Introduction, classification, synthesis and drug action- Chloroquin and Pamaquin.

Analgesics: Introduction, classification, synthesis and drug action-Paracetamol, aspirin, salol, phenyl butazone, antipyrine.

Anti-inflammatory: Introduction, classification, synthesis and drug action- Indomethacin and Ibuprofen.

Self-study: Basics of drugs, chemotherapy, receptor, drug action and SAR studies.

Skill components: Student need to list each class (four) one drug molecule, analyze using spectral data (UV-Vis, FT-IR and NMR) and list out pharmacological and pharmacodynamics data (online source).

UNIT-II

16hr

ANTINEOPLASTIC AGENTS AND CARDIOVASCULAR DRUGS:

Antineoplastic Agents: Introduction, cancer chemotherapy, role of alkylating agents and antimetabolites in treatment of cancer. Mention of carcinolytic antibiotics and mitotic inhibitors.

Synthesis of mechlorethamine, cyclophosphamide, melphalan, mustards and mercaptopurine.

Recent development in cancer- chemotherapy, radiotherapy, photochemotherapy.

Cardiovascular drugs: Introduction, cardiovascular diseases, drug inhibitors of peripheral symphatetic function, central intervention of cardiovascular output direct acting arteriolar dilators, synthesis of dithiazem, verapamil, methyldopa, atenolol, oxprenolol, antihypertensive drugs, lipid lowering agents (atorvastatin, statin derivatives).

Self study: Overview of Antineoplastic, role of Antineoplastic, Toxicity grading scale.

Skill components: Make list of Antineoplastic agents and Cardiovascular drugs, with their uses.

UNIT-III

16 hr

DRUGS AFFECTING THE CENTRAL NERVOUS SYSTEM

Sedatives and hypnotics -Barbiturates (structure-activity relationship, metabolism); benzodiazepines (structure -activity relationship, metabolism)

Synthesis of phenobarbital, hexobarbital nitrazepam and oxazepam.

Anesthetics: General anesthetics; local anesthetics- Mode of action, structure-activity relationships.

Synthesis of methohexital and chloro-procaine.

Synthesis of meperidine, methadone and 6,7 -benzomorphans.

Tranquilizers : phenothiazine derivatives - structure- activity relationship, metabolism and mode of action; other tranquilizers.

Synthesis of chlorpromazine.

Self study: Introduction, Neurotransmitter-receptor relationship, Blood-Brain barrier, Mechanism for action of anticonvulsant drugs.

Skill components: List the major neurotransmitters and neurotransmitter system.

UNIT-IV

16hr

ANTIBIOTICS AND ANTIMYCOBACTERIAL

Antibiotics: Introduction, Development, mechanism of action, uses, doses and side effects of following classes of drugs:

Penicillins-structure activity relationship (SAR) and spectral characterization, streptomycin, chloromycitin and tetracyclins, synthesis of cephalosporin-C.

Antimycobacterial: Introduction, Development, mechanism of action, uses, doses and side effects of following classes of drugs:

a. Antitubercular agents: i) Isoniazid ii) Antibiotics: Rifamycin, Streptomycin, Capriomycin, Canamycin, Clarithromycin, Azithromycin iii) Other Drugs: Pyrazinamide, Ethambutol, para amino Salicylic acid, Ethionamid

b. Antifungal: 1) Polyene membrane disruptors 2) Ergosterol biosynthesis inhibitors

REFERENCE BOOKS:

01. Medicinal Chemistry- An introduction , Gareth Thomas , 2nd edition, John Wiley & sons publications , 2011.
02. Medicinal Chemistry by D.Sriram and P.Yogeeswari, Pearson education , India, 2009.
03. Burger's Medicinal Chemistry and Drug Discovery, Vols. 4, Edited by Donald.J. Abraham, 6th edition John Wiley publication, 2003
04. Foye's Principles of Medicinal Chemistry, 6th Edn., T. L. Lemke, Wolters Kluwer, Lippincott Williams and Wilkins, 2007
05. Medicinal Chemistry, Ashutosh Kar, revised and expanded 3 rd edition, New age international(P) limited, publishers, 2005.
06. An Introduction to Medicinal Chemistry, P Graham, 5th edition, OUP Oxford, 2013.
07. Medicinal Chemistry – G R Chatwal, Himalaya publishing house , New Delhi, 2012.
08. Wilson and Gisvold's Text Book of Organic Medicinal and Pharmaceutical chemistry, Edited by J .H Block , J .M Beale, Jr. published by Wolters Kluwer Lippincott, Williams and Wilkins, 12th edition, 2011.
09. Goodman and Gilman's Pharmacological Basis of Therapeutics, by Laurence L.Brunton , John S. Lazo and Keith L.Parker , 11th Edition., Tata McGraw-Hill, 2005.
10. Essentials of medicinal chemistry, eds., Korolkovas and Burkhaltar, J.H., John wiley & sons, Text book of Organic medicinal and pharmaceutical chemistry by wilson and Gisvold.
11. Synthetic drugs by O. D. Tyagi.
12. Swinyard, E.A.,Remington's phramaceutical sciences ", Ed., Artor Osal, Mack publishing company co., 1980, p.873.
13. "Medicinal Chemistry " Volumes, ed. Burger. '
14. The Organic Chemistry of Drug synthesis by Daniel Lednicer and Lester A. Mitscher

Soft-core: CHORT 4.4

ADVANCED TECHNIQUES FOR ORGANIC COMPOUNDS

Teaching: 2 hr/ week & Total: 32 hr

Credits : 2

UNIT-I

16hr

MOLECULAR LUMINESCENCE SPECTROSCOPY

Molecular luminescence spectroscopy: Theoretical basis for fluorescence and phosphorescence. Singlet and triplet excited states. Variables affecting luminescence-quantum efficiency, transition types, structure and structural rigidity, temperature and solvent effects, effect of pH, dissolved oxygen and concentration effect.

Excitation spectra vs emission spectra.

Fluorescence instrumentation: fluorometers and spectrofluorometers. Sensitivity and selectivity.

Modification necessary to measure phosphorescence.

General scope of applications of luminescence.

UNIT-II

16hr

COMPUTATIONAL CHEMISTRY

Chem Draw and Chem Sketch: Structure drawing and editing, construction of reaction schemes, automated generation of IUPAC nomenclature, molecular formulae and physicochemical properties, and conversion of 2D structures into 3D representations.

Drug discovery process: Computer Aided Drug Design (CADD), Development of New Drugs, Factors Affecting development of New Drugs.

Molecular Modeling: Fundamental techniques of geometry optimization, energy minimization, and conformational analysis through molecular visualization.

Molecular Docking: Rigid docking, flexible docking, manual docking. Autodock and Dock software with examples Preparation of ligands and protein targets, execution and analysis of docking scores with interpretation of non-covalent interactions.

AI Tools for Chemists: Application of artificial intelligence-based platforms for advanced literature search, spectral prediction (NMR, IR), scientific writing assistance, and reference management in research projects.

REFERENCES:

01. Molecular luminescence spectroscopy : Methods and applications by Stephen Gregory Schulman , Wiley publications 1993, digitized on 2010.
02. Cramer, C. J. Essentials of Computational Chemistry: Theories and Models. Wiley, 2nd Edition, 2004.
03. Leach, A. R. Molecular Modelling: Principles and Applications. Pearson, 2nd Edition, 2001.
04. Gasteiger, J., Engel, T. (Eds.). Chemoinformatics: A Textbook. Wiley-VCH, 2003.
05. Gasteiger, J. (Ed.). Handbook of Chemoinformatics. Wiley-VCH, 2003.
06. Jensen, F. Introduction to Computational Chemistry. Wiley, 3rd Edition, 2017.
07. Ertl, P., Schuffenhauer, A. Chemoinformatics in Drug Discovery. Wiley-VCH, 2006
08. V.K.Raman Computational Chemistry

4.6: ORGANIC CHEMISTRY PRACTICALS-IVA

Duration: 4 h/ week & Total: 64 h

Credits :2

QUALITATIVE ANALYSIS OF TERNARY MIXTURE USING ETHER

Ternary Mixture Analysis: Qualitative analysis of three component mixture using ether containing amino acids, low boiling liquids, nitro phenols etc.

Note: Separation of given ternary mixture and analyzing any one component.

Scheme of Examination:

- i. Duration of examination: 04 hours
- ii. Experiment: 30 marks
- iii. Viva-Voce:05 marks
- iv. Journal :05 marks
- v. Internal assessment: 10 marks

Total: 50 marks

SUGGESTED BOOKS

01. Semi-micro qualitative organic analysis, Cheronis, Entrikin & Hoanett.
02. Preparation of organic intermediates, D. A. Hirley, John Wiley.
03. Text book of practical organic chemistry, A. I. Vogel, Pearson, 5th Edition, Delhi, 2004.
04. Organic experiments, L. F. Fieser, 2nd Edn. D. C. Heath & Co. USA, 1974-2000.
05. Practical organic chemistry F.G. Mann and B. C. Saunders 4th Edn. Longman, 2002.
06. Comprehensive practical organic chemistry : Preparation and quantitative Analysis,
07. V. K. Ahluwalia, R. Aggarwal, Universities Press (India), 2000.
08. Comprehensive practical organic chemistry: Qualitative analysis, V. K. Ahluwalia, S.
09. Dhingra, Universities Press (India), 2000.
10. An advanced course in practical chemistry, A. Ghoshal, B. Mahapatra and A. K. Nad,
11. New central book agency, Calcutta, 2000.
12. Advanced practical organic chemistry, J. Mohan, Vol. I and II, Himalaya Publishing House, 1992.
13. Practical organic chemistry (Quantitative analysis), B. B. Dey, M V Sitaraman

14. T. R. Govindachari, Allied Publishers, New Delhi, 1992.
15. Laboratory Techniques in Organic Chemistry, V K Ahluwalia, Pooja Bhagat

4.7: ORGANIC CHEMISTRY PRACTICALS-IVB

Duration: 4 h/ week & Total: 64 h

Credits : 2

PART – A: Preparation of Derivatives: Base, Phenol, Ether soluble neutral, Ether insoluble neutral, Ether insoluble acid, Ether soluble acid.

PART-B : Instrumental methods in Organic analysis

1. Recording/predicting/downloading from web sites the UV, IR, NMR and GC-MS/mass spectra of the compounds prepared in Organic Practical – I, Organic Practical – II, Organic Practical – III and Organic Practical – IV.

02. Structural elucidation of organic compounds with the help of spectra provided by the instructors/examiners.

Note: In Practical examination;

- a) Preparation of any two derivatives.
- b) Elucidation of organic molecule by spectral analysis.

Scheme of Examination:

- i. Duration of examination: 04 hours
- ii. Experiment: 30 marks
- iii. Viva-Voce:05 marks
- iv. Journal :05 marks
- v. Internal assessment: 10 marks

Total: 50 marks

REFERENCES

- 01. Modern experimental Organic Chemistry John H. Miller and E. F. Neugil
- 02. An introduction to practical Organic Chemistry Robert, Wingrove etc.
- 03. A Text book of practical Organic Chemistry A I. Vogel Vol.III

04. Practical Organic Chemistry Mann & Saunders
05. Laboratory Manual of Organic Chemistry R. K. Bansal New AGE International (P) Ltd. London, 3rd edition, 1996.
06. Practical Organic Chemistry N. K. Visno, New AGE International(P) Ltd. London, 3rd edition, 1996.

4.8 : ORGANIC CHEMISTRY PRACTICALS-IVC

Duration: 4 h/ week & Total: 64 h

Credits :2

ISOLATIONS

01. Isolation of cysteine from human hair
02. Isolation of hesperidine from orange peel
03. Isolation of myristine from nutmeg
04. Isolation of lycopene from tomato
05. Isolation of piperine from pepper
06. Isolation of caffeine from tea
07. Isolation of casein from milk
08. Isolation of nicotine from tobacco

Scheme of Examination:

- i. Duration of examination: 04 hours
- ii. Experiment: 30 marks
- iii. Viva-Voce: 05 marks
- iv. Journal : 05 marks
- v. Internal assessment: 10 marks

Total: 50 marks

REFERENCES

01. Modern experimental Organic Chemistry John H. Miller and E. F. Neugil

02. An introduction to practical Organic Chemistry Robert, Wingrove etc.
03. A Text book of practical Organic Chemistry A I. Vogel Vol.III
04. Practical Organic Chemistry Mann & Saunders
05. Semimicro qualitative Organic Analysis Cheronis, Entrikin and Hodnet
06. Laboratory Manual of Organic Chemistry R. K. Bansal New AGE International (P) Ltd. London, 3rd edition, 1996.
07. Practical Organic Chemistry N. K. Visno, New AGE International(P) Ltd. London, 3rd edition, 1996.

SKES' Govindram Seksaria Science College, Belagavi

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CYCLE**

PG DEPARTMENT OF CHEMISTRY

QUESTION PAPER PATTERN

PAPER CODE: –

Title of the paper:

Time: 3 Hours

Max.

Marks: 80

Answer any TEN of the following
10X2=20

1.a

- b
- c
- d
- e
- f
- g
- h
- i
- j
- k

1

Answer any **FOUR** of the following

5X4=20

2

3

4

5

6

7

Answer any **FOUR FULL QUESTIONS** of the following
4X10=40

8 a)

b)

9 a)

b)

10 a)

b)

11 a)

b)

12 a)

b)

Instructions to the Question paper setter:

Please select the questions as follows,

PART A: Three questions from each Unit

PART B: Atleast one question from each Unit

PART C: 8 a) and b) from Unit I

9 a) and b) from Unit II

10 a) and b) from Unit III

11 a) and b) from Unit IV

12 a) and b) are the questions from the two units where the second questions are
not asked in the part B

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PG DEPARTMENT OF CHEMISTRY

QUESTION PAPER PATTERN

PAPER CODE: –

Title of the paper:

Time: 2 Hours

Max. Marks: 40

Note

- 1) Answer all the parts
- 2) Draw diagrams wherever necessary

PART – A

Answer any FIVE of the following

(2X5 =10)

- 1) a.
- b.
- c.
- d.
- e.
- f.

PART – B

Answer any TWO of the following

(2X5 =10)

- 2)
- 3)
- 4)

PART – C

Answer any TWO of the following questions

(2X10 =20)

- 5) a)
- b).
- 6) a)
- b)
- 7) a).
- b)

Instructions to the Question paper setter:

Please select the questions as follows,
PART A: Three questions from each Unit
PART B: Atleast one question from each Unit
PART C: Atleast one question from each Unit