PUNYASHLOK AHILYADEVI HOLKAR SOLAPUR UNIVERSITY, SOLAPUR

NAAC Accredited-2015

'B' Grade (CGPA 2.62)

Name of the Faculty: Science& Technology

CHOICE BASED CREDIT SYSTEM

Syllabus: ORGANIC CHEMISTRY

Name of the Course: M.Sc. II (Sem–III & IV)

(Syllabus to be implemented from w.e.f. June 2021)

PUNYAHLOK AHILYADEVI HOLKAR SOLAPUR UNIVERSITY, SOLAPUR

SCHOOL OF CHEMICAL SCIENCES, SOLAPUR UNIVERSITY, SOLAPUR

M.Sc. Organic Chemistry Choice Based Credit System Revised w.e.f June 2021-22

Two-year duration **M.Sc. Organic Chemistry**course syllabus has beenprepared as per the CBCS semester system. M. Sc. II, SEM-III & SEM-IV OrganicChemistry syllabus will be implemented from June 2021. The syllabus has beenprepared taking into consideration the syllabi of other Universities, SET, NET, UGCguidelines, and the specific inputs of the Expert Committee Members.

General Structure of the Course:

The course will be of four semesters spread over two academic years. Each semester will have four theory papers of 80 marks for university external examination and 20 marks for internal examination of each semester and two practical's of 40 marks, 10 marks for internal practical of each semester. The distribution of marks is mentioned below

Theory Paper (Semester exam), 16 X 80+20 marks 1600 marks

Practicals (semester end exam.), 16 X 40+10 marks 800 marks

Tutorials for each semester, 4 X 25 marks 100 marks

Total 2500 marks

*Add-on-self learning (MOOC /SWAYAM Course /Internship /Industrial Training/ Courses offered by University carries 4 Credit

Semester	Code	Title of the Paper	Semester exam			L	T	P	Credits
I		**Hard core**	**Theory**	**IA**	**Total**				
	HCT-101	Inorganic Chemistry -I	80	20	100	4	--	-	4
	HCT-102	Organic Chemistry -I	80	20	100	4		-	4
	HCT-103	Physical Chemistry -I	80	20	100	4		-	4
		Soft Core (Any one)							
	SCT-104	Analytical Chemistry-I	80	20	100	4		0	4
	SCT-105	Chemistry in Life Sciences	80	20	100	4		0	
		Practicals							
	HCP-106	Practical HCP 1.1	40	10	50	-	-	2	6
	HCP-107	Practical HCP 1.2	40	10	50	-	-	2	
	HCP-108	Practical HCP 1.3	40	10	50	-	-	2	
		Soft core (Any one)							
	SCP-109	Practical SCP1.1	40	10	50	-	-	2	2
	SCP-110	Practical SCP1.2	40	10	50	-	-	2	
	T1	Tutorial			25	-	-		1
		Total for first semester	**480**	**120**	**625**				**25**
II		**Hard core**							
	HCT-201	Inorganic Chemistry -II	80	20	100	4	-	-	4
	HCT-202	Organic Chemistry -II	80	20	100	4	-	-	4

		Soft core (Any one)							
	SCT-203	Physical Chemistry -II	80	20	100	4	-	-	4
	SCT-204	Green Chemistry	80	20	100	4	-	-	
		Open elective (Any one)							
	OET-205	Medicinal Chemistry-I	80	20	100	4		-	4
	OET-206	Analytical Chemistry-II	80	20	100	4		-	4
		Practical							
	HCP-207	Practical HCP 2.1	40	10	50	-	-	2	4
	HCP-208	Practical HCP 2.2	40	10	50	-	-	2	
		Soft core (Any one)							
	SCP-209	Practical SCP 2.1	40	10	50	-	-	2	2
	SCP-210	Practical SCP 2.2	40	10	50	-	-	2	
		Open elective (Any one)							
	OEP-211	Practical OEP 2.1	40	10	50	-	-	2	2
	OEP-212	Practical OEP 2.2	40	10	50	-	-	2	
	T2	Tutorial			25	-	-	-	1
		Total for second semester	**480**	**120**	**625**				**25**
III		**Hard core**	**Theory**	**IA**	**Total**				
	HCT-3.1	Advanced Organic Chemistry-I	80	20	100	4	-	-	4
	HCT-3.2	Chemistry of Bioactive Heterocycles	80	20	100	4	-	-	4
		Soft core (Any one)							
	SCT-3.1	Photochemistry and PericyclicReactions	80	20	100		-	-	
	SCT-3.2	Drug Development	80	20	100	4	-	-	4
		Open elective (Any one)							
	OET-3.1	Applied Organic Chemistry	80	20	100	4	-	-	4
	OET-3.2	Biochemistry	80	20	100	4	-	-	4
		Practical							
	HCP-3.1	Organic Ternary Mixture	40	10	50	-		2	2
	HCP-3.2	Organic Preparation	40	10	50	-	-	2	2
	SCP-3.1	Spectral Analysis	40	10	50	-	-	2	2
		Open elective (Any one)							
	OEP-3.1	Column Chromatography	40	10	50	-	-	2	2
	OEP-3.2	Review Work	40	10	50	-	-	2	2
		Add-on-self learning (MOOC/SWAYAM Course /Internship /Industrial Training/ Courses offered by University *)	-	-	-	-	-	-	4
	T3	Seminar/Tutorial/Industrial Visit/ Field Tour			25	-	-	-	1
		Total for third semester	**480**	**120**	**625**				**29**
IV		**Hard core**	**Theory**	**IA**	**Total**				
	HCT-4.1	Advanced Organic Chemistry-II	80	20	100	4	-	-	4
	HCT-4.2	Modern Organic Chemistry	80	20	100	4	-	-	4
	HCT-4.3	Chemistry of Natural Products	80	20	100	4	-	-	4
		Soft core (Any one)							
	SCT-4.1	Medicinal Chemistry	80	20	100	4	-	-	4
	SCT-4.2	Pharmaceutical Technology	80	20	100	4	-	-	4
		Practical							

	HCP-4.1	Organic Synthesis	40	10	50	-	-	2	2
	HCP-4.2	Organic Chemistry	40	10	50	-	-	2	2
	HCP-4.3	Project Work/In Plant Training	40	10	50	-	-	2	2
		Soft core (Any one)							
	SCP-408	Pharmaceutical Formulation /Medicinal Chemistry	40	10	50	-	-	2	2
	T4	Seminar/Tutorial/Industrial Visit/ Field Tour			25				1
		Total for four semester	**480**	**120**	**625**				**25**

Ratio of marks (Theory: Practical): (73:27)

L = Lecture T = Tutorials P = Practical

4CreditsofTheory=4Hoursofteachingperweek

2CreditofPractical=4hoursperweek

HCT=Hardcoretheory,SCT=Softcoretheory,HCP=Hardcorepractical

SCP=Softcorepractical,OET=Openelectivetheory,

OEP = Open elective practical, HCMP = Hard core main project

HCT/P= Hard Core Theory/Project

Note:

To train the students for the SET/NET/GATE and other competitive examinations, University/College assessment questions should test the understanding of candidate rather than the memory. The question paper should cover all the Units included in the syllabus of the respective paper and the weightage of the questions should correspond to the number of lectures allotted to the respective Units / Topics.

M. Sc. II SEMESTER-III (Organic Chemistry)

Paper Code: HCT-3.1

Advanced Organic Chemistry-I

Credit: 04 **60 L**

Unit-I: Alkylation of Enolates and Other Carbon Nucleophiles [15]

Generation and Properties of Enolates and Other Stabilized Carbanions:Generation of Enolates by Deprotonation, Regioselectivity and Stereoselectivity in Enolate Formationfrom Ketones and Esters, Other Means of Generating Enolates, Solvent Effects on Enolate Structure and Reactivity. Alkylation of Enolates:Alkylation of Highly Stabilized Enolates, Alkylation of Ketone Enolates; Alkylation of Aldehydes, Esters, Carboxylic Acids, Amides, and Nitriles; Generation and Alkylation of Dianions; Intramolecular Alkylation of Enolates; Control of Enantioselectivity in Alkylation Reactions. The Nitrogen Analogs of Enols and Enolates: Enaminesand Imine Anions

Unit -II: Name reactions [18]

Darzen, Prins, Henry, Strecker amino acid synthesis. Bamford-Steven, Baylis-Hillmann, Corey-Fuchs Reaction, Julia Olefination, Mukaiyama aldol, Mitsunobu, Corey-Winter olefination, Shapiro, Ritter, Stille, Heck, Sonogashira, Suzuki, Negishi, Kumada, Hiyama, Tsuji-Trost,Duff, Chugaev, Petasis, McMurry reaction and Coupling. Ring closing metathesis (Grubb's metathesis), Aldol-Tishchenko reaction (Evans-Tishchenko reaction).

Unit-III: Rearrangements [15]

Pummerer, Payne, Eschenmoser fragmentation, Brook, Wagner-Meerwein, Wolf, Semipinacol, Epoxide rearrangement with Lewis acid, Tiffeneau-Demjanov, von Richter, Wittig, Neber, Smiles, Steven, Hofmann, Iodolactonisation, Hoffmann-Loffler Fretag reactions

Unit-IV: Reagents [12]

Complex metal hydrides, Lithium dialkylcuprate, DCC, DDQ, Organotin reagents, Peterson's synthesis, Trimethylsilyl iodide, Peracids, PPA, Ozone, Selenium dioxide, Periodic acid, Iodoisobenzyldiacetate

Reference Books:

1) Francis A. Carey, Richard J. Sundberg - Advanced Organic Chemistry Part B. Reactions and Synthesis-Springer (2007)
2) A guidebook to Mechanism in Organic Chemistry (Orient- Longmens)- Peter Sykes
3) Organic Reaction Mechanism (Benjamin)-R. Bresslow
4) Mechanism and Structure in Organic Chemistry (Holt Reinhartwinston)- B. S. Gould
5) Organic Chemistry (McGraw Hill)-Hendrikson, Cram and Hammond
6) Basic principles of Organic Chemistry (Benjamin) J. D. Roberts and M. C. Caserio.
7) Reactive intermediates in Organic Chemistry 9 Jojn Wiley) N. S. Issacs.
8) Organic reaction mechanism (Mc Graw Hill) R. K. Bansal
9) Advanced organic chemistry, part B: Reaction and synthesis by Francis A. Carey, RichardY. Sandburg.
10) Organic Chemistry by Clayden, Greeves, Warren and Wothers.

Paper Code: HCT-3.2

Chemistry of Bioactive Heterocycles

Credits: 04 60 L

Heterocyclic compounds - Synthesis, reactivity, aromatic character and medicinal importanceof following heterocycles

UNIT -I **[15]**

Baldwin ring closure rules, formation of 3, 4, 5 and 6 membered rings

3-membered rings: Aziridines, Oxiranes, Thiiranes,

4-membered rings:Azetidines, Oxitanes and Thietanes

UNIT II: **[15]**

Five-membered rings with *one* heteroatom: Pyrrollidine, Furan, Pyrrole and Thiophene

Five-membered rings with *two* heteroatoms: Imidazole, Pyrazole, Oxazole, Isoxazole,Thiazole, Isothiazole.

Five-membered rings with *three* heteroatoms: Triazoles, Oxadiazole, Thiadiazole, Tetrazole.

UNIT III: [15]

Six-membered rings with *one* heteroatom: Pyran, Pyridine

Six-membered rings with *two* heteroatoms: Piperazine, Morphine, Thiomorphine,

Pyridazines, pyrimidines, pyrazines,

Six-membered rings with *three* heteroatoms: Hexahydro-1,3,5-triazine

Six-membered rings with *three* heteroatoms: Tetrazine

UNIT- IV: [15]

Benzofused heterocycles:Benzopyrroles, Benzofuran, Indole, Benzothiophene, Benzoxazole, benzthiazole,Benzimidazole, Quinolines, Isoquinoline, Quinazolines, Coumarins and Chromones, Purinesand Pteridines

Reference Books and Text Books

1) R. M. Acheson: An introduction to chemistry of heterocyclic compounds (Interscience)
2) Joule and Smith: Heterocyclic chemistry (Van Nossstrand)
3) R.K. BANSAL: Heterocyclic chemistry (Wiley E)
4) L.A. Paquitte: Principals of modern heterocyclic chemistry
5) M.H. Palamer: The structure and reactions of heterocyclic compounds.
6) A.R. Katrtzhy and A.V. Bootton: Advances in Heterocyclic chemistry (A.P.)
7) Finar: Organic chemistry (Vol. 1 and 2)
8) Conn and Stumf: Outline of Biochemistry
9) Williams, Introduction to the chemistry of enzyme action.
10) The Organic Chemistry of Drug Design and Drug Action, R.B. Silverman AcademicPress.
11) Stralegies for Organic Drug Synthesis and Design. D. Lednicer, John Wiley.
12) Heterocyclic Chemistry Vol. 1-3, R. R. Gupta, M. Kumar, and V. Gupta, SpringerVerlag.
13) The Chemistry of Heterocycles, T Eicher and S. Hauptmann, Thieme.
14) Heterocyclic Chemistry, J. A. Joule, K. Mills and G. F. Smith, Chapman ans Hall.
15) Heterocyclic Chemistry, T. L. Gilchrist, Longman ScietificTechinal
16) Contemporary Heterocyclic Chemistry, G. R. Newkome and W. W. Poudler,Wiley.
17) An Introduction to the Heterocyclic Compounds, R. M. Acheson, John Wiley.
18) Comprehensive Heterocyclic Chemistry, A. R. Katrizky and C. W. Rees, eds,PergamonPress.

Paper Code: SCT- 3.1

Photochemistry and Pericyclic Reactions

Credits: 04 60 Hrs.

UNIT-I Molecular Orbital Theory [15]

Energies calculation of cyclic and acyclic system orbitals, Determination energies and stabilities ofdifferent systems, Calculation of charge densities, PMO theory and reactivity index.

UNIT-II Pericyclic Reactions-I [15]

Features and classification of pericyclic reactions, Phases, nodes and symmetryproperties of molecular orbital in ethylene, 1,3-butadiene, 1,3,5-hexatriene. allyl cation, allyl radical, pentadienyl cation and pentadienyl radical, Thermal and photochemicalreactions.

Electrocyclic reactions: Con-rotation and dis-rotation, electrocyclic closure andopening in 4n and 4n+2 systems, Woodward-Hoffmann selection rules for electrocyclicreactions. Explanation for the mechanism of electrocyclic reactions by: (i) Symmetryproperties of HOMO of open chain partner; (ii) Conservation of orbital symmetry and orbital symmetry correlation diagram and (iii) Huckel-Mobius aromatic and antiaromatictransition state method.

UNIT-III Pericyclic Reactions-II [15]

(a) Cycloaddition reactions: Suprafacial and antarafacial interactions. (π2-cycloadditions, Cycloreversions, Stereochemical aspects in supra–supra, antara-supraand antara-antara (π2 and π4 cycloadditions, Diels-Alder reaction, Woodward-Hoffmann selection rules for cycloaddition reactions, Explanation for the mechanism ofcycloaddition reactions by 1) Conservation of orbital symmetry and orbital symmetry correlation diagrams 2), Fukui Frontier Molecular Orbital (FMO) theory and (3) Huckel-Mobius aromatic and antiaromatic transition state method. Endo-exo selectivity in Diels-Alder reaction and it's explanation by FMO theory, Examples of cycloaddition reactions.

(b) Sigmatropic reactions: [1,j] and [i,j] shifts. Suprafacial and antarafacial shifts, Selection rules for [i, j] shifts. Cope, degenerate Cope and Claisen rearrangements, Explanation for the mechanism of sigmatropic reactions: 1) symmetry properties ofHOMO 2) Huckel-Mobius aromatic and antiaromatic transition state method, chelotropic reactions and explanation of mechanism by FMO theory.

UNIT- IV Photochemistry[15]

Free radical reactions: Types of free radical reactions, detection by ESR, free radical substitution mechanism, mechanism at aromatic substrates, neighboring group assistance. Reactivity for aliphatic and aromatic substitution at a bridge head. Reactivity in attacking radicals. The effect of solvent on reactivity. Allylic hydrogenation (NBS), Oxidation of aldehydes to carboxylic acids, auto-oxidation, coupling of alkynes and arylation of aromatic compounds by diazonium salt, Sandmeyers reaction. Free radical rearrangement, Hunsdiecker reaction

Photochemistry of (π, π∗) transitions: Excited state ofalkenes, cis-trans isomerisation, photochemistry state, electrocyclisation andSigmatropic rearrangements, di π-methane rearrangement.

Intermolecular reactions: photocycloadditions, photodimerasation of sample andconjugated olefins, addition of olefins to α, β unsaturated carbonyl compounds, excimersand exiplexes. Photoaddition reactions. Excited states of aromatic compounds,photodimerisation of benzene, photosubstitution reactions of aromatic compounds andPhoto-Fries rearrangement.

Photochemistry of (n, π∗) transitions: Excited state of carbonyl compounds, haemolytic cleavage of α-bond-Norrish type I reaction in acyclic, cyclic ketones and strainedcycloalkanediones.

Intermolecular abstraction of hydrogen: Photo reduction and photo oxidationinfluence of temperature, solvent, nature of hydrogen donors and structure of thesubstrate.

Intramolecular abstraction of hydrogen: Norrish type II reaction in ketones, estersand 1, 2-diketones.

Addition to C-C multiple bonds: Paterno-Buchi reaction, photodecarboxylation,photochemistry of alkyl peroxides, hypohalites and nitriles. Barton reaction.Photochemistry of azo compounds, diazo compounds, azides and diazonium salts. Singlet oxygen-photo oxygenation reactions. Ene reaction, formation of dioxetanes andendoperoxides. Chemiluminescent reactions. Oxidative coupling.

Recommended Books:

1. Lehar and Merchand: Orbital Symmetry
2. R. B. Woodward and Hoffman: Conservation of Orbital symmetry.
3. Photochemistry and pericyclic reactions by Jagdamba Shingh
4. Cixon and Halton : Organic photochemistry
5. Arnold: Photochemistry

6. N. Turro : Modern Molecular Photochemistry
7. Rohatgi- mukherji : Fundamentals of photochemistry.
8. Ginsburg: Nionbenzoid aromatic compound
9. A. Streitfwieser : Molecular orbital theory for organic chemistry.
10. E. Cler : The aromatic sextet.
11. Lloyd: Carbocyclic non- benzoid aromatic compounds.
12. G. M. Bandger ; The structure and reactions of aromatics compounds
13. W. B. Smith; Molecular orbital methods in Organic Chemist

Paper Code: SCT-3.2

Drug Development

Credits: 04 **60 L**

Unit-I:Concept of drug **[15]**

Concept of drug, Sources of drugs, Drug development, Lipinski rule of 5,Physico chemical properties of molecules: lipophilicity, electrokinetic parameters, steric parameters, pKa (eg. Cimetidine development), and solubility. Types of receptors, Protein and Protein Data Bases,

Unit-II:Computer aided drug designing: **[15]**

Structure and ligand-based drug designing, Lead and drug like properties, concept of lead identification and modification, Structure-activity relationship (SAR), Factors affecting bioactivity, History, and development of QSAR, Types of molecular descriptors, Methods of molecular descriptor selection, 2D QSAR modeling, Introduction to molecular docking and illustrations (NNRTIs and COX-inhibitors).

Unit – III: Pharmacokinetics **[15]**

Introduction to drug absorption, distribution, metabolism, elimination, and toxicity (ADMET). Pharmacokinetic models, bioavailability, Pharmacokinetic parameters (volume of distribution, elimination half-life, clearance). Concept of pro-drug and soft drug.

Unit IV: Pharmacodynamics **[15]**

Introduction to LD_{50}, ED_{50}, IC_{50}, MIC, MEC and Ki. Dose-response relationships, drug potency and efficacy. Principles of drug action, mechanisms of drug action, drug receptor interactions, combined effect of drugs.

Reference Books:

1) Graham L. Patrick, An Introduction to Medicinal Chemistry, Fifth Edition, Oxford University Press
2) Edward H. Kerns and Li Di, Drug-like Properties: Concepts, Structure Design and Methods, Elsevier, 2008
3) Ashutosh Kar, Medicinal Chemistry, New Age International Publishers, Fourth Edition
4) Gupta, S. P. (2011) QSAR & Molecular Modeling. Anamaya Pub.: New Delhi.
5) Jayashree Ghosh, A Textbook of Pharmaceutical Chemistry, 3/eS, Chand Publications
6) Grigauge A, Introduction to Medicinal Chemistry; Wiley-VCH
7) Pandey S S, Dimmock J R, An Introduction to Drug Design; New Age International
8) Wolff Ed M EV, Burger's Medicinal Chemistry and Drug Discovery (6th Edition); JohnWiley
9) 9. Silverman R B, The Organic Chemistry of Drug Design and Drug Action; Academic Press
10) William Foye, Lippicott, Principles of Medicinal Chemistry (4th Edition); William andWilkins
11) Kadam S S, Mahadik, Bothera, Principles of Medicinal Chemistry (11^{th}Edition); Nirali Publication
12) Satoskar R S, Bhandarkar, Pharmacology and Pharmacotherapeutics; PopularPrakashan
13) Organic Chemistry: Clayden, Greeves, Warren and Wo

Paper Code: OET-3.1

Applied Organic Chemistry

Credit: 04 **Hours: 60**

Unit-I Green Chemistry **[10]**

Introduction and basic principles, Ideal synthesis, theoretical and functional details of eco friendly synthetic protocols with suitable examples and applications: Neat synthesis (solvent

free synthesis), Non-volatile organic media and water as green media in organic transformations like ionic liquid, PEG and water, Microwave irradiation as alternative energy source for the chemical transformations, Heterogeneous catalysis/ Immobile catalysis, Ultrasound assisted synthesis.

Unit-II Carbohydrate Chemistry [15]

Introduction, Classification, Monasaccharides, Fisher projection, Dand L-configuration, Conversion of Fisher projection to furanose and pyranose form, Haworth Structure, $^{4}C_{1}$ and $^{1}C_{4}$ Conformations, Conformation of monosaccharides, anomeric effect, Reactions of Monasaccharides, Derivatives of Monosaccharides: Disaccharides, Polysaccharides, homopolysaccharides, heteroploysccarides. Mucopolysaccharides, Gycoprotiens

Unit-III Supramolecular Chemistry [20]

Fundamentals of Supramolecular Chemistry: Terminology and definitions in supramolecular chemistry. Intermolecular forces, Solvent and solution properties, solvation and hydrophobic effect. Binding constants; definition and use.**Molecular Recognition:** Principle of molecular recognition, host-guest complementarity, preorganisation, chelate effect, cooperativity. Synthesis and applications of supramolecular host (crown ethers, lariat ethers, podands, cryptands, spherands, calix[n]arenes, cyclodextrine) as cation and anion binding receptors and receptors for ion-pair recognition.**Supramolecular Reactivity and Catalysis**: Organocatalysis mediated through hydrogen bonding, acid-base catalysis.

Unit-IV Polycyclic Aromatic Compounds [15]

Introduction, Comparative study of the aromatic character of linear and nonlinear Ortho fused Polynuclear Hydrocarbon. General methods of preparation of polycyclic hydrocarbons: Fittig reaction, Ullmann diaryl synthesis, friedel-Craft reaction, Elbs reaction, Phenanthrene synthesis by Paschorr, Haworth, Stobbe condensation, Bardhan-Sengupta, Bogert-Cook methods, Dehydrogenation of hydroaromatic compounds with sulphur, selenium or palladised charcoal. Naphthacene, Rubrene (pentacene and hexacene), 2-benzanthracene, 6-benzanthracene, 4-benzpyrene and 20-methylcholanthrene, Phenanthrene Derivatives: Chrysene, Picene, Pyrene, Perylene, coronene.

References:

1) Supramolecular Chemistry: from Molecules to Nanomaterials Eds. by P.A. Gale and J.W. Steed (2012).
2) Modern Supramolecular Chemistry by F. Diederich, P. J. Stang, R. T. Tykwinski (2008). . Page 20 of 21
3) Core Concepts in Supramolecular Chemistry and Nanochemistry by J. W. Steed, D. R. Turner, K. J. Wallace (2007).
4) Supramolecular Chemistry by J.W. Steed and J.L. Atwood (2011).
5) Supramolecular Chemistry: Concepts and Perspectives by J.-M. Lehn, Wiley VCH, Weinheim (1995).
6) Supramolecular Chemistry by V. Balzani (Editor), L. De Cola, Kluwer, Dordrecht (1992).
7) Introduction to Supramolecular Chemistry by H. Dodziuk, Kluwer Academic Publishers, The Netherlands (2002).
8) Supramolecular Assemblies Y. Murakami (Editor), Mita Press, Tokyo, (1990).
9) Advances in Supramolecular Chemistry, Vol 1 (1990), Vol 2 (1992), Vol 3 (1993) by G. W. Gokel (Editor), JAI Press, Greenwich.
10) Supramolecular Chemistry – Fundamentals and Applications. Advanced Textbook by T. Kunitake, K Ariga, Berlin: Springer-Verlag Heidelberg, 2006. 208 p. ISBN 978-3-540-01298-6.

Paper Code: OET-3.1

Biochemistry

Credits: 04 **60 L**

Unit-I: **[15]**

Introduction of Biochemistry: The molecular logic of life; Structural hierarchy in themolecular organization of Cells. The chemical unity of diverse living organisms,prokaryotic and Eukaryotic.Scope of the subject in pharmaceutical Sciences

Carbohydrates: Classification, basic chemical structure, monosaccharides, aldoses, andketoses, cyclic structure of monosaccharides, stereoisomerisms, anomers and epimers.Reducing properties of monosaccharides, disaccharides, oiligosaccharides,polysaccharides, structural studies methylation and periodate oxidation. Polysaccharidesstructureand function of complex carbohydrates, proteoglycans, glycoproteins,

Glycolipids, mucopolysaccharides

Unit-II: [**15]**

Protein: Classification and properties of amino acids, Primary, Secondary, Tertiary and Quaternary structure of protein. Synthesis, purification, characterization, and sequencing of protein molecules.

Lipids: Classification, structure, and function of lipids.Acylglycerols,circulating lipids: lipoproteins, chylomicrons, LDL, HDL, and VLDL. Pathalogicalchanges in lipid levels. Formation of micelles, monolayers, bilayer, liposomes. Lipid metabolism: Beta oxidation of fatty acids

Unit III: **[15]**

Nucleic acids: Molecules of Heredity: Structure of deoxyribonucleic acid (DNA) and ribonucleicacid (RNA), DNA double helix, A, B, and Z forms of DNA, DNA as genetic material, genetic code, flow of genetic information, DNAreplication, transcription and translation

Vitamins and Co-enzymes: Classification, water-soluble and fat-soluble vitamins.Structure, dietary requirements, deficiency conditions, coenzyme forms.

Unit IV: **[15]**

Bioinorganic Chemistry: Principles of coordination Chemistry related to Bioinorganic– Proteins, nucleic acids, andother metal binding biomolecules. Choice, uptake, and assembly of metal containing units in Biology. Control and utilization of metal ion concentration in cells. Metal ion folding and cross linking of biomolecules. Binding of metal ions and complexes to biomolecular active centers

Reference Books:

1) Principle of Biochemistry, Lehinger D.L. Nelson and M.M. Cox. Macmillan worth
2) Publishers
3) Biochemistry, L. Stryker, W.H. Freeman, San Francisco
4) Schaum's Outline Steries of Theory and Problems of Biochemistry, Philip W. Kuchel and
5) G.B.Ralston. Int. Ed., McGraw-Hill Book Co.
6) Problem Approaches in Biochemistry. Wood and Hood
7) Principle of Biochemistry, Lehinger D.L. Nelson and M.M. Cox. Macmillanworth
8) Publishers
9) Biochemistry, L. Stryer, W.H. Freeman, San Francisco
10) Problem Approaches in Biochemistry Wood and Hood

11) Biochemistry by Satyanarayana

Textbooks:

1) Ligand field theory & its application: B.N.Figgis & M.A. Hitchman (2000) Wiely VCH
2) publ. Chapters 5, 6, 8, 9, 11
3) Principles of Bioinorganic Chemistry: S.J. Lippard & J.M Berg (1994), Universityscience
4) books, Mill Valley, California Chapters-1,2,3,5,6,7,8
5) Inorganic Chemistry: Shriver & Atkins (1999) Oxford
6) Inorganic Electronic spectroscopy: A.B.P. Lever, 2nd edition (1984), Elsevier Science
7) Publishers, New York
8) Biological Chemistry of the Elements: R.J.P. Williams & F.R. de Salvia, Oxford
9) University, Press (1991)
10) Bioinorganic Chemistry: Inorganic elements in the Chemistry of life: An introduction &
11) guide: W.Kaim, B.Schwederski, VCH,(1991)

M. Sc. II, SEMESTER-IV (Organic Chemistry)

Paper Code: HCT- 4.1

Advanced Organic Chemistry-II

Credits: 04 **[60]**

Unit-1: Protecting Groups **[10]**

Protection and deprotection of hydroxyl, carbonyls in aldehydes and ketones, amines, carboxylic acids, alkenes and alkynes

Unit-2: Disconnection Approach **[20]**

Introduction to: Grounding of organic chemistry for understanding retrosynthesis; Retrosynthetic analysis and designing of the synthesis; Disconnection approach: An introduction to synthons, synthetic equivalents, disconnection approach, functional group interconversions, importance of order of events in organic synthesis, one and two group C-X disconnections, selective organic transformations: chemoselectivity, regioselectivity, stereoselectivity, enentioselectivity, Reversal of polarity, cyclization reactions, amine synthesis

C-C Disconnections

i) One group C-C Disconnections:

Alcohols (including stereoslectivity), carbonyls (including regioselectivity), Alkene synthesis, use of acetylenes and aliphatic nitro compounds in organic synthesis

ii) Two group C-C Disconnections:

Diels-Alder reactions, 1,3-difunctionalized compounds and α, β-unsaturated compounds, control in carbonyl condensations, 1,5-difunctionalized compounds, Michael addition and Robbinson annulation

Unit-3: Transitional metals complexes in organic synthesis [15]

Palladium Heck arylation, allylic activation, carbonylation, wacker oxidation, isomarization formation N-aryl and N-alkyl bond transmetalation, allyldeprotection in peptides, coupling reactions: Stille coupling, Sonogashira and Suzuki coupling reactions and their importance

Iron:- Reactions of Iron carbonyls, ferrocenes, Fe-cyclopentadiene complex, protection of dienes, isomerization

Mn & Co:-Manganese and Co-carbonyls in hydroformylation, carboxylations, synthesis of silane complexes and their applications Pausal-khand reactions and its applications protection of alkynes by Co2CO8.

Unit-4: Organoboranes [15]

Preparation and properties of organoborane reagents: RBH_2, R_2BH, R_3B, 9-BBN, catechol borane, Thexylborane, cyclohexylborane, ICPBH2, IPC2BH, Hydrboration-mechanism, stereo and regeoselectivity, uses in synthesis of primary, secondary tertiary alcohols, aldehydes, ketones, alkenes. Synthesis of EE, EZ, ZZ dienes and alkyenes. Mechanism of addition of IPC2BH., Allyl boranes- synthesis, mechanism and uses.

Reference Books:

1) Organic Synthesis: The Disconnection Approach: Stuart Warren
2) Designing Organic Synthesis: Stuart Warren
3) Organic Synthesis: Strategy and Control: Paul Wyatt and Stuart Warren
4) The Logic of Chemical Synthesis: E. J. Corey and Xue-Min Chelg
5) Classics in Total Synthesis I, II and III: K. C. Nicolaou and others
6) Organic Synthesis Concepts, Methods, Starting Materials: J. Fuhrhop, G. Penzlin
7) Some Modern Methods of Organic Synthesis: W. Carruthers
8) Organic Synthesis: M. B. Smith

9) Principles of Organic Synthesis: R. Norman and J. M. Coxan
10) Advanced Organic Chemistry: Jerry March
11) Organic Chemistry: Clayden, Greeves, Warren and Wo

Paper Code: HCT-4.2

Modern Organic Chemistry

Credits: 04 **[60L]**

UNIT-I Multicomponent Reactions [20]

Introduction to Multicomponent Reactions: Strecker amino acid synthesis,Biginelli reaction, Gewald reaction, Hantzsch pyridine synthesis, Mannich reaction, Ugi reaction, Passerini reaction, Petasis reaction

Direct synthesis of heterocycles via MCRs using a namereaction: Biginellireaction, Hantzsch reaction, Click reaction, Gewald reaction, Ugi reaction and Ugi-azide reaction.

Synthesis of heterocycles via MCRs, using a name reaction in combination with another reaction: Michael addition reaction, Mannich reaction,Aldol reaction,Knovenagel reaction andWittigreaction.

UNIT-II Asymmetric synthesis-I **[12]**

Introduction to Stereoselective and stereospecific reactions

Chiral Pool: [α-hydroxy acids and α-amino acids]

Chiral auxiliary: SAMP/RAMP, Mayers Oxazolines, Evans Oxazolidinones, L-valine (Schollkopf Bislactimethers),Seebach Imidazolens from (S)-mandelic acid, Seebach α-hydroxy acids i.e. (*S)*-lactic acids, Cyclic hydrazones.

Chiral reagent: BINAL, BINAP; Hydroboration- Ipc_2BH, $IpcBH_2$, R/S-Alpine borane, DIP-Cl (diisopinocamphylborone chloride), Misamane's Ligand (2,5-dimethylborolane);

Chiral catalyst: CBS, NADH, baker's yeast.Asymmetric epoxidation: Sharpless epoxidation, Jacobson-katsuki epoxidation and Shi epoxidation.Sharpless asymmetric dihydroxylation

UNIT-III Asymmetric synthesis-II **[12]**

Acyclic Stereocontrol – attack on aldehydes and ketones with α-stereocentres (Crams Model, Felkin-Anh model, Cram-Chelate model);Diastereoselective enolate alkylation, Diastereoselectivity of aldol reactions (Zimmerman-Traxler transition state model), Diastereoselective enolate alkylation byEvans oxazolidinone auxiliaries; Diastereoselective

allylation reactions of crotyl boronates and chiral allyl boron reagents; Proline catalyzed asymmetric aldolreactions, mannich reactions; Diastereoselective Reduction; Diastereoselective reduction (Evans-Saksena and Evans-Tishenko); Stereocontrol– attack on alkenes with α-stereocentres in hydroboration and epoxidation reaction.

UNIT-IVMetal-organic framework (MOFs)[16]

Molecules to Materials,Materials of FunctionalMetal-organic framework (MOF):Introduction, Nomenclature of metal-organic frameworks, Structural features of metal-organic frameworks, Basic methods of synthesis of metal-organic frameworks, Functionalization of metal-organic frameworks, Traditional methods of analysis of metal-organic frameworks, Application of MOF.

References:

1) (Topics in Heterocyclic Chemistry 25) Géraldine Masson, Luc Neuville (auth.), Romano V. A. Orru, Eelco Ruijter (eds.) - Synthesis of Heterocycles via Multicomponent Reactions II-Springer-Verlag Berlin
2) Jieping Zhu, Qian Wang, Meixiang Wang - Multicomponent Reactions in Organic Synthesis-Wiley-VCH (2015)
3) K.L. Ameta Ph.D., Anshu Dandia - Multicomponent Reactions_ Synthesis of Bioactive Heterocycles-CRC Press (2017)
4) Zhu J., Bienhame H. (eds.) - Multicomponent Reactions-Wiley-VCH (2005)
5) Raquel P. Herrera, Eugenia Marqués-L_pez - Multicomponent Reactions_ Concepts and Applications for Design and Synthesis-Wiley (2015)
6) Majid M. Heravi, Vahideh Zadsirjan - Recent Advances in Applications of Name Reactions in Multicomponent Reactions-Elsevier (2020)
7) Stereochemistry of Organic Compounds (Principle and application): D. Nasipuri
8) Stereochemistry : Conformation and Mechanism: P. S. Kalsi
9) Stereochemistry of Organic compounds: Ernest L. Eliel / Samuel H. Wilen
10) Advanced Organic Chemistry; Part A and B: F. A. Carey & R. J. Sundberg
11) Organic Chemistry: Clayden, Greeves, Warren and Wothers
12) 6. Organic Synthesis: M. B. Smith
13) Lukehart, Charles M. MacGillivray, Leonard R - Metal-Organic Framework Materials-Wiley (2014)
14) Xian-He Bu, Michael J. Zaworotko, Zhenjie Zhang - Metal-Organic Framework-From Design to Applications-Springer International Publishing_Springer (2020)

15) Wei Xia- Fabrication of Metal–Organic Framework Derived Nanomaterials and Their Electrochemical Applications-Springer Singapore (2018)
16) Wang Zhenqiang.- Design of metal-organic framework materials based upon inorganic clusters and polycarboxylates

Paper Code: HCT-4.3

Chemistry of Natural Products

UNIT-I **[15]**

A] Fused and Bridged rings: Cis- and trans- decalins and nine methyl decalines and perhydraphenanthrene, perhydroanthracene. Bridged rings, Nomenclature stereo chemical restrictions. The Bredts rule, Reactivities.

B] **Steroids:** Occurrence, nomenclature, basic skeleton, Diel's hydrocarbon and stereochemistry. Isolation, structure determination and synthesis of Bile acids, Androsterone, Testosterone, Estrone, Progestrone.

UNIT-II **[15]**

(a) Structure, stereochemistry, synthesis and biogenesis of Hardwickiic acid, Camptothecin and Podophyllotoxin. (Ref. 1 to 4 and 11)

(b) Structure determination and Synthesis of i) Reserpine (Woodward synthesis) Ref. 5, 6 ii) Taxol – Ref. 6 iii) Estrone and Mifepristone – Ref. 6, 7 iv) Strychnine (Overman's synthesis) – Ref. 6 v) Fredericamycin A – Ref. 5.

UNIT-III **[15]**

Biogenesis: The building blocks and construction mechanism of

(i). Terpenoids – Mono, Sesqui, Di and Triterpenoids and cholesterol

(ii) Alkaloids derived from ornithine, lysine, nicotinic acid, tyrosine and trytophan.

(iii) The Shikimate pathway – cinnamic acids, lignans and lignin, coumarins, flavonoids and stilbers, isoflavanoids and terpenoid quinones. Ref. 8, 9, 10.

(iv) Arachidonic acid – Prostagladins & thromboxanes.

UNIT-IV **[15]**

Synthesis and Biological Functions – involving vit. B1, B2, B6, Biotin, Folic acid, Riboflavin, Prostaglandins.

Reference Books:

1) J. Am Chem. Soc. 88, 3888 (1966).
2) M. C. Wani and M.E. Wall J. Org. Chem. 34, 1364 (1969)
3) (i) Tetrahedron Letters, 3751 (1964) (ii) Tetrahedron Letters, 2861 and 2865 (1968)
4) Chemistry of Natural products-Kalsi
5) Principles of organic synthesis by R.O.C. Norman and J. M. Coxon; Chapman and Hall
6) Classics in organic synthesis – K.C. Nicolaou and E.J. Sorensen
7) J. Indian Inst. Sci. 81, 287 (2001).
8) Medial Natural Products – A Biosynthetic approach by Paul M. Dewick 2nd edition (Wiley)
9) Secondary metabolism – J. Mann, 2nd edition.
10) Chemical aspects of Biosynthesis – J. Mann (1994)
11) i) J.C.S. Perkin Transactions II, 288-292, (1973) ii) J. Am. Chem. Soc. Vol. 77, 432-437, (1955).
12) Apsimon: The Total synthesis of natural products.
13) Manskey and Holmes : Alkaloids
14) A.A. Newmen : Chemistry of Terpenes.
15) P. D B.Mayo : The Chemistry of natural products.
16) Simonson : Terpenes.
17) T.W. Goddwin : Aspects of terpenoid chemistry and biochemistry
18) Woguer : Vitamins and Co- enzymes.
19) Bently : Chemistry of natural products,
20) Fieser and Fieser : Steroids
21) Finar : Organic chemistry Vol. II and I
22) J.B. Hendrickson: The molecules of nature.
23) Peter Bernfield : The biogenesis of natural products,
24) R.T. Slickenstaff A.C. Ghosh and G.C. Wole : Total synthesis of steroids.
25) The Chemistry of natural products: by Nakanishi

Paper Code: SCT-4.1

Medicinal Chemistry

Credits: 04 **60 L**

Classification, SAR,Mechanism of action and Synthesis* of drugsfor following classes:

Unit-I **[15]**

Sulfonamides: Sulfisoxazole, Sulfapyridine, Sulfacetamide* and Sulfamethoxazole*

Antibiotics: Penicillin: Ampicillin*, Amoxycillin. Cephalosporin: Cefazolin, Cefadroxil, Cefixime*, Tetracycline, Chloramphenicol*, Amino glycosides: Streptomycin

Antimalerials: Chloroquine*

Unit-II **[15]**

Antiviral: Acyclovir,Remdesivir.

Antifungal: Clotrimazole, Miconazole, Itraconazole

NSAIDs: Aspirin*, Ibuprofen*, Paracetamol*, Diclofenac*, Aceclofenac, Indomethacin, Nimesulide and COX-II inhibitors

Unit-III **[15]**

Antianginal: Nitrates,Nifedipine, Propranolol*

Anti-hypertensive Drugs: Verapamil, Captopril*, Atenolol

Antidiabetics: Insulin,Tolbutamide, Glipizide, Metformin*, Pioglitazone

Antihistamines: Diphenylhydramine*, Chlorpheniramine, Cetrizine

Unit-IV **[15]**

Anaesthetics: Halothane, Lidocaine and Thiopental*

Sedative and hypnotics: Phenobarbital, Diazepam*, Alprazolam

Anticonvulsant: Phenytoin*, Carbamzepine, Valproic acid

Antidepressant: Amitriptiline, Phenelzine*

Antineoplastic: Alkylating agent, Antimetabolites

Reference Books:

1. Comprehensive medicinal chemistry- Corwin and Hansch
1) Medicinal chemistry-Burgers (Vol-I-VI)
2) Principles of medicinal chemistry-William O Foye
3) Textbook of medicinal chemistry- Vol-I&II- Surendra N Pandey
4) Principles of medicinal chemistry- S SKadam, K R Mahadik and K G Bothara
5) Introductory medicinal chemistry- Kennewell and Taylor
6) Wilson and Giswold`sText book of Organic medicinal and Pharmaceutical chemistry- Jaimes N Delgado and William A Remere

7) Fundamentals of microbiology- Forpischer
8) Genetics of antibiotics producing microorganisms- G Sermouti
9) Organic Chemistry: Clayden, Greeves, Warren and Wo
10) Organic Synthesis: The Disconnection Approach: Stuart Warren
11) Designing Organic Synthesis: Stuart Warren

Paper Code: SCT-4.2

Pharmaceutical Technology

Credits: 04 **60 L**

Unit-I: API manufacturing units **[15]**

Chemical process, Chemical plants/Industry,Process flow diagram, Factors affecting chemical processes, Reaction systems, Reactors used in API manufacturing, Plant layout and Effluent Treatment Plant (ETP).

Unit-II: Unit Process **[15]**

Scale up techniques, plant layout of Oxidation: oxidation of Methanol, Liquid phase oxidation with oxygen-Acetaldehyde to Acetic acid, Halogenation: Technical Halogenations-Manufacturing processes for monochloroacetic acid, Chloral, Monochlorobenzene, and Vinyl chloride (Ethylene and Acetylene), Nitration: Typical industrial Nitration process (Nitrobenzene, and α-Nitronaphthalene); Esterification: Esterification by organic acid, Manufacture of Vinyl acetate and Cellulose related to active pharmaceutical ingredients (API) manufacturing-plant layout, Technology transfer.

Unit-III: Unit operation in tableting **[15]**

Milling/Mixing, Granulation, Screening, Drying, Blending, Compression, Coating, Plant layout.

Unit-IV: Validation **[15]**

Validation, Qualifications (DQ, IQ, OQ, PQ), Master plan of validation, Process validation, Cleaning validation, Computer system validation, Utilities validation, Validation of manufacturing equipments and analytical instruments, Analytical method validation, Regulatory guidelines.

Reference Books:

1) The Theory and Practice of Industrial Pharmacy (CBS) by Leon Lachman

2) The Science and Practice of Pharmacy by Remington
3) Pharmaceutical Process Chemistry for Synthesis: Rethinking the Routes to Scale-Up, Peter J. Harrington, John Wiley and Sons Inc. Publication 2011
4) Strategies for Organic Drug Synthesis and Design by Daniel Lednicer, 2nd Edition, John Wiley and Sons Inc. Publication, 2008
5) Process Chemistry in Pharmaceutical Industry, Kumar Gadamasetti, Vol I & II, CRC Press; First edition, 2007.
6) Practical Process Research and Development, Neal G. Anderson, Academic Press., 2000
7) Principles of Process Research and Chemical Development in the Pharmaceutical Industry by O. Repic, John Wiley & Sons. Inc Publication New York, NY, 1998.
8) Organic Synthesis, Groggins P. H, (Third Edition). P. H. Groggins. McGraw-Hill, New York, 1947.
9) Fire Safety Management by Satish Tandon, Arise Publishers & Distributors; 1st edition, 2008.
10) Pollution Prevention of Chemical Processes, Allen David, Wiley-Blackwell, 1996.
11) The Treatment and Handling of Wastes, Bradshaw, A.D. Chapman and Hall for the Royal Society; First Edition edition, 1992.
12) Good Pharmaceutical Manufacturing Practice: Rationale and Compliance by Sharp John, CRC Press; 1st edition, 2004
13) Management Information Systems by Laudon Kenneth C. Prentice Hall; 12th edition, 2011.
14) Plant Design and Economics for Chemical Engineers by Peters, Max S., McGrawHill Science/Engineering/Math; 5 editions, 2002.
15) Textbook of Pharmaceutical Validation (First Edition), by A. A. Kulkarni, V.S. Kashikar, A.H. Hosmani, I.D. Gonjari, Pharma Career Publications
16) ICH Guidelines, www.ich.org
17) WHO Guidelines and GMP Guidelines
18) P.H.Groggins: Unit processes in organic synthesis (MGH)
19) F.A.Henglein: Chemical Technology (Perga mon)
20) M.G.Rao & M. Sitting: Outlines of Chemical Technology (EWP)
21) Clausen, Mattson: Principle of Industrial Chemistry

M. Sc. II, SEMESTER-III(Organic Chemistry)

PRACTICAL COURSE

HCP 3.1: Organic Ternary Mixture

Separation, purification and identification of organic compounds (THREE components mixtures) by chemical tests, derivatives etc. using microscale technique. IR spectra to be used for functional group identification. TLC and Column Chromatography.

HCP 3.2: Organic Preparation

One/Two organic preparations starting with 5g or less (Any five)

(TLC, MP /BP analysis and recrystalization of product is recommended)

1) Preparation of aromatic aldehydes by Vilsmer Haack reaction or R. T.
2) Preparation of 3-formylindole by the Vilsmer Haack reaction
3) Preparation of p-chloronitrobenzene by Sandmeyer reaction
4) Preparation of p-Iodonitrobenzene by Sandmeyer reaction
5) Stork enamine synthesis
6) Mukaiyama Esterification
7) Pechmann Condensation (Coumarin synthesis)
8) Aldol condensation (Chalcone)
9) Benzilic acid rearrangement
10) Fischer indole synthesis
11) FriellanderSynthesis
12) Preparation of Benzanilide by Beckmann rearrangement
13) Preparation of Antharanilic acid
14) Preparation of Phthalimide
15) Preparation of N-Bromosuccinamide
16) Preparatin of p-Aminobenzoic acid
17) Pinacol- Pinacolone rearrangement
18) Preparation of Acetophenones by Fries rearrangement
19) Wittig reaction
20) Preparation of Benzopyrazole

(**Note**: Other suitable experiments may be added)

SCP 3.1: Spectral Analysis

Identification of unknown organic molecules by analysis of their spectra. Photocopies of UV, IR, NMR and Mass spectra of standard compounds are to be interpreted to determine the structure of the compound. At the time of practical examination, candidates are expected to submit the Journal.

OEP 3.1: Column Chromatography

Separation of the given mixture by using column chromatography method
(TLC Analysis is recommended)

OEP 3.2: Review Work

There will be computer laboratory session for hands on Chem draw software and literature survey by using Google Scholar/ Science Direct/Scopus/Web of Science etc. A student shall be expected to carry out literature survey in the field of interest and to select a topic for his/her project work in consultation with the supervisor. It shall be expected that a student justifies the gravity and also the relevance of the problem through his/her seminar. Candidates are expected to do the following work at computer laboratory.

1) Literature survey
2) Work plan
3) Handling of Chem draw software for structure drawing
4) Chem draw assignment
5) Synopsis preparation

Evaluation based on the efforts put in by the student to carry out his/her dissertation work & the results obtained thereof. At the time of practical examination, candidates are expected to submit the synopsis which includes work done/ review of literature for the proposed work along with presentation. It will be valued for 40 marks.

M. Sc. II, SEMESTER-IV (Organic Chemistry)

PRACTICAL COURSE

HCP 4.1: Organic Synthesis

Study of following reactions/organic preparations starting with 5g or less (Any five)

(TLC, MP /BP analysis and recrystalization of product is recommended)

1) Hantzsch pyridine synthesis

2) Ugi Reaction
3) Biginelli reaction
4) Gewald reaction
5) Dess-Martin Oxidation: Oxidation of benzyl alcohol to benzaldehyde
6) Synthesis of benzil from deoxybenzoin using SeO_2 reagent
7) Nifedipine synthesis
8) Hydrolysis of ester (Saponification)
9) Amine to azide via diazotization reaction

(**Note**: Other suitable experiments may be added)

HCP 4.2: Organic Chemistry

Isolation of following constituents from the natural sources: (Any five)

1) Isolation of lycopene from tomato fruits
2) Isolation of limonene from citrus rinds
3) Isolation of β-carotene from carrots
4) Isolation of Eugenol from cloves
5) Isolation of Piperine from black pepper
6) Isolation of Nicotine from tobacco
7) Isolation of Curcumin from turmeric
8) Isolation of capsaicinoids from peppers by Soxhlet extraction

(**Note:** Other suitable experiments may be added)

HCP 4.3:Project Work /In Plant Training

Candidates are expected to work on assigned research project and submit the results at the end of the semester in the form a dissertation. Open defense of the student on his/her dissertation shall be arranged. This defense shall be in front of the panel of examiners. This will be valued for 40 marks.

Project work involving organic synthesis/evaluation of biological studies or in-plant training in any of the pharmaceutical or chemical industry for at least 21 days will be considered. Project should be completed under the guidance of a faculty member in the same Department or Industry or research organization. In case of Industry/research organization one member of that body can also be included as project guide.

Guidelines for Assessment

• Quality of Literature survey and Novelty in the problem

- Clarity of Problem definition and Feasibility of problem solution
- Clarity of objective and scope
- Quality of work attempted
- Presentation skills

SCP 4.1: Pharmaceutical formulation (Any five)

1) Preparation of weak Iodine solution
2) Preparation of Paracetamol Suspension,
3) Preparation of Castor Oil Emulsion
4) Preparation of Simple Syrup IP
5) Preparation of Lemon Syrup
6) Preparation of Sodium chloride eye lotion
7) Preparation of Methyl salicylate Ointment
8) Pre-formulation studies: Drug-drug interaction and drug excipient interaction in physical mixture,
9) Determination of solubility of Paracetamol in water, 0.1N HCl, 0.1N NaOH, Phosphate buffer pH 6.8 and 7.4
10) Study of Stability drug: Room Temperature, UV light, and Sun light

(**Note:** Other suitable experiments may be added)

SCP 4.2: Medicinal Chemistry

Drug synthesis/Molecular modeling: Synthesis of medicinally important compounds:

(TLC Analysis is recommended) **(Any five)**

1) Benzocain
2) Coumarins
3) Benzimidazole
4) Paracetamol
5) Iodoform
6) Phenyl azo-2 naphthol
7) 2-Phenyl quinoline-4-carboxylic acid from benzaldehyde.

(**Note:** Other suitable experiments may be added)

Reference books:

1) A Textbook of Practical Organic Chemistry - A. I. Vogel.

2) Practical Organic Chemistry - Mann & Saunders.
3) A Handbook of Quantitative & Qualitative Analysis- H. T. Clarke.
4) Organic Synthesis Collective Volumes by Blat.
5) Reagents in Organic Synthesis by Fieser and Fieser.
6) Organic Practicals by Ahluwalia.
7) Systematic Lab Experiments in Organic Chemistry by Arun Sethi. (New Age).
8) Advanced Practical Medicinal Chemistry by Ashutosh Kar