



# SYLLABUS

<b>Course Title</b>	<b>STEREOCHEMISTRY</b>	
<b>Course Code</b>	MOC301	
<b>Course Credit</b>	Lecture : 4	
	Practical: 0	
	Tutorial : 0	
	Total : 4	
<b>Detailed Syllabus:</b>		
<b>Sr. No</b>	<b>Name of chapter &amp; Details</b>	<b>Session Allotted</b>
<b>SECTION-I</b>		
<b>1</b>	<b>FUNDAMENTAL STEREOCHEMISTRY</b> Enantiomers and chirality, Planes of symmetry and chirality, Isomerisation (stereo isomer and constitutional isomer), configuration and conformation, Racemic modification and resolution method, optical activity due to molecular dissymmetry, R and S nomenclature, Fischer projection, Mesodiastereomers, Determination of stereochemistry compounds. Resolution (separating enantiomers), natural chirality, chiral drugs and others.	<b>15</b>
<b>2</b>	<b>CONFORMATIONAL ANALYSIS</b> Confirmation and configuration, ring strain, cyclohexane (drawing, substituted cyclohexane), Locking groups(t-butyl groups, decalins and steroids), reactivity of axially and equatorially substituted rings, conformation of ring containing sp <sup>2</sup> hybridized carbon atom, conformation of multi rings (cyclohexanone and cyclohexene) and others.	<b>15</b>
<b>SECTION-II</b>		
<b>3</b>	<b>DIASTEREOSILECTIVITY</b> Stereo specific and stereo selective reactions, prochirality, nomenclature of prochiral faces/groups using R/S type system. Drawing diastereo isomers of acyclic molecules. Lowest energy conformation of carbonyl compounds. Cram's rule, Newman projection and Felkin-Anh model. Chelation, stereoselective reaction of acyclic alkenes. The Hovek model. Diastereoselectivity in aldol reaction and others.	<b>15</b>
<b>4</b>	<b>DETERMINATION OF STEREOCHEMISTRY BY SPECTROSCOPIC METHODS</b> Stereochemistry of fused rings, coupling in furans, determination of homolytic groups, enantiotopic groups, diastereotopic groups, germinal coupling in six membered rings, the nuclear over house effect and others.	<b>15</b>

	3J values vary with H-C-C-H dihedral angle, stereochemistry of Fused Rings, coupling in furans. Determination of homolytic groups, enantiotopic groups, diastereotopic groups, germinal coupling in six membered rings, the nuclear over house effect and others.	
<b>Instructional Method and Pedagogy:</b>		
<ol style="list-style-type: none"> <li>1. Lectures will be conducted with the aid of multi-media projector, black board, OHP etc.</li> <li>2. Assignments based on course content will be given to the students at the end of each unit/topic and will be evaluated at regular interval.</li> <li>3. Surprise tests/Quizzes/Tutorials will be conducted.</li> </ol>		
<b>Students Learning Outcomes:</b>		
<p>After Successful completion of the above course, students will be able to:</p> <p><b>Understand</b> types of isomers.</p> <p><b>Study</b> different reactions from stereosopical aspect.</p> <p><b>Get fundamental</b> idea of enantiomers, diastereomers, racemic mixture and resolution.</p> <p><b>Understand</b> different conformations for acyclic as well as cyclic systems.</p> <p><b>Clear the fundamentals</b> of stereochemistry.</p> <p><b>Conformational analysis</b> including substituted cyclohexane, cyclohexanone, cyclohexenes etc.</p> <p><b>Differences</b> between stereo specific and stereoselective reactions, Drawing of diastereomerers, substituted cyclohexanes etc.</p> <p><b>Study</b> of diastereoselectivity in details.Uses of spectroscopic methods in stereochemistry.</p>		
<b>Reference Books:</b>		
<ol style="list-style-type: none"> <li>1. Stereochemistry of organic compounds - P.S. Kalsi.</li> <li>2. Stereochemistry - D. Nasipuri</li> <li>3. Organic chemistry - I.L. Finar</li> <li>4. Stereochemistry - J.P. Trivedi</li> <li>5. Stereo selective synthesis : A practical approach, - M. Nogradi, VCH</li> </ol>		



# SYLLABUS

<b>Course Title</b>	<b>CHEMISTRY OF SYNTHETIC DRUGS</b>	
<b>Course Code</b>	MOC302	
<b>Course Credit</b>	Lecture: 4	
	Practical: 3	
	Tutorial: 0	
	Total : 7	
<b>Detailed Syllabus:</b>		
<b>Sr. No</b>	<b>Name of chapter &amp; Details</b>	<b>Session Allotted</b>
<b>SECTION-I</b>		
<b>1</b>	<b>HISTORY, CLASSIFICATION SYNTHESIS AND USAGE</b> History of medicinal chemistry, Various types of classifications, synthesis and usage of synthetic and natural product drugs.	<b>12</b>
<b>2</b>	<b>SYNTHESIS AND USAGE</b> <b>CENTRAL NEVRVOUS SYSTEM</b> Anesthetic (local and general), Analgesics, Antipyretics, Sedatives, Hypnotics, Tranquilizers, Antiepileptic, Anticonvulsants and Antimaniacs, antidepressant, drugs used in antiemetics CNS stimulants and activators. <b>MUSCULOSKELETAL DISORDER DRUGS</b> NSAIDS, anti-arthritis, neuromuscular, muscle relaxants, topical analgesics. <b>CARDIOVASCULAR DRUGS</b> Anti-arrhythmic agents, antihypertensive, antianginal, vasodilators, coagulants, anticoagulants, antithrombotic and antiplatelet drugs. <b>RESPIRATORY SYSTEM DRUGS</b> Antitussives, expectorants, mucolytic, respiratory stimulants and anti-asthmatic drugs.	<b>18</b>
<b>SECTION-II</b>		
<b>3</b>	<b>GASTROINTESTINAL TRACT DRUGS</b> Antacids, anti-ulcer and antisecretory, antispasmodic, antidiarrheals, laxatives and lubricants. <b>GENITOURINARY SYSTEM DRUGS</b> Urinary antiseptics, diuretics and antidiuretics, analgesics, spermicidal, contraceptives. <b>DRUGS ON SKIN DISEASES</b> Topical steroidal, topical antifungals, drugs for acne vulgaris, psoriasis and seborrheic dermatitis, topical antiseptics. <b>ANTI-INFECTIONS ANTI INFESTATIONS</b>	<b>20</b>

	<p><b>ANTICANCER INTRODUCTION TO CHEMOTHERAPEUTIC AGENTS</b> Anti-malarial, anti-protozoals, anti-leprosy, anti-tubercular, antifungal, anti-anaerobics, anthelmintic, anti-infective and antiviral drugs.</p> <p><b>ANTIBIOTICS AND ANTIBACTERIAL</b> Penicillins, cophelosporins, fluroquinolones, aminoglycosides, marcolides, antibiotics, chloramphenicol, tetracyclines, oxazolidinediones and sulphonamides.</p>	
4	<p><b>MISCELLANEOUS</b> Organometallic drugs, diagnostic agents.</p> <p><b>RECENTLY INTRODUCED DRUGS</b></p>	10

#### LIST OF PRACTICALS (3 hours/ week)

##### Synthesis and monitoring of the reaction of various drugs.

1. Synthesis of Benzocaine.
2. Synthesis of methyl salicylate.
3. Synthesis of Phenacetin.
4. Synthesis of Sulphanilamide.
5. Synthesis of sulphaguanidine.
6. Synthesis of Aspirin.
7. Synthesis of some drugs intermediates or moiety's related to drugs.

##### Instructional Method and Pedagogy:

1. Lectures will be conducted with the aid of multi-media projector, black board, OHP etc.
2. Assignments based on course content will be given to the students at the end of each unit/topic and will be evaluated at regular interval.
3. Surprise tests/Quizzes/Tutorials will be conducted. Lectures will be conducted with the aid of multi-media projector, black board, OHP etc.

##### Students Learning Outcomes:

After Successful completion of the above course, students will be able to:

**Know** history of drug classification, synthesis and uses.

**Understand** the basic concept of medicinal chemistry

**Know** synthetic route of various drugs

**Understand** the uses of different drug.

**Apply** the knowledge for industrial purpose as well as civilization.

##### Reference Books:

1. Wilson and Gisvold's Textbook of Organic Medicinal & Pharmaceutical Chemistry, Ed. Robert F. dorge.
2. The Organic Chemistry of drug design and drug action, R. B. Silverman.
3. Strategies for organic drug synthesis & design, D. Lednicer John Wiley.
4. Principles of Medicinal Chemistry, William O. Foye, Lippincott, William and Wilkins.
5. Total synthesis of Natural products, Apsimon (Series).
6. Pharmaceutical substances by A. Kaleemann & Engle.
7. Medicinal Chemistry by D. Sriram and P. Yogeeswari, (Pearson education )

8. Principles of medicinal chemistry volume-1 by Dr. S SKadam, Dr. K. R. Mahadik, Dr. K.G. bothara



# SYLLABUS

<b>Course Title</b>	<b>HETEROCYCLIC CHEMISTRY</b>
<b>Course Code</b>	MOC303
<b>Course Credit</b>	Lecture : 04
	Tutorial : 00
	Practical : 03
	Total : 07

## Detailed Syllabus:

<b>Sr. No</b>	<b>Name of chapter &amp; Details</b>	<b>Session Allotted</b>
<b>SECTION-I</b>		
1	<b>FUNDAMENTALS OF HETEROCYCLIC COMPOUNDS:</b> <b>Nomenclature of Heterocyclic compounds:</b> Introduction, trivial name of common ring systems, Hantzsch-Widman nomenclature for monocyclic, fused and bridged heterocycles. Replacement of Hantzsch-Widman nomenclature by IUPAC nomenclature. <b>Three membered heterocyclic compounds with one &amp; Two heteroatoms:</b> Preparation and properties (chemical and physical) of important compounds. <b>Four membered heterocyclic compounds:</b> Preparation and properties (chemical and physical) of azetines, azetidines, oxetanes and thietanes.	10
2	<b>FIVE MEMBERED AND SOME OTHER BICYCLIC SYSTEM</b> <b>Five membered heterocyclic compound with one heteroatom:</b> Preparation and properties (chemical and physical) of pyrroles, furans and thiophenes. <b>Five membered heterocyclic compound with two heteroatom:</b> Preparation and properties (chemical and physical) of pyrazoles, imidazoles, isoxazoles, oxazoles, isothiazoles and thiazoles and their substitution reactions.	10
3	<b>FIVE MEMBERED HETEROCYCLIC COMPOUND WITH THREE/FOUR HETERO ATOM:</b> Preparation and properties (chemical and physical) of triazole and tetrazoles. Bicyclic ring system of five membered heterocyclic compounds: Preparation and properties (chemical and physical) of indoles, isoindols, indolizines, benzofuran, isobenzofuran, benzothiophene and isobenzothiophene and their substitution reactions	10
<b>SECTION-II</b>		

4	<p><b>SIX MEMBERED AND SEVERAL BI AND TRICYCLIC SYSTEM</b></p> <p><b>Six membered heterocyclic compounds with one heteroatom:</b> Preparation and properties (chemical and physical) of pyridines and pyrans. Preparation and properties (chemical and physical) of 2-pyrones and 4-pyrones.</p> <p><b>Six membered heterocyclic compounds with two heteroatom:</b> Preparation of pyridazine, pyrimidine, pyrazine, oxazine, thiazine and dioxane, and their substitution reactions.</p> <p><b>Bi/tri-cyclic ring system of six membered heterocyclic compounds:</b> Preparation and properties (chemical and physical) of quinolines, isoquinolines, quinazolines, quinolizines, acridines and phenothiazines and their substitution reactions.</p>	20
5	<p><b>SEVEN AND EIGHT MEMBERED RING SYSTEMS</b></p> <p><b>Seven membered heterocyclic compounds:</b> Preparation and properties (chemical and physical) of azepines, oxepines, thiepinines, diazepines and benzodiazepines.</p> <p><b>Eight membered heterocyclic compounds:</b> Preparation and properties (chemical and physical) of azocane, oxecane and thiocane.</p>	10

#### LIST OF PRACTICALS (3 hours/ week)

##### Organic preparations and separations:

##### Preparation of various Heterocyclic and Organic compounds

1. To prepare 1, 4-hydropyridine from benzaldehyde.
2. To prepare 4-methyl-7- hydroxycoumarine from resorcinol.
3. To prepare 5-Methyl, 2, 4-dihydropyrazole-3-one from ethylacetoacetate.
4. To prepare benzanilide from benzophenone.
5. To prepare m-dinitrobenzene from nitrobenzene.
6. Preparation of 1, 2, 3, 4-Tetrahydrocarbazole from cyclohexanone.

##### To perform qualitative analysis of given organic mixtures

1. Benzoic acid,  $\beta$ -Naphthol, m-Dinitrobenzene.
2. Naphthalene, Oxalic acid, p-Nitroaniline.
3. Sulphanilic acid, m-Nitroaniline, Thiourea.
4. Phthalic acid,  $\beta$ -Naphthol, p-Nitrotoluene.
5. Benzoic acid,  $\alpha$ -Naphthol, m-Dinitrobenzene.
6. Phthalic acid, Thiourea,  $\beta$ -Naphthol.
7. Miscellaneous: Separation of different organic mixtures.

##### Separation of liquid mixtures using distillation method

1. Acetone and water.
2. Acetone and toluene.
3. Toluene and ethyl acetate.
4. Chloroform and aniline.
5. Nitrobenzene and aniline.
6. Benzaldehyde and nitrobenzene.
7. Miscellaneous: Separation of different liquid mixtures.

##### Instructional Method and Pedagogy:

1. Lectures will be conducted with the aid of multi-media projector, black board, OHP etc.
2. Assignments based on course content will be given to the students at the end of each unit/topic and will be evaluated at regular interval.
3. Surprise tests/Quizzes/Tutorials will be conducted.
4. The course includes a laboratory, where students have an opportunity to build an appreciation for the concepts being taught in lectures.
5. Minimum ten experiments shall be there in the laboratory related to course contents.

#### **Students Learning Outcomes:**

After Successful completion of the above course, students will be able to:

**Understand** various basic fundamentals of heterocycles.

**Differentiate** class of heterocycles.

**Understand** reactions of heterocycles and their utilization in synthesis of new compound.

**Prepare** three, four, five, six and seven membered heterocyclic compounds.

**Able to separate** organic solid mixtures.

**Able to separate** liquid mixtures.

#### **Reference Books:**

1. Heterocyclic chemistry. Thomas L. Gilchrist, Prentice Hall.
2. An introduction to the chemistry of Heterocyclic compounds. R. H. Acheson, John Wiley & Sons.
3. The chemistry of Heterocycles. TheophilEicher, Siegfried, Hauptmann and Andreas Speicher. John Wiley & Sons.
4. Comprehensive Heterocyclic chemistry. A. R. Katritzky and C. W. Rees. Pergamon Press.
5. Vogel's Text Book of Practical Organic Chemistry. Brain. S. Furniss, Antony. J. Hannaford, Peter. W. G. Smith and Austin R. Tatchell. Pearson.



# SYLLABUS

<b>Course Title</b>	<b>CHEMISTRY OF NATURAL PRODUCTS</b>
<b>Course Code</b>	MOC304
<b>Course Credit</b>	Lecture :04
	Practical :03
	Tutorial :00
	Total :07

## Detailed Syllabus:

<b>Sr. No</b>	<b>Name of chapter &amp; Details</b>	<b>Session Allotted</b>
<b>SECTION-I</b>		
<b>1</b>	<b>INTRODUCTION OF NATURAL PRODUCTS</b> Introduction, Classification, source , Primary and secondary metabolite, Extraction and isolation methods of metabolite, General methods for the structure determination of natural products	<b>12</b>
<b>2</b>	<b> BIOGENESIS AND BIOACTIVITY OF NATURAL PRODUCTS</b> Biogenesis of Terpenoid and Steroids – mevalonic acid pathway, Shikimate pathway. Activity guided Isolation, Biological activity and bioassay.	<b>08</b>
<b>3</b>	<b>ALKALOIDS</b> Introduction of Opium alkaloids ,Structure and synthesis of Morphine, rearrangement in opium alkaloids, structure and synthesis of Sceletium alkaloid A4, structure and synthesis of Mahanimbine, synthesis of Reserpine and Tylophorine.	<b>10</b>
<b>SECTION-II</b>		
<b>4</b>	<b>TERPENOIDS AND CAROTENOIDS</b> Structure and synthesis of bicyclic sesquiterpenoids Eudesmol and Cadinene, structure and synthesis of Carotene, synthesis of Caryophyllene and (-) Xanthoxone, molecular rearrangement of Caryophyllene and Logifolene. Importance of vitamin C analogs.	<b>10</b>
<b>5</b>	<b>STEROIDS</b> Structure and synthesis of Cholesterol, synthesis of Cortisone, Androgens and Oestrogens, Chemistry of bile acids.	<b>10</b>
<b>6</b>	<b>VITAMINS</b> General isolation method, Structure and synthesis of Vitamin A1, Vitamin B1(Thiamine), Vitamin B6 (Pyridoxine) and Biotin (Vitamin H).Synthesis of Vitamin C	<b>10</b>

**LIST OF PRACTICALS (3 hours/ week)**

1. To determine the percentage of tannin content.
  2. To determine the amount of starch content in the given sample of turmeric powder.
  3. To determine the crude fiber in the given sample of ginger powder.
  4. To determine the Rf Value of the sugars present in the given mixture by the techniques of ascending paper chromatography.
  5. To determine Rf value of the sugar present in the given mixture by the techniques of Thin layer chromatography.
  6. Demonstration of soxhlet apparatus, How to make thimble?, Every parts of Soxhlet assembly, siphon cycle.
  7. Identification of sterol compound by Thin layer chromatography.
  8. Identification of Alkaloid compound by Thin layer chromatography.
  9. Identification of Phenolic and flavonoids compound by thin layer chromatography.
- To determine ascorbic acid in lemon juice.

#### **Instructional Method and Pedagogy:**

1. Lectures will be conducted with the aid of multi-media projector, black board, OHP etc.
2. Assignments based on course content will be given to the students at the end of each unit/topic and will be evaluated at regular interval.
3. Surprise tests/Quizzes/Tutorials will be conducted. Assignments based on course content will be given to the students at the end of each unit/topic and will be evaluated at regular interval.
4. Surprise tests/Quizzes/Tutorials will be conducted.

#### **Students Learning Outcomes:**

After Successful completion of the above course, students will be able to:

**Learn** synthesis different vitamins, Alkaloids, cholesterol and terpenoids.

**Identify** biogenesis of natural products.

**Identify** the natural product compound using different chromatography techniques.

**Perform** the quantitative analysis of natural product compound.

#### **Reference Books:**

1. Chemistry of Natural products by V.K. Ahluwalia, LalitaS.Kumar, Sanjiv Kumar.
2. Total synthesis of natural products-Jon Apsimon Vol.(1-11)-Wiley india.
3. Organic Chemistry of Natural products by Ayodhya Singh & Seema Singh, campus Publishers (2008).
4. Chemistry of Natural products by S.V. Bhatt, B.A. Nagasampagi, S.Minakshi, Springer- Berlin Heidelberg (2005).
5. Natural Products Chemistry, Vol. I & II, K. Nakanishi et al., Academic press publication (1974)
6. Phytochemical Methods, A guide to modern techniques of plant analysis by J.B. Harbone
7. Thin layer Chromatography by Stahl