

Programme: M. Sc. (Chemistry, Part-II)

Course Code: OCO-501

Title of the Course: Chemistry of Natural Products

Number of Credits: 3

Effective from AY: 2019-20

<u>Prerequisites for the course:</u>	Should have studied the topics on stereochemistry, spectroscopy and synthetic organic chemistry at M. Sc. part-I (Chemistry) levels.	
<u>Course Objective:</u>	<ol style="list-style-type: none">1. To study the main classes of natural products.2. To understand the different methods that are used in natural product chemistry, including extraction, isolation and structural elucidation.3. To understand the key biosynthetic pathways for the biosynthesis of terpenes, alkaloids and steroids.	
<u>Course Outcome</u>	<ol style="list-style-type: none">3. Students should able to identify different types of natural products, their occurrence, structure biosynthesis and properties.4. Students should able to carry out independent investigations of plant materials and natural products.	
<u>Content:</u>	<p>1. General methods of purification and structure elucidation of Natural Products</p> <p>1.1 General methods of isolation-The modern distillation process, maceration, enfleurage, extraction by cold pressing and extraction with solvents.</p> <p>1.2 Fractionation of the crude extracts and purification of the individual compounds from the respective fractions using chemical and chromatographic techniques such as Column Chromatography, TLC, Preparative TLC, HPLC, etc.</p> <p>1.3 Chemical methods based on the functional groups present. Bicarbonate extraction, sodium bisulphite adduct formation, derivatization, etc.</p> <p>1.4 General approach to structure elucidation of the isolated pure compounds using UV, IR, NMR spectroscopy, MS spectrometry, optical polarimetry.</p> <p>2. Structure elucidation by classical chemical methods</p> <p>2.1 Terpenoids: α-cedrene</p> <p>2.2 Alkaloids: Morphine, thebaine and codeine</p> <p>2.3 Steroids: Cholesterol, bile acids</p> <p>3. Structure elucidation by combination of chemical and spectral methods</p> <p>3.1 Terpenoids: α- and β-vetivones, Ishwarone</p> <p>3.2 Hormones: Cecropia Juvenile hormone, brevicomin and frontalinal</p> <p>3.3 Oxygen heterocycles: Aflatoxin-B1, rotenone</p>	<p>5 hours</p> <p>6 hours</p> <p>8 hours</p>

	4. Structure elucidation involving stereochemistry, spectral and Chemical methods 4.1 Terpenoids: Menthol and hardwickiic acid 4.2 Alkaloids: Reserpene	4 hours
	5. Synthesis of selected Natural Products, planning and execution 5.1 Terpenoids: Longifolene (E J Corey), Caryophyllene (E J Corey) Nootkatone (A Yoshikoshi), Menthol (Tagasago) 5.2 Alkaloids: Reserpine (R B Woodward), Morphine (Marshall Gates) 5.3 Hormones: Cecropia JH (Edward), Progesterone 5.4 Prostaglandins: Prostaglandin E ₂ (E J Corey) 5.5 Antibiotics: Cephalosporin (R B Woodward)	8 hours
	6. Biogenesis and biosynthesis of Natural Products 6.1 Terpenoids and Steroids: General approach towards biosynthesis of mono-, sesqui-, di-, tri-, tetraterpenoids and steroids through mevalonate pathway with special reference to the biosynthesis of terpenoids and steroids included in topics 3 to 6 6.2 Alkaloids: The shikimate pathway formation of hydroxybenzoic acid derivatives, aromatic amino acids, L-phenylalanine, L-tyrosine, phenolic oxidative coupling, biosynthesis of thebaine, codeine and morphine.	5 hours
Pedagogy:	Lectures/ tutorials/ seminars/ term papers/assignments/ presentations/ self-study/ Case Studies etc. or a combination of some of these. Sessions shall be interactive in nature to enable peer group learning.	
References/Readings	1. I. L. Finar, <i>Organic Chemistry: Stereochemistry and the Chemistry of Natural Products</i> , Pearson Education India, 1956. 2. K. Nakanishi, <i>Natural Product Chemistry</i> , Academic Press, 1975. 3. D. R. Dalton, <i>The Alkaloids</i> . New York:M. Dekker. 4. Barton and Olis, <i>Comprehensive Organic Chemistry</i> , Pergamon, 1979. 5. Derick Paul, <i>Medicinal Natural Products, a Biosynthetic Approach</i> , John Wiley and Sons, 2002. 6. Mannitto Paolo, <i>Biosynthesis of Natural Products</i> , Wiley. 7. Ian Fleming, <i>Selected Organic Synthesis</i> , John Wiley and Sons 8. J. ApSimon, <i>Total sSynthesis of Natural Products</i> , John Wiley and Sons. 9. E. J. Corey & X-M. Cheng, <i>The Logic of Chemical Synthesis</i> , Wiley Interscience, a division of John Wiley and Sons Inc.	

	10. K. C. Nicolaou & E. J. Sorensen, <i>Classics in Total Synthesis</i> , Weinheim: VCH, 1996	
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