SEMESTER VIII

Discipline Specific Courses (Common Pool) applicable for both B.Sc. Life Sciences and B.Sc. Physical Sciences

DISCIPLINE SPECIFIC ELECTIVE COURSE – 19 (DSE-19)
Fundamentals of Natural Products

CREDIT DISTRIBUTION, ELIGIBILITY AND PRE-REQUISITES OF THE COURSE

Course title & Code	Credits	Credit distribution of the course			Eligibility criteria	Pre-requisite of the course (if any)
		Lecture	Tutorial	Practical / Practice		
Fundamentals of Natural Products **(DSE-19)**	**04**	**02**	**--**	**02**	**Class 12th with Physics, Chemistry**	**--**

Course Objectives

The objectives of this course are as follows:

The primary objective of this course is to provide students with a comprehensive understanding of natural product chemistry, including its historical development, modern applications, classification, biosynthesis, and methods for isolation and purification.

Learning outcomes

By studying this course, the students will be able to:

- Understand the scope and significance of natural product chemistry in both historical and modern contexts, particularly its role in drug discovery.
- Analyze and classify major natural product groups-such as alkaloids, terpenoids, flavonoids, phenolics, peptides, glycosides, polyketides, steroids, and hormones-and understand their structures and functions.

Unit 1: Introduction and Classification of Natural Products: **(11 Hours)**

Definition and scope of natural product chemistry, historical significance and modern relevance, Primary vs secondary metabolites, Sources of natural products: terrestrial and marine origin, importance in drug discovery and development.

Alkaloids, Terpenoids, Flavonoids, Phenolics, Peptides and Proteins, Glycosides, Polyketides, Steroids and Hormones. Isoprene rule, mevalonate and non-mevalonate pathways, Shikimic acid pathway.

Unit 2: Isolation and Purification Techniques: **(4 Hours)**

Extraction methods (solvent extraction, Soxhlet, maceration, etc.), Chromatographic techniques (TLC, Column, HPLC, GC-MS), Crystallization and distillation techniques, Bioassay-guided fractionation.

Unit 3: Total Synthesis of Natural Products: **(10 Hours)**
Artemisinin (Antimalarial); Berberine (anti-inflammatory); Lysergic Acid Diethylamide (Psychedelic drug), and Vitamin B12.

Unit 4: Biosynthesis of Natural Products: **(5 Hours)**
Artemisinin, Berberine, and Lysergic Acid Diethylamide (LSD).

Practicals: **Credits: 02**
(Laboratory periods:15 classes of 4 hours each)

1. Isolation of natural products: Isolation of β-carotene from carrots.
2. Isolation of natural products: Isolation of limonene from lemon peel/orange peel.
3. Isolation of natural products: Isolation of caffeine from tea leaves.
4. Isolation of natural products: Isolation of piperene from black pepper.
5. Isolation of natural products: Isolation of eugenol from cloves.
6. Isolation of protein and carbohydrates from seeds –colour test.
7. Synthesis of 7-hydroxy-4-methylcoumarin
8. Synthesis of a simple dipeptide(gly-gly) by DCC coupling using N-protected amino acids.
9. Synthesis of simple amino acids

Essential/recommended readings
Theory:

1. Mann, J.; Davidson, R. S. & Hobbs, J. B., Natural Products: Their Chemistry and Biological Significance, Longman Scientific & Technical (1994)
2. Mann, J. Secondary Metabolites, Oxford University Press, Oxford, UK, (1980)
3. Hanson, J. R., Natural Products: The Secondary Metabolites, The Royal Society of Chemistry, Cambridge, UK (2003)
4. Chatwal, G., Organic Chemistry of Natural Products, Himalaya Publishing House (1994)

Practical:

1. Vogel, A. I. (2012), Quantitative Organic Analysis, Part 3, Pearson Education.
2. Mann, F. G., Saunders, B.C. (2009), Practical Organic Chemistry, Pearson Education.
3. Furniss, B. S., Hannaford, A. J., Smith, P.W.G., Tatchell, A.R. (2012), Vogel's Textbook of Practical Organic Chemistry, Fifth Edition, Pearson.
4. Ahluwalia, V.K., Dhingra, S. (2004), Comprehensive Practical Organic Chemistry: Qualitative Analysis, University Press.
5. Ahluwalia, V. K., Aggarwal, R. (2004), Comprehensive Practical Organic Chemistry: Preparation and Quantitative Analysis, University Press
6. Pasricha, S., Chaudhary, A. (2021), Practical Organic Chemistry: Volume–I, I K International Publishing house Pvt. Ltd, New Delhi
7. Pasricha, S., Chaudhary, A. (2021), Practical Organic Chemistry: Volume–II, I K International Publishing house Pvt. Ltd, New Delhi

Assessment Methods: All examination and assessments methods shall be in line with the University of Delhi guidelines issued from time to time.