



## SYLLABUS

### A. Course Description

Course Code	Course Num.	Course Name	Credit Hours	Lec.	Lab.	Tut.	Private study	Pre-requisites	Course Level	Language
CHM	429	Carbohydrates Chemistry & Natural Products	4	2	3	1	8	CHM 327	8	English

The course covers introduction to natural product chemistry; classification of natural products, isolation techniques and physiochemical data, the acetate pathway (fatty acids and polyketides), the shikimate pathway (aromatic amino acids and phenylpropanoids), the mevalonate (terpenoid and steroids), alkaloids, peptides and amino acid derivatives, and carbohydrates

At the end of this course the student will be able to:

- To recall functional groups of organic chemistry and their importance in the biosynthesis.
- To recognize the structure and molecular classification of a representative number of compounds belonging to the main classes of natural products.
- To list relevance of selected natural compounds and some chemical elaboration.
- To describe natural compounds and their tasks in nature.
- To outline the structure activity relationship of natural products.

### B. References: Required Textbook & Internal Website

I shall use

***Chemistry of Natural Products***, Bhat, Sujata V., Nagasampagi, Bhimsen A., Sivakumar, Meenakshi Jointly published with Narosa Publishing House 2005, XXX., ISBN: 978-3-540-40669-3. **Students are required to purchase the textbook/materials (it is an obligation).** The book contains the lecture notes as well as activities for the students to take part in; the book serves as a workbook.

Other references:

- ***The Chemistry of Natural Products***, Thomson, R.H. Springer, (2<sup>nd</sup> Ed.) 1993, ISBN-10: 9401049505
- ***Medicinal Natural Products: A Biosynthetic Approach***, Dewick, Paul M., Wiley India Pvt Ltd; (3<sup>rd</sup> Ed.), 2011. ISBN-10: 8126532963

Google Classroom Webpage: <http://www.imamm.org/>



### C. Topics Outline

**Disclaimer:** this is a very fast-paced course. There will be little time—if any—for review. What follows is an approximate outline of the pace of the course. We may go faster or slower, contingent on the class response. The tentative list of topics to cover:

#### a. *Theory:*

1. **Introduction:** Occurrence, origin, main groups of natural products, impact of natural products in medicine.
2. **Alkaloids:** Introduction, Hagnauer system of classification, Physicochemical properties of alkaloids, Structural elucidation of alkaloids, Methods of isolation, Exaples of alkaloids and their application on medicine, Survey of known alkaloids, Biochemistry of alkaloids, Biosynthesis of alkaloids with examples for the formation.
3. **Terpenes and Terpenoids:** Introduction, Isoprene rule, Carbon-carbon bond formation in terpene biosynthesis, Classifiaction of Terpenes, Heme Biosynthesis, Chlorophyll biosynthesis, some examples of terpenes synthesis
4. **Flavonides:** Purpose and delivery of flavonides in plants, Types of flavonides, Flavonides biosynthesis, Chemical analysis of flavonides, Legnin, Complexation and Reduction/Oxidation Reactions of Selected Flavonoids with Iron and Iron Complexes: Implications on In-Vitro Antioxidant Activity
5. **Glycosides and Tannines:** Introduction, Nomenclature, Anthracene glycosides, Anthracene and anthranols, Oxanthrone, Dianthrone, Structure of Saponines, Coumarin glycosides, Flavonide glycosides, Distribution in nature, Structure of glycosides, Tannines, Pseudotannines, Function of tannins in plants.
6. **Protein and amino acids:** Classification of Amino Acids, Stereochemistry of Amino Acids, Acid-Base Behavior of Amino Acids, Synthesis of Amino Acids, Reactions of Amino Acids, Some Biochemical Reactions of Amino Acids, Peptides, Introduction to Peptide Structure Determination, Amino Acid Analysis, Peptide Bond Formation. Insulin, Solid-Phase Peptide Synthesis, Enzymes, Co-enzymes.
7. **Lipids and Fatty acids:** Introduction, Structures, Biological Functions of Lipids, Fatty Acid Naming Systems, Trans Fatty Acids, Wax, Major Types of Lipids, Phosphatidylcholine, Ether Lipids, Sialic Acid, Saponification and Methylation,
8. **Carbohydrates:** Introduction, Monosaccharides, Structure and Nomenclature of Monosaccharides, Stereochemistry and Configuration of Monosaccharides, Amino sugars, Physical properties of Monosaccharides, Modified Monosaccharides, Ketoses, Glucose, Structure and stereochemistry of glucose, Cyclic structure of monosaccharides, Reactions of monosaccharides, Formation of Osazones, Reaction of Osazones, Disaccharides and Oligosaccharides, Relative Sweetness of Some Carbohydrate and Artificial Sweeteners, Cellulose, Heparin with other examples.

#### b. *Practical:*

Testing leaves for Starch, Isolation of Chloroplast, Isolation of caffeine from tea leaves: Caffeine is an organic compound present in the fruit and bark of some plants, as well as in the tea leaves, coffee, cocoa, and cola beans., Isolation of Nicotine from Tobacco leaves: Nicotine is hygroscopic, oily liquid that is miscible with water in its base form. As a nitrogenous base, nicotine forms salts with acids that are usually solid and water soluble, Thin layer Chromatography Characterization of Flavonids, Isolation of Lycopene and  $\beta$ -Carotene from



Tomato, Identification of Plant Pigments by Thin Layer Chromatography, Extraction of Essential Oils from Cinnamon, Clove, and Nigella Sativa by Distillation, Estimation of Tannin in Tea Isolation of Piperine.

#### D. Exams & Grading System

The semi-official dates of the exams for this course, with all the caveats, that the word “semi-official” entails, can be found here:

- **Midterm 1:** 6<sup>th</sup> or 7<sup>th</sup> week & **Midterm 2:** 11<sup>th</sup> or 12<sup>th</sup> week
- **Quizzes & Homeworks: During the semester**

Your course grade will be based on Final Exam, Midterms, Homework, Quizzes, Participation, Attendance and Project.

<b>Midterm 1:</b> 10 %	<b>Midterm 2:</b> 10 %	<b>Final Exam:</b> 40 %
<b>Laboratory:</b> 30 %		<b>Quizzes; Homework &amp; Attendance &amp; Participation:</b> 10 %

#### Grading distribution:

A+: [95, 100], A: [90, 95), B+: [85, 90), B: [80, 85), C+: [75, 80), C: [70, 75), D+: [65, 70), D: [60, 65), F: [0, 60).

#### E. Student Attendance/Absence

Only three situations will be considered as possible excused absences:

- Occurrence of a birth or death in the immediate family will be excused. (“Immediate family” is defined by the University as spouse, grandparents, parents, brother, or sister).
- Severe illness in which a student is under the care of a doctor and physically unable to attend class will be excused. Students are not excused for a doctor's appointment. Do not make appointments that conflict with rehearsals. Notes from the University Health Center will be accepted.

[Executive Rules for Study Regulations and Exams](https://www.examsgoo.gl/ykm7t3)  
[goo.gl/ykm7t3](https://www.examsgoo.gl/ykm7t3)

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