Lecture 1

Organic Chemistry: Fundamentals and Applications (CSO201A)

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First Course Handout for CSO201A

Class Timings: **Friday 5.00-6.00 pm**

Course Instructor: **Dr. Srinivas Dharavath** **and** **Prof. D. H. Dethe**

Course Email id: **srinivasd@iitk.ac.in** **and** **ddethe@iitk.ac.in**

Course Structure:

Sections: Basic Organic Chemistry Concepts: Chemistry in everyday life, introduction to organic molecules and functional groups understanding organic reactions (3 classes), stereochemistry and carbon- carbon bond forming reactions in organic synthesis (6 classes). Drugs some examples including love drugs and molecules of death (2 classes). Nomenclature of organic, heterocyclic compounds (2 classes). Reaction intermediates, substitution and elimination reactions (8 classes).

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CSO201A: Organic Chemistry: Fundamentals and Applications (3-0-0-9) **No. of Lectures: 42**

Dr. Srinivas Dharavath

No. of Lectures: 21

Basic Organic Chemistry Concepts: Chemistry in Everyday life, introduction to organic molecules and functional groups understanding organic reactions. intermediates, substitution and elimination reactions**:** (Ref: Reactive Intermediates in **Organic Chemistry: Structure, Mechanism, and Reactions** Book by Maya Shankar Singh, **Organic Chemistry Sixth Edition**, Janice Gorzynski Smith Chapter 1,3 and 6, Carey, Francis A.; Sundberg, Richard J.; (1984). Advanced Organic Chemistry Part A Structure and Mechanisms (2nd ed.). New York N.Y.: Plenum Press. March Jerry; (1885). Advanced Organic Chemistry reactions, mechanisms and structure (3rd ed.). New York: John Wiley & Sons, inc. GILCHRIST, T. L. (1966). (07)

Nomenclature of organic and heterocyclic compounds (*Ref: Nomenclature of Organic Chemistry Book by* J. Rigaudy and S. P. Klesney) (06)

Carbon- carbon bond forming reactions: (Ref: Sykes, Peter, A guide book to Mechanism in Organic Chemistry, R. Bruckner, Organic Mechanisms, 2010) (07)

Drugs some examples: (Ref: Announced later as multiple books will be followed) (01)

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Prof. D. H. Dethe

No. of Lectures: 21

Chemistry of odors, dyes and flavors. Green Chemistry introduction, principles, sustainability, atom economy, some green initiatives, management of resources and its effect on health and environment. Catalysis and biocatalysts in organic chemistry. Enantioselectivity and chiral-synthesis, organo-catalysis. Enzymes as drug targets and their inhibitors as model inhibitors. Solid phase synthesis and strategies for futuristic designs in organic chemistry. Photo-chemistry: simple concepts and applications (semiconductor photochemistry, solar energy conversion by photovoltaic cells, photo catalysis, etc.); supra molecular photochemistry. Organic Materials: polymers (biodegradable polymers, conducting polymers, etc.), smart materials, OLEDs, intelligent gels, dyes, etc

Books:

1. March, J., Advanced Organic Chemistry, 4th ed, 1999. Clayden, G., Warren, and Wothers, Organic Chemistry, 1st ed, 2001.
2. Nasipuri, D., Stereochemistry of Organic Compounds, 2nd ed., 1995.
3. Sykes, Peter, A guide book to Mechanism in Organic Chemistry, R. Bruckner, Organic Mechanisms, 2010.
4. Nomenclature of Organic Chemistry Book by J. Rigaudy and S. P. Klesney.
5. Reactive Intermediates in Organic Chemistry: Structure, Mechanism, and Reactions Book by Maya Shankar Singh.

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Exam Structure:

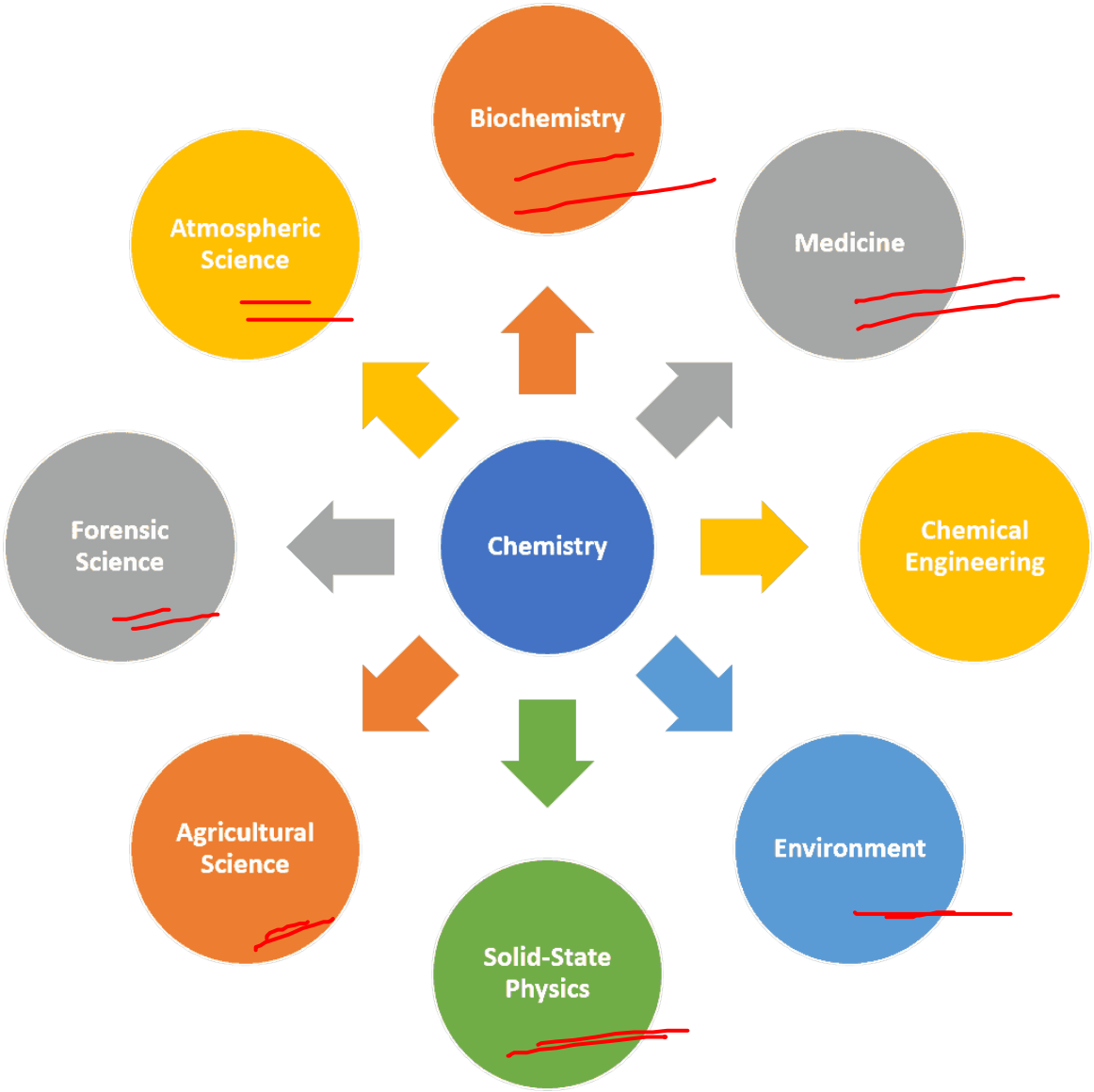
Exam papers will be evaluated and graded on a relative grading system

1. There will be **2-surprise quizzes (Q1 before Mid Sem and Q2 before End Sem)**, each of the quizzes will be for 25 marks each and for a total of 50 from both Q1&2.
2. **Assignments will be given at any time.** This will be 15 marks.
3. **Mid Sem Exam:** The syllabus portion will be mention accordingly in the class. This will hold a weight of 35 marks.
4. **End Sem Exam: The complete portion of the syllabus will be included.** This will be 50 marks.

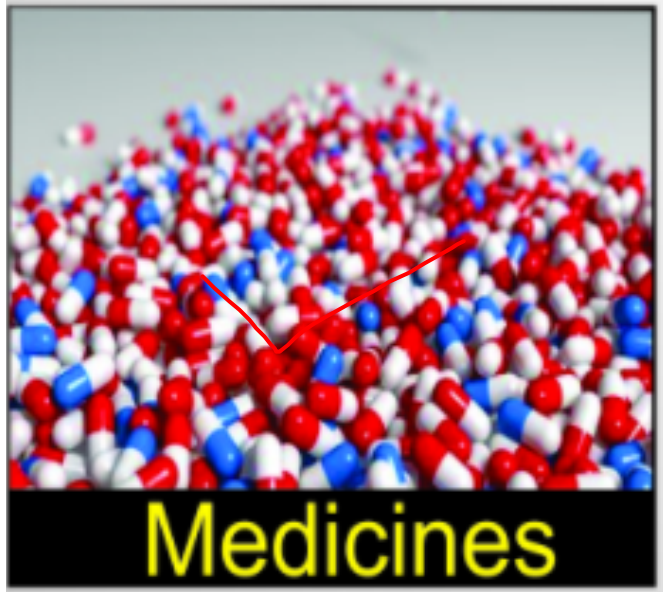
All the exams will carry equal weightage. Therefore, marks scored out of a total of 150 will be converted into the percentage for the final grading.

Chemistry in everyday life

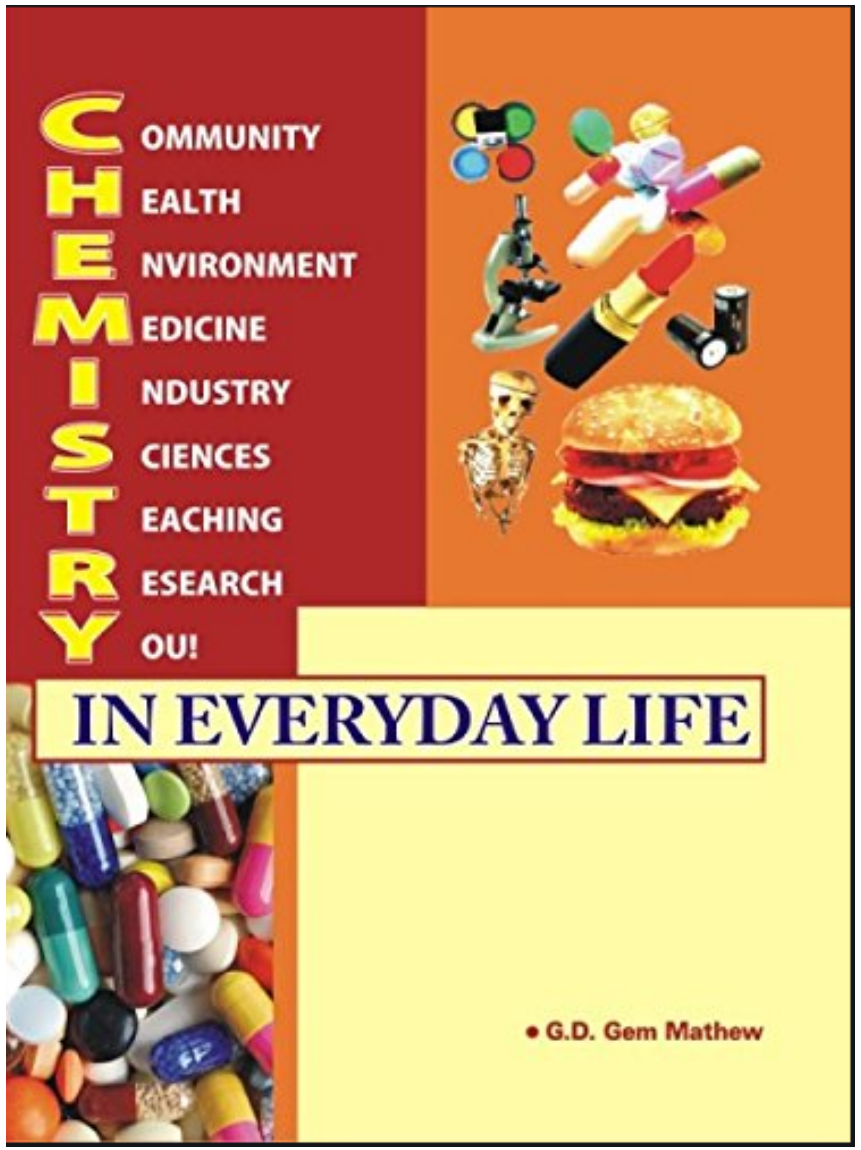
Importance of Chemistry…



Chemistry in everyday life



Chemistry in everyday life



Chemistry in everyday life

Citric acid

Food colouring

Flavour enhancer

Sweetener

Preservatives

Deodorant

Mouthwash

Toothpaste

Shaving cream

Shampoo

Chemistry in everyday life

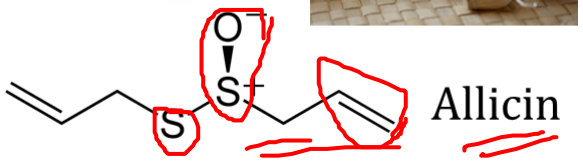
Multi-purpose cleaner

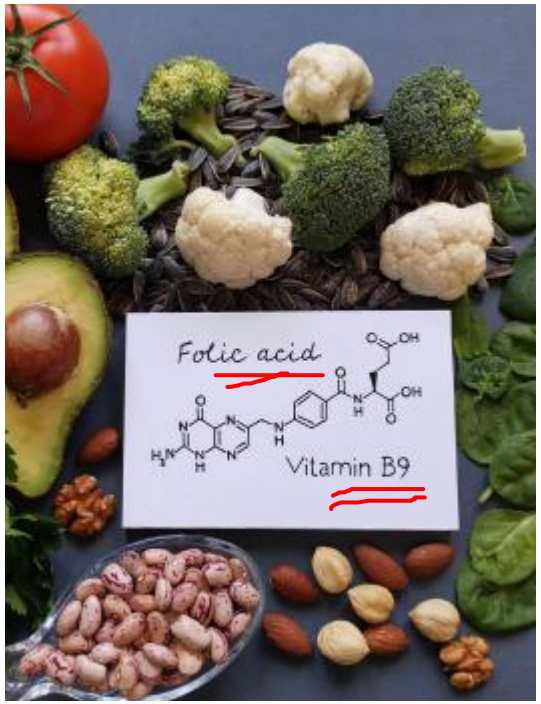
Washing machine cleaner

Glass and surface cleaner

Bathroom cleaner

Chemistry in food…





Blue/purple

Fruits and vegetables like eggplant, blackberries, blueberries, raisins, plums, figs, and purple cabbage are of a blue or purple hue due to phytonutrients known as **anthocyanins** present in them. Anthocyanins are powerful antioxidants that helps the heart function well.

Green

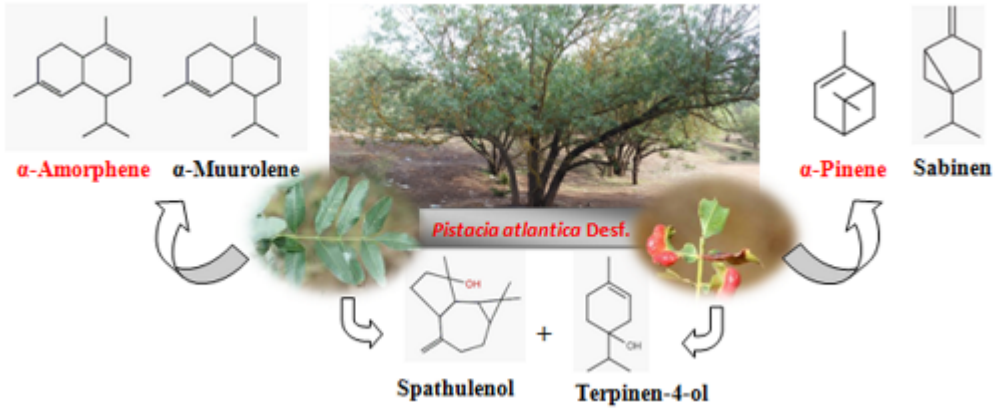
Vegetables like spinach, broccoli, kale, brussels sprouts, cabbage, avocados, kiwi fruit, green herbs, and capsicum display their green colour due to the presence of **sulforaphane**, **isocyanate**, and **indoles**. These chemicals promote human health and protect the body from various diseases.

Red

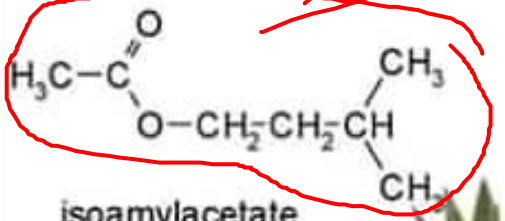
Fruits and vegetables that are red in colour like tomato, red carrots, watermelons, grapefruits, and papayas are due to the presence of **lycopene** (a nutrient with antioxidant properties).

Yellow/orange

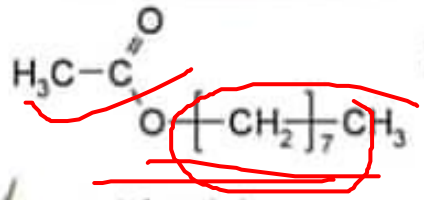
Yellow and Orange coloured fruits and vegetables provide **beta cryptothanxin**, which supports intracellular communication and may help prevent heart disease. Common yellow and orange coloured fruits and vegetables include lemons, pumpkins, oranges, pineapples, bananas, apricots, peaches, carrots, corn, and yellow bell peppers. These fruits and vegetables are essential in boosting our immunity.



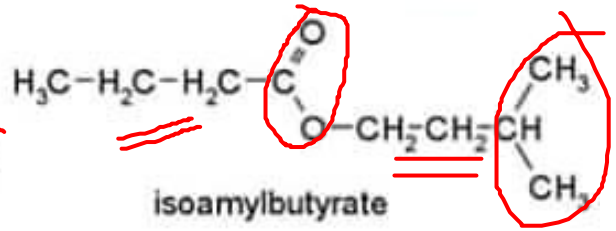
Chemistry in food…



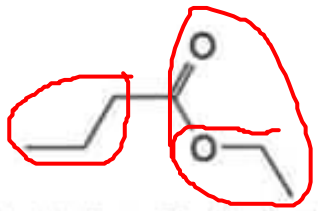
isoamylacetate



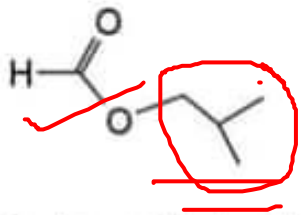
octylacetate



isoamylbutyrate



butyric acid ethyl ester



formic acid isobutyl ester

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Chemistry in food…

- Food additives are substances added to food to preserve flavour or improve its taste and appearance.

- Some additives have been used for centuries:
eg: Salting or using sulfur dioxide as in some wines.

- Several other additives have been introduced, of both natural and artificial origin.

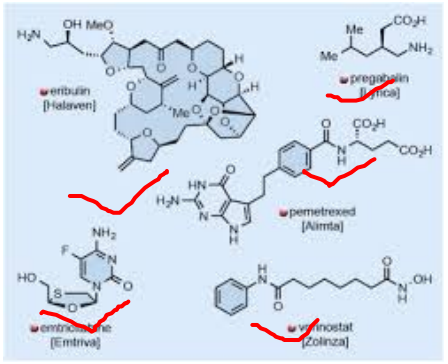
Chemistry in personal care…

- Lipsticks and lip balm contains oils, beeswax and perfumes. These protect, soften and bright the lips.

- Mascaras have a composition based on a volatile solvent, beeswax, pigments (iron oxide) and polymers.

- Nail polish is made of lacquer, and consists of polymers, solvents, plasticisers, colourants, and perfumes.

Chemistry in medicine…



- Chemistry is a huge part of medicine, both as a diagnostic and treatment tool.
- Chemistry departments in hospital medical labs analyze blood, urine, etc. for proteins, sugars and other substances.
- Blood analysis test the amount of potassium and sodium in our blood.

Chemistry in household cleaning …

- The chemistry in household cleaning products affects our environment greatly.
- For example, a very common component in cleaning products is chlorine.
- Chlorine has gaseous elements that can be lethal if large quantities are released into the atmosphere.

Important signs…