

Principles of Organic Synthesis - Web course

COURSE OUTLINE

The course has twelve modules starting from the formation of acid-catalyzed carbon-carbon bond formation to application of the modern transition metal catalysis. The principles and their application for the synthesis of some of the naturally occurring compounds will be described.

COURSE DETAIL

| Module No. | Topic/s | Hours |
|------------|---|-------|
| 1 | Formation of Aliphatic Carbon-Carbon Bonds: Base Catalyzed Reactions 1.1 Principles 1.2 Reactions of Enolates with Carbonyl Compounds 1.3 The Alkylation of Enolates 1.4 Addition of Enolates to Activated Alkenes 1.5 Reactions Involving Alkynes and Cyanides | 3 |
| 2 | Formation of Aliphatic Carbon-Carbon Bonds: Acid Catalyzed Reactions 2.1 Principles 2.2 The condensation of Alkenes 2.3 Reactions of Aldehydes and Ketones 2.4 Friedel-Crafts Reactions 2.5 Prins and Mannich Reactions | 3 |
| 3 | Organometallic Reagents 3.1 Principles 3.2 Organomagnesium and -Lithium Reagents 3.3 Organozinc Compounds 3.4 Organocopper Compounds 3.5 Organomercury Compounds | 3 |
| 4 | Formation of Aliphatic Carbon-Nitrogen Bonds 4.1 Principles 4.2 Substitution of Nitrogen Nucleophile at Saturated Carbon | 3 |



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Chemistry and Biochemistry

Pre-requisites:

Organic Chemistry Background

Coordinators:

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| | <p>4.3 Addition of Nitrogen Nucleophile at Unsaturated Carbon</p> <p>4.4 Substitution of Nitrogen Nucleophile at Unsaturated Carbon</p> <p>4.5 Reactions of Electrophilic Nitrogen</p> <p>4.6 α-Amino acids, peptides and proteins</p> | |
| 5 | <p>Electrophilic Aromatic Substitution</p> <p>5.1 Principles</p> <p>5.2 Formation of Carbon-Carbon Bonds</p> <p>5.3 Formation of Carbon-Nitrogen Bonds</p> <p>5.4 Formation of Carbon-Sulfur Bonds</p> <p>5.5 Formation of Carbon-Halogen Bonds and Other Reactions</p> | 3 |
| 6 | <p>Nucleophilic Aromatic Substitution</p> <p>6.1 Principles</p> <p>6.2 Displacement of Hydride Ion</p> <p>6.3 Displacement of Other Anions</p> <p>6.4 Substitution via Benzyne</p> <p>6.5 The $S_{RN}1$ and Bucherer Reactions</p> | 3 |
| 7 | <p>Aromatic Diazonium Salts</p> <p>7.1 The Formation and Reaction of Diazonium Salts</p> <p>7.2 Reactions in which Nitrogen is Eliminated</p> <p>7.3 Reaction in which Nitrogen is Retained</p> <p>7.4 The synthetic Value of Diazo-coupling</p> | 3 |
| 8 | <p>Molecular Rearrangements</p> <p>8.1 Types of Rearrangement</p> <p>8.2 Rearrangement to Electron - Deficient Carbon</p> <p>8.3 Rearrangement to Electron - Deficient Nitrogen</p> <p>8.4 Rearrangement to Electron - Deficient Oxygen</p> | 3 |
| 9 | <p>Free-Radical Reactions</p> <p>9.1 Principles</p> <p>9.2 Formation of Carbon - Halogen Bonds</p> <p>9.3 Formation of Carbon - Carbon Bonds</p> <p>9.4 Formation of Carbon - Nitrogen Bonds</p> <p>9.5 Formation of Carbon - Oxygen Bonds Module</p> | 3 |

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| | 9.6 Formation of Bonds to Other Elements | |
| 10 | Reagents Containing Phosphorus, Sulfur, Silicon, Boron or Tin 10.1 Phosphorus-Containing Compounds 10.2 Sulfur-Containing Compounds 10.3 Silicon-Containing Compounds 10.4 Boron-Containing Compounds 10.5 Tin-Containing Compounds | 4 |
| 11 | Transition Metal Catalysis 11.1 Principles 11.2 Titanium 11.3 Chromium 11.4 Iron 11.5 Cobalt 11.6 Copper 11.7 Rhodium 11.8 Palladium 11.9 Nickel | 5 |
| 12 | The Synthesis of Some Naturally Occurring Compounds 12.1 Reserpine 12.2 Penicillin 12.3 Prostaglandins E ₂ and F _{2a} 12.4 Ibogamine 12.5 Adenosine Triphosphate | 5 |

References:

1. W. Carruthers and I. Coldham, Modern Methods of Organic Synthesis, 4th ed., Cambridge University Press, UK, 2004.
2. F. A. Carey and R. J. Sundberg, Advanced Organic Chemistry, Part A & B, 5th ed., Springer, New York, 2007.
3. J. March, Advanced Organic Chemistry, 4th ed., John Wiley & Sons, Inc., Canada, 1992.