# SYLLABUS

## A. Course Description

| *Course Code* | *Course Num.* | *Course Name* | *Credit Hours* | *Lec.* | *Lab.* | *Tut.* | *Private study* | *Pre-requisites* | *Course Level* | *Language* |
|---|---|---|---|---|---|---|---|---|---|---|
| **CHM** | **313** | **Heterocyclic Chemistry** | **3** | **3** | **0** | **0** | **6** | **CHM 212** | **5** | **English** |

This course provides students with an introduction to Organometallic Chemistry, definitions, historical developments, Coordination theories, and also the 18-electron rule. The course will cover the Organometallics of Group.1 and Group.2, as well the transition metals. The Organometallic reactions and catalysis, and its application will be included.
At the end of this course the student will be able to:

1. To describe the basic concepts of organometallic chemistry, and its nomenclature.
2. To recall the concept of effective atomic number and molecular orbital diagrams of organometallic compounds,
3. To outline the bonding and bridging modes for organic ligands structure
4. To recognize synthetic methods of organometallic compounds with different applications in catalytic processes.
5. To list the basic reactions covered in the required basic Organometallic Chemistry course.

## B. References: Required Textbook & Internal Website

I shall use **Organometallic Chemistry**, G. S. Sodhi, 2009, Ane Books Pvt. Ltd. ISBN: 8180521982 **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:

- **Inorganic Chemistry**, Catherine E. Housecroft and Alan G. Sharpe, 2nd Ed. 2005, Publisher: Pearson Education Limited, ISBN 0130-39913-2.
- **Inorganic Chemistry**, Gary L. Miessler and Donald A. Tarr, 4th Ed. 2010, Prentice Hall ISBN 10:0136128661.
- **The organometallic chemistry of the transition metals**, Robert H. Crabtree, 4th Ed, 2005, John Wiley & Sons, Inc., ISBN:10987654321.

**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:

1. **Introduction:** Definition of organometallic compounds, Organic ligands and nomenclature Historical developments, types of organometallic compounds, preparation of organometallic compounds, Grignard Reagents, Properties of organometallic compounds.
2. **Coordination Theories:** Valence Bond Theory, Limitations of Valence Bond Theory, Ligand Field Theory, ligand field splitting, Octahedral Fields, Tetrahedral, Tetragonal, and Square Planar Fields, tetragonal distortion, Factors Affecting Δ, Ligand Field Stabilization Energy, Jahn-Teller Distortion, Limitations of Crystal Field Theory, Molecular Orbital Theory
3. **The 18-electron rule**, Exceptions to 18-electron rule, Hapticity, Metallocenes.
4. **Bonding between Metal atoms and Organic π Systems**, Linear systems, π-Ethylene complexes, π-Allyl complexes, other linear π systems, cyclic π Systems, cyclopentadienyl (Cp) complexes, Ferrocene, ($\eta$5 -C5H5)2Fe, complexes containing cyclopentadienyl and CO ligands.
5. **Organometallics of Group 1 and 2:** preparations, reactions and applications, Organoelement Compounds of theCarbon Group (Group 14) (preparations, reactions and applications), Organometallics of group 12 (preparations, reactions and applications).
6. **Organometallic Reactions and Catalysis:** Reactions involving gain or loss of ligands, Ligand dissociation and substitution, Oxidative addition, Reductive elimination, Nucleophilic displacement, Reactions involving modification of ligands, Insertion, Carbonyl insertion (alkyl migration, Hydride elimination, Abstraction, Cyclometallations, Nucleophilic Displacement, CatalyticDeuteration, Hydroformylation, Monsanto Acetic Acid Process, Wacker (Smidt) Process, Hydrogenation (wilkinson's catalyst), Olefin Metathesis.
7. **Applications of Organometallics:** Zieglear- Natta catalysis and Wilkinson catalysis, Organic synthesis, Therapeutics, Biocides, Qualitative analysis, Quantitative analysis, Metallurigical operations, Polymers.

## 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:** 6th or 7th week & **Midterm 2:** 11th or 12th week
- **Quizzes: 3**
- **Homeworks: 5**
- **Final exam: 16th weak**

| | Teaching/learning activities | Contact Hours | Frequency | Total Contact hours | Self-study hours (hrs) | Total self-study hours | Student Learning Time |
|---|---|---|---|---|---|---|---|
| 1 | Lecture | 3 | 15 | 45 | 4 | 60 | 105 |
| 2 | Tutorial | 0 | 0 | 0 | 0 | 0 | 0 |
| 3 | Lab\Practical | 0 | 0 | 0 | 0 | 0 | 0 |
| 4 | Lab report | 0 | 0 | 0 | 0 | 0 | 0 |
| 5 | Homework | 0 | 5 | 0 | 1 | 5 | 5 |
| 6 | Quiz | 0.25 | 3 | 1 | 1 | 3 | 4 |
| 7 | Test (Midterm) | 1.5 | 2 | 3 | 5 | 10 | 13 |
| 8 | Final Exam | 2 | 1 | 2 | 8 | 8 | 10 |
| Total | | | | 63 | | 86 | 137 |

**Independent self-study = 86/15 ≅ 5.7 hrs per week**

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

| | | |
|---|---|---|
| **Midterm 1:** 20 % | **Midterm 2:** 20 % | **Final Exam:** 40 % |
| **Quizzes; Homework & Attendance & Participation:** 20 % | | |

**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**

**goo.gl/ykm7t3**

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