Course specifications

(Postgraduate Degree)

Course Title:	Advanced Organometallic Chemistry
Course Code:	CHEM 524
Program:	**Master of Science in Chemistry (M.Sc.)**
Department:	**Chemistry**
College:	**Science**
Institution:	**King Saud University**

Table of Contents

A. Course Identification

1. Credit hours: 2 (2+0+0)
2. Course type ☒ Required ☐ Elective
3. Level/year at which this course is offered: 1st Level / 1st Year
4. Pre-requisites for this course (if any)**: NA**
5. Co-requisites for this course (if any)**: NA**

6. Mode of Instruction (mark all that apply)

No	Mode of Instruction	Contact Hours	Percentage
1	**Traditional classroom**	28	100%
2	**Blended**		
3	**E-learning**		
4	**Correspondence**		
5	**Other**		

7. Actual Learning Hours (based on academic semester)

No	Activity	Learning Hours
Contact Hours		
1	**Lecture**	26
2	**Laboratory/Studio**	-
3	**Seminars**	2
4	**Others** (specify)	-
	Total	28
Other Learning Hours*		
1	**Study**	10
2	**Assignments**	2
3	**Library**	10
4	**Projects/Research Essays/Theses**	
5	**Others** (specify)	
	Total	22

* The length of time that a learner takes to complete learning activities that lead to achievement of course learning outcomes, such as study time, homework assignments, projects, preparing presentations, library times

B. Course Objectives and Learning Outcomes

1. Course Description:

This course will build up on the student's knowledge about understanding the methods of construction and designing organometallic complexes . Introducing Hoffmann's principal of the Isolobal analogies between hydrocarbon and metal-ligand fragments.

theories maybe applied to the construction of conceptual bridges between inorganic and organic chemistry and predicting the structure of the

polyhedral clusters using Wade's, and Mingos methods.To cover the aspects of carbenes and alkylidenes by reviewing Fisher and Schrock methods . The study of the reactivity of transition metal organometallic complexes as a catalysis and some plausible mechanism for homogeneous catalysis cycles.

2. Course Main Objective:

By completion of this course, the students will be able to:

- Appreciating the importance and significance of organometallic compounds in the modern technologies and chemical sciences.
- Understanding how these characteristics of chemical theories maybe applied to the construction of conceptual bridges between inorganic and organic chemistry.
- Defining the different type of bonding between metals and organic fragment.
- Predicting the structure of the polyhedral clusters using Wade's, and Mingos methods.
- Becoming familiar with the preparation of carbene , alkylidene complexes.
- Understanding the Nature of catalysis and study some plausible mechanism for homogeneous catalysis cycles.

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3. Course Learning Outcomes

Course Learning Outcomes (CLOs)		Aligned PLOs*
1	**Knowledge**	
1.1	Reviewing the methods of preparation of organometallic complexes	K1
1.2	The Hoffmann's principal of the Isolobal of the Isolobal analogies between hydrocarbon and metal-ligand fragments.	K2
1.3	Using Wade's theory to predicting the structure of the polyhedral clusters	K2
1.4	Using Mingos methods to predicting the structure of the polyhedral clusters	K2
1.5	Studying the differences between carbene and alkylidene complexes	K3
1.6	Understanding the preparation of carbene complexes by Fisher methods and	K1
1.7	Understanding the preparation of alkylidene complexes by Schrock methods	K1
1.8	Understanding the main reactions and their mechanism which in the homogeneous catalysis cycles	K2 ,K3
2	**Skills**	

Course Learning Outcomes (CLOs)		Aligned PLOs*
2.1	Corelating the inorganic and the organic fragments electronically under the Hoffmann's principal of the Isolobal	S1,S6
2.2	Calculating the polyhedral skeletal electron pair by applying Wade's rules	S2
2.3	Using the condensation of organometallic compounds fragments to build organometallic cluster and to predict the structure of organometallic cluster by applying Mingos methods	S4
2.4	Studying carbene and alkylidene complexes show the different bonding mode which highlight the reactivity of the complexes	S2
2.5	Determining the possible mechanism reactions in catalysis cycles	S1,S2
3	**Competence**	
3.1	Determining the type of reactions between organic and inorganic fragments	C1
3.2	Estimate the stability of organometallic compounds	C1

* Program Learning Outcomes

C. Course Content

No	List of Topics	Contact Hours
1	Ligand Systems and Electron Counting, Oxidation States, *d* electron configurations, 18-electron *"rule"* , Carbonyls, Phosphines & Hydrides, alkyls, aryls, carbenes, carbynes, allyl, cyclobutadiene, arenes, cyclopentadienyl	6
2	Metal-Metal bonding	4
3	Isolobality	4
4	Clusters	4
5	Fundamental Reactions, Ligand substitutions. Oxidative addition/Reductive elimination. Intramolecular insertions/eliminations	6
6	Catalytic Processes Hydrogenation: symmetric and asymmetric Carbonylations: hydroformylation and the Monsanto Acetic Acid Process. Polymerization/oligomerization/cyclization	4
Total		28

D. Teaching and Assessment

1. Alignment of Course Learning Outcomes with Teaching Strategies and Assessment Methods

Code	Course Learning Outcomes	Teaching Strategies	Assessment Methods
1.0	**Knowledge**		
1.1		• In-class lecturing where the previous knowledge is linked	• In class short MCQs quizzes

Code	Course Learning Outcomes	Teaching Strategies	Assessment Methods
		to the current and future topics	
1.2		• Homework assignments	• Major and final exams
…		• Tutorial discussions	• In class short MCQs quizzes • Major and final exams
2.0	**Skills**		
2.1		• Homework assignments	• In class short MCQs quizzes • Major and final exams
2.2		• Problem solving in the tutorial / recitation sessions • Case studies related to the course topics	• Checking the problems solved in the homework assignments
…			
3.0	**Competence**		
3.1		• Work independently and as part of a team.	
3.2		• Manage resources, time and other members of the group	• Grading homework assignments
…		• Communicate results of work to others	

2. Assessment Tasks for Students

#	Assessment task*	Week Due	Percentage of Total Assessment Score
1	Class activates (in class quizzes, and homework) Project and case study	3,5,7,9	10%
2	Major exams I	6	25%
3	Major exams II	12	25%
4	Final exam	16	40%
5			
6			
7			
8			

***Assessment task** (i.e., written test, oral test, oral presentation, group project, essay, etc.)

E. Student Academic Counseling and Support

Arrangements for availability of faculty and teaching staff for individual student consultations and academic advice:
• Office hours 4h / week

F. Learning Resources and Facilities

1. Learning Resources

Required Textbooks	• C. Elschenbroich, *Organometallics*, 3rd Edition, Wiley-VCH 2006. • Crabtree, Robert H. *The Organometallic Chemistry of the Transition Metals*. 3rd ed. New York, NY: John Wiley, 2000. C. Elschenbroich, *Organometallics*, 3rd Edition, Wiley-VCH 2006. • Crabtree, Robert H. *The Organometallic Chemistry of the Transition Metals*. 3rd ed. New York, NY: John Wiley, 2000.
Essential Reference Materials	
Electronic Materials	Websites on the internet that are relevant to the topics of the course.
Other Learning Materials	Multimedia associated with the text book and the relevant websites.

2. Educational and research Facilities and Equipment Required

Item	Resources
Accommodation (Classrooms, laboratories, demonstration rooms/labs, etc.)	Lecture room with at least 25 seats
Technology Resources (AV, data show, Smart Board, software, etc.)	Data show, smart board
Other Resources (Specify, e.g. if specific laboratory equipment is required, list requirements or attach a list)	

G. Course Quality Evaluation

Evaluation Areas/Issues	Evaluators	Evaluation Methods
Strategies for Obtaining Student Feedback on Effectiveness of Teaching		• Course evaluation by student • Students- faculty meetings
Other Strategies for Evaluation of Teaching by the Instructor or by the Department		• Peer consultation on teaching • Departmental council discussions • Discussions within the group of faculty teaching the course

Evaluation Areas/Issues	Evaluators	Evaluation Methods
Processes for Improvement of Teaching		• Conducting workshops given by experts on the teaching and learning methodologies • Periodical departmental revisions of its methods of teaching • Monitoring of teaching activates by senior faculty members
Processes for Verifying Standards of Student Achievement		• Providing samples of all kind of assessment in the departmental course portfolio of each course • Assigning group of faculty members teaching the same course to grade same questions for various students. Faculty from other institutions are invited to review the accuracy of the grading policy • Conducting standard exams such as the American Chemical Society exams or others.
Describe the planning arrangements for periodically reviewing course effectiveness and planning for improvement.		• The course material and learning outcomes are periodically reviewed and the changes to be taken are approved in the departmental and higher councils. • The head of department and faculty take the responsibility of implementing the proposed changes.

Evaluation Areas/Issues (e.g., Effectiveness of teaching and assessment, Extent of achievement of course learning outcomes, Quality of learning resources, etc.)
Evaluators (Students, Faculty, Program Leaders, Peer Reviewer, Others (specify)
Assessment Methods (Direct, Indirect)

H. Specification Approval Data

Council / Committee	
Reference No.	
Date	