Course Specification

(Postgraduate Programs)

Course Title:	**Inorganic Molecular Spectroscopy**
Course Code:	**CHM 6111**
Program:	**Master of science in chemistry**
Department:	**Chemistry**
College:	**Science**
Institution:	: Imam Mohammad Ibn Saud Islamic University
Version:	*Course Specification Version Number*
Last Revision Date:	*Pick Revision Date.*

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A. General information about the course:

1. Course Identification:

1. Credit hours: (.....)
4 (4 Lectures, 0 Lab, 0 Tutorials)

2. Course type					
A.	☐University	☐College	☐Department	☐Track	
B.	☒ Required		☐Elective		

3. Level/year at which this course is offered: (Level 1/ Year 1)

4. Course General Description:
The aim of the course is the understanding the basic principles of molecular symmetry and symmetry groups and interpretation of major types of spectroscopy: ultraviolet and visible spectroscopy, infrared spectroscopy, Raman spectroscopy, microwave spectroscopy and *Mössbour* spectroscopy that are tools to address questions of structure and reactivity of organometallic and inorganic materials.

5. Pre-requirements for this course (if any):
None

6. Pre-requirements for this course (if any):
None

7. Course Main Objective(s):
• **Recognize the nature of electromagnetic radiation, its properties, the laws of absorption in the visible spectrum, ultraviolet infrared rays, microwave spectroscopy, and the spectroscopy of the *Mössbour*.** • **Be familiar with the basics of electronic transport, its rules, and its effect on the colors of inorganic compounds and compatible complexes.** **Describe the applications of spectroscopic techniques on inorganic and coordination compounds.**

2. Teaching Mode: (mark all that apply)

No	Mode of Instruction	Contact Hours	Percentage
1	Traditional classroom	60	100%
2	E-learning		
3	Hybrid • Traditional classroom • E-learning		
4	Distance learning		

3. Contact Hours: (based on the academic semester)

No	Activity	Contact Hours
1.	**Lectures**	60
2.	**Laboratory/Studio**	0
3.	**Field**	0
4.	**Tutorial**	0
5.	**Others (specify)……**	0
	Total	60

B. Course Learning Outcomes (CLOs), Teaching Strategies and Assessment Methods:

1. Inorganic Chemistry Track

Code	Course Learning Outcomes	Code of PLOs aligned with the program	Teaching Strategies	Assessment Methods
1.0	**Knowledge and understanding**			
1.1	**To recall and apply knowledge of Symmetry Elements and Symmetry Operations.**	**K1. *Inorg.*; K2. *Inorg.*; K3. *Inorg.***	▪ Five hours/week lectures. ▪ Self-study Home-exam.	▪ Regular Exams ▪ Assignments ▪ Short Quizzes ▪ Oral Discussion Participation.
1.2	**To describe the Plane of Symmetry, Inversion Centre, Point groups, Chirality, and Symmetry Operations, and outline its applications.**	**K1. *Inorg.*; K2. *Inorg.*; K4. *Inorg.***	▪ Five hours/week lectures. ▪ Think, to justify the Plane of symmetry, and its operations, using available references (SDL) online. Open discussion.	▪ Midterm. ▪ Assignments. ▪ Group Discussions. ▪ Literatures Survey ▪ Mini-seminar. Participation.
1.3	**To outline Mössbour Spectroscopy and its relation with the Molecular Structure of Inorganic Compounds and Infrared and Raman Spectroscopy,**	**K1. *Inorg.*; K2. *Inorg.* K3. *Inorg.* K4. *Inorg.***	▪ Five hours/week lectures. Group Discussion on spectroscopy interpretation of inorganic compounds using	▪ Assignments ▪ Open Discussions. ▪ Literatures Survey ▪ Mini-seminar. Participation.

Code	Course Learning Outcomes	Code of PLOs aligned with the program	Teaching Strategies	Assessment Methods
	Microwave Spectroscopy Interpretation.		available references (SDL) online.	
1.4	**To state Electronic Absorption Spectroscopy.**	**K1. *Inorg.*; K2. *Inorg.*; K4. *Inorg*.**	▪ Five hours/week lectures. Group Discussion using available references (SDL) online	▪ Assignments ▪ Open Discussions. ▪ Literatures Survey ▪ Mini-seminar. ▪ Participation.
2.0	**Skills**			
2.1	**To summarize Symmetry Elements and Symmetry Operations Concepts with exploring strategies of Plane of Symmetry, Inversion Centre, Point groups, Chirality and Symmetry Operations.**	**S1. *Inorg.*; S4. *Inorg*.**	▪ Lectures activity ▪ Self-study. ▪ Deep discussion on concepts of Symmetry Elements and Symmetry Operations.	▪ Questions in Lectures. ▪ Short Quizzes and Exams. ▪ Open Discussions. ▪ Participation Mini -seminar.
2.2	**To interpret Electronic Absorption Spectroscopy and Molecular transitions, Selection Rule, Morse potential energy diagram.**	**S2. *Inorg.*; S3.*Inorg*.**	▪ Practice examples of Electronic absorption Spectroscopy and Molecular transitions achieving. ▪ Brainstorming. Self-study	▪ Questions in Lectures. ▪ Participation ▪ Oral Discussion Short Quizzes.
2.3	**To illustrate a reasonable argument to explain the Molecular vibrations, Raman Spectroscopy using IT for acquiring and analyzing information.**	**S1. *Inorg.*; S2. *Inorg.*; S3. *Inorg.*; S4. *Inorg*.**	▪ Lectures and Oral Discussions. Brain storming Exercises	▪ Questions in Lectures. ▪ Short Quizzes and Exams. ▪ Oral Discussion. Participation.
2.4	**To demonstrate Oral Communication on**		▪ Group Discussion and Assignments.	▪ Oral Discussion.

Code	Course Learning Outcomes	Code of PLOs aligned with the program	Teaching Strategies	Assessment Methods
	principles of molecular symmetry and symmetry groups, accompanying writing of mini- Reports, operating electronic mail, and Network in communicating with others.	**S1. *Inorg.*; S3. *Inorg.*; S4. *Inorg.*;**	▪ Propose several examples of using principles of molecular symmetry that require reading, writing, and oral presentation. Encourage students to use electronic mail to submit Home Exams and Assignments.	▪ Quizzes, and Exams. ▪ Giving marks for Oral Discussion in Lectures. Marks given for Assignments
3.0	**Values, autonomy, and responsibility**			
3.1	**To Perform communications to integrity, academic ethical practices to find solutions for scientific and social issues, and a commitment to responsible citizenship and using IT.**	**V1. *Inorg.***	▪ Brainstorming. ▪ Exercises ▪ Group Discussion. ▪ Team work.	▪ Oral Discussion. ▪ Group Discussion ▪ Assignments.
3.2	**To appraise effectively the collaboration and inter-professionalism in class discussions or team works, as well as independently.**	**V1. *Inorg.*; V2. *Inorg.***	▪ Small Group tasks ▪ Open discussion at classroom. ▪ Office hour guiding. Group Presentation of mini-projects	▪ Participation ▪ Homework's Mini-project(s).
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2. Organic Chemistry Track

Code	Course Learning Outcomes	Code of PLOs aligned with the program	Teaching Strategies	Assessment Methods
1.0	**Knowledge and understanding**			
1.1	**To recall and apply knowledge of Symmetry Elements and Symmetry Operations.**	**K2. *Org.*; K3. *Org.***	▪ Five hours/week lectures. ▪ Self-study Home-exam.	▪ Regular Exams ▪ Assignments ▪ Short Quizzes ▪ Oral Discussion

Code	Course Learning Outcomes	Code of PLOs aligned with the program	Teaching Strategies	Assessment Methods
				Participation.
1.2	**To describe the Plane of Symmetry, Inversion Centre, Point groups, Chirality, and Symmetry Operations, and outline its applications.**	**K2. *Org.*; K3. *Org.*; K4. *Org.***	▪ Five hours/week lectures. ▪ Think, to justify the Plane of symmetry, and its operations, using available references (SDL) online. Open discussion.	▪ Midterm. ▪ Assignments. ▪ Group Discussions. ▪ Literatures Survey ▪ Mini-seminar. Participation.
1.3	**To outline Mössbour Spectroscopy and its relation with the Molecular Structure of Inorganic Compounds and Infrared and Raman Spectroscopy, Microwave Spectroscopy Interpretation.**	**K2. *Org.*; K4. *Org.***	▪ Five hours/week lectures. Group Discussion on spectroscopy interpretation of inorganic compounds using available references (SDL) online.	▪ Assignments ▪ Open Discussions. ▪ Literatures Survey ▪ Mini-seminar. Participation.
1.4	**To state Electronic Absorption Spectroscopy.**	**K4. *Org.***	▪ Five hours/week lectures. Group Discussion using available references (SDL) online	▪ Assignments ▪ Open Discussions. ▪ Literatures Survey ▪ Mini-seminar. ▪ Participation.
2.0	**Skills**			
2.1	**To summarize Symmetry Elements and Symmetry Operations Concepts with exploring strategies of Plane of Symmetry, Inversion Centre, Point groups, Chirality and Symmetry Operations.**	**S1. *Org.*; S2. *Org.***	▪ Lectures activity ▪ Self-study. ▪ Deep discussion on concepts of Symmetry Elements and Symmetry Operations.	▪ Questions in Lectures. ▪ Short Quizzes and Exams. ▪ Open Discussions. ▪ Participation Mini -seminar.
2.2	**To interpret Electronic Absorption**	**S2. *Org.*; S3.*Org.***	▪ Practice examples of Electronic	▪ Questions in Lectures.

Code	Course Learning Outcomes	Code of PLOs aligned with the program	Teaching Strategies	Assessment Methods
	Spectroscopy and Molecular transitions, Selection Rule, Morse potential energy diagram.		absorption Spectroscopy and Molecular transitions achieving. ▪ Brainstorming. Self-study	▪ Participation ▪ Oral Discussion Short Quizzes.
2.3	**To illustrate a reasonable argument to explain the Molecular vibrations, Raman Spectroscopy using IT for acquiring and analyzing information.**	**S1. *Org*.**	▪ Lectures and Oral Discussions. Brain storming Exercises	▪ Questions in Lectures. ▪ Short Quizzes and Exams. ▪ Oral Discussion. Participation.
2.4	**To demonstrate Oral Communication on principles of molecular symmetry and symmetry groups, accompanying writing of mini- Reports, operating electronic mail, and Network in communicating with others.**	**S1. *Org*.; S4. *Org*.**	▪ Group Discussion and Assignments. ▪ Propose several examples of using principles of molecular symmetry that require reading, writing, and oral presentation. Encourage students to use electronic mail to submit Home Exams and Assignments.	▪ Oral Discussion. ▪ Quizzes, and Exams. ▪ Giving marks for Oral Discussion in Lectures. Marks given for Assignments
3.0	**Values, autonomy, and responsibility**			
3.1	**To Perform communications to integrity, academic ethical practices to find solutions for scientific and social issues, and a commitment to responsible citizenship and using IT.**	**V1. *Org*.**	▪ Brainstorming. ▪ Exercises ▪ Group Discussion. ▪ Team work.	▪ Oral Discussion. ▪ Group Discussion ▪ Assignments.
3.2	**To appraise effectively the collaboration and inter-professionalism**	**V1. *Org*.; V2. *Org*.**	▪ Small Group tasks ▪ Open discussion at classroom.	▪ Participation ▪ Homework's Mini-project(s).

Code	Course Learning Outcomes	Code of PLOs aligned with the program	Teaching Strategies	Assessment Methods
	in class discussions or team works, as well as independently.		▪ Office hour guiding. Group Presentation of mini-projects	
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3. Analytical Chemistry Track

Code	Course Learning Outcomes	Code of PLOs aligned with the program	Teaching Strategies	Assessment Methods
1.0	**Knowledge and understanding**			
1.1	**To recall and apply knowledge of Symmetry Elements and Symmetry Operations.**	**K1. *Anal.*; K2. *Anal.***	▪ Five hours/week lectures. ▪ Self-study Home-exam.	▪ Regular Exams ▪ Assignments ▪ Short Quizzes ▪ Oral Discussion Participation.
1.2	**To describe the Plane of Symmetry, Inversion Centre, Point groups, Chirality, and Symmetry Operations, and outline its applications.**	**K2. *Anal*; K4. *Anal.***	▪ Five hours/week lectures. ▪ Think, to justify the Plane of symmetry, and its operations, using available references (SDL) online. Open discussion.	▪ Midterm. ▪ Assignments. ▪ Group Discussions. ▪ Literatures Survey ▪ Mini-seminar. Participation.
1.3	**To outline Mössbour Spectroscopy and its relation with the Molecular Structure of Inorganic Compounds and Infrared and Raman Spectroscopy, Microwave Spectroscopy Interpretation.**	**K1. *Anal;* K2. *Anal*.**	▪ Five hours/week lectures. Group Discussion on spectroscopy interpretation of inorganic compounds using available references (SDL) online.	▪ Assignments ▪ Open Discussions. ▪ Literatures Survey ▪ Mini-seminar. Participation.
1.4	**To state Electronic Absorption Spectroscopy.**	**K4. *Anal*.**	▪ Five hours/week lectures. Group Discussion using available references (SDL) online	▪ Assignments ▪ Open Discussions. ▪ Literatures Survey ▪ Mini-seminar. ▪ Participation.

Code	Course Learning Outcomes	Code of PLOs aligned with the program	Teaching Strategies	Assessment Methods
2.0	**Skills**			
2.1	**To summarize Symmetry Elements and Symmetry Operations Concepts with exploring strategies of Plane of Symmetry, Inversion Centre, Point groups, Chirality and Symmetry Operations.**	**S1. *Anal*.**	▪ Lectures activity ▪ Self-study. ▪ Deep discussion on concepts of Symmetry Elements and Symmetry Operations.	▪ Questions in Lectures. ▪ Short Quizzes and Exams. ▪ Open Discussions. ▪ Participation Mini -seminar.
2.2	**To interpret Electronic Absorption Spectroscopy and Molecular transitions, Selection Rule, Morse potential energy diagram.**	**S2. *Anal*.; S3. *Anal*.**	▪ Practice examples of Electronic absorption Spectroscopy and Molecular transitions achieving. ▪ Brainstorming. Self-study	▪ Questions in Lectures. ▪ Participation ▪ Oral Discussion Short Quizzes.
2.3	**To illustrate a reasonable argument to explain the Molecular vibrations, Raman Spectroscopy using IT for acquiring and analyzing information.**	**S2. *Anal*.; S3. *Anal*.**	▪ Lectures and Oral Discussions. Brain storming Exercises	▪ Questions in Lectures. ▪ Short Quizzes and Exams. ▪ Oral Discussion. Participation.
2.4	**To demonstrate Oral Communication on principles of molecular symmetry and symmetry groups, accompanying writing of mini- Reports, operating electronic mail, and Network in communicating with others.**	**S1. *Anal*.; S4. *Anal*.**	▪ Group Discussion and Assignments. ▪ Propose several examples of using principles of molecular symmetry that require reading, writing, and oral presentation. Encourage students to use electronic mail to submit Home Exams and Assignments.	▪ Oral Discussion. ▪ Quizzes, and Exams. ▪ Giving marks for Oral Discussion in Lectures. Marks given for Assignments
3.0	**Values, autonomy, and responsibility**			

Code	Course Learning Outcomes	Code of PLOs aligned with the program	Teaching Strategies	Assessment Methods
3.1	**To Perform communications to integrity, academic ethical practices to find solutions for scientific and social issues, and a commitment to responsible citizenship and using IT.**	**V1. *Anal.***	▪ Brainstorming. ▪ Exercises ▪ Group Discussion. ▪ Team work.	▪ Oral Discussion. ▪ Group Discussion ▪ Assignments.
3.2	**To appraise effectively the collaboration and inter-professionalism in class discussions or team works, as well as independently.**	**V1. *Anal.*; V2. *Anal.***	▪ Small Group tasks ▪ Open discussion at classroom. ▪ Office hour guiding. Group Presentation of mini-projects	▪ Participation ▪ Homework's Mini-project(s).
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4. Physical Chemistry Track

Code	Course Learning Outcomes	Code of PLOs aligned with the program	Teaching Strategies	Assessment Methods
1.0	**Knowledge and understanding**			
1.1	**To recall and apply knowledge of Symmetry Elements and Symmetry Operations.**	**K4. *Phy*.**	▪ Five hours/week lectures. ▪ Self-study Home-exam.	▪ Regular Exams ▪ Assignments ▪ Short Quizzes ▪ Oral Discussion Participation.
1.2	**To describe the Plane of Symmetry, Inversion Centre, Point groups, Chirality, and Symmetry Operations, and outline its applications.**	**K1. *Phy*.; K4. *Phy*.**	▪ Five hours/week lectures. ▪ Think, to justify the Plane of symmetry, and its operations, using available references (SDL) online. Open discussion.	▪ Midterm. ▪ Assignments. ▪ Group Discussions. ▪ Literatures Survey ▪ Mini-seminar. Participation.
1.3	**To outline Mössbour Spectroscopy and its relation with the Molecular Structure of**	**K2. *Phy*.; K3. *Phy*.; K4. *Phy*.**	▪ Five hours/week lectures. Group Discussion on spectroscopy	▪ Assignments ▪ Open Discussions.

Code	Course Learning Outcomes	Code of PLOs aligned with the program	Teaching Strategies	Assessment Methods
	Inorganic Compounds and Infrared and Raman Spectroscopy, Microwave Spectroscopy Interpretation.		interpretation of inorganic compounds using available references (SDL) online.	▪ Literatures Survey ▪ Mini-seminar. Participation.
1.4	**To state Electronic Absorption Spectroscopy.**	**K3. *Phy.*; K4. *Phy*.**	▪ Five hours/week lectures. Group Discussion using available references (SDL) online	▪ Assignments ▪ Open Discussions. ▪ Literatures Survey ▪ Mini-seminar. ▪ Participation.
2.0	**Skills**			
2.1	**To summarize Symmetry Elements and Symmetry Operations Concepts with exploring strategies of Plane of Symmetry, Inversion Centre, Point groups, Chirality and Symmetry Operations.**	**S1. *Phy.*; S2. *Phy.***	▪ Lectures activity ▪ Self-study. ▪ Deep discussion on concepts of Symmetry Elements and Symmetry Operations.	▪ Questions in Lectures. ▪ Short Quizzes and Exams. ▪ Open Discussions. ▪ Participation Mini -seminar.
2.2	**To interpret Electronic Absorption Spectroscopy and Molecular transitions, Selection Rule, Morse potential energy diagram.**	**S2. *Phy.*; S3. *Phy.***	▪ Practice examples of Electronic absorption Spectroscopy and Molecular transitions achieving. ▪ Brainstorming. Self-study	▪ Questions in Lectures. ▪ Participation ▪ Oral Discussion Short Quizzes.
2.3	**To illustrate a reasonable argument to explain the Molecular vibrations, Raman Spectroscopy using IT for acquiring**	**S1. *Phy.*; S2. *Phy.*; S3. *Phy.***	▪ Lectures and Oral Discussions. Brain storming Exercises	▪ Questions in Lectures. ▪ Short Quizzes and Exams. ▪ Oral Discussion. Participation.

Code	Course Learning Outcomes	Code of PLOs aligned with the program	Teaching Strategies	Assessment Methods
	and analyzing information.			
2.4	**To demonstrate Oral Communication on principles of molecular symmetry and symmetry groups, accompanying writing of mini- Reports, operating electronic mail, and Network in communicating with others.**	**S3. *Phy.*; S4. *Phy.***	▪ Group Discussion and Assignments. ▪ Propose several examples of using principles of molecular symmetry that require reading, writing, and oral presentation. Encourage students to use electronic mail to submit Home Exams and Assignments.	▪ Oral Discussion. ▪ Quizzes, and Exams. ▪ Giving marks for Oral Discussion in Lectures. Marks given for Assignments
3.0	**Values, autonomy, and responsibility**			
3.1	**To Perform communications to integrity, academic ethical practices to find solutions for scientific and social issues, and a commitment to responsible citizenship and using IT.**	**V1. *Phy.***	▪ Brainstorming. ▪ Exercises ▪ Group Discussion. ▪ Team work.	▪ Oral Discussion. ▪ Group Discussion ▪ Assignments.
3.2	**To appraise effectively the collaboration and inter-professionalism in class discussions or team works, as well as independently.**	**V1. *Phy.* ; V2. *Phy.***	▪ Small Group tasks ▪ Open discussion at classroom. ▪ Office hour guiding. Group Presentation of mini-projects	▪ Participation ▪ Homework's Mini-project(s).
...				

C. Course Content:

No	List of Topics	Contact Hours

1.	***Symmetry Elements and Operations:*** Symmetry Elements and Operations, Identity, Proper Rtations: The Plane of Symmetry, The Inversion Centre, Improper rotation.	**5**
2.	***Symmetry Operations and Products of Operations:*** Background to point groups, closed groups and new operations, Products of operations, fixed symmetry elements, Improper rotations, Properties of symmetry, The inverse of an operation, The order of the product; Operations that commute, Chirality and symmetry.	**11**
3.	***The Point Groups Used with Molecules:*** Molecular Classification using Symmetry Operations, The Nonaxial Groups, The cyclic groups, Axial groups containing mirror planes, Examples of molecules for axial groups containing mirror, Special groups for linear molecules, The Cubic Groups.	**11**
4.	***Point Group Representations, Matrices and Basis Sets:*** Symmetry representations and characters, Water, Multiplication tables for character representations, Matrices and symmetry operations, Diagonal and off-diagonal matrix elements, Reducible representations, Degenerate irreducible representations.	**11**
5.	***Electronic absorption Spectroscopy:*** Molecular transitions, Selection rule, Morse potential energy diagram, electronic transitions, Orgel diagram, charge transfer spectra.	**5**
6.	***Infrared and Raman Spectroscopy*:** Molecular vibrations, force constants, Molecular vibrations and absorption Raman Spectroscopy, polarized Raman lines, Use of symmetry considerations to determine the no. of lines in IR and Raman Spectra, Spectra of gases, applications of Raman and Infrared spectroscopy, Selection rule in Inorganic structure determinations.	**3**
7.	***Microwave spectroscopy:*** Basic concept, rotation spectra of simple inorganic compounds, Classification of molecules, rigid rotor model, effect of isotopic substitution on transition frequencies & intensities non rigid rotor, stark effect nuclear and electron spin interaction and effect of external field. Applications of Micro wave Spectroscopy.	**7**
8.	***Mössbour spectroscopy:*** Methods of determination of Molecular structure of Inorganic compounds**.**	**7**
Total		**60**

D. Students Assessment Activities:

No	Assessment Activities *	Assessment timing (in week no)	Percentage of Total Assessment Score
1.	**Class Activities (Open Discussion, Mini-reports, Oral Presentation, solving questions)**	**weekly**	**30 %**
2.	**Midterm Exam**	**9 th week**	**30 %**
3.	**Final Exam**	**Around**	**40 %**

No	Assessment Activities *	Assessment timing (in week no)	Percentage of Total Assessment Score
		17th week	
...	Total		100%

*Assessment Activities (i.e., Written test, oral test, oral presentation, group project, essay, etc.)

E. Learning Resources and Facilities:

1. References and Learning Resources:

Essential References	***Molecular Symmetry***, D. Willock, John Wiley & Sons Ltd. (2009). ISBN 978-0-470-85347-4 (hbk) 978-0-470-85348-1 (pbk). ***Molecular structure and spectroscopy***, G. Aruldhas, Prentice-Hall of India Pvt.Ltd , (2004), ISBN-13: 978-8120317499
Supportive References	***Fundamentals Of Molecular Spectroscopy***, Colin Banwell., Elaine McCash Dr., 4th Ed, 2016 , Banwell , Mc Graw Hill India, ISBN-10: 9352601734.
Electronic Materials	• European Journal Of inorganic Chemistry • American Chemical Society (Relevant Journals) Saudi Digital Library
Other Learning Materials	• Blackboard Multimedia associated with the text book and the relevant websites

2. Educational and Research Facilities and Equipment Required:

Items	Resources
facilities (Classrooms, laboratories, exhibition rooms, simulation rooms, etc.)	**Each of the classroom should be equipped with a whiteboard and a projector, with a maximum of 20 students.**
Technology equipment (Projector, smart board, software)	**The rooms are equipped with data show, Smart Board, WI-FI access.**
Other equipment (Depending on the nature of the specialty)	**None**

F. Assessment of Course Quality:

Assessment Areas/Issues	Assessor	Assessment Methods
Effectiveness of teaching	Students	**Direct:** Questionnaire.
	Course Responsible	**Direct:** Course e-Portfolio. **Indirect:** Second examiner checklist-Course report.
	Peer Reviewer	**Direct:** Questionnaire. **Indirect:** External assessor report.

Assessment Areas/Issues	Assessor	Assessment Methods
Effectiveness of students' assessment	Program Leaders	**Direct:** Course e-Portfolio. **Indirect:** Course report.
Quality of learning resources	Students	**Indirect:** Second examiner checklist-Course report.
	Faculty (Academic Advisory-GCC)	**Direct:** course Entrance/Exit. **Indirect:** Observations - Accreditation review.
	Program Leaders	**Direct:** Course e-Portfolio.
	Course Responsible	**Indirect:** Course evaluation survey- Observations- Syllabus review- Accreditation review.
The extent to which CLOs have been achieved	Students	**Direct:** Exams - Course e-Portfolio. **Indirect:** Second examiner checklist-Course report.
	Program Leaders	**Indirect:** Exams.
Other		

Assessor (Students, Faculty, Program Leaders, Peer Reviewer, Others (specify)

Assessment Methods (Direct, Indirect)

G. Specification Approval Data:

COUNCIL /COMMITTEE	**Council of Chemistry Department**
REFERENCE NO.	**10 (No. 2/10)**
DATE	**21/04/1444- 15/11/2022**