	Universitas Negeri Surabaya Faculty of Mathematics and Natural Sciences Undergraduate Chemistry Education Study Program	Document Code

SEMESTER LEARNING PLAN

Courses	CODE	Course Family	Credit Weight	SEMESTER	Compilation Date
Coordination Chemistry	8420402151	Compulsory Study Program Subjects	T=2 P=0 ECTS=3.18	6	April 1, 2024

AUTHORIZATION	SP Developer	Course Cluster Coordinator	Study Program Coordinator
	Prof. Dr. Sari Edi Cahyaningrum, M.Si., Dr. Amaria, M.Si., Dina Kartika Maharani, S.Si., M.Sc., Amalia Putri Purnamasari, M.Si.	Prof. Dr. Achmad Lutfi, M.Pd.	Prof. Dr. Utiya Azizah, M.Pd.

Learning model	**Case Studies**	
Program Learning Outcomes (PLO)	**PLO study program which is charged to the course**	
	PLO-5	Able to make decisions based on data/information in order to complete tasks that are their responsibility and evaluate performance that has been carried out both individually and in groups, has an entrepreneurial spirit with an environmental perspective (CPL 7)
	PLO-7	Applying logical, critical, systematic and innovative thinking in the context of the development or implementation of science, technology and art that pays attention to and applies humanities values appropriate to the field of chemistry education in solving problems (CPL 5)
	PLO-11	Able to demonstrate knowledge related to theoretical concepts about structure, dynamics and energy, as well as basic principles of separation, analysis, synthesis and characterization of chemicals (CPL 1)
	Program Objectives (PO)	
	PO - 1	Study of the concepts: chemical bonding, stereochemistry, reaction mechanisms, properties, spectra, generation, and stability of coordination chemistry through discussions, presentations, structured assignments
	PO - 2	Students are able to construct coordination compounds and predict their properties
	PO - 3	Able to communicate both orally and in writing the concepts of chemical bonding, stereochemistry, stability, magnetic properties, and electronic spectrum of coordination compounds
	PO - 4	Students have a caring and responsible attitude in applying coordination compounds to the environment
	PLO-PO Matrix	

P.O	PLO-5	PLO-7	PLO-11
PO-1			
PO-2			
PO-3			
PO-4			

PO Matrix at the end of each learning stage (Sub-PO)

P.O	Week															
	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16
PO-1																
PO-2																
PO-3																
PO-4																

Short Course Description	Study of the concepts: chemical bonding, stereochemistry, reaction mechanisms, properties, spectra, creation and stability of coordination chemistry through discussions, presentations, structured assignments.	
References	**Main :**	

1. Sugiarto, Bambang. 2006.Teori Senyawa Koordinasi.Surabaya: Unesa University Press.
2. Basolo, F and Johnson, R. C. 1986.CoordinationChemistry, 2nd Edition.New York: W. A. Benjamin, Inc.
3. Huheey, E. James, Ellen, A. K, and RichardI. K. 1978.Inorganic Chemistry, Principle of Structure and Reactivity. USA: Harper Collins College Publishers

Supporters:

1. L. Liang, X. Wu, C. Shi, H. Wen, S. Wu. 2022. Synthesis and characterization of polypyridine ruthenium(II) complexes and anticancer efficacy studies in vivo and in vitro. Journal of Inorganic Biochemistry 236 111963.
2. S. Kagatikar, D. Sunil. 2021. Schiff Bases and Their Complexes in Organic Light Emitting Diode Application. Journal of Electronic Materials (50) 6708-5723.
3. M. Lakic, T.C Breijaert, G. Daniel, F.G. Svensson, G.A. Seisenbaeva. 2023. Uptake and separation of rare earth elements and late transition metal cations by nanoadsorbent grafted with diamino ligands. Separation and Purification Technology 323.

Supporting lecturer	Dr. Amaria, M.Si. Prof. Dr. Sari Edi Cahyaningrum, M.Si. Dr. Dina Kartika Maharani, S.Si., M.Sc. Amalia Putri Purnamasari, S.Si., M.Si. Herry Wijayanto, S.Pd., M.Sc., D.Sc.

Week-	Final abilities of each learning stage (Sub-PO)	Evaluation		Help Learning, Learning methods, Student Assignments, [Estimated time]		Learning materials [References]	Assessment Weight (%)
		Indicator	Criteria & Form	Offline (*offline*)	Online (*online*)		
(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
1	Understand the development of the concept of coordination compounds	Compare double salts and coordination compounds.	**Criteria:** 1.Participation during lectures 2.Assignment value for working on questions and writing papers (weight 3) **Form of Assessment** : Participatory Activities	Discussion and questions and answers 2 X 50		**Material:** Concept of coordination compounds **References:** *Sugiarto, Bambang. 2006. Coordination Compound Theory. Surabaya: Unesa University Press.*	5%
2	Understand the development of the concept of coordination compounds	Explain the development and nomenclature of coordination compounds.	**Criteria:** Participation during lectures is carried out through observation with a weight of 20% **Form of Assessment** : Participatory Activities	Discussion and questions and answers 2 X 50		**Material:** Nomenclature of Coordination Compounds **Literature:** *Sugiarto, Bambang. 2006. Coordination Compound Theory. Surabaya: Unesa University Press.*	5%
3	Apply various basic bond theories used in coordination compounds	1. Apply the concept of electron pair bonding. 2. Apply the concept of effective atomic number	**Criteria:** 1.Participation during lectures (weight 2) 2.Sub-summative test, assessed all relevant indicators through a written exam, given a weight of (2) 3.Assignment value for working on questions and writing papers (weight 3) 4.3x UAS score (3) 5.The final NA is (participation value x2) (assignment value x 3) (UTS value x 2) UAS value (3) divided by 10 **Form of Assessment** : Participatory Activities	Discussion and questions and answers 2 X 50		**Material:** Effective Atomic Number **References:** *Sugiarto, Bambang. 2006. Coordination Compound Theory. Surabaya: Unesa University Press.*	5%

4	Apply various basic bond theories used in coordination compounds	1. Apply Valence Bond Theory 2. Apply Crystal Field Theory	**Criteria:** 1. Participation during lectures (weight 2) 2. Sub-summative test, assessed all relevant indicators through a written exam, given a weight of (2) 3. Assignment value for working on questions and writing papers (weight 3) 4. 3x UAS score (3) 5. The final NA is (participation value x2) (assignment value x 3) (UTS value x 2) UAS value (3) divided by 10 **Form of Assessment** : Participatory Activities	Discussion and questions and answers 2 X 50		**Material:** Valence Bond Theory and Crystal Field Theory **References:** *Basolo, F and Johnson, RC 1986. Coordination Chemistry, 2nd Edition. New York: WA Benjamin, Inc.*	5%
5	Apply various basic bond theories used in coordination compounds	Applying Molecular Orbital Theory	**Criteria:** 1. Participation during lectures (weight 2) 2. Sub-summative test, assessed all relevant indicators through a written exam, given a weight of (2) 3. Assignment value for working on questions and writing papers (weight 3) 4. 3x UAS score (3) 5. The final NA is (participation value x2) (assignment value x 3) (UTS value x 2) UAS value (3) divided by 10 **Form of Assessment** : Participatory Activities	Discussion and questions and answers 2 X 50		**Material:** Molecular Orbital Theory **Bibliography:** *Basolo, F and Johnson, RC 1986. Coordination Chemistry, 2nd Edition. New York: WA Benjamin, Inc.*	5%
6	Apply various basic bond theories used in coordination compounds	Apply molecular orbital theory to prove the paramagnetic properties of coordination compounds	**Criteria:** 1. Participation during lectures (weight 2) 2. Sub-summative test, assessed all relevant indicators through a written exam, given a weight of (2) 3. Assignment value for working on questions and writing papers (weight 3) 4. 3x UAS score (3) 5. The final NA is (participation value x2) (assignment value x 3) (UTS value x 2) UAS value (3) divided by 10 **Form of Assessment** : Participatory Activities	Discussion and questions and answers 2 X 50		**Material:** Geometry of Coordination Compounds **Bibliography:** *Basolo, F and Johnson, RC 1986. Coordination Chemistry, 2nd Edition. New York: WA Benjamin, Inc.*	5%

7	Apply various basic bond theories used in coordination compounds	Apply molecular orbital theory to prove bond strength in coordination compounds	**Criteria:** 1. Participation during lectures (weight 2) 2. Sub-summative test, assessed all relevant indicators through a written exam, given a weight of (2) 3. Assignment value for working on questions and writing papers (weight 3) 4. 3x UAS score (3) 5. The final NA is (participation value x2) (assignment value x 3) (UTS value x 2) UAS value (3) divided by 10 **Form of Assessment** : Participatory Activities	Discussion and questions and answers 2 X 50		**Material:** Geometry of Coordination Compounds **Bibliography:** *Basolo, F and Johnson, RC 1986. Coordination Chemistry, 2nd Edition. New York: WA Benjamin, Inc.*	0%
8	UTS	meeting indicators 1-7	**Criteria:** 1. Participation during lectures (weight 2) 2. Sub-summative test, assessed all relevant indicators through a written exam, given a weight of (2) 3. Assignment value for working on questions and writing papers (weight 3) 4. 3x UAS score (3) 5. The final NA is (participation value x2) (assignment value x 3) (UTS value x 2) UAS value (3) divided by 10 **Form of Assessment** : Test	Test 2 X 50			20%
9	Understand the geometry and isomers of coordination compounds	1. Explain the various types of isomers in coordination compounds 2. Determine geometric isomers of coordination compounds 3. Determining optically active isomers of coordination compounds	**Criteria:** 1. Participation during lectures (weight 2) 2. Sub-summative test, assessed all relevant indicators through a written exam, given a weight of (2) 3. Assignment value for working on questions and writing papers (weight 3) 4. 3x UAS score (3) 5. The final NA is (participation value x2) (assignment value x 3) (UTS value x 2) UAS value (3) divided by 10 **Form of Assessment** : Participatory Activities	Discussion and questions and answers 2 X 50		**Material:** Isomers of coordination compounds **References:** *Huheey, E. James, Ellen, A. K, and RichardI. K. 1978. Inorganic Chemistry, Principle of Structure and Reactivity. USA: Harper Collins College Publishers*	5%

10	Understanding the factors determining the stability of coordination compounds	1. Explain the differences in complex stability thermodynamically and kinetically 2. Write the reaction stages for the reaction to form coordination compounds, accompanied by writing the stability constants	**Criteria:** 1. Participation during lectures (weight 2) 2. Sub-summative test, assessed all relevant indicators through a written exam, given a weight of (2) 3. Assignment value for working on questions and writing papers (weight 3) 4. 3x UAS score (3) 5. The final NA is (participation value x2) (assignment value x 3) (UTS value x 2) UAS value (3) divided by 10 **Form of Assessment** : Participatory Activities	Discussion and questions and answers 2 X 50		**Material:** Stability of coordination compounds **References:** *Huheey, E. James, Ellen, A. K, and RichardI. K. 1978. Inorganic Chemistry, Principle of Structure and Reactivity. USA: Harper Collins College Publishers* **Material:** Isomers of coordination compounds **References:** *L. Liang, X. Wu, C. Shi, H. Wen, S. Wu. 2022. Synthesis and characterization of polypyridine ruthenium(II) complexes and anticancer efficacy studies in vivo and in vitro. Journal of Inorganic Biochemistry 236 111963.*	5%
11	Understanding the factors determining the stability of coordination compounds	1. Write the reaction stages for the reaction to form coordination compounds, accompanied by writing the stability constants 2. Explain the 2 factors that influence the stability constant	**Criteria:** 1. Participation during lectures (weight 2) 2. Sub-summative test, assessed all relevant indicators through a written exam, given a weight of (2) 3. Assignment value for working on questions and writing papers (weight 3) 4. 3x UAS score (3) 5. The final NA is (participation value x2) (assignment value x 3) (UTS value x 2) UAS value (3) divided by 10 **Form of Assessment** : Participatory Activities	Discussion and questions and answers 2 X 50		**Material:** Stability of coordination compounds **References:** *Huheey, E. James, Ellen, A. K, and RichardI. K. 1978. Inorganic Chemistry, Principle of Structure and Reactivity. USA: Harper Collins College Publishers*	5%

12	Understanding complex stability	Explain the meaning of the term symbol	**Criteria:** 1. Participation during lectures (weight 2) 2. Sub-summative test, assessed all relevant indicators through a written exam, given a weight of (2) 3. Assignment value for working on questions and writing papers (weight 3) 4. 3x UAS score (3) 5. The final NA is (participation value x2) (assignment value x 3) (UTS value x 2) UAS value (3) divided by 10 **Form of Assessment** : Participatory Activities	Discussion, questions and answers, presentation of 2 X 50 papers		**Material:** Symbol Terms, Multiplicity, Organ Diagrams, and Tanabe-Sugano Diagrams **References:** *Huheey, E. James, Ellen, A. K, and RichardI. K. 1978. Inorganic Chemistry, Principle of Structure and Reactivity. USA: Harper Collins College Publishers*	5%
13	Understand the terms symbols, multiplicity, organ diagrams, and Tanabe-Sugano diagrams	Explain the meaning of the term symbol, multiplicity	**Criteria:** 1. Participation during lectures (weight 2) 2. Sub-summative test, assessed all relevant indicators through a written exam, given a weight of (2) 3. Assignment value for working on questions and writing papers (weight 3) 4. 3x UAS score (3) 5. The final NA is (participation value x2) (assignment value x 3) (UTS value x 2) UAS value (3) divided by 10 **Form of Assessment** : Participatory Activities	Discussion, questions and answers, presentation of 2 X 50 papers		**Material:** Symbol terms and multiplicity **References:** *Basolo, F and Johnson, RC 1986. Coordination Chemistry, 2nd Edition. New York: WA Benjamin, Inc.*	0%
14	Understand the terms symbols, multiplicity, organ diagrams, and Tanabe-Sugano diagrams	Explain the meaning of organ diagrams	**Criteria:** 1. Participation during lectures (weight 2) 2. Sub-summative test, assessed all relevant indicators through a written exam, given a weight of (2) 3. Assignment value for working on questions and writing papers (weight 3) 4. 3x UAS score (3) 5. The final NA is (participation value x2) (assignment value x 3) (UTS value x 2) UAS value (3) divided by 10 **Form of Assessment** : Participatory Activities	Discussion, questions and answers, presentation of 2 X 50 papers		**Material:** Organ Diagrams **Bibliography:** *Basolo, F and Johnson, RC 1986. Coordination Chemistry, 2nd Edition. New York: WA Benjamin, Inc.*	0%

15	Understand the terms symbols, multiplicity, organ diagrams, and Tanabe-Sugano diagrams	Explain the meaning of the Tanabe Sugano diagram	**Criteria:** 1. Participation during lectures (weight 2) 2. Sub-summative test, assessed all relevant indicators through a written exam, given a weight of (2) 3. Assignment value for working on questions and writing papers (weight 3) 4. 3x UAS score (3) 5. The final NA is (participation value x2) (assignment value x 3) (UTS value x 2) UAS value (3) divided by 10 **Form of Assessment** : Participatory Activities	Discussion, questions and answers, presentation of 2 X 50 papers		**Material:** Tanabe-Sugano Diagram **Bibliography:** *Basolo, F and Johnson, RC 1986. Coordination Chemistry, 2nd Edition. New York: WA Benjamin, Inc.*	0%
16	UAS (end of meeting ability 9-15)	Meeting indicators 9-15	**Criteria:** 1. Participation during lectures (weight 2) 2. Sub-summative test, assessed all relevant indicators through a written exam, given a weight of (2) 3. Assignment value for working on questions and writing papers (weight 3) 4. 3x UAS score (3) 5. The final NA is (participation value x2) (assignment value x 3) (UTS value x 2) UAS value (3) divided by 10 **Form of Assessment** : Test	Test 2 X 50			30%

Evaluation Percentage Recap: Case Study

No	Evaluation	Percentage
1.	Participatory Activities	50%
2.	Test	50%
		100%

Notes

1. **Learning Outcomes of Study Program Graduates (PLO - Study Program)** are the abilities possessed by each Study Program graduate which are the internalization of attitudes, mastery of knowledge and skills according to the level of their study program obtained through the learning process.
2. **The PLO imposed on courses** are several learning outcomes of study program graduates (CPL-Study Program) which are used for the formation/development of a course consisting of aspects of attitude, general skills, special skills and knowledge.
3. **Program Objectives (PO)** are abilities that are specifically described from the PLO assigned to a course, and are specific to the study material or learning materials for that course.
4. **Subject Sub-PO (Sub-PO)** is a capability that is specifically described from the PO that can be measured or observed and is the final ability that is planned at each learning stage, and is specific to the learning material of the course.
5. **Indicators for assessing** ability in the process and student learning outcomes are specific and measurable statements that identify the ability or performance of student learning outcomes accompanied by evidence.
6. **Assessment Criteria** are benchmarks used as a measure or measure of learning achievement in assessments based on predetermined indicators. Assessment criteria are guidelines for assessors so that assessments are consistent and unbiased. Criteria can be quantitative or qualitative.
7. **Forms of assessment:** test and non-test.

8. **Forms of learning:** Lecture, Response, Tutorial, Seminar or equivalent, Practicum, Studio Practice, Workshop Practice, Field Practice, Research, Community Service and/or other equivalent forms of learning.
9. **Learning Methods:** Small Group Discussion, Role-Play & Simulation, Discovery Learning, Self-Directed Learning, Cooperative Learning, Collaborative Learning, Contextual Learning, Project Based Learning, and other equivalent methods.
10. **Learning materials** are details or descriptions of study materials which can be presented in the form of several main points and sub-topics.
11. **The assessment weight** is the percentage of assessment of each sub-PO achievement whose size is proportional to the level of difficulty of achieving that sub-PO, and the total is 100%.
12. TM=Face to face, PT=Structured assignments, BM=Independent study.