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

SEMESTER LEARNING PLAN

Courses	CODE	Course Family	Credit Weight			SEMESTER	Compilation Date
Electrochemical Analysis	4720102196	Compulsory Study Program Subjects	T=2	P=0	ECTS=3.18	4	July 17, 2024

AUTHORIZATION	SP Developer	Course Cluster Coordinator	Study Program Coordinator
	.....	.....	Dr. Amaria, M.Si.

Learning model	**Case Studies**
Program Learning Outcomes (PLO)	**PLO study program that is charged to the course**
	Program Objectives (PO)
	PLO-PO Matrix

	P.O

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

Short Course Description	The study of qualitative and quantitative chemical analysis in terms of energetics, dynamics and analysis based on electrical properties includes: potentiometric, conductometric, electrogravimetric, polarographic and voltammetric analysis accompanied by supporting laboratory activities so that students are able to master related concepts, are skilled in using tools, and are able to work together. and can communicate their knowledge and skills scientifically. :
References	**Main :**

1. Bagotsky, V.S, 2006, Fundamentals of Electrochemistry , New Jersey: John Wiley & Sons Ewing G.W, 1981, Instrumental Methods Of Chemical Analysis, International Student Edition, Tokyo: McGraw-Hill Kogakusha Ltd Harvey,D. 2000. Modern Analytical Chemistry. Int. Ed. Singapore: Mc.Graw Hill. Pecsok, et al.1976. Modern Methods of Analytical Chemistry . 2nd New York: John Wiley and Sons Sawyer, Heineman, and Beebe,1984, Chemistry Experiments for Instrumental Methods , New York : John Wiley & Sons Skoog, Douglas.A. 1982, Fundamental of Analytical Chemistry. Fourth Edition. Tokyo: Holt- Sounders Japan

	Supporters:
Supporting lecturer	Prof. Dr. Pirim Setiarso, M.Si. Prof. Dr. Titik Taufikurohmah, S.Si., M.Si. Prof. Dr. Nita Kusumawati, S.Si., M.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 electrochemical analysis methods	Explain the methods of electrochemical analysis	**Form of Assessment** : Participatory Activities	Lecture, question and answer 2 X 50	lecture via zoom, questions and answers 2 x 50	**Material:** lecture orientation on Electrochemical Analysis **Bibliography:** *Bagotsky, VS, 2006, Fundamentals of Electrochemistry, New Jersey: John Wiley & Sons Ewing GW, 1981, Instrumental Methods Of Chemical Analysis, International Student Edition, Tokyo: McGraw-Hill Kogakusha Ltd Harvey, D . 2000. Modern Analytical Chemistry. Int. Ed. Singapore: Mc. Graw Hill. Pecsok, et al. 1976. Modern Methods of Analytical Chemistry. 2nd New York: John Wiley and Sons Sawyer, Heineman, and Beebe, 1984, Chemistry Experiments for Instrumental Methods , New York : John Wiley & Sons Skoog, Douglas.A. 1982, Fundamentals of Analytical Chemistry. Fourth Edition. Tokyo: Holt-Sounders Japan*	0%
2	Understand electrochemical analysis methods	Explain the methods of electrochemical analysis	**Form of Assessment** : Participatory Activities	Lecture, question and answer 2 X 50	lecture via zoom, questions and answers 2 x 50	**Material:** lecture orientation on Electrochemical Analysis and Potentiometry **Literature:**	5%
3	Understand electrochemical analysis methods	Explain the methods of electrochemical analysis	**Form of Assessment** : Participatory Activities	Lecture, question and answer 2 X 50	lecture via zoom, questions and answers 2 x 50	**Material:** lecture orientation on Electrochemical Analysis and Potentiometry **Literature:**	5%

4	Understand electrochemical analysis methods		**Form of Assessment** : Participatory Activities	Lecture, question and answer 2 X 50	lecture via zoom, questions and answers 2 x 50	**Material:** Potentiometry **Bibliography:** *Bagotsky, VS, 2006, Fundamentals of Electrochemistry, New Jersey: John Wiley & Sons Ewing GW, 1981, Instrumental Methods Of Chemical Analysis, International Student Edition, Tokyo: McGraw-Hill Kogakusha Ltd Harvey,D. 2000. Modern Analytical Chemistry. Int. Ed. Singapore: Mc. Graw Hill. Pecsok, et al. 1976. Modern Methods of Analytical Chemistry. 2nd New York: John Wiley and Sons Sawyer, Heineman, and Beebe, 1984, Chemistry Experiments for Instrumental Methods , New York : John Wiley & Sons Skoog, Douglas.A. 1982, Fundamentals of Analytical Chemistry. Fourth Edition. Tokyo: Holt-Sounders Japan*	0%

5	Understand electrochemical analysis methods		**Criteria:** 2P 3T 2Uts 3Uas/10 **Form of Assessment** : Participatory Activities	Lecture, question and answer 2 X 50	lecture via zoom, questions and answers 2 x 50	**Material:** Potentiometry **Bibliography:** *Bagotsky, VS, 2006, Fundamentals of Electrochemistry, New Jersey: John Wiley & Sons Ewing GW, 1981, Instrumental Methods Of Chemical Analysis, International Student Edition, Tokyo: McGraw-Hill Kogakusha Ltd Harvey,D. 2000. Modern Analytical Chemistry. Int. Ed. Singapore: Mc. Graw Hill. Pecsok, et al. 1976. Modern Methods of Analytical Chemistry. 2nd New York: John Wiley and Sons Sawyer, Heineman, and Beebe, 1984, Chemistry Experiments for Instrumental Methods , New York : John Wiley & Sons Skoog, Douglas.A. 1982, Fundamentals of Analytical Chemistry. Fourth Edition. Tokyo: Holt-Sounders Japan*	5%

6	Understand electrochemical analysis methods		**Form of Assessment** : Participatory Activities	Lecture, question and answer 2 X 50	lecture via zoom, questions and answers 2 x 50	**Material:** Potentiometry **Bibliography:** *Bagotsky, VS, 2006, Fundamentals of Electrochemistry, New Jersey: John Wiley & Sons Ewing GW, 1981, Instrumental Methods Of Chemical Analysis, International Student Edition, Tokyo: McGraw-Hill Kogakusha Ltd Harvey,D. 2000. Modern Analytical Chemistry. Int. Ed. Singapore: Mc. Graw Hill. Pecsok, et al. 1976. Modern Methods of Analytical Chemistry. 2nd New York: John Wiley and Sons Sawyer, Heineman, and Beebe, 1984, Chemistry Experiments for Instrumental Methods , New York : John Wiley & Sons Skoog, Douglas.A. 1982, Fundamentals of Analytical Chemistry. Fourth Edition. Tokyo: Holt-Sounders Japan* **Material:** Conductometric analysis **Literature:**	5%
7	Understand electrochemical analysis methods		**Form of Assessment** : Participatory Activities	Lecture, question and answer 2 X 50	lecture via zoom, questions and answers 2 x 50	**Material:** Potentiometry **Bibliography:** *Bagotsky, VS, 2006, Fundamentals of Electrochemistry, New Jersey: John Wiley & Sons Ewing GW, 1981, Instrumental Methods Of Chemical Analysis, International Student Edition, Tokyo: McGraw-Hill Kogakusha Ltd Harvey,D. 2000. Modern Analytical Chemistry. Int. Ed. Singapore: Mc. Graw Hill. Pecsok, et al. 1976. Modern Methods of Analytical Chemistry. 2nd New York: John Wiley and Sons Sawyer, Heineman, and Beebe, 1984, Chemistry*	5%

						Experiments for Instrumental Methods , New York : John Wiley & Sons Skoog, Douglas.A. 1982, Fundamentals of Analytical Chemistry. Fourth Edition. Tokyo: Holt-Sounders Japan **Material:** Conductometric analysis **Bibliography:** *Bagotsky, VS, 2006, Fundamentals of Electrochemistry, New Jersey: John Wiley & Sons Ewing GW, 1981, Instrumental Methods Of Chemical Analysis, International Student Edition, Tokyo: McGraw-Hill Kogakusha Ltd Harvey,D. 2000. Modern Analytical Chemistry. Int. Ed. Singapore: Mc. Graw Hill. Pecsok, et al. 1976. Modern Methods of Analytical Chemistry. 2nd New York: John Wiley and Sons Sawyer, Heineman, and Beebe, 1984, Chemistry Experiments for Instrumental Methods , New York : John Wiley & Sons Skoog, Douglas.A. 1982, Fundamentals of Analytical Chemistry. Fourth Edition. Tokyo: Holt-Sounders Japan*	

8	Understand electrochemical analysis methods		**Form of Assessment** : Test	Lecture, question and answer 2 X 50	lecture via zoom, questions and answers 2 x 50	**Material:** Potentiometry **Bibliography:** *Bagotsky, VS, 2006, Fundamentals of Electrochemistry, New Jersey: John Wiley & Sons Ewing GW, 1981, Instrumental Methods Of Chemical Analysis, International Student Edition, Tokyo: McGraw-Hill Kogakusha Ltd Harvey,D. 2000. Modern Analytical Chemistry. Int. Ed. Singapore: Mc. Graw Hill. Pecsok, et al. 1976. Modern Methods of Analytical Chemistry. 2nd New York: John Wiley and Sons Sawyer, Heineman, and Beebe, 1984, Chemistry Experiments for Instrumental Methods , New York : John Wiley & Sons Skoog, Douglas.A. 1982, Fundamentals of Analytical Chemistry. Fourth Edition. Tokyo: Holt-Sounders Japan*	20%

9			**Form of Assessment** : Participatory Activities	lectures and questions and answers 2 x50	zoom 2 x50	**Material:** Conductometric analysis **Bibliography:** *Bagotsky, VS, 2006, Fundamentals of Electrochemistry, New Jersey: John Wiley & Sons Ewing GW, 1981, Instrumental Methods Of Chemical Analysis, International Student Edition, Tokyo: McGraw-Hill Kogakusha Ltd Harvey,D. 2000. Modern Analytical Chemistry. Int. Ed. Singapore: Mc. Graw Hill. Pecsok, et al. 1976. Modern Methods of Analytical Chemistry. 2nd New York: John Wiley and Sons Sawyer, Heineman, and Beebe, 1984, Chemistry Experiments for Instrumental Methods , New York : John Wiley & Sons Skoog, Douglas.A. 1982, Fundamentals of Analytical Chemistry. Fourth Edition. Tokyo: Holt-Sounders Japan*	0%

10			**Form of Assessment** : Participatory Activities	lectures and questions and answers 2 x50	zoom 2 x50	**Material:** Conductometric analysis **Bibliography:** *Bagotsky, VS, 2006, Fundamentals of Electrochemistry, New Jersey: John Wiley & Sons Ewing GW, 1981, Instrumental Methods Of Chemical Analysis, International Student Edition, Tokyo: McGraw-Hill Kogakusha Ltd Harvey,D. 2000. Modern Analytical Chemistry. Int. Ed. Singapore: Mc. Graw Hill. Pecsok, et al. 1976. Modern Methods of Analytical Chemistry. 2nd New York: John Wiley and Sons Sawyer, Heineman, and Beebe, 1984, Chemistry Experiments for Instrumental Methods , New York : John Wiley & Sons Skoog, Douglas.A. 1982, Fundamentals of Analytical Chemistry. Fourth Edition. Tokyo: Holt-Sounders Japan*	5%

11			**Form of Assessment** : Participatory Activities	lecture and question and answer 2 x 50	zoom 2 x 50	**Material:** voltammetric analysis **Bibliography:** *Bagotsky, VS, 2006, Fundamentals of Electrochemistry, New Jersey: John Wiley & Sons Ewing GW, 1981, Instrumental Methods Of Chemical Analysis, International Student Edition, Tokyo: McGraw-Hill Kogakusha Ltd Harvey,D. 2000. Modern Analytical Chemistry. Int. Ed. Singapore: Mc. Graw Hill. Pecsok, et al. 1976. Modern Methods of Analytical Chemistry. 2nd New York: John Wiley and Sons Sawyer, Heineman, and Beebe, 1984, Chemistry Experiments for Instrumental Methods , New York : John Wiley & Sons Skoog, Douglas.A. 1982, Fundamentals of Analytical Chemistry. Fourth Edition. Tokyo: Holt-Sounders Japan*	0%

12			**Form of Assessment** : Participatory Activities	lecture and question and answer 2 x 50	zoom 2 x 50	**Material:** voltammetric analysis **Bibliography:** *Bagotsky, VS, 2006, Fundamentals of Electrochemistry, New Jersey: John Wiley & Sons Ewing GW, 1981, Instrumental Methods Of Chemical Analysis, International Student Edition, Tokyo: McGraw-Hill Kogakusha Ltd Harvey,D. 2000. Modern Analytical Chemistry. Int. Ed. Singapore: Mc. Graw Hill. Pecsok, et al. 1976. Modern Methods of Analytical Chemistry. 2nd New York: John Wiley and Sons Sawyer, Heineman, and Beebe, 1984, Chemistry Experiments for Instrumental Methods , New York : John Wiley & Sons Skoog, Douglas.A. 1982, Fundamentals of Analytical Chemistry. Fourth Edition. Tokyo: Holt-Sounders Japan*	5%

13			**Form of Assessment** : Participatory Activities	lecture and question and answer 2 x 50	zoom 2 x 50	**Material:** voltammetric analysis **Bibliography:** *Bagotsky, VS, 2006, Fundamentals of Electrochemistry, New Jersey: John Wiley & Sons Ewing GW, 1981, Instrumental Methods Of Chemical Analysis, International Student Edition, Tokyo: McGraw-Hill Kogakusha Ltd Harvey,D. 2000. Modern Analytical Chemistry. Int. Ed. Singapore: Mc. Graw Hill. Pecsok, et al. 1976. Modern Methods of Analytical Chemistry. 2nd New York: John Wiley and Sons Sawyer, Heineman, and Beebe, 1984, Chemistry Experiments for Instrumental Methods , New York : John Wiley & Sons Skoog, Douglas.A. 1982, Fundamentals of Analytical Chemistry. Fourth Edition. Tokyo: Holt-Sounders Japan*	5%

14			**Form of Assessment** : Participatory Activities	lecture and question and answer 2 x 50	zoom 2 x 50	**Material:** voltammetric analysis **Bibliography:** *Bagotsky, VS, 2006, Fundamentals of Electrochemistry, New Jersey: John Wiley & Sons Ewing GW, 1981, Instrumental Methods Of Chemical Analysis, International Student Edition, Tokyo: McGraw-Hill Kogakusha Ltd Harvey,D. 2000. Modern Analytical Chemistry. Int. Ed. Singapore: Mc. Graw Hill. Pecsok, et al. 1976. Modern Methods of Analytical Chemistry. 2nd New York: John Wiley and Sons Sawyer, Heineman, and Beebe, 1984, Chemistry Experiments for Instrumental Methods , New York : John Wiley & Sons Skoog, Douglas.A. 1982, Fundamentals of Analytical Chemistry. Fourth Edition. Tokyo: Holt-Sounders Japan*	5%

15			**Form of Assessment** : Participatory Activities	lecture and question and answer 2 x 50	zoom 2 x 50	**Material:** voltammetric analysis **Bibliography:** *Bagotsky, VS, 2006, Fundamentals of Electrochemistry, New Jersey: John Wiley & Sons Ewing GW, 1981, Instrumental Methods Of Chemical Analysis, International Student Edition, Tokyo: McGraw-Hill Kogakusha Ltd Harvey,D. 2000. Modern Analytical Chemistry. Int. Ed. Singapore: Mc. Graw Hill. Pecsok, et al. 1976. Modern Methods of Analytical Chemistry. 2nd New York: John Wiley and Sons Sawyer, Heineman, and Beebe, 1984, Chemistry Experiments for Instrumental Methods , New York : John Wiley & Sons Skoog, Douglas.A. 1982, Fundamentals of Analytical Chemistry. Fourth Edition. Tokyo: Holt-Sounders Japan*	5%

16			**Form of Assessment** : Test	lecture and question and answer 2 x 50	zoom 2 x 50	**Material:** voltammetric analysis **Bibliography:** *Bagotsky, VS, 2006, Fundamentals of Electrochemistry, New Jersey: John Wiley & Sons Ewing GW, 1981, Instrumental Methods Of Chemical Analysis, International Student Edition, Tokyo: McGraw-Hill Kogakusha Ltd Harvey,D. 2000. Modern Analytical Chemistry. Int. Ed. Singapore: Mc. Graw Hill. Pecsok, et al. 1976. Modern Methods of Analytical Chemistry. 2nd New York: John Wiley and Sons Sawyer, Heineman, and Beebe, 1984, Chemistry Experiments for Instrumental Methods , New York : John Wiley & Sons Skoog, Douglas.A. 1982, Fundamentals of Analytical Chemistry. Fourth Edition. Tokyo: Holt-Sounders Japan*	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.