	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
Computational Chemistry	4720102104		T=2	P=0	ECTS=3.18	4	July 17, 2024

AUTHORIZATION	SP Developer	Course Cluster Coordinator	Study Program Coordinator
	Dr. I Gusti Made Saanjaya, M.Si.	Prof. Dr. Suyono, M.Pd.	Dr. Amaria, M.Si.

Learning model	**Project Based Learning**
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	Study of the basics of programming in chemistry, chemical modeling, and computing on various aspects of chemical behavior studied with classical mechanics using molecular mechanics methods or with quantum mechanics using electronic structure methods such as ab-initio, semi-empirical, and density functional theory or DFT (Density Functional Theory) through study, practicum and simple engineering.
References	**Main :**

1. Atkins, P., Paula, J.d., and Friedman, R. 2009. Quanta, Matter, and Change: A Molecular Approach toPhysical Chemistry. USA: Oxford University Press.
2. Jensen, F. 2007. Introduction to Computational Chemistry, 2nd ed. New York: John Wiley & Sons, Ltd.
3. Commitee on RCACIBCSTDELS, 2006, Visualizing Chemistry, USA: National Academy of Scienc.
4. Hinchliffe, A. 2008. Molecular Modelling For Beginners, 2nd ed. United Kingdom: : John Wiley & Sons, Ltd.

Supporters:

1. Computational Chemistry Highlight

Supporting lecturer	Dr. I Gusti Made Sanjaya, M.Si. Dr. Moh. Mu'alliful Ilmi, S.Si, M.Si.

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 direction of development of computational chemistry	Explain the benefits of computational chemistry for the development of chemical science	**Criteria:** Participation assessment	Presentation and discussion 2 X 50			0%

2	Understand the principles of chemical modeling	Designing chemical models	**Criteria:** Participation Assessment and assignments	performance, presentation and discussion 2 X 50			0%
3	Understanding the Hartree-Focks approach in computational chemistry	Describes the Hartree-Fock approach to materials computing	**Criteria:** participation assessment	Presentation and discussion 2 X 50			0%
4	Understanding Roothaan‘s approach to computational chemistry	Explains improvements in material computing using the Roothaan approach	**Criteria:** Participation assessment	Presentation and discussion 2 X 50			0%
5	Understanding Basis Sets	Analyze the types of basis sets according to their basis functions used in chemical computing	**Criteria:** Assignment assessment	performance 2 X 50			0%
6	Understand computational approaches using ab initio methods	Computationally engineering chemicals with an ab-initio approach	**Criteria:** Assignment Assessment	performance, presentation and discussion 1 X 1			0%
7	Understand computational approaches with semi-empirical methods	Designing chemical computations using semi-empirical methods	**Criteria:** Assignment of assignments	performance, presentation and discussion 2 X 50			0%
8				2 X 50			0%
9	Understand computational approaches with density functional theory or DFT (density functional theory)	Analyzing the use of approaches to the DFT method in computational chemistry	**Criteria:** Participation Assessment	Presentation and discussion 2 X 50			0%
10	Understand computational approaches with density functional theory or DFT (density functional theory)	Designing chemical computations using the DFT method	**Criteria:** Assignment of assignments	performance, presentation and discussion 2 X 50			0%
11	Analyzing the precision of computational results	Comparing chemical computational results with experimental results	**Criteria:** Participation Assessment and assignments	Presentation and discussion 2 X 50			0%
12	Understanding computational chemistry for large molecules	Designing computations for large molecules	**Criteria:** Participation Assessment and assignments	performance, presentation and discussion 2 X 50			0%
13	Understanding computational chemistry for nanoparticles	Designing computations for nano-sized molecules	**Criteria:** Participation Assessment and assignments	performance, presentation and discussion 2 X 50			0%
14	Understanding computational chemistry for drug development	Designing computational chemistry with QSAR methods for drug development	**Criteria:** Participation Assessment and assignments	performance, presentation and discussion 2 X 50			0%
15	Understanding the performance of new medicinal substances through the docking process	Designing the docking of new medicinal materials in the disease healing process	**Criteria:** Participation Assessment and assignments	performance, presentation and discussion 2 X 50			0%
16				2 X 50			0%

Evaluation Percentage Recap: Project Based Learning

No	Evaluation	Percentage

	0%

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** abilities in the process and student learning outcomes are specific and measurable statements that identify the abilities 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.