



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

Document Code

## SEMESTER LEARNING PLAN

|  |  |  |                                   |   |                          |  |                              |   |   |    |    |    |    |    |    |    |     |      |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |   |   |   |   |   |   |   |   |   |    |    |    |    |    |    |
|--|--|--|-----------------------------------|---|--------------------------|--|------------------------------|---|---|----|----|----|----|----|----|----|-----|------|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|---|---|---|---|---|---|---|---|---|----|----|----|----|----|----|
| <b>Courses</b>                         | <b>CODE</b>  | <b>Course Family</b>   | <b>Credit Weight</b>              |   |                          | <b>SEMESTER</b>                          | <b>Compilation Date</b>      |   |   |    |    |    |    |    |    |    |     |      |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |   |   |   |   |   |   |   |   |   |    |    |    |    |    |    |
| Core Chemistry & Radiochemistry        | 8420402149   |  | T=2                               | P=0   | ECTS=3.18                | 6  | July 18, 2024                |   |   |    |    |    |    |    |    |    |     |      |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |   |   |   |   |   |   |   |   |   |    |    |    |    |    |    |
| <b>AUTHORIZATION</b>                   | <b>SP Developer</b>  |  | <b>Course Cluster Coordinator</b> |   |                          | <b>Study Program Coordinator</b>         |                              |   |   |    |    |    |    |    |    |    |     |      |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |   |   |   |   |   |   |   |   |   |    |    |    |    |    |    |
|  | .....  |  | .....                             |   |                          | Prof. Dr. Utiya Azizah,<br>M.Pd.         |                              |   |   |    |    |    |    |    |    |    |     |      |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |   |   |   |   |   |   |   |   |   |    |    |    |    |    |    |
| <b>Learning model</b>                  | Project Based Learning   |  |                                   |   |                          |  |                              |   |   |    |    |    |    |    |    |    |     |      |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |   |   |   |   |   |   |   |   |   |    |    |    |    |    |    |
| <b>Program Learning Outcomes (PLO)</b> | PLO study program which is charged to the course   |  |                                   |   |                          |  |                              |   |   |    |    |    |    |    |    |    |     |      |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |   |   |   |   |   |   |   |   |   |    |    |    |    |    |    |
|  | Program Objectives (PO)  |  |                                   |   |                          |  |                              |   |   |    |    |    |    |    |    |    |     |      |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |   |   |   |   |   |   |   |   |   |    |    |    |    |    |    |
|  | PLO-PO Matrix  |  |                                   |   |                          |  |                              |   |   |    |    |    |    |    |    |    |     |      |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |   |   |   |   |   |   |   |   |   |    |    |    |    |    |    |
|  |  | P.O  |                                   |   |                          |  |                              |   |   |    |    |    |    |    |    |    |     |      |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |   |   |   |   |   |   |   |   |   |    |    |    |    |    |    |
| <b>Short Course Description</b>        | PO Matrix at the end of each learning stage (Sub-PO)   |  |                                   |   |                          |  |                              |   |   |    |    |    |    |    |    |    |     |      |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |   |   |   |   |   |   |   |   |   |    |    |    |    |    |    |
|  |  | <table border="1" style="width: 100%; border-collapse: collapse; text-align: center;"> <tr> <td rowspan="2" style="width: 5%;">P.O</td> <td colspan="16">Week</td> </tr> <tr> <td>1</td><td>2</td><td>3</td><td>4</td><td>5</td><td>6</td><td>7</td><td>8</td><td>9</td><td>10</td><td>11</td><td>12</td><td>13</td><td>14</td><td>15</td><td>16</td> </tr> </table> |                                   |   |                          |  |                              |   |   |    |    |    |    |    |    |    | P.O | Week |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  | 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 | 9 | 10 | 11 | 12 | 13 | 14 | 15 |
| P.O                                    | Week   |  |                                   |   |                          |  |                              |   |   |    |    |    |    |    |    |    |     |      |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |   |   |   |   |   |   |   |   |   |    |    |    |    |    |    |
|  | 1  | 2  | 3                                 | 4   | 5                        | 6  | 7                            | 8 | 9 | 10 | 11 | 12 | 13 | 14 | 15 | 16 |     |      |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |   |   |   |   |   |   |   |   |   |    |    |    |    |    |    |
| <b>References</b>                      | <b>Main :</b><br><ol style="list-style-type: none"> <li>1. Beiser Arthur, 1981Konsep Fisika Modern, edisi ke tiga Erlangga, Jakarta.</li> <li>2. Choppin, Liljenzin, and Rydberg, 2002, Radiochemistry and Nuclear Chemistry, 3rd Edition, Butterworth-Heinemann Press</li> <li>3. Jens-Volker Kratz, Karl Heinrich Lieser, 2012, Nuclear and Radiochemistry: Fundamentals and Applications, 2 Volume Set, Wiley VCH, Verlag GmbH, and Co KgaA, Boschstr, 12 Weinheim, Germany</li> <li>4. Gregory Choppin , Jan-Olov Liljenzin Jan Rydberg and , Christian Ekberg , 2013, Radiochemistry and Nuclear Chemistry, Fourth Edition ISBN-13: 978-0124058972 ISBN-10: 0124058973</li> <li>5. Buku dan jurnal terbaru lain yang relevan dengan kimia inti dan radiokimia</li> </ol> <b>Supporters:</b> |  |                                   |   |                          |  |                              |   |   |    |    |    |    |    |    |    |     |      |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |   |   |   |   |   |   |   |   |   |    |    |    |    |    |    |
| <b>Supporting lecturer</b>             | ISMONO<br>Samik, S.Si., M.Si.  |  |                                   |   |                          |  |                              |   |   |    |    |    |    |    |    |    |     |      |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |   |   |   |   |   |   |   |   |   |    |    |    |    |    |    |
| <b>Week-</b>                           | <b>Final abilities of each learning stage (Sub-PO)</b>   | <b>Evaluation</b>  |                                   | <b>Help Learning, Learning methods, Student Assignments, [ Estimated time ]</b> |                          | <b>Learning materials [ References ]</b> | <b>Assessment Weight (%)</b> |   |   |    |    |    |    |    |    |    |     |      |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |   |   |   |   |   |   |   |   |   |    |    |    |    |    |    |
|  |  | <b>Indicator</b>   | <b>Criteria &amp; Form</b>        | <b>Offline ( offline )</b>  | <b>Online ( online )</b> |  |                              |   |   |    |    |    |    |    |    |    |     |      |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |   |   |   |   |   |   |   |   |   |    |    |    |    |    |    |
| (1)                                    | (2)  | (3)  | (4)                               | (5)   | (6)                      | (7)                                      | (8)                          |   |   |    |    |    |    |    |    |    |     |      |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |   |   |   |   |   |   |   |   |   |    |    |    |    |    |    |

|   |   |   |   |   |  |  |    |
|---|---|---|---|---|--|--|----|
| 1 | Explains the nature of particles from waves and atomic structure based on modern atomic theory  | 1. Able to explain the nature of particles from waves 2. Able to understand atomic structure based on modern atomic theory  | <b>Criteria:</b><br>In accordance with the assessment guidebook that applies at Unesa | Discussion lecture and solving 2 X 50 questions                     |  |  | 0% |
| 2 | Students can explain atomic structure based on modern atomic theory   | Able to explain atomic structure based on modern atomic theory  | <b>Criteria:</b><br>In accordance with the guidelines applicable at Unesa             | Lecture Question and answer discussion and solving 2 X 50 questions |  |  | 0% |
| 3 | Students can explain the Quantum Theory of the Hydrogen Atom  | Able to explain the Quantum Theory of the Hydrogen Atom   | <b>Criteria:</b><br>In accordance with the assessment guidebook that applies at Unesa | Lecture Question and answer discussion and solving 2 X 50 questions |  |  | 0% |
| 4 | Students understand the Atomic Nucleus  | Able to explain about the Atomic Nucleus  | <b>Criteria:</b><br>In accordance with the assessment guidebook that applies at Unesa | Question and answer discussion lecture and solving 2 X 50 questions |  |  | 0% |
| 5 | Students understand core transformation   | Students are able to explain core transformations   | <b>Criteria:</b><br>In accordance with the assessment guidebook that applies at Unesa | Question and answer discussion lecture and solving 2 X 50 questions |  |  | 0% |
| 6 | Students understand nuclear reactions (fission and fusion)  | Students are able to explain about nuclear reactions (fission and fusion)   | <b>Criteria:</b><br>In accordance with the assessment guidebook that applies at Unesa | Question and answer discussion lecture and solving 2 X 50 questions |  |  | 0% |
| 7 | Students understand how to determine the half-life and lifetime of radioactive elements   | 1. Students can explain about determining the half-life and 2. be able to calculate the age of radioactive elements   | <b>Criteria:</b><br>In accordance with the assessment guidebook that applies at Unesa | Question and answer discussion lecture and solving 3 X 50 questions |  |  | 0% |
| 8 | complete the UTS properly and correctly   | able to complete the UTS properly and correctly   | <b>Criteria:</b><br>In accordance with the assessment guidebook that applies at Unesa | subjective test 2 X 50  |  |  | 0% |
| 9 | Students are able to present the results of analyzes from studies in scientific journals related to the implementation of radiochemistry in everyday life such as the medical industry and so on. | Students are able to explain and present the results of analyzes from studies in scientific journals related to the implementation of radiochemistry in everyday life such as the world of the agricultural medical industry and so on. | <b>Criteria:</b><br>In accordance with the assessment guidebook that applies at Unesa | Question and answer discussion presentation 2 X 50                  |  |  | 0% |

|    |  |  |   |   |  |  |    |
|----|--|--|---|---|--|--|----|
| 10 | Students are able to present the results of analysis from a study of a scientific journal related to the implementation of radiochemistry in everyday life such as the world of agriculture, medical industry and so on. | Able to explain and present the results of analysis from a study in a scientific journal related to the implementation of radiochemistry in everyday life such as the world of agriculture, medical industry and so on | <b>Criteria:</b><br>In accordance with the assessment guidebook that applies at Unesa | Question and answer discussion presentation<br>2 X 50 |  |  | 0% |
| 11 | Students are able to present the results of analysis from a study of a scientific journal related to the implementation of radiochemistry in everyday life such as the world of agriculture, medical industry and so on. | Able to explain and present the results of analysis from a study in a scientific journal related to the implementation of radiochemistry in everyday life such as the world of agriculture, medical industry and so on | <b>Criteria:</b><br>In accordance with the assessment guidebook that applies at Unesa | Question and answer discussion presentation<br>2 X 50 |  |  | 0% |
| 12 | Students are able to present the results of analysis from a study of a scientific journal related to the implementation of radiochemistry in the agricultural industry, medicine, etc.                                   | Explain and present the results of analysis from a study in a scientific journal related to the implementation of radiochemistry in the agricultural medical industry and so on  | <b>Criteria:</b><br>In accordance with the assessment guidebook that applies at Unesa | Question and answer discussion presentation<br>2 X 50 |  |  | 0% |
| 13 | Students are able to present the results of analysis from a study of a scientific journal related to the implementation of radiochemistry in the agricultural industry, medicine, etc.                                   | Explain and present the results of analysis from a study in a scientific journal related to the implementation of radiochemistry in the agricultural medical industry and so on  | <b>Criteria:</b><br>In accordance with the assessment guidebook that applies at Unesa | Question and answer discussion presentation<br>2 X 50 |  |  | 0% |
| 14 | Students are able to present the results of analysis from a study of a scientific journal related to the implementation of radiochemistry in the agricultural medical industry and so on.                                | Able to explain and present the results of analysis from a study in a scientific journal related to the implementation of radiochemistry in the agricultural medical industry and so on                                | <b>Criteria:</b><br>In accordance with the assessment guidebook that applies at Unesa | Question and answer discussion presentation<br>2 X 50 |  |  | 0% |
| 15 |  |  |   |   |  |  | 0% |
| 16 | able to do UAS questions   | Able to solve UAS questions well and correctly   | <b>Criteria:</b><br>In accordance with the assessment guidebook that applies at Unesa | UAS<br>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** 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.