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

SEMESTER LEARNING PLAN

Courses	CODE	Course Family	Credit Weight			SEMESTER	Compilation Date
Research methods	4710204001		T=2	P=0	ECTS=4.48	1	July 17, 2024

AUTHORIZATION	SP Developer	Course Cluster Coordinator	Study Program Coordinator
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Learning model	**Project Based Learning**

Program Learning Outcomes (PLO)

PLO study program which is charged to the course

Program Objectives (PO)

PO - 1	ub-CPMK1 Understand the meaning of chemical knowledge & knowledge: scope & position, scientific methods & chemical research, and chemistry in the realm of science
PO - 2	Understand the rules in research (The role of research).
PO - 3	Understand the role of literature in chemical research, the structure of chemical scientific literature, and practical guidelines for searching chemical literature
PO - 4	Understand how to identify and formulate a formula for a research problem
PO - 5	Select and understand a problem and build a hypothesis
PO - 6	Identify and define research variables.
PO - 7	Understand and build operational definitions of research variables.
PO - 8	MIDTERM EXAM
PO - 9	Identify techniques for manipulating and controlling variables

PLO-PO Matrix

P.O
PO-1
PO-2
PO-3
PO-4
PO-5
PO-6
PO-7
PO-8
PO-9

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																
PO-5																
PO-6																
PO-7																
PO-8																
PO-9																

Short Course Description	Study of the concept of the scientific method and its application as a scientific mindset in chemical research, rules in research (the role of research), research problems and hypotheses, ways of reviewing chemical literature, variables in research, how to write operational definitions of variables, techniques identification of manipulated variables, dependent variables, and control variables, research design, data collection techniques, data analysis techniques, data processing techniques, guidelines for writing research reports (theses), and writing articles for scientific publications.
References	**Main :** 1. Tuckman, Bruce W. (1978). Conducting Educational Research. (2nd ed.). New York: Harcourt Brace Jovanovich. 2. Tukiran (2015). Kimia Bahan Alam (KBA) Berbasis Field Study dan Pendekatan Chemo-Entrepreneurship. Surabaya: Unesa University Press **Supporters:** 1. Priadana, Sidik dan Sunarsi, Denok (2021). METODE PENELITIAN KUANTITATIF. Penerbit: Pascal Books, Tangerang Selatan. 2. Hardani, dkk. (2020). METODE PENELITIAN KUALITATIF & KUANTITATIF, Penerbit: CV. Pustaka Ilmu, Yogyakarta.
Supporting lecturer	Prof. Dr. Tukiran, M.Si. Prof. Dr. Sari Edi Cahyaningrum, 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 meaning of chemical knowledge & science: scope & position, scientific methods & chemical research, and chemistry in the realm of science	Explaining the meaning of chemical knowledge & knowledge: scope & position, scientific methods & chemical research, and chemistry in the realm of science	**Criteria:** 1. Participation during lectures and discussions and questions and answers is carried out through observation (weight 2). **Form of Assessment** : Participatory Activities	Lectures, discussions and questions and answers 2 x 50 minutes	Lectures, discussions and questions and answers 2 x 50 minutes	**Material:** CHAPTER II INTRODUCTION TO RESEARCH METHODOLOGY **Library:** *Tukiran (2015). Natural Materials Chemistry (KBA) Based on Field Study and Chemo-Entrepreneurship Approach. Surabaya: Unesa University Press* **Material:** Chapter 1 KNOWLEDGE **Bibliography:** *Priadana, Sidik and Sunarsi, Denok (2021). QUANTITATIVE RESEARCH METHODS. Publisher: Pascal Books, South Tangerang.*	5%
2	Understand the rules in research (The role of research).	1. Identify rules to satisfy internal validity. 2. Identify rules for satisfying external validity. 3. Describe the relationship between internal validity and external validity. 4. Describe the characteristics of the research process. 5. Identify the stages in the research process. 6. Identify ethical considerations in research and their resolution.	**Criteria:** Participation, during lectures is carried out through observation (weight 2) **Form of Assessment** : Participatory Activities	Lectures, discussions and questions and answers 2 x 50 minutes	Lectures, discussions and questions and answers 2 x 50 minutes	**Material:** Chapter 1 The Role of Research **Bibliography:** *Tuckman, Bruce W. (1978). Conducting Educational Research. (2nd ed.). New York: Harcourt Brace Jovanovich.*	5%
3	Understand the role of literature in chemical research, the structure of chemical scientific literature, and practical guidelines for searching chemical literature	1. Able to explain the role of literature in chemical research. 2. Able to structure scientific literature in chemistry 3. Able to create and explain practical guidelines for searching chemical literature	**Criteria:** 1. Participation during lectures and discussions and questions and answers is carried out through observation (weight 2). 2. Assessment of assignments according to each topic (chapter) is given a score with a weight of 3. **Form of Assessment** : Participatory Activities	Lectures, discussions and questions and answers. 2 X 50 minutes	Lectures, discussions and questions and answers. 2 X 50 minutes	**Material:** Chapter V BROWSING AND UTILIZING THE LITERATURE **Pustaka:** *Tukiran (2015). Natural Materials Chemistry (KBA) Based on Field Study and Chemo-Entrepreneurship Approach. Surabaya: Unesa University Press*	5%

4	Understand how to identify and formulate a formula for a research problem	1. Able to explain research and research problems. 2. Able to state the characteristics of a good research problem. 3. Able to identify and formulate research problems.	**Criteria:** 1. Participation during lectures and discussions and questions and answers is carried out through observation (weight 2). 2. Assessment of assignments according to each topic (chapter) is given a score with a weight of 3. **Form of Assessment** : Participatory Activities	Lectures, discussions and questions and answers. 2 X 50 minutes	Lectures, discussions and questions and answers. 2 X 50 minutes	**Material:** CHAPTER IV SOURCES OF PROBLEMS, SENSITIVITY TO PROBLEMS, CHARACTERISTICS AND IDENTIFICATION OF RESEARCH PROBLEMS **Library:** *Tukiran (2015). Natural Materials Chemistry (KBA) Based on Field Study and Chemo-Entrepreneurship Approach. Surabaya: Unesa University Press* **Material:** Chapter 2 Selecting a Problem **Bibliography:** *Tuckman, Bruce W. (1978). Conducting Educational Research. (2nd ed.). New York: Harcourt Brace Jovanovich.*	5%
5	Select and understand a problem and build a hypothesis	1. Selecting a research problem is based on both practicality and interest. 2. Identify general and specific hypotheses, and observations, and describe the differences. 3. Construct alternative hypotheses from a problem statement. 4. Determining the appropriateness/feasibility of a hypothesis using deduction and induction. 5. Identifying concepts, providing operational definitions, which can be used to generalize hypotheses. 6. Constructing a null hypothesis from a hypothesis given in positive form.	**Criteria:** 1. Participation during lectures and discussions and questions and answers is carried out through observation (weight 2). 2. Assessment of assignments according to each topic (chapter) is given a score with a weight of 3. **Form of Assessment** : Participatory Activities	Discussions, lectures and questions and answers. 2 X 50 minutes	Discussions, lectures and questions and answers. 2 X 50 minutes	**Material:** Chapter 5 Constructing Hypotheses and Meta-Analyses **References:** *Tuckman, Bruce W. (1978). Conducting Educational Research. (2nd ed.). New York: Harcourt Brace Jovanovich.* **Material:** CHAPTER VI THEORETICAL FRAMEWORK AND RESEARCH HYPOTHESES. **Bibliography:** *Tukiran (2015). Natural Materials Chemistry (KBA) Based on Field Study and Chemo-Entrepreneurship Approach. Surabaya: Unesa University Press*	5%
6	Identify and define research variables.	1. Identify research variables and define one by one five types of variables: independent, dependent, moderator, control, and intervening. 2. Describe the characteristics of each type of variable. 3. State several factors that must be considered in defining variables.	**Criteria:** 1. Participation during lectures and question and answer discussions is carried out through observation (weight 2). 2. 2. Assessment of assignments according to each topic (chapter) is given a score with a weight of 3. **Form of Assessment** : Participatory Activities	lectures, discussions and questions and answers. 2 X 50 minutes	lectures, discussions and questions and answers. 2 X 50 minutes	**Material:** Chapter 4 Identifying and Labeling Variables **References:** *Tuckman, Bruce W. (1978). Conducting Educational Research. (2nd ed.). New York: Harcourt Brace Jovanovich.*	5%
7	Understand and build operational definitions of research variables.	1. Identify reasons and situations to construct operational definitions of variables. 2. Distinguish between operational definitions and other types of definitions. 3. States minimum observable standards to be included in an operational definition. 4. Construct three different types of operational definitions (Construct three different types of operational definitions). 5. Construct predictions from hypotheses.	**Criteria:** 1. Participation during lectures and question and answer discussions is carried out through observation (weight 2). 2. Assessment of assignments according to each topic (chapter) is given a score with a weight of 3. **Form of Assessment** : Participatory Activities	lectures, discussions and questions and answers. 2 X 50 minutes	lectures, discussions and questions and answers. 2 X 50 minutes	**Material:** Chapter 6 Constructing Operational Definitions of Variables **References:** *Tuckman, Bruce W. (1978). Conducting Educational Research. (2nd ed.). New York: Harcourt Brace Jovanovich.*	5%

8	MIDTERM EXAM	Midterm exam	**Criteria:** The UTS results are given a weight of 2. **Form of Assessment** : Test	Written Test (Essay and/or multiple choice) 2 X 50 minutes	Written Test (Essay and/or multiple choice) 2 X 50 minutes	**Material:** All material at meetings 1-7 **References:**	15%
9	Identify techniques for manipulating and controlling variables.	1. Identify reasons for using a control group. 2. Identify and describe the sources of internal validity and external validity which the use of a control group is an attempt to address. 3. Describe control procedures to combat various sources of invalidity. 4. Identify in a given research excerpt the procedures used for control in order to combat various sources of invalidity and describe their adequacy. 5. Describe the procedures for determining whether a manipulation has been successful. 4. Identify in a given research excerpt the procedures used to control various sources of invalidity and describe their adequacy. 5. Describe the procedures for determining whether a manipulation has been successful.	**Criteria:** Participation during lectures and discussions and questions and answers is carried out through observation (weight 2). **Form of Assessment** : Project Results Assessment / Product Assessment	Lectures, discussions, questions and answers, and assignments. 2 X 50 minutes	Lectures, discussions, questions and answers, and assignments. 2 X 50 minutes	**Material:** Chapter 7 Applying Design Criteria: Internal and External Validity **References:** *Tuckman, Bruce W. (1978). Conducting Educational Research. (2nd ed.). New York: Harcourt Brace Jovanovich.*	5%
10	Building a research design	1. Distinguishing between preexperimental designs, true experimental designs, and quasi-experimental designs is based on their adequacy to address various threats to validity. 2. Construct real experimental designs including factorial designs to provide predictions. 3. Identify the circumstances (surroundings) that require or require the use of a quasi-experimental design. 4. Identify threats to validity due to the lack of complete control by each quasi-experimental design. 5. Constructing quasi-experimental designs to provide specific predictions and conditions in situations that avoid the use of real experiments. 6. Describe the circumstances (surroundings) that require or require the use of a criteria group design (standard) or co-relational design. 7. Construct plans to control reactive effects, provide predictions, and situations in which each effect can take effect.	**Criteria:** Participation during lectures and discussions and questions and answers is carried out through observation (weight 2). **Forms of Assessment** : Participatory Activities, Project Results Assessment / Product Assessment	Presentations, discussions and assignments. 2 X 50 minutes	Presentations, discussions and assignments. 2 X 50 minutes	**Material:** Chapter 8 Experimental Research Designs **Bibliography:** *Tuckman, Bruce W. (1978). Conducting Educational Research. (2nd ed.). New York: Harcourt Brace Jovanovich.* **Material:** CHAPTER VIII PREPARATION OF RESEARCH INSTRUMENTS **Library:** *Tukiran (2015). Natural Materials Chemistry (KBA) Based on Field Study and Chemo-Entrepreneurship Approach. Surabaya: Unesa University Press*	5%

11	Building a research design	1. Distinguishing between preexperimental designs, true experimental designs, and quasi-experimental designs is based on their adequacy to address various threats to validity. 2. Construct real experimental designs including factorial designs to provide predictions. 3. Identify the circumstances (surroundings) that require or require the use of a quasi-experimental design. 4. Identify threats to validity due to the lack of complete control by each quasi-experimental design. 5. Constructing quasi-experimental designs to provide specific predictions and conditions in situations that avoid the use of real experiments. 6. Describe the circumstances (surroundings) that require or require the use of a criteria group design (standard) or co-relational design. 7. Construct plans to control reactive effects, provide predictions, and situations in which each effect can take effect.	**Criteria:** Participation during lectures and discussions and questions and answers is carried out through observation (weight 2). **Form of Assessment** : Project Results Assessment / Product Assessment	Presentations, discussions and assignments. 2 X 50 minutes	Presentations, discussions and assignments. 2 X 50 minutes	**Material:** Chapter 8 Experimental Research Designs **Bibliography:** *Tuckman, Bruce W. (1978). Conducting Educational Research. (2nd ed.). New York: Harcourt Brace Jovanovich.* **Material:** CHAPTER VIII PREPARATION OF RESEARCH INSTRUMENTS **Library:** *Tukiran (2015). Natural Materials Chemistry (KBA) Based on Field Study and Chemo-Entrepreneurship Approach. Surabaya: Unesa University Press*	5%
12	Identify and describe procedures for observation and measurement.	1. Identify and describe different approaches to estimating the reliability of measuring instruments. 2. Identify and describe different approaches to estimating the validity of measuring instruments.	**Criteria:** Participation during lectures and discussions and questions and answers is carried out through observation (weight 2). **Form of Assessment** : Project Results Assessment / Product Assessment	Presentations, discussions and assignments. 2 X 50 minutes	Presentations, discussions and assignments. 2 X 50 minutes	**Material:** Chapter 10 Identifying and Describing Procedures for Observation and Measurement **References:** *Tuckman, Bruce W. (1978). Conducting Educational Research. (2nd ed.). New York: Harcourt Brace Jovanovich.*	5%
13	Able to use statistical analysis	1. Selecting a statistical test that is suitable for various combinations of variables and different levels of measurement. 2. Calculate the mean, median, and standard deviation. Analyze data and report statistical findings using various methods of data analysis.	**Criteria:** Participation during lectures and discussions and questions and answers is carried out through observation (weight 2). **Form of Assessment** : Project Results Assessment / Product Assessment	Presentations, discussions and assignments. 2 X 50 minutes	Presentations, discussions and assignments. 2 X 50 minutes	**Material:** Chapter 12 Carrying Out Statistical Analyzes **References:** *Tuckman, Bruce W. (1978). Conducting Educational Research. (2nd ed.). New York: Harcourt Brace Jovanovich.*	5%
14	Using data processing procedures.	1. Demonstrate procedures for coding and naming data. 2. Identify computer programs that can be used for data analysis and describe their characteristics. 3. Describe and interpret computer output (printout).	**Criteria:** Participation during lectures and discussions and questions and answers is carried out through observation (weight 2). **Form of Assessment** : Project Results Assessment / Product Assessment	Presentations, discussions and assignments. 2 X 50 minutes	Presentations, discussions and assignments. 2 x 50 minutes	**Material:** Chapter 11 Constructing and Using Questionnaires, Interview Schedules, and Survey Research **References:** *Tuckman, Bruce W. (1978). Conducting Educational Research. (2nd ed.). New York: Harcourt Brace Jovanovich.*	5%

15	Understand how to prepare a research report, including a thesis, thesis and dissertation.	1. Write a research proposal that includes an introduction section and a methods section. 2. Report examples of tables to illustrate experimental design. 3. Report examples of images and graphs to illustrate an analysis result.	**Criteria:** 1. Participation during lectures and discussions and questions and answers is carried out through observation (weight 2). 2. Assessment of assignments according to each topic (chapter) is given a score with a weight of 3. **Form of Assessment** : Project Results Assessment / Product Assessment	Presentations, discussions and assignments. 2 X 50 minutes	Presentations, discussions and assignments. 2 x 50 minutes	**Material:** Chapter 13 Writing a Research Report **Bibliography:** *Tuckman, Bruce W. (1978). Conducting Educational Research. (2nd ed.). New York: Harcourt Brace Jovanovich.* **Material:** CHAPTER IX SYSTEMATIC OF RESEARCH PROPOSALS **Library:** *Tukiran (2015). Natural Materials Chemistry (KBA) Based on Field Study and Chemo-Entrepreneurship Approach. Surabaya: Unesa University Press*	5%
16	Final exams	Final exams	**Criteria:** 1. The Summative Test is carried out once, assessing all relevant indicators through a written exam, averaged by the lecturer team of each MK Metpen supervisor and given a weight (3). 2. NA is (Participation value x 2) plus (Assignment value x 3) plus (UTS value x 2) plus (UAS value x 3) divided by 10. **Form of Assessment** : Test	Written Test (Essay and/or multiple choice) 2 X 50 minutes	Written Test (Essay and/or multiple choice) 2 x 50 minutes	**Material:** All material at meeting 9-15 **Reader:**	15%

Evaluation Percentage Recap: Project Based Learning

No	Evaluation	Percentage
1.	Participatory Activities	37.5%
2.	Project Results Assessment / Product Assessment	32.5%
3.	Test	30%
		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.