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

SEMESTER LEARNING PLAN

Courses	CODE	Course Family	Credit Weight			SEMESTER	Compilation Date
STEM Education	8420202004	Study Program Elective Courses	T=2	P=0	ECTS=3.18	6	July 18, 2024

AUTHORIZATION	SP Developer	Course Cluster Coordinator	Study Program Coordinator
	.....	.....	Dr. Endah Budi Rahaju, M.Pd.

Learning model	**Project Based Learning**

Program Learning Outcomes (PLO)

PLO study program which is charged to the course	
PLO-5	Demonstrate a scientific, critical and innovative attitude in teaching and learning mathematics and professional tasks
PLO-8	Designing, implementing and evaluating mathematics learning using IT
PLO-9	Communicate ideas and research results effectively, verbally and literally
PLO-13	Demonstrate pedagogical knowledge in designing, implementing and evaluating mathematics learning.
Program Objectives (PO)	
PO - 1	Able to demonstrate knowledge and insight into basic concepts and principles of STEM education
PO - 2	Able to design STEM-based mathematics learning by utilizing ICT
PO - 3	Able to evaluate STEM-based mathematics learning designs by utilizing ICT
PO - 4	Able to communicate ideas and project results based on social, economic and environmental issues critically and creatively with a multidisciplinary approach
PO - 5	Able to make decisions based on data/information in completing project tasks related to multidisciplinary problems given
PO - 6	Able to demonstrate a scientific, critical and innovative attitude in analyzing surrounding problems using a STEM approach

PLO-PO Matrix

P.O	PLO-5	PLO-8	PLO-9	PLO-13
PO-1				
PO-2				
PO-3				
PO-4				
PO-5				
PO-6				

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				✔												

Short Course Description	STEM education courses discuss the meaning, basic concepts, and principles of STEM education as a multidisciplinary learning model. The lecture began with a discussion about the history and urgency of the emergence of STEM as an alternative learning for the 21st century and its application in classroom learning. This course will also provide students with the opportunity to complete STEM projects related to multidisciplinary problems. Next, students will be given experience in designing STEM-based learning and evaluating the learning designs they have formulated. It is hoped that this course will be able to provide prospective teacher students with knowledge about one of the multidisciplinary learning alternatives that is currently being developed and develop students' science, technology, engineering and mathematics literacy.
References	**Main :**
	1. Rodger W. Bybee. 2013. The Case for STEM Education: Challenges and Opportunities. USA: NSTA Press
	Supporters:
	1. English, L. D. (2016). STEM education K-12: Perspectives on integration. International Journal of STEM education, 3, 1-8 2. Kelley, T. R., & Knowles, J. G. (2016). A conceptual framework for integrated STEM education. International Journal of STEM education, 3, 1-11 3. Beatty, A. S. (2011). Successful STEM education. National Academies Press
Supporting lecturer	Dr. Endah Budi Rahaju, M.Pd. Shofan Fiangga, S.Pd., M.Sc. Dr. Yurizka Melia Sari, M.Pd. Dayat Hidayat, S.Pd., M.Pd., 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	1. Understand the meaning, basic concepts and principles of STEM education (CLO-1) 2. Demonstrate a scientific, critical and innovative attitude in analyzing the meaning, basic concepts and principles of STEM education (CLO-6)	1. Explains basic STEM concepts and principles 2. Explain the history of the formation of STEM education	**Form of Assessment** : Participatory Activities	Through discussions, students are able to get to know STEM education	Through discussions, students are able to get to know STEM education	**Material:** basic concepts and principles of STEM education **Reader:** *Rodger W. Bybee. 2013. The Case for STEM Education: Challenges and Opportunities. USA: NSTA Press*	5%
2	1. Understand the meaning, basic concepts and principles of STEM education (CLO-1) 2. Demonstrate a scientific, critical and innovative attitude in analyzing the meaning, basic concepts and principles of STEM education (CLO-6)	1. Explains basic STEM concepts and principles 2. Explaining the importance of STEM education in the 21st century	**Form of Assessment** : Practice / Performance	Through discussions, students are able to get to know STEM education	Through discussions, students are able to get to know STEM education	**Material:** basic concepts and principles of STEM education **Reader:** *Rodger W. Bybee. 2013. The Case for STEM Education: Challenges and Opportunities. USA: NSTA Press*	10%
3	Understand the basic principles of STEM related to multidisciplinary surrounding problems	1. Explaining energy, environmental, social and economic problems based on a STEM approach 2. Provide examples of real problems that have the potential to become STEM education projects	**Form of Assessment** : Participatory Activities, Practice/Performance	Presentation and discussion of energy, environmental, social and economic issues based on a STEM approach		**Material:** STEM Examples **Bibliography:** *Rodger W. Bybee. 2013. The Case for STEM Education: Challenges and Opportunities. USA: NSTA Press*	5%

4	2. Demonstrate a scientific, critical and innovative attitude in analyzing surrounding problems using a STEM approach	1. Explaining energy, environmental, social and economic problems based on a STEM approach 2. Provide examples of real problems that have the potential to become STEM education projects	**Form of Assessment** : Participatory Activities, Practice/Performance	Presentation and discussion of energy, environmental, social and economic issues based on a STEM approach		**Material:** STEM Examples **Bibliography:** *Rodger W. Bybee. 2013. The Case for STEM Education: Challenges and Opportunities. USA: NSTA Press*	10%
5	1. Use knowledge and insight about STEM to complete project assignments 2. Communicate ideas related to solutions to given STEM problems 3. Make decisions based on data/information in completing project tasks related to multidisciplinary problems given 4. Demonstrate a scientific, critical and innovative attitude in analyzing surrounding problems with a STEM approach	Explains the STEM Quartet Model approach	**Form of Assessment** : Participatory Activities	Presentation and Discussion STEM model quartet		**Material:** STEM Examples **Bibliography:** *Rodger W. Bybee. 2013. The Case for STEM Education: Challenges and Opportunities. USA: NSTA Press*	5%
6	Apply insights from STEM to solve multidisciplinary problems	Apply insights from STEM to solve multidisciplinary problems	**Form of Assessment** : Practice / Performance				5%
7	Apply insights from STEM to solve multidisciplinary problems	Apply insights from STEM to solve multidisciplinary problems	**Form of Assessment** : Practice / Performance				5%
8	UTS		**Form of Assessment** : Test				10%
9	1. Understand knowledge about designing STEM-based classroom learning 2. Understand knowledge about evaluating STEM-based classroom learning	1. Explaining knowledge about designing STEM-based learning 2. Explains how to evaluate STEM-based classroom learning	**Form of Assessment** : Participatory Activities				5%
10	1. Understand knowledge about designing STEM-based classroom learning 2. Understand knowledge about evaluating STEM-based classroom learning	1. Explaining knowledge about designing STEM-based learning 2. Explains how to evaluate STEM-based classroom learning	**Form of Assessment** : Participatory Activities				5%
11	Designing STEM-based mathematics learning by utilizing ICT	Able to design STEM-based learning appropriately	**Form of Assessment** : Participatory Activities				5%

12	Evaluating STEM-based mathematics learning designs by utilizing ICT	Able to evaluate designs that have been made critically and innovatively	**Form of Assessment** : Participatory Activities				5%
13	1. Able to communicate ideas and project results based on social, economic and environmental issues critically and creatively with a multidisciplinary approach 2. Able to make decisions based on data/information in completing project tasks related to multidisciplinary problems given	1. Implementing STEM-based learning designs in the classroom 2. Provide an explanation of the learning carried out based on appropriate data/information	**Form of Assessment** : Participatory Activities				5%
14	Able to demonstrate a scientific, critical and innovative attitude in analyzing surrounding problems using a STEM approach	Demonstrate a scientific, critical and innovative attitude in analyzing surrounding problems with a STEM approach	**Form of Assessment** : Participatory Activities				5%
15	Able to communicate ideas and project results based on social, economic and environmental issues critically and creatively with a multidisciplinary approach	Communicate STEM product results	**Form of Assessment** : Participatory Activities				5%
16	Able to communicate ideas and project results based on social, economic and environmental issues critically and creatively with a multidisciplinary approach	Communicate STEM product results	**Form of Assessment** : Participatory Activities, Practice/Performance				10%

Evaluation Percentage Recap: Project Based Learning

No	Evaluation	Percentage
1.	Participatory Activities	57.5%
2.	Practice / Performance	32.5%
3.	Test	10%
		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.