	Universitas Negeri Surabaya **Faculty of Mathematics and Natural Sciences** **Science Education Doctoral Study Program**	**Document Code**

SEMESTER LEARNING PLAN

Courses	CODE	Course Family	Credit Weight			SEMESTER	Compilation Date
ICT in Science Learning	8400102045	Study Program Elective Courses	T=2	P=0	ECTS=5.04	2	January 10, 2023

AUTHORIZATION	SP Developer	Course Cluster Coordinator	Study Program Coordinator
	Dr. I Gusti Made Sanjaya, M.Si.	Dr. I Gusti Made Sanjaya, M.Si.	Prof. Dr. Suyatno, M.Si.

Learning model	**Project Based Learning**	
Program Learning Outcomes (PLO)	**PLO study program which is charged to the course**	
	PLO-12	2. Master the latest theories related to scientific knowledge and science education
	Program Objectives (PO)	
	PO - 1	Utilizing cyberspace to support student achievement of competencies related to ICT-based science learning
	PO - 2	Students have knowledge and insight into ICT-based science learning including: Industry 5.0-based Science Learning (Cyber Physical Systems, internet of things, networks), Online Learning-based Science Learning, and Blended Learning-based Science Learning.
	PO - 3	Students have the skills to conduct literature reviews, analyze, formulate concepts about ICT-based science learning and communicate to other parties.
	PO - 4	Students have a responsible, objective attitude in identifying issues related to ICT-based science learning.
	PLO-PO Matrix	

P.O	PLO-12
PO-1	
PO-2	
PO-3	
PO-4	

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																

Short Course Description	This course examines the role of ICT in science learning which includes science learning in the Industrial 5.0 era which emphasizes cyber physical systems, internet of things, and networks; implementation of ICT in science learning; science learning with online learning and science learning with web-based or mobile-based blended learning through discussion of literature review and analysis results, computational science practices, discussion of review results and analysis of web-based course management systems (CMS) or learning management systems (LMS). or mobile, development of ICT-based learning tools, practice using CMS or LMS, analysis and discussion of the results of ICT-based science learning practices, and reflection on the results of ICT-based science learning	
References	**Main :**	

1. Abhay Saxena, Durgesh Pant, Amit Saxena, Chandrashekhar Patel. (2020). Emergence of Educators for Industry 5.0 – An ndological Perspective. International Journal of Innovative Technology and Exploring Engineering (IJITEE), 9(12), 359-363
2. Gleason, Nancy W. (2018). Higher Education in the Era of the Fourth Industrial Revolution. Singapore: Springer Nature Singapore Pte Ltd.
3. Team National Academies of Sciences, Engineering, and Medicine. (2016). A 21st Century Cyber-Physical Systems Education. Washington, DC: The National Academies Press.
4. Dr. Shahbaz Pervez, Shafiq ur Rehman, Dr Gasim Alandjani. (2018). Proceedings of ADVED 2018- 4th International Conference on Advances in Education and Social Sciences, 15-17 October 2018- Istanbul, Turkey
5. Dr. Ovidiu Vermesan and Dr. Peter Friess (editor). (2016). Digitising the Industry Internet of Things Connecting the, Physical, Digital and Virtual Worlds. Netherlands: River Publishers
6. Bates A.W. (2015). Teaching in a Digital Age. U.K.: a Creative Commons Attribution-NonCommercial 4.0 International License.
7. Faithe Wempen. (2014). Computing Fundamentals. Digital Literacy Edition. UK: John Wiley & Sons Ltd.
8. Pier Cesare Rivoltella. (2008). Digital Literacy: Tools and Methodologies for Information Society. USA: IGI Publishing
9. Pier Cesare Rivoltella. (2008). Digital Literacy: Tools and Methodologies for Information Society. USA: IGI Publishing.
10. OECD Team. (2016). Innovating Education and Educating for Innovation: The Power of Digital Technologies and Skills. Paris: OECD Publishing.

Supporters:

1. Jurnal-jurnal dan referensi-referensi mutakhir yang relevan

Supporting lecturer	Dr. I Gusti Made Sanjaya, 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	Analyzing the orientation of science learning in the Industry 5.0 era	1. Identifying the orientation of science learning in the industrial era 5.0 2. Analyzing the components of science learning in the industrial era 5.0 3. Evaluating the effectiveness of implementing science learning in the 5.0 era	**Criteria:** Based on the assessment rubric that has been created by the teaching lecturer **Form of Assessment** : Project Results Assessment / Product Assessment	Presentation, discussion and PjBL 2 X 50 minutes	Presentation, discussion and PjBL 2 X 50 minutes	**Material:** Science learning orientation in the industrial era 5.0 **Library:** *OECD Team. (2016). Innovating Education and Educating for Innovation: The Power of Digital Technologies and Skills. Paris: OECD Publishing.* **Material:** Science learning orientation in the industrial era 5.0 **References:** *Abhay Saxena, Durgesh Pant, Amit Saxena, Chandrashekhar Patel. (2020). Emergence of Educators for Industry 5.0 – An ndological Perspective. International Journal of Innovative Technology and Exploring Engineering (IJITEE), 9(12), 359-363* **Material:** Science learning orientation in the industrial era 5.0 **References:** *Gleason, Nancy W. (2018). Higher Education in the Era of the Fourth Industrial Revolution. Singapore: Springer Nature Singapore Pte Ltd.* **Material:** Science learning orientation in the industrial era 5.0 **Reference:** *Pier Cesare Rivoltella. (2008). Digital Literacy: Tools and Methodologies for the Information Society. USA: IGI Publishing.*	5%

2	Evaluating free online courses from various international universities in science learning	1. Using several examples of free online courses from various international universities 2. Evaluate the advantages and disadvantages of free online courses from various international universities	**Criteria:** Based on the assessment rubric that has been created by the teaching lecturer **Form of Assessment** : Project Results Assessment / Product Assessment	Presentation, discussion and PjBL 2 X 50 minutes	Presentation, discussion and PjBL 2 X 50 minutes	**Materials:** https://www.edx.org and https://www.coursera.org **References:**	5%
3	Evaluating various online platforms for science learning	1. Identify various online platforms for science learning 2. Analyze the components of online platforms for science learning 3. Evaluate the advantages and disadvantages of various online platforms for science learning	**Criteria:** Based on the assessment rubric that has been created by the teaching lecturer **Form of Assessment** : Project Results Assessment / Product Assessment	Presentation, discussion and PjBL 2 X 50 minutes	Presentation, discussion and PjBL 2 X 50 minutes	**Material:** Google Classroom, Moodle, Edmodo, Office Suite, etc. **References:**	5%
4	Analyzing science learning in full online learning	1. Identify several examples of science learning using full online learning 2. Analyze effective models, methods, strategies and approaches in science learning using full online learning 3. Evaluating the advantages and disadvantages of learning science using full online learning 4. Developing examples of science learning tools for full online learning	**Criteria:** Based on the assessment rubric that has been created by the teaching lecturer **Form of Assessment** : Project Results Assessment / Product Assessment	Presentation, discussion and PjBL 2 X 50 minutes	Presentation, discussion and PjBL 2 X 50 minutes	**Material:** Power Point **Reader:** *Bates AW (2015). Teaching in a Digital Age. UK: a Creative Commons Attribution-NonCommercial 4.0 International License.* **Material:** Power Point **Reader:** *Pier Cesare Rivoltella. (2008). Digital Literacy: Tools and Methodologies for the Information Society. USA: IGI Publishing*	10%

5	Analyzing science learning in full online learning	1. Identify several examples of science learning using full online learning 2. Analyze effective models, methods, strategies and approaches in science learning using full online learning 3. Evaluating the advantages and disadvantages of learning science using full online learning 4. Developing examples of science learning tools for full online learning	**Criteria:** Based on the assessment rubric that has been created by the teaching lecturer **Form of Assessment** : Project Results Assessment / Product Assessment	Presentation, discussion and PjBL 2 X 50 minutes	Presentation, discussion and PjBL 2 X 50 minutes	**Material:** Power Point **Reader:** *Bates AW (2015). Teaching in a Digital Age. UK: a Creative Commons Attribution-NonCommercial 4.0 International License.* **Material:** Power Point **Reader:** *Pier Cesare Rivoltella. (2008). Digital Literacy: Tools and Methodologies for the Information Society. USA: IGI Publishing*	10%
6	Analyzing science learning using blended learning	1. Identify several examples of science learning using blended learning 2. Analyze effective models, methods, strategies and approaches in learning science using blended learning 3. Evaluate the advantages and disadvantages of blended learning 4. Developing examples of science learning tools for science learning using blended learning	**Criteria:** Based on the assessment rubric that has been created by the teaching lecturer **Form of Assessment** : Project Results Assessment / Product Assessment	Presentation, discussion and PjBL 2 X 50 minutes	Presentation, discussion and PjBL 2 X 50 minutes	**Material:** Power Point **Reader:** *Bates AW (2015). Teaching in a Digital Age. UK: a Creative Commons Attribution-NonCommercial 4.0 International License.* **Material:** Power Point **Reader:** *Faithe Wempen. (2014). Computing Fundamentals. Digital Literacy Edition. UK: John Wiley & Sons Ltd.* **Material:** Power Point **Reader:** *Pier Cesare Rivoltella. (2008). Digital Literacy: Tools and Methodologies for the Information Society. USA: IGI Publishing*	7%

7	Analyzing science learning using blended learning	1. Identify several examples of science learning using blended learning 2. Analyze effective models, methods, strategies and approaches in learning science using blended learning 3. Evaluate the advantages and disadvantages of blended learning 4. Developing examples of science learning tools for science learning using blended learning	**Criteria:** Based on the assessment rubric that has been created by the teaching lecturer **Form of Assessment** : Project Results Assessment / Product Assessment	Presentation, discussion and PjBL 2 X 50 minutes	Presentation, discussion and PjBL 2 X 50 minutes	**Material:** Power Point **Reader:** *Faithe Wempen. (2014). Computing Fundamentals. Digital Literacy Edition. UK: John Wiley & Sons Ltd.* **Material:** Power Point **Reader:** *Faithe Wempen. (2014). Computing Fundamentals. Digital Literacy Edition. UK: John Wiley & Sons Ltd.* **Material:** Power Point **Reader:** *Pier Cesare Rivoltella. (2008). Digital Literacy: Tools and Methodologies for the Information Society. USA: IGI Publishing*	7%
8	Final capabilities from TM-1 to TM-7	Indicators from TM-1 to TM-7	**Criteria:** Based on the assessment rubric that has been created by the teaching lecturer **Form of Assessment** : Project Results Assessment / Product Assessment	Written test or assignment to replace UTS 2 x 50 minutes	Written test or assignment to replace UTS 2 x 50 minutes	**Material:** Learning topics from TM-1 to TM-7 **Library:**	5%
9	Understanding the use of cyber physical systems in science learning	1. Identifying the use of cyber physical systems in science learning 2. Evaluating the success of using cyber physical systems in science learning	**Criteria:** Based on the assessment rubric that has been created by the teaching lecturer **Form of Assessment** : Project Results Assessment / Product Assessment	Presentation, discussion and case method 2 X 50 minutes	Presentation, discussion and case method 2x50 minutes	**Material:** Power Point **Library:** *Team National Academies of Sciences, Engineering, and Medicine. (2016). A 21st Century Cyber-Physical Systems Education. Washington, DC: The National Academies Press.*	5%
10	Understanding the use of the internet of things in science learning	1. Identifying the use of the internet of things in science learning 2. Evaluating the success of using the internet of things in science learning	**Criteria:** Based on the assessment rubric that has been created by the teaching lecturer **Form of Assessment** : Project Results Assessment / Product Assessment	Presentation, discussion and case method 2 X 50 minutes	Presentation, discussion and case method 2 x 50 minutes	**Material:** Power Point **Reader:** *Dr. Ovidiu Vermesan and Dr. Peter Friess (editor). (2016). Digitizing the Industrial Internet of Things Connecting the Physical, Digital and Virtual Worlds. Netherlands: River Publishers*	5%
11	Analyzing the use of virtual reality in science learning	1. Identifying types of virtual reality in science learning 2. Analyzing the effectiveness of virtual reality in science learning 3. Evaluating the advantages and disadvantages of virtual reality in science learning	**Criteria:** Based on the assessment rubric that has been created by the teaching lecturer **Form of Assessment** : Project Results Assessment / Product Assessment	Presentation, discussion and PjBL 2 X 50 minutes	Presentation, discussion and PjBL 2x50 minutes	**Material:** Power Point **Library:** *Team National Academies of Sciences, Engineering, and Medicine. (2016). A 21st Century Cyber-Physical Systems Education. Washington, DC: The National Academies Press.* **Material:** Power Point **Reader:** *Dr. Ovidiu Vermesan and Dr. Peter Friess (editor). (2016). Digitizing the Industrial Internet of Things Connecting the Physical, Digital and Virtual Worlds. Netherlands: River Publishers*	5%

12	Analyzing the use of augmented reality in science learning	1. Identifying types of augmented reality in science learning 2. Analyzing the effectiveness of augmented reality in science learning 3. Evaluating the advantages and disadvantages of augmented reality in science learning	**Criteria:** Based on the assessment rubric that has been created by the teaching lecturer **Form of Assessment** : Project Results Assessment / Product Assessment	Presentation, discussion and PjBL 2 X 50 minutes	Presentation, discussion and PjBL 2x50 minutes	**Material:** Power Point **Reader:** *Dr. Shahbaz Pervez, Shafiq ur Rehman, Dr Gasim Alandjani. (2018). Proceedings of ADVED 2018- 4th International Conference on Advances in Education and Social Sciences, 15-17 October 2018- Istanbul, Turkey* **Material:** Power Point **Reader:** *Bates AW (2015). Teaching in a Digital Age. UK: a Creative Commons Attribution-NonCommercial 4.0 International License.*	7%
13	Analyzing the use of Artificial intelligence (AI) in science learning	1. Identifying the use of Artificial intelligence (AI) in science learning 2. Evaluating the success of using Artificial Intelligence (AI) in science learning	**Criteria:** Based on the assessment rubric that has been created by the teaching lecturer **Form of Assessment** : Project Results Assessment / Product Assessment	Presentation, discussion and PjBL 2 X 50 minutes	Presentation, discussion and PjBL 2 x 50 minutes	**Material:** Power Point **Reader:** *Bates AW (2015). Teaching in a Digital Age. UK: a Creative Commons Attribution-NonCommercial 4.0 International License.* **Material:** Power Point **Reader:** *Faithe Wempen. (2014). Computing Fundamentals. Digital Literacy Edition. UK: John Wiley & Sons Ltd.* **Material:** Power Point **Reader:** *Pier Cesare Rivoltella. (2008). Digital Literacy: Tools and Methodologies for the Information Society. USA: IGI Publishing*	7%
14	Analyzing the use of machine learning in science learning	1. Analyzing the use of machine learning in science learning 2. use of machine learning in science learning 3. Evaluating the success of using machine learning in science learning	**Criteria:** Based on the assessment rubric that has been created by the teaching lecturer **Form of Assessment** : Project Results Assessment / Product Assessment	Presentation, discussion and PjBL 2 X 50 minutes	Presentation, discussion and PjBL 2x 50 minutes	**Material:** Power Point **Reader:** *Bates AW (2015). Teaching in a Digital Age. UK: a Creative Commons Attribution-NonCommercial 4.0 International License.* **Material:** Power Point **Reader:** *Faithe Wempen. (2014). Computing Fundamentals. Digital Literacy Edition. UK: John Wiley & Sons Ltd.* **Material:** Power Point **Reader:** *Pier Cesare Rivoltella. (2008). Digital Literacy: Tools and Methodologies for the Information Society. USA: IGI Publishing*	7%
15	Analyzing the use of deep learning in science learning	1. Identifying the use of deep learning in science learning 2. Evaluating the success of using deep learning in science learning	**Criteria:** Based on the assessment rubric that has been created by the teaching lecturer **Form of Assessment** : Project Results Assessment / Product Assessment	Presentation, discussion and PjBL 2 X 50 minutes	Presentation, discussion and PjBL 2 X 50 minutes	**Material:** Power Point **Reader:** *Bates AW (2015). Teaching in a Digital Age. UK: a Creative Commons Attribution-NonCommercial 4.0 International License.* **Material:** Power Point **Reader:** *Faithe Wempen. (2014). Computing Fundamentals. Digital Literacy Edition. UK: John Wiley & Sons Ltd.* **Material:** Power Point **Reader:** *Pier Cesare Rivoltella. (2008). Digital Literacy: Tools and Methodologies for the Information Society. USA: IGI Publishing*	5%

16	Final capabilities from TM-9 to TM-15	Indicators from TM-9 to TM-15	**Criteria:** Based on the assessment rubric that has been created by the teaching lecturer **Form of Assessment** : Project Results Assessment / Product Assessment	Written test or assignment as a substitute for UAS 2 x 50 minutes	Written test or assignment as a substitute for UAS 2 x 50 minutes	**Material:** Learning topics from TM-9 to TM-15 **Library:**	5%

Evaluation Percentage Recap: Project Based Learning

No	Evaluation	Percentage
1.	Project Results Assessment / Product Assessment	100%
		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** 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.