	Universitas Negeri Surabaya **Faculty of Mathematics and Natural Sciences** **Undergraduate Physics Study Program**	**Document Code**

SEMESTER LEARNING PLAN

Courses	CODE	Course Family	Credit Weight	SEMESTER	Compilation Date
Material Fabrication Methods	4520103130	Study Program Elective Courses	T=3 P=0 ECTS=4.77	5	November 30, 2019

AUTHORIZATION	SP Developer	Course Cluster Coordinator	Study Program Coordinator
	Prof. Dr. Munasir, S.Si., M.Si.	Dr. Zainul Arifin Imam Supardi, M.Si.	Prof. Dr. Munasir, S.Si., M.Si.

Learning model: Project Based Learning

Program Learning Outcomes (PLO)

PLO study program that is charged to the course

Program Objectives (PO)

PO - 1	Students are able to apply top-down processes to fabricate nano-order materials
PO - 2	Students are able to apply the bottom-up method for fabricating nano-order materials
PO - 3	Students are able to apply functional material extraction methods based on natural ingredients such as: SiO2, TiO2, MgO, Fe3O4, etc.
PO - 4	Students are able to apply thin layer material fabrication methods using CVD, MBE and Sputtering techniques.
PO - 5	Students are able to compose scientific articles as a result of research in reputable scientific journals, with the topics: nanoparticle fabrication using certain methods: top-down, or bottom-up process

PLO-PO Matrix

P.O
PO-1
PO-2
PO-3
PO-4
PO-5

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																

Short Course Description: In this lecture various methods of material fabrication are discussed with appropriate methods: top-down processes, bottom-up processes such as sol-gel; co-precipitation, green-synthesis and so on; also various methods of fabricating thin film materials using CVD, Sputtering and electrospining techniques.

References

Main :

1. Masuo Hosokawa, Kiyoshi Nogi, Makio Naito, Toyokazu Yokoyama. 2007. Nanoparticle Technology Handbook. Elsivier, Tokyo, First Edition
2. Wroclow University of Science and Technology. 2020. Materials Science-Poland. Sciendo & De Gruyter, Germany.
3. E.J. Levernia et.al. 2020. Materials Science and Engineering:A. Elsevier
4. Buku Metode Fabrikasi Bahan, yang disusun oleh Dr. Munasir, S.Si., M.Si.
5. Kumpulan artikel dari berbagai jurnal internasional yang cokupannya dibidang sains material dan yang relevan, yang memiliki aspek kebaharuan pada bidang teknologi material.

Supporters:

1. https://www.sciencedirect.com/journal/journal-of-magnetism-and-magnetic-materials
2. https://www.sciencedirect.com/journal/inorganic-chemistry-communications
3. https://pubs.acs.org/
4. the journal Green Processing and Synthesis, https://www.degruyter.com/

Supporting lecturer: Prof. Dr. Munasir, 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	1.Students are able to understand and master top-down processing or synthesis methods for nanoparticles 2.Theory of processing materials by Ball-milling 3.Mechanical properties of particles, particle size and methods of analysis or particle characterization	Able to explain various processing methods for ceramic, polymer and metal materials	**Criteria:** Maximum test and presentation scores are 100 (same weight) **Form of Assessment** : Participatory Activities	Lectures, Question and Answer Discussions and 3 X 50 Assignments	Presentations, discussions, questions and answers and assignments 3x50	**Material:** Introduction to materials fabrication methods: metals, ceramics, polymers and composites **References:** *Material Fabrication Methods Book, compiled by Dr. Munasir, S.Sc., M.Si.*	3%
2	1.Students are able to apply the bottom-up method for fabricating nano-order materials 2.applied nanomaterial synthesis methods: co-precipitation, electrochemistry, and sol-gel	1.Able to explain the method of synthesizing nanomaterials by co-precipitation 2.Able to explain the method of synthesizing nanomaterials using electrochemistry	**Criteria:** Maximum test and presentation scores are 100 (same weight) **Form of Assessment** : Participatory Activities, Portfolio Assessment	Lectures, Question and Answer Discussions and 3 X 50 Assignments	Presentation, Question and Answer Discussion and Assignment 3 x 50	**Material:** Co-precipitation method **Bibliography:** *Masuo Hosokawa, Kiyoshi Nogi, Makio Naito, Toyokazu Yokoyama. 2007. Nanoparticle Technology Handbook. Elsivier, Tokyo, First Edition* **Material:** Electrochemical or electrolysis methods **References:** *Masuo Hosokawa, Kiyoshi Nogi, Makio Naito, Toyokazu Yokoyama. 2007. Nanoparticle Technology Handbook. Elsivier, Tokyo, First Edition* **Material:** Sol-gel method **References:** *Masuo Hosokawa, Kiyoshi Nogi, Makio Naito, Toyokazu Yokoyama. 2007. Nanoparticle Technology Handbook. Elsivier, Tokyo, First Edition*	3%
3	1.Students are able to apply the bottom-up method for fabricating nano-order materials 2.applying nanomaterial synthesis methods: with sol-gel, Hammers 3.applied the nanofiber synthesis method by electrospinning	1.Able to explain the method of synthesizing nanomaterials by co-precipitation 2.Able to explain the method of synthesizing nanomaterials using electrochemistry	**Criteria:** Maximum test and presentation scores are 100 (same weight) **Form of Assessment** : Participatory Activities, Portfolio Assessment	Lectures, Question and Answer Discussions and 3 X 50 Assignments	Presentation, Question and Answer Discussion and Assignment 3 x 50	**Material:** Co-precipitation method **Bibliography:** *Masuo Hosokawa, Kiyoshi Nogi, Makio Naito, Toyokazu Yokoyama. 2007. Nanoparticle Technology Handbook. Elsivier, Tokyo, First Edition* **Material:** Sol-gel method **References:** *Masuo Hosokawa, Kiyoshi Nogi, Makio Naito, Toyokazu Yokoyama. 2007. Nanoparticle Technology Handbook. Elsivier, Tokyo, First Edition* **Material:** Hammers Method **Literature:** *Masuo Hosokawa, Kiyoshi Nogi, Makio Naito, Toyokazu Yokoyama. 2007. Nanoparticle Technology Handbook. Elsivier, Tokyo, First Edition* **Material:** Electrospinning method **Reference:** *Material Fabrication Methods book, compiled by Dr. Munasir, S.Sc., M.Si.*	3%

4	1.Review the article on the topic Green synthesis of SiO2 nanoparticles (Silica Nanoparticle) 2.Create a PPT, and present the results of an article review on the topic Green synthesis of SiO2 nanoparticles (Silica Nanoparticles)	1.Create papers, PPTs and present the topic of Green synthesis of SiO2 nanoparticles (Silica Nanoparticles) 2.Analyzing the synthesis method, characteristics and advantages of SiO2 nanoparticles as well as application prospects in everyday life	**Criteria:** Maximum test and presentation scores are 100 (same weight) **Form of Assessment** : Participatory Activities, Portfolio Assessment	Presentation, Question and Answer Discussion and Assignment 3 X 50	Presentation, Question and Answer Discussion and Assignment 3 x 50	**Material:** SiO2 nanoparticle fabrication **Reference:** *Material Fabrication Methods Book, compiled by Dr. Munasir, S.Sc., M.Si.* **Material:** Synthesis of SiO2 nanoparticles. **Library:** *Collection of articles from various international journals which cover the field of materials science and which are relevant, which have novel aspects in the field of materials technology.* **Material:** Synthesis of sio2 nanoparticles **Reference:** *the journal Green Processing and Synthesis, https://www.degruyter.com/...*	3%
5	1.Review the article on the topic Green synthesis Fe3O4 nanoparticles (magnetic nanoparticles) 2.Create a PPT and present the results of an article review on the topic Green synthesis of Fe3O4 nanoparticles (magnetic nanoparticles)	1.Able to explain the mechanism and stages of synthesis of Fe3O4 nanoparticles using green synthesis 2.Able to explain the characteristics, advantages and various applications in everyday life	**Criteria:** Maximum test and presentation scores are 100 (same weight) **Form of Assessment** : Participatory Activities, Portfolio Assessment	Presentation, Question and Answer Discussion and Assignment 3 X 50	Presentation, Question and Answer Discussion and Assignment 3 x 50	**Material:** Green synthesis of Fe3O4 Nanoparticles and applications **Library:** *https://pubs.acs.org/...* **Material:** Green synthesis of Fe3O4 Nanoparticles **Library:** *the journal Green Processing and Synthesis, https://www.degruyter.com/...*	2%
6	1.Review the article on the topic Green synthesis of TiO2 nanoparticles (Titania Nanoparticle) 2.Create a PPT, and present the results of an article review on the topic Green synthesis of TiO2 nanoparticles (Titania Nanoparticle)	1.Able to explain the mechanism and stages of synthesis of TiO2 nanoparticles using green synthesis 2.Able to explain the characteristics, advantages and various applications in everyday life	**Criteria:** Maximum test and presentation scores are 100 (same weight) **Form of Assessment** : Participatory Activities, Portfolio Assessment	Presentation, Question and Answer Discussion and Assignment 3 X 50	Presentation, Question and Answer Discussion and Assignment 3 x 50	**Material:** Green synthesis of TiO2 Nanoparticles and applications **Library:** *https://pubs.acs.org/...* **Material:** Green synthesis of TiO2 Nanoparticles and applications **Library:** *the journal Green Processing and Synthesis, https://www.degruyter.com/...*	3%
7	1.Study the article on the topic Green synthesis of Gold Nanoparticles and applications 2.Create a PPT and present the results of an article review on the topic Green synthesis Gold nanoparticles	1.Able to explain the mechanism and stages of Au nanoparticle synthesis using green synthesis 2.Able to explain the characteristics, advantages and various applications in everyday life	**Criteria:** Maximum test and presentation scores are 100 (same weight) **Form of Assessment** : Participatory Activities, Portfolio Assessment	Presentation, Question and Answer Discussion and Assignment 3 X 50	Presentation, Question and Answer Discussion and Assignment 3 x 50	**Material:** Green synthesis of Au Nanoparticles and applications **Library:** *https://pubs.acs.org/...* **Material:** Green synthesis of Au Nanoparticles and applications **Library:** *the journal Green Processing and Synthesis, https://www.degruyter.com/...* **Material:** Green synthesis of Au Nanoparticles and applications **Library:** *Collection of articles from various international journals which cover the field of materials science and which are relevant, which have new aspects in the field of materials technology.*	3%
8	1.UTS-Presentation Draft journal review article 2.Creating Table Data, Image Illustrations Synthesis methods and images Applications in everyday life	1.create an outline of a scientific article (review) 2.Creating Table Data, Image Illustrations Synthesis methods and images Applications in everyday life 3.Present the draft article that has been prepared	**Criteria:** Maximum test and presentation scores are 100 (same weight) **Forms of Assessment** : Participatory Activities, Portfolio Assessment, Practice / Performance	Presentation, Question and Answer Discussion and Assignment 3 X 50	Presentation, Question and Answer Discussion and Assignment 3 x 50	**Material:** Green synthesis of AgO Nanoparticles and applications **Library:** *Collection of articles from various international journals covering the field of materials science and those that are relevant, which have novel aspects in the field of materials technology.* **Material:** Green synthesis of AgO Nanoparticles and applications **Library:** *https://pubs.acs.org/...* **Material:** Green synthesis of AgO Nanoparticles and applications **Library:** *the journal Green Processing and Synthesis, https://www.degruyter.com/...*	30%

9	1.Review the article on the topic Green synthesis of AgO Nanoparticles and applications 2.Create a PPT and present the results of an article review on the topic Green synthesis AgO nanoparticles	1.Able to explain the mechanism and stages of AgO nanoparticle synthesis using green synthesis 2.Able to explain the characteristics, advantages and various applications in everyday life	**Criteria:** Maximum test and presentation scores are 100 (same weight) **Form of Assessment** : Participatory Activities, Portfolio Assessment	Presentation, Question and Answer Discussion and Assignment 3 X 50	Presentation, Question and Answer Discussion and Assignment 3 x 50	**Material:** Green synthesis of AgO Nanoparticles and applications **Library:** *Collection of articles from various international journals covering the field of materials science and those that are relevant, which have novel aspects in the field of materials technology.* **Material:** Green synthesis of AgO Nanoparticles and applications **Library:** *https://pubs.acs.org/...* **Material:** Green synthesis of AgO Nanoparticles and applications **Library:** *the journal Green Processing and Synthesis, https://www.degruyter.com/...*	5%
10	1.Study the article on the topic Green synthesis of SnO Nanoparticles and applications 2.Create a PPT and present the results of an article review on the topic Green synthesis SnO nanoparticles	1.Able to explain the mechanism and stages of synthesis of SnO nanoparticles using green synthesis 2.Able to explain the characteristics, advantages and various applications in everyday life	**Criteria:** Maximum test and presentation scores are 100 (same weight) **Form of Assessment** : Participatory Activities, Portfolio Assessment	Presentation, Question and Answer Discussion and Assignment 3 X 50	Presentation, Question and Answer Discussion and Assignment 3 x 50	**Material:** Green synthesis of SnO Nanoparticles and applications **Library:** *the journal Green Processing and Synthesis, https://www.degruyter.com/...* **Material:** Green synthesis of SnO Nanoparticles and applications **Library:** *https://pubs.acs.org/...*	3%
11	Students are able to apply thin layer material fabrication methods using CVD, MBE and Sputtering techniques.	1.Able to explain the material fabrication method (thin film) using the Sputtering method 2.Able to explain the material fabrication method (thin film) using the MBE method 3.Able to explain the material fabrication method (thin film) using the CVD method	**Criteria:** Maximum test and presentation scores are 100 (same weight) **Form of Assessment** : Participatory Activities, Portfolio Assessment	Lectures, Question and Answer Discussions and 3 X 50 Assignments	3 x 50	**Material:** sputtering method **References:** *Masuo Hosokawa, Kiyoshi Nogi, Makio Naito, Toyokazu Yokoyama. 2007. Nanoparticle Technology Handbook. Elsivier, Tokyo, First Edition* **Material:** MBE Method **References:** *EJ Levernia et.al. 2020. Materials Science and Engineering:A. Elsevier* **Material:** CVD Method **Library:** *https://pubs.acs.org/...*	3%
12	Write articles and posters for one selected topic (as a project assignment)	Drafting articles and presentations (continued)	**Criteria:** Maximum test and presentation scores are 100 (same weight) **Forms of Assessment** : Participatory Activities, Project Results Assessment / Product Assessment, Portfolio Assessment	Presentation, Question and Answer Discussion and Assignment 3 X 50	Presentation, Question and Answer Discussion and Assignment 3 x 50	**Material:** Green synthesis nanoparticles **References:** *EJ Levernia et.al. 2020. Materials Science and Engineering:A. Elsevier* **Material:** Green synthesis nanoparticles **Library:** *https://www.sciencedirect.com/...* **Material:** Green synthesis nanoparticles **Library:** *https://pubs.acs.org/...* **Material:** Green synthesis nanoparticles **Library:** *Collection of articles from various international journals which cover the field of materials science and which are relevant, which have novel aspects in the field of materials technology.*	3%

13	Write articles and posters for one selected topic (as a project assignment)	Drafting articles and presentations (continued)	**Criteria:** Maximum test and presentation scores are 100 (same weight) **Forms of Assessment** : Participatory Activities, Project Results Assessment / Product Assessment, Portfolio Assessment	Presentation, Question and Answer Discussion and Assignment 3 X 50	Presentation, Question and Answer Discussion and Assignment 3 x 50	**Material:** Green synthesis nanoparticles **References:** *EJ Levernia et.al. 2020. Materials Science and Engineering:A. Elsevier* **Material:** Green synthesis nanoparticles **Library:** *https://www.sciencedirect.com/...* **Material:** Green synthesis nanoparticles **Library:** *https://pubs.acs.org/...* **Material:** Green synthesis nanoparticles **Library:** *Collection of articles from various international journals which cover the field of materials science and which are relevant, which have novel aspects in the field of materials technology.*	3%
14	Write articles and posters for one selected topic (as a project assignment)	Drafting articles and presentations (continued)	**Criteria:** Maximum test and presentation scores are 100 (same weight) **Forms of Assessment** : Participatory Activities, Project Results Assessment / Product Assessment, Portfolio Assessment	Presentation, Question and Answer Discussion and Assignment 3 X 50	Presentations, Question and Answer Discussions and Assignments	**Material:** Green synthesis nanoparticles **References:** *EJ Levernia et.al. 2020. Materials Science and Engineering:A. Elsevier* **Material:** Green synthesis nanoparticles **Library:** *https://www.sciencedirect.com/...* **Material:** Green synthesis nanoparticles **Library:** *https://pubs.acs.org/...* **Material:** Green synthesis nanoparticles **Library:** *Collection of articles from various international journals which cover the field of materials science and which are relevant, which have novel aspects in the field of materials technology.*	3%
15	Write articles and posters for one selected topic (as a project assignment)	Arrange posters according to the chosen topic and presentation	**Criteria:** Maximum test and presentation scores are 100 (same weight) **Forms of Assessment** : Participatory Activities, Project Results Assessment / Product Assessment, Portfolio Assessment, Practice / Performance	Presentation, Question and Answer Discussion and Assignment 3 X 50	Presentation, Question and Answer Discussion and 3x50 Assignments	**Material:** Green synthesis nanoparticles **References:** *EJ Levernia et.al. 2020. Materials Science and Engineering:A. Elsevier* **Material:** Green synthesis nanoparticles **Library:** *https://www.sciencedirect.com/...* **Material:** Green synthesis nanoparticles **Library:** *https://pubs.acs.org/...* **Material:** Green synthesis nanoparticles **Library:** *Collection of articles from various international journals which cover the field of materials science and which are relevant, which have novel aspects in the field of materials technology.*	3%

16	UAS: Presentation of articles and posters of project results	1. Write articles on specific topics with appropriate structure and correct language 2. Create posters with complete content, good and correct language, and attractive 3. Able to present the contents of articles/posters in good language and master the contents correctly	**Forms of Assessment** : Participatory Activities, Project Results Assessment / Product Assessment, Portfolio Assessment	Presentation and questions and answers 3x50	Presentation and questions and answers 3x50	**Material:** Material fabrication: nanoparticles **References:** *Masuo Hosokawa, Kiyoshi Nogi, Makio Naito, Toyokazu Yokoyama. 2007. Nanoparticle Technology Handbook. Elsivier, Tokyo, First Edition* **Material:** Green synthesis nanoparticles **References:** *EJ Levernia et.al. 2020. Materials Science and Engineering:A. Elsevier* **Material:** Green synthesis nanoparticles **Library:** *Wroclow University of Science and Technology. 2020. Materials Science-Poland. Sciendo & De Gruyter, Germany.* **Material:** Green synthesis nanoparticles **Library:** *https://pubs.acs.org/...* **Material:** Green synthesis nanoparticles **Reference:** *the journal Green Processing and Synthesis, https://www.degruyter.com/...*	30%

Evaluation Percentage Recap: Project Based Learning

No	Evaluation	Percentage
1.	Participatory Activities	40.75%
2.	Project Results Assessment / Product Assessment	13.75%
3.	Portfolio Assessment	37.75%
4.	Practice / Performance	10.75%
		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.