



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																																																																																																																										
Medical Materials	4520102245	Study Program Elective Courses	T=2	P=0	ECTS=3.18	6	April 30, 2023																																																																																																																										
AUTHORIZATION		SP Developer	Course Cluster Coordinator			Study Program Coordinator																																																																																																																											
		Lydia Rohmawati, M.Si.	Dr. ZA Imam Supardi, M.Si.			Prof. Dr. Munasir, S.Si., M.Si.																																																																																																																											
Learning model	Project Based Learning																																																																																																																																
Program Learning Outcomes (PLO)	PLO study program which is charged to the course																																																																																																																																
	PLO-11	Design and conduct experiments in physics learning by applying scientific methods																																																																																																																															
	Program Objectives (PO)																																																																																																																																
	PO - 1	Mastering the meaning, properties of medical materials and their differences from other common materials																																																																																																																															
	PO - 2	Have the ability to use learning resources from around and ICT to study medical material																																																																																																																															
	PO - 3	Able to formulate, show and demonstrate methods for characterizing the biological, physical and chemical properties of medical materials																																																																																																																															
	PO - 4	Have knowledge to explain the application of material properties available in the medical world																																																																																																																															
	PO - 5	Have the ability to communicate ideas or thoughts from the results of searches for scientific articles related to medical materials, both individually and in groups, expressed in written form (narrative review/poster) and presentations																																																																																																																															
	PLO-PO Matrix																																																																																																																																
		<table border="1" style="margin-left: auto; margin-right: auto;"> <thead> <tr> <th>P.O</th> <th colspan="6">P.O</th> </tr> <tr> <th></th> <th>PO-1</th> <th>PO-2</th> <th>PO-3</th> <th>PO-4</th> <th>PO-5</th> <th></th> </tr> </thead> <tbody> <tr> <td>PO-1</td> <td></td> <td></td> <td></td> <td></td> <td></td> <td></td> </tr> <tr> <td>PO-2</td> <td></td> <td></td> <td></td> <td></td> <td></td> <td></td> </tr> <tr> <td>PO-3</td> <td></td> <td></td> <td></td> <td></td> <td></td> <td></td> </tr> <tr> <td>PO-4</td> <td></td> <td></td> <td></td> <td></td> <td></td> <td></td> </tr> <tr> <td>PO-5</td> <td></td> <td></td> <td></td> <td></td> <td></td> <td></td> </tr> </tbody> </table>						P.O	P.O							PO-1	PO-2	PO-3	PO-4	PO-5		PO-1							PO-2							PO-3							PO-4							PO-5																																																																															
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	<table border="1" style="margin-left: auto; margin-right: auto;"> <thead> <tr> <th rowspan="2">P.O</th> <th colspan="16">Week</th> </tr> <tr> <th>1</th> <th>2</th> <th>3</th> <th>4</th> <th>5</th> <th>6</th> <th>7</th> <th>8</th> <th>9</th> <th>10</th> <th>11</th> <th>12</th> <th>13</th> <th>14</th> <th>15</th> <th>16</th> </tr> </thead> <tbody> <tr> <td>PO-1</td> <td></td><td></td><td></td><td></td><td></td><td></td><td></td><td></td><td></td><td></td><td></td><td></td><td></td><td></td><td></td><td></td><td></td> </tr> <tr> <td>PO-2</td> <td></td><td></td><td></td><td></td><td></td><td></td><td></td><td></td><td></td><td></td><td></td><td></td><td></td><td></td><td></td><td></td><td></td> </tr> <tr> <td>PO-3</td> <td></td><td></td><td></td><td></td><td></td><td></td><td></td><td></td><td></td><td></td><td></td><td></td><td></td><td></td><td></td><td></td><td></td> </tr> <tr> <td>PO-4</td> <td></td><td></td><td></td><td></td><td></td><td></td><td></td><td></td><td></td><td></td><td></td><td></td><td></td><td></td><td></td><td></td><td></td> </tr> <tr> <td>PO-5</td> <td></td><td></td><td></td><td></td><td></td><td></td><td></td><td></td><td></td><td></td><td></td><td></td><td></td><td></td><td></td><td></td><td></td> </tr> </tbody> </table>						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																	
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Short Course Description	Study of the classification and characteristics of medical materials in terms of biological, physical and chemical properties, structure and basic properties of medical materials, testing methods for medical materials, and their applications in the medical field. This course aims for students to understand the classification of natural materials that can be applied in the medical field and understand the body's natural response to implantation materials. Assessment of learning outcomes is carried out through experimental results reports (conformity with design, theoretical studies, experimental methods, results and discussion, conclusions, literature), presentation material in the form of PPT (performance structure, ideas for each presentation, creativity, IT applications), presentation skills (delivery technique, ability to defend ideas, respond to other people's opinions, cohesiveness)																																																																																																																																
References	Main :																																																																																																																																
	<ol style="list-style-type: none"> 1. Jeremy Ramsden. 2009. Nanotechnology. Free Study Books, www. BOOKBOON.COM, @Jaremy Ramsden & Ventus Publishing ApS. 2. Ratner, B.D. et al. , 2013. Biomaterials Science: An Introduction to Materials in Medicine (3rd Edition). Academic Press 3. Ayoub, A.S. and Lucia, L.A., 2017. Introduction to Renewable Biomaterils: First Principles and Concepts. Wiley 4. Bastidas-Oyadenel, J. R. et al., 2019. Biorefinery: Integrated Sustainable Processes for Biomass Conversion to Biomaterials, Biofuels, and Fertilizers. Springer. 5. Temenoff, Johnna S. 2008. "Biomaterials : The Intersection of Biology and Materials Science, 1st Ed", Prentice Hall 6. Rosario Pignatello, 2011, BIOMATERIALS SCIENCE AND ENGINEERING, In Tech, Kroasia 																																																																																																																																
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1. Rohmawati, L., Setyarsih, W., Munasir. 2022, Fungsional Material Alam TiO₂: Ingredient Pemutih Gigi. Surabaya: JDS.
2. Rohmawati, L. and Setyarsih, W. 2021. Antibakterial rongga mulut dari dolomit Bangkalan. Surabaya: JDS.
3. Rohmawati, L., Putri, NP., Kusumawati, DH., Munasir. 2021. Nanopartikel Fe₃O₄ sebagai material antibakteri. Surabaya: JDS.
4. Rohmawati, L., and Setyarsih, W., 2021, Pemutih gigi dari TiO₂@Polydopamine (PDA). Surabaya: JDS.
5. artikel jurnal internasional up to date yang berkaitan dengan bidang medis

Supporting lecturer
Prof. Dr. Munasir, S.Si., M.Si.
Lydia Rohmawati, S.Si., M.Si.

Week- (1)	Final abilities of each learning stage (Sub-PO) (2)	Evaluation		Help Learning, Learning methods, Student Assignments, [Estimated time]		Learning materials [References] (7)	Assessment Weight (%) (8)
		Indicator (3)	Criteria & Form (4)	Offline (offline) (5)	Online (online) (6)		
1	Able to master the concept of medical materials: classification and characteristics	1.Explain the difference between medical materials and materials in general 2.Identify medical materials based on biological, chemical and physical properties 3.Classifying medical materials based on biological, chemical and physical properties	Criteria: Quantitative Form of Assessment : Participatory Activities, Project Results Assessment / Product Assessment	Presentation, discussion and questions and answers 2 X 50	Presentations, discussions and questions and answers 2 x 50	Material: Properties of materials (part one section 1) References: Ratner, BD et al. , 2013. <i>Biomaterials Science: An Introduction to Materials in Medicine (3rd Edition)</i> . Academic Press	2%
2	Able to understand and explain the structure and properties of biometals and bioceramics	1.able to classify materials that can be used in the medical field 2.able to explain the structure and properties of biometals and bioceramics	Criteria: Quantitative Form of Assessment : Participatory Activities, Project Results Assessment / Product Assessment	Presentation, discussion and questions and answers 2 X 50	Presentations, discussions and questions and answers 2 x 50	Material: Classes of Materials used in medicine (Setion 1.2) References: Ratner, BD et al. , 2013. <i>Biomaterials Science: An Introduction to Materials in Medicine (3rd Edition)</i> . Academic Press	3%
3	Able to understand and explain the structure and properties of biopolymers and bioplastics	1.able to explain the structure and properties of biopolymers and bioplastics 2.able to classify types of biopolymers and bioplastics	Criteria: Quantitative Form of Assessment : Participatory Activities, Project Results Assessment / Product Assessment	Presentation, discussion and questions and answers 2 X 50	Presentations, discussions and questions and answers 2 x 50	Material: Classes of Materials used in medicine (Setion 1.2) References: Ratner, BD et al. , 2013. <i>Biomaterials Science: An Introduction to Materials in Medicine (3rd Edition)</i> . Academic Press Material: Chemical structure of biomaterials (Chapter 2) References: Temenoff, Johnna S. 2008. "Biomaterials : The Intersection of Biology and Materials Science, 1st Ed", Prentice Hall	2%

4	Able to formulate, show and demonstrate methods for characterizing the biological, physical and chemical properties of medical materials	<p>1.Able to explain methods of characterization of mechanical, physical, chemical and biological properties</p> <p>2.Able to analyze characterization results in terms of biological, mechanical, physical and chemical properties</p>	<p>Criteria: Quantitative</p> <p>Form of Assessment : Participatory Activities, Project Results Assessment / Product Assessment</p>	Presentation, discussion and questions and answers 2 X 50	Presentations, discussions and questions and answers 2 x 50	<p>Material: Biological testing of biomaterials (section II.3)</p> <p>References: <i>Ratner, BD et al. , 2013. Biomaterials Science: An Introduction to Materials in Medicine (3rd Edition). Academic Press</i></p> <hr/> <p>Material: Physical properties of biomaterials (Ch 3), Mechanical Properties of Biomaterials (ch 4), Biomaterial Degradation (ch 5)</p> <p>References: <i>Temenoff, Johnna S. 2008. "Biomaterials: The Intersection of Biology and Materials Science, 1st Ed", Prentice Hall</i></p>	3%
5	Able to formulate, show and demonstrate methods for characterizing the biological, physical and chemical properties of medical materials	<p>1.Able to explain methods of characterization of mechanical, physical, chemical and biological properties</p> <p>2.Able to analyze characterization results in terms of biological, mechanical, physical and chemical properties</p>	<p>Criteria: Quantitative</p> <p>Form of Assessment : Participatory Activities, Project Results Assessment / Product Assessment</p>	Presentation, discussion and questions and answers 2 X 50	Presentations, discussions and questions and answers 2 x 50	<p>Material: Biological testing of biomaterials (section II.3)</p> <p>References: <i>Ratner, BD et al. , 2013. Biomaterials Science: An Introduction to Materials in Medicine (3rd Edition). Academic Press</i></p> <hr/> <p>Material: Physical properties of biomaterials (Ch 3), Mechanical Properties of Biomaterials (ch 4), Biomaterial Degradation (ch 5)</p> <p>References: <i>Temenoff, Johnna S. 2008. "Biomaterials: The Intersection of Biology and Materials Science, 1st Ed", Prentice Hall</i></p>	2%

6	Able to master knowledge and application of materials in the medical field: sensors, drug delivery	<p>1.able to explain the concept of drug delivery systems for ceramic materials</p> <p>2.able to explain the concept of biosensors and bioelectrodes and their applications</p>	<p>Criteria: Quantitative</p> <p>Form of Assessment : Participatory Activities, Portfolio Assessment</p>	Presentation, discussion and questions and answers 2 X 50	Presentations, discussions and questions and answers 2 x 50	<p>Material: Chapters 1-3</p> <p>References: <i>Rohmawati, L., Setyarsih, W., Munasir. 2022, Functional Natural Material TiO2: Teeth Whitening Ingredient. Surabaya: JDS.</i></p> <hr/> <p>Material: chapters 1-3 regarding the application of natural ingredients for antibacterial.</p> <p>Reference: <i>Rohmawati, L. and Setyarsih, W. 2021. Oral antibacterial from Bangkalan dolomite. Surabaya: JDS.</i></p> <hr/> <p>Material: material application</p> <p>Reader: <i>Jeremy Ramsden. 2009. Nanotechnology. Free Study Books, www.BOOKBOON.COM, @Jeremy Ramsden & Ventus Publishing ApS.</i></p> <hr/> <p>Material: potential of TiO2 for teeth whitening</p> <p>Reference: <i>Rohmawati, L., and Setyarsih, W., 2021, Teeth whitening from TiO2@Polydopamine (PDA). Surabaya: JDS.</i></p> <hr/> <p>Material: Chapters 1-9</p> <p>References: <i>Rosario Pignatello, 2011, BIOMATERIALS SCIENCE AND ENGINEERING, In Tech, Croatia</i></p> <hr/> <p>Material: Chapter 3</p> <p>References: <i>Bastidas-Oyadenel, JR et al., 2019. Biorefinery: Integrated Sustainable Processes for Biomass Conversion to Biomaterials, Biofuels, and Fertilizers. Springer.</i></p> <hr/> <p>Material: Chapter 10 (Implantation and active inflammation), Chapter 11 (Wound healing), Chapter 14 (Infection, Tumorigenesis)</p> <p>Bibliography: <i>Temenoff, Johnna S. 2008. "Biomaterials: The Intersection of Biology and Materials Science, 1st Ed", Prentice Hall</i></p> <hr/> <p>Material: Section II.5 (Applications of biomaterials)</p> <p>References: <i>Ratner, BD et al. , 2013. Biomaterials Science: An Introduction to Materials in Medicine (3rd Edition). Academic Press</i></p>	3%
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7	Able to master knowledge and application of materials in the medical field (beauty: soap, scrub and facial wash)	<p>1. Able to explain the concept of the performance of medical materials in eliminating bacteria and germs in soap along with how to make it and its characterization</p> <p>2. Able to explain the concept of the performance of medical materials as whiteners for the face and body</p>	<p>Criteria: Quantitative</p> <p>Form of Assessment : Participatory Activities, Portfolio Assessment</p>	Presentation, discussion and questions and answers 2 X 50	Presentations, discussions and questions and answers 2 x 50	<p>Material: Chapters 1-3</p> <p>References: <i>Rohmawati, L., Setyarsih, W., Munasir. 2022, Functional Natural Material TiO2: Teeth Whitening Ingredient. Surabaya: JDS.</i></p> <hr/> <p>Material: chapters 1-3 regarding the application of natural ingredients for antibacterial.</p> <p>Reference: <i>Rohmawati, L. and Setyarsih, W. 2021. Oral antibacterial from Bangkalan dolomite. Surabaya: JDS.</i></p> <hr/> <p>Material: material application</p> <p>Reader: <i>Jeremy Ramsden. 2009. Nanotechnology. Free Study Books, www.BOOKBOON.COM, @Jeremy Ramsden & Ventus Publishing ApS.</i></p> <hr/> <p>Material: the role of Fe₃O₄ as an antibacterial</p> <p>Reference: <i>Rohmawati, L., Putri, NP., Kusumawati, DH., Munasir. 2021. Fe₃O₄ nanoparticles as antibacterial material. Surabaya: JDS.</i></p> <hr/> <p>Material: Chapters 1-9</p> <p>References: <i>Rosario Pignatello, 2011, BIOMATERIALS SCIENCE AND ENGINEERING, In Tech, Croatia</i></p> <hr/> <p>Material: Chapter 3</p> <p>References: <i>Bastidas-Oyadenel, JR et al., 2019. Biorefinery: Integrated Sustainable Processes for Biomass Conversion to Biomaterials, Biofuels, and Fertilizers. Springer.</i></p> <hr/> <p>Material: Chapter 10 (Implantation and active inflammation), Chapter 11 (Wound healing), Chapter 14 (Infection, Tumorigenesis)</p> <p>Bibliography: <i>Temenoff, Johnna S. 2008. "Biomaterials: The Intersection of Biology and Materials Science, 1st Ed", Prentice Hall</i></p> <hr/> <p>Material: Section II.5 (Applications of biomaterials)</p> <p>References: <i>Ratner, BD et al., 2013. Biomaterials Science: An Introduction to Materials in Medicine (3rd Edition). Academic Press</i></p>	2%
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8	Able to create products (prototypes) and report in written and verbal form	<ol style="list-style-type: none"> 1. Apply all article components to medical material project design 2. Product manufacturing report complete with manufacturing video 	<p>Criteria:</p> <ol style="list-style-type: none"> 1. there is a product manufacturing report 2. there are relevant reference articles as the main source of project activities 3. there are ppt (presentation) media results 4. there is a making video <p>Forms of Assessment : Participatory Activities, Project Results Assessment / Product Assessment, Portfolio Assessment, Practical Assessment, Practice / Performance</p>	Project group investigation, group discussion, presentation 2 x 50	Project group investigation, group discussion, presentation 2 x 50	<p>Material: topic articles on the application of medical midwife material. Library: up to date international journal articles related to the medical field</p>	20%
9	Able to master the knowledge and application of materials in the medical field (characterization of SPF or sunscreen)	<ol style="list-style-type: none"> 1. able to explain the concept of performance of medical materials as sunscreen 2. able to explain the characteristics of medical materials as sunscreen 	<p>Criteria: Quantitative</p> <p>Form of Assessment : Participatory Activities, Portfolio Assessment</p>	Presentations, discussions and questions and answers 2 x 50	Presentations, discussions and questions and answers 2 x 50	<p>Material: topic articles on the application of medical midwife material. Library: up to date international journal articles related to the medical field</p> <p>Material: material application Reader: Jeremy Ramsden. 2009. Nanotechnology. Free Study Books, www. BOOKBOON.COM, @Jeremy Ramsden & Ventus Publishing ApS.</p>	5%
10	Able to master the knowledge and application of materials in the medical field (wound dressing)	<ol style="list-style-type: none"> 1. able to explain the performance of medical materials as wound dressings 2. able to explain the characteristics of medical materials as wound dressings 	<p>Criteria: Quantitative</p> <p>Forms of Assessment : Participatory Activities, Project Results Assessment / Product Assessment, Portfolio Assessment</p>	Presentation, Questions and Answers 2 x 50	Presentation, Questions and Answers 2 x 50	<p>Material: topic articles on the application of medical midwife material. Library: up to date international journal articles related to the medical field</p>	5%
11	Able to master the knowledge and application of materials in the medical field (teeth whitening)	<ol style="list-style-type: none"> 1. able to explain the performance of medical materials as teeth whiteners 2. able to explain the characteristics of medical materials as teeth whiteners 	<p>Criteria: Quantitative</p> <p>Form of Assessment : Participatory Activities, Portfolio Assessment</p>	Presentation, Questions and Answers 2 x 50	Presentation, Questions and Answers 2 x 50	<p>Material: topic articles on the application of medical midwife material. Library: up to date international journal articles related to the medical field</p> <p>Material: chapters 1-3 References: Rohmawati, L., Setyarsih, W., Munasir. 2022, Functional Natural Material TiO2: Teeth Whitening Ingredient. Surabaya: JDS.</p> <p>Material: chapters 1-3 References: Rohmawati, L., and Setyarsih, W., 2021, Teeth whitener from TiO2@Polydopamine (PDA). Surabaya: JDS.</p>	5%
12	Able to review and analyze scientific articles from National/International journals	Quantitative	<p>Criteria: Quantitative</p> <p>Forms of Assessment : Participatory Activities, Portfolio Assessment, Practice / Performance</p>	Presentation and questions and answers 2 x 50	Presentation and questions and answers 2 x 50	<p>Material: topic articles on the application of medical midwife material. Library: up to date international journal articles related to the medical field</p>	5%

13	Able to review and analyze scientific articles from National/International journals	Quantitative	Criteria: Quantitative Forms of Assessment : Participatory Activities, Portfolio Assessment, Practice / Performance	Presentation and questions and answers 2 x 50	Presentation and questions and answers 2 x 50	Material: topic articles on the application of medical midwife material. Library: up to date international journal articles related to the medical field	2%
14	Able to review and analyze scientific articles from National/International journals	Quantitative	Criteria: Quantitative Forms of Assessment : Participatory Activities, Portfolio Assessment, Practice / Performance	Presentation and questions and answers 2 x 50	Presentation and questions and answers 2 x 50	Material: topic articles on the application of medical midwife material. Library: up to date international journal articles related to the medical field	5%
15	Able to review and analyze scientific articles from National/International journals	Quantitative	Criteria: Quantitative Forms of Assessment : Participatory Activities, Portfolio Assessment, Practice / Performance	Presentation and questions and answers 2 x 50	Presentation and questions and answers 2 x 50	Material: topic articles on the application of medical midwife material. Library: up to date international journal articles related to the medical field	3%
16	Realize the design made in the form of a prototype (trial) and report it in written and oral form	1.writing articles according to the preparation template 2.Number of references referred (less than 5 years) 3.material topic 4.the sharpness of the review of the articles studied	Criteria: 1.there are reference/reference articles 2.weight of scientific articles (depth of material reviewed) 3.writing articles according to a template and systematically 4.The data studied is complete and relevant Forms of Assessment : Participatory Activities, Project Results Assessment / Product Assessment, Portfolio Assessment, Practice / Performance	2 x 50 group discussions and presentations	2 x 50 group discussions and presentations	Material: topic articles on the application of medical midwife material. Library: up to date international journal articles related to the medical field	30%

Evaluation Percentage Recap: Project Based Learning

No	Evaluation	Percentage
1.	Participatory Activities	31.68%
2.	Project Results Assessment / Product Assessment	19.17%
3.	Portfolio Assessment	25.68%
4.	Practical Assessment	4%
5.	Practice / Performance	16.51%
		97.04%

Notes

- 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.
- 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.
- 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.
- 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.
- 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.
- 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.
- Forms of assessment:** test and non-test.
- 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.
- 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.
- Learning materials** are details or descriptions of study materials which can be presented in the form of several main points and sub-topics.
- 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%.
- TM=Face to face, PT=Structured assignments, BM=Independent study.

