| | Universitas Negeri Surabaya<br>Faculty of Mathematics and Natural Sciences<br>Undergraduate Physics Study Program | Document Code |
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# SEMESTER LEARNING PLAN

| Courses | CODE | Course Family | Credit Weight | | | SEMESTER | Compilation Date |
|---|---|---|---|---|---|---|---|
| Optics | 4520102149 | Compulsory Study Program Subjects | T=2 | P=0 | ECTS=3.18 | 5 | November 30, 2019 |

| AUTHORIZATION | SP Developer | Course Cluster Coordinator | Study Program Coordinator |
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| | Dr. Muhimmatul Khoiro, S.Si. | Dr. Titin Sunarti, M.Si. | Prof. Dr. Munasir, S.Si., M.Si. |

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| **Learning model** | **Project Based Learning** | |
| **Program Learning Outcomes (PLO)** | **PLO study program that is charged to the course** | |
| | **PLO-11** | Design and conduct experiments in physics learning by applying scientific methods |
| | **PLO-13** | Demonstrate knowledge of Classical Physics and Modern Physics |
| | **Program Objectives (PO)** | |
| | **PO - 1** | Students are able to apply the physical optics system to Huygens' principles and equations |
| | **PO - 2** | Students are able to apply basic concepts of physical optics to interference (wavefront splitting interferometers and amplitude splitting). |
| | **PO - 3** | Students are able to apply physical optics to various diffraction systems (Fresnell, Frounthoufer, single slit and diffraction grating). |
| | **PO - 4** | Students are able to apply the polarization system to optical systems |
| | **PO - 5** | Students are able to apply geometric optics systems to Fermat's principles of reflection and refraction |
| | **PO - 6** | Students are able to apply the concept of geometric optics to optical instruments |
| | **PO - 7** | Students are able to apply light propagation systems in media and between media |
| | **PLO-PO Matrix** | |

| P.O | PLO-11 | PLO-13 |
|---|---|---|
| PO-1 | | |
| PO-2 | | |
| PO-3 | | |
| PO-4 | | |
| PO-5 | | |
| PO-6 | | |
| PO-7 | | |

**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 | | | | | | | | | | | | | | | | |

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| **Short Course Description** | Lecture material includes the concept of light according to classical and modern views, the process of generating light measurements, concepts of geometric optics, Matrix Methods in optics, working principles of optical instrumentation, wave superposition, light interference phenomena, light polarization, light diffraction, multi-layer films, equations Fresnel, working principles of lasers, optical waveguides, and Non-Linear Optics. Learning is carried out using material presentation methods, discussions, laboratory practice, problem solving and assignments. |
| **References** | **Main :** |
| | 1. Hecht, E., 2012. Optics. Pearson Education. India.<br>2. Pedrotti, F.L., Pedrotti, L.M. and Pedrotti, L.S., 2017. Introduction to optics. Cambridge University Press. |
| | **Supporters:** |
| | 1. Keiser, G., 2000. Optical fiber communications (Vol. 2). New York: McGraw-Hill.<br>2. Jenkins, F.A., 1976. Fundamentals of Optics: By Francis A. Jenkins and Harvey E. White (No. 535 J45 1950.). McGraw-Hill.<br>3. Walker, J., Resnick, R. and Halliday, D., 2014. Halliday and resnick fundamentals of physics. Wiley.<br>4. Bueche, F.J. and Jerde, D.A., 1995. Principles of physics (Vol. 6). New York: McGraw-Hill.<br>5. Giancoli, D.C., 2005. Physics: principles with applications (Vol. 1). Pearson Educación. |
| **Supporting lecturer** | Dr. Titin Sunarti, M.Si.<br>Setyo Admoko, S.Pd., M.Pd.<br>Dr. Rohim Aminullah Firdaus, S.Pd, M.Si<br>Dr. Muhimmatul Khoiro, S. 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** | Able to analyze geometric optics on the Fermat principle of reflection and refraction | 1. Explain Newton's corpuscular theory and Huygen's wave theory of light<br>2. Explain and analyze geometric optics on the Fermat principle of reflection<br>3. Explain the concept of geometric optics based on the Fermat principle of refraction | **Criteria:** Quantitative<br><br>**Form of Assessment** : Participatory Activities | Lectures, Questions and Answers, Discussions and Presentations 100 minutes | Lectures, Questions and Answers, Discussions and Presentations 100 minutes | **Material:** Introduction to optics, History of optics, Particle-wave dualism, Optical spectrum<br>**Bibliography:** *Hecht, E., 2012. Optics. Pearson Education. India.* | 3% |
| **2** | Able to master the concept of light propagation in media and between media | Be able to explain reflection and refraction on a flat surface | **Criteria:** Quantitative<br><br>**Form of Assessment** : Participatory Activities | Lectures, Questions and Answers, Discussions and Presentations 100 minutes | Lectures, Questions and Answers, Discussions and Presentations 100 minutes | **Material:** Reflection in a plane mirror, refraction in different media<br>**Reference:** *Hecht, E., 2012. Optics. Pearson Education. India.* | 3% |

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| **3** | Able to master the concept of light propagation in media and between media | Be able to explain reflection and refraction on a flat surface | **Criteria:** Quantitative<br><br>**Form of Assessment** : Participatory Activities | Lectures, Questions and Answers, Discussions and Presentations 100 minutes | Lectures, Questions and Answers, Discussions and Presentations 100 minutes | **Material:** Light propagation in parallel plane glass and prisms **Reference:** *Hecht, E., 2012. Optics. Pearson Education. India.* | 3% |
| **4** | Able to master reflection and refraction on curved surfaces | Be able to explain reflection and refraction on curved surfaces | **Criteria:** Quantitative<br><br>**Form of Assessment** : Participatory Activities | Lectures, Questions and Answers, Discussions and Presentations 100 minutes | Lectures, Questions and Answers, Discussions and Presentations 100 minutes | **Material:** Light propagation in curved mirrors **Reference:** *Hecht, E., 2012. Optics. Pearson Education. India.* | 3% |
| **5** | Able to master reflection and refraction on curved surfaces | Be able to explain reflection and refraction on curved surfaces | **Criteria:** Quantitative<br><br>**Form of Assessment** : Participatory Activities | Lectures, Questions and Answers, Discussions and Presentations 100 minutes | Lectures, Questions and Answers, Discussions and Presentations 100 minutes | **Material:** Light propagation in thin lenses and thick lenses **References:** *Hecht, E., 2012. Optics. Pearson Education. India.* | 3% |
| **6** | Able to master reflection and refraction on curved surfaces | Be able to explain reflection and refraction on curved surfaces | **Criteria:** Quantitative<br><br>**Forms of Assessment** : Participatory Activities, Project Results Assessment / Product Assessment | Lectures, Questions and Answers, Discussions and Presentations 100 minutes | Lectures, Questions and Answers, Discussions and Presentations 100 minutes | **Material:** Light propagation on spherical surfaces **References:** *Hecht, E., 2012. Optics. Pearson Education. India.* | 4% |
| **7** | Able to master the concept of optical instruments | Able to explain the working principles of optical instruments | **Criteria:** Quantitative<br><br>**Forms of Assessment** : Participatory Activities, Project Results Assessment / Product Assessment | Lectures, Questions and Answers, Discussions and Presentations 100 minutes | Lectures, Questions and Answers, Discussions and Presentations 100 minutes | **Material:** Optical tools: loupe, microscope, binoculars, telescope **Reference:** *Hecht, E., 2012. Optics. Pearson Education. India.* | 4% |
| **8** | Able to master and analyze the principles and concepts of geometric optics and optical instruments | Able to understand and solve USS questions that are relevant to geometric optics teaching material | **Criteria:** Quantitative<br><br>**Form of Assessment** : Project Results Assessment / Product Assessment | 100 minute written test | 100 minute written test | **Material:** UTS Material **Reference:** *Hecht, E., 2012. Optics. Pearson Education. India.* | 20% |
| **9** | Able to explain wave superposition | 1. Able to explain the concept of superposition of two wave sources<br>2. Able to apply the concept of superposition to explain various related phenomena | **Criteria:** Quantitative<br><br>**Forms of Assessment** : Participatory Activities, Project Results Assessment / Product Assessment | 100 minutes of questions and answers, discussions and presentations | 100 minutes of questions and answers, discussions and presentations | **Material:** Superposition of optical waves **References:** *Hecht, E., 2012. Optics. Pearson Education. India.* | 4% |

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| **10** | Able to explain and apply the phenomenon of light interference, | Explain the concept of physical optics in the phenomenon of light interference | **Criteria:**<br>Quantitative<br><br>**Forms of Assessment** :<br>Participatory Activities, Project Results Assessment / Product Assessment | 100 minutes of questions and answers, discussions and presentations | 100 minutes of questions and answers, discussions and presentations | **Material:**<br>Light interference phenomena,<br>**Reference:**<br>*Hecht, E., 2012. Optics. Pearson Education. India.* | 4% |
| **11** | Able to master the concept of physical optics in diffraction | 1. Able to explain the concept of physical optics in Fresnell diffraction<br>2. Able to explain the concept of physical optics in Frounthoufer diffraction | **Criteria:**<br>Quantitative<br><br>**Forms of Assessment** :<br>Participatory Activities, Project Results Assessment / Product Assessment | 100 minutes of questions and answers, discussions and presentations | 100 minutes of questions and answers, discussions and presentations | **Material:**<br>Fresnell and Frounthoufer Diffraction<br>**References:**<br>*Hecht, E., 2012. Optics. Pearson Education. India.* | 3% |
| **12** | Able to master the concept of physical optics in diffraction | Able to explain the concept of physical optics in single slit diffraction and diffraction gratings | **Criteria:**<br>Quantitative<br><br>**Forms of Assessment** :<br>Participatory Activities, Project Results Assessment / Product Assessment | 100 minutes of questions and answers, discussions and presentations | 100 minutes of questions and answers, discussions and presentations | **Material:**<br>Single slit and grating diffraction<br>Reference<br>**:** *Hecht, E., 2012. Optics. Pearson Education. India.* | 4% |
| **13** | Able to master the concept of physical optics on polarization | Able to explain the concept of physical optics on polarization | **Criteria:**<br>Quantitative<br><br>**Forms of Assessment** :<br>Participatory Activities, Project Results Assessment / Product Assessment | 100 minutes of questions and answers, discussions and presentations | 100 minutes of questions and answers, discussions and presentations | **Material:**<br>Light Polarization<br>**References:**<br>*Hecht, E., 2012. Optics. Pearson Education. India.* | 4% |
| **14** | Able to understand the application of optics to lasers and fiber optics | 1. Be able to mention the working principle process for making a laser<br>2. Able to understand the characteristics of laser light | **Criteria:**<br>Quantitative<br><br>**Forms of Assessment** :<br>Participatory Activities, Project Results Assessment / Product Assessment | 100 minutes of questions and answers, discussions and presentations | 100 minutes of questions and answers, discussions and presentations | **Material:**<br>Laser<br>**Library:**<br>*Hecht, E., 2012. Optics. Pearson Education. India.* | 4% |
| **15** | Able to understand the application of optics to lasers and fiber optics | 1. Able to understand various optical properties of materials<br>2. Able to understand various optical properties of materials for various applications | **Criteria:**<br>Quantitative<br><br>**Forms of Assessment** :<br>Participatory Activities, Project Results Assessment / Product Assessment | 100 minutes of questions and answers, discussions and presentations | 100 minutes of questions and answers, discussions and presentations | **Material:**<br>Optical Fiber and Other Optical Applications<br>**Reference:**<br>*Hecht, E., 2012. Optics. Pearson Education. India.* | 4% |
| **16** | Able to understand optical concepts in the application of optical technology | Able to understand various optical properties of materials | **Criteria:**<br>Quantitative<br><br>**Form of Assessment** :<br>Project Results Assessment / Product Assessment | Preparation and presentation of a scientific paper<br>100 minutes | Preparation and presentation of a scientific paper<br>100 minutes | **Material:**<br>Modern Optics<br>**Bibliography:**<br>*Hecht, E., 2012. Optics. Pearson Education. India.* | 30% |

**Evaluation Percentage Recap: Project Based Learning**

| No | Evaluation | Percentage |
|---|---|---|
| 1. | Participatory Activities | 32.5% |
| 2. | Project Results Assessment / Product Assessment | 67.5% |
| | | 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.