	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
Opto Electronics	4520102150	Study Program Elective Courses	T=2	P=0	ECTS=3.18	6	November 1, 2019

AUTHORIZATION	SP Developer	Course Cluster Coordinator	Study Program Coordinator
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Learning model: Project Based Learning

Program Learning Outcomes (PLO)

PLO study program which is charged to the course

PLO-10	Analyze physical systems by applying mathematics and computing/ICT tools.
PLO-14	Formulate physical systems as physical models using mathematics

Program Objectives (PO)

PO - 1	Students are able to apply the concept of light sources as components of semiconductors, LEDs and lasers.
PO - 2	Students are able to apply path and phase difference equations in uniaxial crystals to uniaxial anisotropic crystals.
PO - 3	Students are able to apply electro-optical modulator systems, magneto-optic and acousto-optic properties as optoelectronic components
PO - 4	Students are able to apply the waveguide guidance process on step index & graded index optical fibers as a power divider or switching in an integrated optical system
PO - 5	Students are able to apply optoelectronic applications to cathode ray tubes (CRT), CRT screens, LCDs and their applications in the fields of industrial telecommunications, instrumentation and photonics.

PLO-PO Matrix

P.O	PLO-10	PLO-14
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: Optoelectronics is a branch of science that studies electronic devices related to light and is also considered a sub-field of photonics. In this context, the light studied also includes all the spectrum of light in electromagnetic waves (electromagnetic spectrum) such as gamma rays, alpha rays, X-rays, ultraviolet and infrared, which are forms of invisible radiation other than the light visible to the normal human eye (visible spectrum) as well as laser light. In this branch of science, the advantages found in combining the fields of optics and electronics are the ability to produce much better and more useful equipment, especially those related to fiber optic telecommunications technology itself.

References

Main :

1. Yudoyono, G. 2001 Lecture Notes on Optoelectronics. Unpublished work
2. Singh, J., 1996. Optoelectronics: An introduction to materials and devices. McGraw-Hill College.
3. Kumpulan artikel dari berbagai jurnal internasional yang cakupannya dibidang material optics-optoelectronics dan yang relevan, yang memiliki aspek kebaharuan pada bidang komunikasi, intrumentasi dan fotonik.

Supporters:

1. Yariv, A., 1991. Optical Electronics: Saunders College. California Institute of Technology, pp.519-524.
2. Gao, J., 2011. Optoelectronic integrated circuit design and device modeling. John Wiley & Sons.
3. Wilson, J. and Hawkes, J.F., 1989. Optoelectronics-an introduction. Optoelectronics-An introduction (2nd edition). University of Northumbria. Newcastle
4. Bhattacharya, P., 1997. Semiconductor optoelectronic devices. Prentice-Hall, Inc.
5. Alferness, R.C., Burns, W.K., Donelly, J.F., Kaminow, I.P., Kogelnik, H., Leonberger, F.J., Milton, A.F., Tamir, T. and Tucker, R.S., 2013. Guided-wave optoelectronics (Vol. 26). Springer Science & Business Media.

Supporting lecturer	Dzulkiflih, S.Si., M.T. Dr. Rohim Aminullah Firdaus, S.Pd, M.Si 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 master the concept of various light sources in opto-electronic systems	1.Explain the basic concepts of semiconductors and pn junctions 2.Explains LED and laser technology 3.Explain the important role of EM waves in everyday life	**Criteria:** 1.Able to explain the working principles of PN junctions based on semiconductor concepts clearly and in detail 2.Able to explain the formation of light in LED and laser technology systematically and in detail 3.Be able to name several applications for using EM waves correctly **Form of Assessment** : Participatory Activities	Lectures, questions and answers, discussions and presentations 2 x 50 minutes	Lectures, questions and answers, discussions, presentations and watching 2 x 50 minute learning videos	**Material:** LIGHT SOURCES: Semiconductors, PN Junction, LED (Light Emitting Diode), Laser **Library:** *Yudoyono, G. 2001 Lecture Notes on Optoelectronics. Unpublished work*	3%
2	Able to master the concept of various light sources in opto-electronic systems	1.Explain the basic concepts of semiconductors and pn junctions 2.Explains LED and laser technology 3.Explain the important role of EM waves in everyday life	**Criteria:** 1.Able to explain the working principles of PN junctions based on semiconductor concepts clearly and in detail 2.Able to explain the formation of light in LED and laser technology systematically and in detail 3.Be able to name several applications for using EM waves correctly **Form of Assessment** : Participatory Activities	Lectures, questions and answers, discussions and presentations 2 x 50 minutes	Lectures, questions and answers, discussions, presentations and watching 2 x 50 minute learning videos	**Material:** LIGHT SOURCES: Semiconductors, PN Junction, LED (Light Emitting Diode), Laser **Library:** *Yudoyono, G. 2001 Lecture Notes on Optoelectronics. Unpublished work*	4%
3	Able to master the characteristics of modulation, light and technological developments for optoelectronics	1.Explain the properties of electro-optics, magneto-optics, and acousto-optics. 2.Briefly explain the three properties of optical materials that can be used as modulators. 3.Explain the benefits of the properties of these materials in applications with mechanical devices.	**Criteria:** 1.Able to state the properties of materials in electro-optic, magneto-optic and acousto-optic phenomena in detail 2.Able to explain the working principles of modulators of the three properties of optical materials systematically and clearly 3.Able to fully state the benefits of optical material properties in mechanical device applications **Form of Assessment** : Participatory Activities, Project Results Assessment / Product Assessment	Lectures, questions and answers, discussions and presentations 2 x 50 minutes	Lectures, questions and answers, discussions, presentations and watching 2 x 50 minute learning videos	**Material:** LIGHT MODULATION: Double Refraction and Optical Activity **References:** *Yudoyono, G. 2001 Lecture Notes on Optoelectronics. Unpublished work*	3%

4	Able to master the characteristics of modulation, light and technological developments for optoelectronics	1. Explain the properties of electro-optics, magneto-optics, and acousto-optics. 2. Briefly explain the three properties of optical materials that can be used as modulators. 3. Explain the benefits of the properties of these materials in applications with mechanical devices.	**Criteria:** 1. Able to state the properties of materials in electro-optic, magneto-optic and acousto-optic phenomena in detail 2. Able to explain the working principles of modulators of the three properties of optical materials systematically and clearly 3. Able to fully state the benefits of optical material properties in mechanical device applications **Form of Assessment** : Participatory Activities, Project Results Assessment / Product Assessment	Lectures, questions and answers, discussions and presentations 2 x 50 minutes	Lectures, questions and answers, discussions, presentations and watching 2 x 50 minute learning videos	**Material:** LIGHT MODULATION: Double Refraction and Optical Activity **References:** *Yudoyono, G. 2001 Lecture Notes on Optoelectronics. Unpublished work*	4%
5	Able to master the characteristics of modulation, light and technological developments for optoelectronics	1. Explain the properties of electro-optics, magneto-optics, and acousto-optics. 2. Briefly explain the three properties of optical materials that can be used as modulators. 3. Explain the benefits of the properties of these materials in applications with mechanical devices.	**Criteria:** 1. Able to state the properties of materials in electro-optic, magneto-optic and acousto-optic phenomena in detail 2. Able to explain the working principles of modulators of the three properties of optical materials systematically and clearly 3. Able to fully state the benefits of optical material properties in mechanical device applications **Form of Assessment** : Participatory Activities, Project Results Assessment / Product Assessment	Lectures, questions and answers, discussions and presentations 2 x 50 minutes	Lectures, questions and answers, discussions, presentations and watching 2 x 50 minute learning videos	**Material:** LIGHT MODULATION: Double Refraction and Optical Activity **References:** *Yudoyono, G. 2001 Lecture Notes on Optoelectronics. Unpublished work*	3%
6	Able to master several other materials that can be used as optical modulators	1. Explain the properties of electro-optics, magneto-optics, and acousto-optics. 2. Briefly explain the three properties of optical materials that can be used as modulators. 3. Explain the benefits of the properties of these materials in applications with mechanical devices.	**Criteria:** 1. Able to state the properties of materials in electro-optic, magneto-optic and acousto-optic phenomena in detail 2. Able to explain the working principles of modulators of the three properties of optical materials systematically and clearly 3. Able to fully state the benefits of optical material properties in mechanical device applications **Form of Assessment** : Participatory Activities, Project Results Assessment / Product Assessment	Lectures, questions and answers, discussions and presentations 2 x 50 minutes	Lectures, questions and answers, discussions, presentations and watching 2 x 50 minute learning videos	**Material:** LIGHT MODULATION: Double Refraction and Optical Activity **References:** *Yudoyono, G. 2001 Lecture Notes on Optoelectronics. Unpublished work*	3%

7	Able to master several other materials that can be used as optical modulators	1.Explain the properties of electro-optics, magneto-optics, and acousto-optics. 2.Briefly explain the three properties of optical materials that can be used as modulators. 3.Explain the benefits of the properties of these materials in applications with mechanical devices.	**Criteria:** 1.Able to state the properties of materials in electro-optic, magneto-optic and acousto-optic phenomena in detail 2.Able to explain the working principles of modulators of the three properties of optical materials systematically and clearly 3.Able to fully state the benefits of optical material properties in mechanical device applications **Form of Assessment** : Participatory Activities, Project Results Assessment / Product Assessment	Lectures, questions and answers, discussions and presentations 2 x 50 minutes	Lectures, questions and answers, discussions, presentations and watching 2 x 50 minute learning videos	**Material:** LIGHT MODULATION: Double Refraction and Optical Activity **References:** *Yudoyono, G. 2001 Lecture Notes on Optoelectronics. Unpublished work*	4%
8	Able to understand the use of optoelectronic material regarding light sources and optical modulation	Can solve problems regarding light sources and light modulation cases	**Criteria:** Able to solve problems regarding light sources and light modulation in detail, complete and clear **Form of Assessment** : Project Results Assessment / Product Assessment	Work on questions in the form of optoelectronics cases 2 x 50 minutes	Work on questions in the form of optoelectronics cases 2 x 50 minutes	**Material:** OPTICAL MODULATION: Electro-optics, Magneto-optics, Acousto-optics **References:** *Yudoyono, G. 2001 Lecture Notes on Optoelectronics. Unpublished work*	20%
9	Able to explain the application of waveguides as transmission media for optoelectronic systems	1.Explains the transmission medium, light from a light source to be captured by the detector. 2.Explain several transmission media used in optoelectronic systems. 3.Explain the application of waveguides in their role in the field of integrated communications/optics	**Criteria:** 1.able to explain the transmission medium, light from the light source to be captured by the detector clearly and in detail 2.able to explain several transmission media used in optoelectronic systems and waveguide applications clearly and in detail **Form of Assessment** : Participatory Activities, Project Results Assessment / Product Assessment	Lectures, questions and answers, discussions and presentations 2 x 50 minutes	Lectures, questions and answers, discussions, presentations and watching 2 x 50 minute learning videos	**Material:** WAVEGUIDES: Total Internal Reflection, Planar Dielectric Waveguides, Fiber Optic Waveguides, Integrated Optics **References:** *Yudoyono, G. 2001 Lecture Notes on Optoelectronics. Unpublished work*	4%
10	Able to explain the application of waveguides as transmission media for optoelectronic systems	1.Explains the transmission medium, light from a light source to be captured by the detector. 2.Explain several transmission media used in optoelectronic systems. 3.Explain the application of waveguides in their role in the field of integrated communications/optics	**Criteria:** 1.capable of transmission media, light from the light source to be captured by the detector section clearly 2.able to explain several transmission media used in optoelectronic systems and waveguide applications in their role in the field of integrated communications/optics **Form of Assessment** : Participatory Activities, Project Results Assessment / Product Assessment	Lectures, questions and answers, discussions and presentations 2 x 50 minutes	Lectures, questions and answers, discussions, presentations and watching 2 x 50 minute learning videos	**Material:** WAVEGUIDES: Total Internal Reflection, Planar Dielectric Waveguides, Fiber Optic Waveguides, Integrated Optics **References:** *Yudoyono, G. 2001 Lecture Notes on Optoelectronics. Unpublished work*	4%
11	Able to explain the application of waveguides as transmission media for optoelectronic systems	1.Explains the transmission medium, light from a light source to be captured by the detector. 2.Explain several transmission media used in optoelectronic systems. 3.Explain the application of waveguides in their role in the field of integrated communications/optics	**Criteria:** 1.able to explain the transmission medium, light from the light source to be captured by the detector clearly and in detail 2.able to explain several transmission media used in optoelectronic systems and waveguide applications clearly and in detail **Form of Assessment** : Participatory Activities, Project Results Assessment / Product Assessment	Lectures, questions and answers, discussions and presentations 2 x 50 minutes	Lectures, questions and answers, discussions, presentations and watching 2 x 50 minute learning videos	**Material:** WAVEGUIDES: Total Internal Reflection, Planar Dielectric Waveguides, Fiber Optic Waveguides, Integrated Optics **References:** *Yudoyono, G. 2001 Lecture Notes on Optoelectronics. Unpublished work*	4%

12	Able to analyze the function of opto electronic system detectors	1.Discuss and understand optical detectors as one component of optoelectronic systems 2.Explain the types of detectors related to changing light intensity into electrical quantities.	**Criteria:** 1.able to explain optical detectors as one component of optoelectronic systems clearly and in detail 2.able to explain the types of detectors related to changes in light intensity into electrical quantities correctly **Form of Assessment** : Participatory Activities, Project Results Assessment / Product Assessment	Lectures, questions and answers, discussions and presentations 2 x 50 minutes	Lectures, questions and answers, discussions, presentations and watching 2 x 50 minute learning videos	**Material:** PHOTODETEKTOR: Thermal detector and photon detector **Reference:** *Yudoyono, G. 2001 Lecture Notes on Optoelectronics. Unpublished work*	3%
13	Able to analyze the function of opto electronic system detectors	1.Discuss and understand optical detectors as one component of optoelectronic systems 2.Explain the types of detectors related to changing light intensity into electrical quantities.	**Criteria:** 1.able to explain optical detectors as one component of an optoelectronic system correctly 2.able to explain the types of detectors related to changes in light intensity into electrical quantities clearly and in detail **Form of Assessment** : Participatory Activities, Project Results Assessment / Product Assessment	Lectures, questions and answers, discussions and presentations 2 x 50 minutes	Lectures, questions and answers, discussions, presentations and watching 2 x 50 minute learning videos	**Material:** PHOTODETEKTOR: Thermal detector and photon detector **Reference:** *Yudoyono, G. 2001 Lecture Notes on Optoelectronics. Unpublished work*	4%
14	Able to master and design optoelectronic system display devices	1.Explains the data transmission system from a system to the visual/information media owned by a system properly 2.Explain the role of display devices in life in all fields. Explain active and passive display devices correctly	**Criteria:** 1.able to explain the data transmission system from a system to the visual/information media owned by a system 2.able to explain the role of display devices in life in all fields. Explain active and passive display devices. **Form of Assessment** : Participatory Activities, Project Results Assessment / Product Assessment	Lectures, questions and answers, discussions and presentations 2 x 50 minutes	Lectures, questions and answers, discussions, presentations and watching 2 x 50 minute learning videos	**Material:** DISPLAY DEVICES: Luminescen Cathode Ray Tube (CRT), Light Emitting Diode (LED), Liquid Crystal Display (LCD) **References:** *Yudoyono, G. 2001 Lecture Notes on Optoelectronics. Unpublished work*	3%
15	Able to master and design optoelectronic system display devices	1.Explains the data transmission system from a system to the visual/information media owned by a system 2.Explain the role of display devices in life in all fields. Explain active and passive display devices.	**Criteria:** 1.able to explain the data transmission system from a system to the visual/information media owned by a system clearly and in detail 2.capable of the role of display devices in life in all fields. Explain active and passive display devices correctly **Form of Assessment** : Participatory Activities, Project Results Assessment / Product Assessment	Lectures, questions and answers, discussions and presentations 2 x 50 minutes	Lectures, questions and answers, discussions, presentations and watching 2 x 50 minute learning videos	**Material:** DISPLAY DEVICES: Luminescen Cathode Ray Tube (CRT), Light Emitting Diode (LED), Liquid Crystal Display (LCD) **References:** *Yudoyono, G. 2001 Lecture Notes on Optoelectronics. Unpublished work*	4%

16	Able to master and design optoelectronic system display devices	1. Explains the data transmission system from a system to the visual/information media owned by a system 2. Explain the role of display devices in life in all fields. Explain active and passive display devices.	**Criteria:** 1. able to explain the data transmission system from a system to the visual/information media owned by a system correctly 2. able to explain the role of display devices in life in all fields. Explain active and passive display devices clearly and in detail **Form of Assessment** : Assessment of Project Results / Product Assessment, Practices / Performance	Lectures, questions and answers, discussions and presentations 2 x 50 minutes	Lectures, questions and answers, discussions, presentations and watching 2 x 50 minute learning videos	**Material:** DISPLAY DEVICES: Luminescen Cathode Ray Tube (CRT), Light Emitting Diode (LED), Liquid Crystal Display (LCD) **References:** *Yudoyono, G. 2001 Lecture Notes on Optoelectronics. Unpublished work*	30%

Evaluation Percentage Recap: Project Based Learning

No	Evaluation	Percentage
1.	Participatory Activities	28.5%
2.	Project Results Assessment / Product Assessment	56.5%
3.	Practice / Performance	15%
		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.