Mencerdaskan &
Memartabatkan Bangsa

MODUL DESCRIPTION

Master Degree of Physics Education

Faculty of Mathematics and Natural Science
Jakarta State University

2023

Daftar Isi

Module Description

Module tittle	Course Module of Advanced Electrodynamics
Persons responsible for each module	Prof. Dr. Mangasi Alion Marpaung
Teaching Methods	Teaching methods used in this course are: - Lecture (i.e., case-based learning, cooperative learning, and blended learning) - Structured assignments (i.e., essays and case study) - Practice (i.e., computer simulation and case study in laboratorium) The class size for lecture is 20 students. Contact hours for lecture is 26.67 hours, assignments are 64 hours, and privat study is 64 hours
Credits and Workload	Credit points : 5.2 ECTS For this course, students required to meet a minimum of 154.67 hours in one semester, which consist of: 26.67 hours for lecture, 64 hours for structured assignments, 64 hours for private study,
Intended Learning Outcomes	PLO 2 Master advanced knowledge of classical physics and modern physics PLO 4 Able to develop learning aids by utilizing advanced information technology and the student environment.
Module Content	**Students will learn about:** This course is a compulsory course that discusses the essential concepts of electrodynamics and their application in more depth. The discussion covers the phenomena of electricity, magnetism, electromagnetic induction, electromagnetic wave radiation and their interactions in materials. It also discusses how to apply it in everyday life and today's technology. Lectures will be held with a case-based learning approach. Mastery of this study will help students improve their knowledge, take other related scientific lectures, and develop themselves professionally in the field of physics education.
Admission and examination	**Admission and examination requirements:** - Students must attend 15 minutes before the class starts.

requirements	- Students must switch off all electronic devices. - Students must inform the lecturer if they will not attend the class due to sickness, etc. - Students must submit all class assignments before the deadline. - Students must attend the exam to get final grade.
Forms of exams and details explaining how to the modolue mark is calculate	**Form of examination:** Essay, Projects, and Written Exam **Form of Assasement:** Assessment of the learning process follows the following components: attendance 5%; assignments and presentations 30%; mid-test 30%, and final-test 35%.
Recommended Literature	1. D J Griffiths (1999) Introduction of Electrodynamics, Prentise Hall [Griffiths] 2. J Vanderlinde (2004) Classical Electromagnetic Theory 2 nd Ed., Kluwer Academic [Vanderlinde] 3. J D Jackson (1998) Clasical Electrodinamics 3 rd ed., John Wiley [Jackson
Date of Last Amendment	November 13th, 2018

Module Description

Module tittle	Course Module of Advanced Mechanics
Persons responsible for each module	Prof. Dr. Mangasi Alion Marpaung
Teaching Methods	Teaching methods used in this course are: - Lecture (i.e., case-based learning, cooperative learning, and blended learning) - Structured assignments (i.e., essays and case study) - Practice (i.e., computer simulation and case study in laboratorium) The class size for lecture is 20 students. Contact hours for lecture is 26.67 hours, assignments are 64 hours, and privat study is 64 hours
Credits and Workload	Credit points : 5.2 ECTS For this course, students required to meet a minimum of 154.67 hours in one semester, which consist of: 26.67 hours for lecture, 64 hours for structured assignments, 64 hours for private study,
Intended Learning Outcomes	PLO 2 Master advanced knowledge of classical physics and modern physics PLO 4 Able to develop learning aids by utilizing advanced information technology and the student environment.
Module Content	**Students will learn about:** This course is a compulsory course that discusses the essential concepts of classical mechanics in more depth. Study material includes the development of classical mechanics and its applications, Newtonian mechanics – particle motion, oscillations, methods in the calculus of variations, Lagrangian and Hamiltonian mechanics, gravity and central force, dynamics of particle systems, motion in non-inertial frames, dynamics of rigid bodies, and continuous systems : wave equation. Furthermore, to provide a factual understanding, students will be provided with the latest topics on classical mechanics and issues in physics education. Lectures will be conducted using a case-based blended learning approach.

	Mastery of this study will help students improve their knowledge, take other related scientific lectures, and develop themselves professionally in the field of physics education.
Admission and examination requirements	**Admission and examination requirements:** - Students must attend 15 minutes before the class starts. - Students must switch off all electronic devices. - Students must inform the lecturer if they will not attend the class due to sickness, etc. - Students must submit all class assignments before the deadline. - Students must attend the exam to get final grade.
Forms of exams and details explaining how to the modolue mark is calculate	**Form of examination:** Essay, Projects, and Written Exam **Form of Assasement:** Assessment of the learning process follows the following components: attendance 5%; assignments and presentations 30%; mid-test 30%, and final-test 35%.
Recommended Literature	1. S T Thornton and J B Marion (2004) Classical Dynamics of Particles and Systems 5 th Ed., Brooks/Cole [Thornton] 2. G R Fowles and G L Cassiday (2005) Analytical Mechanics 7 th Ed., Brooks/Cole [Fowles] 3. A Bettini (2016) A Course in Classical Physics 2—Fluids and Thermodynamics, Springer [Bettini] 4. M L Boas (2005) Mathematical Methods in the Physical Sciences 3 rd Ed., Wiley [Boas]
Date of Last Amendment	June 14th, 2018

Module Description

Module tittle	Course Module of Physics Learning Innovation
Persons responsible for each module	Prof. Dr. I Made Astra, M.Si
Teaching Methods	Teaching methods used in this course are: - Lecture (i.e., group investigation, small group discussion, casestudy, and video-based learning) - Structured assignments (i.e., essays and case studies) - Project-based Learning The class size for the lecture is 20 students. Contact hours for the lecture is 26.67 hours, assignments are 64.00 hours, and private study is 64.00 hours.
Credits and Workload	Credit points : 5.2 ECTS For this course, students required to meet a minimum of 154.67 hours in one semester, which consist of: 26.67 hours for lecture, 64 hours for structured assignments, 64 hours for private study,
Intended Learning Outcomes	PLO 2. Master advanced knowledge of classical physics and modern physics PLO 3. Able to design innovative physics learning in accordance with the demands of the curriculum by using appropriate evaluation and assessment techniques. PL0 8. Able to produce scientific articles that have novelty, and publish them in accredited national scientific journals, proceedings of international seminars, or international journals.
Module Content	**Students will learn about:** This course aims to discuss the concept of learning and learning, various learning innovations, and their application in learning physics. Topics discussed include: learning theory and learning philosophy, psychological factors and student development towards learning, multiple intelligence theory, content standards (curriculum) that are relevant to the demands of the National Education Standards, learning models, learning management (determining strategies,

	approaches, methods , and learning models), components of classroom management and physics teaching and learning interactions, and field studies. Lectures will be held with a case-based learning approach. Through this lecture, it is hoped that students will be able to increase advanced knowledge in science, innovation, and develop their professionalism in the field of physics education.
Admission and examination requirements	**Admission and examination requirements:** - Students must attend 15 minutes before the class starts. - Students must switch off all electronic devices. - Students must inform the lecturer if they will not attend the class due to sickness, etc. - Students must submit all class assignments before the deadline. - Students must attend the exam to get final grade.
Forms of exams and details explaining how to the modolue mark is calculate	**Form of examination:** Project and Presentation **Form of Assasement:** Assessment of the learning process follows the following components: attendance 5%; assignments and presentations 30%; mid-test 30%, and final-test 35%.
Recommended Literature	1. --Walter Dick, Lou Carey, James O Carey (2015) 2. The Systematic Design of Instructional 8th Edition, Pearson, New York Arends, R. I. (2014). 3. Learning to Teach. New York: McGraw-Hill Companies, Inc. Mc Loughlin, Eilish, dan Van Kampen, Paul (2019) 4. Concepts, Strategies and models to enhance physics teaching and learning, Springer. Hassard, J (2018) 5. The Art of Teaching Science: Inquiry and Innovation in Middle School and Secondary High School, New York: Oxford University Press. 6 Don Lincoln (2019) 6. Understanding the Misconceptions of Science. The Teaching Company. Kemmdikbud, Permendikbud No. 37 Tahun 2018 - Perubahan KI KD K13.
Date of Last Amendment	June 15th, 2018

Module Description

Module tittle	Course Module of Physics Learning Curriculum and Design
Persons responsible for each module	Prof. Dr. Sunaryo
Teaching Methods	- Lecture (i.e., group investigation, small group discussion, andragogy approach, collaborative learning, and video-based learning) - Structured assignments (i.e., essays and case study) The class size for lecture is 20 students. Contact hours for lecture is 26.67 hours, assignments are 64 hours, and privat study is 64 hours.
Credits and Workload	Credit points : 5.2 ECTS For this course, students required to meet a minimum of 154.67 hours in one semester, which consist of: 26.67 hours for lecture, 64 hours for structured assignments, 64 hours for private study,
Intended Learning Outcomes	PLO 2 Master advanced knowledge of classical physics and modern physics PLO 5. Able to propose various alternative solutions to the problems of physics education with inter- and multidisciplinary approaches.
Module Content	**Students will learn about:** This course aims to discuss the general education curriculum, both nationally and internationally, and its implementation in designing a physics learning curriculum. Topics discussed in this course include: curriculum conception, certification and curriculum, curriculum development principles, curriculum development methods, curriculum implementation in learning, curriculum as a scientific discipline, studies of the National curriculum, international curriculum, and current issues about curriculum development and physics learning design. Learning strategies and evaluation systems in developed countries will also be discussed as case studies. Students will be trained in a guided manner how to design a physics curriculum in schools as part of the learning process. Lectures will be held with a case-based learning approach. Mastery of these lectures will

	help students increase their knowledge, knowledge and develop themselves professionally.
Admission and examination requirements	**Admission and examination requirements:** - Students must attend 15 minutes before the class starts. - Students must switch off all electronic devices. - Students must inform the lecturer if they will not attend the class due to sickness, etc. - Students must submit all class assignments before the deadline. - Students must attend the exam to get final grade.
Forms of exams and details explaining how to the modolue mark is calculate	**Form of examination:** Project, Presentation, and Written Exam **Form of Assasement:** Assessment of the learning process follows the following components: attendance 5%; assignments and presentations 30%; mid-test 30%, and final-test 35%.
Recommended Literature	1. Jules Pieters, Joke Voogt, Natalie Pareja Roblin (2019) Collaborative Curriculum Design for Sustainable Innovation and Teacher Learning. Springer International Publishing. 2. MaurícioPietrocola,IvãGurgel (2017) Crossing the Border of the Traditional Science Curriculum: Innovative Teaching and Learning in Basic Science Education. Bold Visions in Educational Research, Sense Publishers 3. Lynnette R Porter (2004) Developing an online curriculum: technologies and techniques. Information Science Publishing. 4. Aaron D. Isabelle, Gilbert A. Zinn (2017) STEPS to STEM: A Science Curriculum Supplement for Upper Elementary and Middle School Grades – Teacher's Edition
Date of Last Amendment	June 12th, 2018

Module Description

Module tittle	Course Module of Educational Research Methodology
Persons responsible for each module	Dr. Firmanul Catur Wibowo, M. Pd
Teaching Methods	Teaching methods used in this course are: - Lecture (i.e., group investigation, small group discussion, casestudy, and video-based learning) - Structured assignments (i.e., essays and case studies) - Research & writing for assignments. The class size for lecture is 20 students. Contact hours for lecture is 40 hours, assignments are 96 hours, and privat study is 96 hours.
Credits and Workload	Credit points : 7.8 ECTS For this course, students required to meet a minimum of 232 hours in one semester, which consist of: 40 hours for lecture 96 hours for structured assignments 96 hours for private study,
Intended Learning Outcomes	PLO 2 Master advanced knowledge of classical physics and modern physics PLO 7 Able to carry out scientific research in the field of physics education based on scientific methodology, logical, critical, systematic and creative thinking. PLO 8 Able to produce scientific articles that have novelty, and publish them in accredited national scientific journals, proceedings of international seminars, or international journals.
Module Content	**Students will learn about:** The physics education research methodology course examines the principles and procedures of scientific research, including quantitative, qualitative, and R&D research, as basic knowledge for students in conducting research and writing thesis. Topics covered include: types of research, development research (R&D), selection of research topics, problem formulation, research variables, population and sampling, data collection instruments and techniques, data analysis techniques, hypothesis testing, writing research proposals,

	writing research results in the thesis, techniques for writing references and bibliography, and rules for writing research reports. At the end of the course, students are expected to be able to write a thesis research proposal.
Admission and examination requirements	**Admission and examination requirements:** - Students must attend 15 minutes before the class starts. - Students must switch off all electronic devices. - Students must inform the lecturer if they will not attend the class due to sickness, etc. - Students must submit all class assignments before the deadline. - Students must attend the exam to get final grade.
Forms of exams and details explaining how to the modolue mark is calculate	**Form of examination:** Project, Presentation, and Written Exam **Form of Assasement:** Assessment of the learning process follows the following components: attendance 5%; assignments and presentations 30%; mid-test 30%, and final-test 35%.
Recommended Literature	1. nsi Utama: 1. Cohen, L., Manion, L., & Morrison, K. (2018). Research methods in education. London, UK: Routledge. 2. Creswell, J. W., & Plano Clark, V. L. (2018). Designing and conducting mixed methods research (2nd ed.). Los Angeles, LA: Sage. 3. Denzin, N. K., & Lincoln, Y. S. (Eds.). (2017). 3. The Sage handbook of qualitative research (4th ed.). Los Angeles, LA: Sage. 4. John W. Creswell. (2012). 4. Educational Research_ Planning, Conducting, and Evaluating Quantitative and Qualitative Research, 4th Edition -Addison Wesley 5. Buku Pedoman Penyusunan Tesis & Disertasi. Jakarta: Universitas Negeri Jakarta.
Date of Last Amendment	June 11th, 2018

Module Description

Module tittle	Course Module of Science Philosophy
Persons responsible for each module	Prof. Dr. Sunaryo
Teaching Methods	Teaching methods used in this course are: - Lecture (i.e., group investigation, small group discussion, case study, case-based learning, cooperative learning, and blended learning.) - Structured assignments (i.e., essays and case studies) The class size for the lecture is 20 students. Contact hours for lecture is 26.67 hours, assignments are 64 hours, and privat study is 64 hours.
Credits and Workload	Credit points : 5.2 ECTS For this course, students required to meet a minimum of 154.67 hours in one semester, which consist of: 26.67 hours for lecture, 64 hours for structured assignments, 64 hours for private study,
Intended Learning Outcomes	PLO 1 Able to develop logical, critical, systematic, and creative thinking through scientific research in the field of physics education. PLO 2 Master advanced knowledge of classical physics and modern physics PLO 4 Able to develop learning aids by utilizing advanced information technology and the student environment.
Module Content	**Students will learn about:** The aim of this course is to increase students' understanding of the philosophy of science. Topics covered include: the notion of philosophy, philosophy of science, understanding of science, branches of philosophy, aspects of knowledge (ontology, epistemology, axiology), the concept of truth, science and religion, scientific truth, scientific method, means of scientific thinking, logic and reasoning, characteristics of scientific knowledge, and the relationship between science and morals. Lectures will be conducted using an inquiry-based learning approach. Through this lecture, it is hoped that students will assist students in increasing knowledge in scientific fields and

	quality research.
Admission and examination requirements	**Admission and examination requirements:** - Students must attend 15 minutes before the class starts. - Students must switch off all electronic devices. - Students must inform the lecturer if they will not attend the class due to sickness, etc. - Students must submit all class assignments before the deadline. - Students must attend the exam to get final grade.
Forms of exams and details explaining how to the modolue mark is calculate	**Form of examination:** Project, Presentation, and Written Exam **Form of Assasement:** Assessment of the learning process follows the following components: attendance 5%; assignments and presentations 30%; mid-test 30%, and final-test 35%.
Recommended Literature	1. Alex Rosenberg and Lee McIntyre (2020) Philosophy of Science A Contemporary Introduction, Fourth Edition. Routledge. 2. Hans Halvorson (2019) The Logic in Philosophy of Science, Cambridge University Press 3. Immanuel Kant (2015) Critique of Practical Reason, Cambridge University Press. 4. Noeng Muhajir (2011) Filsafat Ilmu: Ontology, Epistemology, Axiology, Yogyakarta: Rake Sarasin.
Date of Last Amendment	June 15th, 2018

Module Description

Module tittle	Course Module of Educational Research Statistics
Persons responsible for each module	Dr. Firmanul Catur Wibowo, M.Pd
Teaching Methods	Teaching methods used in this course are: - Lecture (i.e., group investigation, small group discussion, case study, and video-based learning) - Structured assignments (i.e., essays and case study) The class size for lecture is 20 students. Contact hours for lecture is 40 hours, assignments are 96 hours, and privat study is 96 hours.
Credits and Workload	Credit points : 7.8 ECTS For this course, students required to meet a minimum of 232 hours in one semester, which consist of: 40 hours for lecture, 96 hours for structured assignments, 96 hours for private study,
Intended Learning Outcomes	PLO 2 Master advanced knowledge of classical physics and modern physics PLO 7 Able to carry out scientific research in the field of physics education based on scientific methodology, logical, critical, systematic and creative thinking. PLO 8 Able to produce scientific articles that have novelty, and publish them in accredited national scientific journals, proceedings of international seminars, or international journals.
Module Content	**Students will learn about:** This course aims to discuss data analysis techniques using descriptive and inferential statistics and their interpretations. Topics covered include: basic statistical concepts, error theory, descriptive statistics, probability distribution, sampling technique, statistical hypothesis testing, normality test, homogeneity test, average similarity test, regression and correlation analysis, analysis of variance, analysis of covariance, path analysis , and a structural equation model (SEM). Students will also learn to process and analyze data using special software so that it will help them in practical

	research activities. Lectures will be held with a case-based learning approach. Mastery of lecture material will assist students in conducting quality research.
Admission and examination requirements	**Admission and examination requirements:** - Students must attend 15 minutes before the class starts. - Students must switch off all electronic devices. - Students must inform the lecturer if they will not attend the class due to sickness, etc. - Students must submit all class assignments before the deadline. - Students must attend the exam to get final grade.
Forms of exams and details explaining how to the modolue mark is calculate	**Form of examination:** Essay and Project **Form of Assasement:** Assessment of the learning process follows the following components: attendance 5%; assignments and presentations 30%; mid-test 30%, and final-test 35%.
Recommended Literature	1. Neil A Weiss (2017) Introductory Statistics 10th Edition, Pearson. 2. Jimmie Leppink (2019) Statistical Methods for Experimental Research in Education and Psychology. Springer 3. Ronald E. Walpole (1997) Pengantar Statistika, Jakarta: PT Gramedia Pustaka
Date of Last Amendment	November 15th, 2018

Module Description

Module tittle	Course Module of Physics Education Research Study
Persons responsible for each module	Prof. Dr. I Made Astra, M.Si.
Teaching Methods	Teaching methods used in this course are: - Lecture (i.e., group investigation, small group discussion, casestudy, and video-based learning) - Research & writing for assignments. The class size for the lecture is 20 students. Contact hours for lecture is 26.67 hours, assignments are 64 hours, and privat study is 64 hours.
Credits and Workload	Credit points : 5.2 ECTS For this course, students required to meet a minimum of 154.67 hours in one semester, which consist of: 26.67 hours for lecture, 64 hours for structured assignments, 64 hours for private study,
Intended Learning Outcomes	PLO 2 Master advanced knowledge of classical physics and modern physics PLO 3 Able to design innovative physics learning in accordance with the demands of the curriculum by using appropriate evaluation and assessment techniques. PLO 6 Able to design scientific research to solve physics education problems PLO 7 Able to carry out scientific research in the field of physics education based on scientific methodology, logical, critical, systematic and creative thinking. PLO 8 Able to produce scientific articles that have novelty, and publish them in accredited national scientific journals, proceedings of international seminars, or international journals
Module Content	**Students will learn about:** The course develops students' abilities in problem identification, analysis of research results, and research trends in the field of physics education based on the latest reputable national and international journal papers. Topics of study include the development of current issues, research trends,

	and problems in physics education and their solutions based on the results of journal paper studies. Studies were also carried out on several aspects, such as learning methods, learning processes, learning tools, assessment, curriculum, and government policies in the education sector. Students will also learn how to technically find reputable journal papers, conduct bibliometric research, identify research originality and novelty based on the journal papers studied. At the end of the lecture students will be guided to produce a literature study paper on selected topics in the field of physics education. Lectures will be carried out using a case-based learning approach so that it is expected to be able to help students improve their knowledge, professionalism, and carry out quality research in the field of physics education
Admission and examination requirements	**Admission and examination requirements:** - Students must attend 15 minutes before the class starts. - Students must switch off all electronic devices. - Students must inform the lecturer if they will not attend the class due to sickness, etc. - Students must submit all class assignments before the deadline. - Students must attend the exam to get final grade.
Forms of exams and details explaining how to the modolue mark is calculate	**Form of examination:** Project and Presentation **Form of Assasement:** Assessment of the learning process follows the following components: attendance 5%; assignments and presentations 30%; mid-test 30%, and final-test 35%.
Recommended Literature	1. Eunjeong Yun (2020) Review of trends in physics Education research using Topic Modeling, Journal of Baltic Science Education Vol. 19 No. 3, 2020. 2. Michael R. Matthews (2018) History, Philosophy and Science Teaching, New Perspectives. Springer. 3. Mauricio Pietrocola (2019) Upgrading Physics Education to Meet the Needs of Society. Springer. 4. Anne Hume, Rebecca Cooper, Andreas Borowski (2019) Repositioning Pedagogical Content Knowledge in Teachers' Knowledge for Teaching Science. 5. Keith S. Taber (2013) Modelling Learners and Learning in Science Education: Developing Representations of Concepts,

	Conceptual Structure and Conceptual Change to Inform Teaching and Research. Springer Netherlands.
Date of Last Amendment	November 11th, 2018

Module Description

Module tittle	Course Module of Physics Learning Assessment
Persons responsible for each module	Dr. Firmanul Catur Wibowo, M.Pd.
Teaching Methods	Teaching methods used in this course are: - Lecture (i.e., group investigation, small group discussion, casestudy, and video-based learning) - Research & writing for assignments. The class size for the lecture is 20 students. Contact hours for lecture is 26.67 hours, assignments are 64 hours, and privat study is 64 hours.
Credits and Workload	Credit points : 5.2 ECTS For this course, students required to meet a minimum of 154.67 hours in one semester, which consist of: 26.67 hours for lecture, 64 hours for structured assignments, 64 hours for private study
Intended Learning Outcomes	PLO 2 Master advanced knowledge of classical physics and modern physics PLO 7 Able to carry out scientific research in the field of physics education based on scientific methodology, logical, critical, systematic and creative thinking. PLO 8 Able to produce scientific articles that have novelty, and publish them in accredited national scientific journals, proceedings of international seminars, or international journals.
Module Content	**Students will learn about:** This course aims to discuss the concept of class-based evaluation and assessment, how to compile and develop assessment plans, develop instruments, analyze and interpret assessment results to make policies and improve the quality of learning physics in class. Topics covered include: the classroom assessment paradigm in making changes; the validity and reliability of the assessment results; bias in judgment, applying alternative assessments and developing the instrument; develop and analyze diagnostic assessments; compiling, administering, and improving assessments in class;

	evaluation and grading of student progress and assessment of student progress in class. Practically students will be trained in guided projects to design physics learning assessment instruments in class. To provide practical experience to students, lectures will be carried out using a case- and project-based learning approach. Through this lecture, it is hoped that students will be able to increase advanced knowledge in science and develop their professionalism in the field of physics education.
Admission and examination requirements	**Admission and examination requirements:** - Students must attend 15 minutes before the class starts. - Students must switch off all electronic devices. - Students must inform the lecturer if they will not attend the class due to sickness, etc. - Students must submit all class assignments before the deadline. - Students must attend the exam to get final grade.
Forms of exams and details explaining how to the modolue mark is calculate	**Form of examination:** Project and Presentation **Form of Assasement:** Assessment of the learning process follows the following components: attendance 5%; assignments and presentations 30%; mid-test 30%, and final-test 35%.
Recommended Literature	1. Lorin W dan Krathwohl, DR. (2001) A Taxonomy for Learning, Teaching, and Assessing: a revision of Bloom`s taxonomy of educational objectives. New York: Addison Wesley Longman Inc. 2. Charles Secolsky, D Brian Denison (2017) Handbook on Measurement, Assessment, and Evaluation in Higher Education, Publisher: Routledge. 3. David L. McArthur PhD (1989) Alternative Approaches to the Assessment of Achievement. Series: Evaluation in Education and Human Services. Publisher: Springer Netherlands. 4. Jacqueline Leighton, Mark Gierl (2007) Cognitive Diagnostic Assessment for Education: Theory and Applications 5. Matthias von Davier, Young-Sun Lee (2019) Handbook of Diagnostic Classification Models: Models and Model Extensions, Applications, Software Packages.

	6. Susan M Brookhart; James H McMillan (2019) Classroom Assessment and Educational Measurement. Routledge.
Date of Last Amendment	November 14th, 2018

Module Description

Module tittle	Course Module of IT and Physics Learning Multimedia Development
Persons responsible for each module	Dr. Bambang Heru Iswanto, M.Si
Teaching Methods	Teaching methods used in this course are: - Lecture (i.e., small group discussions and project-based learning) - Structured assignments (i.e., project development and presentations) The class size for lecture is 20 students. Contact hours for lecture is 40 hours, assignments are 96 hours, and privat study is 96 hours.
Credits and Workload	Credit points : 7.8 ECTS For this course, students required to meet a minimum of 232 hours in one semester, which consist of: 40 hours for lecture, 96 hours for structured assignments, 96 hours for private study,
Intended Learning Outcomes	PLO 2 Master advanced knowledge of classical physics and modern physics PLO 3 Able to design innovative physics learning in accordance with the demands of the curriculum by using appropriate evaluation and assessment techniques PLO 5 Able to propose various alternative solutions to the problems of physics education with inter- and multidisciplinary approaches PLO 6 Able to design scientific research to solve physics education problems PLO 8 Able to produce scientific articles that have novelty, and publish them in accredited national scientific journals, proceedings of international seminars, or international journals.
Module Content	**Students will learn about:** This course aims to enrich knowledge in the field of Information and Communication Technology (ICT) in education and skills in building physics learning multimedia

	systems. Topics of discussion include: (1) ICT in education: ICT infrastructure, e-learning systems, ICT-based educational technology; and (2) Development of multimedia learning: multimedia introduction, production of multimedia content, multimedia data representation, storage and retrieval of multimedia data, multimedia networks, and multimedia distribution. Lectures are equipped with practicums to provide students with practical experience on how to design and produce multimedia according to student characteristics. Lectures are carried out with a project-based learning approach. Through this lecture, it is expected that students will be skilled and able to create innovative and tested works through the development of knowledge in the field of Physics education. Lectures will be carried out using the Project Based Learning (PjBL) Learning Model using various media and facilities such as Ispring suite software, etc.
Admission and examination requirements	**Admission and examination requirements:** - Students must attend 15 minutes before the class starts. - Students must switch off all electronic devices. - Students must inform the lecturer if they will not attend the class due to sickness, etc. - Students must submit all class assignments before the deadline. - Students must attend the exam to get final grade.
Forms of exams and details explaining how to the modolue mark is calculate	**Form of examination:** Project, Presentation, and Written Exam **Form of Assasement:** Assessment of the learning process follows the following components: attendance 5%; assignments and presentations 30%; mid-test 30%, and final-test 35%.
Recommended Literature	1. Liping Deng, Will W. K. Ma, Cheuk Wai Rose Fong. (2018). New Media for Educational Change. Springer Singapore. 2. Sharon Smaldino. (2015). Instructional Technology and Media for Learning. Pearson, Year 3. Richard E. Mayer. (2009). Multimedia Learning-Cambridge University Press 4. Tzu-Bin Lin, Victor Chen, Ching Sing Chai. (2015). New Media and Learning in the 21st Century_ A Socio-Cultural Perspective-Springer.

	5. Johannes Konert. (2014). Interactive. Multimedia Learning Using Social Media for Peer Education in Single-Player Educational Games. Springer: New York London. 2014 6. Robert Maribe Branch, Hyewon Lee, Sheng Shiang Tseng. (2019). Educational Media and Technology Yearbook: Volume 42. Springer International Publishing
Date of Last Amendment	November 12th, 2018

Module Description

Module tittle	Course Module of Advance Modern Physics
Persons responsible for each module	Dr. Iwan Sugihartono, M.Si
Teaching Methods	Teaching methods used in this course are: - Lecture (i.e., case-based learning, cooperative learning, and blended learning) - Structured assignments (i.e., essays and case study) - Practice (i.e., computer simulation and case study in laboratorium) The class size for lecture is 20 students. Contact hours for lecture is 26.67 hours, assignments are 64 hours, and privat study is 64 hours
Credits and Workload	Credit points : 5.2 ECTS For this course, students required to meet a minimum of 154.67 hours in one semester, which consist of: 26.67 hours for lecture, 64 hours for structured assignments, 64 hours for private study,
Intended Learning Outcomes	PLO 2 Master advanced knowledge of classical physics and modern physics PLO 4. Able to develop learning aids by utilizing advanced information technology and the student environment.
Module Content	**Students will learn about:** This course is a compulsory course that discusses the development of modern physics and its application in various current technologies. The discussion in this lecture covers various topics, including the development of classical physics and its weaknesses in explaining some experimental results, the theory of special relativity, particle-wave properties, atomic modeling, introduction to quantum mechanics in the form of the Schroedinger equation which is applied to the application of the Hydrogen atomic model and atomic spectroscopy, many-electron atoms, molecules, radioactivity, and their uses. Furthermore, to provide a factual understanding, students will be provided with the latest topics related to research in the field of modern physics. Lectures will

	be conducted using a case-based blended learning approach. Mastery of this study will help students improve their knowledge and develop themselves professionally in the field of physics education.
Admission and examination requirements	**Admission and examination requirements:** - Students must attend 15 minutes before the class starts. - Students must switch off all electronic devices. - Students must inform the lecturer if they will not attend the class due to sickness, etc. - Students must submit all class assignments before the deadline. - Students must attend the exam to get final grade.
Forms of exams and details explaining how to the modolue mark is calculate	**Form of examination:** Essay, Project, and Written Exam **Form of Assasement:** Assessment of the learning process follows the following components: attendance 5%; assignments and presentations 30%; mid-test 30%, and final-test 35%.
Recommended Literature	1. Thornton, S. T. and Rex, A. Modern Physics for Scientists and Engineers 3rd Edition. Singapore: Thomson, 2006 2. Krane, K. Modern Physics 2nd Edition. New York: John Wiley & Sons, 1996.
Date of Last Amendment	November 11th, 2018

Module Description

Module tittle	Course Module of Scientific Article Writing Technique
Persons responsible for each module	Dr. Iwan Sugihartono, M.Si
Teaching Methods	Teaching methods used in this course are: - Lecture (i.e., group investigation, small group discussion, case study, and video-based learning) - Structured assignments (i.e., essays and case study) The class size for lecture is 20 students. Contact hours for lecture is 26.67 hours, assignments are 64 hours, and privat study is 64 hours.
Credits and Workload	Credit points : 5.2 ECTS For this course, students required to meet a minimum of 154.67 hours in one semester, which consist of: 26.67 hours for lecture, 64 hours for structured assignments, 64 hours for private study
Intended Learning Outcomes	PLO 2 Master advanced knowledge of classical physics and modern physics PLO 3 Able to design innovative physics learning in accordance with the demands of the curriculum by using appropriate evaluation and assessment techniques PLO 7 Able to carry out scientific research in the field of physics education based on scientific methodology, logical, critical, systematic, and creative thinking. PLO 8 Able to produce scientific articles that have novelty, and publish them in accredited national scientific journals, proceedings of international seminars, or international journals
Module Content	**Students will learn about:** This course aims to provide knowledge and practical experience in writing scientific articles in a structured and comprehensive manner, starting from the preparation of article writing to the publication process in reputable journals both nationally and internationally. This lecture will discuss, among others, the principles and planning of scientific publications; scientific article design and structure; use of grammar, spelling, and writing numbers; processing of images,

	tables and graphs; reference writing; code of ethics for scientific writing and publication; techniques for selecting reputable journals; and journal publication process. In this course, students will be guided to write drafts of scientific articles according to their research themes as outputs and will be reviewed by lecturers as part of the learning process. To provide direct experience to students, lectures will be carried out using a case- and project-based learning approach. It is hoped that the practical experience in these lectures will assist students in increasing their knowledge, professionalism in quality research so that it is beneficial to society and science.
Admission and examination requirements	**Admission and examination requirements:** - Students must attend 15 minutes before the class starts. - Students must switch off all electronic devices. - Students must inform the lecturer if they will not attend the class due to sickness, etc. - Students must submit all class assignments before the deadline. - Students must attend the exam to get final grade.
Forms of exams and details explaining how to the modolue mark is calculate	**Form of examination:** Project, Presentation, and Written Exam **Form of Assasement:** Assessment of the learning process follows the following components: attendance 5%; assignments and presentations 30%; mid-test 30%, and final-test 35%.
Recommended Literature	
Date of Last Amendment	June, 12th 2018

Module Description

Module tittle	Course Module of Electronic Instrumentation for Physics Education
Persons responsible for each module	Dr. Iwan Sugihartono, M.Si
Teaching Methods	Teaching methods used in this course are: - Lecture (i.e., group investigation, small group discussion, case study, case-based learning, cooperative learning, and blended learning.) - Structured assignments (i.e., essays and case studies) The class size for lecture is 20 students. Contact hours for lecture is 40 hours, assignments are 96 hours, and privat study is 96 hours.
Credits and Workload	Credit points : 7.8 ECTS For this course, students required to meet a minimum of 232 hours in one semester, which consist of: 40 hours for lecture, 96 hours for structured assignments, 96 hours for private study,
Intended Learning Outcomes	PLO 2 Master advanced knowledge of classical physics and modern physics PLO 8 Able to produce scientific articles that have novelty, and publish them in accredited national scientific journals, proceedings of international seminars, or international journals
Module Content	**Students will learn about:** This course aims to enrich students' knowledge and skills in building educational aids using electronic instruments to produce physics learning aids. The topic of discussion covers various aspects in the development of electronic instruments, including the basic concepts of electronics, semiconductors, analog and digital circuits, sensors, microprocessors, microcontrollers, and interfaces, and their applications in the development of physics education teaching aids. Lectures are equipped with practicums so that students have practical experience on how to design and produce teaching aids.

	Lectures will be carried out using a case- and project-based learning approach. Through this lecture, it is expected that students will be skilled and able to create innovative and tested works through the development of knowledge in the field of Physics education.
Admission and examination requirements	**Admission and examination requirements:** - Students must attend 15 minutes before the class starts. - Students must switch off all electronic devices. - Students must inform the lecturer if they will not attend the class due to sickness, etc. - Students must submit all class assignments before the deadline. - Students must attend the exam to get final grade.
Forms of exams and details explaining how to the modolue mark is calculate	**Form of examination:** Project, Presentation, and Written Exam **Form of Assasement:** Assessment of the learning process follows the following components: attendance 5%; assignments and presentations 30%; mid-test 30%, and final-test 35%.
Recommended Literature	1. Harvey Gould, Jan Tobochnik, and Wolfgang Christian, An Introduction to Computer Simulation Methods, Third Edition, 2016.
Date of Last Amendment	June, 16th 2018

Module Description

Module tittle	Course Module of Computer Simulation for Physics Learning
Persons responsible for each module	Dr. rer nat. Bambang Heru
Teaching Methods	Teaching methods used in this course are: - Lecture (i.e., group investigation, small group discussion, case study, and video-based learning) - Structured assignments (i.e., essays and case study) The class size for lecture is 20 students. Contact hours for lecture is 26.67 hours, assignments are 64 hours, and privat study is 64 hours.
Credits and Workload	Credit points : 5.2 ECTS For this course, students required to meet a minimum of 154.67 hours in one semester, which consist of: 26.67 hours for lecture, 64 hours for structured assignments, 64 hours for private study
Intended Learning Outcomes	PLO 2 Master advanced knowledge of classical physics and modern physics PLO 8 Able to produce scientific articles that have novelty, and publish them in accredited national scientific journals, proceedings of international seminars, or international journals
Module Content	**Students will learn about:** In physics, computer simulations are now an integral part of basic and computational physics as important as theory and experimentation. This course aims to enrich students' knowledge in more depth about the importance of computers in physics, computer simulations, numerical methods, tools for building visual simulations, and object-oriented programming in the context of learning science. This course also facilitates students to develop practical skills on how to make interactive simulations, especially for the purpose of teaching and learning physics using discrete computer simulation software. To achieve this goal, lectures will be carried out using a case- and project-based learning approach.
Admission and	**Admission and examination requirements:**

examination requirements	- Students must attend 15 minutes before the class starts. - Students must switch off all electronic devices. - Students must inform the lecturer if they will not attend the class due to sickness, etc. - Students must submit all class assignments before the deadline. - Students must attend the exam to get final grade.
Forms of exams and details explaining how to the modolue mark is calculate	**Form of examination:** Project, Presentation, and Written Exam **Form of Assasement:** Assessment of the learning process follows the following components: attendance 5%; assignments and presentations 30%; mid-test 30%, and final-test 35%.
Recommended Literature	1. Harvey Gould, Jan Tobochnik, and Wolfgang Christian, An Introduction to Computer Simulation Methods, Third Edition, 2016. 2. Jaan Kiusalaas, 2005. Numerical Methods in Engineering with Python, Cambridge Univ Press. 3. Rubin H. Landau, Manuel J. Páez,and Cristian C. Bordeianu, Computational Physics Problem Solving with Computers, 2nd Ed., Wiley-VCH Verlag, 2007 4. Pang, T., An Introduction to Computational Physics, 2nd Ed., Cambridge University Press, 2006. 5. Alesandro L. Garcia, 2000. Numerical Methods for Physics, 2nd Ed .Prentice-Hall, Inc. 6. Soichiro Nakamura, 1993. Applied Numerical Analysis in C. Prentice-Hall. 7. Burden, R. L., and Faires, J. D., (2001), Numerical Analysis, 7th Ed., Brooks/Cole, Thomson Learning Academic Resource Center.
Date of Last Amendment	June, 18th 2018

Module Description

Module tittle	Course Module of Raya Data in Physics Education
Persons responsible for each module	Dr. rer nat. Bambang Heru
Teaching Methods	Teaching methods used in this course are: - Lecture (i.e., group investigation, small group discussion, case study, and video-based learning) - Structured assignments (i.e., essays and case study) The class size for lecture is 20 students. Contact hours for lecture is 26.67 hours, assignments are 64 hours, and privat study is 64 hours.
Credits and Workload	Credit points : 5.2 ECTS For this course, students required to meet a minimum of 154.67 hours in one semester, which consist of: 26.67 hours for lecture, 64 hours for structured assignments, 64 hours for private study
Intended Learning Outcomes	PLO 2 Master advanced knowledge of classical physics and modern physics PLO 8 Able to produce scientific articles that have novelty, and publish them in accredited national scientific journals, proceedings of international seminars, or international journals
Module Content	**Students will learn about:** In physics, computer simulations are now an integral part of basic and computational physics as important as theory and experimentation. This course aims to enrich students' knowledge in more depth about the importance of computers in physics, computer simulations, numerical methods, tools for building visual simulations, and object-oriented programming in the context of learning science. This course also facilitates students to develop practical skills on how to make interactive simulations, especially for the purpose of teaching and learning physics using discrete computer simulation software. To achieve this goal, lectures will be carried out using a case- and project-based learning approach.
Admission and	**Admission and examination requirements:**

examination requirements	- Students must attend 15 minutes before the class starts. - Students must switch off all electronic devices. - Students must inform the lecturer if they will not attend the class due to sickness, etc. - Students must submit all class assignments before the deadline. - Students must attend the exam to get final grade.
Forms of exams and details explaining how to the modolue mark is calculate	**Form of examination:** Project, Presentation, and Written Exam **Form of Assasement:** Assessment of the learning process follows the following components: attendance 5%; assignments and presentations 30%; mid-test 30%, and final-test 35%.
Recommended Literature	
Date of Last Amendment	June, 10th 2018

Module Description

Module tittle	Course Module of Advance Thermodynamics
Persons responsible for each module	Dr. Iwan Sugihartono
Teaching Methods	Teaching methods used in this course are: - Lecture (i.e., case-based learning, cooperative learning, and blended learning) - Structured assignments (i.e., essays and case study) - Practice (i.e., computer simulation and case study in laboratorium) The class size for lecture is 20 students. Contact hours for lecture is 26.67 hours, assignments are 64 hours, and privat study is 64 hours
Credits and Workload	Credit points : 5.2 ECTS For this course, students required to meet a minimum of 154.67 hours in one semester, which consist of: 26.67 hours for lecture, 64 hours for structured assignments, 64 hours for private study
Intended Learning Outcomes	PLO 2 Master advanced knowledge of classical physics and modern physics PLO 4. Able to develop learning aids by utilizing advanced information technology and the student environment.
Module Content	**Students will learn about:** This course will discuss the basic concepts of thermodynamics and their applications in physics and engineering, followed by a discussion of statistical mechanics and its applications in the current field of science and technology. Lectures will be held with a case-based learning approach. Mastery of this study will help students improve their knowledge, take other related scientific lectures, and develop themselves professionally in the field of physics education.
Admission and examination requirements	**Admission and examination requirements:** - Students must attend 15 minutes before the class starts. - Students must switch off all electronic devices. - Students must inform the lecturer if they will not attend the

	class due to sickness, etc. - Students must submit all class assignments before the deadline. - Students must attend the exam to get final grade.
Forms of exams and details explaining how to the modolue mark is calculate	**Form of examination:** Essay Projects, and Written Exam **Form of Assasement:** Assessment of the learning process follows the following components: attendance 5%; assignments and presentations 30%; mid-test 30%, and final-test 35%.
Recommended Literature	
Date of Last Amendment	November 15th, 2018

Module Description

Module tittle	Course Module of Integrated Science and the Environment
Persons responsible for each module	Prof. Dr. Sunaryo
Teaching Methods	Teaching methods used in this course are: - Lecture (i.e., group investigation, small group discussion, case study, and video-based learning) - Structured assignments (i.e., essays and case study) The class size for lecture is 20 students. Contact hours for lecture is 26.67 hours, assignments are 64 hours, and privat study is 64 hours.
Credits and Workload	Credit points : 5.2 ECTS For this course, students required to meet a minimum of 154.67 hours in one semester, which consist of: 26.67 hours for lecture, 64 hours for structured assignments, 64 hours for private study
Intended Learning Outcomes	PLO 1 Able to develop logical, critical, systematic, and creative thinking through scientific research in the field of physics education. PLO 2 Master advanced knowledge of classical physics and modern physics PLO 8 Able to produce scientific articles that have novelty, and publish them in accredited national scientific journals, proceedings of international seminars, or international journals
Module Content	**Students will learn about:** This course aims to improve student competence in the field of integrated science and the environment which is an important subject in learning science in high schools. Lectures will discuss a number of topics, including the conception of science integration; fundamental concepts in the fields of physics, chemistry, biology, environment, astronomy, geology, and biotechnology; integrated science development; various problems and methods of solving through integrated science, environmental studies from the perspective of the concept of integrated science, including issues of global warming, renewable energy, and sustainable environment. Lectures will

	be held with a case-based approach learning. Mastery of this course will assist students in increasing knowledge in science and its application so that they are able to develop themselves professionally.
Admission and examination requirements	**Admission and examination requirements:** - Students must attend 15 minutes before the class starts. - Students must switch off all electronic devices. - Students must inform the lecturer if they will not attend the class due to sickness, etc. - Students must submit all class assignments before the deadline. - Students must attend the exam to get final grade.
Forms of exams and details explaining how to the modolue mark is calculate	**Form of examination:** Project, Presentation, and Written Exam **Form of Assasement:** Assessment of the learning process follows the following components: attendance 5%; assignments and presentations 30%; mid-test 30%, and final-test 35%.
Recommended Literature	
Date of Last Amendment	June 12th, 2018

Module Description

Module tittle	Course Module of English for Scientific Communication
Persons responsible for each module	Dr. Iwan Sugihartono
Teaching Methods	Teaching methods used in this course are: - Lecture (i.e., group investigation, small group discussion, case study, and video-based learning) - Structured assignments (i.e., essays and case study) The class size for lecture is 20 students. Contact hours for lecture is 26.67 hours, assignments are 64 hours, and privat study is 64 hours.
Credits and Workload	Credit points : 5.2 ECTS For this course, students required to meet a minimum of 154.67 hours in one semester, which consist of: 26.67 hours for lecture, 64 hours for structured assignments, 64 hours for private study
Intended Learning Outcomes	PLO 2 Master advanced knowledge of classical physics and modern physics PLO 8 Able to produce scientific articles that have novelty, and publish them in accredited national scientific journals, proceedings of international seminars, or international journals
Module Content	**Students will learn about:** The purpose of this lecture is to improve students' ability to write articles and oral presentations at international scientific forums using English. In this course students will learn: understanding communication in English, formal English, tone, grammar, and vocabulary enrichment, sentence analysis, and proof reading, effective reading strategies, making articles, making posters and slides and presenting them orally, answering questions , familiar with chairing sessions and panel discussions in scientific forums, such as conferences or other scientific meetings. In addition, students will also learn how to practically use editing tools to improve the quality of article writing. To provide practical experience, lectures will be conducted using a case- and project-based learning approach. Through this lecture, it is hoped that students will be able to

	increase their knowledge and professionalism in the field of physics education and publish their research results so that they are beneficial to society and science.
Admission and examination requirements	**Admission and examination requirements:** - Students must attend 15 minutes before the class starts. - Students must switch off all electronic devices. - Students must inform the lecturer if they will not attend the class due to sickness, etc. - Students must submit all class assignments before the deadline. - Students must attend the exam to get final grade.
Forms of exams and details explaining how to the modolue mark is calculate	**Form of examination:** Project, Presentation, and Written Exam **Form of Assasement:** Assessment of the learning process follows the following components: attendance 5%; assignments and presentations 30%; mid-test 30%, and final-test 35%.
Recommended Literature	
Date of Last Amendment	November 13th, 2018

Module Description

Module tittle	Course Module of Seminar on Thesis Proposal
Persons responsible for each module	Dr. rer nat. Bambang Heru
Teaching Methods	Teaching methods used in this course are: - Lectures (i.e., group investigations, small group discussions, case studies, and video-based learning) - Research & writing for assignments (ie, doing research on misconceptions in physics and write scientific papers for publication). The class size for college is 20 students. Contact hours for lectures is 26.67 hours, assignments are 64 hours, and private study is 64 hours.
Credits and Workload	Credit points : 5.2 ECTS For this course, students required to meet a minimum of 154.67 hours in one semester, which consist of: 26.67 hours for lecture, 64 hours for structured assignments, 64 hours for private study
Intended Learning Outcomes	PLO 2 Master advanced knowledge of classical physics and modern physics PLO 3 Able to design innovative physics learning in accordance with the demands of the curriculum by using appropriate evaluation and assessment techniques PLO 4 Able to develop learning aids by utilizing advanced information technology and the student environment PLO 5 Able to propose various alternative solutions to the problems of physics education with inter- and multidisciplinary approaches PLO 6 Able to design scientific research to solve physics education problems PLO 7 Able to carry out scientific research in the field of physics education based on scientific methodology, logical, critical, systematic and creative thinking.
Module Content	**Students will learn about:** The aim of this course is to provide students with independent work experience in preparing a physics education research

	thesis proposal. The thesis proposal includes several main parts, including: problem background, problem formulation, research objectives, research benefits, theoretical studies, and research methodology. Proposals must be supported by references to journal articles that are relevant to the issues to be researched and published in the last ten years. After the proposal is approved, students will be guided by two supervisors. Furthermore, the proposal will be tested for feasibility in a thesis proposal seminar. Lectures are conducted using a project-based learning approach, which is expected to assist students in conducting quality research.
Admission and examination requirements	**Admission and examination requirements:** - Students must attend 15 minutes before the class starts. - Students must switch off all electronic devices. - Students must inform the lecturer if they will not attend the class due to sickness, etc. - Students must submit all class assignments before the deadline. - Students must attend the exam to get final grade.
Forms of exams and details explaining how to the modolue mark is calculate	**Form of examination:** Project and Presentation **Form of Assasement:** Assessment of the learning process follows the following components: attendance 5%; assignments and presentations 30%; mid-test 30%, and final-test 35%.
Recommended Literature	1. Buku pedoman akademik (BPA) Program Pasca UNJ Tahun 2018 2. Buku Pedoman Akademik (BPA) FMIPA Tahun 2020 3. Mekanisme penulisan Tesis Program Magister Pendidikan FMIPA, 2017
Date of Last Amendment	November 17th, 2018

Module Description

Module tittle	Course Module of Thesis
Persons responsible for each module	Dr. rer nat. Bambang Heru
Teaching Methods	Teaching methods used in this course are: - Lectures (i.e., group investigations, small group discussions, case studies, and video-based learning) - Research & writing for assignments (ie, doing research on misconceptions in physics and write scientific papers for publication). The class size for the lecture is 20 students. Contact hours for lecture is 80 hours, assignments are 192 hours, and private study is 192 hours
Credits and Workload	Credit points : 15.6 ECTS For this course, students required to meet a minimum of 464 hours in one semester, which consist of: 80 hours for lecture, 192 hours for structured assignments, 192 hours for private study
Intended Learning Outcomes	PLO 1 Able to develop logical, critical, systematic, and creative thinking through scientific research in the field of physics education. PLO 2 Master advanced knowledge of classical physics and modern physics PLO 3 Able to design innovative physics learning in accordance with the demands of the curriculum by using appropriate evaluation and assessment techniques PLO 4 Able to develop learning aids by utilizing advanced information technology and the student environment PLO 5 Able to propose various alternative solutions to the problems of physics education with inter- and multidisciplinary approaches PLO 6 Able to design scientific research to solve physics education problems PLO 7 Able to carry out scientific research in the field of physics education based on scientific methodology, logical, critical, systematic and creative thinking.

	PLO 8 Able to produce scientific articles that have novelty, and publish them in accredited national scientific journals, proceedings of international seminars, or international journals
Module Content	**Students will learn about:** This course aims to provide students with independent work experience in carrying out research in the field of physics education under two supervisors. The research results must then be written in research reports in the form of theses and scientific articles for publication. The reference for thesis writing follows the guidebook for thesis writing from the university. The thesis that has been approved by the two supervisors is then submitted to be tested in the thesis examination session. Through this course it is hoped that students will be able to conduct quality research, be recognized nationally and internationally, as well as be of benefit to society and science.
Admission and examination requirements	**Admission and examination requirements:** - Students must attend 15 minutes before the class starts. - Students must switch off all electronic devices. - Students must inform the lecturer if they will not attend the class due to sickness, etc. - Students must submit all class assignments before the deadline. - Students must attend the exam to get final grade.
Forms of exams and details explaining how to the modolue mark is calculate	**Form of examination:** Independent research and presentation **Form of Assasement:** Assessment of the learning process follows the following components: attendance 5%; assignments and presentations 30%; mid-test 30%, and final-test 35%.
Recommended Literature	1. Buku pedoman akademik (BPA) Program Pasca UNJ Tahun 2018 2. Buku Pedoman Akademik (BPA) FMIPA Tahun 2020 3. Mekanisme penulisan Tesis Program Magister Pendidikan FMIPA, 2017
Date of Last Amendment	November 18th, 2018