MINISTRY OF EDUCATION, CULTURE, RESEARCH, AND TECHNOLOGY
UNIVERSITAS NEGERI YOGYAKARTA
FACULTY OF MATHEMATICS AND NATURAL SCIENCES

CURRICULUM MASTER PROGRAM IN PHYSICS EDUCATION

2022

s2pfis.fmipa.uny.ac.id
s2pfisika@uny.ac.id
Jl. Colombo no. 1, Karang Malang, Depok, Sleman, Yogyakarta 55281

MASTER PROGRAM IN PHYSICS EDUCATION

Table of Contents

The Master Program in Physics Education (MPPE) was permitted to operate by the Minister of Education and Culture of the Republic of Indonesia on October 2, 2014, with Decree Number 434/E/O/2014 signed by the Director General of Higher Education. MPPE is a continuation of the existing concentration in the Master of Science Education Program, which has been implemented since 2010. The Master of Science Education Program obtained an operational permit from the Directorate General of Higher Education, Ministry of National Education Number 2951/D/T/2003, dated October 10, 2003. Master of Physics Education Program is accredited B by National Accreditation Bureau for Higher Education with Letter of Statement No. 0004/SK/BAN-PT/Akred/M/I/2016 dated 11 January 2016, valid until 11 January 2021.

I. VISION AND MISSION OF THE STUDY PROGRAM

A. Vision

In 2025, MPPE will become one of the references for implementing a Master program in physics education for the Southeast Asian region based on the values of piety, independence, and intellectualism.

B. Missions

1. Organizing academic education at the Master level in the field of physics education,
2. Conducting research activities on physics education to discover, develop, and disseminate knowledge that empowers individuals and communities, supports regional and national development, and contributes to solving regional problems,
3. Organizing community service and empowerment activities that encourage the development of the human, community, and environmental potentials,
4. Organizing a credible, transparent, accountable, responsible, and fair study program management in the implementation of higher education autonomy.

C. Goals

1. To produce graduates who can criticize theories and research findings in the field of physics education,
2. To implement physics education research activities to discover, develop, and disseminate physics education science that empowers individuals and communities, supports regional and national development, and contributes to solving regional problems
3. To implement community service and empowerment activities that encourage the development of human and community potential
4. To implement a credible, transparent, accountable, responsible, and fair study program governance in the implementation of higher education autonomy.

II. GRADUATE PROFILE

Profile	Profile Description
Teaching Staff of Physics Education	Physics education lecturers master theory and application theory in the field of physics education and can develop physics education science through research, innovation, and solving problems with an inter/multidisciplinary approach, and can use ICT in teaching and follow the development of physics education, have the spirit of Pancasila, supported by the ability to speak English, and have a leadership spirit.
Physics Education Researchers	Physics education researchers master educational research methodology, understand the characteristics of physics education objects and problems, master ICT and international languages to follow the latest trends and issues in physics education, and can publish research findings in the field of physics education in national and international forums and journals.
Developer of Physics Curriculum and Instructional Evaluation	Developers of physics curriculum and instructional evaluation understand the basic principles of the curriculum, the characteristics of objects, and problems of physics education in secondary schools or colleges, always follow the dynamics of education in schools and higher education, have sensitivity to the development of physics education and competency needs in the world of work, and understand institutional characteristics as a material and basis for curriculum development and teaching innovation.
Developer of Physics Learning Media and Materials	Developers of physics learning media and materials can design and produce ICT-based learning media and materials, both for sources learning, learning media, and LMS for physics learning in schools and at PSP Physics.

III. GRADUATE'S LEARNING ACHIEVEMENT

A. Attitudes

1. Being devoted to God Almighty and able to show a religious attitude.
2. Upholding human values in carrying out duties based on religion, morals, and ethics.
3. Contributing to improving the quality of life in society, nation, state, and the progress of civilization based on Pancasila.
4. Behaving as citizens who love and are proud of their homeland and have nationalism and a sense of responsibility to the state and nation.
5. Appreciating the diversity of cultures, views, religions, and beliefs, as well as the opinions or original findings of others.

6. Cooperating and having social sensitivity and concern for society and the environment.
7. Obeying the law and discipline in the life of society and the state.
8. Internalizing academic values, norms, and ethics.
9. Demonstrating a responsible attitude towards work in the field of expertise independently.
10. Internalizing the spirit of independence, struggle, and entrepreneurship.
11. Having sincerity, commitment, and seriousness to develop the attitudes, values, and abilities of students.

B. Knowledge

1. In the substance of the scientific field, the mastery of:
   a. the theoretical concepts of classical and modern (quantum) physics in depth.

2. In the substance of the field of education, the mastery of:
   a. the concept of academic integrity in general and the concept of plagiarism in particular, in terms of the types of plagiarism, the consequences of violations, and efforts to prevent them.
   b. philosophy, i.e., concepts and theories of learning in physics education and their implications in teaching.
   c. issues and problems of physics education as well as various alternative solutions to physics education problems with an inter- or multidisciplinary approach.
   d. physics education research methodology quantitatively, qualitatively, and the mixture of both.
   e. advanced pedagogical physics content to develop the science of physics education.

C. Special Abilities

1. The ability to develop knowledge and technology in the field of physics education through research to produce innovative and valid works.
2. The ability to conduct and manage research and development to solve physics education problems with quantitative and/or qualitative approaches and using various inter- or multidisciplinary approaches.
3. The ability to publish the findings of research on physics education in national journals or proceedings of international seminars or international journals, and to develop knowledge, technology, and/or art in the field of physics education through research to produce innovative and valid works.

D. General Ability:

The ability to develop logical, critical, systematic, and creative thinking through scientific research; to create designs or works of art in the field of science and technology that pays attention to and applies humanitarian values according to their field of expertise; to form scientific conceptions and review based on rules, procedures, and scientific ethics in the form of a thesis or other equivalent form, and uploaded on the website.

IV. COURSES TO UNDERTAKE

Code	Courses
Major courses	
BK1	Learning and Learning Theory for Adults (andragogy)
BK2	Curriculum and Learning
BK3	Approach/Strategy/Model/Learning Method
BK4	Materials and Learning Resources for Learning Physics
BK5	Measurement, Assessment, and Evaluation of Physics Learning
BK6	Issues in Physics Education
BK7	Issues in Classical Physics
BK8	Issues in Modern Physics
BK9	Issues in Material Physics
BK10	Issues in Physics: Theory, Experiments, and Computing
Supporting Science and Technology	
BK11	Educational Research Methodology
BK12	Mathematics and Language
BK13	Information and Communication Technology
BK14	Educational Science
BK15	College Culture and Dynamics of 21st Century Physics Education
Science and Technology to Develop	
BK16	ICT-Based Physics Teaching and Learning
University-Specific Courses	
BK17	Culture-Oriented and Local Wisdom-Oriented Education
BK18	Character Education, Piety, Independence, and Intellectualism
BK19	Creativity-, Superiority-, and Innovation-Oriented Education

V. CURRICULUM STRUCTURE AND COURSE DISTRIBUTION

A. Curriculum Structure

NO.	Types of Courses	Weight (crd)
1	Compulsory Courses of MPPE (FMI)	7
2	Compulsory Courses of Physics Department (FIP)	26
	a. Educational	17
	b. Physical	9
3	Elective Courses of Physics Dept (out of 22 credits offered)	6
Total		39

B. Distribution of credits

No.	Types of Courses	Semester (credits)				Total (credits)
		I	II	III	IV	
1	Compulsory Graduate Courses (FMI)	7				7
2	Compulsory Study Program Courses (FIP)	9	9	2	6	26
3	Elective Study Program Courses		6			6
Total		16	15	2	6	39

No	CODE	COURSES	CREDIT			SEMESTER				
			Total	T	P	1	2	3	4	
I.	**BASIC SCIENCE COURSES**									
1	FMI8201	Philosophy of Science	2	2		2				**7**
2	FMI8202	Statistics	2	2		2				
4	FMI8303	Research Methodology in Education	3	3		3				
II.	**STUDY PROGRAM COURSES**									**26**
1	FIP8201	Physics Curriculum Design and Implementation	2	2		2				
2	FIP8202	Study and Research in Physics Education	2	2		2				
3	FIP8203	Field Work of Physics Learning Innovation in School	2		2		2			
4	FIP8204	Mathematical Physics	2	2		2				
5	FIP8305	Theory and Practicum of Electrodynamics	3	2	1	3				
6	FIP8206	Classical Physics	2	2			2			
7	FIP8207	Quantum Physics	2	2			2			
8	FIP8308	Thesis Proposal	3	2	1		3			
9	FIP8209	Academic Writing	2	1	1			2		
10	FIP8610	Thesis	6		6				6	
Total			33			16	9	2	6	**33**
III.	**ELECTIVE COURSES **)**									**6**
1	FIP8211	Assessment and Evaluation in Physics Learning	2	2			2			
2	FIP8212	Item Response Theory	2	2			2			
3	FIP8213	Assessment Instrument Construction in Physics Learning	2	2			2			
4	FIP8214	IT-Based Learning and Technology Project	2	2			2			
5	FIP8215	Development of Physics Tools	2	2			2			
6	FIP8216	Disaster Learning	2	2			2			
7	FIP8217	Development of Physics Learning Materials	2	2			2			
8	FIP8218	Material Physics	2	2			2			
9	FIP8219	Optics and Photonics	2	2			2			
10	FIP8220	Computational Physics	2	2			2			
11	FIP8221	Medical Physics	2	2			2			
TOTAL OF COMPULSORY CREDITS UNDERTAKEN						**16**	**15**	**2**	**6**	**39**

Remarks: students without a physics education background must cover the knowledge of educational psychology, educational science, educational socio-anthropology

VI. COURSE DESCRIPTION

1. **FMI8201 Philosophy of Science**
   This course discusses the meaning and scope of the philosophy of science; the nature and characteristics of science; the relationship among science, technology, culture, and society; the structure of science; scientific means; the morality of science; and the challenges and the future of science.

2. **FMI8202 Statistics**
   This course discusses various statistical concepts applied in educational research cases. The discussion material includes descriptive statistics, univariate and multivariate statistics, and their application using statistical programs, especially SPSS. This course is expected to provide an understanding of statistical concepts and methods to analyze and solve problems, especially physics education research rationally, and to prioritize data objectivity.

3. **FMI8303 Research Methodology in Education**
   This course discusses the basic methods of educational research, which discusses the role of research in education, identification of research problems, literature review in research, formulation of research hypotheses, identification and measurement of research variables, determination of validity, experimental design, determination of research populations and samples, development of research instruments, educational research and development, data analysis, and preparation of research proposals.

4. **FIP8201 Physics Curriculum Design and Implementation**
   This course discusses (1) the foundations and references in the design, implementation, and development of the physics curriculum, which includes the National Education System Act, education national standards, science/physics education standards, life skills, science and technology literacy, noble characters; (2) physics curriculum design based on 2013 Curriculum; (3) Curriculum implementation in physics leraning, which includes models, approaches, strategies, methods, and learning techniques; (4) evaluation and development of physics curriculum.

5. **FIP8202 Study and Research in Physics Education**
   In this course, students are invited to analyze 25 journal articles related to physics education research. They do the first synthesis of the articles of their choice. They are introduced to journal categories: reputable, international, nationally accredited, and national. At the end of the lecture, they are expected to be able to find problems that can be used as their thesis material. The last product is the background for research that uses no less than 25 article as references. This product is uploaded to the similarity checker software (turnitin.com).

6. **FIP8203 Field Work of Physics Learning Innovation in School**
   This course trains students to do case studies where students start the activity by making observations at school to find problems related to physics learning (content and pedagogy). After identifying the problems, the students discuss them with the

lecturers to find the solutions to the problems found; and then proceed to develop a problem-solving design regarding content and pedagogy. The development of the problem-solving design is packaged in a Physics Subject-Specific Pedagogy (SSP) format, whose results of the development are trained to teachers in schools to be implemented in teaching, so that it is expected to be able to overcome existing problems.

7. **FIP8204 Mathematical of Physics**

   This course begins with a discussion of Coordinate Transformations including linear transformations, orthogonal transformations, curvilinear coordinates, and tensor analysis. Furthermore, ordinary differential equations are discussed including first-order ordinary differential equations and second-order linear differential equations with various forms of coefficients. The next discussion is solving differential equations using the series method, namely differential equations that have a special polynomial function solution. The next is discussing partial differential equations, which are applied to boundary condition problems. The last discussion is about integral transformation.

8. **FIP8305 Theory and Practicum of Electrodynamics**

   This course covers topics including Electric, Magnetic, and Gravitational Fields. The subject of the lecture begins with the calculation of the electric field, both generated by the point and distribution charges. Furthermore, the interaction force and the electric potential are discussed. The discussion arrives at the deriving the field through special techniques in calculating the distribution of electric potential including Cartesian coordinate systems, spheres and cylinders, then calculating the electrostatic field in the material. The next discussion is about Magnetostatics, including magnetic fields in the material. The occurrence of electromagnetic waves is also discussed. At the end of the lecture, the gravitational field is discussed including the theory of gravity, Theory of Special Relativity, and Basic Principles of the Theory of General Relativity.

9. **FIP8206 Classical Physics**

   This course discusses Newtonian Mechanics, Lagrange Mechanics, Hamiltonian Mechanics, Special Relativity Theory, and Continuous Medium Mechanics.

10. **FIP8207 Quantum Physics**

    This course includes a study on the application of quantum physics to physics problems in three dimensions.

11. **FIP8308 Thesis Proposal**

    This course consists of: the aspects of research methodology, important components in a thesis proposal, and the development of a research proposal for physics education in the context of writing a thesis. The resulting proposals are presented in seminars to obtain input.

12. FIP8209 Academic Writing

This course provides students with the skills to write scientific papers in accordance with the intended variety of journals, especially for reputable international journals.

13. FIP8610 Thesis

This course improves students' ability to systematically express the results of their thoughts in writing, to conduct research data collecting, data analysis, and write a complete thesis draft with the supervision of the supervisor; and to defend the thesis in front of the examiner and make revisions according to the examiner's input.

14. FIP8211 Assessment and Evaluation in Physics Learning

This course discusses the measurement, assessment, and evaluation of physics teaching and learning. After attending this course, students are expected to be able to design/construct assessment and evaluation instruments and can measure physics learning outcomes and analyze measurement results using applications and their interpretations.

15. FIP8212 Item Response Theory

This course discusses the method of interpreting the results learning outcome measurements using the Item Response Theory (IRT) approach for the purposes of item analysis and scoring. After attending this course, students are expected to be able to analyze and interpret test items as well as to score learning outcomes.

16. FIP8213 Assessment Instrument Construction in Physics Learning

This course discusses the method of developing assessment instruments for physics learning, both cognitive and non-cognitive assessment instruments. After attending this course, students are expected to be able to produce/construct valid and reliable cognitive and non-cognitive instruments.

17. FIP8215 Development of Physics Tools

This course discusses devices that are commonly encountered in everyday life, and discusses their physical aspects. After attending this course, students are expected to be able to make simple devices that apply the laws of physics and/or educational aids to introduce physics concepts. The products resulted from this course are expected to contain elements of novelty that can be submitted for intellectual property rights.

18. FIP8216 Disaster Learning

This course discusses the types of disasters and the factors that trigger disasters and strategies for reducing the impact of natural disasters through the physics learning oriented to disaster mitigation. After taking this course, students are expected to have good insights into planning and implementing disaster mitigation education through the development of physics learning tools that support disaster risk reduction (DRR). Students are also equipped with the ability to analyze research results related to disaster studies and disaster mitigation learning.

19. FIP8218 Material Physics

This course invites students to understand the relationship between the structure of materials and the characteristics of the materials, such as thermal, electrical, magnetic, and optical properties. The course discusses how technology modifies materials that are being adapted to ever-changing needs.

20. FIP8219 Optics and Photonics

This course discusses advanced light phenomena. The topics include light as waves, rays and photons, periodic and non-periodic waves, electromagnetic waves, fiber optics and waveguides, diffraction grating and its applications, holography, lasers, semiconductor lasers, and light detection.

21. FIP8220 Computational Physics

This course develops competencies to apply numerical analysis in the field of physics with a particular programming language in computers. The teaching material begins with an overview study of the programming language used. Then the course is continued with numerical analysis and its applications in the field of physics, which include: (1) curve matching, (2) ordinary differential equations, (3) hyperbolic partial differential equations: wave equations, (4) parabolic partial differential equations: heat equations, and (5) elliptical partial differential equation: Helmholtz equation.

22. FIP8221 Medical Physics

This course discusses the application of physics in the medical field. Living systems and processes in living systems are explained from the point of view of physics. Medical treatment for patients and medical devices are explained based on the concepts, theories, and laws of physics. After attending the course, the students are equipped with the experience of applying physics through research in the medical field.

VII. TEACHING-LEARNING PROCESSES

The teaching-learning process is carried out in accordance with the Academic Regulations 2019, namely.

1. Lectures are carried out using the Semester Credit System.
2. The unit load and roundness of study that must be undertaken by students are stated in the semester credit units.
3. There are three types of semesters at UNY as follows:
   a. Odd semester, which is held from September to January of the following year.
   b. Even semester, which is held from February to August of the current year.
   c. Intermediate semester, which is held from July to August of the current year.
4. The number of lectures is 16 (sixteen) times per semester excluding end-of-semester exams.
5. The lectures can be conducted using blended learning or full e-learning models.
6. The lectures using blended learning or a full e-learning model is regulated by the Rector Regulation.
7. Lectures of the Master and Doctoral programs are conducted through lectures and research.

8. Student must attend lectures of each subject in one semester at least 75% (seventy-five percent) of the lecture meetings as referred to in clause (1).
9. The student who is absent due to illness or duty, with a permit that can be accounted for, is counted as present.
10. Students who do not meet the 75% (seventy-five percent) attendance are not entitled to take the final exam, and the students concerned are given an E grade.
11. The end-of-semester exams are held simultaneously according to the academic calendar.
12. 12. Students are required to fill out a lecture evaluation form for each course that they participate via the website page: https://emonev.lppmp.uny.ac.id/.

VIII. ASSESSMENT

The assessment methods and determination of the final score are as follows:

1. Determination of a student's academic ability includes knowledge, skills, and attitudes/characters that reflect the student's competency.
2. Assessment of learning outcomes uses various approaches in accordance with the competencies that must be mastered by students.
3. The final score of a course ranges from 0 (zero) to 100 (one hundred) with a passing grade of 56 (fifty-six).
4. The final score is converted into letters A, A-, B+, B, B-, C+, C, D, and E, whose standards and weights are gvien as follows:

Final Score	Conversion	
Scale 100	Letter	Weight
86-100	A	4.00
81-85	A-	3.67
76-80	B+	3.33
71-75	B	3.00
66-70	B-	2.67
61-65	C+	2.33
56-60	C	2.00
41-55	D	1.00
0-40	E	0.00

IX. LESSON PLAN

MINISTRY OF RESEARCH, TECHNOLOGY, AND HIGHER EDUCATION

YOGYAKARTA STATE UNIVERSITY

MASTERS PROGRAM

Address : Jl. Colombo No. 1, Campus Karangmalang, Yogyakarta 55281. Telp 0274-586168 ext 229, 285, 367, 458

BASIC COURSE OUTLINE

Study Program	: Master Program in Physics Education
Course Name	: Philosophy of Science
Course Code	: PPS 8201
Credit	: 2
Semester	: 1
Prerequisite Course	: -
Lecturer	: Prof. Dr. Jumadi

Course Description:

This course reviews the meaning and basic concepts as well as the relationship among knowledge, philosophy, science, and philosophy of science; quantitative and qualitative research paradigms in revealing the truth; relationship, development and impact of science, technology, and culture/civilization.

Learning Objectives:

To develop comprehensive, fundamental, and deep thinking expressed in the form of presentation grade and a book produced
To develop a wise attitude of love of truth in using science and technology expressed in the score of presentation behavior
To conduct simple qualitative research realized in the form of journal/seminar articles

Meeting No.	Instructional Sub-objectives (Sub Comp.)	Topics	Instructional Type/ Model	Learning Experience	Assessment Indicators	Assessment Technique	Assessment Weight (per sub-comp)	Duration	Reference
1	2	3	4	5	6	7	8	9	10
1-5	1. To review the concept and meaning of knowledge, philosophy, science, and philosophy of science 2. To develop comprehensive, fundamental, and in-depth thinking based on the concept of knowledge, philosophy, science, and philosophy of science 3. Develop a wise attitude and love of truth based on the topic of the nurturant effect	Knowledge, Philosophy, Science, and Philosophy of Science -Knowledge -Philosophy -Science -Philosophy of Science Ontology Epistemology Axiology	Assignment Presentation Discussion	1. Review the literature on the concept and meaning of knowledge, science, and philosophy of science. 2. Presenting and discussing the results of the literature review on knowledge, science, and philosophy of science 3. Composing a problem-solving essay based on thorough, essential, and deep thinking	1. Understanding of the concept and meaning of knowledge, philosophy, science 2. Performance in reviewing, presenting/ discussing, and compiling book chapters related to the position of science in science and technology 3. The essay written	1. Cognitive assessment 2.Performance assessment 3. Product assessment	10 % 10 % 10 %	□×2×50 min.	1- 12

Meeting No.	Instructional Sub-objectives (Sub Comp.)	Topics	Instructional Type/ Model	Learning Experience	Assessment Indicators	Assessment Technique	Assessment Weight (per sub-comp)	Duration	Reference
1	2	3	4	5	6	7	8	9	10
6--12	1.To review quantitative and qualitative research 2. To conduct simple qualitative researc	Quantitative and qualitative research as a means of revealing the truth	Assignment Presentation Discussion	1. Reviewing the literature on quantitative and qualitative research. 2. Presenting and discussing the result of the literature review on quantitative and qualitative research 3. Conducting simple qualitative research	1. Understanding of quantitative and qualitative research concepts 2. Performance in conducting simple qualitative research 3. The result of qualitative research	1. Cognitive assessment 2.Performance assessment 3. Product assessment	10 % 10 % 25 %	×2×50 min.	1- 12

Meeting No.	Instructional Sub-objectives (Sub Comp.)	Topics	Instructional Type/ Model	Learning Experience	Assessment Indicators	Assessment Technique	Assessment Weight (per sub-comp)	Duration	Reference
1	2	3	4	5	6	7	8	9	10
13-16	1. To assess the relationship, development, and impact of science, technology, and culture/civilization 2. To develop thoughts and attitudes towards the impact of science and technology	Relationship, development and impact of science, technology, and culture/ civilization	Assignment Presentation Discussion	1. Reviewing the literature on the relationship, development, and impact of science, technology, and culture/civilization 2. Presentation and discussion of the results of the literature review on the relationship, development, and impact of science, technology, and culture/civilization 3. Solving problems related to the negative impact of science and technology	1. Understanding of the relationship, development, and impact of science, technology, and culture/civilization 1. Performance in presentations on the relationship, development, and impact of science, technology, and culture/civilization 2. Troubleshooting products	1. Cognitive assessment 2.Performance assessment 3. Product assessment	5 % 10 % 10 %	□×2×50 min.	1- 12

Final Score (FS) Determination:

$$FS = \frac{\text{(Score per unit)}}{3}$$

References :

1. Poedjiadi, A. (2001). *Pengantar Filsafat Ilmu Bagi Pendidik*. Bandung : Yayasan Cenderawasih
2. Suriasumantri, J.S. (1984). *Filsafat Ilmu*. Jakarta : Sinar Harapan
3. _____. (1982). *Ilmu dalam Perspektif*. Jakarta : Gramedia
4. Gjetsen, Derek. 1989. *Scince and Philosophypast and Present*. England: Penguin Books Ltd.
5. The Liang Gie. 1991. *Pengantar Filsafat Ilmu*. Yogyakarta: Penerbit dan Percetakan "Liberty" bekerjasama dengan Yayasan Studi Ilmu dan Teknologi,
6. Charlmers, A.F. 1983. *Apa itu yang dinamakan ilmu: Suatu penilaian tentang watak dan status ilmu serta metodenya*. Terjemahan redaksi HasanMitra.Jakarta: P/T. Upima Utama Indonesia.
7. Khun, Thomas S. 1989. *Peran Peradilan dalam Revolusi Sains*. Terjemahan Tjun Surjaman. Bandung: Remadja Karya Offset.
8. Muhadjir, Noeng, 1998. *Filsafat Ilmu: Telah Sistematis Fungsional Komparatif*. Yogyakarta: Penerbit Rake Sarasin.
9. Zen, M.T.1981. Sains, Teknologi dan Hari Depan Manusia. Jakarta PT. Gramedia:.
10. Barnadib, Imam. Kode Etik Akademik.
11. Kerlinger, F N. (1986). *Foundation of Behavioural Research*. Holt Rinehart and Winston. (Ker)
12. Creswell, John W., (1994). *Research Design : Qualitative & Quantitative Approaches*, London: Sage Publications.

Approved by,
Head of Master Program in Physics Education

Dr. Heru Kuswanto
NIP. 196111121987021001

Yogyakarta, 17 September 2019
Head of Teaching Staff,

Prof.Dr.Jumadi
NIP. 19550112 197803 1 001

BASIC COURSE OUTLINE

Study Program	:	Master Program in Physics Education
Course Name	:	Practicum of Physics Education Innovation
Course Code	:	MPF8203
Weight	:	2 credits
Semester	:	II
Prerequisite Course	:	-
Lecturer	:	Team

Course Description :

This course trains students to conduct case studies, where students start activities by making observations at school to find problems related to physics teaching and learning (content and pedagogy). After identifying the problems, the students discuss with the lecturers to find the solutions (solutions) to the problems found, then proceed to develop a problem-solving design regarding content and pedagogy. The development of a problem-solving design is packaged in a physics subject-specific pedagogy (SSP) format, whose results are then taught to the teachers in schools to be implemented in teaching and learning, so that it is expected to be able to overcome existing problems.

Teaching Objectives:

The students are able to develop the subject-specific pedagogy (SSP) of physics according to the characteristics of the material, students, and learning environment; and to teach the developed SSP to teachers in schools and implement it in teaching.

Meeting	Instructional Sub-objectives (Sub Comp.)	Topics	Instructional Type/ Model	Learning Experience	Assessment Indicators	Assessment Technique	Assessment Weight (per sub-comp)	Duration	Reference
1	2	3	4	5	6	7	8	9	10
1-2	Students understand the basic concepts of physics teaching	Essence of Physics	Discussion information	1. Students with the help of lecturers understand a body of knowledge in physics. 2. Students with the help of lecturers understand a way of thinking about physics. 3. Students with the help of lecturers understand a way of investigating physics.	1. Students' analysis of facts, concepts, principles, laws, and physical theories 2. Students' ability to explain the difference between critical and creative thinking skills in studying physics 3. Students' ability to explain physics process skills as a method of inquiry. 4. Students' ability to explain practical skills in physics teaching.	Assessment test	20 %	2×50 min.	Critical thinking and problem solving - the theory behind flexible thinking a... Dave Pushkin Journal of Science Education; 2007; 8, 1; ProQuest Education Journals New Blooms in Establishe

Meeting	Instructional Sub-objectives (Sub Comp.)	Topics	Instructional Type/ Model	Learning Experience	Assessment Indicators	Assessment Technique	Assessment Weight (per sub-comp)	Duration	Reference
1	2	3	4	5	6	7	8	9	10
									d Fields: Four Domains of Learning and Doing Peggy Dettmer Roeper Review; Winter 2006; 28, 2; ProQuest Education Journals
3	Students are able to analyze physics materials according to grade level in school.	Analysis of physics materials	Discussion and presentation	Students with the guidance of lecturers analyze the materials related to facts, concepts, principles, laws, and theories according to the competencies being analyzed.	1. Students' ability to make a material analysis table 2. Students' ability to analyze facts, concepts, principles, laws, and theories	Group performance evaluation	20 %	2×50 menit	Kurikulum fisika jenjang SMA/MA
4	Students are able to analyze pedagogy	Analysis of physics pedagogy	Discussion and presentation	Students with the guidance of lecturers analyze the pedagogy (methods/approaches/mo	1. Students' ability to make pedagogical analysis tables	Group performance evaluation	20 %	2×50 menit	Kurikulum fisika jenjang SMA

Meeting	Instructional Sub-objectives (Sub Comp.)	Topics	Instructional Type/ Model	Learning Experience	Assessment Indicators	Assessment Technique	Assessment Weight (per sub-comp)	Duration	Reference
1	2	3	4	5	6	7	8	9	10
	(methods/approaches/models; media and evaluation) that are appropriate for physics according to grade level in school.			dels; media and evaluation) that are suitable for science according to the competencies under analysis.	2. Students' ability to analyze scientific skills (process skills, thinking skills, and thinking strategy)				
5	Students are able to write a physics teaching observation sheet	Observation instrument	Discussion about information Group work	Students discuss in groups to develop a physics teaching observation instrument	1. Students' ability to set the objectives of observing physics learning 2. Students' ability to determine aspects of observation 3. Students' ability to arrange the grid of observation sheets 4. Students' ability to develop observation instruments according to the grid	Group performance evaluation and portfolio	20 %	2×50 min	Examples of observation sheets of physics teaching

Meeting	Instructional Sub-objectives (Sub Comp.)	Topics	Instructional Type/ Model	Learning Experience	Assessment Indicators	Assessment Technique	Assessment Weight (per sub-comp)	Duration	Reference
1	2	3	4	5	6	7	8	9	10
6-7	Students make observations at school	Needs assessment (Analysis of problems in school)	Field observation	Students make observations to analyze problems referring to the observation sheet that has been developed.	1. Students' ability to use the physics learning observation sheet at school 2. Students' ability to analyze problems to be used as the basis for developing innovative SSP	Group performance evaluation	20 %	2×50 min	Fieldwork
8	Students prepare reports on the results of observations of physics learning	Analysis of observation result	presentation	Students present their observations at school.	1. Students' ability to write reports on observations 2. Students' ability to propose solutions to specified problems	Group performance evaluation	20 %	2×50 min	
9-10	Students develop problem solving plans	SSP	Group work	Students discuss in groups to develop the SSP based on the problems observed	1. Students' ability to analyze the curriculum 2. Students' ability to analyze the material 3. Students' ability to design lesson plans 4. Students' ability to design worksheets	Group performance evaluation	20 %	2×50 min	Group performance evaluation

Meeting	Instructional Sub-objectives (Sub Comp.)	Topics	Instructional Type/ Model	Learning Experience	Assessment Indicators	Assessment Technique	Assessment Weight (per sub-comp)	Duration	Reference
1	2	3	4	5	6	7	8	9	10
					5. Students' ability to design teaching materials 6. Students' ability to design media and assessment The overall design of the device serves to solve problems and is innovative.				
11	Students conduct SSP training to teachers	SSP training	Discussion about information Group work	Students give training to teachers related to innovative SSP development results.	1. Students' ability to give training related to the results of curriculum analysis and material analysis 2. Students' ability to give training related to innovative learning tools (lesson plan, student worksheet, teaching materials, media, and assessment)	Group performance evaluation	20 %	2×50 min	Fieldwork
12-13	Students use the developed	Modeling	Presentation	Students use lesson plans as a model in teaching for a class and the partner	1. Students' ability to teach physics material referring to the	Group performance evaluation	20 %	2×50 menit	Fieldwork

Meeting	Instructional Sub-objectives (Sub Comp.)	Topics	Instructional Type/ Model	Learning Experience	Assessment Indicators	Assessment Technique	Assessment Weight (per sub-comp)	Duration	Reference
1	2	3	4	5	6	7	8	9	10
	innovative SSP as a teaching model in schools			physics teachers become observers	developed innovative SSP 2. Students' ability to analyze the results of modeling by students				
14-15	Students observe the implementation of innovative SSP developed by partner teachers	Implementasi SSP	Observation	Students become observers when partner teachers implement SSP for one class that is different from the modeling class	1. Students' ability to observe the teaching of physics material referring to innovative development results 2. Students' ability to analyze the results of innovative SSP implementation by partner teachers	Group performance evaluation	20 %	2×50 min	Fieldwork
15-16	Writing the report of the result of developing physics teaching innovation and packaging the video of modelling and implementation Final assessment (innovative SSP product, with two modeling and implementation videos)								

References (compulsory):

1. High School Physics Curriculum
2. Science Instruction in the Middle and Secondary Schools : Alfred T. Collete & Eugene L. Chiappetta

3. Pedagogical Content Knowledge Taxonomies: William R. Veal and James G. MaKinster.
4. Source and Development of Pedagogical Content Knowledge for Science Teaching: Shirley magnusson, *et al.*

Suggested Reading

1. Classroom Instruction and Management : Richard I. Arends
2. Supporting books of high school physics

Final Score (FS) Determination:

$$F = \frac{(\text{Score weight per sub-comp.} \times 70) + (\text{Seminar exam score} \times 30)}{100}$$

Approved by,
Head of Master Program in Physics Education

Prof. Dr. Heru Kuswanto
NIP. 196111121987021001

Yogyakarta, December 2019
Lecturer,

Dr. Insih Wilujeng
NIP. 196712021993032001

s2pfis.fmipa.uny.ac.id

s2pfisika@uny.ac.id

Jl. Colombo no. 1, Karang Malang, Depok, Sleman,
Yogyakarta 55281