MINISTER OF EDUCATION, CULTURE, RESEARCH, AND HIGHER EDUCATION

UNIVERSITAS NEGERI JAKARTA

ACADEMIC GUIDELINES 2021

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PART 1: HISTORY AND IDENTITY

I. INTRODUCTION

A. HISTORY

After Indonesia's independence, the Indonesian government felt a lack of education personnel at all levels and types of educational institutions. To solve this problem the government established various teacher education courses. Around the 1950s, at the level above secondary education, BI, B-II, and PGSLP were established in charge of preparing teachers for secondary schools. Efforts to improve the quality and number of teachers continue to be carried out through the establishment of Teacher Education Colleges (PTPG) by the government through the Decree of the Minister of Education and Culture No. 382/Kab. in 1954. PTPG was established in four cities namely Batusangkar, Manado, Bandung, and Malang. Thus there are two kinds of educational institutions that produce teachers, namely the BI/B-II/PGSLP Course andPTPG. These two institutions were then integrated into one educational institution through various stages. In 1957, PTPG was integrated into the Faculty of Teacher Training and Education at a nearby university. Based on PP No. 51 of 1958 the Faculty of Pedagogy was integrated into FKIP.

In 1963, the Ministry of Basic Education established the Teacher Education Institute (IPG) to produce secondary school teachers; while based on Ministerial Decree P and K No. 6 and 7, February 8, 1961 The BI and B-II courses

were integrated into the FKIP (Faculty of Teacher Training and Education) under the Ministry of Higher Education which also produced secondary school teachers. This dualism is felt to be less effective and interferes with the management of teacher education. To overcome this, the BI and B-II courses in Jakarta were integrated into the FKIP of the University of Indonesia. Through the Decree of the President of the Republic of Indonesia No. 1 year 1963 dateJanuary 3, 1963, the integration of the teacher education institutional system was established. One of the points in the Presidential Decree is that this Decree has been in effect since May 16, 1964, which was later declared as the birthday of the Jakarta IKIP. FKIP and IPG were changed to IKIP (Institute of Teacher Training and Education). FKIP Universitas Indonesia and IPG Jakarta were integrated into IKIP Jakarta. In subsequent developments, IKIP was given an expanded mandate to develop educational and non-educational knowledge within the university. IKIP Jakarta since August 4, 1999 has changed to Universitas Negeri Jakarta (UNJ) based on Presidential Decree 093/1999 dated August 4, 1999, and the inauguration was carried out by the President of the Republic of Indonesia on August 31, 1999 at the State Palace.

B. VISION, MISSION, AND GOALS

1. **Vision**
   To become a reputable university in Asia
2. **Mission**
   Organizing the tridharma of tertiary institutions that are superior and useful for human benefit
3. **Purpose**
   Realizing an intelligent, advanced, and civilized society through the development, application, and

dissemination of science and technology. The objectives are broken down into:

a. The establishment of identity branding as a university that leads in the development of human resources in the field of transformative education in Asia
b. Achievement of excellence in institutions and study programs with international standards in development and service through science, technology and art that educates and advances the nation's civilization through capacity building of human resources
b. The construction of an academic infrastructure and culture that is conducive to the development of science, art and technology towards a reputable university in Asia
c. Integrated use of information and communication technology to provide comprehensive services for the academic community, local public and international networks
d. The realization of the development of bureaucratic, financial and human resource governance that is transparent, accountable, responsible, independent and reasonable.

C. MOTTO
Educating and Dignifying the Nation

D. ORGANIZATIONAL STRUCTURE BASED ON STOCK UNJ

STRUKTUR ORGANISASI DAN TATA KERJA
UNIVERSITAS NEGERI JAKARTA
PERMENRISTEKDIKTI NOMOR. 44 TAHUN 2016

DEWAN PENYANTUN

SENAT UNIVERSITAS

REKTOR

WR I | WR II | WR III | WR IV

SATUAN PENGAWAS INTERNAL

FAKULTAS ILMU PENDIDIKAN | FAKULTAS BAHASA DAN SENI | FAKULTAS MATEMATIKA DAN IPA | FAKULTAS ILMU SOSIAL | FAKULTAS TEKNIK | FAKULTAS ILMU KEOLAHRAGAAN | FAKULTAS EKONOMI | FAKULTAS PEND. PSIKOLOGI | PROGRAM PASCA SARJANA | LEMBAGA PENELITIAN DAN P2M | LEMBAGA PENGEMBANGAN PEND. DAN PENJAMINAN MUTU

BIRO AKADEMIK KEMAHASISWAAN DAN HUBUNGAN MASYARAKAT | BIRO UMUM DAN KEPEGAWAIAN | BIRO KEUANGAN | BADAN PENGELOLA USAHA

UPT PERPUSTAKAAN | UPT TEKNOLOGI INFORMASI DAN KOMUNIKASI | UPT LAYANAN BIMBINGAN DAN KONSELING | UPT BAHASA

E.   FUNCTIONS AND COMPETENCE OF GRADUATES

UNJ will produce academic and professional personnel in the education and non-education fields, with the following graduate learning outcomes:

1. Diploma Three Program

a. Mastering theoretical concepts in the field of knowledge and skills in accordance with their field of expertise and applying human values in accordance with their field of expertise, based on scientific principles, procedures and ethics in order to produce solutions, ideas, designs or art criticism, as well as compiling a scientific description of the results of their studies in final project report form; by demonstrating independent, quality, and measurable performance, and documenting, storing, securing, and retrieving data to ensure

validity and prevent plagiarism.

b. Implement superior character based on the values of honesty, integrity, openness, intra and interpersonal skills, adaptive and able to work together in carrying out professional responsibilities in their field of expertise.

c. Develop a superior entrepreneurial spirit accompanied by an independent attitude and a strong work ethic to be able to synergize and compete in a healthy manner in the information age and free market at the national, regional and international levels

2. **Degree program**

a. Applying logical, critical, systematic, and innovative thinking in the context of the development or implementation of science and technology that pays attention to and applies human values in accordance with their field of expertise, based on scientific principles, procedures and ethics in order to produce solutions, ideas, designs or art criticism, as well as compiling a scientific description of the results of the study in the form of a thesis; by demonstrating independent, quality, and measurable performance, and documenting, storing, securing, and retrieving data to ensure validity and prevent plagiarism.

b. Carry out a leadership role characterized by skills in making strategic and professional decisions in making appropriate decisions based on the results of analysis of information and data in the context of solving problems in their area of expertise, being responsible for the achievement of organizational work results, as well as supervising and evaluating the completion of the work for which they are responsible .

c. Implement superior character based on the values of honesty, integrity, openness, intra and interpersonal skills, adaptive and able to work together in carrying out professional responsibilities in their field of expertise.

d. Develop a superior entrepreneurial spirit accompanied by an independent attitude and a strong work ethic to be able to synergize and compete in a healthy manner in the information age and free market at the national, regional and international levels.

3. **Graduate program**

a. Carry out academic validation or studies according to their field of expertise in solving problems in society or relevant industries based on logical, critical, systematic, and creative thinking through scientific research, creation of designs or works of art, through the development of their knowledge and expertise; compile scientific conceptions and the results of their studies using scientific principles, procedures, and ethics in the form of a thesis, and publish articles in accredited scientific journals at the national level and obtain international recognition in the form of scientific presentations or the equivalent.

b. Identify the scientific field that is the object of research and position it into a research map developed through an interdisciplinary or multidisciplinary approach to make decisions in the context of solving problems in the development of science and technology that pays attention to and applies humanities values based on analytical or experimental studies.

c. Find or develop new scientific theories/conceptions/ideas that can contribute to the development and practice of science and/or technology in their fields of expertise, and produce problem solving, through scientific research based on scientific methodologies, logical, critical, systematic, and creative thinking with prepare a research roadmap with an interdisciplinary or multidisciplinary or transdisciplinary approach, including theoretical studies and/or experiments in the fields of science, technology, art and innovation in the form of a dissertation, and communicate it through the mass media or directly to the public in accredited scientific journals at national and international levels.

d. Demonstrate academic leadership in managing, developing, fostering resources and organizations under their responsibility including storing, auditing, securing, and retrieving research data and information under their responsibility through effective and efficient management, as well as developing and maintaining collegial relationships and colleagues within their own environment or through collaborative networks with the research community outside the institution.

II.   IDENTITY

A.   SYMBOL

UNJ has a symbol (logo) in the form of fire, five eagle wings and a book in a blooming flower frame with the core meaning:

a. The three-layered red flame is the soul of academic and educational fire, fulfilling the Tri Dharma of Higher Education accompanied by daring to defend the truth to achieve lofty ideals.

b. The five pairs of green eagle wings symbolize the strong spirit of Pancasila which underlies the attitudes and actions of all UNJ citizens to play a role in realizing national development goals.

c. The white book as the basis, symbolizes UNJ as a source of science, technology and art.

d. The five blooming and circular lotuses symbolize the nobility of the UNJ academic community in serving the interests of the nation and state, based on Pancasila and oriented towards the future.

e. The yellow base color symbolizes nobility.

CONTOH WARNA	NAMA WARNA	WARNA PROSES	WARNA SPOT
	Putih	—	—
	Kuning	M10 Y100	TC 033
	Hijau	C100 M50 Y100	TC 417
	Merah	M100 Y100	TC 124

Jenis huruf : Optima Bold

B. COLORS OF UNIVERSITY, FACULTY AND POSTGRADUATE PENDANTS

Universitas Negeri Jakarta is green with CMYK code: 93,51, 100, 17

Faculty of Educational Sciences is green with CMYK code: 76, 0, 76, 45

Faculty of Languages and Arts in turquoise green with CMYK code: 66, 0, 50, 0

FAKULTAS BAHASA DAN SENI

The Faculty of Mathematics and Natural Sciences is purple with CMYK codes: 50, 80, 10, 0

FAKULTAS MATEMATIKA DAN ILMU PENGETAHUAN ALAM

Faculty of Social Sciences is red with CMYK code: 0, 100, 100, 5

FAKULTAS ILMU SOSIAL

Faculty of Engineering is navy blue with CMYK code: 100, 40, 0.15

FAKULTAS TEKNIK

Faculty of Sports Science is white with CMYK code: 0, 0, 0, 0

FAKULTAS ILMU KEOLAHRAGAAN

Faculty of Economics copper color with CMYK code: 15, 70, 100, 5

FAKULTAS EKONOMI

Faculty of
Psychology
Education is light
blue with CMYK
code: 100, 0, 0, 0

FAKULTAS PENDIDIKAN PSIKOLOGI

Postgraduate
gold with CMYK
code: 0, 40, 90,
10

PASCASARJANA

C. HYMNE AND MARS UNJ

UNJ Hymn

F = do   M. Soeharto

4/4

Khidmat

mf

| 1 .7 1 2 | 3 .2 1 . | 5 .5 4 3 | 2 . . 2 |

Dengan ra - sa ha - ru ka - mi pan-jat - kan ke-

f

| 6 2 3 4 | 5 . 3 . | 1 .1 3 2 | 1 . . 0 |

ha–di - rat Mu Tu - han syu kur dan do - a

mf

| 1 .7 1 2 | 3 .2 1 . | 5 .5 4 3 | 2 . . 2 |

Dengan ra sa bang -ga ka - mi bak - ti - kan i-

f

| 6 2 3 4 | 5 . 3 . | 1 .1 3 2 | 1 . . 0 |

man, il-mu, dan a - mal ba - gi ne - ga - ra

mp

| 2 .2 27 12 | 3 . 1 . | 3.3 3 2 3 4 | 5 . . 5 |

Dalam hati kami se - mua te-guh bertekad sa tu Jun-

f

| 1 .1 7 7 33 | 6 . 5 1 2 | 3 . 2 1 | 2 . . 5 |

jung tinggi Universitas Negri Ja - kar - ta jun-

f   rit

| 1 .1 7 7 33 | 6 . 5 1 2 | 3 . 2 . | 1 . . 0 |

jung tinggi Universitas Negeri Ja - kar - ta

Mars UNJ

C = do   M. Soeharto
4/4
Marcia/Penuh Semangat

   mf   *f*
5 . 5 │ 1　5　3　1 │ 5 . 6 5 7.1 │ 2　7　5　4 │ 3 . . 5.5 │
Dengar-lah de-rap gem -bi - ra,　suara langkah ber-sa- ma　Uni

│ 1　5.5 3 1 │ 4 . 5 6 7.6 │ 5　4　3　2 │　1 . . 3 . 3 │
ver- si-tas Negri　Ja-kar-ta da-lam bak- ti Tri　Dhar-ma　membim-

         mp
│ 3　6 . 6　6 5.6 │ 7 . . 　3 . 3 │ 3　7.7　7　6 . 7 │ 1 . . 3 . 5 │
bing sumber daya kita　　Men-di -dik tunas tunas bangsa Kem

         f
│ 1 . 1　2　5 │ 3　3 . 1 . 6│ 5　　6　7　1 │ 2 . . 3 . 5 │
bangkan sa-yap il - mu　Se – pan-jang ha-yat ki - ta　　Se-

         F   *rit*
│ 1 . 1　2　　5 │ 3　3 . 1　　6 │ 5 5 1 2 3 1 2 │ 1 . .││
　mo-ga dir - ga -ha - yu Uni-ver - si-tas Negeri Jakarta

D. TOGA FORM

BAHAN & WARNA

1. TC HITAM
2. SATIN SUPER BIRU KEHITAMAN
3. SATIN SUPER MERAH
4. SATIN SUPER HIJAU TUA
5. SATIN SUPER JINGGA KUNING

Jubah

Bahan	: Tetoron Cotton (TC)
Warna	: Hitam
Lengan	: Longgar dengan ikatan karet pada pergelangan tangan

Tanda Pangkat

Arti Pangkat: Pangkat 0 = wisudawan Diploma
Pangkat 1 = wisudawan S1
Pangkat 2 = wisudawan S2
Pangkat 3 = wisudawan S3

Bahan	: Satin Super
Warna	: Hijau Tua
Ukuran	: Panjang 24 cm, Lebar 3,5 cm Jarak antar pangkat 3 cm

Krah

Bahan	: Satin Super
Warna	: Biru Kehitaman, Merah, Hijau Tua Bisban krah Jingga Kuning

Topi

Bentuk	: Segi Lima
Bahan	: Tetoron Cotton (TC) Hitam
Aksesori	: Kancing di titik tengah bagian atas topi sebagai pengait pita (kuncir)

Pita (kuncir)

Warna	: Sesuai dengan warna Fakultas
Bahan	: Tali Kur Nylon

III. INSTITUTIONS, BUREAUS AND SERVICE UNITS

A. INSTITUTION

1. Institute for Research and Community Service (LP2M)

Head of LP2M	Dr. Ucu Cahyana, M.Si
LP2M Secretary	Dr. Iwan Sugihartono, M.Si
Corpus. Education Research, Teacher Training, and Women's Studies, LP2M	Dr. Ika Lestari, M.Pd
Corpus. Center for Science, Technology and Environment Research, LP2M	Dr. Setia Budi, S.Si., M.Sc.
Corpus. Social, Economic, and Humanities Research, LP2M	Dr. Abdul Haris Fatgehipon, S.Pd., M.Si
Corpus. Sports and Health Research, LP2M	Dr. Hernawan, SE, M.Pd
Corpus. Innovation and Business Incubator, LP2M	Dr. Karuniana Dianta Arfiando Sebayang, ME
Corpus. Development of Scientific Publications and Intellectual Property Rights, LP2M	Dr. Erfan Handoko, M.Si
Corpus. Management	Dr. Sarkadi, M.Si

of Real Work Lectures & Community Service, LP2M	

2. **Institute for Educational Development and Quality Assurance (LP3M)**

Head of LP3	Dr. Muhammad Zid, M. Si
LP3 Secretary	Dr. Budiaman, M.Si
Corpus. Learning Development & Disability Services, LP3	Dr. Asep Supena, M. Psi
Corpus. Certification and Profession, LP3	Dr. Nofi Marlina Siregar, S.Pd., M.Pd
Corpus. PPL, LP3	Dr. Nuruddin, S.Ag., M.Ag
Corpus. PKL, LP3	Drs. Arris Maulana, ST, MT
Corpus. Learning Resources, LP3	Cecep Kustandi, M.Pd
Corpus. University Courses, LP3	Martini, SH, MH
Head of Teacher Professional Education (PPG), LP3	Prof. Dr. Ir. Arita Marini, ME
Secretary of Teacher Professional Education (PPG), LP3	Dra. Sri Zulaihati, M.Si

B. BUREAU

1. Bureau of Academic Administration, Student Affairs, and Public Relations (BAKH)

Head of BAKH	Woro Sasmoyo, SH., MH
Head of Division. Academic & Cooperation, BAKH	Dra. Tri Suparmiyati, M.Si
Head of Division. Student Affairs, BAKH	Uded Darussalam, M.AP
Head of sub division. Registration, BAKH	Bagus Young Irawan, ST
Head of sub division. Academic and Evaluation, BAKH	Achmad Lutfi, S. Kom.
Head of sub division. Student Welfare, BAKH	Partini, S.Pd.
Head of sub division. Alumni, BAKH	Yunedi, S.Pd.
Head of sub division. Interests, Talents, Reasoning, and Information, BAKH	Merlen Setiady, SE
Head of sub division. Cooperation and Public Relations, BAKH	Sri Ayu Suciningdiah, S.Pd.

2. Bureau of Public Administration and Personnel (BUK)

Head of BUCK	Kamandoko, S. Sos.
Head of Division. Staffing, BUK	Dwi Achmad Noor, SH, MH

Head of Division. UHTL, BUK	Miswan, S.Pd., M.AB
Head of Division. State Property, BUK	Ramlan Lumbantoruan, S. Sos., MM
Head of sub division. Educator, BUK	Siti Mastoah, SH
Head of sub division. Education Personnel, BUK	Hermanto, S.Sos., M.Sc.
Head of sub division. Administration and Household, BUK	Hary Suhari, S.Pd.
Head of sub division. Law and Administration, BUK	Wiwie Marwiyah, ST, M.Pd.
Head of sub division. Procurement, BUK	Susilo Parmoko, S.Pd., MM
Head of sub division. Inventory and Removal, BUK	Hafsyah, S.Pd.

3. **Financial Bureau**

Head of Bureau of Finance (BK)	Edy Witanto, SH, MH
Head of Division. Finance, BK	Feny Daruny, SE, M.AK.
Head of Division. Planning, BK	
Head of Division. Accounting and Reporting, BK	Arif Permana, S.Pd
Head of sub division.	Mohammad Khaironi, S.Pd.

Non-Tax State Revenue Budget, BK	
Head of sub division. Non-Budget Non-Tax State Revenue, BK	Aris Parmono, S, AP., M.AP.
Head of sub division. Program and Budget, BK	Rahim, S.Pd.
Head of sub division. Evaluation of Program and Budget Implementation, BK	Happy Ningdyah Nadhi Hapsari, SEAris Parmono, S.AP., M.AP.
Head of sub division. Accounting, BK	Rr. Selly Rosaria Ayu Cita Murti, SE
Head of sub division. Financial Reporting, BK	Delima Sari, S. Kom.

4. Business Management Agency

Head of BPU	Prof. Dr. Dedi Purwana ES, M. Bus
BPU Secretary	Dr. Sukro Muhab, M. Si
Head of Division. Asset Utilization and Optimization, BPU	Drs. Irzan Zakir, M.Pd
Head of Division. Business Cooperation, BPU	Dede Rahmat Hidayat, M.Psi., Ph.D
Head of Division. Creative Business Development, BPU	Dr. Maria Paristiowati, M.Si

C. TECHNICAL IMPLEMENTATION UNIT

1. Quality Assurance Unit (SPM)

Head of SPM	Dr. Karnadi, M.Si
SPM Secretary	Dr. Siti Nurjanah, SE, M.Si
Head of Division. Internal Quality Assurance, SPM	Dr. Wirda Hanim, M. Psi
Head of Division. External Quality Assurance, SPM	Fauzi Bakri, S.Pd., M.Si
Head of Division. Data and Information Systems, SPM	Dr. Dalia Sukmawati, M.Si

2. Internal Supervisory Unit (SPI)

Head of SPI	Dr. Choirul Anwar, M. Ak
Head of Division. Financial Supervision, SPI	Dra. Umi Mardiyati, M.Si
Head of Division. HR Supervision, SPI	Dr. Dewi Susita, M.Si
Head of Division. Infrastructure Supervision, SPI	Dr. Ir. Irika Widiasanti, MT

3. Office Admission

Head of Admission Office	Dr. eng. Agung Premono, MT
Secretary of the Admissions Office	Dr. Ir. Fatah Nurdin, MM

Head of Division. Selection, Admissions Office	I Wayan Sugita, ST, MT
Head of Division. Cooperation and Promotion, Admissions Office	Dr. Hanip Pujiati, M.Pd

D. TECHNICAL IMPLEMENTATION UNIT

1. UPT Information and Communication (UPT TIK)

Head of UPT ICT	Med Irzal, S. Kom., M. Kom
Head of Division. Data, UPT ICT	Tri Hesti Utaminingtyas, SE, MSA.
Head of Division. Information System, UPT ICT	Hamidillah Ajie, MT
Head of Division. Infrastructure, UPT ICT	Arya Adipurwa, S. Kom

2. UPT Library

Head of UPT Library	Dr. Yossa Istiadi, M.Pd

3. UPT Counseling Guidance

Head of UPT Counseling Guidance	Deasyanti, M.Psi., Ph.D

4. UPT Language Service

Head of UPT Language Service	Dr. Widya Parimita, SE, M.PA.

5. Public Relations and Public Information Office

Head of Public Relations and Public Information Office	Heryanti Utami, S.St., MMPar
Secretary of the Office of Public Relations and Public Information	Dr. Elisabeth Nugrahaeni PS, M.Si
Head of Division. Public Services, Public Information and Protocol	Marja, S.Pd., M.Pd
Head of Division. Coverage and News	Asep Supriyana, SS, M.Pd

6. Office of International Affairs

Head of Office of International Affairs	Dra. Asma Irma Setianingsih, M.Si
Secretary of the Office of International Affairs	Diyantari, SS, M.APP.Ling

7. BPS Labschool UNJ

Head of BPS Labschool UNJ	Prof. Dr. Achmad Sofyan Hanif, M.Pd
Deputy Head of Academic Affairs BPS Labschool UNJ	Dr. Achmad Ridwan, M.Si
Deputy Head of General Affairs and Finance BPS Labschool UNJ	Adam Zakaria, M.Ak., Ph.D
Deputy Head of Cooperation and Development of BPS Labschool UNJ	Dr. Khaerudin, M.Pd
Head of Research and Development (R&D) of BPU Labschool UNJ	Dr. Anggara Budi Susila, M.Si
Secretary for Research and Development (R & D) BPS Labschool UNJ	Drs. M. Fakhruddin, M. Si

PART 2: ACADEMIC POLICY

ACADEMIC POLICY
UNIVERSITAS NEGERI JAKARTA

I.   INTRODUCTION

Statutes are basic guidelines for organizing activities that are used as a reference for planning, developing programs and implementing functional activities in accordance with the objectives of the university concerned. The statute is the basis used as a reference for the development of general regulations, academic regulations, and operational procedures applicable in the concerned tertiary institution (Government Regulation No. 60 of 1999 concerning Higher Education Article 1 point 7). On the basis of this decree, the Minister of Research, Technology and Higher Education has established the Statute of the Universitas Negeri Jakarta (UNJ) as stated in Permenristekdikti No 42 of 2018.

Based on the statutes of the Universitas Negeri Jakarta (UNJ), the UNJ Senate, hereinafter referred to as the Senate, is the element that carries out the function of formulating, determining and considering the implementation of policies in the academic field. UNJ's academic policies are prepared based on philosophical aspects (humanism and multiculturalism), socio-academic aspects, juridical aspects, and pay attention to strategic issues both internally and externally, and based on Law no. 20 of 2003 concerning the National Education System, Law no. 12 of 2012 concerning Higher Education, Government Regulation no. 60 of 1999 concerning Higher Education, and other related laws and regulations within the framework of

Pancasila and the 1945 Constitution. Referring to the UNJ statutes, then the principle of determining the Academic Policy refers to the basic values of implementing the tridharma activities of higher education at UNJ which include: (a) truth and wisdom; (b) academic integrity; (c) democratic and humanist; (d) diversity and equality; (e) benefit humanity; and (f) sustainable.

UNJ's Academic Policy is the basis and direction for strategic plans and academic operational policies covering the fields of education, research, and community service within UNJ. Academic policies are also a guide in an effort to realize the role of UNJ as a reputable university in the Asian Region in the era of the industrial revolution 4.0. The policy is also the main reference for all university leaders in preparing the Strategic Business Plan (RSB), Business Budget Plan (RBA) and allocating the resources needed to carry out the planned program of activities. For all lecturers, education staff, and students, this policy is used as a guide in implementing and developing higher education tridharma activities that are relevant to the needs of the community, nation and state.

II.   ACADEMIC POLICY BASIC
A. PHILOSOPHICAL HISTORICAL BASIS

The world of education is a dynamic world, which changes and changes human life and civilization. UNJ as an educational institution has experienced this change or transformation. The first transformation occurred with the change of the Faculty of Teacher Training and Education at the University of Indonesia (FKIP UI) which was established on January 3, 1963 based on Presidential Decree No. 1/1963 to become the Jakarta Teacher Training Institute (IKIP Jakarta). IKIP Jakarta was officially ratified by the Minister of

Higher Education and Science on May 16, 1964, which was later designated as the birthday (dies natalis) of UNJ. The second transformation occurred on August 4, 1999 with the change of the Jakarta Education Teacher Training Institute (IKIP Jakarta) to UNJ based on Presidential Decree No. 93 of 1999 concerning the Change of the Teacher Training and Education Institute (IKIP) into a University. These two transformations are evidence of dynamics in the world of education and this dynamic is the driving force for UNJ to continue to make changes and updates.

Education, throughout the history of human life, is believed to be the greatest changing force, even called the engineer of civilization. In the view of humanism, only through education can humans prove themselves as beings who have values and roles that determine the course of life in this world by prioritizing critical thinking skills (rationalism) and providing evidence (empiricism). In fact, humanism was originally synonymous with the education system, education is what makes humans as humans so that the educational process is seen as a process of humanizing humans. In this context, the necessity to plan the academic process in education contained in the tridarma becomes inevitable.

Education actually prepares humans to be able to create harmony with the reality around them. The era of knowledge and information opens the veil that covers various differences; diverse reality. Differences that often trigger tension and unrest are cultural and religious differences so that multiculturalism should be an inseparable part of the tridharma planning in order to create individuals who can accept differences as a necessity and wealth, not a threat.

The sacred mission of humanizing humanity through education is philosophically outlined in the symbol of UNJ.

The three-layered tongue of fire means the spirit of academic and educational fire in carrying out the tridharma of higher education accompanied by courage in defending the truth to achieve noble ideals. A pair of eagle wings, each consisting of five pieces, means the strong spirit of Pancasila which underlies the attitudes and actions of the Academic Community and UNJ Education Personnel to play a role in realizing national development goals. Books mean UNJ as a source of science, technology, art, and sports. The five petals of the lotus flower that bloom signify the nobility of the UNJ Academics and Education Personnel in serving the interests of the nation and state, based on Pancasila and oriented to the future.

B. SOCIOLOGICAL BASIS

Education is a manifestation of the interaction of various elements. As a practice, education at UNJ is an act and process of creating graduates who have certain competencies based on educational theory and other sciences. Sociologically, education is an interaction between individuals who are essentially social beings and part of society. In education, there is interaction between individuals with different roles (educators, education staff, and students), with different ages, experiences, and abilities.

Interaction in the implementation of the tridharma at UNJ cannot be separated from its position in the community. First, UNJ is one of the subsystems in the education system in Indonesia and other social systems that are interrelated, either directly or indirectly. Second, UNJ is an intellectual community that is among the many social, political, economic, and cultural communities around it. Third, as a system, UNJ is a special institution that has its own system of values and norms that regulate the relationships between

individuals within it. Fourth, UNJ as an educational institution plays a major and strategic role in changing, shaping, and creating students with the expected behavior. Therefore,

UNJ as a higher education institution located in the center of the Indonesian capital is very thick with multiculturalism born of multi-ethnic and religious conditions so that it requires a system of academic values and norms that can protect these differences and diversity. To ensure that the system of academic values and norms runs as expected, UNJ sets a vision, mission, goals, motto, and basic values that become the reference for the implementation of the tridharma.

UNJ has a vision to become a reputable university in the Asian region with the mission of organizing the tridharma of tertiary institutions that are superior and useful for human benefit. UNJ aims to create an intelligent, advanced, and civilized society through the development, application, and dissemination of science and technology with the motto of educating and dignifying the nation. To support the achievement of the goals, implementation of the vision, and the realization of the mission above, UNJ carries out the basic values of organizing the Tridharma tertiary education activities at UNJ which include: truth and wisdom, academic integrity, democracy and humanity, diversity and equality, benefiting humanity, and sustainable.

These basic values are translated into IKHLAS energy which must become a work culture in carrying out the tridharma. UNJ's work culture must have color in the form of Integrity which is always maintained, Commitment which characterizes performance, Humanist which is service orientation, Logical which is the basis for addressing problems, Accountability which characterizes performance, and Synergy in achieving goals. Academic policies in the

implementation of the tridharma should accommodate these characteristics so that efforts to achieve UNJ goals can be realized.

C. JURIDICAL BASIS

The implementation of the Tridharma of Higher Education at the Universitas Negeri Jakarta is carried out on the following basis:

1. Law of the Republic of Indonesia Number 20 of 2003 concerning the National Education System;
2. Government Regulation of the Republic of Indonesia Number 60 of 1999 concerning Higher Education;
3. Government Regulation of the Republic of Indonesia Number 4 of 2014 concerning the Implementation of Higher Education and Management of Higher Education;
4. Regulation of the Minister of Research, Technology and Higher Education of the Republic of Indonesia Number 44 of 2015 concerning National Standards for Higher Education;
5. Regulation of the Minister of Research, Technology and Higher Education of the Republic of Indonesia Number 50 of 2018 concerning Amendments to the Regulation of the Minister of Research, Technology and Higher Education of the Republic of Indonesia Number 44 of 2015 concerning National Standards for Higher Education National Standards for Higher Education.

D. FUNCTION AND PURPOSE

Academic policy functions:

1. Academic Policy is a policy direction and guideline for the implementation of academic activities at UNJ;
2. Academic Policy contains policies in the fields of education, research, and community service, which are

intended as guidelines for the implementation of UNJ's academic life.

Academic Policy Objectives:
1. Realizing the implementation of quality Tridharma activities in order to achieve the vision, mission, and goals of UNJ;
2. Realizing the creation of an academic atmosphere that guarantees the freedom of the academic pulpit in the implementation of the tridharma that is responsible and contributes to the benefit of the people;
3. Realizing the implementation of a transparent, conducive and accountable management system for Tridharma activities.

III.   ACADEMIC POLICY

A. EDUCATION

1.   Definition
Education is a conscious and planned effort to create a learning atmosphere and learning process so that students actively develop their potential to have religious spiritual strength, self-control, personality, intelligence, noble character, and skills needed by themselves, society, nation and state.

2.   Organizational Purpose
a. Realizing an intelligent, advanced, and civilized society through the development, application, and dissemination of science and technology so as to produce people who have high competence in the fields of educational and non-educational professions and have Pancasila character, so that they are able to understand, apply, and develop

science, technology , and the arts to promote human welfare, civilization and dignity;

b. Realizing a quality learning process that is able to produce graduates who are confident, have a high commitment to work, prioritize a quality culture, maintain and develop noble values, which can educate and dignify the nation.

3. **Maintenance principle**

a. The implementation of education at UNJ refers to Law no. 12 of 2012 Articles 2 and 3 which are based on: (a). scientific truth; (b). reasoning; (c). honesty; (d). Justice; (e). benefit; (f). virtue; (g). responsibility; (h). diversity; and (i). affordability. Specifically, the implementation of education at UNJ also refers to the basic values of organizing tridharma activities which include: (a) truth and wisdom; (b). academic integrity; (c) democratic and humanist; (d). diversity and equality; (e). beneficial to humanity; and (f). sustainable;

b. The implementation of education at UNJ utilizes and develops data literacy, technology, and human resources that are in line with the dynamics and challenges of the times by using a monodisciplinary, multidisciplinary, interdisciplinary, or transdisciplinary approach. Education through multimodal in accordance with the provisions of the legislation;

c. The implementation of education at UNJ must at least meet the elements specified in the National Higher Education Standards (SNPT), and have characteristics that are developed based on the values of the University, and the characteristics of the Study Program;

d. The implementation of education at UNJ must also refer to the Internal Quality Assurance System (SPMI) which is a cycle of Determining/Planning the Implementation of Improvement Control Evaluation (PPEPP) accompanied by evidence of the implementation of the PPEPP;

e. The mechanism for setting educational standards at UNJ which includes learning content (curriculum), the learning process which includes an academic atmosphere, integration of research and community service (PkM) in learning, and learning assessments at least meet the SNPT standards, and it is possible for UNJ to develop standards that go beyond the SNPT as its additional performance indicators;

f. UNJ organizes Academic Education, Vocational Education, and Professional Education. Academic education includes education for undergraduate programs, master programs, and doctoral programs. Vocational education includes diploma programs, applied master programs, and applied doctoral programs. Professional Education is higher education after the undergraduate program which is held to have expertise in certain professions;

g. The implementation of education at UNJ uses the academic year as outlined in the academic calendar, by implementing a semester credit system that uses semester credit units. The academic calendar is prepared every academic year and accommodates the implementation of the intermediate semester;

h. The implementation of education at UNJ refers to the curriculum that is compiled and developed for each study program by taking into account the development of Science and Technology (IPTEK) globally (scientific vision), community needs (societal needs), stakeholders (stakeholder needs), in accordance with SNPT, education standards teachers, the Indonesian National Qualifications Framework, international quality standards, and/or input from stakeholders; as well as inter-level competence in the same discipline;

i. In line with the policy regarding the Independent and Independent Campus Learning, the UNJ curriculum accommodates learning activities outside the study program or outside the campus that are part of the lecture process with various learning methods by utilizing information technology, including blended learning and e-learning according to the characteristics and needs of the study program;

j. Certain study programs within UNJ facilitate the implementation of inclusive education for students with special needs;

k. The university facilitates transfer students both from within and outside UNJ according to applicable regulations;

l. To improve the quality of UNJ graduates, the UNJ curriculum accommodates internship courses at various national and international agencies in accordance with applicable regulations;

m. UNJ actively participates in providing education on a regional or global scale through various

educational cooperation programs, for example in the form of international classes, twin programs, joint degrees and double degrees;

n. Curriculum achievement control mechanisms are carried out internally and externally. Internal control mechanisms through: (1) situation analysis, (2) periodic curriculum development, (3) monitoring the preparation of the lecture process as curriculum implementation, (4) monitoring the lecture evaluation process by looking at the input of lecturers, students, and the academic community as supporters implementation implementation, (5) Follow-up and improvement. Meanwhile, the external control mechanism is carried out by national and international accreditation bodies as well as input from stakeholders as graduate users;

o. Curriculum implementation, in the form of the learning process at UNJ, must refer to the National Higher Education Standards (SN Dikti), SPMI quality standards, and international standards related to the learning process;

p. The assessment and development of the system and the quality of learning are handled by various organizational units at the University, Faculty and Study Program levels. All units refer to the same goal, which is to help lecturers and students realize learning that is in accordance with curriculum objectives and achieve the specified learning outcomes;

q. The achievement of standard learning processes involves the synergy of existing resources at the University, Faculties, and Study Programs within UNJ, which includes the availability of funding,

infrastructure, lecturers, education staff, laboratory assistants, technicians, administrative staff and other supporting staff such as building managers, cleaning and security personnel;

r. Determination of standards for integrating research and PKM, as well as reporting of final work in learning is determined in a synergy between universities, faculties, study programs and the Institute for Research and Community Service (LPPM) as stated in the Guidelines for Research and Community Service;

s. The implementation of the learning process at UNJ can be carried out in Indonesian, Bilingual, and International languages according to the needs and improving the quality of graduates with a minimum TOEP score according to the standards set and validated by the authorities. Resources involved in the learning process, namely Lecturers, can come from permanent lecturers, DPK, or foreign lecturers as needed;

t. UNJ organizes Non-Degree Education, which is managed by the Professional Certification Institute and the Institute for Education and Learning Development.

u. UNJ has a code of ethics and academic ethics, which includes: (1) Lecturer's code of ethics; (2) code of ethics for Education Personnel; and (3) Student code of ethics. The Lecturer's Code of Ethics is a guide to the attitudes and behavior of lecturers in implementing the Tridharma of Higher Education and life both on campus and in the community. The code of ethics for education personnel is a guideline for the attitudes and behavior of educational staff in carrying out the

duties of supporting the tridharma of higher education and life both on campus and in the community. The Student Code of Ethics is a guide to student attitudes and behavior in carrying out the Tridharma of Higher Education and life both on campus and in the community.

4. **Educational Institutions**
    a. UNJ guarantees the creation of scientific autonomy, upholds academic freedom, academic freedom and pulpit. Academic freedom is the right of the Academic Community which is carried out in an effort to explore, apply, and develop science and technology through education, research, and community service activities. Freedom of the academic pulpit is the authority of professors and/or lecturers who have scientific authority and authority to state openly and responsibly regarding something related to the clump of knowledge and branches of science. Scientific autonomy is the autonomy of the academic community in a branch of science and/or technology in finding, developing, revealing, and/or maintaining scientific truth according to scientific principles, methods, and academic culture;
    b. UNJ upholds the nature of scientific principles which are reflected in the attitudes and academic freedom of the academic community by referring to norms, rules, and academic achievements. The freedom of the academic pulpit is directed at strengthening the realization of the development of the identity of lecturers and students as well as science and

technology guided by scientific autonomy. Academic freedom and the freedom of the academic pulpit are utilized by UNJ to: (1) protect and defend intellectual property; (2) protect and maintain the natural, biological, social and cultural wealth and diversity of the Indonesian people; (3) add and/or improve the quality of the intellectual property of the Indonesian nation and state; and (4) strengthen the competitiveness of the Indonesian nation and state;

c. UNJ is managed based on the principles of independence, partnership, participation, openness, accountability, and in favor of the interests of the people.

B. STUDY

1. Definition

Scientific activities based on analysis and construction carried out in a systematic, methodological, consistent and aim to reveal the truth.

2. Types of Research Conducted

UNJ conducts research that includes basic research, applied research, and development research.

a. Basic research is research whose ideas and findings underlie, strengthen, and support science;

b. Applied research is research to obtain specific and relevant applied knowledge;

c. Development research is research that utilizes previous knowledge or experience which is directed to produce new materials, tools, ideas

or policies that lead to the expansion of knowledge;

d. UNJ carries out research in accordance with the development of science and technology that is integrated in the fields of education and community service by complying with the research code of ethics;

e. Research is carried out with a monodisciplinary, multidisciplinary, interdisciplinary or transdisciplinary approach.

3. **Principles of Conducting Research**

a. The university plans and directs a research roadmap that seeks to meet the interests of the community, has a global perspective, and can be carried out individually, in groups, or in institutions;

b. Research planning and implementation is carried out in an integrated manner and in synergy with educational activities and community service;

c. The University is responsible for developing, implementing, monitoring, informing and evaluating research policies to:

1) maintain the integrity of the university,

2) protect the safety and welfare of researchers and research objects,

3) maintain conformity with regulations relating to the research implementation process, and

4) manage research information.

d. The University facilitates the development of research facilities for all academics;

e. The university is obliged to support the implementation of research which is managed and carried out professionally in research organizing units;

f. The university has the role of facilitating, empowering, and improving the capabilities of research organizing units;
g. The university increases student involvement in research activities as a fulfillment of academic requirements, learning arena, actualization of scientific competence, and self-development;
h. The university supports, empowers, and facilitates academic staff to produce research outputs which can be in the form of intellectual property, scientific articles, appropriate technology, social engineering, teaching materials, textbooks, and other outcomes that can be applied and developed in society at national and international levels. ;
i. The University develops an adequate reward system for all academics to encourage the creation of a conducive research environment.

4. **Research Institutions**
   a. The university plans and directs research roadmaps that seek to meet the interests of advancing science and technology, the needs of the community, with a global perspective, and can be carried out individually, in groups, or in institutions;
   b. Research institutions include research groups, study centers, research centers coordinated by institutions that manage research at the university level;
   c. The university compiles and stipulates the governance and research organization, university research policies, research quality assurance standards for research organizing

units, research implementation guidelines and research codes of ethics for researchers;

d. The University ensures that the university's research policies apply to all university research projects;

e. The University develops an adequate reward system for all academics to encourage the creation of a conducive research environment;

f. The university develops research collaborations that include research activities involving researchers from outside the university, utilization of shared facilities, and utilization of research objects;

g. The university must have a unit responsible for regulating the involvement of foreign researchers and the exchange of specimens or research materials that meet legal and safety requirements;

C. COMMUNITY DEDICATION

1. Definition

Community service is the dissemination and application of science, technology and art (science and technology) to provide services, support, empowerment, facilitation, mentoring and advocacy to the community to improve welfare, independence, sovereignty and quality of life.

2. Principles of Implementation of Community Service

a. The university organizes community service in research-based institutions that have been carried out by UNJ;

b. The University carries out community service based on the principles of caring, sincerity, and non-profit;

c. The university provides community service based on participatory and empowerment principles;

d. The university carries out community service based on the principle of sustainability;

e. Community service as part of the tridharma of higher education is implemented in a balanced, sustainable and integrated manner with education and research;

f. Community service is directed to be based on research developed according to the UNJ research roadmap;

g. Community service is part of the active participation of the UNJ academic community in national development.

3. **Community Service Institutions**

   a. Community service institutions include community service groups, empowerment centers, community service centers coordinated by institutions that manage community service at the university level;

   b. Institutions that provide community service are in favor of the interests of the community;

   c. Institutions providing community service work together with government, private and community institutions with the principles of equality and independence;

D. **HUMAN RESOURCES**

1. **Lecturers and Education Personnel**

   a. The university is responsible for increasing the number of lecturers with doctoral qualifications of at least 75% of the number of lecturers at the university;

b. The university is responsible for increasing the number of professors by at least 10% of the number of lecturers at the university;

c. The university ensures that the assignment of lecturers and education staff must be in accordance with the required competencies and qualifications;

d. The university ensures that lecturers and education staff have the opportunity to improve competence through study assignments, research, writing and dissemination of scientific papers, training, and work experience;

e. The university ensures the availability of facilities and infrastructure for lecturers and education staff in supporting the implementation of the tridharma;

f. The university creates a fair and sustainable work system and division of tasks;

g. The university develops and implements a transparent and accountable performance evaluation system for lecturers and education staff;

h. The university provides awards or sanctions for lecturers and education staff according to work performance;

i. The university seeks to improve the ability of lecturers and education staff through certified training in accordance with applicable regulations;

j. The university may assign researchers, practitioners, and or experts from outside with certain competencies that meet the qualifications set by the university to support the implementation of the tridharma;

k. The University undertakes development programs for lecturers to improve the quality of research and scientific publications;

l. The university is responsible for increasing the number of indexed publications at least 50% of the number of lecturers in each year;

m. The university facilitates lecturers/researchers to interact and contribute in professional organizations and/or and/or international bodies;

n. The university develops community service programs based on the results of lecturers' research;

o. The university cooperates with partners/guided areas that can be used as places for implementing community service programs;

p. The University ensures that every lecturer and student has access to services or utilizes the University's community service activities.

2. **Student**

   a. The university ensures that the admissions process adheres to a system of equity, diversity, fairness, transparency, accountability, egalitarianism, non-discrimination and still pays attention to the quality of inputs;

   b. The university ensures that every student gets the same academic services;

   c. The university is responsible for providing facilities for students with disabilities;

   d. The university facilitates the existence of programs, facilities, and sources of funds for the development of self-potential, interests, and

talents of students in co-curricular and extra-curricular programs;

e. The university is responsible for the development of students' soft skills;

f. The university provides dormitory services for prospective teacher students;

g. The University is responsible for the validity of all student academic documents;

h. The university seeks to provide career development services for students;

i. The University seeks funding sources in the context of developing student creativity programs and competitions at national and international levels.

IV.   ACADEMIC ETHICS

The values of Academic Integrity in higher education tridharma activities are implemented in order to ensure academic quality and avoid academic violations. Dishonest acts in an academic environment such as falsifying data, cheating, lying, theft of ideas or data is unacceptable behavior. Therefore, the university is obliged to ensure that every lecturer and student adheres to academic ethics. Academic ethics, which is also mentioned in the UNJ Statutes, is a behavioral guide for the academic community in carrying out the tridharma of higher education.

Academic ethics that must be understood and become a concern for all activities of the academic community at UNJ include:

A. ACADEMIC INTEGRITY

Namely the moral principles that are applied in the academic environment, in the form of the values of honesty, trust, justice, respect, and responsibility.

B. ACADEMIC VIOLATIONS

Namely every act of lecturers, students, and/or education staff that deviates from the value of Academic Integrity. The types of academic violations in question include:

1. Fabrication, is the creation of false research data and/or information into scientific works
2. Falsification is the unauthorized manipulation of research data and/or information into scientific works
3. Plagiarism is an act
   a. "referring and/or quoting phrases and/or sentences that are not common without mentioning the source of one's own work or

others in the citation notes and/or without stating the source in accordance with the reference and/or citation in scientific writing."

b. "using sources of ideas, opinions, views, data, and/or theories without stating the source of their own or other people's work in accordance with references and/or citations in scientific writing."

c. "to formulate in one's own words from the source of the sentence, data, or theory without stating the source of one's own work or that of others in accordance with references and/or citations in scientific writing."

d. "translating writings from a source's own or other people's work in whole or in part which is recognized as a scientific work."

e. "acknowledging a work produced by another party as a scientific work."

4. Authorship is not valid, is an act
   a. Join voluntarily or by force as co-authors without contributing to published scientific works
   b. Eliminate the name of someone who contributed to the published scientific work
   c. Ordering other people to make scientific work as their scientific work without any contribution. The contribution in question can be in the form of ideas, opinions, or active roles related to the scientific field and can be proven
   d. Conflict of interest is the act of producing scientific work following the wishes of the party who gives or benefits without conducting research in accordance with scientific principles and ethics.

    e. Multiple submissions are the act of submitting the same scientific work and published in more than one journal and/or publisher

V. COOPERATION

Academic collaboration is UNJ's effort to strengthen processes and realize superior academic performance (Education, Research and Community Service) and have an impact on society, the nation and the State.

A. PURPOSE OF COOPERATION

The university cooperates with various organizations and universities at home and abroad in order to achieve UNJ's mission as a reputable university in Asia by paying attention to equality and benefits from both parties.

B. COOPERATION PARTNER

The University carries out academic cooperation with universities, the business world, and other institutions both at home and abroad to support the implementation of the Tridharma of Higher Education.

C. FORM OF COOPERATION

The University facilitates collaboration in the form of:
1. Implementation of education, research, community service
2. Internal quality assurance
3. Twin, co-degree and double-degree programs
4. Transfer and/or acquisition of credit scores and/or other similar units
5. Assignment of competent lecturers to conduct coaching at other universities in need
6. Lecturer/student exchange
7. Shared resource utilization

8. Development of a center for the study of science and technology
9. Scientific periodicals
10. Apprenticeship
11. Organizing joint seminars
12. Organizing competency tests with professional associations
13. Scholarship award

D. COOPERATION TERMS
1. The university provides an opportunity for faculties or institutions to initiate cooperation with external parties in accordance with the applicable terms and conditions.
2. The university legalizes cooperation in the form of an MoU signed by the Chancellor or the person authorized.
3. The university draws up terms and conditions of cooperation for the sake of creating mutually beneficial cooperation, prioritizing the principle of equality, and actually supporting the advancement of the implementation of the tridharma activities of higher education.

E. FINANCIAL MANAGEMENT
The university is responsible for providing and managing finances in accordance with the cooperation agreement with the partner party.

F. COOPERATION QUALITY ASSURANCE
The university conducts quality assurance audits for the implementation of the cooperation.

PART 3: ACADEMIC RULES

PART 4: ACADEMIC OPERATIONAL GUIDE

This section contains information about faculties, postgraduates, and study programs which include vision, mission, goals, management, profiles, competencies, degrees, accreditation, curriculum, and lecturers.

To complete education in a study program, a student must go through a learning process as stated in the study program curriculum. The learning process can be carried out inside and/or outside the study program with a certain learning load and various forms of learning activities. The forms of learning activities that can be taken are lectures (including student exchanges), internships or work practices, teaching assistance in education units, research, humanitarian projects, entrepreneurial activities, independent studies, village building or thematic real work lectures. Further arrangements regarding the learning load and forms of learning activities are left to the study program with reference to the applicable guidelines and regulations.

part 2
Faculty Guidelines Math and Natural Science

Academic year 2021/2022

Faculty
Math and
Natural Science

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Universitas Negeri Jakarta Campus A
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Facculturation
Math and
Natural Science

A. INTRODUCTION

The Faculty of Mathematics and Natural Sciences (FMIPA) is the implementing element of the Universitas Negeri Jakarta (UNJ) in Education and Teaching, Research, Community Service, and Cooperation in the MIPA field. The Faculty of Mathematics and Natural Sciences, Universitas Negeri Jakarta organizes two levels of education, namely the Master of Education Program (Strata 2) and the Undergraduate Program (Strata 1) in the Mathematics and Natural Sciences Education field.

Starting in 2020, the implementation of the Bachelor program at FMIPA UNJ accommodates the Independent and Independent Learning Campus (KM-MB) policy which is implemented in the implementation of education and teaching programs, as well as other relevant non-academic activities. So that it is expected to produce graduates who are more qualified and according to the needs of stakeholders.

Master Program (S2) Education managed by FMIPA are:

1. Mathematics Education Master Program
2. Masters Program in Physics Education

3. Master's Program in Chemistry Education
4. Masters Program in Biology Education

Undergraduate Programs (S1) of Education managed by FMIPA are:

1. Mathematics Education Undergraduate Program
2. Physics Education Undergraduate Program
3. Chemistry Education Bachelor Program
4. Biology Education Undergraduate Program

Non-Educational Undergraduate (S1) Programs managed by FMIPA are:

1. Undergraduate Mathematics Program
2. Physics Undergraduate Program
3. Chemistry Undergraduate Program
4. Biology Undergraduate Program
5. Computer Science Undergraduate Program
6. Bachelor Program in Statistics

B. VISION

By 2030, become an excellent and competitive faculty in the field of Mathematics and Natural Sciences and Mathematics and Natural Sciences education at the ASIA level based on faith and piety.

C. MISSION

1. Organizing quality education and teaching activities by utilizing information and communication technology to produce graduates who are in accordance with the needs of stakeholders and are able to compete at the ASIA level;
2. Creating a conducive academic atmosphere, creating a religious atmosphere in every academic and non-

academic activity, and fostering entrepreneurial skills for students;
3. Organizing research and development activities in the field of MIPA and MIPA education in line with the development of science and technology;
4. Organizing community service activities both related to the MIPA and MIPA education fields;
5. Establish and develop cooperation with various institutions both at home and abroad.

D. PURPOSE
1. Produce graduates in the field of Mathematics and Natural Sciences education who are professional, able to utilize information and communication technology, have faith and piety, have entrepreneurial skills, according to stakeholder needs, and are able to compete at the ASIA level;
2. Produce quality scientific works based on research results in the field of Mathematics and Natural Sciences and Mathematics and Natural Sciences education in accordance with the development of science and technology;
3. Produce works of community service in the field of Mathematics and Natural Sciences and Mathematics and Natural Sciences education that can be directly utilized by the community;
4. Establishing mutually beneficial cooperation with partner institutions both from within and from abroad, especially those related to the development of FMIPA UNJ.

E. MANAGEMENT

1. Faculty

1.	Dean	Dr. Adisyahputra, M.Si
2.	Vice dean of academic fields	Prof. Dr. Muktiningsih.NMSi
3.	Deputy Dean for General Affairs and Finance	Drs. Sudarwanto, M.Si, DEA
4.	Vice Dean for Student Affairs and Cooperation	Hadi Nasbey, M.Si,PhD

2. Master Study Program

1.	Coordinator of the Master of Mathematics Education Study Program	Dr. Makmuri, M.Si
2.	Coordinator of the Master of Physics Education Study Program	Dr.rer.nat. Bambang Heru Iswanto, M.Si
3.	Coordinator of Chemistry Education Masters Study Program	Dr. Afrizal, M. Si
4.	Coordinator of the Biology Education Masters Study Program	Dr. Supriyatin, M.Si

3. Bachelor of Education Study Program

1.	Mathematics Education Study Program Coordinator	Dwi Antari, S.Pd, M.Pd
2.	Coordinator of Physics Education Study Program	Dr. Esmar Budi, M.Si
3.	Chemistry Education Study Program Coordinator	Yuli Rahmawati, S.Pd, M.Sc, Ph.D

4.	Biology Education Study Program Coordinator	Dr. Rusdi, M. Bio. Med

4. Non-Educational Undergraduate Study Program

1.	Mathematics Study Program Coordinator	Dr. Lukita Ambarwati, M.Si
2.	Physics Study Program Coordinator	Dr. Widyaningrum Indrasari, M.Si
3.	Chemistry Study Program Coordinator	Dr. Fera Kurniadewi, M.Si
4.	Biology Study Program Coordinator	Dr. Reny Indrayanti, M.Si
5.	Coordinator of Computer Science Study Program	Ir. Fariani, M. Kom
6.	Statistics Study Program Coordinator	Dr. Bagus Sumargo, M.Si

BPA S1 Mathematics Education

A. STUDY PROGRAM

1. Introduction

We thank God Almighty, because of His blessings and grace, we were able to publish the Academic Manual Book (BPA) for the Undergraduate Mathematics Education Study Program, Faculty of Mathematics and Natural Sciences, Universitas Negeri Jakarta. This BPA can be used by undergraduate students of Mathematics Education FMIPA UNJ as a basis for determining the courses that students will take each semester. In addition to students, this BPA can be used by Academic Advisors in guiding students to determine which courses should be taken by their tutored students.

This BPA is prepared based on the curriculum of the Mathematics Education S1 Study Program FMIPA UNJ which has been in effect since 2021. The S-1 Mathematics Education Study Program itself always develops a mathematics education curriculum in accordance with the KKNI, SN-Dikti, and the National Standards for Teacher Education (SNPG). So that the objectives in the curriculum of the Mathematics Education Study Program of FMIPA UNJ will be achieved. As time goes by, the curriculum in the Mathematics Study Program continues to change. Changes made are based on stakeholder needs, competency standards set by the government and associations. This curriculum was built to accommodate the policy of independent learning.

We would like to express our deepest gratitude to all those who have assisted in the preparation of this BPA.

Suggestions and constructive criticism from various parties in order to improve the BPA that has been compiled can be submitted to us so that it can be a future improvement. Hopefully, efforts to improve the quality of Indonesian education graduates, especially the S1 Mathematics Education Study Program, Universitas Negeri Jakarta, can be well realized.

2. Vision, Mission and Goals

Vision

Become a religious study program, have a high academic culture, be actively involved in the scientific community and be able to compete at a global level.

Mission

a. Organizing quality, effective, efficient educational activities in a conducive, responsible, religious, accountable and transparent academic atmosphere.

b. Organizing research activities for the development of mathematics education and providing solutions to mathematics education problems.

c. Organizing community service activities in the field of mathematics education that are meaningful, inspiring, useful, and following the development of science and technology.

d. Establish cooperation between domestic and foreign agencies, and the community to carry out education, research and service.

Purpose

a. To produce mathematics education graduates who have professional, pedagogical, social and personality competencies, are religious, have noble

character, and are capable of entrepreneurship and compete globally.
b. Produce research and scientific work for the development of mathematics education that is innovative, creative, applicable and able to provide solutions to mathematics education problems.
c. Generate ideas, ideas, activities and works in the field of mathematics education that are meaningful, inspiring and beneficial for the community.
d. The occurrence of good communication and cooperation with educational institutions at home and abroad, training institutions, local governments, and other agencies that support each other for the development and progress of mathematics education both nationally and globally.

3. **Profile**

GRADUATE PROFILE

	GRADUATE PROFILE	GRADUATE PROFILE DESCRIPTION
1	Mathematics Educator	As a junior/high school mathematics teacher or equivalent and able to design, implement, and evaluate learning.
2	Researcher in Mathematics Education	As a researcher who is able to conduct research based on research methodologies to provide alternative solutions to problems in mathematics education at the junior high/high school level.
3	Entrepreneur in Education	As an entrepreneur who is able to create his own employment and is engaged in education.

4. **Competence**
   a. **Attitude**
      1) Fear of God Almighty and able to show a religious attitude;
      2) Upholding human values in carrying out duties based on religion, morals, and ethics;
      3) Contribute to improving the quality of life in society, nation, state, and the advancement of civilization based on Pancasila;
      4) To act as citizens who are proud and love their homeland, have nationalism and a sense of responsibility to the state and nation;
      5) Appreciate the diversity of cultures, views, religions, and beliefs, as well as the opinions or original findings of others;
      6) Cooperate and have social sensitivity and concern for society and the environment;
      7) Obey the law and discipline in the life of society and the state;
      8) Internalize academic values, norms, and ethics;
      9) Demonstrate a responsible attitude towards work in their area of expertise independently; and
      10) Internalize the spirit of independence, struggle, and entrepreneurship
      11) Understanding himself fully as an educator

   b. **General Skills**
      1) Able to apply logical, critical, systematic, and innovative thinking in the context of the development or implementation of science and technology that pays attention to and applies humanities values in accordance with their field of expertise;

2) Able to demonstrate independent, quality, and measurable performance;
3) Able to study the implications of the development or implementation of science and technology that pays attention to and applies humanities values according to their expertise based on scientific principles, procedures and ethics in order to produce solutions, ideas, designs or art criticisms;
4) Able to compile a scientific description of the results of the studies mentioned above in the form of a thesis or final project report, and upload it on the university's website;
5) Able to make appropriate decisions in the context of solving problems in their area of expertise, based on the results of information and data analysis;
6) Able to maintain and develop work networks with supervisors, colleagues, colleagues both inside and outside the institution;
7) Able to be responsible for the achievement of group work results and supervise and evaluate the completion of work assigned to workers under their responsibility;
8) Able to carry out the process of self-evaluation of the work group under their responsibility, and able to manage learning independently; and
9) Able to document, store, secure, and retrieve data to ensure validity and prevent plagiarism.

c. **Special skill**
   1) Identify the characteristics of students from the physical, psychological, social, and cultural aspects for the sake of learning;

2) Provide services to students according to their characteristics
3) Develop the potential of students optimally
4) Select and apply learning approaches and models, teaching materials, and assessments for the benefit of learning;
5) Applying information and communication technology (TIK) in planning, implementing the learning process, evaluating learning and managing learning;
6) Improving the quality of learning based on process assessment and assessment of learning outcomes,
7) Develop a learning environment that is safe, fun, and challenges students to be creative.
8) Conducting a deepening of the field of study in accordance with the environment and developments of the times;
9) Develop a curriculum according to the field of work;
10) Managing the education unit level curriculum
11) Able to analyze real situations to find problems and design alternative problem solving based on scientific studies in the field of mathematics education.
12) Able to carry out mathematics education research and data analysis with the help of appropriate software and interpret the results of data analysis.
13) Able to apply research results to self-reflect in carrying out learning and provide alternative improvements in the continuous learning process

14) Able to design, produce and use mathematics education teaching aids.

d. __Knowledge__
1) understand the philosophical, juridical, historical, sociological, psychological, and empirical foundations of education
2) understand the concepts, instrumentation, and praxis of educational psychology
3) mastering learning and learning theory;
4) master the objectives, content, learning experiences, and assessments in the curriculum of the education unit
5) mastering scientific concepts and methods that overshadow the substance of the field of study
6) Able to formulate parts of the field of knowledge in mathematics into a structured unit and apply it in carrying out tasks as a professional mathematics educator
7) Able to formulate Educational Theory and development model of mathematics learning and be able to apply it to design mathematics learning that is adapted to today's learning paradigm.
8) Able to use various learning resources and science and technology-based mathematics learning media to support the implementation of bilingual learning.
9) Able to be responsible in carrying out his profession as a mathematics educator as well as developing himself, adapting to technological developments and educational paradigms in order to achieve the goals of the teaching profession organization.

5. **Title**

   Graduates of the Mathematics Education Study Program are given a Bachelor of Education degree and abbreviated as S.Pd.

6. **Accreditation**

   The Mathematics Education Study Program has been accredited by the National Accreditation Board for Higher Education (BAN-PT) of the Ministry of National Education of the Republic of Indonesia with an "A" (Excellent) score based on the Decree of the National Higher Education Credit Agency of the Ministry of National Education of the Republic of Indonesia Number: 2518/SK/BAN -PT/AK-PPJ/S/IV/2021 April 28, 2021.

7. **Curriculum (Structure, Distribution, and Course Description)**

   a. Curriculum Structure

   The curriculum structure of the Mathematics Education Study Program consists of 4 (four) groups of courses that can be completed during the study period of 8 (eight) semesters and a maximum limit of 14 (fourteen) semesters with a minimum number of credit units: 144 credits.

CURRICULUM STRUCTURE TABLE

No	Course Group	credits
1	**General Course**	**21**
	National Compulsory Courses	8
	University Compulsory Courses	6
	Basic Education Course	7
2	**Course Characteristics of the Faculty**	**3**

3	Study Program Courses	Minimum 120
	Expertise and Supporting Courses (MKBKP)	Minimum 107
	Learning Courses (MKP)	13
TOTAL		**Minimum 144**

b. Distribution of Courses Each Semester

No	Code	Subject	credits	1	2	3	4	5	6	7	8
— Semesters & credits header above 1–8										
A. General Course										
1	0005-111-2	Pancasila	2	V							
2	3005-006-2	Indonesia Language	2	V							
3	0005-312-3	Religion	2		v						
4	0005-111-3	Citizenship	2		v						
5	0005-321-2	Education Insights	2		v						
6	0005-322-2	Data Raya and Programming	2			v					
7	0005-320-2	Logic and Scientific Reasoning	2				v				
B. Basic Education Course										
1	0005-307-4	Educational Foundation	3	v							
2	0005-210-2	Student Development	2		v						
3	0005-214-4	Learning and Learning Theory	2			v					
C. Study Program Courses										
1	3005-004-2	English	2	v							
2	3005-112-1	Olympics	1	v							

No	Code	Subject	credits	Semesters & credits							
				1	2	3	4	5	6	7	8
3	3115-204-3	Differential Calculus	3	v							
4	3115-036-2	Introduction to Basic Mathematics	2	v							
5	3115-038-3	Basic Statistics	3	v							
6	3115-071-3	Linear Algebra	3	v							
7	3005-002-2	Philosophy of Mathematics and Natural Sciences	2		v						
8	3115-205-3	Integral Calculus	3		v						
9	3115-030-2	Number Theory	2		v						
10	3115-044-3	Mathematical Statistics I	3		v						
11	3115-067-2	English Math I	2		v						
12	3115-211-3	Programming Algorithm	3		v						
13	3115-073-2	Euclidean geometry	2			v					
14	3115-211-3	Complex Variable Functions	3			v					
15	3115-206-3	Multiple variable calculus	3			v					
16	3115-082-2	English Math II	2			v					
17	3115-212-3	Introduction to Computer Animation	3			v					
18	3115-207-3	Elementary Differential Equations	3				v				

No	Code	Subject	credits	Semesters & credits							
				1	2	3	4	5	6	7	8
19	3115-051-3	Numerical Method	3				v				
20	3115-011-2	Space Geometry	2				v				
21	3115-209-3	Analytical Geometry	3				v				
22	3115-048-3	Real I Analysis	3				v				
23	3115-045-3	Mathematical Statistics II	3				v				
24	3115-208-3	Advanced Differential Equations	3					v			
25	3115-043-3	Transformation Geometry	3					v			
26	3115-049-3	Real Analysis II	3					v			
27	3115-053-3	Discrete Mathematics	3					v			
28	3115-010-2	Workshop	2					v			
29	3115-017-2	History of Mathematics	2					v			
30	3115-031-3	Abstract Algebra	3						v		
31	3115-035-3	Linear Program	3						v		
32	3115-214-3	ICT-Based Mathematics Learning	3						v		
33	3115-222-2	Educational Research Methods	2						v		
34	3115-210-3	Capita Selecta Mathematics	3						v		
35	3115-216-3	Entrepreneurship	3						v		

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No	Code	Subject	credits	Semesters & credits							
				1	2	3	4	5	6	7	8
36	3115-073-2	Mathematics Seminar	2							v	
37	3005-207-2	Prescription Seminar	2							v	
38	3005-402-4	Essay	4								v
39	0005-300-2	KKN**)	2					v	v	v	
40	3115-054-2	Painting Geometry**)	2					v	v	v	
41	3115-233-3	Non Parametric Statistics**)	2					v	v	v	
42	3115-223-3	Operation Reset Technique**)	3					v	v	v	
43	3115-232-3	Experimental design**)	3					v	v	v	
44	3115-213-3	Regression Analysis**)	3					v	v	v	
45	3115-215-3	Multiple Variable Analysis**)	3					v	v	v	
46	3115-946-3	Mathematical Modeling**)	3					v	v	v	
D. Learning Courses											
1	3115-063-2	Elementary Mathematics Learning	2			v					
2	3115-064-2	Middle School Mathematics Learning	2				v				
3	3115-075-2	High School Mathematics Learning	2					v			
4	3005-202-3	Learning Management and Evaluation Planning (PPEP)	3					v			

No	Code	Subject	credits	Semesters & credits							
				1	2	3	4	5	6	7	8
5	3115-237-2	Microteaching	2						v		
6	3005-503-2	Teaching Skills Practice (PKM)	2							v	
Amount			Min 144								

Notes:

**) Elective courses are selected for a minimum of 10 credits from the 21 credits available

 provided (taken in semester 5, 6 and 7)

c. Course Description

Differential Calculus (3 credits)
This course aims to make students understand the concept of differential calculus of functions of one and two variables and are skilled at applying it in various problems.

These courses include: Real Number Systems; One-variable functions: special functions, limit and continuity, derivatives, use of derivatives; L' Hopital's Theorem; Functions of two variables: limit and continuity, partial derivatives, directed derivatives, total differentials and the use of derivatives.

Integral Calculus (3 credits)
(Prerequisite: Differential Calculus)
This course aims to make students understand the concepts of integral, double integral, triple integral and their application.

These courses include: The theory of integrals (indeterminate integrals); integration technique; definite integral; the basic theorem of calculus; improper integral; integral use of course; double integral; triple integrals and the application of double and triple integrals.

Multiple Variable Calculus (3 credits)
(Prerequisite : Integral Calculus)
This course aims to make students understand the concepts of sequences and series, vectors and vector calculus and apply the knowledge learned to related problems.

These courses include: Sequences and series; convergence test; power series; convergence area; the

Taylor and Maclaurin series; vector function (vector field); limits; continuity, differential and integral vector functions; scalar field; gradient and directed derivative of a scalar field; the divergence and curl of the vector field; line integral; Green's theorem; surface integrals; Gaussian divergence theorem and Stokes' theorem

Elementary Differential Equations (3 credits)
(Prerequisite : Integral Calculus)
This course aims to make students understand the forms of Differential Equations (PD), how to solve them and be able to apply them to real problems.
This course includes: first-degree differential equations including: separable, exact, linear variables. PD level one high power, linear PD level n with constant coefficient homogeneous/non homogeneous; n-level linear PD with variable coefficients include: PD Cauchy, PD Legendre, PD Level two; System of Linear Differential Equations. PD applications in various fields of science.

Advanced Differential Equations (3 credits)
(Precondition :Elementary Differential Equations)
This course aims to make students understand the forms of Differential Equations with initial values, how to solve them and can apply them to real problems.
This course covers: Laplace transform and inverse laplace transform; Laplace Transform application to solve PD with initial values; Rank Series; Series Solutions of Linear Differential Equations, Cauchy-Euler Equations, Frobenius Method.

Numerical Method (3 credits)
This course aims to make students understand the use of numerical methods in non-linear root causes, systems of

linear equations, interpolation, curve matching, integration and ordinary differential equations.

This course covers: determining errors in numerical calculations, floating point numbers, binary numbers, determining the roots of linear intertwined problems with open and closed methods, solving systems of linear equations, determining Lagrange interpolation and Newton's Divided Difference, curve matching, calculating integration and differential equations. normal. Presentation of this course is given through face-to-face and practical.

Complex Variable Functions (3 credits)

This course aims to make students understand the nature of complex numbers, complex functions, the concept of continuous limits, derivatives and integrals of complex functions and complex number series.

These courses include: Algebra of complex numbers; complex functions; Limits and Continuity, Derivatives, Elementary Functions, Complex Integrals and Complex Number Series

Linear Algebra (3 credits)

This course aims to enable students to use matrix operations and elementary row operations to solve systems of linear equations and understand the meaning and properties of Euclid's space R".

These courses include: SPL: Homogeneous and Non Homogeneous, Gaussian Elimination, Gauss-Jordan; Matrix: Operation, Inverse, Rank, Elementary Matrix, and Determinant; Vector Spaces: Definition, Vectors in R2 and R3, Euclid Space Rn, Bases and Dimensions, Inner Multiplication Spaces, Gram-Schmidt Process; Linear

Transformation: Kernel & Range, Transformation Matrix, Eigenvalues; Eigenvectors; diagonalization.

Number Theory (2 credits)

This course aims to make students understand the properties of integers, basic algorithms, arithmetic and be able to use them in algebra and recognize the concept of congruence as the basis for the basic concepts of groups, rings and fields.

These courses include: Number System; Mathematical induction; T Binomial; allotment; FPB; KPK; Euclid's Algorithm; Diophantine Equation; Num. Prime; Congruence; Congruent Applications; Linear Congruence; T Fermat; T Euler; T Wilson.

Abstract Algebra (3 credits)
(Prerequisite: Number Theory & Linear Algebra)

This course aims to enable students to understand algebraic operations and the structures associated with them so that they can be used for logical thinking.

This course covers: set theory, mapping and integers. Groups and their properties, subgroups and their types, homomorphisms and automorphisms in groups, Cayley's theorem, permutation groups, inner products and finite Abelian groups. Definition of ring and examples, classes of ring homomorphism, ideal and ring quotient, field of quotient of integral domain, Euclid ring, ring and special Euclidean ring.

Euclid's Geometry (2 credits)

This course aims to make students understand the method of constructing a Euclidean geometry using definitions, axioms, postulates and theorems as the basis for logical reasoning.

This course includes: Understanding the Base; Definition; Deductive Reasoning; Postulates and Theorems; Two-column proof; Friendship; Congruent Polygons; Cognition Analysis; Special Triangle; Circle; Perpendicular and distance; Indirect Evidence; Alignment; Parallelogram; Polygon Corners; Congruent Triangles; Right triangle; Ratio and Proposition

Geometry of Space (2 credits)
This course aims to provide students with knowledge and understanding of the concept of spatial geometry and its axiomatic systems, the relationships between its elements and the shapes of spaces.
This course covers: Line-to-line relationships: Intersect, Parallel, Intersect, and Occurring Angles; Line-to-plane relationship: on the plane, intersect the plane, parallel to the plane, perpendicular to the plane/point of penetration, angle that occurs; Field-to-Plane Relationships: Parallel, Perpendicular and intersecting; Distance: between a point and a line, two parallel lines, two intersecting lines; Many planes and regular polygons: Prisms, cubes, pyramids, quadrilaterals, cylinders, cones, spheres, prisms, truncated prisms, truncated pyramids, truncated cones; Field slices against many fields; many field nets; Large; Volume; Application volume of several fields many.

Analytical Geometry (3 credits)
(Prerequisite: Linear Algebra)
This course aims to make students understand the properties of a quadratic curve, the position of two lines, a line to a plane, a plane to a plane and a conic section.

This course covers: Lines in R2, planes and lines in R3, Conic sections: circle, parabola, ellipse, hyperbola; quadratic equation; tube, ball.

Transformation Geometry (3 credits)
This course aims to provide students with knowledge and understanding of geometric concepts from the point of view of transformation groups, while group concepts are demonstrated through operations on transformations of geometric shapes on a plane.
This course covers: Functions: Definition, kinds, composition and transformation; Isometric Transformation: Definition, collienation, Involution, reflection, half turn, translation and rotation; The product of several isometry: two reflections, two half turns, two translations and two rotations; A single isometry identical to the product: two reflections, two half turns, two translations and two rotations; Glide Reflection : product of translation by reflection, product of reflection by rotation; Transformation Groups: Group properties, capable groups, symmetry groups and caylay diagrams; Similarity: Definition, dilatation, product of dilation, displacement and strain.

Real I Analysis (3 credits)
(Prerequisite: Integral Calculus)
This course aims to make students understand the concepts and theorems about sets, real number systems, functions and sequences.
This course covers: Sets, functions, real number systems: algebraic properties, sequence properties, completeness properties and sequences of real numbers.

Real Analysis II (3 credits)

(Prerequisite: Real Analysis I)

This course aims to make students understand the concept of function limits, function continuity and function derivatives as well as related theorems.

This course covers: limit function, continuous function, uniform continuous, derivative, mean value theorem and Taylor theorem.

Introduction to Basic Mathematics (2 credits)

This course aims to make students understand the meaning of language, principles of logic and sets and are able to formulate thinking deductions and express their thoughts mathematically.

This course includes: Statements and Links; Arguments and Quantities; Logic Algebra; Sets and Operations; Set Algebra; Relationships and the Nature of Relationships.

Basic Statistics (3 credits)

This course aims to make students understand the basic concepts of statistics, interpret data both descriptively and inferentially and apply them in everyday life.

This course covers: Summarizing data, basics of probability, random variables, hypothesis testing, simple linear regression, correlation, One-Way Analysis of Variance. Presentation of this course is given through face-to-face and practical.

Mathematical Statistics I (3 credits)
(Prerequisite: Basic Statistics)

This course aims to provide students with knowledge and understanding of the concepts and theorems of probability and provide skills in choosing the right concept/opportunity theorem to solve problems related to probability.

These courses include: Combinatorial Analysis; Opportunity Theory; Discrete and Continuous Random Variable Distribution Functions; Expected Value; Random Variable Moment; Chebyshef's Theorem; Multiple Random Variable Distribution Function: Expected Value; Mixed Moment; Moment Generating Function; Types of Distribution of Random Variables; Distribution of Random Variable Functions; Distribution of Statistic Arrangements; Convergence in Statistics; Central Limit Theorem.

Mathematical Statistics II (3 credits)
(Prerequisite: Mathematical Statistics I)
This course aims to provide students with knowledge and understanding of the limit theorem of random variables and their use in inference techniques, estimating point and interval parameters of a population, and testing hypotheses.
These courses include: Sufficient Statistics; Factorization Theorem; Parameter Estimation Method; Estimator Evaluation Method; Hypothesis test; Test Statistics Derivation Method; Evaluation of the Test; Hose Estimation Method; Evaluation of the Estimating Hose.

Discrete Mathematics (3 credits)
This course aims to make students familiar with some mathematical concepts and objects used in computer science.
This course includes: Generating Functions: Power Series, Generating Functions for Combinations and Permutations; Recursive Relations: Linear and Linear Homogeneous with Constant Coefficients, Solving Recursive Relations with Generating Functions,

Derangement; Inclusion/Exclusion Principles; Graph Theory; Boolean Algebra.

Linear Program (3 credits)
(Prerequisite: Linear Algebra)
This course aims to enable students to formulate standard decision-making problems from linear model optimization problems and to solve them using available software.

These courses include: Linear Program Models: Simple, Mixed, Transport/Transformation, Assignment; Linear Program Completion: Probing, Graph, Simplex Methods; Duality: Dual Relations, Theorems; Transformation: NWC method, Least Cost, Vobel; Integer Programming. Presentation of this course is given through face-to-face and practical.

Programming Algorithms (3 credits)
This course aims to make students understand the basics of algorithms and provide knowledge about designing and making simple programs.

These courses include: Introduction to computers and programming; troubleshooting and programming; high-level language program processing; algorithm representation; examples of efficient algorithms; flow chart. The presentation of this course is given through face-to-face and practicum.

Introduction to Computer Animation (3 credits)
This course aims to make students have knowledge and understanding in making animation using computer applications.

This course discusses digital image representation, the basics of making digital images (making basic objects,

creating advanced objects), animation basics, simple computer animation techniques such as tween (motion and shape) and frames. -by-frame, multimedia data insertion (audio video), programming in making high-level animations, interaction mechanisms between humans and computers. Presentation of this course is given through face-to-face and practical.

ICT-Based Mathematics Learning 3 (credits)
This course aims to make students have the ability to create, analyze and use mathematics learning software and apply them in mathematics learning.
This course includes: knowledge of information technology in mathematics learning and the introduction of learning media in the form of mathematics learning software. Presentation of this course is given through face-to-face and practical.

English Mathematics I (2 credits)
This course aims: Students can use English properly and correctly in the field of mathematics.
This course includes:Recognize and understand mathematical terms in English. Pronounce mathematical terms in English correctly. Write down mathematical terms in English. Listening / listening to mathematical terms in English. Explain mathematical terms in English.

English Mathematics II (2 credits)
This course aims: So that students are able to understand text, write simple English articles related to the subject of mathematics, and be able to present them using English
This course includes: comprehensive understanding of English texts through understanding problem solving

texts and scientific articles. The rewriting of ideas related to the subject of mathematics in the form of the essence of reading and its disclosure in the form of presentations in English.

Educational Research Methods (2 credits)
This course aims to provide students with knowledge and understanding of research methods.
These courses include: Types of research; expand problem areas: Observation, problem identification; Formulation of the problem; Theoretical framework; Hypothesis submission; Sampling technique; Arrange Instruments; Test Statistical Analysis; Making proposals; Presentation of reports: written and oral)

Mathematics Seminar (2 credits)
This course aims for students to be able to independently discuss a mathematical topic as a bearer and deepening of lecture material and write it down in the form of a seminar paper.
These courses include: Theoretical study of mathematical topics or mathematics education.

Capita Selecta Mathematics (3 credits)
This course aims to enable students to study essential topics in high school mathematics.
This course covers: the field of study of geometry, the field of algebra and the field of applied mathematics.

Workshop (2 credits)
This course aims to provide students with knowledge and understanding of the design, manufacture and use of mathematics teaching aids in the form of hardware or software.

This course covers: design, manufacture and use of hardware or software mathematics teaching aids. Presentation of this course is given through face-to-face and practical.

Pre Thesis Seminar (2 credits)
(Prerequisite: Research Methods)
This course aims to make students able to make research proposals correctly.
This course includes: Preparation of research proposals conducting open research proposal seminars.

Thesis (4 credits)
This course aims to enable students to conduct research in the field of mathematics education.
This course includes: development of research tools, implementation of research, analysis of research data, reporting and accountability of research results.

Entrepreneurship (3 credits)
This course aims to enable students to utilize the concepts of entrepreneurship, human resources, creativity and innovation in entrepreneurship in developing an entrepreneurial spirit and preparing business plans.
This course includes: Understanding and concepts of entrepreneurship, the development of entrepreneurship in Indonesia, the nature and characteristics of successful entrepreneurs, self-analysis, creativity and innovation in entrepreneurship, business opportunities, determining the type and field of business, forms of business ownership, strategies for establishing a business, human resources in entrepreneurial organizations and develop business plans.

History of Mathematics (2 credits)

This course aims to make students understand the development of number symbols and counting as well as understanding new mathematics and understanding today's mathematics

This course covers: counting: in antiquity, before and after Zeno's paradox, after the creation of zero, in old Europe and the age of the rise of science; numbers and their symbols as well as the understanding of new mathematics and various understandings of today's mathematics.

Painting Geometry (2 credits)
(Prerequisite : Euclid's Geometry and Geometry of Space)

This course aims to make students understand the projection of points, lines, planes and planes with many regularities on the projection plane

This course includes: Point and line projection; third projection plane and point coordinates, plane plane; points, lines and planes; a new third projection field; many regular fields.

Regression Analysis (3 credits)

This course aims to enable students to be able to use regression analysis as a quantitative analysis method needed to study real problems and make decisions on these problems.

This course includes: simple linear regression, multiple linear regression, residual analysis, selecting the best regression model, violating regression assumptions, and dummy variables.

Non Parametric Statistics (3 credits)

This course aims to make students understand non-parametric statistical techniques and can apply them correctly in analyzing experimental data

This course includes: Basic aspects of probability theory and hypothesis testing, test for one sample, test for two independent and independent samples, test for k independent and independent samples, nonparametric correlation coefficient, nonparametric regression

Operations Research Techniques (3 credits)
(Prerequisite: Linear Programming)

This course aims to enable students to use their mathematical knowledge to solve real problems.

These courses include: Sensitivity analysis, project management, dynamic programming, non-linear programming, Metaheuristics, Decision analysis, Inventory theory and Markov's decision process.

Trial Design (3 credits)

This course aims to enable students to explore data through experimental design and at the same time solve problems.

This course covers: principles of experimental design, classification of experimental designs, one-factor experiments, two-factor experiments, comparison of treatment mean values and assumptions of analysis of variance.*.*

Teaching Skills Practice (PKM) (2 credits)

This course aims for students to gain initial experience as teacher candidates in implementing academic mastery of education and academic expertise, through guided

teaching by civil servant teachers and supervisory lecturers.

This course includes: planning and implementing learning with the inherent guidance of teachers and supervisors, with the aim of experiencing the learning process firsthand, strengthening the identity of educators, carrying out student mentoring tasks and extra-curricular activities

Learning Management and Evaluation Planning (PPEP) (3 credits)
(Prerequisite: Learning and Learning Theory)

This course aims to provide students with an understanding of planning, learning management, and evaluation of mathematics learning.

This course includes: Learning planning includes understanding, objectives, learning planning models, content standards, KTSP and syllabus, lesson plans and learning scenarios. Learning management includes understanding, objectives, class management and student grouping. Learning evaluation includes understanding. objectives, evaluation of learning outcomes, types and forms of assessment of learning outcomes and practice analysis of test questions in school mathematics.

Elementary Mathematics Learning (2 credits)

This course aims to provide students with knowledge and understanding of learning mathematics at the elementary school level.

This course includes: Understanding Elementary Mathematics Curriculum, characteristics of students' cognitive abilities at the elementary age stage and how elementary school students learn mathematics, learning

essential mathematics materials: Introduction of initial numbers, addition of numbers up to 20, multiplication of initial numbers, initial division, introduction of concepts fractions, operations on fractions, operations with numbers more than 20, introduction to the concept of flat shapes, geometric shapes, initial statistics, and elementary math problem solving.

Middle School Mathematics Learning (2 credits)
This course aims to provide students with knowledge and understanding of the mathematics education curriculum in junior high schools.
This course discusses graduate competency standards, content standards and mathematics materials at the junior high school level, recognizes the characteristics of students' cognitive abilities at the junior high school age stage and mathematics learning in junior high school within the framework of an international standard school, this course also discusses the application of appropriate mathematics learning at the junior high school level .

High School Mathematics Learning (2 credits)
This course aims to provide students with knowledge and understanding of mathematics learning at the SMA/SMK level.
This course discusses graduate competency standards, content standards, process standards, assessment standards, and recognizes the characteristics of students' cognitive abilities at the SMA/SMK age stage and high school/vocational high school mathematics learning materials and mathematics learning in SMA/SMK implementing International Standard Schools.

Microteaching (2 credits)
(Prerequisite: PPEP)
This course aims to equip students with basic teaching competencies including personal competence, social competence, professional competence, pedagogic competence, introduction of various types of skills in teaching, which include opening and closing lessons, explaining skills, basic and advanced questioning skills, and strengthening skills. , skills in conducting/using variations, small group discussion skills, class management skills, and small group and individual teaching skills. Practice practice of basic teaching skills through peer teaching and micro teaching.

Olympiad (1 credit)
This course aims to foster sports values (Olympic) in an integrated and consistent manner.
This course includes: Introduction to the philosophy and values of sports (Olympic), a combination of physical and spiritual balance, harmonization of the relationship between sport, culture and education, harmony of life based on happiness and noble endeavor, appreciation of the principles of universal ethics.

Philosophy of Mathematics and Natural Sciences (2 credits)
This course aims to make students able to understand the Philosophy of Science, Philosophy of Mathematics, and Philosophy of Science.
This course covers: The nature of philosophical thought, tautology, omtology, epistemology, and axiology, science and culture, science and language, scientific writings on philosophy of mathematics: human thought, thinking and scientific principles, facts, beliefs, truths; methods in

seeking knowledge and development of science, natural sciences and social sciences, mathematics and statistics, language functions, mathematics and logic, ethical relations and philosophy of science.

e. Permanent Lecturer of Study Program

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4	0887	Dr. Pinta Deniyanti Sampoerno, M.Si	pinta-ds@unj.ac.id
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NO	LECTURER CODE	NAME	EMAIL ADDRESS
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INDEPENDENT CAMPUS CURRICULUM STRUCTURE
PHYSICS EDUCATION S-1 STUDY PROGRAM

FACULTY OF MATH AND SCIENCE
UNIVERSITAS NEGERI JAKARTA
2021

BPA S1 Physics Education

A. VISION

The vision of the Physics Education Study Program at the Universitas Negeri Jakarta is:

"To make the Physics Education Study Program at the Universitas Negeri Jakarta competitive in the fields of education, teaching, research and community service in 2030".

B. Study Program's MISSION

The mission of the Physics Education Study Program at the Universitas Negeri Jakarta until 2030 is:

1. Organizing quality education and teaching activities in the field of physics education to produce graduates who are in accordance with the needs of users for both the education sector in schools and educational development institutions.
2. Organizing quality research and development of science and technology in the field of Physics Education to improve the quality of education in particular and the quality of life of the community in general.
3. Organizing community service activities through the application of research results in solving scientific problems and teaching physics and education in the community.
4. Organizing mutually beneficial cooperation activities with government and non-government institutions both at home and abroad in the fields of education, teaching, research and community service to produce graduates who are globally competitive.

C. OBJECTIVE OF STUDY

The objectives of the Physics Education Study Program at the Universitas Negeri Jakarta until 2030 are:

1. Produce Physics Education graduates who:
   a. Quality so that they are able to master, explore and develop science and technology in physics learning.
   b. Mastering theoretical and practical concepts in physics and physics education.
   c. Able to work as a teacher or educator who is professional, qualified, competitive and innovative in the field of science and teaching physics through mastery of theoretical concepts of physics, ability to analyze, research and apply learning models and technology-based learning tools according to the needs of learning physics in the classroom and in the classroom laboratory.
   d. Able to continue education to a higher level in order to develop science in further physics education both at home and abroad
   e. Have scientific insight, skills, entrepreneurship, sportsmanship and honesty values so that they are able to develop themselves in society.
2. Produce quality scientific works from research results in the field of Physics Education published in accredited national journals and reputable international journals.
3. Produce community service works that improve the quality of life of the community, especially those related to the field of physics education.
4. Have collaborative activities with domestic and foreign agencies to improve the quality of the output of the Physics Education Study Program, FMIPA UNJ in the fields of learning, research and community service.

D. GRADUATE PROFILE

From the results of the tracer study, a profile can be made of the graduates of the Physics Education Study Program, FMIPA Universitas Negeri Jakarta, first as Physics Educators including SMA/MA/SMK teachers or equivalent and SMP/MTs teachers or equivalent, researchers in the field of physics education and managers of laboratories and educational institutions. In addition, graduates of the Physics Education Study Program can also continue their studies to the Masters level in the field of Physics or Physics Education.

	GRADUATE PROFILE	GRADUATE PROFILE DESCRIPTION
1	Physics Educator	Physics education graduate who is able to act as a Physics educator/teacher at the high school level or equivalent with the ability to master the science and concepts of physics as well as educational concepts including planning, implementation and evaluation to support physics learning in schools.
2	Researcher in Physics Education	Bachelor of Physics Education who is able to carry out physics education research in the form of assessment and evaluation of physics learning with quantitative and/or qualitative approaches to solving physics learning problems and communicating them or reporting in the form of written and oral scientific articles to support professional development.
3	Laboratory and Educational Institution	Bachelor of Physics Education who is able to manage resources and organizing activities

GRADUATE PROFILE	GRADUATE PROFILE DESCRIPTION
Manager	physics laboratories and educational institutions in a comprehensive manner.

E. FORMULATION OF LEARNING OUTCOMES OF GRADUATES (CPL) PHYSICS EDUCATION STUDY PROGRAM

1. Attitude
a. Fear of God Almighty and able to show a religious attitude;
b. Upholding human values in carrying out duties based on religion, morals, and ethics;
c. Contribute to improving the quality of life in society, nation, state, and the advancement of civilization based on Pancasila;
d. To act as citizens who are proud and love their homeland, have nationalism and a sense of responsibility to the state and nation;
e. Appreciate the diversity of cultures, views, religions, and beliefs, as well as the opinions or original findings of others;
f. Cooperate and have social sensitivity and concern for society and the environment;
g. Obey the law and discipline in the life of society and the state;
h. Internalize academic values, norms, and ethics;
i. Demonstrate a responsible attitude towards work in their area of expertise independently;
j. Internalize the spirit of independence, struggle, and entrepreneurship;
k. Fully understand himself as an educator (additional to SNPG).

l. Internalize the values of excellence, honesty, competitiveness, and leadership in various activities.

2. **General Skills**
   a. Able to apply logical, critical, systematic, and innovative thinking in the context of the development or implementation of science and technology that pays attention to and applies humanities values in accordance with their field of expertise;
   b. Able to demonstrate independent, quality, and measurable performance;
   c. Able to study the implications of the development or implementation of science and technology that pays attention to and applies humanities values according to their expertise based on scientific principles, procedures and ethics in order to produce solutions, ideas, designs or art criticisms;
   d. Able to compile a scientific description of the results of the studies mentioned above in the form of a thesis or final project report, and upload it on the university's website;
   e. Able to make appropriate decisions in the context of solving problems in their area of expertise, based on the results of information and data analysis;
   f. Able to maintain and develop work networks with supervisors, colleagues, colleagues both inside and outside the institution;
   g. Able to be responsible for the achievement of group work results and supervise and evaluate the completion of work assigned to workers under their responsibility;
   h. Able to carry out the process of self-evaluation of the work group under their responsibility, and able to manage learning independently; and

i.   Able to document, store, secure, and retrieve data to ensure validity and prevent plagiarism

3. Knowledge

a. Mastering the basic concepts of education which include student development, learning theories, the nature of science and scientific mindset;

b. Mastering innovative learning methods oriented to personal, social and academic skills (life skills) in physics learning;

c. Mastering graduate competency standards, content standards, process standards and assessment standards for physics education in secondary schools;

d. Mastering the principles of assessment in physics learning to analyze students' learning difficulties and success (through diagnosis, formative, and summative) and utilize the results to design Physics learning according to student characteristics;

e. Mastering the principles of developing science-based physics learning media, contextual technology, especially ICT (Information and Communication Technology), and the surrounding environment;

f. Mastering physics education research methods;

g. Mastering the management of resources in the administration of classes, physics laboratories and educational institutions;

h. Mastering mathematics, computing, and instrumentation to support understanding of physics concepts;

i. Mastering the concepts of physics, scientific thinking patterns of physics based on natural phenomena that support physics learning in schools;

j. Mastering the concepts of physics based on natural phenomena that support further education to the master's level.

k. Able to use English effectively.

4. **Special skill**
   a. Able to plan, implement, and evaluate physics learning based on learning activities to develop thinking skills in accordance with the characteristics of physics material, and scientific attitudes according to the characteristics of students in curricular, co-curricular and extracurricular learning by utilizing various science-based learning resources, contextual technology and the environment around;
   b. Able to assess and apply various proven innovative learning methods;
   c. Able to guide and direct students by providing a foothold, asking questions, providing alternative solutions, and feedback to achieve the expected competencies;
   d. Able to conduct physics education research in the form of assessment and evaluation of physics learning with quantitative and/or qualitative approaches to solve physics learning problems and communicate them or report in the form of written and oral scientific articles to support professional development.
   e. Able to manage resources and activities comprehensively which includes classroom management, physics laboratories and educational institutions;
   f. Able to make strategic decisions based on studies of quality, relevance and access issues in the field of education in classroom administration, physics laboratories and educational institutions that are their responsibility.

F. GRADUATE DEGREE

The graduate degree from the Physics Education Study Program at the Universitas Negeri Jakarta is a Bachelor of Education (S.Pd) characterized by educators or teachers who master physics and physics education and practice supported by mastery of ICT technology and English as well as scientific development based on leadership and entrepreneurship.

G. STUDY PROGRAM ACCREDITATION

The Physics Education Study Program, FMIPA, Universitas Negeri Jakarta has been accredited with a B value based on the Decree of the National Accreditation Board for Higher Education of the Ministry of National Education of the Republic of Indonesia Number 6621/SK/BAN-PT/Akred/S/X/2020 dated October 20, 2020.

H. CURRICULUM STRUCTURE

In accordance with Permendikbud No. 3 of 2020 in particular article 15 states that the form of learning in Higher Education can be done inside and outside the Study Program. The other study programs referred to are as follows:
1. Other Study Programs at the same College.
2. The same study program in different universities.
3. Other Study Programs at different Colleges.
4. Learning at Non-University Institutions.

Furthermore, based on the regulation, the fulfillment of the study period in the Physics Education Study Program is between 4 (four) -11 (eleven) semesters and 1 (one) semester or equivalent to 20 (twenty) credits of learning carried out outside the Study Program at the same Higher Education or a maximum of 2 (two) semesters or the equivalent of 40 credits is learning as in points 2-4 above.

Independent Campus learning forms are divided into 8 types, namely:
1. Teaching assistant in Education unit
2. Internship/Work Practice
3. Student Exchange
4. Research/Research
5. Building a Thematic Village/KKN
6. Entrepreneurial Activities
7. Independent Study/Project
8. Humanitarian Project

For this reason, the 2020 FMIPA UNJ Physics Education curriculum framework was prepared based on the Indonesian National Qualifications Framework (KKNI) which was refined by implementing the Merdeka Campus curriculum. This curriculum is structured to adapt to current developments, especially related to the readiness of Study Program graduates to face changes in social, culture, world of work, rapid development of science and technology.

The Independent Campus Physics Education Curriculum Framework is as follows:

Minor Physics Education
- MK Mandatory Choice Study Program (40 credits)

Major in Physics Education (105 credits)
- MK Compulsory Study Program (85 credits)
- MK Mandatory Outside Study Program

Minor Independent Campus
- 8 Independent Campus Activities (40 credits)
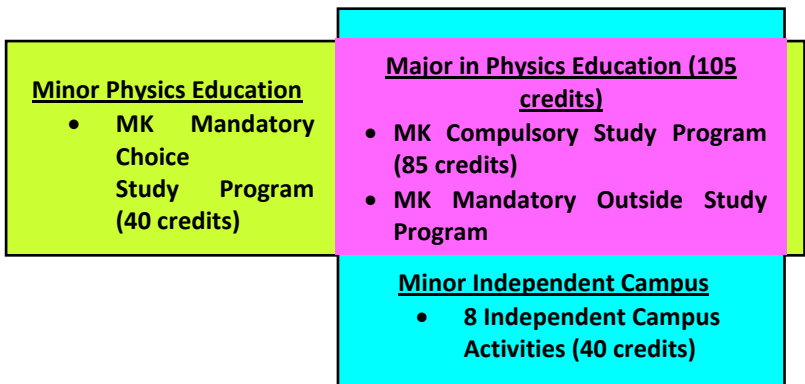
Figure 1 Free Curriculum Framework for Physics Education FMIPA UNJ

The fulfillment of the Physics Education study period can be chosen through two paths, namely:
1. Major Pathway in Physics Education (105 credits) + Minor Physics Education (40 credits)
2. Physics Education Major Path (105 credits) + Merdeka Campus Minor (40 credits)

For the Independent Campus Curriculum, the fulfillment of the study period with a minimum credit load of 145 credits for Physics Education students, FMIPA UNJ is described as follows (Figure 1):
1. The major compulsory subjects for the study program are 85 credits and the compulsory subjects outside the study program are 20 credits.
2. The optional minor courses for Study Program are 22 credits and the Merdeka Campus activities are 18 credits.
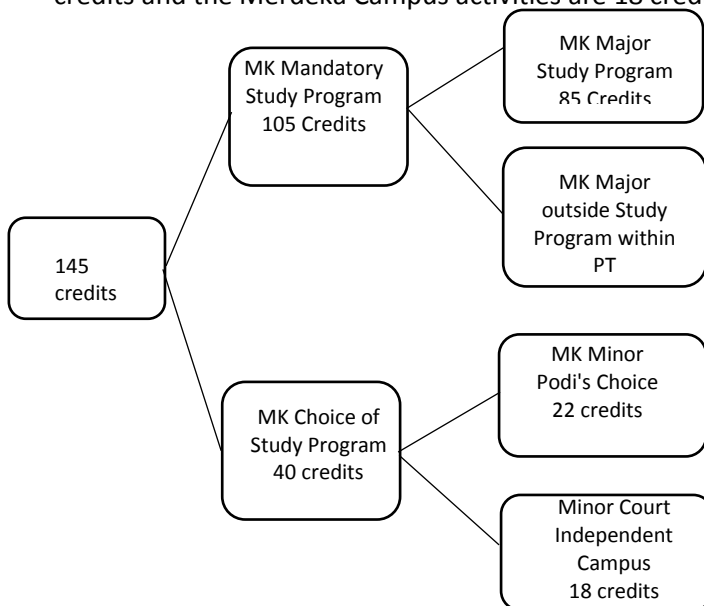
Figure 2. Design of the Independent Campus Curriculum Structure for Physics Education FMIPA UNJ

Form The curriculum structure of the Physics Education Study Program at the Universitas Negeri Jakarta at the undergraduate level (S-1) is organized into courses which are distributed into eight semesters with a minimum number of credit units that must be completed is 145 credits. In accordance with the proposed curriculum changes in accordance with Permendikbud No. 3 of 2020, students are given the freedom to choose the graduation route through Path 1 Regular or Path 2 Independent Campus with the following design:

1. Independent Campus Path

No	Course Group	credits
A	**Compulsory Major Courses in PT**	**85**
1	Basic Physics 1	3
2	Basic Physics Practicum 1	1
3	Basic Physics 2	3
4	Basic Physics Practicum 2	1
5	Calculus 1	3
6	Calculus 2	3
7	Math Physics 1	4
8	Math Physics 2	4
9	Statistics	3
10	Modern Physics	3
11	Modern Physics Practicum	1
12	Electronics	4
13	Electronics Practicum	1
14	Thermodynamics	3
15	Classical Mechanics	4
16	Wave	4
17	Magnetic Electric	4
18	Introduction to Solid Substance Physics	3
19	Olympics	1
20	Algorithms and Programming	2
21	Algorithm and Programming Practicum	1
22	Computational Physics	3
23	Computational Physics Practicum	1
24	Teaching Skills	4
26	Educational Research Methodology	3
27	Pre Thesis Seminar	2

No	Course Group	credits
28	Essay	4
29	Educational Foundation	4
30	Learning and Learning Theory	4
31	Student Development	2
32	Profession of Educators and Education Personnel	2
B	**Compulsory Courses Outside Study Programs in PT**	**20**
1	Pancasila	2
2	Citizenship	2
3	Religion	3
4	Indonesia Language	2
5	English	2
6	Basic Social and Cultural Sciences	2
7	Philosophy of Mathematics and Natural Sciences	2
8	General Chemistry	2
9	General Chemistry Practicum	1
10	General biology	2
	Number of Mandatory MK Credits	**105**
C	**Elective courses**	**40**
C.1	**MINOR EDUCATION (Required KK 22 credits)**	**22**
1	Quantum Physics	3
2	Introduction to Nuclear Physics	3
3	Science Learning Design	2
4	Curriculum Analysis	2
5	Introduction to Information Technology	2

No	Course Group	credits
6	Science Learning Strategy	2
7	Science Learning Assessment	2
8	Learning Media Development	2
9	Development of Teaching Materials	2
10	English for Teaching	2
	8 OPTIONS OF INDEPENDENT CAMPUS ACTIVITIES ACCORDING TO THE FIELD OF PHYSICS EDUCATION	**10**
1	School Physics Special Topic	2
3	Laboratory Management	2
4	ICT-based learning	2
5	Earth and Space Physics	2
6	Environmental Physics Education	2
7	Environmental Studies in Physics Learning	2
8	Entrepreneurship	2
9	Big Data and Coding	2
10	Statistical Physics	3
11	Solid Physics	3
12	Quantum Mechanics	3
13	Electromagnetic Field Theory	3
14	Digital Electronics	3
15	Digital Electronics Practicum	1
16	Sensor Technology	2
17	MK OPTIONS OUTSIDE PS IN/OUTSIDE PT	
	Number of Credits Total/Per Semester	**145**
	Number of Credits Total Merdeka Campus	**145**

No	Course Group	credits
C.2	**MINOR INDEPENDENT CAMPUS (Min. 20 Credits)**	
C.2.1	**Assistance in Education Unit**	**20**
1	Independent Campus Materials (Choice MK)	12
3	Activity Proposal Preparation Practice	2
5	PKM/PPL/PLP Merdeka Campus	4
6	Reports and Publications	2

Independent campus activities carried out in the Physics Education Study Program of FMIPA UNJ are Assistance in the Education Unit in the form of Teaching Skills Practice activities in schools with a block system for one full semester with a total credit weight of 18 credits consisting of 12 credits of independent campus materials, 2 credits of drafting practice proposal for assistance activities, 4 credits of practical assistance implementation and 2 credits of reports and publications. Independent campus activities are held in the 7th semester.

I. DISTRIBUTION OF COURSES

Independent Campus Path

No	Course Group	credits	Semesters & credits								Note:
			I	II	III	IV	V	VI	VII	VII	
A	**Compulsory Major Courses in PT**	85									
1	Basic Physics 1	3	3								
2	Basic Physics Practicum 1	1	1								
3	Basic Physics 2	3		3							
4	Basic Physics Practicum 2	1		1							
5	Calculus 1	3	3								
6	Calculus 2	3		3							
7	Math Physics 1	4			4						
8	Math Physics 2	4				4					
9	Statistics	3					3				
10	Modern Physics	3			3						
11	Modern Physics Practicum	1			1						
12	Electronics	4			4						

No	Subject										
13	Electronics Practicum	1			1						
14	Thermodynamics	3					3				
15	Classical Mechanics	4					4				
16	Wave	4				4					
17	Magnetic Electric	4				4					
18	Introduction to Solid Substance Physics	3					3				
19	Olympics	1	1								
20	Algorithms and Programming	2			2						
21	Algorithm and Programming Practicum	1			1						
22	Computational Physics	3				3					
23	Computational Physics Practicum	1				1					
24	Teaching Skills	4						4			
26	Educational Research Methodology	3						3			
27	Pre Thesis Seminar	2							2		
28	Essay	4								4	
29	Educational Foundation	4	4								

No	Course	Credits								
30	Learning and Learning Theory	4			4					
31	Student Development	2		2						
32	Profession of Educators and Education Personnel	2		2						
B	**Compulsory Courses Outside Study Programs in PT**	**20**								
1	Pancasila	2		2						
2	Citizenship	2			2					
3	Religion	3		3						
4	Indonesia Language	2		2						
5	English	2	2							
6	Basic Social and Cultural Sciences	2	2							
7	Philosophy of Mathematics and Natural Sciences	2	2							
8	General Chemistry	2	2							
9	General Chemistry Practicum	1	1							
10	General biology	2		2						
	Number of Mandatory MK Credits	**105**								

		Credits								
C	**Elective courses**	**40**								
C.1	**MINOR EDUCATION (Required KK 22 credits)**	**22**								
1	Quantum Physics	3					3			
2	Introduction to Nuclear Physics	3						3		
3	Science Learning Design	2						2		
4	Curriculum Analysis	2						2		
5	Introduction to Information Technology	2		2						
6	Science Learning Strategy	2				2				
7	Science Learning Assessment	2				2				
8	Learning Media Development	2					2			
9	Development of Teaching Materials	2				2				
10	English for Teaching	2						2		
	8 OPTIONS OF INDEPENDENT CAMPUS ACTIVITIES ACCORDING TO THE FIELD OF PHYSICS EDUCATION	**10**					4	6		

No	Course	Credits										
1	School Physics Special Topic	2										
3	Laboratory Management	2										
4	ICT-based learning	2										
5	Earth and Space Physics	2										
6	Environmental Physics Education	2										
7	Environmental Studies in Physics Learning	2										
8	Entrepreneurship	2										
9	Big Data and Coding	2										
10	Statistical Physics	3										
11	Solid Physics	3										
12	Quantum Mechanics	3										
13	Electromagnetic Field Theory	3										
14	Digital Electronics	3										
15	Digital Electronics Practicum	1										
16	Sensor Technology	2										
17	MK OPTIONS OUTSIDE PS IN/OUTSIDE PT											

	Number of Credits Total/Per Semester	**145**	**21**	**22**	**22**	**22**	**18**	**16**	**2**	**4**	**127**
	Number of Credits Total Merdeka Campus	**145**	**21**	**22**	**22**	**22**	**22**	**22**	**10**	**4**	**145**
C.2 **C.2.1**	**MINOR INDEPENDENT CAMPUS (Min. 20 Credits)** **Assistance in Education Unit**	**20**	SYSTEM BLOCK 1 SEMESTER MK OPTIONS OF STUDY PROGRAM AND OUTSIDE OF THE STUDY								
1	Independent Campus Materials (Choice MK)	12									
2	Activity Proposal Preparation Practice	2									
3	PKM/PPL/PLP Merdeka Campus	4									
4	Reports and Publications	2									

a. Distribution of Courses per Semester
Independent Campus Path

No.	Semester 1	credits
1	Basic Physics 1	3
2	Basic Physics Practicum 1	1
3	Calculus 1	3
4	General Chemistry	2
5	General Chemistry Practicum	1
6	ISBD	2
7	Olympics	1
8	Educational Science Foundation	4
9	English	2
10	Philosophy of Mathematics and Natural Sciences	2
	Amount	**21**

No.	Semester 2	credits
1	Basic Physics 2	3
2	Basic Physics Practicum 2	1
3	Calculus 2	3
4	General biology	2
5	Student Development	2
6	Profession of Educators and Education Personnel	2
7	Indonesia Language	2
8	Religious education	3
9	Introduction to Information Technology	2
10	Pancasila	2
	Amount	**22**

No.	3rd semester	credits
1	Math Physics 1	4
2	Electronics	4
3	Electronics Practicum	1
4	Algorithms and Programming	2
5	Algorithm and Programming Practicum	1
6	Modern Physics	3
7	Modern Physics Practicum	1
8	Learning and Learning Theory	4
9	Civic education	2
	Amount	**22**
No.	5th semester	credits

No.	Semester 4	credits
1	Math Physics 2	4
2	Wave	4
3	Magnetic Electric	4
4	Computational Physics	3
5	Computational Physics Practicum	1
6	Learning strategies	2
7	Learning Assessment	2
8	Development of Teaching Materials	2
	Amount	**22**
No.	6th semester	credits

1	Quantum Physics	3		1	Educational Research Methodology	3
2	Thermodynamics	3		2	Teaching Skills	4
3	Introduction to Solid Substance Physics	3		3	Science Learning Design	2
4	Development of Physics Learning Media	2		4	Introduction to Nuclear Physics	3
5	Statistics	3		5	English for Teaching	2
6	Classical Mechanics	4		6	Curriculum Analysis	2
	Choices According to 8 Independent Activities	**4**			**Choices According to 8 Independent Activities**	**6**
1	School Physics Special Topic	2		1	School Physics Special Topic	2
3	Laboratory Management	2		3	Laboratory Management	2
4	ICT-based learning	2		4	ICT-based learning	2
5	Earth and Space Physics	2		5	Earth and Space Physics	2
6	Environmental Physics Education	2		6	Environmental Physics Education	2
7	Environmental Studies in Physics Learning	2		7	Environmental Studies in Physics Learning	2

No.		credits
8	Entrepreneurship	2
9	Big Data and Coding	2
10	Statistical Physics	3
11	Solid Physics	3
12	Quantum Mechanics	3
13	Electromagnetic Field Theory	3
14	Digital Electronics	3
15	Digital Electronics Practicum	2
16	Sensor Technology	
17	MK OUTSIDE PS INSIDE/OUTSIDE PT	
	Amount	**22**
No.	**Semester 7 Independent Campus Activities**	**credits**
1	Activity Proposal Preparation Practice	2
2	PKM/PPL/PLP Merdeka Campus (Block system)	4

No.		credits
8	Entrepreneurship	2
9	Big Data and Coding	2
10	Statistical Physics	3
11	Solid Physics	3
12	Quantum Mechanics	3
13	Electromagnetic Field Theory	3
14	Digital Electronics	3
15	Digital Electronics Practicum	2
16	Sensor Technology	
17	MK OUTSIDE PS INSIDE/OUTSIDE PT	
	Amount	**22**
No.	**Semester 8**	**credits**
1	Essay	4

3	Reports and Publications	2	
4	Pre Thesis Seminar	2	
	Choices According to 8 Independent Activities		
1	School Physics Special Topic	2	
3	Laboratory Management	2	
4	ICT-based learning	2	
5	Earth and Space Physics	2	
6	Environmental Physics Education	2	
7	Environmental Studies in Physics Learning	2	
8	Entrepreneurship	2	
9	Big Data and Coding	2	
10	Statistical Physics	3	
11	Solid Physics	3	
12	Quantum Mechanics	3	

13	Electromagnetic Field Theory	3					
14	Digital Electronics	3					
15	Digital Electronics Practicum	2					
16	Sensor Technology						
17	MK OUTSIDE PS INSIDE/OUTSIDE PT						
	Amount	**10**			**Amount**		**4**
	Total Credits	**145**					

J. Course Description

3215-101-3 Basic Physics I (3 Credit Points)
Purpose:
Students can analyze and apply the basic concepts of physics related to mechanics, fluids, waves, optics and thermodynamics in everyday life.
Course material:
In general, this course examines physical phenomena including the phenomena of motion (mechanics), fluids, heat and waves as well as optics. These studies are analyzed using Newton's laws, waves, optics and thermodynamics and their application in everyday life. Lecture activities are also supported by practical activities in the laboratory.

3215-101-1 Practicum of Basic Physics I (1 credit)
Purpose:
Able to carry out and analyze the results of experiments or basic physics practicums, especially for mechanics, fluids, heat and optical waves.
Course material:
The theory of uncertainty in measurement, introduction to measuring instruments, making graphs, designing and carrying out experiments as well as making experimental reports on mechanics, heat and heat conduction and optical waves.

3225-103-3 Basic Physics II (3 Credit Points)
Purpose:
Understand the advanced basic physics (Basic Physics 1) required as a graduate in the field of Physics studies and also become the basis for following further lectures, for the Physics study program and Physics Education study program.
Course material:

Fundamentals of Physics, continuing Basic Physics 1, which includes: Waves and Optics, Electricity, Magnetism, Atomic Physics, Core Physics and Modern Physics.

3225-104-1 Practicum of Basic Physics II (1 credit)

Purpose:
Able to use physical measurement tools and understand how to write experimental results as a first step in research.
Course material:
The theory of uncertainty in measurement, introduction to measuring instruments, making graphs, designing and carrying out experiments as well as making experimental reports on electricity, magnetism, waves and optics.

3225-301-4 Electronics (4 Credit Points)

Purpose:
Thorough understanding of electronics, especially in the practical application of electronic devices with an emphasis on analog instrumentation systems.
Course material:
Introduction to electronics, electronic quantities, electrical conductivity in semiconductors, pn diodes, bipolar transistors, "field effect" transistors, the basics of amplification at low frequencies, frequency amplifiers, inversion amplifiers, operational amplifiers, oscillators, waveformers.

3225-302-1 Electronic Practicum (1 Credit)

Purpose:
Able to measure electrical quantities in electronic circuits, circuit analysis, and design basic electronic circuits.
Course material:
Measurement of electronic quantities, diode characteristics, bipolar transistors, non-inverting, inverting amplifier circuits, simple analog electronic instrumentation design.

3225-401-4 Calculus I (4 Credit Points)

Purpose:

Mastering the principles of one and two variable differential calculus and their application

Course material:

Limits and continuity, derivatives, use of derivatives, L'Hospital's theorem, functions, transcendences, and differential equations.

3225-402-4 Calculus II (4 Credit Points)

Purpose:

Mastering the basic principles of integral calculus, double and triple integrals, and vector spaces with their application.

Course material:

Integral theory in general, integration techniques, definite integrals, indefinite integrals, infinite series, vectors in planes, polar functions, motion in vector spaces, multivariable functions and their derivatives.

3225-403-4 Mathematical Physics I (4 Credit Points)

Understand the basic concepts of mathematics and apply them in solving various basic physics problems

Course material:

Power series: definition and notation of series, convergent and divergent series, convergence test, alternating series and its convergence, power series and its convergent interval, function expansion into power series. Complex numbers: definition of complex numbers, complex algebra, complex power series and their convergence, Euler's formula. Linear algebra: definition and notation, solution of linear equations by row reduction method, determinants (Cramer's rule), vectors, lines and planes, matrix operations, linear combinations, linear functions and linear operators, special

matrices. Partial differential: definition and notation, total differential, chain rule, application of partial differential in determining extreme values, Lagrange multiplier, variable transformation, Leibniz rule. Double integrals: double and triple integrals, application of double integrals, transformation of variables in integrals, surface integrals. Vector analysis: vector differential, directed field and derivative, line integral, Green's theorem, divergence theorem and Stoke's theorem. Fourier series and transformations: Fourier series, Dirichlet terms, complex forms of Fourier series, odd and even functions, applications, Fourier transforms. Ordinary differential equations: definitions, first-order differential equations and their solutions, second-order linear differential equations for several cases and their solutions, Laplace transforms, solutions of differential equations using Laplace transforms, convolutions, Delta Dirac functions, Green functions. Fourier series, Dirichlet conditions, complex forms of Fourier series, odd and even functions, applications, Fourier transforms. Ordinary differential equations: definitions, first-order differential equations and their solutions, second-order linear differential equations for several cases and their solutions, Laplace transforms, solutions of differential equations using Laplace transforms, convolutions, Delta Dirac functions, Green functions. Fourier series, Dirichlet conditions, complex forms of Fourier series, odd and even functions, applications, Fourier transforms. Ordinary differential equations: definitions, first-order differential equations and their solutions, second-order linear differential equations for several cases and their solutions, Laplace transforms, solutions of differential equations using Laplace transforms, convolutions, Delta Dirac functions, Green functions.

3225-404-4 Mathematical Physics II (4 Credit Points)

Purpose:

Apply mathematical concepts to describe and solve physics problems mathematically.

Course material:

Calculus of variations: Euler equations, brachistochrome problems, Lagrange equations, isoperimetric problems. Coordinate transformation: linear transformation, orthogonal transformation, eigenvalues and eigenvectors of matrices, matrix diagonalization. Special functions: the gamma function and its recursive relationship, the beta function and its relationship to the gamma function. simple pendulum. Series solutions of differential equations: Legendre's equations, Rodrigues formula, generating functions for Legendre polynomials, Bessel functions and their recursive relationships, Hermite and Laguerre functions. Partial differential equations: Lapace equations, diffusion equations, wave equations, Poisson equations. Complex variable functions: analytical functions, contour integrals, Laurent series, residual theorem, applications in integral calculations.

3225-405-3 Basic Statistics (3 Credit Points)

Purpose:

Mastering basic statistics so as to be able to apply it to various disciplines, especially to support physics research and physics education

Course material:

Definition of statistics: probability theory, probability distribution, measurement of tendency and dispersion; Presentation of data, mean, mode, median, population, sample and normal distribution theory, test of variance homogeneity and regression linearity, hypothesis testing, mean difference significance, one variable test, regression and correlation, chi squared.

3225-201-2 Introduction to Information Technology (2 Credit Points)

Purpose:

Introducing students to the development of information and communication technology including systems and supporting infrastructure and their use in the fields of science and education.

Course material:

basic knowledge of computers, computer development, hardware, software, computer programming, data processing systems, database systems, computer-based information systems, computer networks, internet, computer security and ethics, ICT applications in science and education.

3225-204-3 Computational Physics (3 Credit Points)

Purpose:

Provide basic knowledge about computational methods and skills in the field of computer programming so that students are able to apply it to perform data processing, modeling and simulation of physical systems.

Course material:

Programming and computing in physics, solutions of non-linear equations, systems of linear equations, numerical differentials, Monte-Carlo method, polynomial interpolation, curve matching of measurement data, spectrum analysis, elliptic partial differential equations.

3225-205-1 Computational Physics Practicum (1 Credit)

Purpose:

Able to make computer programs to solve physics problems using numerical methods in computational physics course material

Course material:

Making computer programs for solving physics problems numerically including physics problems covered in computational physics course material.

3225-501-4 Classical Mechanics (4 Credit Points)
Purpose:
Understand the basic concepts of motion of objects from the point of view of objects as particles or particle systems through a review of Newtonian physics and the Lagrangian system.
Course material:
Introduction to Newtonian mechanics, particle dynamics in one dimension, harmonic oscillator, motion in two and three dimensions, Lagrange and Hamilton equations, gravitational force, motion in central force, particle system, rigid body motion, curved coordinate system.

3225-502-3 Thermodynamics (3 Credit Points)
Purpose:
Understand the basic concepts and laws of thermodynamics and be able to apply them to solve problems in thermodynamic systems
Course material:
Introduction and basic concepts of thermodynamics, mathematics for thermodynamics, properties of matter, temperature and the zeroth law of thermodynamics, systems and equations of state, external mechanical work, heat and the first law of thermodynamics for closed and open systems, second law of thermodynamics, Carnot cycle, diesel, otto and reversibility, entropy, thermodynamic potential, and the complete formulation of thermodynamics.

3225-503-4 Wave (4 Credits)
Purpose:

Understand phenomena, general properties and general wave equations and their application to solve problems of mechanical waves and electromagnetic waves

Course material:

Harmonic vibrations, related oscillators, general wave equations, transverse and logitudinal wave motion, waves in two and three-dimensional space, wave analysis through Fourier transforms, electromagnetic waves, wave modulation, diffraction and wave interference.

3225-504-4 Electricity and Magnetism (4 Credit Points)

Purpose:

Understand the concepts of electricity and magnetism comprehensively to be able to explain related phenomena and their application

Course material:

Electrostatics, problems and solutions to electrostatics, electric potential, electrostatic fields in dielectric materials. Magnetostatics, magnetostatic fields in materials, electromagnetic induction, Maxwell's equations.

3225-601-3 Modern Physics (3 Credit Points)

Purpose:

Understand modern physical theory including special relativity theory and quantum theory for atoms, molecules, solids and atomic structures, atomic and molecular spectra and atomic nuclei.

Course material:

Special theory of relativity: Einstein's special theory of relativity, the principle of the equivalence of mass and energy. Quantum theory in the phenomena of black body radiation, the photoelectric effect, and the Compton effect, wave properties of particles, Heisenberg uncertainty principle, quantum mechanics, atomic models, atomic

structure, atomic spectra, stimulated emission, crystal lattices and phonons, nuclear structures, nuclear transformations.

3225-602-1 Modern Physics Practicum (1 Credit)
Purpose:
Able to carry out experiments and measurements of physical quantities in the study of modern physics and analyze experimental results
Course material:
Elementary charge experiments with Millikan's oil drops, Balmer series experiments, electron charge measurements experiments, X-ray experiments, crystallographic experiments.

3225-603-3 Quantum Physics (3 Credit Points)
Purpose:
Provides an introduction to the fundamental ideas of non-relativistic quantum mechanics, the Schroedinger equation, introduces the general framework of quantum mechanics, and the methods used in solving simple quantum mechanical problems.
Course material:
These courses include: failure of classical physics to explain the phenomena of black body radiation and the photoelectric effect as well as quantum ideas, wave properties of particles, wave packets and Heisenberg uncertainty principle, methodology of quantum physics, Schoedinger equation, general structure of wave mechanics, stationary states of particles in one-dimensional box potential, harmonic oscillations, and angular momentum.

3225-605-3 Introduction to Solid Substance Physics (3 Credit Points)
Purpose:

Understand the structure and analyze the physical properties of solids.

Course material:

Solid structure: crystal structure, X-ray diffraction, reciprocal lattice, solid bonding, binding energy, atomic vibration, crystal elasticity constant, thermal properties of materials. Free electron model, lattice vibration, energy band theory. Fundamentals of metals: Fermi electron gases and their physical properties.

3225-060-2 English for Teaching (2 Credit Points)

Purpose:

Introducing the basic techniques of effective communication in English, so that they are able to communicate, present and express their ideas or opinions in teaching practice.

Course material:

Overview of grammar, style and communication techniques both verbal and written. Enrichment and vocabulary development through the study of textbooks, science magazines, and journal papers. Writing articles based on the sources provided. Presentation of articles about simple physical phenomena using a projector.

3225-067-2 Olympism (2 Credit Points)

Purpose:

Growing sports values (olympism) in an integrated and consistent manner.

Course material:

Introduction to the philosophy and values of sport (olympism), a combination of physical and spiritual balance, harmonization of the relationship between sports life, culture and education, harmony of life based on happiness and noble endeavor, respect for universal ethical principles.

3225-066-2 Entrepreneurship (2 Credit Points)

Purpose:

Grow and improve the entrepreneurial spirit of students so that after graduation they will be able to become entrepreneurs and get high selling points in the community for their knowledge and expertise.

Course material:

Basic concepts of entrepreneurship, microeconomics, finance, marketing, Intellectual Property Rights (HAKI), business entities, business feasibility studies.

3225-613-3 Physics Education Research Methodology (3 Credit Points)

Purpose:

So that students have knowledge of scientific research methodology, code of ethics in scientific writing, preparation of research proposals/results, and are able to present/publish research results.

Course material:

Scientific methods, types of research, research problems, theoretical framework, hypothesis submission, sampling technique, instrument preparation, statistical tests, preparation of research proposals and results, presentation and publication of research results, code of ethics for scientific writing.

3005-207-2 Pre-Thesis Seminar (0 Credits)

Purpose:

Able to make research proposals in accordance with the problems and research methods used.

Course material:

Writing scientific research proposals and presenting them in pre-thesis seminars.

3005-402-4 Thesis (6 Credits)

Purpose:

Able to conduct scientific research according to the proposals that have been submitted, and report and account for the results.

Course material:

The research process, report generation, presentation of research results and accountability in the thesis trial.

3225-901-2 Environmental Physics

Purpose :

After the lecture activities, students have the ability to understand the structure of the environment comprehensively, as well as to be able to implement it in the application of technology without damaging the environment

3215-130-2 Laboratory Management

Purpose :

This course aims to provide knowledge and skills in managing basic science laboratories in schools which include the roles and functions of science laboratories, laboratory administration and inventory, high school physics laboratory standards, operation of laboratory equipment and supporting materials and work safety in laboratories. . Plan and design administrative equipment and room inventory, school laboratory standards and operation of laboratory supporting equipment and materials. Plan, implement, and report the results of school laboratory observations.

ACADEMIC HANDBOOK1 CHEMICAL EDUCATION INDEPENDENT-INDEPENDENT LEARNING CAMPUS CURRICULUM

A. ACADEMIC VISION

To become a chemistry education program that produces chemistry education graduates who are professional, innovative, adaptive, and competitive at the national, regional and global levels.

B. STUDY PROGRAM MISSION

1. Educate reliable and professional human resources to become educators in the field of chemistry at various levels
2. Improving the professionalism of educators and education staff in the field of chemistry
3. Applying chemistry learning innovations in improving the competence of graduates who are professional and competitive
4. Develop facilities that support the implementation of quality education
5. Conduct research that develops transformative, innovative, and creative learning
6. Establish collaborations/partnerships with various institutions in order to improve the quality of learning and research

C. Study Program Objectives

1. Produce chemical education graduates who have excellence in professional competence, pedagogic

competence, social competence and personality competence

2. Produce chemical education graduates who are broad-minded, follow the development of science and technology, are virtuous, highly dedicated, and have strong personalities and are able to compete at national and global levels
3. Produce chemical education graduates who can adapt to relevant scientific fields
4. Produce education and laboratory managers who can design, implement and evaluate the implementation of education and laboratories
5. Produce graduates who are able to continue their education to a higher level.
6. Produce graduates who are entrepreneurial in creating jobs in education and other relevant fields

D.   Graduate Profile and Qualifications
Graduates of the Chemical Education Study Program have a bachelor's qualification in Chemistry Education, which is described as follows:

Profile	Graduate Qualification
1. Chemistry Educator	Chemistry educators who have excellence in professional competence, pedagogic, social competence, and personal competence in the field of chemistry
2. Beginner Researcher	Beginner researchers who are able to conduct research based on research methodologies in the field of chemistry education
3. Entrepreneur	Entrepreneurs who are able to

Profile	Graduate Qualification
	develop and apply entrepreneurial values in the field of chemistry education or other relevant fields

E. GRADUATE LEARNING OUTCOMES (CPL)

Learning Outcomes of Graduates (CPL) of the Chemistry Education Study Program which refers to the formulation of the Indonesian National Qualifications Framework on the dimensions of attitudes and skills, as well as specific knowledge and skills agreed on in the IPR forum, as well as compliance with international standards on general competencies and special competencies, as follows:

General Competence

CPL 1   Able to apply religious attitude, responsibility, leadership, communication skills, professionalism, and able to work individually and work together in groups

CPL 2   Able to apply logical, critical, systematic, innovative thinking, collaborative skills to build networks, self-development, argue scientifically to solve problems in career, society, nation, and globally

Special Competencies

CPL 3   Able to integrate mathematical concepts and basic science to solve chemistry problems

CPL 4   Able to understand theoretical concepts, such as organic chemistry, biochemistry, analytical chemistry, physical chemistry, inorganic chemistry

CPL 5   Able to integrate chemistry concepts,

pedagogical chemistry knowledge, curriculum, methodology, classroom management, media, assessment and evaluation

CPL 6   Able to apply the basics of the scientific method and academic integrity in research and scientific work

CPL 7   Able to design and apply chemistry learning based on Technological Pedagogical and Content Knowledge (TPACK)

CPL 8   Able to plan, manage, and evaluate activities in the laboratory by taking into account the principles of HSE (Health Safety and Environment)

CPL 9   Able to identify problems and determine alternative solutions based on theory and research findings, as well as design and implement them in chemical education research

CPL 10   Able to apply entrepreneurial values as the basis for simple business design in the field of chemistry education or other relevant fields

CPL 11   Able to apply basic skills in managing educational institutions in an innovative and adaptive manner

F.   GRADUATE DEGREE

Graduates of the Chemistry Education Study Program are entitled to hold a Bachelor of Education degree in Chemistry which is abbreviated to S.Pd

G.   STUDY PROGRAM ACCREDITATION

The Chemistry Education Study Program has been accredited with an A (Very Good) score based on the Decree of the National Accreditation Board for Higher

Education (BAN PT) of the Ministry of Education and Culture of the Republic of Indonesia No. 8501/SK/BAN-PT/Ak-PPJ/S/XII/2020 dated December 22, 2020.

H.   RESEARCH METHODS

The passing value of a course is based on the value of the mid-semester exam (UTS), the value of the final semester exam (UAS), the value of both independent and structured assignments. Some courses are integrated with practicum, so the assessment is combined with practicum scores. The final grade of the course is calculated based on the weighting of each assessment source. The assessment scores are as follows:

Table 1. Value and Weight of Assessment

Mastery Level	Mark	Weight
86-100	A	4
81-85	A-	3.7
76-80	B+	3.3
71-75	B	3
66-70	B-	2.7
61-65	C+	2.3
56-60	C	2
51-55	C-	1.7
46-50	D	1
0-45	E	0

I. CURRICULUM

1. Curriculum Structure

The curriculum structure of the Chemistry Education Study Program consists of groups of general subjects (MKU), basic education courses (MKDK), supporting expertise courses (MKBKP) and learning courses (MKP). during the study period a minimum of 8 (eight) semesters and a maximum of 14 (fourteen) semesters with a minimum number of credit units of 144 credits. To become a graduate in chemistry education, students are required to write a final project (thesis) based on research in the field of chemistry education.

Group of General Courses (MKU), Basic Educational Courses (MKDK), University and Faculty characteristic courses, compulsory and elective courses for Study Programs consisting of Supporting Expertise Courses (MKBKP) and Learning Courses (MKP), as well as activities Merdeka Learning Campus Merdeka (MBKM).

Table 2. Independent Learning Curriculum Structure by Group of Subjects

No	Group	Status	Credits
1.	General Course (MKU)	Must	14
2.	Basic Education Course (MKDK)	Must	7
3.	Faculty Characteristics Course	Must	1
4.	Compulsory Courses Characteristics of Study Programs	Must	
	a. Supporting Expertise Courses (MKBKP)	Must	87
	b. Learning Courses	Must	12

No	Group	Status	Credits
	(MKP)		
5.	Elective Course Characteristics of Study Program	Choice	4
6.	Independent Learning Activities Independent Campus (MBKM)	Mandatory and Optional	20
	Amount		**145**

2. Distribution of Courses

Table 3. Distribution of Courses

Group	Code	Subject	credits	Semester							
				1	2	3	4	5	6	7	8
MKU	00052033	Religious education	2		v						
(14 credits)	00051122	Pancasila	2	v							
	00051162	Civic education	2		v						
	0051142	Indonesia Language	2	v							
	00053192	Data Raya and Programming	2			v					
	00053182	Education Insights	2		v						
	00053202	Logic and Scientific Reasoning	2				v				
		Sub Quantity	**14**								
MKDK	00053074	Educational Foundation	3	v							

Group	Code	Subject	credits	Semester							
				1	2	3	4	5	6	7	8
(7 credits)	00052152	Student Development	2		v						
	00052144	Learning and Learning Theory	2			v					
		Sub Quantity	**7**								
MK Faculty Characteristics (1 credit)	30051121	Olympisum	1	v							
		Sub Quantity	**1**								
MK Characteristics of Study Program-MKBKP- (Required-87 credits)	33150023	Basic Chemistry I	3	v							
		Basic Chemistry Practicum	2		v						
	33150033	Basic Chemistry II	3		v						
	30055043	Basic Physics	2								
	32251012	Basic Physics Practicum	1	v							
	34150013	General biology	2	v							

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Group	Code	Subject	credits	Semester							
				1	2	3	4	5	6	7	8
	33154062	General Biology Practicum	1	v							
	33150842	Chemistry Math	3		v						
		K3(Occupational Safety and Health) Laboratory	2		v						
	33154143	Environmental Education (PLH)	3		v						
	33150933	Chemical Thermodynamics	3			v					
	33151324	Organic Chemistry	4			v					
	33150172	Organic Chemistry Practicum	2				v				
	30055053	Atomic Structure and Structure of Inorganic Compounds	3			v					
	33150893	Quantitative Qualitative Analytical Chemistry	3			v					
	33154212	Qualitative and Quantitative Analysis Chemistry Practicum	2			v					
	33150842	Chemical Reaction Kinetics	3				v				

Group	Code	Subject	credits	Semester							
				1	2	3	4	5	6	7	8
	33154221	Physical Chemistry Practice	1					v			
	30055082	Basic Inorganic Reaction	2				v				
	33150682	Inorganic Chemistry Practicum	2					v			
	33250232	Separation Chemistry	3				v				
	30055082	Organic Compound Reaction	4					v			
	33151013	Transition metals and complex compounds	3						v		
	33250343	Structure and Function of Biomolecules	3					v			
		Biochemistry Practicum	2						v		
		Quantum Mechanics	3					v			
	33250053	Research methodology	3				v				
	33154083	Statistics	3					v			
	33154182	Metal and Non-Metal Chemistry	2					v			

Group	Code	Subject	credits	Semester							
				1	2	3	4	5	6	7	8
	33250333	Instrument Chemistry	3						v		
	33151122	Practicum in Instrument and Separation Chemistry	2						v		
	33151093	Biomolecular Metabolism	3						v		
	33250632	Chemistry Education Seminar	2						v		
	30054024	Essay	4								V
		Sub quantity	**87**								
MK Characteristics of Study Program-MKP **(required-12 credits)**	33151542	Learning Planning and Management	2		v						
	33154263	Chemistry Curriculum Review (TKK)	3				v				
	30052012	Learning Methodology	2				v				
		Learning Assessment and Evaluation	3					v			
	33151192	Microteaching	2						v		

Group	Code	Subject	credits	Semester							
				1	2	3	4	5	6	7	8
		Sub quantity	12								
MK Characteristics of Study-Options **(4 credits)**		**Field of Bioscience Studies**									
	33150012	Medical Biochemistry	2							v	
	33150462	Biotechnology	2							v	
	33151482	Chemical Natural Ingredients	2						v		
	33151492	Determination of Molecular Structure	2							v	
		Field of Materials Science									
	33250362	Nanoscience and Nanotechnology	2							v	
	33150282	Polymer Chemistry	2							v	
		Fields of Analytical Chemistry and Environmental Chemistry									
	33150272	Chemical environment	2					v			

Group	Code	Subject	credits	Semester							
				1	2	3	4	5	6	7	8
	33154322	Green Chemistry	2						v		
		Chemical Education Studies									
	33151332	History of Chemistry and Chemistry Education	2		v						
	33151342	Science Learning	2		v						
	33151392	Science Technology Engineering Mathematics (STEM)	2			v					
	33154202	Computer	2			v					
	33151422	Ethnopedagogy	2					v			
	33151432	Chemistry for Children with Special Needs	2					v			
	33151452	Qualitative Research Methodology	2						v		
	33154302	Learning Environment	2								
	33154272	Misconceptions in Chemistry Learning	2								

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Group	Code	Subject	credits	Semester							
				1	2	3	4	5	6	7	8
	33154312	Instrument Development	2								
	33151442	ICT in Chemistry Learning	2						v		
	33151402	Important Concepts in Chemistry	2								
	3151382	School Management	2								
MBKM (20 credits)	Option 1										
	30055032	PKM (Teaching Skills Practice)	6							v	
	30052072	Pre Thesis Seminar (SPS)	2							v	
	University Elective Courses										
	KM-00392	Development of Teaching Materials	6								
	KM-00944	Learning Media Development	4							v	
	KM-00954	Instrument Development	4								
	Option 2										

Group	Code	Subject	credits	Semester							
				1	2	3	4	5	6	7	8
	30055032	PKM (Teaching Skills Practice)	6							v	
	30052072	Pre Thesis Seminar (SPS)	2							v	
Study Program Elective Courses											
	30050042	English	2		v					v	
	33150952	Entrepreneurship	2							v	
	33154092	Instructional Media	2							v	
		Elective courses	6						v		
Choice 3											
	30055032	PKM (Teaching Skills Practice)	6							v	
	30052072	Pre Thesis Seminar (SPS)	2							v	
		MBKM Activities (8 Types of Activities)	12								
Amount			145-147								

J.   SPREAD

Semester 1

No	MK code	Semester 1	credits
1	0051142	Indonesia Language	2
2	00051122	Pancasila	2
3	00053074	Educational Foundation	3
4	33150023	Basic Chemistry I	3
5	30055043	Basic Physics	2
6	32251012	Basic Physics Practicum	1
7	33154031	General biology	2
8	33154062	General Biology Practicum	1
9	33154071	Chemistry Math	3
10	33150842	Olympisum	1
Total Credits			**20**

Semester 2

No	MK code	Semester 1	credits
1	00053182	Education Insights	2
2	00052033	Religious education	2
3	00052152	Student Development	2
4	00051162	Civic education	2
5	33151542	Learning Planning and Management	2
6	33150033	Basic Chemistry II	3
7		Basic Chemistry Practicum	2
8	33154143	Environmental education	3
9		K3 (Occupational Safety and Health) Laboratory	2
Total Credits			**20**

3rd semester

No	MK code	Semester 1	credits
1	00053192	Data Raya and Programming	2
2	00052144	Learning and Learning Theory	2
3	30055053	Atomic Structure and Structure of Inorganic Compounds	3
4	33151324	Organic Chemistry	4
5	33150933	Chemical Thermodynamics	3
6	33150893	Quantitative Qualitative Analytical Chemistry	3
7	33154212	Qualitative and Quantitative Analysis Practicum	2
Total Credits			**19**

Semester 4

No	MK code	Semester 1	credits
1	00053202	Logic and Scientific Reasoning	2
2	33154263	Study the Chemistry Curriculum	3
3	30052012	Learning Methodology	2
4	30055082	Basic Inorganic Reaction	2
5	33150983	Chemical Reaction Kinetics	3
6	33250232	Separation Chemistry	3
7	33250053	Research methodology	3
8	33150172	Organic Chemistry Practicum	2
Total Credits			**20**

5th semester

No	MK code	Semester 1	credits
1		Learning Assessment and Evaluation	3
2		Metal and Non-Metal Chemistry	2
3	33150682	Inorganic Chemistry Practicum	2
4		Quantum Mechanics	3
5	33250343	Structure and Function of Biomolecules	3
6	33154083	Statistics	3
7	33150041	Physical Chemistry Practicum	1
8	30055082	Organic Compound Reaction	4
Total Credits			**21**

6th semester

No	MK code	Semester 1	credits
1	33151192	Microteaching	2
2	33154182	Transition Metals and Complex Compounds	3
3	33250333	Instrument Chemistry	3
4		Practicum in Instrument and Separation Chemistry	2
5	33151093	Biomolecular Metabolism	3
6		Biochemistry Practicum	2
7	33250632	Chemistry Education Seminar	2
8		Elective courses	4
Total Credits			**21**

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Semester 7 (MBKM 20 credits)

No	MK code	Semester 1	credits
1	30052072	Pre Thesis Seminar (SPS)	2
2	30055032	PKM (Teaching Skills Practice	6
		MBKM (Option 1,2,3)*	12
Total Credits			20

*MBKM (Option 1,2,3)

No	MBKM Options	Subject	credits
Option 1			
1	KM-00392	Development of Teaching Materials	4
2	KM-00944	Learning Media Development	4
3	KM-00954	Instrument Development	4
Option 2			
1	30050042	English	2
2	33150952	Entrepreneurship	2
3	33154092	Instructional Media	2
4		Elective courses	6
Choice 3			
MBKM Activities (8 Types of Activities)			12

Semester 8

No	MK code	Semester 1	credits
1	30054024	Essay	4
Total Credits			4

K. COURSE DESCRIPTION

1. General Course

Indonesia Language (2 credits)

This course aims to develop students' personalities so that they are able to speak Indonesian properly and correctly, have good personalities, are intelligent and care about others. The topics of discussion in this course are: a good, intelligent and caring personality, the meaning and function of the Indonesian language as a national and state culture, various languages, EYD, scientific language, words, terms, definitions, essay planning, scientific essay development, paragraph development , sentence effectiveness, word choice, reasoning in essays, written words and spelling, notation techniques, scientific writing techniques.

Religion (2 credits)

This course studies the physical and spiritual balance in humans, human relations with Allah SWT, human relationships with: themselves, fellow humans, other creatures and their environment. Faith in the oneness of God Tawhid, the function and role of humans in the universe. The task of humans in building a world that is blessed by Allah SWT. The essence of the purpose of human life. The relationship between faith and good deeds. Man after death, the true purpose of life.

Citizenship (2 Credit Points)

This course serves as a source of value in society, personality development to become a complete

Indonesian person, establishes a consistent personality in realizing the basic values of society, nation and state, fosters a sense of nationality and love for the homeland throughout life in mastering and implementing and developing science and technology and his art with a sense of responsibility. The basic competencies of citizenship education courses are so that students become professional scientists, have a sense of nationality and love for the homeland, civilized democracy, become citizens who have high competitiveness, discipline, actively participate in building a peaceful life based on the Pancasila value system.

Pancasila (2 credits)
This course provides an understanding of the foundations and objectives of Pancasila Education, Pancasila in the context of the history of the struggle of the Indonesian people, philosophical systems, political ethics and national ideology.

Big Data and Programming (2 Credit Points)
In this course, students will study trends and aspects of big data (data on a large scale). This course emphasizes the introduction and implementation of data storage systems with large scale (volume), type (variety), and data storage speed (velocity). In addition, several data processing and data mining techniques for big data will also be discussed

2. **Basic Education Course**

Educational Science Foundation (3 Credits)
This course presents a discussion of various educational assumptions. The course material includes the basic concepts of education, the implications of human nature for education, the notion of education, education as a science and art, the philosophical foundations of education, the psychological foundations of education, the sociological and anthropological foundations of education, the historical foundations of education and the juridical foundations of education.

Student Development (2 Credits)
This course studies the concept of development in general and its relationship to student development, developmental theory, principles of human development, as well as studying physical, intellectual, emotional, social and moral development with implications for education in every period of human development from prenatal to old age. .

Learning and Learning Theory (2 Credit Points)
This course studies comprehensively about learning and learning theory as well as its development and application in the learning process. The discussion focused on the basic concepts of learning and learning. Learning principles, and learning and learning theories.

3. **MKBKP**

   Basic Chemistry I (3 credits)
   This course studies basic laws, measurement concepts, classification of matter and change, development of atomic theory, structure and bonding in molecules, forms of matter and their changes in terms of macroscopic and microscopic properties and the accompanying energy effects. After attending this course, students are expected to be able to apply the basic concepts of chemistry in calculations, structural analysis and chemical changes.

   Basic Chemistry Practicum (2 credits)
   This course aims to make students able to understand theories and concepts through experiments, which include the ability to observe chemical phenomena, analyze data, and make conclusions so that they can connect experiments and theories in basic chemistry courses, as well as provide skills as a basis for conducting more experiments. carry on. Experimental materials include: Proving Lavoiser's Law, Determination of the Relative Atomic Mass of Substances, Chemical Reactions, Determination of Reaction Enthalpy Changes, Refining Refining, Separation, Properties of Elements, and the Periodic system, Acid-Base Reactions, Colligative Properties of Solutions, Redox and Determination of Oxides , Reaction Kinetics, Equilibrium, Determination of DGL and electrolysis, colloids, recognize the properties and synthesis of Simple Carbon Compounds.

Basic Chemistry II (3 credits)
This course studies the physical properties of solutions, chemical kinetics, chemical equilibrium, acids and bases, acid-base and solution equilibrium, thermodynamics, redox reactions and electrochemistry. The course also examines the chemistry of coordination compounds, nuclear chemistry, and organic-synthetic and natural polymers. After attending this course, students are expected to be able to understand chemical concepts and their applications in everyday life.

Basic Physics (2 Credit Points)
Basic physics is a subject that belongs to the branch of natural sciences. The basic physics course material consists of quantities and units, relative motion, dynamics of point objects (newton's laws with the concepts of force, work, energy, impulse, and momentum, laws of conservation), rotational motion, elasticity and oscillation, gravity, fluid mechanics, heat, wave mechanics, Gauss's law, electric fields and forces, potential energy, electricity and electric potential, capacitors, magnetic induction emf, alternating current, modern physics.

Basic Physics Practicum (1 Credit)
This course aims to make students able to understand theories and concepts through experiments, which include the ability to observe physical phenomena, analyze data, and make conclusions so that they can connect experiments and theories in basic physics courses, as well as provide skills as a basis for

conducting more experiments. carry on. Experimental materials include: quantities and units, relative motion, dynamics of point objects (newton's laws with the concepts of force, work, energy, impulse, and momentum, laws of conservation), rotational motion, elasticity and oscillation, gravity, fluid mechanics, heat, wave mechanics, gauss law, electric fields and forces, potential energy, electricity and electric potential, capacitors, magnetic induction emf, alternating current, modern physics.

General Biology (2 Credit Points)
This course is carried out by containing the basic conception of the scientific structure of biology, which is identified in terms of objects, the organization of the level of life, and the theme of the problem, scientific methods and approaches both inductively and deductively to obtain the truth of the findings in the form of: concepts, principles, laws, and biological theories.

General Biology Practicum (1 Credit)
This course aims to make students able to understand theories and concepts through experimentation, which includes the ability to observe, analyze data, and make conclusions so that they can connect experiments and theories in general biology courses, as well as provide skills as a basis for conducting further experiments. Experimental materials include:concepts, principles, laws, and biological theories.

Chemistry Mathematics (3 Credits)
This course discusses mathematical concepts related to chemical problems, namely: series, differential and integral, differential equations, some special functions, coordinate systems, vectors, matrices and determinants, complex numbers, operators, eigen equations, function graphs and solving high power equations .

Environmental Education (PLH) (3 credits)
This course comprehensively discusses ecology as the basis of environmental science, the basic principles of environmental science, material and energy cycles, population and changes in population, population problems, the role of humans in ecosystems with all their impacts, and sustainable development in saving our earth from destruction. .

K3(Occupational Safety and Health) Laboratory (2 credits)
After taking this course, students are expected to be able to properly manage a chemical laboratory in accordance with occupational health and safety rules, and to be able to contribute to the development process of chemistry in particular and science in general.

Chemical Thermodynamics (3 Credit Points)
This course studies the ideal gas equation, the real gas equation, the energy that accompanies the chemical change process, as well as the laws of thermodynamics

and their application to chemical equilibrium, phase equilibrium and electrochemical equilibrium.

Organic Chemistry (4 Credits)

This course discusses the structure and bonds in organic molecules, intra-molecular properties, molecular forces, chemical and physical properties, acidity and basicity, chemical classification and reactions based on functional groups, nomenclature based on IUPAC and trivial compounds. alkane hydrocarbons, alkenes, alkynes, benzene aromatic compounds, alcohols, ethers, aldehydes, ketones, amines, amides, carboxylic acids and their derivatives. In addition, it discusses molecular conformation based on Newmann projections, axial-equatorial concepts and cis-trans isomers in cyclic molecules, chirality of carbon atoms, mirror images, enantiomers, optical isomers of carbohydrate compounds, rectus (R) and sinister (S) absolute conformations. Fisher projection of carbohydrate and amino acid compounds, racemic mixtures and their separation methods.

Atomic Structure and Structure of Inorganic Compounds (3 Credit Points)

This course covers the study of atomic and elemental theory consisting of Bohr's atomic theory and wave mechanics. hydrogen atoms and polyelectron atoms; atomic orbitals and quantum numbers; shield effect; periodicity of the elements; boron and carbon group elements; elements of the nitrogen and oxygen groups; halogen elements and noble gases; lanthanides and actinides.

Qualitative and Quantitative Analytical Chemistry (3 Credit Points)

This course explains the basic supporting theory in analyzing a sample (covering Solutions & their properties, electrolyte dissociation, ion balance, pH, solubility and solubility products) and Qualitative Analysis (covering preliminary analysis, separation and identification of cations and anions), as well as Quantitative Analysis (covering sampling technique, accuracy, precision, correction factor, volumetric and gravimetric analysis).

Qualitative and Quantitative Analysis Practicum (2 credits)

This practicum aims to make students acquire basic skills in analyzing a sample qualitatively and quantitatively. Practical material includes: qualitative analysis in determining anions, single/mixed cations contained in a sample, quantitative analysis using volumetric methods including making standard solutions, determining the concentration of primary and secondary standards and determining the concentration of a chemical compound in a sample, and using indicators, quantitative analysis with gravimetric method in determining the concentration of a chemical compound/cation/anion contained in a sample.

Chemical Kinetics (3 Credit Points)

This course studies the theory of gas kinetics, Maxwell Boltzman distribution, collision theory and the nature of the transport of substances to determine the rate of

chemical reactions in basic reactions, successive basic reactions, unimolecular and complex reactions and their reaction mechanisms. This course also learns about the adsorption process on solid surfaces and the analysis of ion mobility in electrolyte solution systems, so that students are able to analyze the dynamic properties and energy that accompanies various chemical changes.

Physical Chemistry Practicum (2 credits)
This practicum aims to make students have the ability and skill to measure physical quantities of substances in various systems and to be able to use these data to study the properties of reactions including the relative atomic mass of gas/liquid, heat, heat of dissolution/neutralization, dissolution as a function of temperature, mutual dissolution, ternary diagrams, activity and conduction of electrolytes, determination of reaction order and rate constant of reaction, acid catalyst, ionization constant, sugar inversion rate, viscosity, critical micelle concentration, determination of equilibrium constant.

Basic Inorganic Reaction (2 Credit Points)
Basic courses in inorganic reactions include acid-base theories, acid-base strength, bond energy and bond length in acids and bases, hard and soft acids and bases, and thermodynamic aspects in acids and bases; systems in aqueous and non-aqueous solvents, salt solubility; Elemental extraction, reduction potential, reduction stability in aqueous solvents, reduction potential diagram; water dissolving system; non-

aqueous solvent system; salt solubility; elemental extraction techniques; reduction potential; and a reduction potential diagram.

Separation Chemistry (3 Credits)
This course explains: the basic theories of separating a substance by distillation, extraction, electrolysis, coulometry, chromatography and their applications.

Organic Compound Reaction (4 credits)
This course aims to make students able to predict the structural properties of organic molecules in relation to the properties of acidity and basicity and to examine the types of reactions and their mechanisms.

Organic Chemistry Practicum (2 Credits)
This course aims to give students the ability to experiment with more complex organic molecules (natural materials) in terms of preliminary tests, isolation and purity. Practical material includes isolation in various ways (extraction, maceration, soxhletation), separation and purification, purity test, hydrolysis etc.

Transition Metals and Complex Compounds (3 credits)
This course examines the concepts of coordination chemistry, namely: valence bond theory, crystal field theory, molecular orbital theory; nomenclature of coordination compounds; ligand classification; Complexing by monodentate ligands; complexing by polydentate ligands; The concepts of isomerism and stereoisomerism in coordination chemistry; Distortion

in the geometry of complex compounds; The thermodynamic and kinetic stability of the coordination compound; Factors affecting the stability of coordination compounds; The reaction mechanism of complex compounds; Application of coordination compounds; Application of coordination compounds; Recent research in the field of coordination compounds; and Coordination compounds and their potential applications.

Inorganic Chemistry Practicum (2 Credit Points)
This course aims to make students more understanding and skilled in the synthesis of complex compounds and their characterization. This course covers the basics of inorganic reactions, synthesis of inorganic compounds, and their purification. Practical materials include: recrystallization, photoelectric reactions, and determination of acid-base strength, synthesis of complex compounds, purification of complex compounds, and their characterization.

Structure and Function of Biomolecules (3 Credit Points)
The subject of Structure and Function of Biomolecules which includes Theory and Experiments/Practicum aims to enable students to analyze and explain the structure, classification, physical and chemical properties, test reactions and functions of biomolecules in metabolism and daily life. Psychomotor skills developed after attending this course are that students are able to perform qualitative tests of amino acids, qualitative tests of proteins, analyze protein

samples, isolate carbohydrates, qualitative tests of carbohydrates, isolate lipids, qualitative tests of lipids, analyze lipid samples, isolate enzymes, determine the effects (temperature, pH, incubation time, concentration of substrate, inhibitor, coenzyme) on enzyme activity.

Biochemistry Practicum (2 credits)
This course aims to make students understand and be able to conduct experiments on isolation, qualitative tests and sample analysis of amino acids, proteins, carbohydrates and lipids, kinetics of enzymatic reactions and isolation, sample analysis and DNA electrophoresis. Practical material includes: qualitative test of amino acids, and sample analysis, protein isolation, qualitative test and analysis of protein samples followed by isolation, qualitative test and analysis of carbohydrate, lipid samples, isolation and determination of activity and observation of factors affecting enzyme activity, isolation DNA, DNA sample analysis, and electrophoresis.

Quantum Mechanics (3 Credit Points)
Molecular symmetry courses cover study topics such as classification of symmetry operations, internal; symmetry properties of the wave function, exact wave properties, representation of diatomic, triatomic, straight and bent molecules; and LCAO-MO description, molecular orbital distribution, projection operations. In addition, this course also aims to make students understand the nature of chemical reactions through

chemical bonds with the basis of quantum chemical analysis.

Research Methodology (3 Credits)
This course discusses comprehensively the principles of scientific research. The discussion focuses on several concepts and definitions in research, theoretical exercises and hypothesis submission. Sampling techniques, types of research methods, experimental designs, measurements and measuring instruments, data collection and analysis techniques as well as research structures and writing research proposals.

Statistics (3 credits)
This course comprehensively discusses the role of statistics in research, strategic statistics, inferential statistics, and various advanced data analysis.

Metal and Non Metal Chemistry (2 Credit Points)
This course covers the study of atomic and elemental theory consisting of Bohr's atomic theory and wave mechanics. hydrogen atoms and polyelectron atoms; atomic orbitals and quantum numbers; shield effect; periodicity of the elements; boron and carbon group elements; elements of the nitrogen and oxygen groups; halogen elements and noble gases; lanthanides and actinides.

Instrument Chemistry (3 Credit Points)
This course explains: theory and the use of various instruments in conducting quantitative and qualitative chemical analysis, through a chemical instrumentation

method approach, which includes spectroscopic and chromatographic analysis which includes Introduction to Instrumental Analysis; Electromagnetic Radiation and Its Interaction with Matter; UV-Vis Spectrometry, Atomic Absorption Spectrometry; Infrared Spectrometry; Mass Spectrometry; Proton Magnetic Resonance Spectrometry.

Practical Chemistry of Instruments and Separation (2 Credits)
This course aims to train students in designing basic equipment schemes for the purposes of separation analysis and conducting sample analysis using chemical instruments both qualitatively and quantitatively. Practical material includes: sample analysis using volumetric methods and separation methods by distillation, extraction, electrolysis and chromatography, gravimetry, spectrometry, colorimetry, and photometry.
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Biomolecular Metabolism (3 Credit Points)
This course provides students with the ability to analyze and solve various problems using a biochemical concept approach at the genomic, proteomics, and metabolomics levels. Psychomotor skills developed after completing this course students are able to analyze blood sugar levels, analyze the role of enzymes in metabolic processes, analyze lipid and protein metabolism, as well as isolate and characterize DNA as a molecule carrying genetic information using electrophoresis techniques.

Biochemistry Practicum (2 credits)
This course aims to make students understand and be able to conduct experiments on quantitative tests and sample analysis of carbohydrates, lipids, proteins, analysis of blood glucose and cholesterol levels, urine analysis, as well as analysis of protein samples and protein electrophoresis.

4. **MKP**

Learning Planning and Management (2 Credit Points)
This course aims to develop student competence in designing chemistry learning in secondary education according to the applicable curriculum and being able to manage chemistry learning in the classroom and in the laboratory.

Chemistry Curriculum Review (TKK) (3 credits)
This course aims to make students have the ability to analyze the chemistry education curriculum at the elementary, high school and vocational education levels.

Learning Methodology (2 Credits)
This course discusses the nature of learning and learning, behaviorism learning theories, cognitivism learning theory, constructivism learning theory, humanism learning theory, learning models, various approaches to the learning process, and learning strategies.

Learning Assessment and Evaluation (3 Credits)

The student competencies that will be developed in this course are able to plan and develop assessment methods (learning processes and outcomes), as well as being able to process research results into learning evaluations to improve student learning and teacher teaching competencies.

Microteaching (2 Credit Points)
Microteaching aims to establish and develop basic teaching competencies as a provision for teaching practice in schools/educational institutions in order to fully face teaching work in front of the class by having the knowledge, skills, skills and attitudes as professional teachers. The microteaching materials include: understanding the basics of microteaching, preparing a teaching implementation plan (RPP), forming and improving the competence of limited basic teaching skills, integrated teaching basic skills competence, forming personality competencies, and forming social competencies.

Chemistry Education Seminar (2 Credits)
This course aims to enable students to have the ability to study, understand the content of a scientific article in the field of chemistry education, compile a report on the results of the study and submit it in certain assessment forums.

Thesis (4 credits)
This course aims to make students have the ability to compile an educational research report and be able to defend it in a certain assessment forum.

5. **Elective courses**

Determination of Molecular Structure (3 Credit Points)
Molecular Structure Determination Lecture, is an advanced course and must be followed. Aims to provide an understanding of ways to determine the structure of organic compounds chemically and spectroscopically. This includes elementary analysis, functional groups, derivatives, ultra violet, visible, infrared spectroscopy, nuclear magnetic resonance (1H and 13C), and mass spectroscopy.

Chemistry of Natural Materials (2 Credit Points)
This course studies aboutintroduction of natural compound compounds: Definition of natural compound compounds, classification, structure, properties, origin of biogenesis, biosynthesis, isolation methods, and identification which include groups of terpenoid compounds, steroids, flavonoids, polyketides, polyphenols, alkaloids, as well as several examples of natural compound compounds. useful, which are found in certain plant families.

Nanoscience and Nanotechnology (2 Credit Points)
This course is an introduction to the field of nanotechnology and advanced materials through related lecture topics such as: History and opportunities of nanoscience and nanomaterials; Definition and scope of study of the terms nanochemistry, nanoscience and nanotechnology; Types of nanomaterials; Effect of size on nanometer dimensions on chemical, physical and particle

reactivity; nanomaterial synthesis techniques; analysis techniques and nanomaterial characterization benefits and risks of nanoscience and nanotechnology; nanomaterials application.

Polymer Chemistry (2 Credit Points)
Polymer chemistry is a course that introduces and studies the manufacture, properties, and characterization of macromolecules. The course content includes: basic concepts of polymer science, condensation polymerization, addition polymerization, polymerization conditions, polymer chemical transformation, polymerization, and polymer characterization.

Environmental Chemistry (2 Credit Points)
This course discusses comprehensively about chemicals that exist in nature, the processes involving these materials that occur in the environment both academically and as a result of human activities which in addition to having a positive impact also have a negative impact on all life on this earth. .

History of Chemistry and Chemistry Education (2 Credit Points)
This course in History of Chemistry and Chemistry Education studies the development (history) of chemistry from prehistoric times to the early 20th century through a philosophical analysis of these historical developments by emphasizing how chemists of the past thought and worked at the same time they also developed, evaluated, and applied theory. and

new practical methods, as well as their application in the learning process of chemistry in secondary schools

Science Learning (2 Credits)
Science Learning Courses are courses that equip students with experience related to natural science disciplines. Equipping students with a science process skill approach, so that learning is more meaningful. Students bring theories into scientific practice. Through the practice of science students can comprehensively understand the theory. This course includes activities to design and demonstrate the phenomenon of applying science in everyday life as well as making products of economic value using scientific principles and explaining them scientifically.

Learning Environment (2 Credits)
This course examines the learning environment, factors, impacts, measurement instruments and research in the learning environment. Students are expected to understand the concept of the learning environment and apply concepts in analyzing the learning environment, especially in learning chemistry

Misconceptions in Chemistry Learning (2 Credits)
This course examines preconceptions, alternative misconceptions in chemistry learning based on reference books, research results and innovations contained in journals in chemistry education and chemistry journals. Students are expected to be able to identify misconceptions and overcome them and understand the characteristics of the material and the

interrelationships between concepts in chemistry learning.

Instrument Development (2 Credit Points)
Students have broad knowledge of instruments and are able to develop them, both for tests and non-tests. Therefore, they need to be facilitated and encouraged to master: instrument concepts, measurement, assessment, evaluation, types of instruments, validity, reliability, how to develop instruments, item analysis, and theoretical and empirical practice of item analysis.

ICT in Chemistry Learning (2 Credits)
The course discusses the development of ICT-based learning multimedia, starting from the basics of media and learning innovation, design, development and production of learning multimedia.

Biotechnology (2 Credit Points)
This course aims to enable students to analyze solutions to various environmental problems using a biotechnology concept approach at the genomic, proteomics, and metabolomics levels through analysis of textbooks, review of journals, practicum, and assessment of information through various sources.

Medical Biochemistry (2 Credit Points)
In the Medical Biochemistry course, students study the metabolism that occurs in living things starting from metabolism in general, including the processes of anabolism and catabolism. Biomolecular metabolism, namely carbohydrate metabolism, lipid metabolism,

protein metabolism including protein biosynthesis and nucleic acid metabolism and their regulation.

STEM (2 Credit Points)

The STEM (Science, Technology, Engineering, and Mathematics) course in Chemistry Education aims to provide students with an understanding of one of the trends in chemistry education, through the integration of chemistry with mathematics, engineering technology, and effective ICT for specific purposes, especially to develop problem solving skills, critical thinking skills, creative thinking skills of students/students. Besides being facilitated to study STEM applications that can facilitate students to design, compile, apply, and evaluate the implementation of learning with STEM in Chemistry education in schools.

Transformative Education (2 Credit Points)

The course provides the basic principles of transformative education and its integration in chemistry learning. Application of transformative education related to learning planning and transformative research

Qualitative Methodology (2 Credit Points)

This course provides an overview of the principles and types of qualitative methodologies, data collection techniques, data analysis and representation, and data validity techniques in qualitative research.

Scientific Writing (2 Credits)

Scientific writing provides an overview of the basic concepts of scientific writing, aspects, and technical writing. This course provides briefing in the application of scientific writing in the field of chemistry education

Ethnopedagogy (2 Credit Points)
This course is an actualization of learning that is oriented to the cultivation of local wisdom values. As an approach, ethnopedagogy in elementary schools needs to be implemented with innovative learning strategies and media that are able to attract students' attention to understand and apply local wisdom.

Chemistry for Children with Special Needs (2 Credit Points)
This course studies strategies for teaching chemistry to children with special needs and identifies the use of chemistry learning media for children with special needs.

6. **Independent Learning Independent Campus**
   a. **Option 1**
      Teaching Competency Practice (6 credits)
      The Teaching Competency Practice (PKM) course aims to improve students' abilities in managing learning in schools in a professional manner. This gradual and systematic exercise is provided in the PKM course. PKM aims to provide opportunities for students to practice applying the knowledge, skills, and attitudes they have acquired through various courses, into the management of learning activities in their own classrooms.

Pre-Thesis Seminar (2 Credits)
This course aims to make students have the ability to prepare an educational research proposal and be able to defend it in a certain assessment forum.

b. **Option 2**
   Teaching Competency Practice (6 credits)
   The Teaching Competency Practice (PKM) course aims to improve students' abilities in managing learning in schools in a professional manner. This gradual and systematic exercise is provided in the PKM course. PKM aims to provide opportunities for students to practice applying the knowledge, skills, and attitudes they have acquired through various courses, into the management of learning activities in their own classrooms.

   Pre-Thesis Seminar (2 Credits)
   This course aims to make students have the ability to prepare an educational research proposal and be able to defend it in a certain assessment forum.

   Learning Media (2 Credits)
   This course discusses the understanding of media materials, objectives, benefits, sources and teaching aids, roles, functions, classifications and characteristics of learning media; module development procedures; types and criteria of learning media; ICT-based learning; computer-based learning; web-based learning; presentation based

multimedia learning; distance learning and assessment in learning.

English (2 credits)
This course is one of the courses that contribute to the achievement of special competencies in the supporting skills of chemistry/chemistry education students. The competencies that will be achieved in this course are that students are able to apply English language skills in reading, listening, writing, and speaking related to the student profession in the field of chemistry/chemistry education. Study material on basic knowledge of English will be provided for application in the four required skills. Students are expected to read texts, listen to lectures/materials, discuss and present, and write essays in English with the context of chemistry/chemistry education. The learning method used is oriented towards student-centred learning, namely group discussions, presentation of group assignments, and individual assignments. Assessment uses observation (performance), portfolio, and English application tests in chemistry/chemistry education.

Entrepreneurship (2 Credit Points)
This course examines general aspects of entrepreneurship, entrepreneurial character, making entrepreneurial ideas and plans, recognizing forms of entrepreneurial ownership, starting entrepreneurship, product/service quality assurance management, to human resource management.

Students are expected to be able to recognize their own potential, seek and create business opportunities, and dare to try entrepreneurship according to their abilities and fields and apply them especially in the field of chemistry.

c. **Choice 3**
   Teaching Competency Practice (6 credits)
   The Teaching Competency Practice (PKM) course aims to improve students' abilities in managing learning in schools in a professional manner. This gradual and systematic exercise is provided in the PKM course. PKM aims to provide opportunities for students to practice applying the knowledge, skills, and attitudes they have acquired through various courses, into the management of learning activities in their own classrooms.

   Pre-Thesis Seminar (2 Credits)
   This course aims to make students have the ability to prepare an educational research proposal and be able to defend it in a certain assessment forum.

MBKM Activities (8 Forms) (12 Credits)
1) **Study**
   This course provides an opportunity for students who have a passion to become researchers to be able to develop critical thinking. This course is expected to improve the quality of student research, students gain research competence

through direct mentoring by researchers at research institutions/study centers, and improve the ecosystem and quality of research in Indonesian laboratories and research institutes by providing research resources and regeneration of researchers from an early age. .

2) **Student exchange**

The objectives of holding student exchange practices include cross-campus study (domestic and overseas), living together with family at the destination campus, students' insight into Bhinneka Tunggal Ika (Unity in Diversity) will develop, cross-cultural and ethnic brotherhood will be stronger, build student friendships among students. regions, ethnicities, cultures, and religions, thereby increasing the spirit of national unity and integrity, and organizing the transfer of knowledge to cover educational disparities between domestic universities, as well as conditions of higher education in the country and abroad.

3) **Teaching Assistance**

Learning activity courses in the form of teaching assistance are carried out by students in the education unit. Schools where teaching practice can be located in urban or remote areas. The objectives of the teaching assistance program in educational units include providing opportunities for students who have an interest in education to participate in teaching and deepening their knowledge by becoming teachers in education units and helping to

improve the distribution of quality education, as well as the relevance of primary and secondary education to higher and higher education. current development.

4) **Businessman**

These entrepreneurial practice courses include applying entrepreneurial learning applications, providing opportunities for students who have an interest in entrepreneurship to develop their businesses early and are guided, dealing with unemployment problems that result in intellectual unemployment from undergraduates, and being able to carry out initial entrepreneurial practices with a comprehensive understanding of entrepreneurial concepts. .

5) **Humanitarian Project**

This course involves students with youth, scientific competence, and interest in becoming "foot soldiers" in humanitarian and other development projects both in Indonesia and abroad. The objectives of the humanitarian project practice include preparing excellent students who uphold human values in carrying out their duties based on religion, morals, and ethics as well as training students to have social sensitivity to explore and explore existing problems and participate in the project.

6) **Building a Village/KKN**

The KKN program is a mandatory program with a weight of 2 credits which is carried out for at least 1

month, and for a maximum of 4 months. KKN is attended by UNJ students who take a minimum of 100 credits. KKN is carried out in semester 6 and is guided by lecturers from each department, under the coordination and guidance of the Community Service Institute (LPM). The Community Service Program aims to mature the minds of students and improve skills to be able to participate in implementing development programs in DKI Jakarta or other areas that become UNJ target areas.

7) **Internship/Practice**
The internship program courses aim to provide students with sufficient experience, hands-on learning in the workplace (experiential learning), to be able to improve hard skills (skills, complex problem solving, analytical skills, etc.), as well as soft skills (professional/work ethics). , communication, cooperation, etc.).

8) **Independent Project**
Field of Study (2 Credits)
Independent Project Practice (4 Credits)
This course is a program that is run to complement the curriculum that has been taken by students, completing topics that are not included in the lecture schedule, but are still available in the syllabus of the study program or faculty. Independent project activities can be carried out in the form of cross-disciplinary group work. The objectives of independent study programs/projects include realizing student ideas in developing

innovative products that become their ideas, conducting research and development (R&D)-based education, improving student achievement in national and international events.

L. **TEACHING STAFF**

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1.	0589	Prof. Dr. Erdawati, M.Sc	erdawati@unj.ac.id
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STUDY PROGRAM: BIOLOGICAL EDUCATION

A. INTRODUCTION

Biology Education Study Program, FMIPA, Universitas Negeri Jakarta was accredited with an A grade based on BAN-PT Decree No. 2202/SK/BAN-PT/Ak-PPJ/S/IV/2021, dated April 20, 2021, which is valid until April 16, 2026. With the support of excellent laboratories and human resources, the Biology Education Study Program strives to become a center of excellence. of excellence) in the field of Biology learning based on digital technology.

B. VISION, MISSION, AND GOALS

1. Vision

To become a leading digital technology-based Biology learning reference center in the Asian region.

2. Mission

a. Organizing based Biology education and learning accountable digital technology.
b. Organizing research studies and scientific publications.
c. Organizelearning service oriented to community empowerment.

3. Purpose

a. Produce graduates who are religious, nationalist, able to work together, are responsible, have integrity, have leadership and entrepreneurial spirit.
b. Producing prospective Biology teachers who are able to organize learning based on technological pedagogical content knowledge (TPACK).

c. To produce Biology learning products based on technological pedagogical content knowledge (TPACK) as a result of research and development.
d. Produce graduates who master the management of Biology laboratories based on digital technology.
e. Produce graduates who master digital technology-based entrepreneurial management.
f. Develop cooperation with various institutions that are stakeholders in the implementation of education, research and community service..

C. COMPETENCE OF GRADUATES

Competencies of Graduates of the Biology Education Study Program, Universitas Negeri Jakarta, are as follows:
1. Able to become a biology teacher who has Biological literacy skills and masters technological pedagogical content knowledge (TPACK) based on digital technology.
2. Able to manage biology laboratories, namely designing, implementing and evaluating the functions of digital technology-based biology learning and research laboratories.
3. Able to design, implement and evaluate entrepreneurial activities in the field of biology and biology education based on digital technology.

D. DESCRIPTION GRADUATE PROFILE AND COMPETENCY

	GRADUATE PROFILE	GRADUATE COMPETENCE DESCRIPTION
1	Biology Educator	Able to become a Biology teacher who has literacy skills and masters technological pedagogical content knowledge (TPCK) based on digital technology.
2	Biology Laboratory Manager	Able to manage the Biology laboratory, namely designing, implementing and evaluating the functions of digital technology-based biology learning and research laboratories.
3	Entrepreneur	Able to design, implement and evaluate entrepreneurial activities in the field of biology and biology education based on digital technology.

E. GRADUATE LEARNING ACHIEVEMENTS

The Learning Outcomes of Graduates (CPL) of the Biology Education Study Program, FMIPA, Universitas Negeri Jakarta are as follows:

1. **Attitude**
   a. Demonstrate religious, nationalist, cooperative, and responsible attitudes.
   b. Internalizing academic values, norms, and ethics.

2. **General Skills**
   a. Demonstrate conceptual, analytical, logical, critical, creative, and innovative thinking skills to solve problems.
   b. Have the ability to social sensitivity, ethics and caring attitude to the community.

   c. Have communication skills, literacy, leadership and self-development strategies.

3. **Knowledge**
   a. Understanding educational philosophy and applying it in Technological Pedagogical Content Knowledge (TPACK) based learning.
   b. Understanding professional expertise (professional ethics) in Biology Education.
   c. Mastering the basic concepts of science (basic mathematics, basic physics, basic chemistry, and general biology).
   d. Understand the concepts of cell and molecular biology, developmental structures, biosystematics and evolution, physiology, genetics and biotechnology, ecology, environment and conservation.
   e. Able to understand the management of the Biology laboratory.
   f. Able to analyze and generate ideas for entrepreneurial activities in the field of biology and biology education.

4. **Special skill**
   a. Able to apply the competence of biology teachers based on technological pedagogical content knowledge (TPACK).
   b. Capable apply professional expertise (professional ethics) in Biology Education.
   c. Able to solve problems and make decisions in the fields of cell and molecular biology, developmental structures, biosystematics and evolution, physiology,

genetics and biotechnology, ecology, environment and conservation through the application of relevant knowledge, methods and technologies in a multidisciplinary manner.

d. Able to conduct research and publications in the field of biology and biology education.
e. Able to manage biology learning laboratory both based on class, field and virtual laboratory.
f. Able to apply strategic management, biological laboratory management and field activities in educational units.
g. Able to design and implement entrepreneurship based on biology and biology education environment.

F. GRADUATION CRITERIA

Students are declared graduated from the Biology Education Study Program if they have taken a minimum of 144 credits with a minimum achievement index of 2.75.

G. GRADUATE DEGREE

S.Pd. - Bachelor of Education

H. STUDY PROGRAM ACCREDITATION

The Biology Education Study Program has been accredited with an A grade in 2021 based on the Decree of the National Accreditation Board for Higher Education of the Republic of Indonesia through BAN-PT Decree No. 2202/SK/BAN-PT/Ak-PPJ/S/IV/2021, dated 20 April 2021 which is valid until 16 April 2026.

I. CURRICULUM

1. Curriculum Structure

The courses that must be completed during the study period are a minimum of 144 credits.

Biology Education Curriculum Structure

NO	GROUP	credits
1	University Courses (MKU)	14
2	Basic Education Course (MKDK)	7
3	Faculty Characteristics Course (MKF)	1
3	Study Program Compulsory Courses (MKWP)	94
4	Study Program Supporting Courses (PKPP)	8*
4	Supporting Courses (MBKM)	20*
	Amount	144*

*Remarks: the minimum number of credits, can be added to supporting courses or activities outside the university according to the Independent Learning-Independent Campus policy with a credit load according to the applicable regulations at the university.

The minimum course load is 144 credits consisting of University Courses (MKU) with a load of 14 credits, Basic Education Courses (MKDK) with a load of 7 credits, Faculty Characteristics Courses (MKF) with a load of 1 credit, Compulsory Courses Study Program (MKWP) with a load of 94 credits, Study Program Supporting Courses (MKP) with a minimum load of 8 credits, and Independent Campus Learning Courses (MBKM) taken off campus with a minimum load of 20 credits. Therefore, every student who graduates from the

Biology Education Study Program takes at least a course with a minimum credit load of 144 credits.

MBKM activities outside the university consist of 8 activities which include the following activities: 1. Internship/work practice in a company, non-profit foundation, multilateral organization, government institution, or start-up company, 2. Village projects, namely social projects to help communities in rural areas or remote areas in developing the people's economy, infrastructure, and others, 3. Teaching elementary, middle, and high schools for several months, 4. Student exchange, namely taking courses at foreign and domestic universities, based on a cooperation agreement. 5. Research, namely academic research activities, both science and social humanities, which are carried out under the supervision of lecturers/researchers. 6. Entrepreneurial activities, namely students develop entrepreneurial activities independently, as evidenced by proposals for entrepreneurial activities and proof of consumer transactions or employee salary slips. 7. Independent study/project ie students can develop a project based on social topics. 8. Humanitarian projects are social activities for a university-approved foundation or humanitarian organization, both at home and abroad.

Students can take activities outside the university from semesters 3-7. In semester 7 students are required to take MBKM courses of at least 20 credits which can be fully integrated with Teaching Skills Practice (PKM) courses.

2. Distribution of Courses

Group	No.	Subject	credits	1	2	3	4	5	6	7	8	Note:
MKU (14 credits)	1	Religion	2		v							Must
	2	Pancasila	2	V								Must
	3	Indonesian Language	2	V								Must
	4	Citizenship	2		v							Must
	5	Logic and Scientific Reasoning	2		v							Must
Group	No.	Subject	credits	1	2	3	4	5	6	7	8	Note.
	6	Data Raya and Programming	2			V						Must
	7	Education Insights	2		v							Must
		Sub Quantity	14									
MKDK (7 credits)	1	Educational Foundation	3	V								Must
	2	Student Development	2		v							Must
	3	Learning and Learning Theory	2			V						Must
		Sub quantity	7									
MKF (1 credit)	1	Olympics	1	V								Must
		Sub quantity	1									
MKWP (94 credits)	1	General biology	2	V								Must
	2	General Biology Practicum	1	V								Must
	3	Basic mathematic	2	V								Must
	4	Basic chemistry	2	V								Must
	5	Basic Physics	2	V								Must
	6	Basic Physics Practicum	1	V								Must
	7	Laboratory Management	2	V								Must
	8	Biochemistry	2		v							Must
	9	Biochemistry Practicum	1		v							Must
	10	Animal Development Structure	2		v							Must
	11	Animal Development Structure Practicum	1		v							Must

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Group	No.	Subject	credits	Semester								Note.
				1	2	3	4	5	6	7	8	
	12	Plant Development Structure	2		v							Must
	13	Practicum Structure of Plant Development	1		v							Must
	14	Science philosophy	2		v							Must
	15	Supporting courses for semester 2	3**		v							Choice
	16	Cell Biology	2			V						Must
	17	Cryptogram Botany	2			V						Must
	18	Cryptogram Botanical Practicum	1			V						Must
	19	Invertebrate Zoology	2			V						Must
	20	Invertebrate Zoology Practicum	1			V						Must
	21	Basic Statistics	2			V						Must
	22	Environmental education	2			V						Must
	23	Biology-Based Entrepreneurship	2			V						Must
	24	Study the Biology Curriculum	2			V						Must
	25	Supporting courses for semester 3	4**			V						Choice
	26	Phanerogamy Botany	2				v					Must
	27	Phanerogamy Botanical Practicum	1				v					Must
Group	No.	Subject	credits	Semester								Note.
				1	2	3	4	5	6	7	8	
MKWP (94 credits)	28	Vertebrate Zoology	2				v					Must
	29	Vertebrate Zoology Practicum	1				v					Must
	30	Animal physiology	2				v					Must
	31	Animal Physiology Practicum	1				v					Must
	32	Plant Physiology	2				v					Must
	33	Plant Physiology Practicum	1				v					Must
	34	Genetics	2				v					Must
	35	Genetics Practicum	1				v					Must

No	Course	Credits							Category
36	Research methodology	2				v			Must
37	Teaching Methodology	2				v			Must
38	Supporting courses for semester 4	5**				v			Choice
39	Microbiology	2					v		Must
40	Microbiology Practicum	1					v		Must
41	Human Anatomy and Physiology	2					v		Must
42	practice. Human Anatomy and Physiology	1					v		Must
43	Ecology	2					v		Must
44	Ecology Practicum	1					v		Must
45	Evolution	2					v		Must
46	Biotechnology	2					v		Must
47	Learning Planning, Management and Evaluation	2					v		Must
48	School Management	2					v		Must
49	Supporting courses for semester 5	7**					v		Choice
50	Biology Education Seminar	2						v	Must
51	Study Excursion	2						v	Must
52	Teaching Competency Development	2						v	Must
53	6th semester supporting courses	18**						v	Choice
54	Pre Thesis Seminar	2							v	Must
55	Teaching Skills Practice***	6							v	Must
56	Development of Teaching Materials***	4							v	Choice
57	Learning Media Development***	4							v	Choice
58	Learning Evaluation Development***	4							v	Choice
59	Scientific Publications***	2							v	Choice
60	7th semester supporting courses	4**							v	Choice

	61	Essay	4									V	Must
		Sub Quantity	94										
		TOTAL NUMBER OF CREDITS	144										

Note: ** The maximum number of credits for supporting courses per semester is determined by the semester achievement index.

*** The 7th semester MBKM course is 20 credits

3. Course Description

a. General Course (MKU)

MKU provides general life skills (generic life skills): Religion (2 credits), Pancasila (2 credits), Indonesian language (2 credits), Citizenship (2 credits), Logic and Scientific Reasoning (2 credits), Data Raya and Programming (2 Credits), and Educational Insights (2 Credits).

b. Basic Education Course (MKDK)

MKDK prepares students to have basic educational competencies including: Educational Foundation (2 credits), Learning and Learning Theory (2 credits), and Student Development (2 credits).

c. Study Program Compulsory Courses (MKWP)

1) Learning Courses (MKP)

MKP prepares students to have teacher competencies, consisting of: Biology Curriculum Study (2 credits), Teaching Methodology (2 credits), Learning Planning, Management, and Evaluation (2 credits), School Management (2 credits), Teaching Competence Development (2 credits) credits), and Practice of Teaching Skills (6 credits).

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The description of the MKP courses is as follows:

Teaching Methodology (2 Credit Points)
Precondition : Learning and Learning Theory
Lecturer Team: Dra. Nurmasari Sartono, M. Biomed.
Eka Putri Azrai, S.Pd., M.Sc.
Dr. Hanum Isfaeni, M.Sc.
Ade Suryanda, S.Pd., M.Sc.
Daniar Setyo Rini, S.Pd., M.Pd.
Course Description:
This course studies about concepts of knowledge, attitudes, skills, and behavior in the learning process, organization and classification of knowledge, learning theories, methods, approaches, models in learning. Simulation and its application to Lesson Study. The learning method is oriented towards active student learning (student-centered learning).

Biology Curriculum Review (2 credits)
Precondition   : Learning and Learning Theory
Lecturer Team   : Drs. Refirman DJ, M.Kes.
Dr. Hanum Isfaeni, M.Sc.
Ade Suryanda, S.Pd., M.Sc.
Daniar Setyo Rini, S.Pd., M.Pd.
Course Description:
This course examines the Biology curriculum for junior and senior high schools according to the national curriculum. The aspect of the study also makes comparisons of national and international curricula, especially in countriesOrganization for Economic Cooperation and Development (Organization for Economic Cooperation and

Development/OECD). Students are directed to be able to determine essential materials, develop concept maps, determine learning models, teaching methods, and design educational evaluations and research related to curriculum implementation.

Learning Planning, Management, and Evaluation (PPEP) (2 Credit Points)
Precondition   : Learning Methodology
Lecturer Team : Dra. Mieke Miarsyah, M. Si.
                          Dra. Ratna Dewi Wulaningsih, M.Sc.
                          Dr. Rizhal Hendi Ristanto, M.Pd.
                          Dr. Hanum Isfaeni, S.Pd., M.Sc.
Course Description:
This course aims to equip students to have pedagogical competencies related to integrated learning planning, management and evaluation. Planning materials train students to prepare lessons per semester, yearly, and syllabus. Learning management materials include identifying and solving problems that arise in the teaching and learning process, spatial planning, materials, and media, providing motivation, enforcing discipline, and leadership, managing time and implementing learning according to planning. Learning evaluation materials include understanding, objectives, functions, types and forms of tests and non-tests, steps for preparing instruments for assessing learning processes and outcomes, item analysis, interpretation of learning outcomes and their use for corrective actions.
School Management (2 Credit Points)

Precondition   :-
Lecturer Team   : Prof. Dr. I Made Putrawan
Course Description:
This course provides the basics of management consisting of planning, managing, implementing, and controlling, and includes financing, marketing, entrepreneurial concepts, which can be applied in school and laboratory management, laboratory-based entrepreneurship basics, and School-Based Management. This course prepares students to be able to lead or as managers in schools.

Teaching Competency Development (2 Credits)
 Precondition   : Learning Management and
                    Evaluation Planning (PPEP)
Lecturer Team: Eka Putri Azrai, S.Pd., M.Sc.
                    Dra. Ratna Dewi WMSi.,
                    Dra. Yulilina Rd., M. Biomed.
                    Drs. Refirman Dj., M. Biomed.
                    Dr. Supriyatin, M.Si.
                    Daniar Setyo Rini, S.Pd., M.Pd.
Course Description:
This course aims to equip students with an understanding of teacher competence and basic teaching skills as well as to practice various basic teaching skills (opening and closing lessons, giving reinforcement, conducting variations, basic questioning skills, advanced questioning skills, explaining skills and class management skills) through peer teaching activities.

Teaching Skills Practice (6 Credits)
Precondition : Teaching Competence Development
Lecturer Team : Biology Education Lecturer Team
Course Description:
This course prepares students to be skilled in teaching Biology in schools and has four teacher competencies, namely pedagogic, personality, and social competencies. It is expected that students will become professional teachers.

2) **Expertise Courses**
General Biology (2 Credit Points)
Precondition :-
Lecturer Team: Dr. Rusdi, M. Biomed.
Dra. Nurmasari Sartono, M. Biomed.
Eka Putri Azrai, S.Pd., M.Sc.
Dra. Ratna Dewi Wulaningsih, M.Sc.
Ade Suryanda, S.Pd., M.Sc.
Dr. Rizhal Ristanto, M.Pd.
Dra. Yulilina Retno D., M. Biomed.
Erna Heryanti, S.Hut, M.Sc.
Course Description:
This course equips students to understand the basic materials of Biology, namely: scientific methods, characteristics of living things, chemistry of life, cells, metabolism, genetic material and heredity, biotechnology, structure and function of plants and animals, biodiversity, and ecology.

General Biology Practicum (1 Credit)
Precondition :-
Lecturer Team: Ade Suryanda, S.Pd., M.Sc.
Dra. Yulilina Retno D., M. Biomed.
Erna Heryanti, S.Hut, M.Sc.
Annisa Wulan Agus Utami, S.Si., M.Sc.
Nailul Rahmi Aulia, S.Si., M.Sc.
Daniar Setyo Rini, M.Pd.
Course Description:
This course trains skills: using a microscope, observing cells, plant and animal tissues, transport across cell membranes, photosynthesis, respiration, heredity, and ecology.

Basic Mathematics (2 Credits)
Precondition :-
Lecturer Team : Mathematics Education Study Program
Course Description:
The course equips students to understand the basic principles of mathematics related to biology, including: the basics of calculus, integral and differential.

Basic Physics (2 Credit Points)
Precondition :-
Lecturer Team: Department of Physics Education
Course Description:
This course equips students to understand the basic principles of physics related to biology,

including: kinetics and particle dynamics, work and work, momentum and impulses, moments of inertia, fluids, waves, electric energy, magnetic fields, electromagnets and optics.

Basic Physics Practicum (1 Credit)
Precondition:-
Lecturer Team: Department of Physics Education
Course Description:
This course trains students to be skilled in practicing physics related to biology, including: particle kinetics and dynamics, momentum and impulses, moments of inertia, fluids, waves, electrical energy, magnetic fields, optics.

Basic Chemistry (2 Credit Points)
Precondition   :-
Lecturer Team: Chemistry Education Study Program
Course Description:
This course aims to make students understand the basic principles of chemistry related to biology. The topics taught include stoichiometry, thermodynamics, atomic and molecular structure, chemical balance, solution chemistry, analysis of cations and anions, and electrochemistry.

Laboratory Management (2 Credit Points)
Precondition:-
Lecturer Team : Dr. Rusdi, M. Biomed.
                         Drs. Refirman Dj., M. Biomed.
Course Description:

This course provides provisions for early-level students in laboratory activities. Students are expected to have competence in managing laboratories, knowledge of chemical and biological materials, equipment, maintenance and inventory, work safety in the laboratory. Competency skills involve handling chemicals and biological specimens, using various instruments and handling accidents in the laboratory, as well as developing a high school biology learning laboratory.

Olympism (1 Credit)
Precondition   :-
Lecturer Team   : Erna Heryanti, S.Hut., M.Si.
Course Description:
Introduction to the philosophy and values of sport (olympism), a combination of physical and spiritual balance, harmonization of the relationship between sports life, culture and education, harmony of life based on happiness and noble endeavor, respect for universal ethical principles.

Biochemistry (2 Credit Points)
Precondition   : Basic chemistry
Lecturer Team : Dr. Supriyatin, M.Si.
                 Ns. Sri Rahayu, S. Kep, M. Biomed.
                 Annisa Wulan Agus Utami, S.Si., M.Sc.
Course Description:

This course examines the structure, function (role) and classification of biomolecules (carbohydrates, lipids, proteins, enzymes, nucleic acids, water, vitamins, and minerals).

Biochemistry Practicum (1 Credit)
Precondition   : Basic chemistry
Lecturer Team:Dr. Supriyatin, M.Si.
                            Ns. Sri Rahayu, S. Kep, M. Biomed.
                            Annisa Wulan Agus Utami, S.Si., M.Sc.
Course Description:
This course provides biomolecule testing skills to examine the structure, function (role) and classification of biomolecules (carbohydrates, lipids, proteins, enzymes, nucleic acids, water, vitamins and minerals) through practical work.

Plant Structure and Development (2 Credit Points)
Precondition   : General biology
Lecturer Team : Dr Mieke Miarsyah, M.Sc.
                            Dra. Ratna Dewi Wulaningsih, M.Sc.
                            Dra. Eka Putri Azra'i S.Pd, M.Sc.

Course Description:
This course aims to equip students to understand the external and internal structures of vegetative and generative organs of higher plants by considering the physiology of organ development in plants.

Practicum of Plant Structure and Development (1 Credit)

Precondition   : General biology

Lecturer Team : Dr Mieke Miarsyah, M. Si.

Dra. Ratna Dewi Wulaningsih, M. Si.

Dra. Eka Putri Azra'i S. Pd, M. Si.

Course Description:

This course studies the external and internal structures of the vegetative and generative organs of higher plants by considering the physiology of the development of these organs through laboratory practicum and field observations.

Animal Structure and Development (2 Credit Points)

Precondition   : General biology

Lecturer Team : Dra. Nurmasari S, M. Biomed.

Dra. Yulilina RD, M. Biomed

Daniar Setyo Rini, S.Pd., M.Pd.

Course Description:

This course examines the history of embryology, tissue structure and function, reproductive system, regeneration and metamorphosis, cleavage, extra-embryonic membranes, nuclear control mechanisms, cytoplasm, and hormones in organogenesis, as well as structure, development, and comparative anatomy of various organ systems in vertebrates.

Animal Structure and Development Practicum (1 Credit)
Precondition   : General biology
Lecturer Team : Dra. Nurmasari S, M. Biomed.
                         Dra. Yulilina RD, M. Biomed
                         Daniar Setyo Rini, S.Pd., M.Pd.
Course Description:
This course studies gametogenesis, ground tissue, and whole and cross-sectional chicken embryos at incubation periods of 18, 24, 48, and 72 hours, as well as macroscopic observations of embryonic development through wax models, vertebrate skeletal systems, and integumentary systems in turtle shells. turtles, muscular system, comparative anatomy of vertebrates and brain structure.

Science philosophy (2 credits)
Precondition   :-
Lecturer Team : Drs. Refirman Dj. M.Biomed
Course Description:
The material includes the nature of science, the basics of knowledge, namely reasoning, logic, criteria for truth and sources of knowledge, ontology, epistemology, axiology, nature of thinking, development of knowledge, ethics, means of scientific thinking which includes language as scientific communication, mathematics and statistics as a means of supporting development of science.

Cell Biology (2 Credit Points)

Precondition   : Biochemistry

Lecturer Team : Drs. Refirman Dj., M. Biomed.

Dr. Supriyatin, M.Si.

Dra. Yulilina RD, M. Biomed.

Course Description:

This course equips students to be able to understand the structure and function of cell membranes, transport across cell membranes includes diffusion, osmosis, active transport, facilitated diffusion, communication between cells, structure and function of cell organelles in the endomembrane system, ribosomes, mitochondria, chloroplasts, microbody, vacuole, cell cycle, and cell reproduction.

Environmental Education (2 Credit Points)

Precondition   : General biology

Lecturer Team : Dr. Mieke Miarsyah, M.Si.

Dr. Diana Vivanti Sigit, M.Si.

Eka Putri Azrai, S.Pd., M.Sc.

Erna Heryanti, S. Hut, M. Si

Course Description:

This course discusses the rationale of Environmental Education; ecology as the basis of environmental knowledge; Environmental principles; Population; Technology and economic activities and their impact on the environment; Urban Ecosystems and Environmental Ethics.

Cryptogamy Botany (2 Credit Points)

Precondition   : General biology

Lecturer Team : Dr. Diana Vivanti Sigit, M.Si.
Dr. Rizhal Ristanto, M.Pd.
Nailul Rahmi Aulya, S.Si., M.Sc.

Course Description:

This course examines biodiversity, systematics, ecological aspe cts, utilization and conservation of cryptogamous plants. The scope of theoretical material includes: basics of taxonomy, the Five Kingdoms of Life classification system, cryptogam polyphyleticism, Phycology, Mycology, Lichenology, Bryology and Pteridology; ecology, utilization and conservation of cryptogam group members.

Cryptogamy Botanical Practicum (1 Credit)

Precondition : General biology
Lecturer Team : Dr. Diana Vivanti Sigit, M.Si
Dr. Rizhal Ristanto, M.Pd.
Nailul Rahmi Aulia, S.Si., M.Sc.

Course Description:

Practicing taxonomic activities: reciting, making descriptions, naming, classifying and analyzing systematics. The scope of the practicum material: Microscopic algae, macroscopic algae, microscopic fungi, macroscopic fungi, lichens, mosses and ferns.

Invertebrate Zoology (2 Credit Points)

Precondition : General biology
Lecturer Team : Dr. Hanum Isfaeni, S.Pd, M.Sc.
Dr. Ratna Komala, M.Sc.

Course Description:

This course studies taxonomy, phylogeny, characteristics, habitat, life cycle, and conservation of invertebrate animals, and their role in life.

Invertebrate Zoology Practicum (1 Credit)
Precondition   : General biology
Lecturer Team : Dr. Hanum Isfaeni, S.Pd, M.Sc.
                Dr. Ratna Komala, M.Sc.
Course Description:
This course provides skills to observe morphology, anatomy, morphometrics, meristics, species diversity, ecology, and taxonomy of invertebrate animals.

Basic Statistics (2 Credit Points)
Precondition   :-
Lecturer Team   : Prof. Dr. I Made Putrawan
Course Description:
This course studies the role of statistics in the research process, descriptive statistics, the nature of hypotheses, sampling distribution, normality testing, hypothesis testing of 2 mean difference, one way ANOVA, multiple comparison test, variance similarity test, simple and multiple correlation regression, first order correlation, non-parametric test.

Biology-Based Entrepreneurship (2 Credit Points)
Precondition   : General biology
Lecturer Team : Lecturer of Biology Education

Train students to be able to do entrepreneurship. Materials include: leading Indonesian and world entrepreneurs, and factors that support success. Students create mini projects, run businesses, manage production/business, understand marketing, financial management, and human resource management, with biology and biology education-based businesses.

Vertebrate Zoology (2 Credit Points)
Precondition   : Invertebrate Zoology
Lecturer Team : Dr. Hanum Isfaeni, S.Pd, M.Sc.
                          Dr. Ratna Komala, M.Sc.
Course Description:
Studying the basic principles of evolution, taxonomy, classification, phylogeny, characteristics, habitat, life cycle, conservation and other biological aspects of vertebrate animals, the relationship between one animal and another and its role in human life and other living things.

Vertebrate Zoology Practicum (1 Credit)
Precondition   : Invertebrate Zoology
Lecturer Team : Dr. Hanum Isfaeni, S.Pd, M.Sc.
                          Dr. Ratna Komala, M.Sc.
Course Description:
This course equips students with skills to observe morphology, anatomy, morphometrics, meristics, species diversity, habitat, taxonomy, and classification of vertebrate animals through practical work and field lectures.

Phanerogam Botany (2 Credit Points)

Precondition   : Cryptogamy Botany

Lecturer Team : Dr. Mieke Miarsyah, M.Si.

Dr. Diana Vivanti Sigit, M.Si

Nailul Rahmi Aulia, S.Si., M.Sc.

Course Description:

This course examines biodiversity, systematics, ecological aspects, utilization and conservation of seed plants. The scope of theoretical material is the historical basis of taxonomy, the basis of botanical nomenclature, the basis of plant systematics, the modern classification system (APG) covering all seed plants from Gymnosperms to Monocotyledons, their ecology, distribution, use and conservation.

Phanerogam Botany Practicum (1 Credit)

Precondition   : Cryptogamy Botany

Lecturer Team : Dr. Mieke Miarsyah, M.Si.

Dr. Diana Vivanti Sigit, M.Si

Nailul Rahmi Aulya, S.Si., M.Sc.

Course Description:

This course aims for students to be able to make observations and studies on the basic concepts of taxonomy which include writing, making descriptions, naming, classifying and studying systematics. The scope of practicum material includes Gymnosperms, Basal Clade, Magnoliid, Eudicotyledon (Ranunculaceae, Rosid, Asterid), and Monocotyledon (Alismatid, Lilioid, Commeliniid)

Research Methodology (2 Credit Points)
Precondition : Basic Statistics
Lecturer Team : Prof. Dr. I Made Putrawan
Course Description:
This course discusses the process of scientific research, formulation of scientific problems, types of research, research types and designs, the power of survey research, experimental concepts, population and sampling, data collection techniques, development of measuring instruments, instrument calibration (concepts of validity and reliability), qualitative research. , action research, mix methods, techniques and research writing.

Animal Physiology (2 Credit Points)
Precondition : Animal Structure and Development
Lecturer Team : Dr. Rusdi, M. Biomed.
Course Description:
Animal Physiology course discusses the processes and life activities that occur in the bodies of lower animals to higher animals with a cellular approach. Materials for this course include: Biomembrane, Bioelectricity, Nervous System and Senses, Hormone System, Movement System, Circulation System, Respiratory System, Digestive System, Excretion System, Reproductive System, and Thermoregulation.

Animal Physiology Practicum (1 Credit)

Precondition : Animal Structure and Development
Lecturer Team : Dr. Rusdi, M. Biomed.
Daniar Setyorini, S.Pd., M.Pd.
Course Description:
The Animal Physiology Practicum course aims to equip students to be skilled at observing physiological processes that occur in animal bodies which include: Digestive System, Respiratory System, Bioelectricity, Nerves, Senses, Hormones, Movement System, Circulation System, Excretion System, Reproductive System, and Thermoregulation .

Genetics (2 Credit Points)
Precondition : Biochemistry, Cell Biology
Lecturer Team : Dra. Yulilina RD., M. Biomed.
Dr. Rini Puspitaningrum, M. Biomed.
Annisa Wulan Agus Utami, S.Si., M.Sc.
Course Description:
This course aims to enable students to understand molecular genetic material: genetic material, regulation of gene expression, mutations, cancer, and mutations, as well as classical genetics: Mendelism heredity, Chi Square probability and statistical analysis, allele and gene interactions, sex determination, genes sex-linked, linkage, crossover and chromosome maps, extranuclear gene phenotyping, and population genetics.

Genetics Practicum (1 Credit)
Precondition   : Biochemistry, Cell Biology
Lecturer Team : Dra. Yulilina RD., M. Biomed.
Dr. Rini Puspitaningrum, M. Biomed.
Annisa Wulan Agus Utami, S.Si., M.Sc.
Course Description:
This course prepares students to be skilled in measuring human phenotypic diversity index, DNA isolation, PCR, spectrophotometry, allele and gene interactions, chromosomal analysis, and Drosophila culture.

Plant Physiology (2 Credit Points)
Precondition: Plant Structure and Development
Lecturer Team : Dr. Supriyatin, M.Si.
Nailul Rahmi Aulia, S.Si., M.Sc.
Course Description:
This course aims to make students understand physiological processes and functions in plants. This course discusses the processes and functions in plants, the response of plants to environmental changes, and the growth and development resulting from these responses.

Plant Physiology Practicum (1 Credit)
Precondition: Plant Structure and Development
Lecturer Team : Dr. Supriyatin, M.Si.
Nailul Rahmi Aulia, S.Si., M.Sc.
Course Description:

This course equips students to be skilled in studying plant physiology through experiments and observations on plant diffusion and osmosis, seed germination, respiration, photosynthesis, root pressure, plant transpiration and plant motion.

Microbiology (2 Credit Points)
Precondition   : Cell Biology
Lecturer Team : Dr. Tri Handayani Kurniati, M.Sc.
Dr. Dalia Sukmawati, M.Sc.
Annisa Wulan Agus Utami, S.Si., M.Sc.
Course Description:
This course examines: the history of microbiology, the role, characteristics and structure of microorganisms, basic laboratory techniques; growth medium, isolation, staining, control of microorganisms, nutrition and environmental factors affecting the growth of microorganisms, reproduction and growth curve, metabolism: fermentation, aerobic and anaerobic respiration, oxygenic and anoxygenic photosynthesis, genetics: transfer of genetic material in bacteria (transformation, transduction and conjugation)

Microbiology Practicum (1 Credit)
Precondition   : Cell Biology
Lecturer Team : Dr. Tri Handayani Kurniati, M.Sc.
Dr. Dalia Sukmawati, M.Sc.
Annisa Wulan Agus Utami, S.Si., M.Sc.

Course Description:
Practice basic microbiology skills: media manufacture, sterilization techniques, isolation of microorganisms, determination of bacterial growth, bacterial staining techniques, observation of fungal morphology (mold and yeast), activity test of antimicrobial compounds, calculation of the number of microorganisms using the Total Plate Count and Most Probable Number methods.

Human Anatomy and Physiology (2 Credit Points)
Precondition   : Animal physiology
Lecturer Team : Drs. Refirman DJ, M. Biomed.
                            Dr. Rusdi, M. Biomed.
                            Sri Rahayu, S. Kep, M. Biomed.
Course Description:
This course aims to equip students to be able to understand the structure, function and working mechanism of human organs. Topics covered include: Nervous System, Senses, Hormones, Movement System, Circulatory System, Immune System, Excretion System, Reproductive System, and Thermoregulation.

Practicum of Human Anatomy and Physiology (1 Credit)
Precondition   : Animal physiology
Lecturer Team : Drs. Refirman DJ, M. Biomed.
                            Dr. Rusdi, M. Biomed.
                            Sri Rahayu, S. Kep, M. Biomed.
Course Description:

This course aims to equip students to be skilled in designing, observing, and reporting experiments on Human Anatomy and Physiology. The subjects observed were the Digestive System, Respiratory System, Movement System, Circulation System, Immune System, Excretion System, Reproductive System, Thermoregulation, Nervous System, Senses, and Hormones.

Ecology (2 Credit Points)
Precondition : Plant Physiology, Animal Physiology
Lecturer Team : Dr. Diana Vivanti Sigit S., M.Sc.
            Ade Suryanda, S.Pd., M.Sc.
            Eka Putri Azrai, S.Pd., M.Sc.
            Erna Heryanti, S. Hut. M.Si.
Course Description:
This course aims to equip students to have broad insight related to ecological concepts so that they are able to think rationally, systematically, systemic and critically, as well as be wise and creative in responding to and formulating solutions to ecosystem problems including the interactions that occur in them both in terms of micro and macro scale.

Ecology Practicum (1 Credit)
Precondition :Plant Physiology, Animal Physiology
Lecturer Team : Eka Putri Azrai, S.Pd., M.Sc.
            Ade Suryanda, S.Pd., M.Sc.
            Dr. Diana Vivanti S., M.Sc.
            Erna Heryanti, S. Hut. M.Si

Course Description:
Ecology Practicum equips students to acquire skills in using tools and instruments of ecological research in the laboratory and in the field, observing, taking and analyzing samples, analyzing data related to species, populations and their interactions in a habitat/ecosystem, either manually or using software.

Evolution (2 Credit Points)
Precondition   : Genetics
Lecturer Team : Erna Heryanti, S. Hut., M.Sc.
                 Dr. Rizhal Hendi Ristanto, M.Pd.
Course Description:
This course aims to make students understand the concepts, theories and mechanisms of evolution which include natural selection, evidence of evolution, genetic variation, mechanisms and processes for the occurrence of new species and molecular evolution.

Field Work Lecture (2 credits)
Precondition   : Ecology
Lecturer Team : Lecturer of Biology Education
Course Description:
This course provides students with field experience in designing research, observing, observing, processing research data and compiling research reports to publishing field research results. This course is also to improve students' soft skills which are useful in social life.

Biotechnology (2 Credit Points)
Precondition   : Genetics
Lecturer Team : Dr. Tri Handayani Kurniati, M.Sc.
                Dr. Rini Puspitaningrum, M. Biomed.
                Annisa Wulan Agus Utami, S.Si., M.Sc.
Course Description:
Material includes Basic Principles of Recombinant DNA Technology; Molecular Analysis Techniques; The "Omics" Era: Genomics, Transcriptomics, Proteomics, and Metabolomics; Microbial Biotechnology: Fermentation, Single Cell Protein, Plant Biotechnology: Uses of Agrobacterium tumefaciens Animal Biotechnology: Somatic Cell Nuclear Transfer Techniques, Biotechnology Applications in Humans: Fingerprint DNA and Stem Cells, Environmental Biotechnology: Bioremediation, Regulation and Safety of Biotechnology products. Practical activities include: DNA extraction, DNA amplification (Polymerase Chain Reaction) and DNA visualization using electrophoresis.

Biology Education Seminar (2 Credits)
Precondition   : Research methodology
Lecturer Team : Lecturer of Biology Education
Course Description:
This course discusses scientific writing techniques, data analysis techniques, journal studies, plagiarism, the use of SPSS, Mendeley, and Turnitin applications, and the preparation of

research proposals. The proposal from the Biology Education Seminar can be continued as a thesis proposal.

Thesis Proposal Seminar (2 Credits)
Precondition : At least have passed 126 credits
Lecturer Team : Lecturer of Biology Education Study Program
Course Description:
This course aims to equip students to prepare thesis research proposals. Students prepare research proposals based on scientific principles and communicate through seminar activities with the aim of getting suggestions and improvements from examiners.

Thesis (4 credits)
Precondition : Thesis Proposal Seminar
Lecturer Team : Lecturer of Biology Education Study Program
Course Description:
This course is the stage of the trial to defend the results of thesis research. Assessments are made on the quality of thesis research results, writing techniques, presentations, correctness of concepts, correctness of research methodologies, data analysis techniques, research and discussion results, originality of writings, up-to-date content of writings, ability to answer questions, and publication of thesis research results. The student examiner team defends and argues against the

final project that has been prepared based on scientific studies.

d. Study Program Supporting Courses (MKPP)
Character Education (2 Credit Points)
Precondition   :-
Lecturer Team : Dr. Rusdi, M. Biomed.
Course Description:
This course equips students to adapt to global life by forming religious characters, independent, scientific culture, responsibility, ethics, courtesy, courtesy, critical, creative, collaboration, scientific communication, leadership skills, personal branding ability, adaptive to demands 21st century learning and industrial revolution 4.0/society 5.0.

Biogeography (2 credits)
Precondition   : General biology
Lecturer Team : Ade Suryanda, S.Pd., M.Sc.
Course Description:
The Biogeography course offers knowledge that connects ecology, evolution and geography. Discussed about the scientific approach used in biogeographic studies as well as examples of the implementation of this approach in the distribution of living things on this earth.

Family Life Education (2 Credit Points)
Precondition   : General biology
Lecturer Team : Dra Nurmasari Sartono, M.
                 Biomed

Course Description:
Students can analyze and explain the meaning and purpose of Family Life Education (PK2), communication in families, basic human needs, family management, financial management in the family, reproductive health, Sexually Transmitted Diseases, Drugs, Family Planning and abortion, Domestic Violence and Schools, the role of culture and religion in the family as well as the quality of life of adolescents and NKKBS.

Urban Biology Education
Precondition   :-
Lecturer Team : Dr. Rizhal Hendi Ristanto, M.Pd.
                 Ade Suryanda, S.Pd., M.Sc.,
Course Description:
This course studies the characteristics and phenomena of biology education in big cities. The course studies are based on biological education methods in densely populated areas with high population diversity and multi-ethnicity. This refers to a situation and demand in biology education that characterizes learning in a metropolitan area.

Nutrition and Health Sciences (2 Credits)
Precondition   : Biochemistry
Lecturer Team : Dra. Nurmasari Sartono, M. Biomed.
                 Annisa Wulan Agus Utami, M.Sc.
Course Description:
Students can understand the development of nutrition science, balanced nutrition guidelines,

calculate food calories, calculate nutritional value, analyze food and calories, health and nutrition for pregnant women, breastfeeding, toddlers, the elderly, and athletes. Nutrition and disorders of the digestive system, mineral deficiencies, diet, and treatment due to malnutrition.

Entomology (2 Credit Points)
Precondition   : Invertebrate Zoology
Lecturer Team : Dr. Hanum Isfaeni, S.Pd. M.Si.
                        Drs. Refirman Dj, M. Biomed.
Course Description:
This course examines aspects of morphology, anatomy, physiology and ecology of insects and their role in human life. Lecture materials include: the purpose and benefits of entomology, integument, color and body segmentation: Head, thorax, abdomen, muscle system, nerves, organs of taste and perception, digestive and nutritional systems, respiratory system, circulation, excretion, and secretion, digestive system reproduction, development and metamorphosis, insect way of life, insect ecology and classification.

Parasitology (2 Credit Points)
Precondition   : Invertebrate Zoology
Lecturer Team : Drs. Refirman Dj., M. Biomed.
Course Description:
This course discusses the basic concepts of parasitology, life cycles, diagnostic preparations, environmental effects, and impacts on the body

as well as management methods, the discussion covers helminths, protozoa, insects, both as intermediate hosts/vectors as well as disease-causing and mycology. Delivery of lectures through face-to-face with interactive presentation and discussion methods.

Plant Anatomy (2 Credit Points)
Precondition   : Plant Development Structure
Lecturer Team : Dra. Ratna Dewi Wulaningsih, M.Sc.
Course Description:
Plant anatomy courses study the structure of cells, meristem tissue, protective tissues, namely the epidermis and periderm; ground tissue which includes parenchyma, collenchyma and sclerenchyma; vascular tissue such as xylem and phloem in the organs of roots, stems, leaves, flowers, fruits, seeds, embryos and plant sprouts with respect to genetics and the environment.

Plant Microtechnics (2 Credit Points)
Precondition   : Plant Development Structure
Lecturer Team : Dra. Ratna Dewi Wulaningsih, M.Sc.
Course Description:
Plant microtechnics discusses paraffin methods including fixation, dehydration, infiltration, implanting in paraffin, slicing, staining and assessing the preparations made, and other microtechnical methods.

Plant Development (2 Credit Points)
Precondition   : Plant Structure and Development
Lecturer Team : Dra. Ratna Dewi Wulaningsih,
                M.Sc.
Course Description:
The plant development course studies genetic information, regeneration, cellular association, colonizing organisms, asexual and sexual reproduction, embryology of flowering plants, hormonal and environmental control and extracellular products in plants and their application to life.

Enzymology (2 Credit Points)
Precondition   : Biochemistry
Lecturer Team : Dr. Rini Puspitaningrum, M.
                Biomed.
                Dr. Supriyatin, M.Si.
Course Description:
This course examines the structure of enzymes and enzyme biosynthesis, class and nomenclature of enzymes, the difference between oligomeric and monomeric enzymes, the structure of the active site and how enzymes work, the theory of protein binding to enzymes, chemical properties of enzyme catalysis, allosteric enzymes and sigmoid curves, kinetics and catalytic reactions. enzymes: bioenergetics, mechanism of action of 1 enzyme 1 substrate, mechanism of enzyme inhibition, mechanism of action of multi-substrate enzymes, extraction, purification, elution and dialysis of enzymes, determination of

concentration values, number and activity of enzymes, types of enzymes that can be applied in the environment, health and food.

Human Reproductive Biology (2 Credit Points)
Precondition : Animal Structure and Development
Lecturer Team : Dra. Yulilina RD, M. Biomed.
Course Description:
This course aims to enable students to be able to discuss topics on the male and female reproductive systems, gonadal development, fertilization, pregnancy, and birth, puberty and reproductive organ aging, procreation, contraception, and infertility, both independently and in groups, as development and deepening of material from the subject of animal structure and development as well as human anatomy and physiology.

Economic Botany (2 Credit Points)
Precondition   : Panerogamy Botany
Lecturer Team : Agung Sedayu, S.Si., M.Sc.
                             Nailul Rahmi Aulya, S.Si., M.Sc.
Course Description:
Studying human interactions with plant biological resources locally and globally, through botanical and anthropological approaches in understanding patterns of human exploitation of plant-based materials. Plant diversity is the basis of the evolution of human culture in accordance with the climatic and phytogeographic characteristics of a region. The scope of matter is the

accelerated evolution of diversity due to selection/domestication by human culture. Cultural diversity of plant use is mapped based on the types of commodities that are important to the economy.

Ethology (2 Credit Points)
Prerequisite   :   Vertebrate Zoology
Lecturer Team :   Dr. Rusdi, M. Biomed.
Course Description:
This course discusses animal behavior, animal adaptation to the environment, animal ecophysiology, and animal conservation. Lecture materials cover animal behavior, physiological adaptation to the environment, ecophysiology, and conservation.

Ornithology (2 Credit Points)
Precondition   : Vertebrate Zoology
Lecturer Team : Dr. Rusdi, M. Biomed.
Course Description:
This course discusses the basics of Aves' life. Lecture materials include taxonomy, physiology, reproduction, ecology, ethology, and bird conservation.

Primatology (2 Credit Points)
Precondition   : Vertebrate Zoology
Lecturer Team : Dr. Hanum Isfaeni, M.Sc.
Course Description:
This course examines aspects of morphology, evolution, biosystematics, phylogeny, primate

ecology and conservation, and biothetics in primate research.

Environmental Impact Analysis (2 Credit Points)
Precondition   : Environmental education
Lecturer Team : Erna Heryanti, S.Hut., M.Si.
Course Description:
The Environmental Impact Analysis (Amdal) course studies environmental management formally. Lecture materials include the history of the implementation of EIA as an environmental feasibility study for development in Indonesia, EIA as a multidisciplinary scientific activity, terms in EIA, the stakeholders involved, the use of the Amdal document for stakeholders, the steps for the EIA study, team formation studies, screening of development activities for which EIA studies are required, Scoping and Terms of Reference for EIA, applicable laws and regulations, how to prepare project descriptions and sources of information, approaches to determining the environmental baseline (environmental base line), methods of estimating environmental impacts, identification potential impact, determine the major and significant impacts,

Authentic Assessment of Biology Learning (2 Credits)
Precondition   : Learning and Learning Theory
Lecturer Team : Dr. Rizhal Hendi Ristanto, M.Pd.
Course Description:

This course aims to enable students to plan and develop authentic assessment designs in biology learning. Students learn about definitions, principles, types of authentic assessment, and course products. Students develop authentic assessment instruments that are suitable for use in biology learning in secondary schools.

Science Learning (2 Credits)
Precondition   : Teaching Methodology
Lecturer Team : Dr. Rizhal Hendi Ristanto, M.Pd.
Course Description:
This course studies the definition of science education, the principles and nature of science, science learning theory, content standards, process and assessment of the science curriculum in Indonesia and compares it with other countries, 21st century skills in science learning (critical thinking, creative thinking, collaboration, and communication). , and analyze innovative science learning designs from national and international journal sources.

Instructional Design (2 Credit Points)
Precondition   : Teaching Methodology
Lecturer Team : Ade Suryanda, S.Pd., M.Sc.
                         Eka Putri Azrai, S.Pd., M.Sc.
Course Description:
This course studies the systems, concepts, principles, procedures of various instructional designs that can be developed in learning. The concept of learning as a system, competency-

based learning, developing learning outcomes assessment tools, developing instructional strategies and instructional materials.

Learning Media (2 Credits)
Precondition   : Teaching Methodology
Lecturer Team : Dra. Nurmasari S, M. Biomed.
Course Description:
In this course students can analyze the nature of media and their position, knowledge of the function and use of media, classification of learning media according to various expert perspectives and describe each type of media characteristics, knowledge and skills about media production mechanisms including pre, production and post-production of learning media with practicing integrated IT and Blended Learning.

Learning Innovation (2 Credits)
Precondition   : Teaching Methodology
Lecturer Team : Ade Suryanda, S.Pd., M.Sc.
                           Daniar Setyorini, S.Pd., M.Pd.
Course Description:
This course discusses the basic concepts of innovation, innovation processes and strategies, biology learning innovations that are commonly carried out in schools, the development of biology learning research, and the results of biology learning innovations developed by students.

High School Biology Practicum Learning (2 credits)

Precondition   : Teaching Methodology
Lecturer Team : Ade Suryanda, S.Pd., M.Sc.
                 Dr. Rizhal Hendi Ristanto, M.Pd.
                 Daniar Setyorini, S.Pd., M.Pd.
Course Description:
This course provides an understanding of the nature and function of practicum in Biology learning, selecting concepts and determining breadth and depth, planning tools and materials, designing tools and determining materials, making/assembling tool models and compiling guidelines for using worksheets, testing tool models and their guidelines, make improvements to the model of tools and guidelines based on the results of trials, develop lesson plans

Histology (2 Credit Points)
Precondition : Animal Structure and Development
Lecturer Team : Dra. Nurmasari S, M. Biomed.
Course Description:
In this course, students analyze basic and special networks. The basic tissues include epithelial tissue, connective tissue, muscle tissue and nervous tissue, while special tissues are found in the integumentary, muscle, skeletal, circulatory, respiratory, urogenital, nervous, sensory and endocrine systems as well as the histopathology of each tissue.

Phytochemistry (2 Credit Points)
Precondition   : Plant Physiology
Lecturer Team : Dr. Supriyatin, M.Si.

Nailul Rahmi Aulya, S.Si., M.Sc.

Course Description:

This course examines the biochemical compounds found in plants, as well as their role in living things. The material is given in the form of theory and laboratory practice. The scope of theoretical material is primary and secondary metabolism of plants, structure, calcification and biosynthesis of plant netabolites. Laboratory practice materials include screening and isolation techniques for secondary metabolites of various plant species and phytochemical tests.

Endocrinology (2 Credit Points)

Precondition   : Animal physiology

Lecturer Team : Dr. Rusdi, M. Biomed

Course Description:

The material includes hormone biosynthesis, hormone mechanism of action, hormone physiology, mechanism of hormonal disorders/diseases, and hormone measurement. Materials discussed include: Hormone regulation of water content, sodium-potassium ion, calcium ion, metabolism of energy sources, male and female reproduction, hormonal family planning, special hormones in digestion, kidneys and heart, hormone regulation in the metamorphosis of insects, shrimp, crustaceans , and frogs, as well as hormone measurement techniques.

Immunology (2 Credit Points)

Precondition   : Animal physiology

Lecturer Team : Dr. Rusdi, M. Biomed.
Dr. Erni Erfan, M. Biomed.
Dra. Yulilina RD, M. Biomed.

Course Description:

The Immunology course studies the immune system in humans by briefly comparing it with the immune system in vertebrate animals, the role of bacteria, viruses, fungi and worms as infectious agents, inflammation, immunopathology, immunodiagnostics, immunopharmacology, immunotherapy, monoclonal antibody techniques and artificial immune systems.

Qualitative Research Methodology in Education

Precondition   :Research methodology
Lecturer Team :Dra.   Nurmasari   Sartono,   M.
Biomed.
Daniar Setyo Rini, S.Pd., M.Pd.

Course Description:

This course discusses methods, strategies and qualitative research designs within the scope of education, especially in biology education. This course uses a qualitative method approach, the use of information technology, and the development of biology learning strategies in the industrial era 4.0 in compiling educational research.

Biology Research (2 Credit Points)

Precondition   : Research methodology
Lecturer Team : Dr. Rusdi, M. Biomed.
Course Description:

This course discusses experimental design, biostatistics, sampling technique, LD50, measurement of Biological parameters, Biology research methods, Biology research proposal preparation, Biology research projects, and publication of research results. The aim of the course is to prepare students to be able to conduct biological research and publish research results in Biology journals.

Biodiversity (2 Credit Points)
Precondition   :Plant Physiology and Animal
                        Physiology
Lecturer Team : Dr. Diana Vivanti Sigit, M.Si.
Course Description:
This course provides students with experience to be able to analyze the extraordinary role of biodiversity in the life and development of human civilization from the beginning of the earth to the present century. Students are expected to be able to analyze the condition of biodiversity on earth which has decreased mainly due to human activities, and to make real efforts as intellectuals in contributing to the sustainability of biodiversity, especially in Indonesia. This course provides insight into biodiversity on earth based on the history of biodiversity, diversity based on 6 kingdoms, major ecosystems with the highest biodiversity, human behavior towards biodiversity, cases of biodiversity decline, biodiversity hotspots and conservation priorities, the importance of preserving biodiversity for humans,

Bacteriology (2 Credit Points)
Precondition   : Microbiology
Lecturer Team : Dr. Tri Handayani, M.Sc.
                          Annisa Wulan Agus Utami, M.Sc.
Course Description:
This course aims to enable students to understand the taxonomy of bacteria and the simple determination of bacteria, to relate it in an integrated manner to microbial diseases and their pathogenesis, and to recognize bacteria from the aspects of metabolism, genetics and growth characteristics. Lecture materials cover history, structure and function, growth and control, metabolism and genetics, pathogenesis characteristics, the use of bacteria in veterinary.

Environmental Microbiology (2 Credits)
Precondition   : Microbiology
Lecturer Team : Dr. Tri Handayani Kurniati, M.Sc.
                          Annisa Wulan Agus Utami, M.Sc.
Course Description:
This course discusses the history of microbiology; phylogenetic, classification of microorganisms; biological characteristics of microorganisms (bacteria, fungi, viruses and protozoa); growth and control of the growth of microorganisms, ecology; examines the relationship between microorganisms and the environment and, the influence of the environment on microorganisms and the role of microorganisms in the environment.

Health Microbiology (2 Credit Points)
Precondition   : Microbiology
Lecturer Team : Dr. Tri Handayani Kurniati, M.Sc.
                 Annisa Wulan Agus Utami, M.Sc.
Course Description:
This course discusses disease and its causes, through the Carbohydrate test, IMVIC, TSIA, Catalase and Selective Media. Analyzing the mechanism of infection, the pattern of microbial distribution and the pattern of co-existing between microorganisms and the mechanism of nosocomial infection. Explaining the immune system (limitations) that are acquired in humans

Classroom Action Research (2 credits)
Precondition   : Research methods
Lecturer Team : Eka Putri Azrai, S.Pd., M.Sc.
Course Description:
This course aims to equip students with the characteristics, variety, problems, steps, instruments for classroom action research, and skills in preparing class action research proposals.

Fundamentals of Bioinformatics (2 Credits)
Precondition   : General biology
Lecturer Team : Dr. Hanum Isfaeni, M.Sc.
Course Description:
This course covers the introduction of basic sequences, pairwise and multiple sequence alignment. Methods for phylogenetic analysis of bioinformatics databases and servers. Prediction

of secondary and tertiary structure of the sequence and homology modeling of the three-dimensional structure of proteins. Molecular dynamics simulation and molecular docking with applications for drug design. Applications of bioinformatics research in bioinformatics learning (biotechnology), software (platforms) in bioinformatics studies, ethical aspects of bioinformatics in education, research and development.

Mycology (2 Credit Points)
Precondition   : Microbiology
Lecturer Team : Dr. Dalia Sukmawati, M.Sc.
                        Annisa Wulan Agus Utami, M.Sc.
Course Description:
Mycology courses discuss the morphology, anatomy, and physiology of fungi; fungal classification system with the latest classification system update; the benefits of fungi in the health sector; the role of fungi in industry; the role of fungi in agriculture; students are provided with the skills to be entrepreneurs based on endible mushroom cultivation; and manufacture of probiotic fungi to increase body immunity, both for animals and humans.

Food and Industrial Microbiology (2 Credits)
Precondition   : Microbiology
Lecturer Team : Dr. Tri Handayani Kurniati, M.Sc.
                        Annisa Wulan Agus Utami, M.Sc.
Course Description:

This course discusses the development of microorganisms for industry, the development of fermentation technology, microbiological quality control of industrial products, and the production of primary and secondary metabolites of microorganisms. Materials discussed include: performance of microorganisms, isolation techniques of microorganisms, fermentation media, fermentation systems, microbiological quality control of industrial products, production of compounds produced by microorganisms produced on an industrial scale.

Teaching Evaluation (2 Credits)
Precondition   : PPEP
Lecturer Team : Dr. Mieke Miarsyah, M.Si.
Course Description:
This course examines Minimum Completeness Criteria, Higher Order Thinking Skills (HOTS), Student Worksheets, psychomotor assessment, affective assessment, self-assessment, peer assessment, assessment rubric, e-learning-based assessment, project assessment, product assessment and evaluation. portfolio assessment.

Environmental Learning (2 Credits)
Precondition   : PPEP
Lecturer Team : Dr. Diana Vivanti Sigit, M.Si.
Course Description:
This course examines local, national and global environmental problems, plans and analyzes learning models to solve environmental problems

through project/research activities. Lecture materials include basic concepts of environmental science, environmental problems, environmental-based learning models, planning of environmental science-based learning research projects and writing reports and research articles.

Development Research (2 credits)
Precondition   : Research methods
Lecturer Team : Dr. Hanum Isfaeni, M.Sc.
Course Description:
This course provides students with the ability to recognize principles, concepts, models, and the ability to conduct development research in the field of education. Lecture materials include learning development and producing products, such as syllabus, learning models and methods, learning media, assessment and evaluation tools, and so on.

Biology Learning Tool (2 Credits)
Prerequisite   : PPEP
Lecturer Team : Dra. Nurmasari Sartono, M.
Biomed
Course Description:
Students can analyze and make biology learning tools at the junior high and high school levels starting from semester 1 to semester 6, the tools requested are Syllabus, Learning Implementation Plan (RPP), Standard Operating Procedures from media that are in accordance with the material (Not Making), materials teaching, LKPD and

evaluation. Face-to-face delivery, presentations and products for media SOPs, teaching materials, LKPD and evaluations made digitally

Biology Learning Technology (2 Credits)
Precondition   : PPEP
Lecturer Team : Dr. Hanum Isfaeni, M.Sc.
Course Description:
This course examines the concepts, principles, and applications of information technology, augmented and virtual reality, artificial intelligence, and other modern technology platforms in biology learning. Lecture activities for this course are carried out through face-to-face, practicum, and mini projects.

Tropical Forest Ecology (2 Credit Points)
Precondition   : Ecology
Lecturer Team   : Erna Heryanti, S.Hut., M.Si.
Course Description:
Tropical Forest Ecology course as a continuation of the Ecology course, studies human dependence on forest ecosystems, theory of tropical forest succession, tropical forest environmental factors, forest ecological functions, geographical distribution of tropical forests in Indonesia, types of ecosystems in the tropics, shape -forms of tropical forest management, challenges and opportunities of tropical forest management.

Conservation Biology (2 Credit Points)

Precondition   : Ecology
Lecturer Team : Dra. Mieke Miarsyah, M.Si.
                        Dr. Hanum Isfaeni, S.Pd. M.Si

Course Description:

This course discusses the concept of biological conservation at the genetic, species, ecosystem level; economic value; threats to biodiversity; community-based conservation; conservation and sustainable development. This course includes an understanding of biodiversity, threats to biodiversity, conservation at the species, population, community and ecosystem levels and the relationship between conservation and sustainable development, as well as the condition of biodiversity and conservation in Indonesia.

Limnology (2 Credit Points)

Precondition   : Ecology
Lecturer Team : Dr. Ratna Komala, M.Sc.

Course Description:

Studying inland water ecosystems (fresh and brackish), classification of lentic and lotic waters, structure and relationship between inland aquatic organisms and the physical-chemical and biological dynamics of their environment, utilization, inland water problems and efforts to overcome them.

Marine Ecology (2 Credit Points)

Precondition   : Ecology
Lecturer Team : Ade Suryanda, M.Si

Course Description:

Studying the marine environment, physical and chemical factors of sea water, dynamic factors in the sea, marine organisms (plankton, nekton, benthos), adaptation of organisms, pollution, production of energy and organic matter in marine ecosystems, mangrove ecosystems, coral reef ecosystems and other factors. -factors that influence it

Scientific Publications (2 Credit Points)
Precondition   : Research methodology
Lecturer Team : Dr. Rusdi, M. Biomed.
Course Description:
This course aims to make students able to write scientific articles according to the correct scientific rules. Materials covered include: statistical reviews and research methods; scientific writing style techniques: American Psychological Association (APA), Turabian, Harvard, and Vancouver Style; Mendeley's application practice; national and international journals; predatory journal; plagiarism; practical application of the Statistical Package for the Social Sciences (SPSS); Turnitin application; practice writing scientific articles.

Digital Learning (2 Credits)
Precondition   : PPEP
Lecturer Team : Daniar Setyo Rini, S.Pd., M.Pd.
                        Dra. Yulilina RD, M. Biomed.
Course Description:

This course allows students to do digital technology-based learning. Students are expected to have competence in designing, implementing, and evaluating effective and safe digital learning.

Blended Learning (2 Credits)
Precondition   : PPEP
Lecturer Team : Dr. Rizhal Hendi Ristanti, S.Pd., M.Pd.
                Daniar Setyo Rini, S.Pd., M.Pd.
Course Description:
This course studies learning design that combines conventional learning through face-to-face in the classroom with several technology-based learning media online (online). This course discusses the definition, character, types, advantages and disadvantages of blended learning and its implementation based on research results both nationally and internationally. The learning design in this course is implemented through blended learning which is integrated with various learning approaches such as cooperative learning and inquiry.

Lesson Study (2 credits)
Precondition   : PPEP
Lecturer Team : Ade Suryanda, S.Pd., M.Sc.
                Dra. Nurmasari Sartono, M. Biomed.
Course Description:
This course prepares students to be able to practice learning and teacher professional

development in a sustainable manner. The materials discussed include: Continuous improvement of teacher quality, concepts, stages, planning and practice of lesson study in partner schools.

Industrial Internships (SKS converted from internship hours)
Precondition   :-
Lecturer Team : Lecturer of Biology Education
Course Description:
This course prepares students to work in industry, non-profit foundations, multilateral organizations, government institutions, and start-ups. When students do company internships, they can take other supporting courses with the guidance of lecturers.

Projects in the Village (SKS converted from internship hours)
Precondition   :-
Lecturer Team : Lecturer of Biology Education
Course Description:
This course prepares students to be able to help people in rural or remote areas in building the people's economy, infrastructure, and others. When students do Projects in the Village, they can take other supporting courses with the guidance of the lecturer.

Teaching in Schools (credits converted from internship hours)

Precondition : PPEP
Lecturer Team : Lecturer of Biology Education
Course Description:
This course prepares students to be skilled at teaching in elementary, middle, and high schools for several months, both in schools in cities and remote areas. When students teach at schools, they can take other supporting courses with the guidance of lecturers.

Student Exchange (SKS of courses taken)
Precondition :-
Lecturer Team : Lecturer of Biology Education
Course Description:
This course prepares students to be able to take courses at foreign and domestic universities, based on cooperation agreements.

Research (credits according to conversion hours)
Precondition : Research methodology
Lecturer Team : Lecturer of Biology Education
Course Description:
This course prepares students to be able to carry out academic research activities, both science and social humanities under the supervision of lecturers/researchers. When students conduct research, they can take other supporting courses with the guidance of the lecturer.

Entrepreneurship (credits according to conversion hours)
Precondition : Biology-Based Entrepreneurship

Lecturer Team : Lecturer of Biology Education
Course Description:
This course prepares students to be able to develop entrepreneurial activities independently, as evidenced by proposals for entrepreneurial activities and proof of consumer transactions or employee salary slips. When students do entrepreneurship, they can take other supporting courses with the guidance of lecturers.

Independent Project (credit according to conversion hours)
Precondition   :-
Lecturer Team : Lecturer of Biology Education
Course Description:
This course prepares students to develop a project based on a social topic.

Humanitarian Project (credit according to conversion hours)
Precondition :-
Lecturer Team   : Lecturer of Biology Education
Course Description:
This course is a social activity for a university-approved foundation or humanitarian organization, both at home and abroad. In the event of a disaster, students can program courses after carrying out humanitarian activities.

J. LECTURER

No.	Name	E-mail	Scopus ID	Sinta ID
1	Prof. Dr. I Made Putrawan	Putrawan.imade@unj.ac.id	56672834000	6003199
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BPA MATHEMATICS S1 STUDY PROGRAM YEAR 2021

A. INTRODUCTION

The Mathematics Study Program is one of the study programs at the Faculty of Mathematics and Natural Sciences UNJ, whose establishment was based on the Decree on the Establishment of Study Programs by the Directorate General of Higher Education (Dirjen DIKTI) No. 1059/D/T/2002, while the implementation of the study program was based on in the Decree on Operational Permits by the Director General of Higher Education 5450/D/T/KN/2011. The curriculum of the Mathematics Study Program of the Mathematics and Natural Sciences Faculty of UNJ is designed in accordance with the vision, mission, goals, and objectives of the study program, with reference to various competencies that must be mastered by graduates which include attitudes, knowledge, general skills and special skills. As time goes by, the curriculum in the Mathematics Study Program continues to change.

Several policies issued by the Ministry of Education and Culture, and the Universitas Negeri Jakarta (UNJ) require changes to the applicable curriculum applied in the Mathematics Study Program, FMIPA UNJ. Therefore, the study program must also develop a curriculum that includes four components that characterize UNJ, namely 21st century skills, Outcome Based Education (OBE), Digital Literacy, and Merdeka Learning Campus Merdeka (MBKM).

Based on the results of the Focus Group Discussion (FGD) with alumni and stakeholders related to the suitability of the Study Program curriculum with the needs in the world of

work, several inputs were obtained which could later be implemented in study program learning. In addition, the development of this curriculum is also adjusted to the vision and mission of the Study Program as well as the 2020-2024 UNJ Business Strategy Plan (RSB), where at the RSB one of the program targets is to improve the quality of learning. One of the curriculum developments carried out by the Study Program is by conducting learning using the Case Based-Learning (CBL) and Project Based-Learning (PjBL) methods in several courses in the Study Program..

B. VISION, MISSION AND GOALS

1. Vision

By 2030, it will become a study program that is able to compete at the ASEAN level, has a high academic culture, is actively involved in the scientific community, has entrepreneurial and religious abilities.

2. Mission

a. Organizing educational and teaching activities that are effective, efficient, in a conducive, responsible, accountable and transparent academic atmosphere to produce mathematics graduates who are able to compete at the ASEAN level.

b. Organizing research activities in the field of mathematics and its applications.

c. Organizing community service activities related to mathematics and the application of science and technology.

d. Creating a high academic culture, fostering entrepreneurial skills, and creating a religious

atmosphere in every academic and non-academic activity.
e. Establish communication and cooperation with institutions both at home and abroad related to the development and use of mathematics

3. **Purpose**
   a. Produce mathematicians who:
      1) Faithful, noble, able to work together, be responsible, and have social sensitivity and high concern for society and the environment.
      2) Mastering mathematical concepts and theories and using them in solving problems
      3) Able to make strategic decisions based on analysis of information and data and provide solutions based on the results of mathematical studies.
   b. Produce ideas, ideas, and scientific work in the field of mathematics that are meaningful, inspiring and beneficial to society.
   c. Communicating and working together with institutions both at home and abroad that support the development of the field of mathematics.

C. GRADUATE PROFILE

No	Graduate Profile (PL)	Description of Graduate Profile*
PL1	Academics	• Mastering mathematical concepts in theory • Able to convey mathematical knowledge • Able to develop science independently

No	Graduate Profile (PL)	Description of Graduate Profile*
PL2	research assistant	- Able to analyze data, manage and update database - Able to conduct literature review or field research - Able to make reports systematically, structured, and massive - Able to manage project time management to achieve a goal
PL3	Financial Expert/ Banking/ Actuary	- Able to analyze statistical data - Be able to estimate the probability and possible costs for an event - Able to design, test, and manage policies to minimize risk and maximize profits - Able to design insurance products to determine the premiums and benefits of the product
PL4	Data Analyst	- Have the ability to analyze, read business directions, interpret data - Mastering statistical and mathematical concepts, able to visualize data, and

No	Graduate Profile (PL)	Description of Graduate Profile*
		able to use machine learning
PL5	Entrepreneur	• Able to see opportunities • Able to map and solve problems • Have the ability to compete in a healthy manner • Able to develop marketing strategy

D. COMPETENCE OF GRADUATES

Graduate competencies are stated in Graduate Learning Outcomes (CPL) which include attitudes, general skills, knowledge and special skills as follows:

1. **Attitude**
   a. Fear of God Almighty and able to show a religious attitude;
   b. Upholding human values in carrying out duties based on religion, morals, and ethics;
   c. Contribute to improving the quality of life in society, nation, state, and the advancement of civilization based on Pancasila;
   d. To act as citizens who are proud and love their homeland, have nationalism and a sense of responsibility to the state and nation;
   e. Appreciate the diversity of cultures, views, religions, and beliefs, as well as the opinions or original findings of others;
   f. Cooperate and have social sensitivity and concern for society and the environment;

g. Obey the law and discipline in the life of society and the state;
h. Internalize academic values, norms, and ethics;
i. Demonstrate a responsible attitude towards work in their area of expertise independently;
j. Internalize the spirit of independence, struggle, and entrepreneurship;
k. Internalize the values of excellence, honesty, competitiveness and leadership in various activities.

2. **General Skills**
   a. Able to apply logical, critical, systematic, and innovative thinking in the context of the development or implementation of science and technology that pays attention to and applies humanities values in accordance with their field of expertise;
   b. Able to demonstrate independent, quality, and measurable performance;
   c. Able to study the implications of the development or implementation of science and technology that pays attention to and applies humanities values according to their expertise based on scientific principles, procedures and ethics in order to produce solutions, ideas, designs or art criticisms;
   d. Able to compile a scientific description of the results of the studies mentioned above in the form of a thesis or final project report, and upload it on the university's website;
   e. Able to make appropriate decisions in the context of solving problems in their area of expertise, based on the results of information and data analysis;

f. Able to maintain and develop work networks with supervisors, colleagues, colleagues both inside and outside the institution;

g. Able to be responsible for the achievement of group work results and supervise and evaluate the completion of work assigned to workers under their responsibility;

h. Able to carry out the process of self-evaluation of the work group under their responsibility, and able to manage learning independently; and

i. Able to document, store, secure, and retrieve data to ensure validity and prevent plagiarism

3. **Knowledge**

a. Mastering mathematical theoretical concepts including mathematical logic, discrete mathematics, algebra, analysis and geometry, as well as probability theory and statistics (CPL-PP 1)

b. Mastering the principles of mathematical modeling, linear programming, differential equations, and numerical methods (CPL-PP 2)

c. Able to conduct research independently or in groups that can be used to provide guidance to stakeholders in choosing various alternative solutions to problems in the field of mathematics. (CPL-PP 3)

4. **Special skill**

a. Able to develop mathematical thinking, starting from procedural / computational understanding to a broad understanding including exploration, logical

reasoning, generalization, abstraction, and formal proof (CPL-KK 1)
b. Able to observe, recognize, formulate and solve problems through a mathematical approach with or without the help of software (CPL-KK 2)
c. Able to reconstruct, modify, analyze/think in a structured manner to the mathematical problems of a phenomenon, examine the accuracy and interpret it and communicate orally and in writing accurately, and clearly. (CPL-KK 3)
d. Able to take advantage of various alternative mathematical problem solving available independently or in groups for appropriate decision making (CPL-KK 4)
e. Able to adapt or develop themselves, both in mathematics and other relevant fields (including fields in the world of work) (CPL-KK 5)

E. TITLE
Graduates of the Mathematics Study Program are entitled to hold the title of S.Mat (Bachelor of Mathematics).

F. ACCREDITATION
The Mathematics Study Program is accredited B based on BAN-PT Decree No.943/SK/BAN-PT/Akred/S/IV/2018.

G. CURRICULUM
  1. Curriculum Matrix

Table 1. Group of Subjects and Weight of Curriculum Credits

No	Course Group	credits
1	University Courses	16

2	Basic Education Course*	-
3	Course Characteristics of the Faculty	5
4	Study Program Courses	152
TOTAL		**173**

*) Especially for Education Study Program

Table 2. List of Courses

No	MK code	Subject	credits
(1)	(2)	(3)	(4)
National Compulsory Courses			
1	**0005-155-2**	Pancasila	2
2	**0005-313-2**	Indonesia Language	2
3	**00000012**	Religion	2
4	**0005-111-2**	Citizenship	2
University Compulsory Courses			
5	**0005-320-2**	Logic and Scientific Reasoning	2
6	**0005-319-2**	Data Raya and Programming	2
7	**0005-318-2**	Educational Insights	2
University Elective Courses			
8	**0005-300-2**	KKN**	2
TOTAL			**16**
Faculty Characteristics Course			
1	**0005-113-2**	English	2
1	**3005-002-2**	Philosophy of Mathematics and Natural Sciences	2
2	**3005-112-1**	Olympics	1
TOTAL			**5**

Study Program Courses			
1	**3125-201-2**	Introduction to Basic Mathematics	2
2	**3125-202-2**	Number Theory	2
3	**3125-203-4**	Linear Algebra	4
4	**3125-501-3**	Basic Statistics	3
5	**3125-939-4**	Differential Calculus	4
6	**3125-204-3**	Linear Program	3
7	**3125-601-3**	Programming Algorithm	3
8	**3125-604-3**	Analytical Geometry	3
9	**3125-901-3**	Discrete mathematics	3
10	**3125-940-4**	Integral Calculus	4
11	**3125-004-2**	English Math	2
12	**3125-301-3**	Transformation Geometry	3
13	**3125-602-3**	Numerical Method	3
14	**3125-906-3**	Data Structure	3
15	**3125-941-4**	Multiple variable calculus	4
16	**3125-942-3**	Elementary Differential Equations	3
17	**3125-401-3**	Real Analysis I	3
18	**3125-403-3**	Complex Variable Functions	3
19	**3125-503-3**	Mathematical Statistics I	3

20	**3125-934-3**	Financial mathematics	3
21	**3125-947-3**	Algorithm Design and Analysis	3
22	**3125-950-3**	Partial Differential Equation	3
23	**3125-938-3**	Entrepreneurship	3
24	**3125-053-2**	Research methods	2
25	**3125-205-4**	Abstract Algebra	4
26	**3125-402-3**	Real Analysis II	3
27	**3125-504-3**	Mathematical Statistics II	3
28	**3125-702-3**	Probability Theory	3
29	**3125-015-3**	Introduction to General Linear Models	3
30	**3125-007-3**	Dynamic System	3
31	**3125-051-2**	Mathematics Seminar	2
32	**3125-505-3**	Stochastic Process	3
33	**3125-808-3**	Insurance Math	3
34	**3125-933-3**	Operations Research Techniques	3
35	**3125-946-3**	Mathematical Modeling	3
36	**3125-954-2**	Business communication	2
37	**3005-206-2**	Field practice	2
38	**3005-207-2**	Pre Thesis Seminar	2
39	**3005-402-4**	Essay	4

40	**3125-404-3**	Introduction to Topology**	3
41	**3125-405-3**	Size Theory**	3
42	**3125-704-2**	Non Parametric Statistics**	2
43	**3125-706-3**	Time Series Analysis**	3
44	**3125-932-3**	Economic math**	3
45	**3125-951-3**	Risk Theory**	3
46	**3125-000-3**	Introduction to Functional Analysis**	3
47	**3125-011-3**	Investment and Asset Theory**	3
48	**3125-012-3**	Optimum Control Theory**	3
49	**3125-701-3**	Sampling Theory**	3
50	**3125-013-3**	Calculus of Variations**	3
51	**3125-014-3**	Parallel Computing**	3
52	**3125-003-2**	Graph Theory**	2
TOTAL			**152**

Notes:
National Compulsory Courses (MKWN) each with a minimum weight of 2 credits:
a. Religion;
b. Pancasila;
c. Citizenship; and
d. Indonesia Language.

a. Curriculum Map Based on CPL Study Program

PETA KURIKULUM PROGRAM STUDI S1 MATEMATIKA
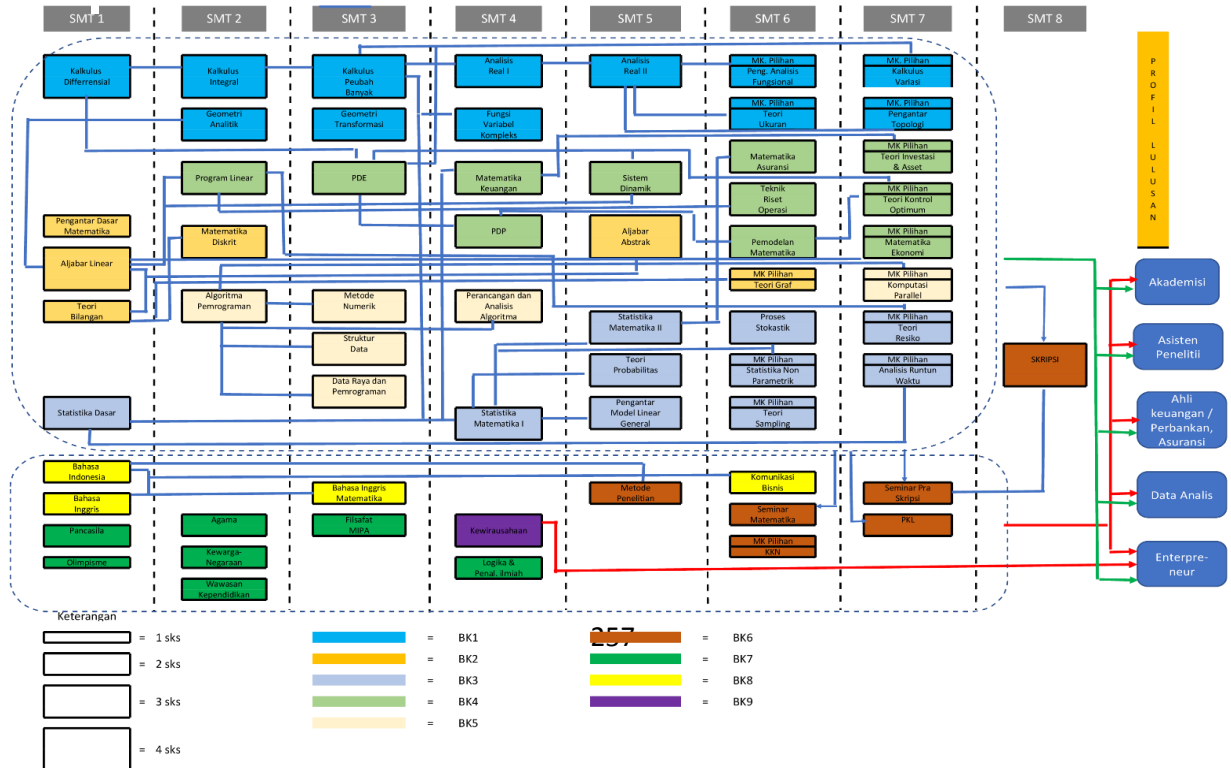
b. Distribution of Courses Each Semester and Description of Courses
Table 3. List of courses per semester-I

No	MK code	Courses (MK)	Course Description	Credits weight			
				Theory	practice-kum	Practice	Amount
1	**0005-113-2**	English	This course aims to make students able to capture and organize meaning in descriptive texts and news texts in spoken and written English with the right structure of meaning and lexogrammatical elements and according to the context of the situation, its use is based on good mental and social attitudes and utilizes information and communication technology.	2			

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No	MK code	Courses (MK)	Course Description	Credits weight			
				Theory	practice-kum	Practice	Amount
2	**0005-155-2**	Pancasila	This course is a personality development course that aims to make students understand the concepts/theories of Pancasila Education. This course studies Introduction to Pancasila education, Pancasila in the historical flow of the Indonesian nation, Pancasila as the State Ideology, Pancasila as a philosophical system, Pancasila as an ethical system, Pancasila as the basis for the value of developing knowledge, Pancasila and anti-corruption values.	2			

No	MK code	Courses (MK)	Course Description	Credits weight			
				Theory	practice-kum	Practice	Amount
3	**0005-313-2**	Indonesia Language	This course generally aims to create academicians who are intelligent in communicating in Indonesian, while specifically aims to create academics who are skilled at producing and using texts according to their social goals and functions. Indonesian language teaching materials are presented with the principle of text-based learning.	2			
4	**3005-112-1**	Olympics	This course is a character building for new students to be able to have honest, sporty, superior, creative, and friendly characters. Graduates are	1			

No	MK code	Courses (MK)	Course Description	Credits weight			
				Theory	practice-kum	Practice	Amount
			expected to be able to apply and develop the Olympic philosophy in various aspects of life.				
5	3125-201-2	Introduction to Basic Mathematics	The Basic Introduction to Mathematics course is a basic course in the Mathematics Study Program. This course is included in the study material of algebra. Learning activities in this course are carried out with a Blended Learning approach. The learning materials that will be studied are statements and their couplings, understanding of quantifiers, arguments and	2			

No	MK code	Courses (MK)	Course Description	Theory	practice-kum	Practice	Amount
			validity of arguments, understanding of quantified arguments, sets and relations.				
6	**3125-202-2**	Number Theory	This course discusses the concept of number theory in algebra as a basis for logical reasoning. The contents of the course include the integer system, mathematical induction, binomial theorem, division, KPK, GCF, prime numbers and congruence..	2			
7	**3125-203-4**	Linear Algebra	After taking this course, students are expected to be able to understand the concepts of systems of linear	4			

No	MK code	Courses (MK)	Course Description	Credits weight			
				Theory	practice-kum	Practice	Amount
			equations, elementary row operators, Gaussian elimination, methods of calculating matrix inverses, determinants, cofactor expansions, Cramer's rule, vectors, point products, cross products, line equations and fields in R3, vector space, basis and dimension of row space, column space, null space, rank and nullity of a matrix, orthonormal rows, Gram-Schmidt process, change of basis, eigenvalues, and eigenvectors, diagonalization,				

No	MK code	Courses (MK)	Course Description	Theory	practice-kum	Practice	Amount
			and linear transformations, and apply it to related problems.				
8	3125-501-3	Basic Statistics	Students are able to carry out research and analyze appropriate data and interpret the results of the data analysis whether using software or not. The content of this course is the basic concepts of statistics, types of data, random variables and several types of distributions and their benefits in various fields, conducting descriptive and inferential data analysis and interpretation.	3			
9	3125-939-	Differential	The competencies that will be	4			

No	MK code	Courses (MK)	Course Description	Credits weight			
				Theory	practice-kum	Practice	Amount
	4	Calculus	achieved in the differential calculus course are understanding the concept of limits and derivatives of functions of one variable and function of two variables, how to solve them and be able to apply them to problems. The contents of this course include: real number system, one-variable function, limit and continuity of one-variable function, derivative of one-variable function, application of derivative of one-variable function, function of two				

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No	MK code	Courses (MK)	Course Description	Credits weight			
				Theory	practice-kum	Practice	Amount
			variables, limit and continuity of two-variable function, derivative of two-variable function, and applications derivative of a function of two variables.				
	Number of Semester I . Study Loads			**22**			

Table 4. List of courses per semester-II

No	MK code	Courses (MK)	Course Description	Credits weight			
				Theory	practice kum	Practice	Amount
1	**0005-312-2**	Religion	The Islamic Religious Education course aims to provide knowledge related to understanding Islamic religious studies in general. This course discusses the philosophical and theological foundations of PAI in universities, concepts about God, humans, and religion in building harmony, concepts about the Koran, as-Sunnah, and ijtihad in building culture, moral concepts in the development of science, technology, art, and work ethic, the concept of Islam in fostering family, community, state, and the environment, and an Islamic perspective on contemporary issues.	2			

No	MK code	Courses (MK)	Course Description	Credits weight			
				Theory	practice kum	Practice	Amount
			Learning will be carried out by applying a student centered learning approach, including case-based assignment (CBL) and project-based (PBL) methods. Assessment is carried out through written examinations, task/product assessments, and performance assessments.				
2	**0005-111-2**	Citizenship	This course is a personality development course that trains students to have the skills to analyze contextual problems by developing positive attitudes and displaying behaviors related to the spirit of nationalism, love for the homeland, civilized democracy and legal	2			

No	MK code	Courses (MK)	Course Description	Credits weight			
				Theory	practice kum	Practice	Amount
			awareness. This course will discuss materials on national identity and Indonesian national integration, the state and the constitution, rights and obligations of citizens, democracy and democratic education, the state of law and human rights, Indonesian geopolitics, regional autonomy and Indonesian geostrategy. Learning will be carried out by applying a student centered learning approach, including the assignment method, case method and project-based learning. Assessment is carried out through written examinations, task/product assessments, and performance assessments.**http://onlinelearning.**				

No	MK code	Courses (MK)	Course Description	Credits weight			
				Theory	practice kum	Practice	Amount
			unj.ac.id.				
3	**3125-204-3**	Linear Program	This course covers the formulation of linear programming and the basic concepts of modeling, graphical methods, simplex methods, degeneration cases, primaldual problems, integer programming, transportation and assignment problems, as well as solutions using computers for linear programming problems. The learning methods in this course include expository methods, problem solving, group discussions, and practice using software. The assessment indicators for this course	3			

No	MK code	Courses (MK)	Course Description	Credits weight			
				Theory	practice kum	Practice	Amount
			are student activity in the learning process to formulate linear programming mathematical models, problem solving abilities on relevant problems, and implementing linear programming theory concepts through software.				
4	**3125-601-3**	Programming Algorithm	The programming algorithm course is one of the basic courses given to Mathematics Study Program students. The material in this course includes an introduction to algorithms, flowcharts, branching, repetition, Python programming language, lists, and subroutines. The learning methods/approaches used in this	3			

No	MK code	Courses (MK)	Course Description	Credits weight			
				Theory	practice kum	Practice	Amount
			lecture are expository, inquiry, and Case Based Learning (CBL). Presentation of lectures in this course includes theory and practice using Python software. By following this course, students are expected to be able to achieve the predetermined graduate learning achievement targets.				
5	3125-604-3	Analytical Geometry	The analytical geometry course is one of the subjects included in the study of geometry and analysis. Descriptively, analytic geometry material includes equations of straight lines, conic sections, circles, parabolas, ellipses, hyperbolas, and spheres. In this	3			

No	MK code	Courses (MK)	Course Description	Credits weight			
				Theory	practice kum	Practice	Amount
			lecture, the methods used are discussion and question and answer as well as case-based learning. The assessment in this lecture consists of test and non-test assessments, so that the assessment is expected to include an assessment of students regarding aspects of attitudes, general skills, special skills, and knowledge in accordance with the predetermined CPL.				
6	**3125-901-3**	Discrete mathematics	This course uses inquiry and case-based learning methods. The material to be studied includes generating functions, recursive relations, inclusion-exclusion principles, boolean	3			

No	MK code	Courses (MK)	Course Description	Credits weight			
				Theory	practice kum	Practice	Amount
			functions, logic gates and minimal circuits, graphs, isomorphisms, trees, and directed graphs. The assessment in this lecture consists of test and non-test assessments, so that the assessment is expected to include an assessment of students regarding aspects of attitudes, general skills, special skills, and knowledge in accordance with the predetermined CPL.				
7	**3125-940-4**	Integral Calculus	This course covers: Indefinite integrals; Integration techniques include: integral with substitution, integral trigonometric functions, integral with rationalizing integrants,	4			

No	MK code	Courses (MK)	Course Description	Credits weight			
				Theory	practice kum	Practice	Amount
			partial integrals, integral rational functions. Certain integrals; improper integral; Certain integral applications include: area, volume of a rotating body, curve length, surface area, mass and center of mass. The double integral in Cartesian coordinates and polar/polar coordinates, the application of the double integral includes: volume of solid objects, surface area, mass and center of mass. Triple integrals in Cartesian, cylinder and spherical coordinates; Triple integral applications include: solid body volume, mass and center of mass.				

No	MK code	Courses (MK)	Course Description	Credits weight			
				Theory	practice kum	Practice	Amount
8	**0005-318-2**	Outlook Education	This course aims to make students have an understanding of differentiating, giving examples, analyzing and critiquing educational concepts, and relating them to the realities of everyday education. This course constructively provides a learning experience, conditions for conducting assessments and guided actions in an effort to have basic educational insights that can be used as a starting point in carrying out educational activities. The scope of this course includes: the concept of education, the concept of educational science, the relationship between humans and education, the	2			

No	MK code	Courses (MK)	Course Description	Credits weight			
				Theory	practice kum	Practice	Amount
			foundations, principles and principles of education, the history of education in Indonesia, as well as educational problems in educational practice. Learning will be carried out by applying a student center learning approach, including the assignment method, case method and project based learning. Assessment is carried out through written examinations, task/product assessments, and performance assessments. Learning is carried out online (in a network). Students are encouraged and facilitated to actively seek and discover knowledge and acquire skills				

No	MK code	Courses (MK)	Course Description	Theory	practice kum	Practice	Amount
			and attitudes.				
Total Semester II Study Load				**23**			

Table 5. List of courses per semester-III

No	MK code	Courses (MK)	Course Description	Theory	practice kum	Practice	Amount
1	**3005-002-2**	Philosophy of Mathematics and Natural Sciences	This course covers the nature of science, logic, language and mathematics and science through ontology, epistemology and axiology and their relation to cultural development. Lectures are carried out using discussion, reflection and	2			

No	MK code	Courses (MK)	Course Description	Credits weight			
				Theory	practice kum	Practice	Amount
			question and answer methods between students and lecturers as learning facilitators. This course aims to make students understand the basics of scientific thinking and prepare themselves to conduct scientific research. In particular, this course is expected to introduce the noble values of social life through an understanding of science, logic, language, mathematics and science, and culture. In addition, with this lecture, students are expected to be able to prepare themselves to develop themselves in accordance with the demands of the development of science and				

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No	MK code	Courses (MK)	Course Description	Credits weight			
				Theory	practice kum	Practice	Amount
			challenges in the world of education.				
2	**3125-004-2**	English Math	This course covers the following materials: Recognize and understand mathematical terms in English; Pronouncing mathematical terms correctly in English; Write down mathematical terms in English; Listening/listening to mathematical terms in English; Explain mathematical terms in English.	2			
3	**3125-301-3**	Transformation Geometry	The course aims to provide students with knowledge and understanding of geometric concepts, including point, line, and plane transformations. This course covers the meaning of transformation, isometric transformation, non-	3			

No	MK code	Courses (MK)	Course Description	Credits weight			
				Theory	practice kum	Practice	Amount
			isometric transformation, and transformation product. The learning model used in the transformation geometry lecture is the PBL (Poblem Based Learning) model, which includes the lecture method, discussion method, question and answer method, and assignment method.				
4	3125-602-3	Numerical Method	The competencies to be achieved are that students are able to analyze errors in numerical calculations, explain floating point numbers, binary numbers and base k numbers. In addition, students are able to determine the roots of nonlinear equations using closed and open	3			

No	MK code	Courses (MK)	Course Description	Credits weight			
				Theory	practice kum	Practice	Amount
			methods, solve systems of linear equations using elementary row operations and iterations, explain linear and non-linear interpolation, curve matching, numerical integration and determine initial value problems. Students are also expected to be able to implement algorithms from numerical methods through software assistance. The learning methods used include discussions, presentations, and assignments.				
5	3125-906-3	Data Structure	This course teaches basic techniques for abstracting data, creating algorithms that can access the data, and manipulating the abstract	3			

No	MK code	Courses (MK)	Course Description	Credits weight			
				Theory	practice kum	Practice	Amount
			structure. This course will also introduce space and time complexity analysis in implementing an algorithm. Topics covered include: abstract data type concepts, linear data models (arrays and dynamic lists, stacks and queues), sets, hierarchical data models (binary tree, heap, binary search tree, AVL-tree, B-Tree), graph models, hashtables, tracking algorithms.				
6	3125-941-4	Multiple variable calculus	This course includes: Real number sequences, Convergence of Real number sequences, Number Series, Convergence Test of Series, Power Series, Convergence of Power Series, Taylor and Mac Laurin Series, Vectors	4			

No	MK code	Courses (MK)	Course Description	Credits weight			
				Theory	practice kum	Practice	Amount
			in R2 and R3, Vector Operations and Properties of Vector Operations in R2 and R3,Parameterization of Curves and Surfaces, Vector Fields, Divergences and Curls, Limits and Continuity of Vector Valued Functions, Derivatives and Integrals of Vector Valued Functions, Scalar Fields, Directional Gradients and Derivatives, Line Integrals in R2 and R3, Green's Theorem, Surface Integrals, Gaussian Divergence Theorem , and Stokes' theorem. The learning methods in this course include Case based Blended Learning, Flipped Classroom. The assessment indicator for this course is the				

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No	MK code	Courses (MK)	Course Description	Credits weight			
				Theory	practice kum	Practice	Amount
			activeness of students in the learning process to understand the concepts of Multivariable Calculus and the ability to problem solve relevant problems.				
7	3125-942-3	Elementary Differential Equations	The competencies that will be achieved in the Elementary Differential Equation course are understanding the forms of Differential Equations (PD), how to solve them and being able to apply them to real problems. Contents This course discusses first-degree differential equations including: separable, exact, linear variables. PD level one high power,	3			

No	MK code	Courses (MK)	Course Description	Credits weight			
				Theory	practice kum	Practice	Amount
			linear PD level n with constant coefficient homogeneous/non homogeneous; n-level linear PD with variable coefficients include PD Cauchy, PD Legendre, PD Level two; System of Linear Differential Equations. PD applications in various fields of science. The learning methods used include discussions, presentations and assignments.				
8	0005-319-2	Data Raya and Programming		2			
	Total Semester III Study Load			**22**			

Table 6. List of courses per semester-IV

No	MK code	Courses (MK)	Course Description	Credits weight			
				Theory	practice kum	Practice	Amount
1	3125-401-3	Real Analysis I	This course discusses concepts and theories about the set of real numbers with all their properties and characteristics, real-valued functions with all their properties and characteristics, mathematical induction, finite and infinite sets, sequences of real numbers and their convergence, and theorems related to sequences of real numbers. .	3			
2	3125-403-3	Complex Variable Functions	This course discusses concepts and theories about complex numbers and their properties, De Moivre's theorem, limits, continuity, derivatives, analytical	3			

No	MK code	Courses (MK)	Course Description	Credits weight			
				Theory	practice kum	Practice	Amount
			functions, harmonic functions, Euler equations, path integrals, complex function integrals, Cauchy integrals, Cauchy-Goursat theorem, principles maximum modulus, sequences and series, residues, and remainder theorems.				
3	3125-503-3	Mathematical Statistics I	The competencies that will be achieved in the Mathematics Statistics course I are to know the basics of probability theory and mathematical statistics. The contents of this course discuss probability, random variables and their distributions, discrete distributions, continuous distributions, joint distributions, functions of random	3			

No	MK code	Courses (MK)	Course Description	Credits weight			
				Theory	practice kum	Practice	Amount
			variables, and limit distributions.				
4	**3125-934-3**	Financial mathematics	After taking this course, students are expected to be able to understand the concepts of Simple Interest, Compound Interest, Present Value, Discount, Variable Interest, Annuities, Options, Asset Price Movements, Asset Price Models, Black-Scholes Partial Differential Equations, Hedging, Risk Neutrality , and Implied Volatility, and can apply it to related problems.	3			
5	**3125-938-3**	Entrepreneurship	This course discusses the concepts and theories of entrepreneurship, innovation in entrepreneurship, and the entrepreneurial process. Entrepreneurship lectures use the	2	1		

No	MK code	Courses (MK)	Course Description	Credits weight			
				Theory	practice kum	Practice	Amount
			Project Based Learning method, where the project that will be carried out by students is to run a business in groups. It is hoped that after attending this course, students have knowledge of entrepreneurship concepts and theories and have experience in making business plans and putting them into practice.				
6	3125-947-3	Algorithm Design and Analysis	This course examines the criteria for evaluating the goodness of sorting algorithms (Bubble sort, Bose-Nelson Sort, Merge-sort, Insertion sort, Selection sort, Heap sort, Quick Sort, Radix sort), searching, graph problems (MST, Shortes). Path, DFS, BFS, Connectivity), designing algorithms with	3			

No	MK code	Courses (MK)	Course Description	Credits weight			
				Theory	practice kum	Practice	Amount
			approaches: Iterative, divide and conquer, Greedy, dynamic programming, branch and bound, backtracking, Matrix multiplication: Optimal cost and Parenthesization, NP-Complete: Tractable/Intractable Problem.				
7	3125-950-3	Partial Differential Equation	This course studies the basic properties of PDP and their solutions for the heat equation, wave equation, and Laplace/Poisson equation. The analytical method for solving the PDP includes the characteristic method, the coordinate method and the variable separation method as well as the finite difference numerical method along with	3			

No	MK code	Courses (MK)	Course Description	Credits weight			
				Theory	practice kum	Practice	Amount
			the stability requirements for the three canonical equations.				
8	0005-320-2	Logic and Scientific Reasoning	This course examines statements and their combinations, quantification, arguments, proof of the validity of arguments, and quantified arguments.	2			
Total Study Load for Semester IV				22	1		

Table 7. List of Courses per semester-V

No	MK code	Courses (MK)	Description of MK	Credits weight			
				Theory	practice kum	Practice	Amount
1	3125-053-2	Research methods	The competencies that will be achieved in this course are that students are able to develop a journal-based research background as	2			

No	MK code	Courses (MK)	Description of MK	Credits weight			
				Theory	practice kum	Practice	Amount
			a reason for conducting research, formulate research problems properly and correctly according to the type of research, analyze theories regarding variables and develop a synthetic framework of thought and formulate hypotheses. , develop a research methodology well from determining the research design to the preparation of instruments and techniques for analyzing it, using statistical software tools to perform data analysis, and compiling a good and complete proposal.				
2	**3125-205-4**	Abstract Algebra	This course examines the concepts of groups, subgroups, cosets, normal subgroups, group homomorphisms,	4			

No	MK code	Courses (MK)	Description of MK	Theory	practice kum	Practice	Amount
			kernels, group permutations, cycle decomposition, even/odd permutations, ring, sub-ring, integral area, division ring, field, ring homomorphism, ideal, ideal. maximum, Euclidean ring, prime ideal region, polynomial ring, and single factorization region.				
3	**3125-402-3**	Real Analysis II	This course is a continuation of the Real Analysis course 1. This course requires the ability to formulate problems and make deductions to draw conclusions. The expected competence of graduates is to be able to formulate parts of the field of knowledge in mathematics into a structured unit and apply them in	3			

No	MK code	Courses (MK)	Description of MK	Theory	practice kum	Practice	Amount
			carrying out their duties as professional mathematics teachers. This course contains limit functions, continuous functions, uniform continuity, monotonous functions, inverse functions, derivatives of functions, the mean value theorem, L'hospital rules, and Taylor's theorem.				
4	**3125-504-3**	Mathematical Statistics II	The contents of this course discuss statistics and sample distribution, parameter estimation methods, estimator evaluation criteria, sufficient statistics, interval estimation, and hypothesis testing.	3			
5	**3125-702-3**	Probability Theory	This course examines probability, conditional probability, Bayes rule, random variables, probability	3			

No	MK code	Courses (MK)	Description of MK	Credits weight			
				Theory	practice kum	Practice	Amount
			functions, combined probability functions, expected values, and variance.				
6	**3125-015-3**	Introduction to General Linear Models	This course examines model matching, exponential distribution families and their properties, maximum likelihood estimator, sampling distribution, log-likelihood ratio statistics, multiple linear regression, analysis of variance, analysis of covariance, generalized linear model, logistic regression model, Poisson regression, log-linear model, and survival analysis.	3			
7	**3125-007-3**	Dynamic System	This course contains a discussion of autonomic differential equations and systems, dynamic systems, balanced	3			

No	MK code	Courses (MK)	Description of MK	Credits weight			
				Theory	practice kum	Practice	Amount
			solutions and their stability (linearization and Lyapunov functions). In addition, it also contains a discussion of bifurcation (change in the orbital structure of a differential equation containing a parameter when the parameters are varied) and their types.				
Total Study Load for Semester V				21			

Table 8. List of Courses per semester-VI

No	MK code	Courses (MK)	Course Description	Credits weight			
				Theory	practice kum	Practice	Amount
1	**3125-051-2**	Mathematics Seminar	The competence of the subjects that will be achieved through the Mathematics Seminar course is that students know, understand and can compose scientific papers that are equivalent to national or international journals. The lecture methods used in this course include independent studies of national and international journals, discussions, project based and presentations. The evaluation uses a performance assessment (task values in the form of making scientific papers and presentations). 60% paper making and 40% presentation.	2			

No	MK code	Courses (MK)	Course Description	Credits weight			
				Theory	practice kum	Practice	Amount
2	3125-505-3	Stochastic Process	After attending the Stochastic Process course, students are expected to understand the concepts, properties and characteristics of stochastic processes and their application in solving problems in other fields. Contents This course discusses concepts and theories about stochastic processes, discrete and continuous Markov processes, Poisson processes, Renewal processes and Wiener processes. The learning methods in this course include expository methods, problem base learning, problem solving, group discussions, and group presentations.	3			

No	MK code	Courses (MK)	Course Description	Credits weight			
				Theory	practice kum	Practice	Amount
			The assessment indicator for this course is the activeness of students in the learning process to understand the concepts of stochastic processes and the ability to problem solve relevant problems. Meanwhile, the evaluation uses attitude observation, performance, and written tests (independent assignments and structured assignments, UTS and UAS) with weights, respectively, 10%, 40%, and 50%.				
3	3125-808-3	Insurance Math	After taking this course, students are expected to be able to understand the concepts of interest, interest rates, annuities, insurance, mortality tables, and premiums, and be able to apply	3			

No	MK code	Courses (MK)	Course Description	Credits weight			
				Theory	practice kum	Practice	Amount
			them to related problems. The learning methods in this course include expository methods, problem solving, group discussions, and group presentations. The assessment indicator for this course is the activeness of students in the learning process to understand the concepts of Insurance Mathematics and the ability to problem solve relevant problems. Meanwhile, the evaluation uses observation of attitudes, performance, and written tests (UTS and UAS) with weights, respectively, 10%, 40%, and 50%.				
4	3125-	Operations	Graduate competencies that will be	3			

No	MK code	Courses (MK)	Course Description	Credits weight			
				Theory	practice kum	Practice	Amount
	933-3	Research Techniques	achieved in this course students are expected to be able to analyze real situations to find problems and design alternative solutions to problems based on scientific studies in the field of Mathematics. The contents of this course include Mathematical Modeling related to constrained optimization problems and their solutions, sensitivity analysis, queuing models, stock and goods distribution models, forecasting models, decision theory models, transportation network models, project management as well as Monte Carlo models and algorithms. The lecture method used is a				

No	MK code	Courses (MK)	Course Description	Credits weight			
				Theory	practice kum	Practice	Amount
			combination of theories in the form of discussions, assignments and presentations and practice in the computer laboratory, while the evaluation uses performance observations in the form of presentations and assignments with a weight of 30%, theory and practice tests for UTS with a weight of 30% and UAS with a weight of 30%. 40%.				
5	3125-946-3	Mathematical Modeling	Mathematical modeling is a bridge between mathematics and its application in solving problems in everyday life. This course teaches and trains students in honing their mathematical formulation skills, problem solving for the various	2			

No	MK code	Courses (MK)	Course Description	Credits weight			
				Theory	practice kum	Practice	Amount
			modeling topics offered, the ability to work in groups and the ability to communicate both orally and in writing in the modeling process. The modeling process here includes problem identification and formulation, mathematical model construction, interpretation, and model improvement. The competence to be achieved in mathematical modeling is being able to formulate the application of mathematical concepts in real problems.				
6	3125-954-2	Business communication	This course discusses change (Change), how to act as a member in a company and how to deal with problems in a company, Turnaround Analysis,	2			

No	MK code	Courses (MK)	Course Description	Theory	practice kum	Practice	Amount
			breaking down complexity and working faster and learning organizations,				
7		MK Choice		6			
			Total Study Load for Semester VI	**22**			

Table 9. List of courses per semester-VII

No	MK code	Courses (MK)	Course Description	Theory	practice kum	Practice	Amount
1	**3005-206-2**	Field Work Practice	Field work practice courses are non-face-to-face lectures. This street vendor activity is carried out by students directly in professional work activities at an institution, company or agency within a certain period of time in accordance with the curriculum of the study program.			2	

No	MK code	Courses (MK)	Course Description	Credits weight			
				Theory	practice kum	Practice	Amount
2	**3005-207-2**	Pre Thesis Seminar	Subject this covers discussion thesis proposal preparation student,determination lecturer mentor by head of study program as well as mentoring by lecturer appointed supervisor by Head of Study Program ended with thesis proposal seminar exam by team assigned lecturer by head of study program.Method learning on eye studying this of them is method Duty independent,study independent through journal,book and various source,presentation individual.Indicator evaluation eye studying this is exam proposal hearing.	2			
3		MK Choice		4			
Total Study Load for Semester VII				6		2	

Table 10. List of courses per semester-VIII

No	MK code	Courses (MK)	Course Description	Credits weight			
				Theory	practice kum	Practice	Amount
1	**3005-402-4**	Essay	Students are able to conduct research and make research reports with the guidance of 2 supervisors, according to the rules that apply to the Guidelines for Writing Thesis for Mathematics Studies FMIPA UNJ. The types of research that can be done include: theoretical and applied studies. Problems submitted by students are approved by the Study Program Coordinator and supervisor.	4			
Total VIII Semester Study Load				**4**			

Table 11. List of elective courses

No	MK code	Courses (MK)		Credits weight			
				Theory	practice kum	Practice	Amount
1	**0005-300-2**	KKN**		2			
2	**3125-404-3**	Introduction to Topology**	This course includes : Metric space, complete metric space, topology space in R, topology space in R2, general topology space, elementary properties of topology space,base space topology,Compact space, Separable space, Connected space The learning methods in this course include expository methods, problem solving, group discussions, and group presentations. The assessment	3			

No	MK code	Courses (MK)		Credits weight			
				Theory	practice kum	Practice	Amount
			indicator for this course is student activity in the learning process to understand metric spaces, topological spaces and classify spaces according to their properties.				
3	3125-405-3	Size Theory**	Competencies that will be achieved in the Size Theory course are students understand the basic concepts of size, measurable functions, Lebesque integrals and integral function spaces. Contents This course discusses concepts and theories about size, Lebesque measure, measure space, measurable	3			

No	MK code	Courses (MK)		Credits weight			
				Theory	practice kum	Practice	Amount
			function, s-field, monotonous class, Lebesque integral, monotonous convergence theorem and convergent dominance, relation between Lebesque integral and Riemann integral, Space integral function $L1L1$, Hilbert space and Lp, p≥3,$Lp, p≥3,$ Radon Nikodym's theorem, Lebesque Stieltjes integral and the convergence model.				
4	3125-704-2	Non Parametric Statistics**	This course studies statistical analysis techniques without needing to be fixated on the assumption of distribution or	2			

No	MK code	Courses (MK)		Credits weight			
				Theory	practice kum	Practice	Amount
			distribution of certain data. Materials that will be studied in this course include one-sample hypothesis testing including the Binomial test, Chi-Square one-sample test, and Kolmogorov Smirnov; hypothesis testing of two independent samples includes the Sign, Mc Nemar, Wilcoxon, Walsh, and Randomization test; two-sample independent hypothesis testing includes Median, Mann Whitney, Kolmogorov two samples, Chi Square two samples, Fisher, and Wald Wolfowitz tests; Hypothesis				

No	MK code	Courses (MK)		Credits weight			
				Theory	practice kum	Practice	Amount
			testing for k samples that are not independent includes Cochran and Friedman tests, while for the case k independent samples include Chi Square, Median Expansion, and Kruskal Wallis tests. Correlation measures that will be studied include contingency coefficients, Spearman rank correlations, After studying this course, students are expected to be able to apply hypothesis testing procedures and nonparametric statistical analysis techniques appropriately to problems encountered in various fields.				

No	MK code	Courses (MK)		Credits weight			
				Theory	practice kum	Practice	Amount
			Learning is carried out online (in a network).				
5	**3125-706-3**	Time Series Analysis**	This course presents the basic concepts of time series analysis using the Box-Jenkins ARIMA method for forecasting stationary, non-stationary and seasonal data. The competencies that will be achieved from this time series analysis course are being able to forecast several future periods for stationary, non-stationary, and seasonal time series data, and being able to apply it to real problems.	3			
6	**3125-932-3**	Economic math**	Competence What will be achieved in the Mathematical	3			

No	MK code	Courses (MK)		Credits weight			
				Theory	practice kum	Practice	Amount
			Economics course is being able to formulate parts of the knowledge field in mathematics into a structured unit and apply them in micro and macro economics using a mathematical assumption approach. Contents This course discusses basic economic theory, micro and macro, understanding of supply and demand, consumer behavior theory, production theory, markets, calculation of national income and its elements as well as economic growth and examines economic problems. Application of					

No	MK code	Courses (MK)		Credits weight			
				Theory	practice kum	Practice	Amount
			economic mathematics in various fields of science. The learning methods used include discussions, presentations, assignments and using problem-posing learning. While the evaluation uses performance observations (task scores), written tests (UTS) and (UAS) with a weight of 20%, 30% UTS and 50% UAS.				
7	3125-951-3	Risk Theory**	After attending this Risk Theory course, students are expected to understand concepts and be able to solve problems both theoretically and practically,	3			

No	MK code	Courses (MK)		Credits weight			
				Theory	practice kum	Practice	Amount
			matters relating to risk based on existing data. Contents This course discusses concepts and theories about risk measurement, actuarial models and risk models, probability models in the risk process, loss models, claims distribution, risk distribution estimation, bankruptcy theory and credibility theory. The learning methods in this course include expository methods, problem solving, group discussions, and group presentations. The assessment indicator for this course is the				

No	MK code	Courses (MK)		Credits weight			
				Theory	practice kum	Practice	Amount
			activeness of students in the learning process to understand the concepts of Risk and the ability to problem solve relevant problems. Meanwhile, the evaluation uses attitude observation, performance, and written tests (independent assignments and structured assignments, UTS and UAS) with weights, respectively, 10%, 40%, and 50%.				
8	3125-000-3	Introduction to Functional Analysis**	This course includes: Metric spaces, open and closed sets in metric spaces, complete metric spaces, normed spaces, Banach spaces, Linear operators, Inner	3			

No	MK code	Courses (MK)		Credits weight			
				Theory	practice kum	Practice	Amount
			product spaces, Hilbert spaces.				
9	3125-011-3	Investment and Asset Theory**	After attending this Investment and Asset Theory course, students are expected to understand concepts and be able to solve problems both theoretically and practically on matters related to investment and asset management. Contents This course discusses the concepts and theories of mathematical models for Exchange, portfolios, bonds, the benefits of financing and investment.	3			
10	3125-012-3	Optimum Control	This course studies the application of optimum control	3			

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No	MK code	Courses (MK)		Credits weight			
				Theory	practice kum	Practice	Amount
		Theory**	theory in the fields of economics, business, biological sciences to physics and engineering. Optimum control theory is a good mathematical tool for making management and strategic decisions. Optimal Control thoroughly develops the mathematical aspects of optimal control theory and provides insight into the application of this theory to biological models. Optimum control theory addresses the most basic problems for continuous-time ordinary differential equations (ODE) before discussing more				

No	MK code	Courses (MK)		Credits weight			
				Theory	practice kum	Practice	Amount
			complex problems, such as variations in initial conditions, constraints imposed on controls, multiple initial and control conditions, linear dependence on controls, and free-terminal time. In addition to continuous time, this theory also discusses the optimal control of discrete systems and partial differential equations (PDE). Several application examples were studied, including immunological and disease epidemic models, management decisions in harvesting, and resource allocation models. Basic				

No	MK code	Courses (MK)		Credits weight			
				Theory	practice kum	Practice	Amount
			knowledge of multivariable calculus, simple ODE, and mathematical models is a prerequisite for taking the Optimum Control Theory course.				
11	3125-701-3	Sampling Theory**	This course aims to enable students to understand the basic concepts of sampling, to be able to design and determine the appropriate sampling method and to be able to determine the appropriate sample size, according to the specified level of accuracy, and be able to calculate parameter estimates. This course covers: Fundamentals of sampling.	3			

No	MK code	Courses (MK)		Credits weight			
				Theory	practice kum	Practice	Amount
			Sampling is random, chance and systematic. The sampling design is simple, layered, gradual and clustered. Estimating parameters normally, through ratio and regression. Comparison of design efficiency, determination of sample size and estimation of population size.				
12	3125-013-3	Calculus of Variations**	These courses include: Standard Optimization Problems,Linear Space and Gateaux Variations, Minimization Function Convex,Euler Lagrange Persamaan Equation,Principle Variation in mechanic.	3			

No	MK code	Courses (MK)		Credits weight			
				Theory	practice kum	Practice	Amount
			The learning methods in this course include Case based Blended Learning, Flipped Classroom. The assessment indicator for this course is student activity in the learning process to understand the concepts of Calculus of Variations, completion of assignments, cases, UTS and UAS.				
13	3125-701-3	Parallel Computing**	Competencies that will be achieved in the Parallel Computing course are students who are able to : 1) Able to understand applications using	3			

No	MK code	Courses (MK)		Credits weight			
				Theory	practice kum	Practice	Amount
			parallel computing in the use of numerical algorithms and image processing 2)Able to understand how to measure parallel processing performance 3)Able to understand theory about load balancing,*shared memory*, and sorting in parallel Contents This course discusses concepts and theories about processing theory, MPI, PVM, message passing, measuring parallel processing performance,					

No	MK code	Courses (MK)		Credits weight			
				Theory	practice kum	Practice	Amount
			dividend and conquer techniques, pipeline techniques, synchronous computing, load balancing and its types, shared memory, parallel sorting, algorithms numeric in parallel, image processing in parallel, searching and optimization in parallel.				
14	3125-003-2	Graph Theory**	This course is an elective course for the Mathematics Study Program. This course will discuss further theories in the field of graphs. The material to be studied in this lecture includes the basic concepts of graph theory, graph coloring, circuits	2			

No	MK code	Courses (MK)		Credits weight			
				Theory	practice kum	Practice	Amount
			and cycles, extreme problems, counting in graphs, graph labeling, and graph algorithms and applications. The learning method used is discussion and question and answer as well as project-based learning.				
Total Study Load of Elective Courses				**39**			

H. LECTURER

The following are the names of the homebase lecturers of the Mathematics S1 Study Program, FMIPA UNJ

Name	Certificate		
	S1	S2	S3
Drs. Sudarwanto, M.Si, DEA	Mathematics Education IKIP Yogyakarta	Mathematics ITB Bandung Mathematics De Rouen France	
Dr. Lukita Ambarwati, M.Sc.	Mathematics Education IKIP Malang	Mathematics ITB Bandung	Mathematics ITB Bandung
Ibn Hadi, M. Si	Mathematics ITB Bandung	ITB Mathematics Bandung	
Debby Agustine, M.Si	Parahyangan University Mathematics, Bandung	ITB Mathematics Bandung	
Dr. Ety Dwi Wiraningsih, M.Sc.	Mathematics Education UMM Malang	Mathematics UGM Yogyakarta	Mathematics UGM Yogyakarta
Dr. Judi Mahatma.	Mathematics ITB Bandung	Mathematics ITB Bandung	Mathematics ITB Bandung
Devi Eka Wardhani, M, M.Si	Jember University Mathematics Education Jember	Mathematics University of Jember Jember	

ACADEMIC GUIDELINES
S-1 PHYSICS STUDY PROGRAM

Independent Learning Curriculum

FACULTY OF MATH AND SCIENCE
UNIVERSITAS NEGERI JAKARTA
2021

A. INTRODUCTION

The Academic Guidebook for Physics students (S1), Faculty of Mathematics and Natural Sciences (FMIPA), Universitas Negeri Jakarta (UNJ) in 2020, is part of the UNJ or FMIPA Academic Guidelines Book which is an academic guide for Physics students batch of 2021 to attend lectures in the Physics Study Program, FMIPA UNJ. This book contains the Physics Study Program curriculum including the distribution of courses and the Semester Credit System (SKS) load each semester which is organized into 8 (eight) semesters of lectures for both the Regular program and the Independent Learning Program. Learning outcomes and descriptions of each course are also described. The curriculum presented is also equipped with the Vision, Mission, Objectives, Profile, Competencies and Degrees of Graduates and Lecturers of Study Programs.

B. VISION, MISSION AND GOALS

1. VISION

The vision of the Physics Study Program at the Universitas Negeri Jakarta is:

"Producing graduates who can compete at the national level and are known internationally in scientific development and research in the fields of computational physics, instrumentation, and materials."

2. MISSION

The missions of the Physics Study Program at the Universitas Negeri Jakarta are:

a. Carry out quality education and teaching activities in the field of physics by utilizing information and communication technology in producing graduates who are religious, love the homeland, are able to

think critically, have educational insight, have high integrity and concern, are able to collaborate actively in solving problems for the benefit of humanity and civilization.

b. To develop science and technology in the field of physics through research on the concentration of computational physics, instrumentation, and quality materials with proven innovations.

c. Organizing community service activities related to physics applications to improve people's quality of life.

d. Establish mutually beneficial cooperation with government and non-government institutions, both at home and abroad, which is oriented towards strengthening study programs.

3. PURPOSE

The objectives of the Physics Study Program, Faculty of Mathematics and Natural Sciences, Universitas Negeri Jakarta are: To produce professional physics graduates who can have careers as academics, research assistants, and industrial practitioners with the following competencies:

a. Mastering the basic concepts and methodologies of physics and applying them to a wider field by utilizing the development of science and technology to be able to find solutions according to their field of work.

b. Have the ability to continue to deepen and develop knowledge through studies at a higher level, both formally and informally.

c. Able to collaborate actively and effectively in a team (working group), communicate ideas orally and in

writing, and have managerial skills in relevant work fields.

d. Have a creative, innovative, and adaptive spirit to the development of science and technology according to the field of work occupied

C. GRADUATE PROFILE

Profiles of graduates of the Physics Study Program, Universitas Negeri Jakarta, are as follows:

GRADUATE PROFILE		GRADUATE PROFILE DESCRIPTION
PL1	Academics in Physics	Able to develop themselves sustainably in the field of physics and its applications through further studies to a higher level, and able to convey knowledge and expertise widely to the public in an effort to educate and dignify the nation
PL2	Physics research assistant	Able to conduct research in the field of Physics independently and collaboratively based on standard scientific methods to formulate and provide solutions to problems physics, as well develop it in a wider field
PL3	Physics Practitioner	Able to develop themselves professionally and apply their knowledge and skills effectively creative and innovativeby utilizing the development of science and technology in accordance with their field of interest, in solve problems in society andindustry world.

D. COMPETENCY / LEARNING OUTCOMES FOR GRADUATES (CPL) PHYSICS STUDY PROGRAM

1. Attitude
   a. Able to show piety to God Almighty, respect cultural diversity, and uphold nationalism and human values.
   b. Able to internalize the values of independence, discipline, responsibility, critical thinking, innovative, communicative, and collaborative in solving various problems.

2. General Skills
   a. Able to work optimally both independently and in groups, supervising and evaluating the completion of his work.
   b. Able to document and perform data analysis to compile scientific descriptions based on standard scientific rules in order to produce appropriate problem solutions.
   c. Able to communicate orally and in writing as well as implement and publish ideas based on scientific principles, procedures, and ethics.

3. Knowledge
   a. Mastering the theoretical concepts and basic principles of classical physics and modern physics.
   b. Mastering the concepts of mathematics, computing, and instrumentation in scientific studies of physics and solving Physics problems.
   c. Mastering knowledge of technology that uses the basic principles of physics, and their application.

4. **Special skill**
   a. Able to perform theoretical analysis, by applying the basic principles of physics and mathematical concepts to produce models or simulations that match the hypothesis.
   b. Able to conduct experiments by applying the basic principles of physics measurement and standard scientific methodologies to interpret data and formulate physical phenomena or problems.
   c. Able to master instrumentation and computational skills, as well as synthesis and characterization of materials to improve and develop them in a wider field.
   d. Able to apply physics concepts in relevant applied fields by utilizing science and technology developments in accordance with the field of interest.
   e. Improving competence to be able to continue studies at the level of further education.

E. GRADUATE DEGREE

Graduates of the Physics Study Program are entitled to hold a Bachelor's degree in Science which is abbreviated to S.Sc., with a graduate who masters the concepts of physics and its practice supported by mastery of ICT technology.

F. STUDY PROGRAM ACCREDITATION

The Physics Study Program has been accredited by the National Accreditation Board for Higher Education (BAN PT) of the Ministry of Research, Technology and Higher Education of the Republic of Indonesia by obtaining an A accreditation rating based on **Decree (SK) BAN PT No SK: 1658/SK/BAN-PT/Akred/S/VII/2018** and valid until July 2, 2023.

G. CURRICULUM
STRUCTURE

The curriculum structure of the Independent Learning Physics Study Program, Faculty of Mathematics and Natural Sciences, Universitas Negeri Jakarta, undergraduate level (S-1), is organized into courses that are distributed into eight semesters with a minimum number of credit units that must be completed is 144 credits, including subjects lectures managed by universities, faculties, study programs, across study programs or outside the university. In accordance with the proposed curriculum changes in accordance with Permendikbud No. 3 of 2020, students are given the freedom to choose the path of graduation through Path 1 Regular or Path 2 Independent Campus. The curriculum structure of the Physics Study Program is shown in Figure 1.
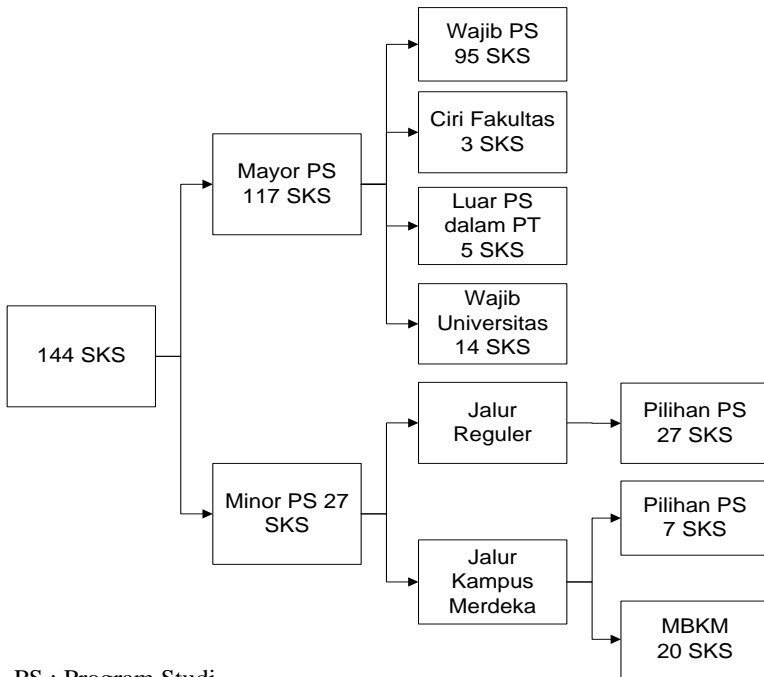
PS : Program Studi

Figure 1. Curriculum Structure of the Physics Study Program,

FMIPA Universitas Negeri Jakarta

H. DISTRIBUTION OF COURSES

Distribution of courses for the Regular program and the Independent Learning program are as follows:

1. **Regular Program**

MK code	Course Name *	credits	Semester/Credit							
			1	2	3	4	5	6	7	8
A	**University Compulsory Courses**									
00051122	Pancasila	2	2							
0051142	Indonesia Language	2	2							
00031062	Citizenship	2		2						
	Religion	2		2						
	Education Insights	2		2						
	Data highway and programming	2					2			
	Logic and Scientific Reasoning	2				2				
B	**Faculty Compulsory Courses**									
3005-002-2	Philosophy of Mathematics and Natural Sciences	2	2							

MK code	Course Name *	credits	Semester/Credit							
			1	2	3	4	5	6	7	8
3225067-1	Olympics	1	1							
C	**Courses Outside the Study Program (Supporting)**									
3325-012-3	General Chemistry	3	3							
3415-001-2	General biology	2		2						
D	**Course Characteristics of Study Program**									
32250683	Calculus I	3	3							
32251013	Basic Physics I	3	3							
32251021	Practical Physics I	1	1							
32250602	English For Physics	2	2							
32250703	Calculus II	3		3						
32251033	Basic Physics II	3		3						
32251041	Practical Physics II	1		1						
32252012	Introduction to Information Technology	2		2						
32250112	Industrial Physics	2		2						

MK code	Course Name *	credits	Semester/Credit							
			1	2	3	4	5	6	7	8
32254034	Mathematics Physics I	4			4					
32253014	Electronics	4			4					
32255014	Classical Mechanics	4			4					
32253021	Electronics Practicum	1			1					
32252022	Computer programming	2			2					
32252031	practice. Computer programming	1			1					
32256013	Modern Physics	3			3					
32256021	Modern Physics Practicum	1			1					
32254044	Mathematics Physics II	4				4				
32255044	Electric and Magnet	4				4				
32252043	Computational Physics	3				3				
32252051	Practical Computational Physics	1				1				
32250052	Digital Electronics	2				2				
32253041	Digital Electronics Practicum	1				1				
32255034	Wave	4				4				
3225xxx2	Statistics	2					2			

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MK code	Course Name *	credits	Semester/Credit							
			1	2	3	4	5	6	7	8
32256073	Thermodynamics	3					3			
32256033	Quantum Physics	3					3			
32250014	Solid Physics	4					4			
32250242	Data measurement and analysis	2					2			
32256122	Physics Experiment	2					2			
32256063	Introduction to Nuclear Physics	3							3	
32256043	Statistical Physics	3							3	
32250152	Physics Research Methodology	2							2	
30052072	Pre-Thesis Seminar	2							2	
32250264	Field practice	4							4	
32250752	Scientific Communication	2							2	
30054024	Essay	4								4
E	**Study Program Elective Courses (PS)**									
3225xxx-x	Elective Course I	3					3			
3225xxx-x	Elective Courses II-X	20						20		

MK code	Course Name *	credits	Semester/Credit							
			1	2	3	4	5	6	7	8
3225xxx-x	Elective Course XI	2							2	
3225xxx-x	Optional Course XII	2							2	
Amount		**144**	**19**	**19**	**20**	**21**	**21**	**20**	**20**	**4**

2. **Independent Campus Program**

MK code	Course Name *	credits	Semester/Credit							
			1	2	3	4	5	6	7	8
A	**University Compulsory Courses**									
00051122	Pancasila	2	2							
0051142	Indonesia Language	2	2							
00031062	Citizenship	2		2						
	Religion	2		2						
	Education Insights	2		2						
	Data highway and programming	2					2			
	Logic and Scientific Reasoning	2				2				
B	**Faculty Compulsory Courses**									
3005-002-2	Philosophy of Mathematics and Natural Sciences	2	2							
3225067-1	Olympics	1	1							
C	**Courses Outside the Study Program**									

MK code	Course Name *	credits	Semester/Credit							
			1	2	3	4	5	6	7	8
	(Supporting)									
3325-012-3	General Chemistry	3	3							
3415-001-2	General biology	2		2						
D	**Course Characteristics of Study Program**									
32250683	Calculus I	3	3							
32251013	Basic Physics I	3	3							
32251021	Practical Physics I	1	1							
32250602	English For Physics	2	2							
32250703	Calculus II	3		3						
32251033	Basic Physics II	3		3						
32251041	Practical Physics II	1		1						
32252012	Introduction to Information Technology	2		2						
32250112	Industrial Physics	2		2						

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MK code	Course Name *	credits	Semester/Credit							
			1	2	3	4	5	6	7	8
32254034	Mathematics Physics I	4			4					
32253014	Electronics	4			4					
32255014	Classical Mechanics	4			4					
32253021	Electronics Practicum	1			1					
32252022	Computer programming	2			2					
32252031	practice. Computer programming	1			1					
32256013	Modern Physics	3			3					
32256021	Modern Physics Practicum	1			1					
32254044	Mathematics Physics II	4				4				
32255044	Electric and Magnet	4				4				
32252043	Computational Physics	3				3				
32252051	Practical Computational Physics	1				1				
32250052	Digital Electronics	2				2				
32253041	Digital Electronics Practicum	1				1				
32255034	Wave	4				4				

MK code	Course Name *	credits	Semester/Credit							
			1	2	3	4	5	6	7	8
3225xxx2	Statistics	2					2			
32256073	Thermodynamics	3					3			
32256033	Quantum Physics	3					3			
32250014	Solid Physics	4					4			
32250242	Data measurement and analysis	2					2			
32256122	Physics Experiment	2					2			
32256063	Introduction to Nuclear Physics	3							3	
32256043	Statistical Physics	3							3	
32250152	Physics Research Methodology	2							2	
30052072	Pre-Thesis Seminar	2							2	
32250264	Field practice	4							4	
32250752	Scientific Communication	2							2	
30054024	Essay	4								4
E	**Study Program Elective Courses (PS)**									

MK code	Course Name *	credits	Semester/Credit							
			1	2	3	4	5	6	7	8
3225xxx-x	Elective Course I	3					3			
3225xxx-x	Elective Course II	2							2	
3225xxx-x	Elective Course III	2							2	
F	**Independent Campus Courses**									
	MBKM activities	20						20		
	Amount	**144**	**19**	**19**	**20**	**21**	**21**	**20**	**20**	**4**

*Notes:

MBKM activities that can be carried out by students are:
1) Industrial Intern
2) KKN/KKNT
3) Businessman
4) Teaching assistant at Education Unit (AMSP)
5) Research/Research
6) Independent Study/Project
7) Humanity project
8) Student Exchange

Physics Study Program Elective Courses

No	MK code	Course Name	Credits weight
1	32256143	Magnetic Material Physics	3
2	32256153	Semiconductor Physics and Technology	3
3	32256093	Solid Physics	3
4	32256183	Ceramic Physics	3
5	32256213	X-Ray Diffraction	3
6	32256222	Mechanical Properties of Materials	2
7	32256342	Composite Physics	2
8	32256173	Metal Physics	3
9	32256253	Material Physics	3
10	32256232	Electrical Properties of Materials	2
11	32256163	Polymer Physics	3
12	32256103	Lasers and Modern Optics	3
13	32256242	Solar Cell Technology	2
14	32259012	Environmental Physics	2
15	32259032	Rock Physics	2
16	32259072	Rock Magnetism	2
17	32258013	Capita Selecta Computational Physics	3
18	32258022	Physics Simulation	2
19	32257052	Programming Language C/C++	2
20	32250763	Introduction to Machine Learning in Physics	3
21	32250773	Introduction to Intelligent Systems Physics	3
22	32250693	Digital Signal Analysis	3

No	MK code	Course Name	Credits weight
23	32257063	Digital Image Processing	3
24	32257033	Sensor Technology	3
25	32257022	Control System	2
26	32257013	Microprocessor and Interface	3
27	32250702	Ultrasonics: theory and application	2
28	32250712	Basics of Biomedical Instrumentation	2
29	32250722	Industrial Electronics	2
30	32256112	Physics Workshop	2
31	32256083	Quantum Mechanics	3
32	32256172	Condensed Matter Theory	2
33	32250002	Introduction to Radiation Physics	2
34	32250272	Materials for sensors	2
35	32250262	Advanced Electronics	2
36	32256073	Electromagnetic Field	3
37	3225066-2	Entrepreneurship	2
		Total credits provided	**89**

I. DISTRIBUTION OF COURSES EVERY SEMESTER

The distribution of Physics Study Program courses each semester is as follows:

1. Regular Program

No	Semester 1	credits	No	Semester 2	credits
1	Indonesia Language	2	1	Religious education	2
2	Pancasila Education	2	2	Education Insights	2
3	General Chemistry	3	3	Citizenship	2
4	Philosophy of	2	4	Calculus II	3

No		credits		No		credits
	Mathematics and Natural Sciences					
5	Olympics	1		5	General biology	2
6	Calculus I	3		6	Basic Physics II	3
7	Basic Physics I	3		7	Practical Physics II	1
8	Practical Physics I	1		8	Introduction to Information Technology	2
9	English For Physics	2		9	Industrial Physics	2
	Number of semester credits 1	**19**			**Number of semester 2 credits**	**19**

No	3rd semester	credits		No	Semester 4	credits
1	Mathematics Physics I	4		1	Mathematics Physics II	4
2	Electronics	4		2	Electric and Magnet	4
3	Classical Mechanics	4		3	Computational Physics	3
4	Electronics Practicum	1		4	Practical Computational Physics	1
5	Computer programming	2		5	Digital Electronics	2
6	practice. Computer programming	1		6	Digital Electronics Practicum	1
7	Modern Physics	3		7	Wave	4
8	Modern Physics Practicum	1		8	Logic and Scientific Reasoning	2
	Number of semester 3 credits	**20**			**Number of semester credits 4**	**21**

No	5th semester	credits	No	6th semester	credits
1	Statistics	2	1	Elective courses	2
2	Thermodynamics	3	2	Elective courses	2
3	Quantum Physics	3	3	Elective courses	2
4	Solid Physics	4	4	Elective courses	2
5	Data measurement and analysis	2	5	Elective courses	2
6	Physics Experiment	2	6	Elective courses	3
7	Data highway and programming	2	7	Elective courses	3
8	PS . Elective Courses	3	8	Elective courses	3
			9	Elective courses	3
			10	Elective courses	2
	Number of semester credits 5	21		Number of semester credits 6	20

No	7th semester	credits	No	Semester 8	credits
1	Introduction to Nuclear Physics	3	1	Essay	4
2	Statistical Physics	3			
3	Physics Research Methodology	2			
4	Pre Thesis Seminar	2			
5	Field practice	4			
6	Scientific Communication	2			
7	PS . Elective Courses	2			
8	PS . Elective Courses	2			
	Number of semester credits 7	20		Number of semester credits 8	4

2. MBKM Program

No	Semester 1	credits	No	Semester 2	credits
1	Indonesia Language	2	1	Religious education	2
2	Pancasila Education	2	2	Education Insights	2
3	General Chemistry	3	3	Citizenship	2
4	Philosophy of Mathematics and Natural Sciences	2	4	Calculus II	3
5	Olympics	1	5	General biology	2
6	Calculus I	3	6	Basic Physics II	3
7	Basic Physics I	3	7	Practical Physics II	1
8	Practical Physics I	1	8	Introduction to Information Technology	2
9	English For Physics	2	9	Industrial Physics	2
	Number of semester credits 1	19		Number of semester 2 credits	19

No	3rd semester	credits	No	Semester 4	credits
1	Mathematics Physics I	4	1	Mathematics Physics II	4
2	Electronics	4	2	Electric and Magnet	4
3	Classical Mechanics	4	3	Computational Physics	3
4	Electronics Practicum	1	4	Practical Computational Physics	1

5	Computer programming	2
6	practice. Computer programming	1
7	Modern Physics	3
8	Modern Physics Practicum	1
	Number of semester 3 credits	**20**

5	Digital Electronics	2
6	Digital Electronics Practicum	1
7	Wave	4
8	Logic and Scientific Reasoning	2
	Number of semester credits 4	**21**

No	5th semester	credits
1	Statistics	2
2	Thermodynamics	3
3	Quantum Physics	3
4	Solid Physics	4
5	Data measurement and analysis	2
6	Physics Experiment	2
7	Data highway and programming	2
8	PS . Elective Courses	3
	Number of semester credits 5	**21**

No	6th semester	credits
1	MBKM activities	**20**
	Number of semester credits 6	**20**

No	7th semester	credits
1	Introduction to	3

No	Semester 8	credits
1	Essay	4

	Nuclear Physics				
2	Statistical Physics	3			
3	Physics Research Methodology	2			
4	Pre Thesis Seminar	2			
5	Field practice	4			
6	Scientific Communication	2			
7	PS . Elective Courses	2			
8	PS . Elective Courses	2			
	Number of semester credits 7	20		Number of semester credits 8	4

Notes:

For students who take part in MBKM activities in the form of Industrial Internships in semester 6, Field Work Practices in semester 7 can be replaced with selected PS courses according to student interests.

J. COURSE DESCRIPTION

Course Description:

A. University Compulsory Courses

0005-112-2   Pancasila Education (2 credits)

The Pancasila Education course is a personality development course that aims to make students understand the concepts/theories of Pancasila Education. This course studies Introduction to Pancasila Education, Pancasila in the Current History of the Indonesian Nation, Pancasila as the Basic State of the Republic of Indonesia,

Pancasila as the State Ideology, Pancasila as a Philosophical System, Pancasila as an Ethical System, Pancasila as the Basic Value of Science Development, Pancasila and Values Anti Corruption

0005-114-2   Indonesia Language (2 credits)
Students as academics in higher education are required to be able to argue, ask questions, discuss, argue, make presentations, refute, even access and transform knowledge with high-level languages, both in spoken and written language. To achieve this requires an understanding of the Indonesian language with its aspects and applications. Therefore, Indonesian language courses include theory (competence) and language practice (performance), especially writing and speaking.

0003-106-2   Citizenship Education (2 Credit Points)
Citizenship Education courses include citizenship education as a subject for personality development, national identity and Indonesian national integration, the state and the constitution, the rights and obligations of citizens, democracy and democratic education, the rule of law and human rights, Indonesian geopolitics, regional autonomy and Indonesian geostrategy. After attending this course, students are expected to be able to analyze contextual problems of PKN, develop positive attitudes and display supportive behavior related to the spirit of nationalism, love for the homeland, civilized democracy and legal awareness.

000   Logic and Scientific Reasoning (2 credits)
The Logic and Scientific Reasoning course aims to make

students able to formulate ideas, thoughts or ideas and solutions in answering problems according to their respective fields effectively and efficiently, based on logical, systematic and scientific thinking. At the end of the lecture, students are expected to be skilled in solving cases relevant to their field of expertise and compiling projects based on Mini Instructional Based Research (MIBR).

000   Big Data and Programming (2 credits)
This course will introduce the use of programming (coding) and techniques (problem solving) in solving problems. This course also introduces the use of Big Data as a part of facing the Industrial Revolution 4.0. The topics discussed were the Industrial Revolution 4.0, introduction to algorithms and programming, Big Data and Big Data processing techniques.

0005-203-3   Islamic Religious Education (3 Credits)
The Islamic Religious Education course discusses How to Study Islam in Higher Education, How Man is God, How Religion Guarantees Happiness, How to Integrate Faith, Islam, and Ihsan in Forming Insan Kamil, How to Build a Quranic Paradigm for Modern Life, How to Ground Islam in Indonesia, How Islam Builds Unity in Diversity, How Islam Faces the Challenges of Modernization, How Islam Contributions to the Development of World Civilization, How to Develop Islamic Culture through Campus Mosques, Islam as Rahmatan lil 'alamin.

0005-203-3   Christian Religious Education (3 Credit Points)
The   Christian   Religious   Education   course   aims   to

understand God's love through the Way of salvation that exceeds the imagination of sinful humans. The life of a sinner who was redeemed for believing in God. A successful believer/child of God. God of refuge. Trinity/Trinity. Humans created by God are precious and noble. The life of an obedient Christian leads to salvation. Understanding of faith, church, nation and state. Christian youth association-social interaction. A life that always praises God every day, national harmony, the omnipotence of God.

B. Faculty Compulsory Courses

3005-002-2   Philosophy of Mathematics and Natural Sciences (2 credits)

The Mathematics and Natural Sciences Philosophy course examines the nature of science, the development of natural science, the human mindset, sources of knowledge, means of supporting the development of natural science, thinking models, components of natural science, academic ethics, self-concept and language as a means of scientific communication. After attending this course, students are expected to be able to have an understanding of the basic concepts of natural science (IPA), the development of science and technology (IPTEK) in society according to scientific principles and its development is in line with the development of the human mindset to be able to think logically, analytically, creatively and have concepts. strong self and can apply academic ethics properly and correctly

3225067-2   Olympism (1 Credit)

The Olympism course examines the introduction to the philosophy and values of sport (olympism), the

combination of physical and spiritual balance, harmonization of the relationship between sports life, culture and education, harmony of life based on happiness and noble effort, respect for universal ethical principles . After attending this course, students are expected to be able to apply the values of sport (olympism) in an integrated and consistent manner.

C. Courses Outside Study Programs in Higher Education

3415-001-2   General Biology (2 credits)

General Biology is a cross-study course that must be taken by Physics students. The General Biology course aims to make students able to discuss topics on Biology science, characteristics of living things, chemistry of life, cell structure and function, metabolism, genetic material and heredity, biotechnology, plant structure and function, animal structure and function, diversity. biology, and ecology independently as the basis for understanding lecture materials through peer discussion and tutoring.

3325-012-3   General Chemistry (3 credits)

General Chemistry is a cross-study course that must be taken by Physics students. Through this course, students will be given knowledge about the physical and chemical properties of a material and apply the laws of thermodynamics to explain the physical properties, chemical properties and changes in the material. The topics that will be studied in this course include atomic structure and periodic properties of elements, intramolecular and intermolecular chemical bonds, basic laws in chemical calculations and thermodynamics.

3225101-3   Basic Physics I (3 credits)

The Basic Physics I course is a prerequisite for the group of expertise courses at the undergraduate level (S1) in the Physics Study Program. After attending this course, students are expected to be able to master basic knowledge of mechanics, vibration, waves, sound, gravity, fluids, and heat, so that they can study and apply them to further physics studies.

3225102-1   Practicum of Basic Physics I (3 credits)

The Basic Physics Practicum Course I discusses the theory of uncertainty in measurement, introduction to measuring instruments, making graphs, designing and implementing experiments as well as making experimental reports on mechanics, heat and heat conduction and optical waves. After following this course, students are expected to be able to carry out and analyze the results of experiments or basic physics practicums, especially for mechanics, fluids, heat and optical waves.

3225103-3   Basic Physics II (3 credits)

The Basic Physics II course is a prerequisite for the group of expertise courses at the undergraduate level (S1) in the Physics Study Program. After attending this Basic Physics II course, students are expected to be able to master basic knowledge about electric charge, electric force and field, Gauss's law, electric potential, resistance and electric current, DC circuit, magnetism, electromagnetic induction, electromagnetic oscillation. AC circuits, electromagnetic waves, quantum theory, and atomic models. With this knowledge, students are expected to be able to learn and

apply it to further physics studies.

3225104-1   Practical Physics II (3 credits)

Basic Physics II Practicum course discusses optical material consisting of refractive index, mirror, lens properties and image defects, microscope, spectrometer, polarimeter, and oscilloscope. While the next chapter is electricity which consists of alternating current, the character of incandescent lamps, and transformers. After following this course, students are expected to have the ability to analyze and solve wave-optic and electric-magnetic problems and write quantitative results from the practicum that has been done. This course

3225201-2   Introduction to Information Technology (2 Credit Points)

The Introduction to Information and Communication Technology (PTI) course aims to provide basic knowledge and skills of Information Technology in a comprehensive manner so that students are able to learn and apply them to further studies of related expertise courses. In this course, topics will be discussed: Development of Information Technology, Concepts of Computer Systems and Operating Systems, Multimedia Technology, Telecommunication Technology, Coding, Big Data, and Artificial Intelligence. After attending this course, students are expected to be able to operate computer systems with various operating systems, recognize various information technology devices and their functions, and be able to use them practically for simple work.

3225060-2   English for Physics (2 Credit Points)

The English for Physics course discusses an overview of grammar, style and communication techniques both verbal and written, enrichment and vocabulary development through the study of textbooks, science magazines, and journal papers, article writing based on the sources provided, presentation of articles on physical phenomena simple. After taking this course, students are expected to be able to apply basic techniques of effective communication in English, so that they are able to communicate, present and express their ideas or opinions in a scientific forum.

3225068-3   Calculus I (3 credits)

The Calculus I course discusses the concept of numbers, the definition of functions, limits & continuity, derivatives and their applications, integration and applications, integration techniques. After attending this course, students are expected to be able to understand the basic concepts of mathematics to solve problems in physics.

3225070-3   Calculus II (3 credits)

The Calculus II course covers infinite series, Parametric Equations & Coordinate Systems, Vector & Geometry of Space, Vector Calculus, Partial Derivatives, Fold Integrals, Ordinary Differential Equations of Order-1. After attending this course, students are expected to be able to understand the basic concepts of mathematics to solve problems in physics.

3225 403-4   Mathematics Physics I (4 credits)

The Mathematics Physics I course discusses power series, complex numbers, linear algebra, partial differentials,

multiple integrals, vector analysis, Fourier series and transformations, ordinary differential equations, Laplace transforms, convolutions, Delta Dirac functions, and Green functions. After taking this course, students are expected to be able to use and analyze basic mathematical concepts and apply them in solving various physics problems.

3225 -301-4   Electronics (4 credits)

The Electronics course discusses the basic concepts of electronic circuits and their application to circuit analysis, as well as their application to semiconductor circuits, namely: basic concepts of electric circuits, electrical circuit elements, resistive circuits, resistive circuit analysis, circuit theorems, capacitors and inductors, alternating current , semiconductors, diodes, transistors, and op-amplifiers. After taking this course, students are expected to be able to analyze electrical circuits using the circuit theorem and apply it to various electronic circuits.

3225 501-4   Classical Mechanics (4 Credit Points)

Mechanics is fundamental and the key to further mastery of physics. With the concepts of mechanics, many physical phenomena are successfully explained very well. Theories of mechanics are also widely used as the basis for the development of modern physics and models of more complex physical systems. This course discusses classical mechanics which is intended for physics study program students, starting with a discussion of the fundamental concepts of vectors to describe particle motion, then reviewing the scope of classical mechanics and its relationship to other fields of physics, basic concepts of Newtonian mechanics and applying them to explain

straight motion. on particles and oscillations, general motion of particles in three dimensions, central forces, non-inertial reference systems,

3225 302-1   Electronics Practicum (1 Credit)

Practical Electronics course discusses the measurement of electronic quantities, characteristics of diodes, bipolar transistors, non-inverting, inverting amplifier circuits, design of simple analog electronic instrumentation. After taking this course, students are expected to be able to measure electrical quantities in electronic circuits, circuit analysis, and design basic electronic circuits.

3225601-3   Modern Physics (3 Credit Points)

Modern Physics course discusses the special theory of relativity: Einstein's special theory of relativity, the principle of the equivalence of mass and energy. Quantum theory in the phenomena of black body radiation, the photoelectric effect, and the Compton effect, wave properties of particles, Heisenberg uncertainty principle, quantum mechanics, atomic models, atomic structure, atomic spectra, stimulated emission, crystal lattices and phonons, nuclear structures, nuclear transformations. After taking this course, students are expected to be able to analyze modern physical theory including special relativity theory and quantum theory for atoms, molecules, solids and atomic structures, atomic and molecular spectra and atomic nuclei.

3225602-1   Modern Physics Practicum (1 Credit)

In the Modern Physics Practicum course, students conduct elementary charge experiments with Millikan oil drops,

Balmer series experiments, electron charge measurement experiments, X-ray experiments, crystallographic experiments. After following this course, students are expected to be able to conduct experiments and measure physical quantities in the study of modern physics and analyze experimental results.

3225202-2 Computer Programming (3 Credits)

The Computer Programming course provides basic algorithm knowledge and programming skills. The programming language used is Python Programming Language as a high-level programming language that is easy to use. Through this course, students have the ability to compose algorithms and the skills to make computer programs to solve various problems.

3225 203-1 Computer Programming Practicum (1 Credit)

The Computer Programming Practicum course is a practical course that applies concepts from computer programming courses. This course is practical based on case examples covering various related concepts in algorithms and programming. This course uses a high-level, interactive programming language, supports graphic visual programming and object-oriented programming to solve scientific computing problems and scientific presentations.

3225 404-4 Mathematics Physics II (4 credits)

The Mathematics Physics II course discusses the calculus of variations: Euler equations, brachistochrome problems, Lagrange equations, isoperimetric problems. Coordinate transformation: linear transformation, orthogonal

transformation, eigenvalues and eigenvectors of matrices, matrix diagonalization. Special functions: the gamma function and its recursive relationship, the beta function and its relationship to the gamma function. simple pendulum. Series solutions of differential equations: Legendre's equations, Rodrigues formula, generating functions for Legendre polynomials, Bessel functions and their recursive relationships, Hermite and Laguerre functions. Partial differential equations: Lapace equations, diffusion equations, wave equations, Poisson equations. Complex variable functions: analytical functions, contour integrals, Laurent series, residual theorem, applications in integral calculations.

3225 504-4   Electricity and Magnetism (4 Credit Points)
The Electricity and Magnetism course provides students with provisions to understand the basic concepts of electricity and magnetism as well as the interaction between electricity and magnetism. Materials discussed in this course include: Electrostatics, Potential Determination Techniques, Electrostatic Fields in Materials, Magnetostatics and Magnetostatic Fields in Materials. After attending this course, students are expected to be able to apply the basic concepts of electricity to solve related technology problems, and to be able to apply the basic concepts of magnetism to solve technology related problems.

3225 204-3   **Computational Physics (3 Credits)**
Computational Physics course provides the basics of making computer programs for solving physics problems numerically. After taking this course, students are

expected to have basic knowledge of computational methods and skills in computer programming so that students are able to apply them to data processing, modeling and simulation of physical systems.

3225205-1 **Computational Physics Practicum (1 Credit)**

The Computational Physics Practicum course discusses making computer programs for solving physics problems numerically including physics problems covered in the computational physics course material. After taking this course, students are expected to be able to create computer programs to solve physics problems using numerical methods in computational physics course material

3225 005-2 Digital Electronics (2 Credit Points)

The Digital Electronics course discusses the basic concepts and principles in digital electronics and their application in digital-based circuits, the concept of logic circuits based on the nature of logic gates both basic and combined, especially for the concept of digital computer organization, the concept of combination logic circuits using Boolean Algebra methods, concepts combination logic circuits using the Karnaugh map method, the nature and workings of combination logic modules, the nature and workings of sequential logic modules. After taking this course, students are expected to have an understanding of the concepts and principles of digital electronics, the ability to analyze digital circuits, the ability to design digital electronics system requirements, and produce digital electronics-based equipment.

3225 304-1   **Digital Electronics Practicum (1 credit)**

The Digital Electronics Practicum course builds basic principle skills in digital electronics and their application in digital-based circuits, namely Logic Gate, Karnaugh Map, SR Latch, Flip-Flops, Clocks and Oscillators, 4-Bit Shift Register, 4-Bit Counter, LED Chaser, 7400 Series Logic Devices, and 4000 Series Logic Devices.

3225503-4   Wave (4 credits)

Waves courses are generally divided into four main topics, namely vibration, mechanical waves, electromagnetic waves and optics. Vibration theory discusses several simple vibration/oscillation systems, especially mechanical and electrical systems in describing free, damped, forced and coupled vibrations. General formulations of vibrations of various systems for all types of vibrations are formulated and used to analyze various physical problems. The study of wave phenomena discussed includes mechanical and electromagnetic waves to then formulate general wave equations. Also discussed are wave phenomena such as reflection, transmission, interference and diffraction. After following this course, students are expected to be able to analyze phenomena,

3225502-3   Thermodynamics (3 Credit Points)

Thermodynamics course discusses physical properties and phenomena from a macroscopic point of view related to changes in the state of the system to its environment involving thermal and mechanical changes. The interaction of the system and its environment involves changes in energy in the form of work and heat which are related in

the laws of thermodynamics. After following this course, students are expected to be able to understand the concepts and theories of thermodynamics so that they are able to study and apply them to solve problems in physics phenomena.

3225603-3   Quantum Physics (3 Credit Points)

The Quantum Physics course contains an explanation of the concept of black body radiation, the photoelectric effect, Compton scattering, atomic spectrum, wave and particle dualism, De Broglie waves, Heisenberg uncertainty, wave functions, interpretation of probability/probability, normalization concepts, commutation relations, Hermitian concepts, Eigen values and functions, Schrodinger's equation, Schrodinger's equation on a single electron, and the application of Quantum Physics to the electron model in periodic potential. After taking this course, students are expected to be able to analyze the fundamental ideas of non-relativistic quantum mechanics, the Schroedinger equation, introduce the general framework of quantum mechanics, and the methods used in solving simple quantum mechanical problems.

32250014   Solids Physics (4 Credits)

The Introduction to Solids Physics course discusses the structure of solids: crystal structure, X-ray diffraction, reciprocal lattice, solid-state bonds, binding energies, atomic vibrations, crystal elasticity constants, thermal properties of materials, free electron models, lattice vibrations, energy band theory , the basics of metals: Fermi electron gases and their physical properties. After taking this course, students are expected to have an

understanding of the basic concepts and theories of Solid Substance Physics so that they are able to study and apply them to solve material physics problems.

3225xxx-2   Statistics (2 Credit Points)
The Statistics course examines the basic concepts of descriptive statistics, which includes a discussion of scales on descriptive statistics, and the basic concepts of inferential statistics. After taking this course, students are expected to be able to analyze data and interpret and communicate the results of their analysis into the field of application, and be able to formulate statistical problems in a field, make designs, and collect data. Basics of statistics to support the field of Physics research.

3225024-2   Data measurement and analysis (2 credits)
Measurement and data analysis courses support the abilities possessed by graduates of the Physics study program in measuring and analyzing data. The discussions that will be delivered in this course include: Concepts of Measurement Systems, Measurement System Instruments, Static and Dynamic Characteristics, Uncertainty in Measurement, Calibration, Data Acquisition Systems, Measurement of Temperature, Pressure, Flow Rate and Mechanics. Students who have taken this course are expected to be familiar with the basic concepts of measurement systems, be able to design and conduct experiments according to procedures, be able to analyze measurement data and be able to analyze errors generated in measurements.

3225604-3   Statistical Physics (3 Credits)

The Statistical Physics course discusses binomial and polynomial systems, discrete and continuous probability distributions, Poisson and Gauss equations, thermodynamic coordinates and potentials, particle fluxes, rate distributions, energy distributions, the principle for energy averages, mean free paths, transport equations, state of affairs. micro, macrostate, Maxwell-Boltzmann distribution, Bose-Einstein distribution, Fermi-Dirac distribution, canonical and microcanonical ensembles. . After taking this course, students are expected to have an understanding of binomial and polynomial systems, discrete and continuous probability distributions, Poisson and Gauss equations, microstates, macrostates, Maxwell-Boltzmann distributions, Bose-Einstein distributions, Fermi-Dirac distributions.

3225015-2   Physics Research Methods (3 Credits)

The Physics Research Methods course discusses the basic concepts of statistical science, Physics experimental design in terms of analysis of variance (ANOVA), definitions of scientific research, types of scientific research, research procedures, case studies, code of ethics in scientific research and writing, writing techniques and presentation of scientific papers. . After taking this course, students are expected to be able to understand and understand the meaning of the basics of statistical science in research, scientific research, codes of ethics in writing scientific papers and be able to publish the results of their scientific works in national or international scientific journals. Students are also expected to have the ability to present research results in seminars or scientific conferences.

3225612-2   Physics Experiment (2 Credits)

The Experimental Physics course leads students to understand the basics of physics in designing laboratory experiments/experiments for physics research. This course is an independent practical course in the laboratory/field. After taking this course, students are expected to be able to understand, recognize physics problems and equipment and be able to design equipment for simple experiments and research.

3225 073-3   Methods of Measurement and Data Acquisition (3 Credits)

The Measurement Method and Data Acquisition course supports the abilities possessed by graduates of the Physics study program in measuring and analyzing data. The discussions that will be delivered in this course include: Concepts of Measurement Systems, Measurement System Instruments, Static and Dynamic Characteristics, Uncertainty in Measurement, Calibration, Data Acquisition Systems, Measurement of Temperature, Pressure, Flow Rate and Mechanics. Students who have taken this course are expected to be familiar with the basic concepts of measurement systems, be able to design and conduct experiments according to procedures, be able to analyze measurement data and be able to analyze errors generated in measurements.

3225606-3   Introduction to Nuclear Physics (3 Credit Points)

The Introduction to Nuclear Physics course discusses nuclear structure and properties: nuclear transformation,

nuclear arrangement, nuclear size and shape, nuclear electric and magnetic moments, nuclear force, binding energy, proton and neutron resiogiromagnetism, and nuclear gyromagnetic ratio. Radioactivity: the amount of radioactivity, successive disintegration, radioactive balance and engineering radioactivity. Nuclear radiation: alpha decay, beta decay and gamma decay. Nuclear reactions: classification and mechanism of nuclear reactions and the use of nuclear technology. After following this course, students are expected to have an understanding of the basic concepts of nuclear physics knowledge related to nuclear structure and properties, radioactivity, nuclear radiation and nuclear reactions.

3225075-2   Introduction to Scientific Communication (2 Credit Points)

Scientific communication is a science to convey scientific and technological facts to various groups, both professionals and the general public. Scientific communication can be done through mass media, electronic media, social media, scientific publications and other media. These media are sources of information for all people to understand the results and scientific processes carried out by a researcher. In this course, students are guided to communicate well, understand the audience, practice making information, communicate with the public, convey information in scientific language in scientific forums, convey information in popular language to the general public and communicate with the mass media. By attending this course, students are expected to be able to convey the results of their research,

3005-207-2   Pre Thesis Seminar (2 Credits)

The Pre Thesis Seminar course examines the writing of scientific research proposals and presents them in the pre-thesis seminar. Through this course, students are expected to be able to make research proposals according to the problems and research methods used.

3005-402-4   Thesis (4 credits)

Thesis course is the process of research, making reports, presenting research results and being responsible for them in the thesis trial. Through this course, students are expected to be able to carry out scientific research according to the proposals that have been submitted, and to report and account for the results

E.   Study Program Elective Courses

3225609-3   Solids Physics (3 Credit Points)

The Solid Substance Physics course discusses the basic phenomena and classification of solids in order to comprehensively understand the structure/composition of solids, fermi-free electrons, electrical properties, semiconductors, magnetic properties and superconduction. After following this course, students are expected to be able to understand the basic concepts and theories of Solid Substance Physics so that they are able to study and apply them to solve material physics problems.

3225614-3   Physics of Magnetic Materials (3 Credit Points)

Magnetic Material Physics course discusses the phenomena of magnetic properties and materials to their measurements and applications. After taking this course,

students are expected to be able to have an understanding of the concepts and theories of magnetism in materials from magnetic materials for use in soft magnets and hard magnets which are applied to various technologies.

3225615-3   Physics and Semiconductor Technology (3 Credit Points)

The Physics and Semiconductor Technology course discusses the characteristics of various electronic components and the possibility of their development in practical applications as well as getting to know various electronic component fabrication technologies and how they work.

After taking this course, students are expected to be able to understand the basic workings of various microelectronic components and their laboratory fabrication processes.

3225618-3   Ceramic Physics (3 Credits)

The Ceramic Physics course discusses the definition and types of ceramic materials, their structure and effects on physical properties, thermodynamics, defects and their types on ceramic materials, diffusion of electrical conductivity, phase equilibrium, glass structure and formation, sintering and grain growth, mechanical properties, chemical properties. dielectric, magnetic properties, optical properties

After taking this course, students are expected to be able to recognize and understand types of ceramic materials, understand manufacturing methods, characterization of physical properties, functions and applications of ceramic materials.

3225 621-3   **X-Ray Diffraction (3 Credit Points)**
The X-Ray Diffraction course discusses the properties and characteristics of X-rays and their application in crystal structure analysis. After following this course, students are expected to be able to understand the properties of x-rays, structure and geometry of crystals, techniques and methods of measuring x-ray diffraction, methods of analyzing x-ray diffraction data.

3225605-2   Mechanical Properties of Materials (2 Credit Points)
The Mechanical Properties of Materials course discusses the concept of bonding and atomic crystal structure on the mechanical properties of materials. The discussion also includes the nature and effect of crystal defects on elastic and plastic deformations in crystals that affect the results of mechanical tests which include tensile tests, hard tests, impact tests, torsion tests, fatigue tests. The process of strengthening materials both chemically, mechanically and thermally is also discussed. After taking this course, students are expected to be able to understand the concepts of atomic bonding and crystal structure and understand the process of strengthening materials to be able to plan, produce and produce mechanical measurements of materials including tensile, hard, torsional, impact, fatigue tests.

3225 634-2   **Composite Physics (2 Credit Points)**
The Composite Physics course discusses the physics concepts of composite materials and the process of their formation in the form of thin layers. Types of composite

materials include metal, ceramic and polymer combinations and more specifically metal/nitride/carbide/oxide systems. Types of formation processes through deposition processes include electrodeposition, sputtering, spray, dip coating, vacuum arc etc. Characterization includes composition, morphology, crystal structure, mechanical properties, optical properties and electrical properties as well as magnetic properties. Its applications include the fields of mechanics, optics, electricity and magnetism. After following this course, students are expected to understand the physics concept of composite materials and the process of their formation, their physical properties, and their applications.

3225617-3   Metal Physics (3 Credit Points)

Metal physics course examines solidification, nucleation theory, crystal growth kinetics, grain boundary structure, solution solidification mechanism, metal microstructure, alloy thermodynamics (free energy diagram), solid and phase solutions, chemical potential and activation, preparation of solution phase diagrams binary, eutectic and eutectic reactions, diffusion, phase transformation, phase transformation kinetics, changes in properties and microstructure in Fe-C alloys, TTT / IT diagrams, CTT diagrams, basic concepts of corrosion, and experimental methods. After following this course, students are expected to be able to understand the mechanism of metal solodification, metal alloy design, phase diadram, phase transformation, physical properties, and experimental methods.

3225619-2   Materials Physics (2 credits)

Materials Physics courses include material classification, material classification and basic concepts about atoms, types and parameters of crystals and how to identify them, macroscopic properties of crystals, microscopic properties of crystals, phase diagrams and their parameters, types and processes of alloys. metal, non-metallic materials. After following this course, students are expected to be able to understand the classification of materials and the physical properties of materials.

3225 623-2   Electrical Properties of Materials (2 Credit Points)

The Electrical Properties of Materials course discusses the electrical properties and mechanisms of solid materials, especially the properties and characteristics of electrons as particles and waves through the metal-free electron model and energy band. Furthermore, the role of electrical properties in semiconductor devices, superconductors, dielectrics and magnetic materials is discussed. After following this course, students are expected to be able to explain about electrical properties, especially the behavior of electrons as particles and waves in solid materials as well as in application materials.

3225616-3   Polymer Physics (2 Credit Points)

The Polymer Physics course discusses the properties, characteristics, processing, measurements and applications of polymeric materials. After taking this course, students are expected to be able to understand the concepts of polymer physics starting from classification, properties, characteristics, processing, polymerization and its application.

3225610-3 Laser and Modern Optics (3 Credit Points)

The Laser and Modern Optics course explains the working principle of lasers and laser operating threshold conditions and is able to apply an energy meter measuring instrument to measure laser energy, apply lasers in coherent optics. After taking this course, students are expected to have the ability to understand electron transitions in atoms, the basics of laser work, laser operations, characteristics of laser beams and the application of coherent optics.

3225 624-2 Solar Cell Technology (2 Credit Points)

The Solar Cell Technology course discusses the introduction of Solar energy, silicon crystals as the basic material for making solar cells, solar modules and their application to solar home systems, calculating the current and voltage functions in solar modules, thin film solar cells optical as well as electrical characteristics and manufacturing methods as materials. basic photo voltaic. After taking this course, students are expected to have the ability to understand alternative energy from solar sources, especially in photo voltaic modules and their applications, thin film technology, manufacturing methods and their optical and electrical characterization.

3225 617-2 Condensed Matter Theory (2 Credit Points)

Condensed matter theory is an elective course for students taking computational material theory. This course aims to provide students with an in-depth understanding of material simulation which analytically is very difficult to find a solution for. The lecture begins with a discussion of the theoretical concepts of the electron model, such as the

electron gas theory and the delocalized electron theory. This material is given at the beginning of the lecture so that students learn the basic properties of the appearance of electric/magnetic properties in materials. After that, the material continued with the density functional. In this material, several approaches will be given, such as the Born-Oppenheimer approach and the Hartree-Fock approach. The next material is the theory of band energy. This concept is very useful when discussing the concept of metal materials, insulators, and semi-conductors. After that, the material discussed next is the electronic and magnetic structure in the material. This material includes an understanding of the electronic and magnetic properties of materials. For some cases, several theoretical models will be given. The final material is the Bose-Einstein condensation. In this material, an example of condensation in boson particles is given and some of the solutions that can be produced.

3225901-2   Environmental Physics (2 credits)

The Environmental Physics course discusses the comprehensive understanding of the environment (earth), mathematical methods, planet earth, electromagnetic radiation and radioactivity, fluid mechanics, evapotranspiration, soil and hydrology, marine and atmosphere, energy and the environment as well as natural resources and their uses. After taking this course, students are expected to have the ability to analyze the structure of the environment comprehensively, as well as to be able to implement technology without damaging the environment

3225903-2   Rock Physics (2 credits)

Rock Physics course discusses minerals, rock types and their formation processes, physical and mechanical properties of rocks, physical properties of porous media, rock deformation, rock elasticity, elastic waves, electrical properties of rock, thermal conductivity, and magnetic properties of rocks. After taking this course, students are expected to be able to study and apply the physical properties of rocks and minerals.

3225 907-2   Rock Magnetism (2 Credit Points)

The Rock Magnetism course discusses Geomagnetic, Paleomagnetic, basic principles of magnetism, magnetic fields, Remanence and magnetic induction. Diamagnetism and Paramagnetism, Ferro-, Antiferro-, and Ferrimagnetism, Hysteresis, Magnetic minerals in rocks, Mineralogy, Titanomagnetites, Physical theory in rock magnetism, Magnetic domains, Single domain grain theory, Magnetic viscosity, Size in single domain grains, Remanent, crystallization, Samples and measurements, Grouping of samples in magnetic fields, Sample measurement, Statistical methods, Statistical concepts, Fisher distribution, Test statistics, Calculation of paleomagnetic poles and their deviations. After taking this course, students are expected to have the ability to analyze the magnetic properties of rocks.

3225801-3   Capita Selecta Computational Physics (3 Credit Points)

The Capita Selecta Computational Physics course is an elective course for students specializing in Complex Systems Physics and has taken Computer Programming

and Computational Physics courses. The aim of the course is to examine various elective topics in the field of computational physics that have not been discussed in the Computational Physics course. Lecture material also develops dynamically with references to national and international journal articles as study material for the research theme of a student's final project. The topics discussed are dynamic, including: numerical solutions of partial differential equations and their applications: finite difference method and finite element method; Ising model simulation for magnetic system modeling; computational physics of condensed matter; analysis of complex audio signals on sound physics, and more.

3225802-2 Physics Simulation (2 Credit Points)
The Physics Simulation course discusses the modeling or simulation of physical properties and phenomena using computation through the eigensystem, fast Fourier transform, Monte Carlo method, and event by event method. After taking this course, students are expected to be able to understand the eigensystem, fast Fourier transform, the Monte Carlo method and the event by event method in making physics modeling or simulations.

3225702-2 Programming Language C/C++ (2 Credits)
The C/C++ Programming Language course discusses computer programming using the C++ Programming Language. After taking this course, students are expected to be able to understand and use the C++ Programming Language to create programs and build an application system in the field of physics.

3225076-3   Introduction to Machine Learning in Physics (3 credits)

This course is an elective course for students specializing in Complex Systems Physics and has taken Computer Programming and Computational Physics courses.

The aim of the course is to provide students with insight into intelligent systems and their development by leveraging machine learning for various developments including control, recognition, object identification, and machine interaction and use. The topics covered in this lecture are: conception of intelligent systems, concepts of intelligent systems, building systems with user experience, implementing intelligent systems: running, managing, and measuring smart systems in practice, building intelligence on systems using various approaches, including machine learning (machine learning), intelligent systems development strategy.

3225077-3   Introduction to Intelligent Systems Physics (3 credits)

The Introduction to Intelligent Systems Physics course is an elective course for students specializing in Complex Systems Physics and has taken Computer Programming and Computational Physics courses. The aim of the course is to provide students with insight into intelligent systems and their development by leveraging machine learning for various developments including control, recognition, object identification, and machine interaction and use. The topics covered in this lecture are: conception of intelligent systems, concepts of intelligent systems, building systems with user experience, implementing intelligent systems: running, managing, and measuring smart systems in

practice, building intelligence on systems using various approaches, including machine learning (machine learning), intelligent systems development strategy.

3225 069-3   Digital Signal Analysis (3 Credit Points)

The Digital Signal Analysis course is an optional course for students specializing in Complex Systems Physics and has taken Computer Programming and Computational Physics courses. The aim of the course is to provide students with insight into the analysis and processing of non-stationary signals, such as those found in a wide range of applications including intelligent systems, biomedical engineering, telecommunications, and radar. Students will be introduced to Time-Frequency Signal Analysis and Processing methods that can be used to develop the required engineering application systems. The topics discussed in this lecture are: the concept of signal analysis, mathematical description of signals, description and analysis of systems, Fourier series, Fourier transforms, Fourier transforms and systems analysis, sampling techniques,

3225706-3   Digital Image Processing (3 Credits)

The Digital Image Processing course will provide an understanding and application of Physics in digital signal processing and its use in various related fields. The lecture material starts from the basics of image processing. Lecture materials include: Fundamentals of Digital Imagery, Image Enhancement in the Spatial Domain, Image Enhancement in the Frequency Domain, Image Coloring Process, Wavelet and Multiresolution Process, Image Compression, Image Morphology Process, Image

Segmentation, Image Representation and Description, Object Recognition, Applications in the Medical, Communications, Defense, Transportation and other Industries.

3225703-3   Sensor Technology (3 Credit Points)

Sensor Technology course discusses sensors and their characterization, physical properties of sensors, pressure sensors, flow sensors, light sensors, motion sensors, temperature sensors, radiation detectors, chemical sensors, magnetic sensors, new technologies and materials for sensors. After taking this course, students are expected to be able to analyze the basic principles of sensors, sensor materials, fabrication and characterization properties of each sensor, as well as apply sensor applications to various fields of life.

3225702-2   Control System (2 Credits)

The control system course provides students with the opportunity to study and understand regulatory systems, system modeling & block diagrams, the definition of system response, the definition of system stability, the process of designing a root locus system, Bode diagrams, the process of designing and applying digital control systems. After taking this course, students are expected to understand the basic principles of control systems and to design and apply control systems.

3225701-3   Microprocessor and Interface (3 Credits)

The Microprocessor and Interface course discusses the development and technology of microprocessors, microprocessor architects, differences between

microprocessors and microcontrollers and computers, microcontroller architects, programming on microcontrollers, time control and counting, serial communication on microcontrollers, microcontroller applications and interface systems. After following this course, students are expected to be able to analyze the basic principles of microprocessors and microcontrollers, and be able to apply them to create various interface programs.

3225070-2   Ultrasonics: theory and application (2 credits)

Ultrasonic Waves course: theory and application examines the use of ultrasonic waves in various fields, including non-destructive testing of materials, measurement of position and dimensions, measurement of fluid flow and other physical quantities, medical technology, manufacturing and biotechnology are currently growing very rapidly, so the need for Experts in ultrasonic technology continue to grow. After taking this course, students are expected to have an understanding of physics concepts, especially ultrasonic waves and be able to apply them in research.

3225071-2   Basic Biomedical Instrumentation (2 Credit Points)

The Basic Biomedical Instrumentation course provides basic knowledge for students who are interested in conducting research in the field of medical physics, reviewing concepts regarding the basics of biomedical instrumentation, limits and regulations of medical instrumentation systems, biomedical signal sources, measuring instruments, recording and monitoring,

processes and transport properties in the body. , Therapy equipment, physiotherapy and radiotherapy devices. After taking this course, students are expected to be able to understand the basics of biomedical instrumentation system design and know its characteristics.

3225026-2   Advanced Electronics

The Advanced Electronics course is an elective course for Instrumentation Physics majors. This course will discuss the principles of multistage amplifiers using transistors, power amplifier principles, basic principles of JFETs and MOSFETs, JFET and MOSFET applications as amplifiers and switching, filter circuits along with frequency response, oscillator circuits, and feedback circuits. After taking this course, students are expected to be able to analyze electrical circuits using the circuit theorem and apply it to various electronic circuits.

3225072-2   Industrial Electronics (2 Credit Points)

The Industrial Electronics course examines the concepts of electronics, components, and control systems used in industrial control processes, as well as an introduction and overview of industrial instrumentation systems. After taking this course, students are expected to have an overview and understanding of the application of electronics and instrumentation in the industrial world.

3225611-2   Physics Workshop (2 credits)

The Physics Workshop course teaches students to carry out practical activities using a Physics workshop. After taking this course, students are expected to be able to understand how tools work and practice and make various forms of materials.

3225608-3   Quantum Mechanics (3 Credit Points)

This course discusses mathematical concepts more deeply in the formulation and analysis of multiple-particle quantum systems through the perturbation and scattering approach. After attending this course, students are expected to be able to understand the formal concepts of quantum mechanics in Dirac notation and be able to apply them in the fields of science and engineering.

3225607-3   Electromagnetic Fields (3 Credit Points)

The Electromagnetic Field course discusses the introduction to the theory of electromagnetic waves formulated by Maxwell: the result of the marriage between electric theory and magnetic theory into electromagnetic theory, electromagnetic wave energy, electromagnetic wave pointing vector, electromagnetic wave impedance. Propagation of electromagnetic waves: propagation of electromagnetic waves in a conductive-non-conductive medium, the boundary conditions are met by electromagnetic waves in two different mediums. Waveguide: TE, TM, and TEM modes on square and cylindrical shapes. Potential fields: electric and magnetic potential, gauge freedom (Coulomb and Lorentz gauge), Jefimenko potential (forward and reverse potential), Lienard-Wiechert potential. Radiation dipole: electric dipole, magnetic dipole, radiation resistance, the working principle of some antennas.

3225000-2   Introduction to Radiation Physics (2 Credit Points)

This course is an optional subject with the requirements

that the student has taken courses in Mathematics, Physics, Modern Physics. After attending this course, students are expected to understand the basic principles and concepts of radiation physics used in the medical field. After attending this course, students are able to understand the factors that influence the effects of radiation, understand the dangers of radiation and design an action to reduce the dangers of radiation.

3225066-2 Entrepreneurship (2 Credit Points)

The Advanced Electronics course is an elective course for Instrumentation Physics majors. This course will discuss the principles of multistage amplifiers using transistors, power amplifier principles, basic principles of JFETs and MOSFETs, JFET and MOSFET applications as amplifiers and switching, filter circuits along with frequency response, oscillator circuits, and feedback circuits. After taking this course, students are expected to be able to analyze electrical circuits using the circuit theorem and apply it to various electronic circuits.

F. Free Learning Courses

3225 xxx-x Measurement and Data Acquisition System (3 Credits)

The Measurement Method and Data Acquisition course supports the abilities possessed by graduates of the Physics study program in measuring and analyzing data. The discussions that will be delivered in this course include: Concepts of Measurement Systems, Measurement System Instruments, Static and Dynamic Characteristics, Uncertainty in Measurement, Calibration, Data Acquisition Systems, Measurement of Temperature, Pressure, Flow

Rate and Mechanics. Students who have taken this course are expected to be familiar with the basic concepts of measurement systems, be able to design and conduct experiments according to procedures, be able to analyze measurement data and be able to analyze errors generated in measurements.

3225026-4 Field Work Practice (4 credits)

Field Work Practice (PKL) courses are mandatory curricular activities for every non-educational program student whose implementation is carried out outside the campus, especially in research institutions. During this course, students are expected to be able to apply the knowledge and skills acquired on campus to work in a research team, to increase discipline and responsibility in carrying out their duties.

3225xxx-3 Industrial Internship (3 credits)

Industrial Internship courses are off-campus learning activities as part of students' self-development in the world of workaccording to the area of interest. Students are expected to be able to identify various problems in the world of work, gain real experience in the world of work, be able to apply the knowledge and skills acquired on campus in the world of work.

3225xxx-x Independent Study Courses I-III

Independent learning courses are courses that can be taken by students outside the Physics Study Program or outside the Universitas Negeri Jakarta campus. This course is part of the process that students carry out to obtain Graduate Learning Outcomes (CPL) determined by the

Physics Study Program. Through this course, students can gain learning experiences, add scientific insight and skills in any field according to student interests that can support the implementation of research and preparation for entering the world of work.

K. LECTURER
1. Lecturer of Physics Study Program

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2. Permanent Lecturer of S1 Physics Education Study Program

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3. Permanent Lecturer of Master's Degree Physics Education Study Program

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3.	0806	Prof. Dr. Yetty Supriyati, M.Pd	ysupriyati@unj.ac.id
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ACADEMIC HANDBOOK 1 CHEMISTRY UNJ INDEPENDENT-INDEPENDENT LEARNING CAMPUS CURRICULUM

A. INTRODUCTION

The Academic Guidebook for Chemistry students (S1), FMIPA, Universitas Negeri Jakarta (UNJ) in 2021, is part of the UNJ or FMIPA Academic Guidebook which is an academic guide for Chemistry students batch of 2021 to take lectures at the Chemistry Study Program, FMIPA UNJ. This book contains the Chemistry Study Program curriculum including the distribution of courses and the Semester Credit System (SKS) load each semester which is organized into 8 (eight) semesters of lectures for the Independent Campus Independent Learning Program (MBKM) and the Regular Program.

B. ACADEMIC VISION

Become a study program that produces professional chemistry graduates who can compete at national and international levels, are responsive to the development of science and technology, have social and environmental sensitivity.

C. STUDY PROGRAM MISSION

1. Organizing professional education in chemistry based on morals and ethics to produce graduates who are independent and have expertise in chemistry and are able to continue their education at a higher level.

2. Carry out research that is useful for deepening and developing MIPA sciences, especially in the field of chemistry (bioscience and materials chemistry).
3. Carry out community service to develop sensitivity and social responsibility of all academics, based on the scientific field they are engaged in.
4. Collaborating with various parties in developing institutions and human resources.

D. PROFILE AND QUALIFICATIONS OF GRADUATES

The Profile of Graduates of the Chemistry Study Program is determined based on:

1. The Indonesian National Qualifications Framework (KKNI) level 6 (S1) is a competency qualification rating framework that can juxtapose, equalize, and integrate between the education sector and the field of job training and work experience.
2. Conducting alumni tracking studies (tracer study)
3. Input from the Association of Professional Associations (Indonesian Chemical Association)
4. Conducting market needs analysis related to the graduates that will be produced and distributing questionnaires to stakeholders or stakeholders to get a profile that is really needed by the community.
5. Identify the role of graduates based on the purpose of holding the study program in accordance with the Vision and Mission of the Universitas Negeri Jakarta.

The Profiles of Graduates of the Chemistry Study Program (Table 1) include scientists/academics, industrial practitioners, and science entrepreneurs who are innovative, creative, competitive, responsive to the

development of science and technology, transformative, and have social sensitivity to the environment.

Table 1. Profile of Graduates and their descriptions

NO	GRADUATE PROFILE	GRADUATE PROFILE DESCRIPTION
T 1	Scientist/academic	able to develop themselves professionally and sustainably in studies to a higher level both formally and informally (certification) as well as providing alternative solutions to problems in chemistry in general or in bioscience and material chemistry in particular, compiling scientific papers and communicating them effectively.
T 2	Industrial Practitioner	able to apply knowledge and skills of laboratory and instrumentation in the field of chemistry and develop themselves professionally in solving problems in applied fields that are relevant in industry
T 3	science *entrepreneur*	Able to develop and apply entrepreneurial principles in the relevant chemical field

E. CHEMICAL STUDY PROGRAM LEARNING ACHIEVEMENTS

Learning Outcomes of Graduates (CPL) of the Chemistry Study Program, FMIPA UNJ (Table 2), which refers to the CPL Chemistry formulation agreed in the HKI forum and in

accordance with ASIIN's SSC (Subject Specific Criteria). The Chemistry Study Program, FMIPA UNJ added several standards that refer to the achievement of the Vision and characteristics of the study program.

Code	Graduate Learning Outcomes
CPL 1	Able to show religious attitude, humanity, love for the homeland, nationalist, internalize the spirit of independence, responsibility, and entrepreneurship.
CPL 2	Able to demonstrate excellence, honesty, competitiveness, leadership, and have social sensitivity towards society and the environment.
CPL 3	Able to demonstrate performance independently or as part of a team in a professional and measurable manner by applying interdisciplinary knowledge and skills, critical thinking, and creatively in the context of being a lifelong learner
CPL 4	Understand the basic principles of science and mathematics for solving various chemistry problems
CPL 5	Able to master knowledge of chemistry (organic, inorganic, analytical, physical and biochemical chemistry) which includes structure, properties, function, change, energy and dynamics, identification, separation, characterization, transformation, and synthesis of micromolecular chemicals and their application
CPL 6	Understand concepts and applications in the field of biosciences and materials chemistry to solve problems in the field of chemistry and its applications

CPL 7	Understand operational knowledge about functions, how to operate chemical instruments, as well as analysis of data and information from these instruments
CPL 8	Understand work safety, ethics, environmental issues and policies related to the chemical field
CPL 9	Able to communicate ideas, scientific research results clearly in oral or written format to scientists and the wider community
CPL 10	Able to carry out laboratory and research work by paying attention to the safety and security of laboratory work and applying responsible scientific behavior.
CPL 11	Able to obtain, process, interpret, and evaluate scientific data and produce conclusions by considering scientific and technological aspects as well as scientific ethics.
CPL 12	Able to solve science and technology problems in chemistry independently based on relevant scientific methodologies

F. GRADUATE DEGREE

Bachelor of Science (S.Si)

G. STUDY PROGRAM ACCREDITATION

The Chemistry Study Program is accredited by the National Accreditation Board for Higher Education (BAN PT) of the Ministry of Education and Culture of the Republic of Indonesia with the latest accreditation rating of A by decree (SK) BAN PT No 822/SK/BAN-PT/Akred/S/III/2018 dated 20 March 2018, Validity period until 20 March 2023.

H. RESEARCH METHODS

Assessment Assessment of courses is carried out through process assessment, assignments, mid-semester examinations, end-of-semester examinations and practice. The assessment of student study results is based on the criteria in table 3 below:

Table 3. Assessment Criteria

Mastery Level	Mark	Weight
86-100	A	4
81-85	A-	3.7
76-80	B+	3.3
71-75	B	3
66-70	B-	2.7
61-65	C+	2.3
56-60	C	2
51-55	C-	1.7
46-50	D	1
0-45	E	0

I. CURRICULUM

1. Curriculum Structure

Structure Curriculum structure The Chemistry study program consists of 4 (four) groups of courses that must be completed during a minimum study period of 8 (eight) semesters and a maximum of 14 (fourteen) semesters with a credit unit range of 144-146 credits. To become a chemistry graduate, students are required to write a final project (thesis) based on the results of research in the field of chemistry.

The four course groups consist of the General Course (MKU) group, the Faculty feature courses, the Study Program feature courses consisting of Compulsory and

Elective Courses and the Independent Learning Activity Course at the Independent Campus (MBKM). The structure of the courses in the Chemistry Study Program curriculum is presented in table 4.

Table 4. Structure of Courses in Chemistry Study Program Curriculum

No	Group	Status	Credits
1	General Course (MKU)	Must	14
2	Faculty Characteristics Course	Must	1
3	Compulsory Courses Characteristics of Study Programs	Must	103
4	Elective courses	Choice	26
	Amount		144-146

The difference between the regular program and the MBKM is the elective courses taken. The provisions for the structure of elective courses for the regular program are presented in table 5 below:

Table 5. Structure of elective courses for the Regular Program of Chemistry Study Program

No	Elective courses	Credits
1	Outside PS in PT (minimum)	6
2	Outside PS outside PT (minimum)	6
3	In PS	14
	Amount	**26**

The provisions for the structure of the MBKM program elective courses are presented in table 6 below:

Table 6. Structure of Elective Courses for the MBKM Chemistry Study Program

No	Elective courses	credits
1	Elective courses in the Study Program	6
2	MBKM course conversion	20
Amount		**26**

J. DISTRIBUTION OF COURSES

Code	Subject	credits	Semester							
			1	2	3	4	5	6	7	8
GENERAL COURSES (14 credits)										
00051122	Pancasila	2	2							
0051142	Indonesia Language	2	2							
00051112	Citizenship	2		2						
00052033	Religion	2		2						
00053192	Data Raya and Programming	2			2					
00053202	Logic and Scientific Reasoning	2				2				
00053182	Education Insights	2						2		
MK CHARACTERISTICS OF FACULTY (1 Credit)										
30051122	Olympism	1	1							
MK CHARACTERISTICS OF PRODI (MANDATORY 103 CREDITS)										
33250023	Chemistry Math	3	3							
33251083	Basic Chemistry 1	3	3							
33251071	Basic Chemistry 2	3		3						
	Basic Chemistry Practicum	2		2						

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Code	Subject	credits	Semester 1	2	3	4	5	6	7	8
33250891	Basic Physics	2	2							
32251012	Basic Physics Practicum	1	2							
34150013	General biology	3	3							
	Bioscience	4				4				
	Material Chemistry	4				4				
33250332	K3 (Safety and safety of laboratory work)	2	2							
30050042	English	2	2							
	Entrepreneurship	2						2		
	Environmental Science	2		2						
33250933	Qualitative and quantitative analytical chemistry	3			3					
33250222	Qualitative and quantitative analytical chemistry practicum	2			2					
33250233	Separation Chemistry	3				3				
33250333	Chemical Analysis Instrument	3					3			
	Practical Analysis of Instrumental Chemistry and separation	2					2			

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Code	Subject	credits	Semester							
			1	2	3	4	5	6	7	8
30055053	Atomic Structure and Structure of Inorganic Compounds	3		**3**						
	Basic Inorganic Reaction	2			2					
33250303	Main Class Chemistry	2				2				
	Transition Metals and Complex Compounds	3					3			
	Inorganic Chemistry Practicum	2					2			
	Organic Chemistry	4			4					
	Organic Compound Reaction	4				4				
	Organic Chemistry Practicum	2			2					
33250193	Chemical Thermodynamics	3		**3**						
33250263	Chemical Kinetics	3			3					
	Physical Chemistry Practicum	1				1				
	Quantum Mechanics	3					3			
33250343	Structure and Function of Biomolecules	3			3					
33250393	Biomolecular Metabolism	3				3				
	Biochemistry Practicum	2				2				

Code	Subject	credits	Semester							
			1	2	3	4	5	6	7	8
	Bioscience	4				4				
	Material Chemistry	4				4				
33250103	Determination of the Structure of Organic Compounds	3					3			
	Material characterization method	3					3			
33250632	Chemistry Seminar	2						2		
30052072	Pre Thesis Seminar	2							2	
	Research Methodology and statistics	3						3		
30054024	Essay	4								4
MK CHARACTERISTICS OF PRODI (OPTIONS)										
33250582	Chemical environment	2								
33250042	Environmental Chemical Analysis	2								
	Green Analytical Chemistry	2								
	Chemometry	2								
33250442	Secondary Metabolite Organic Chemistry	2								
33251012	Capita Selecta Organic Chemistry	2								

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Code	Subject	credits	Semester							
			1	2	3	4	5	6	7	8
33250462	Organic Chemical Synthesis	2								
33251042	Determination of the Structure of Natural Compounds	2								
33250422	Surface Chemistry	2								
33250872	Material Chemistry	2								
33250572	Solid Substance Chemistry	2								
33250562	Polymer Chemistry	2								
33251053	Applied Electrochemistry	2								
33250652	Molecular Symmetry	2								
33150802	Organometallic Chemistry	2								
33250412	Bioinorganic	2								
33250822	Industrial Inorganic Chemistry	2								
33250362	Nanoscience and Nanomaterials	2								
33250742	Synthesis and Characterization of nanomaterials	2								
33250382	Inorganic Chemical Synthesis	2								
30055172	Inorganic Structure Elucidation	2								

Code	Subject	credits	Semester							
			1	2	3	4	5	6	7	8
	Advanced material characterization technique	3								
33250982	Biotechnology	2								
332500553	Microbiology	3								
33250402	Food Biochemistry	2								
	forensic biochemistry	2								
	medical biochemistry	2								
	halal food	2								
	Toxicology	2								
1. MBKM Research Internship	MBKM Research Internships can be converted to the following courses:									
	a. street vendors	6								
	b. Professional ethics	3								
	c. Creativity and innovation	3								
	d. Communication skills	2								
	e. Problem solving and decision making	3								
	f. Information and digital literacy	3								

Code	Subject	credits	Semester 1	2	3	4	5	6	7	8
	Total	20							20	
2. MBKM Industry Internship	MBKM Industrial Internships can be converted to the following courses:									
	a. street vendors	6								
	b. Professional ethics	3								
	c. Creativity and innovation	3								
	d. Communication skills	2								
	e. Problem solving and decision making	3								
	f. Information and digital literacy	3								
	Total	20							**20**	
3. MBKM Teaching Assistant	MBKM teaching assistance activities can be converted into the following courses:									
	a. Teaching Planning	3								
	b. Teaching methodology	4								
	c. Teaching practice	6								
	d. Evaluation of teaching activities	4								

Code	Subject	credits	Semester							
			1	2	3	4	5	6	7	8
	e. Reports and Dissemination of Teaching Results	3								
	Total	20							20	
4. Businessman	MBKM Entrepreneurial Activities can be converted into the following courses:									
	a. Social entrepreneurship	3								
	b. business ethics	2								
	c. Introduction to Management and business	2								
	d. Digital marketing	3								
	e. Businessman: 1) Entrepreneurial design and presentation 2) business practice 3) Entrepreneurship activity report	10								
	Total	20							20	
5. Student exchange	**Activity 5-8** MBKM can be converted to the following courses:									

Code	Subject	credits	Semester							
			1	2	3	4	5	6	7	8
6. Building a Village/KKN	Project Planning and Design/ IS	3								
	Project Management/IS	4								
7. Humanitarian Project	Project implementation/IS	6								
	Project Data Analysis/IS	4								
8. Independent Project	Report and Dissemination of Project Results/SI	3								
	Total	20							20	

K. DISTIBUTION OF COURSES PER SEMESTER

No	MK code	Courses (MK)	Theory	Practice	Practice	Amount
SEMESTER I						
			Credits weight			
1	33251083	Basic Chemistry 1	3			3
2	33250891	Basic Physics	2			2
3	32251012	Basic Physics Practicum		1		1
4	34150013	General biology	2	1		3
5	33250023	Chemistry Math	3			3
6	33250332	K3 (Occupational Safety and Security) Lab	2			2
7	30050042	English	2			2
8	30051122	Olympism	1			1
9	0051142	Indonesia Language	2			2
10	00051122	Pancasila Education	2			2
Total Study Load for Semester 1			19	2		21

No	MK code	Courses (MK)	Theory	Practice	Practice	Amount
SEMESTER 2						
			Credits weight			
1	33251071	Basic Chemistry II	3			3
2		Practical Chemistry II		2		2
3		Environmental Science	2			2
4	33250004	Organic	4			4

SEMESTER 2						
No	MK code	Courses (MK)	Credits weight			
			Theory	Practice	Practice	Amount
		Chemistry				
5	30055053	Atomic structure and structure of inorganic compounds	3			3
6	33250193	Chemical Thermodynamics	3			3
7	00053262	Religion	2			2
8	00051112	Citizenship Education	2			2
Total Study Load for Semester 2			19	2		21

3RD SEMESTER						
No	MK code	Courses (MK)	Credits weight			
			Theory	Practice	Practice	Amount
1	33250933	Qualitative and Quantitative Analytical Chemistry	3			3
2	33250222	Qualitative and Quantitative Analysis Chemistry Practicum		2		2
3	33250263	Chemical Reaction Kinetics	3			3
4		Organic Compound Reaction	4			4

3RD SEMESTER						
No	MK code	Courses (MK)	Credits weight			
			Theory	Practice	Practice	Amount
5	33250002	Organic Chemistry Practicum		2		2
6		Basic Inorganic Reaction	2			2
7	33250343	Structure and Function of Biomolecules	3			3
8	00053222	Data Raya and Programming	2			2
Total Study Load for Semester 3			**17**	**4**		**21**

SEMESTER 4						
No	MK code	Courses (MK)	Credits weight			
			Theory	Practice	Practice	Amount
1	33250233	Separation Chemistry	3			3
2		Physical Chemistry Practicum		1		1
3	33250393	Biomolecular Metabolism	3			3
4		Main group chemistry	2			2
5		Bioscience	4			4
6		Material Chemistry	4			4
7		Biochemistry Practicum		2		2
	00053202	Logic and Scientific Reasoning	2			2

Total Study Load for Semester 4	18	3		21

5TH SEMESTER						
No	**MK code**	**Courses (MK)**	**Credits weight**			
			Theory	**Practice**	**Practice**	**Amount**
1	33250333	Instrument Chemistry	3			3
2		Practical Chemistry Instruments and separation		2		2
3		Quantum Mechanics	3			3
4		Material Characterization Method	3			3
5	33250103	Determination of Organic Molecular Structure	3			3
6		Transition Metals and Coordination Chemistry	3			2
7		Inorganic Chemistry Practicum		2		2
Total Study Load for Semester 5			**15**	**4**		**20**

6TH SEMESTER						
No	**MK code**	**Courses (MK)**	**Credits weight**			
			Theory	**Practice**	**Practice**	**Amount**
1	33250632	Chemistry Seminar	2			2

6TH SEMESTER						
No	MK code	Courses (MK)	Credits weight			
			Theory	Practice	Practice	Amount
2		Research Methodology and statistics	3			3
3		Entrepreneurship	2			2
4		Education Insights	2			2
5		Molecular Spectroscopy	3			
		Choice	8			
Total Study Load for Semester 6			20			20

7TH SEMESTER						
No	MK code	Courses (MK)	Credits weight			
			Theory	Practice	Practice	Amount
1	30052072	Pre Thesis Seminar	2			2
2	Regular Program	Choice	16			16
	MBKM Program	MBKM	20			20
Total Study Load for Semester 7			18/22			18/22

SEMESTER 8						
No	MK code	Courses (MK)	Credits weight			
			Theory	Practice	Practice	Amount
1	30054024	Essay	4			4
Total Semester Study Load 8			4			4

MBKM Implementation Model

Smt-1	Smt-2	Smt-3	Smt-4	Smt-5	Smt-6	Smt-7	Smt-8
20 credits	20 credits	20 credits	20 credits	20 credits	20 credits	20 credits	4 credits
MKWU MK-Prodi in Study Program	MKWU MK-Prodi in Study Program	MKWU MK-Prodi inside & outside the study program at the same PT	MKWU MK-Prodi Inside & outside the study program at PT is the same	MK-Prodi inside & outside & Learning outside PT	MK-Prodi inside & outside the study program	Off-campus learning activities: MBKM	MK-Prodi inside & TA

Elective courses

No	MK CODE	COURSE NAME	Credits
Field of Analytical and Environmental Chemistry Studies		
1	33250582	Chemical environment	2
2	33250042	Environmental Chemical Analysis	2
3		Green Analytical Chemistry	2
4		Chemometry	2
	Field of Organic Chemistry Studies		
5	33250442	Secondary Metabolite Organic Chemistry	2
6	33251012	Capita Selecta Organic Chemistry	2
7	33250462	Organic Chemical Synthesis	2
8	33251042	Determination of the Structure of Natural Compounds	2

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No	MK CODE	COURSE NAME	Credits
Field of Physical Chemistry Studies			
9	33250422	Surface Chemistry	2
10	33250872	Material Chemistry	2
11	33250572	Solid Substance Chemistry	2
12	33250562	Polymer Chemistry	2
Field of Inorganic Chemistry Studies			
13	33251053	Applied Electrochemistry	2
14	33250652	Molecular Symmetry	2
15	33150802	Organometallic Chemistry	2
16	33250412	Bioinorganic	2
17	33250822	Industrial Inorganic Chemistry	2
18	33250362	Nanoscience and Nanomaterials	2
19	33250742	Synthesis and Characterization of Nano Materials	2
20	33250382	Inorganic Chemical Synthesis	2
21	30055172	Inorganic Structure Elucidation	2
22		Advanced Materials Characterization Techniques	3
Field of Biochemical Studies			
23	33250982	Biotechnology	2
24	332500553	Microbiology	3
25	33250402	Food Biochemistry	2
26		Forensic Biochemistry	2
27		Medical Biochemistry	2
28		Halal Food	2
29		Toxicology	2
Total			**58**

L. COURSE DESCRIPTION

1. General Course

a. Indonesia Language (2 credits)

This course aims to develop students' personalities so that they are able to speak Indonesian properly and correctly, have good personalities, are intelligent and care about others. The topics of discussion in this course are: a good, intelligent and caring personality, the meaning and function of the Indonesian language as a national and state culture, various languages, EYD, scientific language, words, terms, definitions, essay planning, scientific essay development, paragraph development , sentence effectiveness, word choice, reasoning in essays, written words and spelling, notation techniques, scientific writing techniques.

b. English (2 credits)

This course aims to make students have English language skills related to reading skills according to the field of study and discipline they are engaged in.

c. Islamic Religious Education (3 Credits)

This course studies the physical and spiritual balance in humans, human relations with Allah SWT, human relationships with: themselves, fellow humans, other creatures and their environment. Faith in the oneness of God Tawhid, the function and role of humans in the universe. The task of humans in building a world that is blessed by Allah SWT. The essence of the purpose of human life. The relationship between faith and good deeds. Man after death, the true purpose of life.

d. Citizenship Education (2 Credit Points)

This course serves as a source of value in society, personality development to become a complete Indonesian person, establishes a consistent personality in realizing the basic values of society, nation and state, fosters a sense of nationality and love for the homeland throughout life in mastering and implementing and developing science and technology and art. which he has with a sense of responsibility.

The basic competencies of civic education courses are so that students become professional scientists, have a sense of nationality and love for the homeland, are civilized democrats, become citizens who have high competitiveness, discipline, actively participate in building a peaceful life based on the Pancasila value system.

2. University Characteristics Course
Big Data and Coding (2 Credits)

In this course, students will study trends and aspects of big data (data on a large scale). This course emphasizes the introduction and implementation of data storage systems with large scale (volume), type (variety), and data storage speed (velocity). In addition, several data processing techniques and data mining for big data will also be discussed.

3. Faculty Characteristics Course
Olymphisum (1 Credit)

This course is the result of a collaboration between FMIPA UNJ and the Indonesian Olympic Committee (KOI) which began in 2013. By inculcating the values of

Olympiad, it is hoped that the character of leaders who are optimistic, honest, responsible, trustworthy and trustworthy will be formed. This course emphasizes the aspects of student attitudes in dealing with problems, both academic and non-academic.

4. **Expertise Courses**
   a. **Basic Chemistry I (3 credits)**
      This course studies basic laws, measurement concepts, classification of matter and change, development of atomic theory, structure and bonding in molecules, forms of matter and their changes in terms of macroscopic and microscopic properties and the accompanying energy effects. After attending this course, students are expected to be able to apply the basic concepts of chemistry in calculations, structural analysis and chemical changes.
   b. **Basic Chemistry II (3 credits)**
      This course studies the physical properties of solutions, chemical kinetics, chemical equilibrium, acids and bases, acid-base and solution equilibrium, thermodynamics, redox reactions and electrochemistry. The course also examines the chemistry of coordination compounds, nuclear chemistry, and organic-synthetic and natural polymers. After attending this course, students are expected to be able to understand the concept of chemistry and its application in everyday life.
   c. **Environmental Education (PLH) (2 credits)**
      This course comprehensively discusses ecology as the basis of environmental science, the basic

principles of environmental science, material and energy cycles, population and changes in population, population problems, the role of humans in ecosystems with all their impacts, and sustainable development in saving our earth from destruction. .

d. **K3 (Laboratory Work Safety and Security) (2 Credit Points)**

After taking this course, students are expected to be able to properly manage a chemical laboratory in accordance with occupational health and safety rules, and to be able to contribute to the process of developing chemistry in particular and science in general.

e. **Chemical Thermodynamics (3 Credit Points)**

This course studies the ideal gas equation, the real gas equation, the energy that accompanies the chemical change process, as well as the laws of thermodynamics and their application to chemical equilibrium, phase equilibrium and electrochemical equilibrium.

f. **Chemical Kinetics (3 Credit Points)**

This course studies the theory of gas kinetics, Maxwell Boltzman distribution, collision theory and the nature of the transport of substances to determine the rate of chemical reactions in basic reactions, successive basic reactions, unimolecular and complex reactions and their reaction mechanisms. This course also learns about the adsorption process on solid surfaces and the analysis of ion mobility in electrolyte solution systems, so that students are able to analyze the dynamic

properties and energy that accompanies various chemical changes.

g. **Quantum Mechanics (3 Credit Points)**

This course aims to make students understand the nature of chemical reactions through chemical bonds with the basis of quantum chemical analysis. Molecular symmetry material includes study topics such as classification of symmetry operations, analysis of the symmetry of water molecules, multiplication tables; group definition, subgroup, group example, rotation plane, mirror plane, inversion, stereographic projection; coordinate system, vector, angle and inner product, generalization, orthogonality and generalization, normality, and transformation and multiplication matrix; group representation, character table, character table properties, and character table calculations; classical description of molecular vibrations, eigenvalue problems; determination of symmetry in normal mode, use of internal coordinates; symmetrical properties of the wave function, exact wave properties, Harte-Fock approximation; diatomic molecule representation, triatomic, straight and bent; and LCAO-MO description, molecular orbital distribution, projection operations.

h. **Qualitative and Quantitative Analytical Chemistry (3 Credit Points)**

This course explains the basic supporting theory in analyzing a sample (covering Solutions & their properties, electrolyte dissociation, ion balance, pH, solubility and solubility products) and Qualitative

Analysis (covering preliminary analysis, separation and identification of cations and anions), as well as Quantitative Analysis (covering sampling technique, accuracy, precision, correction factor, volumetric and gravimetric analysis)

i. Separation Chemistry (3 Credits)
This course explains: the basic theories of separating a substance by distillation, extraction, electrolysis, coulometry, chromatography and their applications.

j. Chemical Analysis Instruments (3 Credit Points)
This course explains: theory and the use of various instruments in conducting quantitative and qualitative chemical analysis, through a chemical instrumentation method approach, which includes spectroscopic and chromatographic analysis which includes Introduction to Instrumental Analysis; Electromagnetic Radiation and Its Interaction with Matter; UV-Vis Spectrometry, Atomic Absorption Spectrometry; Infrared Spectrometry; Mass Spectrometry; Proton Magnetic Resonance Spectrometry.

k. Organic Chemistry (4 Credits)
This course discusses the structure and bonds in organic molecules, intra-molecular properties, molecular forces, chemical and physical properties, acidity and basicity, chemical classification and reactions based on functional groups, nomenclature based on IUPAC and trivial compounds. alkane hydrocarbons, alkenes, alkynes, benzene aromatic compounds, alcohols, ethers, aldehydes, ketones, amines, amides, carboxylic acids and their derivatives. In addition, this course discusses

molecular conformations based on Newmann projections, axial-equatorial concepts and cis-trans isomers in cyclic molecules, chirality of carbon atoms, mirror images, enantiomers, optical isomers of carbohydrate compounds, absolute rectus (R) and sinister (S) conformations.), Fisher projection of carbohydrate and amino acid compounds, racemic mixtures and their separation methods.

l. **Organic Compound Reaction (4 Credits)**

This course discusses the main reaction mechanisms in organic chemistry which include unimolecular (SN1) and bimolecular (SN2) nucleophilic substitution reactions, addition reaction mechanisms in alkene compounds (C=C), and addition of carbonyl groups (C=O) in aldehydes, ketones and carboxylic acids, unimolecular (E1), and bimolecular (E2) elimination reactions and electrophilic substitution (SE) reactions on aromatic benzene and substituted benzene. This course also discusses the mechanism of the reaction for the formation of cyclic compounds or the Perixlic reaction, and the mechanism of the molecular combination reaction or the Aldol and Claisen condensation reaction. Before going into the discussion of the reaction mechanism, we will first discuss the properties of reactive intermediates consisting of: Carbocation, Carbanion, Carben, free radicals.

m. **Elemental Chemistry (2 Credit Points)**

This course covers the study of atomic and elemental theory consisting of Bohr's atomic theory and wave mechanics. Hydrogen atoms and polyelectron atoms; atomic orbitals and quantum numbers; shield effect;

periodicity of the elements; boron and carbon group elements; elements of the nitrogen and oxygen groups; halogen elements and noble gases; lanthanides and actinides.

n. Molecular Structure And Reactivity (3 Credit Points)
This course consists of lattice energy; effect of ion size; metallic bond theories; crystal structure of metals and alloys; metal and alloy applications; chemical conceptualization; VSEPR theory; hybridization; and MOT; oxidation state; molecular structure and bond length; determination of molecular structure; dipole moment; and chemical forces.

o. Basic Inorganic Reaction (3 Credit Points)
Basic courses in inorganic reactions include acid-base theories, acid-base strength, bond energy and bond length in acids and bases, hard and soft acids and bases, and thermodynamic aspects in acids and bases; systems in aqueous and non-aqueous solvents, salt solubility; Elemental extraction, reduction potential, reduction stability in aqueous solvents, reduction potential diagram; water dissolving system; non-aqueous solvent system; salt solubility; elemental extraction techniques; reduction potential; and a reduction potential diagram.

p. Coordination Chemistry (3 Credit Points)
This course examines the concepts of coordination chemistry, namely: valence bond theory, crystal field theory, molecular orbital theory; nomenclature of coordination compounds; ligand classification; Complexing by monodentate ligands; complexing by

polydentate ligands; The concepts of isomerism and stereoisomerism in coordination chemistry; Distortion in the geometry of complex compounds; The thermodynamic and kinetic stability of the coordination compound; Factors affecting the stability of coordination compounds; The reaction mechanism of complex compounds; Application of coordination compounds; Application of coordination compounds; Recent research in the field of coordination compounds; and Coordination compounds and their potential applications.

q. **Structure and Function of Biomolecules (3 Credit Points)**

The subject of Structure and Function of Biomolecules which includes Theory and Experiments/Practicum aims to enable students to analyze and explain the structure, classification, physical and chemical properties, test reactions and functions of biomolecules in metabolism and daily life. Psychomotor skills developed after attending this course are that students are able to perform qualitative tests of amino acids, qualitative tests of proteins, analyze protein samples, isolate carbohydrates, qualitative tests of carbohydrates, isolate lipids, qualitative tests of lipids, analyze lipid samples, isolate enzymes, determine the effects (temperature, pH, incubation time, concentration of substrate, inhibitor, coenzyme) on enzyme activity.

r. **Basic Chemistry Practicum (2 credits)**

This course aims to make students able to understand theories and concepts through experiments, which include the ability to observe

chemical phenomena, analyze data, and make conclusions so that they can connect experiments and theories for basic chemistry 1 courses, as well as provide skills as a basis for conducting experiments. Furthermore. Experimental materials include: Proving Lavoiser's Law, Determination of Relative Atomic Mass of Substances, Chemical Reactions, Determination of Reaction Enthalpy Changes, Refining Refining, Separation, Properties of Elements, and the Periodic system.

s. Organic Chemistry Practicum (2 Credits)

This course aims to make students have an understanding of some equipment in an organic laboratory, as well as being skilled at using it in organic experiments. In addition, students have the ability to experiment with more complex organic molecules (natural materials) in terms of preliminary tests, isolation and purity. Practical material includes isolation in various ways (extraction, maceration, soxhletation), separation and purification, purity test, hydrolysis and others.

t. Inorganic Chemistry Practicum (2 Credit Points)

This course aims to make students better understand and be skilled in the basics of inorganic reactions, synthesis of inorganic compounds, and their purification. Practical material includes: recrystallization, photoelectric reactions, and determination of acid-base strength.

u. Qualitative and Quantitative Analysis Practicum (2 credits)

This practicum aims to make students acquire basic skills in analyzing a sample qualitatively and

quantitatively. Practical material includes: qualitative analysis in determining anions, single/mixed cations contained in a sample, quantitative analysis using volumetric methods including making standard solutions, determining the concentration of primary and secondary standards and determining the concentration of a chemical compound in a sample, and using indicators, quantitative analysis with gravimetric method in determining the concentration of a chemical compound/cation/anion contained in a sample.

v. Practicum of Chemical Analysis of Instruments and Separation (2 Credits)

This practicum course aims to make students skilled in using analytical chemistry equipment for analytical purposes, and able to design basic equipment schemes for separation analysis purposes. Practical materials include: analysis of the content of a sample using volumetric methods and separation methods by distillation, extraction, electrolysis and chromatography. In addition, it trains students in conducting sample analysis using chemical instruments both qualitatively and quantitatively. Practical material includes: sample analysis using volumetric, gravimetric, spectrometric, colorimetric, and photometric methods.

w. Physical Chemistry Practicum (1 Credit)

Train students to be skilled in determining physical chemical quantities through experiments, including relative atomic masses of gases/liquids, heat, heat of dissolution/neutralization, dissolution as a function of temperature, reciprocal dissolution, ternary

diagrams, activity and electrolyte conduction, reaction properties including determination of reaction order and reaction rate constant, acid catalyst, ionization constant, sugar inversion rate, viscosity, critical micelle concentration, determination of equilibrium constant.

x. Biochemistry Practicum (2 credits)

This course aims to make students understand and be able to conduct experiments on isolation, qualitative tests and sample analysis of amino acids, proteins, carbohydrates and lipids, kinetics of enzymatic reactions and isolation, sample analysis and DNA electrophoresis. Practical material includes: qualitative test of amino acids, and sample analysis, protein isolation, qualitative test and analysis of protein samples followed by isolation, qualitative test and analysis of carbohydrate, lipid samples, isolation and determination of activity and observation of factors affecting enzyme activity, isolation DNA, DNA sample analysis, and electrophoresis.

y.   Biomolecular Metabolism (3 Credit Points)

Aims for students to understand metabolic interrelationships in heterotrophic organisms, the citric acid cycle, ATP cycle and cell bioenergetics, electron transport, oxidative phosphorylation, regulation of ATP production and biomolecular metabolism including carbohydrate catabolism, photosynthesis, lipid catabolism, protein catabolism, carbohydrate biosynthesis, lipid biosynthesis. , biosynthesis of amino acids, biosynthesis of nucleotides and the control of their respective

metabolism and biosynthesis; In addition, students can develop and apply problem-based learning analysis to solve problems related to metabolism.

z. Chemistry Seminar (2 Credits)

This course aims to make students have the ability to study, understand the content of a scientific article in the field of chemistry, compile a report on the results of the study and submit it in a certain assessment forum.

aa. Research Methodology and Statistics (3 Credits)

This course discusses comprehensively the principles of scientific research. The discussion focuses on several concepts and definitions in research, theoretical exercises and hypothesis submission. Sampling techniques, types of research methods, experimental designs, measurements and measuring instruments, data collection and analysis techniques as well as research structures and research proposal writing and the role of statistics in research, strategy statistics, inferential statistics, and advanced data analysis .

bb. Pre-Thesis Seminar (2 Credits)

This course aims to make students have the ability to prepare an educational research proposal and be able to defend it in a certain assessment forum.

cc. Thesis (4 credits)

This course aims to make students have the ability to compile an educational research report and be able to defend it in a certain assessment forum.

5. **Elective Course Characteristics of Study Program**
   a. **Biotechnology (2 Credit Points)**
      This course aims to enable students to analyze solutions to various environmental problems using a biotechnology concept approach at the genomic, proteomics, and metabolomics levels through analysis of textbooks, review of journals, practicum, and assessment of information through various sources.

   b. **Environmental Chemistry (2 Credit Points)**
      This course discusses comprehensively about chemicals that exist in nature, the processes involving these materials that occur in the environment both academically and as a result of human activities which in addition to having a positive impact also have a negative impact on all life on this earth. .

   c. **Nanoscience And Nanomaterials (2 Credit Points)**
      This course is an introduction to the field of nanotechnology and advanced materials through related lecture topics such as: History and opportunities of nanoscience and nanomaterials; Definition and scope of study of the terms nanochemistry, nanoscience and nanotechnology; Types of nanomaterials; Effect of size on nanometer dimensions on chemical, physical and particle reactivity; nanomaterial synthesis techniques; analysis techniques and nanomaterial characterization benefits and risks of nanoscience and nanotechnology; nanomaterials application.

   d. **Secondary Metabolite Chemistry (2 Credit Points)**

Competencies that will be achieved in this course are students have understanding and skills in the field of natural material chemistry. The subject matter that will be delivered includes the diversity of secondary metabolites in terms of the molecular structure of the secondary metabolite group (terpenoids, steroids, phenylpropanoids, polyketides, flavonoids, alkaloids), biogenesis pathways (mevalonate, shikimate, acetate malonate, combined shikimate pathway and acetate malonate pathway). and the characteristics of the spectroscopic data (UV, IR, NMR and MS) besides studying various phytochemical screening methods on plant samples, isolation techniques (separation and purification by various chromatographic techniques) and secondary metabolite bioactivity tests.

e. **Microbiology (3 Credit Points)**

This course aims to enable students to analyze the solutions to various environmental problems at a basic level using a microbiological concept approach that includes aspects of morphology, physiology, genetics, microbial cultivation and their role in various fields of life such as medical microbiology, food microbiology and environmental microbiology through text book analysis, journal studies. , practicum, and assessment of information through various sources

f. **Applied Electrochemistry (2 Credits)**

This course discusses the concepts of electrochemistry, electrochemical socioeconomics, electrosynthetic techniques, electroanalytical techniques, and the application of electrochemical

techniques in the industrial world, electrochemistry for renewable energy and the development of electrosynthetic and electroanalytical research, especially in the field of advanced materials.

g. **Surface Chemistry (2 Credit Points)**

The course studies aspects of surface thermodynamics, adsorption isotherms, liquid-gas interfaces, liquid-liquid interfaces, solid-liquid interfaces, electrical aspects of surface chemistry. As well as Colloid, colloidal state, colloid stability. Learning in this course is given through a student-centered learning-oriented method, with assessment of learning achievement through test and non-test methods.

h. **Solid Substance Chemistry (2 Credit Points)**

Solid Substance Chemistry is a course that discusses about understanding of solids and the types of solids that exist in nature and synthesis results, methods for synthesizing solids, namely: Wagner, Thin Layer, and single crystals. A study on the characterization of solids which includes the characterization of the molecular structure by FTIR and NMR. Thermal characterization with DTA and DSC. Absorption characterization with UV-Vis. Chemical Crystallography and X Ray Diffraction (XRD) and the use of XRD to characterize the crystallinity properties of solids.

i. **Organic Chemistry Synthesis (2 Credit Points)**

In this course, students will gain basic knowledge about the synthesis of organic compounds in research and industry, especially those that have important uses in everyday life. The lecture material

that will be delivered is knowledge about the methodology of organic chemical synthesis which includes functional group interconversion, disconnection analysis, selection of synthone and synthetic equivalent compounds, making umpolung (polarity inversion), and functionalization of aromatic rings. The learning methods used include lectures/lectures, discussions, presentations, and assignments.

j. Determination of the Structure of Natural Compounds (2 Credit Points)

In this course, students are required to be able to interpret spectroscopic data (UV, IR, and NMR) to be able to determine the structure of natural compounds of phenolic or non-phenolic groups commonly found in plants. The group of phenolic compounds in question are flavonoids and stilbenoids while the non-phenolic compounds in question are terpenoid group compounds. The lecture material that will be delivered includes knowledge of IR and NMR spectroscopy which can be used to determine the basic framework of the natural compound in question. Furthermore, an understanding of the 2D NMR spectrum was developed to be able to determine the location of the functional groups and side groups that exist in the framework of these natural compounds. In addition, it will also explain the typical UV spectrum pattern in the identification of groups of phenolic compounds.

k. Food Biochemistry (2 Credit Points)

This course discusses the chemical composition, structure, chemical reactions, classification, function, and chemical properties of food ingredients including water, carbohydrates, proteins, fats and oils, vitamins, minerals, food colors, flavors, food additives, compounds. -Toxic compounds in foodstuffs, and enzymes and their functions in vegetable, animal/sea products and their processed products.

l. **Material Characterization Techniques (3 Credit Points)**

This course describes the concept of material characterization: material character, material character measurement, and material measuring tools.

m. **Environmental Analysis Chemistry(2 Credits)**

This course is directed to provide students with an understanding of 1) understanding, use and function of environmental analysis, 2) types of environmental quality parameters including water, air and soil environments, 3) physical, chemical and biological properties of the environment, 4) sampling techniques and preparation of environmental samples, 5) methods of environmental sample analysis and 6) interpretation of environmental quality from analytical data.

n. **Green Analytical Chemistry(2 Credits)**

This course discusses the understanding, concepts, and application of green chemistry in education or in everyday life. Green chemistry is also closely related to energy and its use, either directly or

indirectly, such as the use of a material in the manufacturing, storage and distribution process.

o. Chemometry (2 Credit Points)

This course studies how toextract information from chemical systems in a data-driven way. Chemometrics is inherently interdisciplinary, using methods frequently used in core data-analytic disciplines such as multivariate statistics, applied mathematics, and computer science, to address problems in chemistry, biochemistry, medicine, biology, and chemical engineering. In addition, learn the techniques of multivariate calibration, classification, pattern recognition, clustering, multivariate curve resolution, and other techniques.

p. Entrepreneurship (2 Credit Points)

This course aims to make students have an entrepreneurial mindset, so that they learn the notion of entrepreneurship, entrepreneurship, types of entrepreneurs, advertising, business plans, life circle products, entrepreneurship, and how to read entrepreneurial opportunities.

6. Independent Campus Activities Course

a. Internship/Work Practice

Internships or Field Work Practices are off-campus learning activities facilitated by universities as part of students' self-development in the world of work which is one of the requirements for completing studies. This learning activity is carried out in collaboration with partners, both companies, non-profit foundations, multilateral organizations, government institutions, and startups to apply

science and technology owned by students in accordance with student competencies in the field of science/study program. Agreements on internships/work practices between universities and industrial partners are stated in the MoU or cooperation agreement between the two parties.

b. **Teaching Assistant in Education Unit**

Teaching assistance is a process of field learning activities where students practice teaching in domestic and foreign education units with the guidance of lecturers and civil servants in schools. a process of teaching guidance given to students carried out by supervising lecturers and tutor teachers in formal and non-formal education units (course institutions and study groups) at home and abroad.

c. **Research**

Research in the concept of independent learning applied at the Universitas Negeri Jakarta (UNJ) adheres to the principle of independence in the right to choose the field of research to be occupied. Of course, through research that is in accordance with their interests, students are expected to be able to build critical thinking and produce creative/innovative research. The freedom to choose research themes is also accompanied by UNJ's support for lecturers at the study program level to have the widest possible collaboration with research partners at national and international levels. Independent research is a final project taken by students as one of the requirements to fulfill a bachelor's degree. The research is carried out under

the guidance of study program lecturers as well as lecturer collaboration with lecturers from outside universities as well as researchers from research institutes or industries at national and international levels. Students have the full right to choose the final project supervisor and choose the field of research and determine the research theme according to their interests. However, technically the implementation still considers the maximum number of guidance for each lecturer based on SN-DIKTI.

d. **Student exchange**

The objectives of holding student exchange practices include cross-campus study (domestic and overseas), living together with family at the destination campus, students' insight into Bhinneka Tunggal Ika (Unity in Diversity) will develop, cross-cultural and ethnic brotherhood will be stronger, build student friendships among students. regions, ethnicities, cultures, and religions, thereby increasing the spirit of national unity and integrity, and organizing the transfer of knowledge to cover educational disparities between domestic universities, as well as conditions of higher education in the country and abroad.

e. **Businessman**

These entrepreneurs, among others, apply entrepreneurship learning applications, provide opportunities for students who have an interest in entrepreneurship to develop their businesses early and are guided, deal with unemployment problems that result in intellectual unemployment from undergraduates, and are able to carry out initial

entrepreneurial practices with a comprehensive understanding of entrepreneurial concepts.

f. **Humanitarian Project**

This course involves students with youth, scientific competence, and interest in becoming "foot soldiers" in humanitarian and other development projects both in Indonesia and abroad. The objectives of the humanitarian project practice include preparing excellent students who uphold human values in carrying out their duties based on religion, morals, and ethics as well as training students to have social sensitivity to explore and explore existing problems and participate in the project.

g. **Building a Village/KKN**

The KKN program is a mandatory program with a weight of 2 credits which is carried out for at least 1 month, and for a maximum of 4 months. KKN is attended by UNJ students who take a minimum of 100 credits. KKN is carried out in semester 6 and is guided by lecturers from each department, under the coordination and guidance of the Community Service Institute (LPM). The Community Service Program aims to mature the minds of students and improve skills to be able to participate in implementing development programs in DKI Jakarta or other areas that become UNJ target areas.

h. **Independent Project**

This independent project is a program that is run to complement the curriculum that has been taken by students, completing topics that are not included in the lecture schedule, but are still available in the

syllabus of the study program or faculty. Independent project activities can be carried out in the form of cross-disciplinary group work. The objectives of independent study programs/projects include realizing student ideas in developing innovative products that become their ideas, conducting research and development (R&D)-based education, increasing student achievement in national and international events.

M. TEACHING STAFF

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ACADEMIC HANDBOOK
INDEPENDENT-INDEPENDENT LEARNING CAMPUS CURRICULUM

BIOLOGY STUDY PROGRAM IDENTITY (S1)

Study Program Name	:	Biology
Major	:	-
Faculty	:	Mathematics and natural science
University	:	STATE UNIVERSITY JAKARTA
Study program address	:	Gd. Hasjim Asj'arie Campus A UNJ Jl. Rawamangun Face East Jakarta UNJ Campus B Biology Laboratory Jl. Youth No. 10 East Jakarta
No. PS Phone	:	-
No. PS fax	:	-
Homepage PS	:	www.fmipa.unj.ac.id>biology
e-mail PS		biologi@unj.ac.id
No. SK Establishment	:	187/DIKTI/KEP/1998 12 June 1998
No. Operational Permit Decree	:	7114/D/T/KN/2011
Last accreditation score	:	B
No. Last accreditation decree	:	SK BAN-PT No. 1077/SK/BAN-PT/Akred/S/IV/2018
		Valid April 17, 2018 – April 17, 2023

S1 BIOLOGY STUDY PROGRAM, FMIPA UNJ

A. INTRODUCTION

The Biology Study Program is one of the non-educational study programs under the Faculty of Mathematics and Natural Sciences, Universitas Negeri Jakarta. This Study Program was established through Decree No. 187/DIKTI/KEP/1998 on June 12, 1998. Accreditation B with SK Accreditation Number: SK BAN-PT No. 1077/SK/BAN-PT/Akred/S/IV/2018. The Biology Study Program at UNJ is a study program that introduces students to education and research in the basic sciences of plants, animals and microorganisms, as well as their interactions with the biotic and abiotic environment. The scientific core developed refers to the KOBI (Indonesian Biology Consortium) which includes Cell and Molecular Biology, Physiology, Genetics, Structure and Development, Biosystematics and Evolution, Ecology, Big Data Analysis and Management.

At this time the policy of Merdeka Learning – Merdeka Campus launched by the Minister of Education and Culture is a framework to prepare students to become strong scholars, relevant to the needs of the times, and ready to become leaders with a high national spirit. Permendikbud No. 3 of 2020 gives students the right to study 3 semesters outside their study program. Through this program, the Biology study program prepares a curriculum that opens up opportunities for students to increase their knowledge and be able to interact with a more comprehensive world of work.

Human resources (lecturers and education staff) in the Biology Study Program have the potential to face technological developments in the era of the industrial revolution 4.0. Currently, there are 8 lecturers in the Biology

Study Program with a Doctoral (S3) background and 8 Masters (S2) graduates from IPB, ITB, UI, UNAIR, UNJ, Leiden University - Netherlands and MIE Universitay - Japan graduates. diverse backgrounds and expertise. At this time one lecturer is taking doctoral education, it is planned to graduate in 2021

B. VISION, MISSION AND GOALS

1. Study Program Vision

To become a leading provider of biological education and research at the ASIA level with a focus on biodiversity studies and conservation.

2. Study Program Mission

Carry out education, research and community service to produce superior human resources in exploring, conserving and utilizing biodiversity for human welfare.

3. The objectives of the Study Program are designed as follows

a. Understand basic mathematics and natural sciences, basic biology and other related fields.
b. Able to utilize his knowledge and skills based on research methodology to solve biological problems and other related problems
c. Able to communicate in team work to collaborate and create a network of cooperation (networking).
d. Have good ethics in academic, social, and environmental contexts
e. Able to develop knowledge for further study and work needs as a lifelong learner

C. GRADUATE PROFILE

1. Scientists and academics
2. Practitioners in the laboratory and in industry

GRADUATE PROFILE DESCRIPTION

Table 1. Profile of Graduates (PL) and their descriptions

No	GRADUATE PROFILE	GRADUATE PROFILE DESCRIPTION
OT 1	Scientists and academics *(Scientists and academics)*	Scientists and academics who are able to design and develop research in the laboratory and in the field and are able to transfer the acquired knowledge and have the motivation to study to a higher level of education.
OT 2	Practitioners in laboratories and industry *(Practitioners in laboratory and industry)*	Practitioners who are able to manage, analyze, make decisions on the data provided, carry out their duties with full responsibility, have appropriate laboratory safety standards including occupational safety and health concepts with good communication, good problem solving skills, and good understanding of ethics .

D. COMPETENCE

Table 2. Learning Outcomes of Graduates (CPL) of Biology Study Program

Area	Competence	Code	Learning Outcomes
Social Competence	Attitude (Attitude)	CPL 1	Demonstrate religious attitudes, good ethics, social care, responsibility, leadership.
	General Skills (General Skills)	CPL 2	Able to apply logical, critical, systematic, innovative, scientific thinking and methods in solving problems in biology and other related fields/
		CPL 3	Able to demonstrate good communication skills in social and academic contexts, disseminate scientific information communicatively and responsibly regarding the cultural environment, build networks and collaborations.
Special Competencies (Specialist Competencies)	Knowledge and understanding	CPL 4	Able to understand the concepts and applications of basic mathematics and the basics of science.

Area	Competence	Code	Learning Outcomes
		CPL 5	Mastering knowledge of cellular and molecular biology, physiology, genetics, structure and development, biosystematics and biodiversity, evolution, ecology in a comprehensive and scientific manner.
		CPL 6	Mastering other relevant sciences in an integrated and sustainable manner
	Special Skill (Specific Skills)	CPL 7	Able to apply the scientific method in solving a problem in biology and other relevant contexts that include approaches in big data analysis.
		CPL 8	Able to apply biological sciences in designing and producing creative and innovative products on an ongoing basis.
		CPL 9	Able to plan, manage, implement, and evaluate laboratory and field assignments independently by considering

Area	Competence	Code	Learning Outcomes
			environmental health and safety.

E. GRADUATE DEGREE

Students who have met the graduation requirements can be graduated by obtaining the title: S.Si.

F. ACCREDITATION

Accreditation Score B. No SK BAN-PT No. 1077/SK/BAN-PT/Akred/S/IV/2018.

G. EVALUATION

The passing value of a course is based on the assessment of the Mid-Semester Examination (UTS), the value of the Final Semester Examination (UAS), the value of both independent and structured assignments. Some courses are integrated with practicum, so the assessment is combined with practicum scores. The final grade of the course is calculated

based on the weighting of each assessment source. The assessment score refers to the rules set by the University, namely:

Table 3. Value and Weight of Assessment

Mastery Level	Mark	Weight
86-100	A	4
81-85	A-	3.7
76-80	B+	3.3
71-75	B	3
66-70	B-	2.7
61-65	C+	2.3
56-60	C	2
51-55	C-	1.7
46-50	D	1
0-45	E	0

H. CURRICULUM-INDEPENDENT LEARNING (STRUCTURE, DISTRIBUTION, AND COURSE DESCRIPTION) BIOLOGY STUDY PROGRAM

Table 4. Groups of Courses and Weight of Curriculum Credits

No	Course Group	credits
1	General Course (MKU) – Compulsory	16
2	Basic Skills Course (MDK) – Compulsory	89
3	Study Program Courses (MKPS)	
	3.1. Expertise and Supporting Courses (MBKP) – Elective	21
	3.2. Independent Learning Activities Course (MKMB) – Options	18
TOTAL		144 - 145

DISTRIBUTION OF COURSES

Table 5. Distribution of Courses in Each Semester

No	MK code	Subject	credits	1	2	3	4	5	6	7	8
A.	**National Compulsory Courses**										
1		Religion	2	2							
2	00051112	Pancasila	2	2							
3	30050062	Indonesia Language	2	2							
4	00051062	Citizenship	2		2						
B.	**University Compulsory Courses**										
5		Logic and Scientific Reasoning	2		2						
6		Data Raya and Programming	2			2					
7		Education Insights	2		2						
			14								
C.	**Basic Skills Course (MDK)**			1	2	3	4	5	6	7	8
8	34250862	English – Biology	2		2						
9	34251632	General biology	3	3							
10	34251641	practice. General biology	1	1							
11	32251012	Basic Physics	2	2							

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12	32251021	Basic Physics Practicum	1	1							
13	34251612	K3 Biology Laboratory	2	2							
14	34251652	Basic chemistry	2	2							
15	34251661	Basic Chemistry Practicum	1	1							
16	34250093	Basic mathematic	3	3							
17	34251673	Biochemistry and Organic Chemistry	3		3						
18	34251681	Biochemistry and Organic Chemistry Practicum	1		1						
19	34251693	Animal Structure and Development	3		3						
20	34251701	practice. Structure and Development. animal	1		2						
21	34251713	Plant Structure and Development	3		3						
22	34251721	practice. Tumb's Structure and Development.	1		1						
23	34251732	Biodiversity and Cryptogamy Systematics	2			2					
24	34251741	practice. Biodiversity & Cryptogamy Systematics	1			1					
25	34251752	Invertebrate Biodiversity and Systematics	2			2					
26	34251761	practice. Invertebrate Biodiversity & Systematics	1			1					
27	34250603	Cell Biology	3			3					
28	34250013	Environmental Science	3			3					
29	34250142	Basic Statistics	2			2					

30	34251772	Biodiversity and Phanerogamy Systematics	2			2				
31	34251781	Prakt.Biodiverstas and Phanerogamy Systematics	1			1				
32	34251842	Vertebrate Biodiversity and Systematics	2			2				
33	34251851	practice. Vertebrate Biodiversity and Systematics	1			1				
34	34251793	Genetics	3			3				
35	34251801	Genetics Practicum	1			1				
36	34251822	Microbiology	2			2				
37	34251831	Microbiology Practicum	1			1				
38	34251812	Biological Research Methods	2			2				
39	34251373	Biology-Based Entrepreneurship	3			3				
40	34251862	Molecular Biology	2				2			
41	34252051	Molecular Biology Practicum	1				1			
42	34251893	Animal physiology	3				3			
43	34251901	Animal Physiology Practicum	1				1			
44	34251913	Plant Physiology	3				3			
45	34251921	Plant Physiology Practicum	1				1			
46	34250812	Experimental design	2				2			
47	34251873	Basic Ecology	3						3	

No	Code	Course	SKS	1	2	3	4	5	6	7	8
48	34251881	Basic Ecology Practicum	1						1		
49	34250212	Evolution	2						2		
50	34251932	Plant Tissue Culture	2						2		
51	34251941	Plant Tissue Culture Practicum	1						1		
52	34251952	Scientific Writing Techniques	2						2		
53	34251092	Biotechnology	2						2		
54	34251202	Field Work Lecture (KKL)	2							2	
55	30052072	Research Proposal Seminar	1							1	
56	34251961	**Biology Seminar (Research Results Seminar)**	1								1
57	30054024	Essay	4								4
			93								
D.	**Study Program Courses**			**1**	**2**	**3**	**4**	**5**	**6**	**7**	**8**
C.1. Expertise and Supporting Courses											
	Animal Biology Bidang										
58	34251492	Animal Histology	2			2					
59	34251502	Animal Behavior	2		2						
60	34250822	Animal Bioethics	2		2						
61	34250512	Animal Microtechnics	2				2				

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No	Code	Course						
62	34250482	Ornithology	2				2		
63	34251972	Enzymology	2					2	
64	34251422	Animal Reproductive Biology	2					2	
65	34252042	Animal Endocrinology	2					2	
66	34251172	Immunology	2					2	
67	34250262	Experimental Animal Management	2					2	
68	34251992	Endo Animal Parasitology	2					2	
69	34251192	Teratology	2						2
70	34251432	Animal Biotechnology	2						2
71	34251982	Ecto Animal Parasitology	2						2
			28						
	Plant Biology Bidang								
72	34251523	Horticulture Basics	3		3				
73	34252162	Physiology	2		2				
74	34252152	Briology	2			2			
75	34250532	Economic Botany	2			2			
76	34250662	Pteridology	2			2			
77	34250682	Plant Microtechnics	2				2		

No	Code	Course							
78	34251523	Plant Pathogenic Microbes	3				3		
79	34252073	Hara's Science	3					3	
80	34250852	Plant Biotechnology	2					2	
81	*34252122*	*Plant Secondary Metabolism*	2					2	
82	34250721	Plant Ecology	2						2
83	**34251553**	***Plant Reproduction and Breeding***	3						3
			21						
		Field of Microbiology and Mycology							
82	34250462	Mycology	2		2				
83	34250842	Microorganism Biosystematics	2			2			
84	34251402	Yeast Biology	2			2			
85	34250642	Environmental Microbiology	2			2			
86	34251382	Bacteriology	2				2		
87	34251533	Food & Industrial Microbiology	2				2		
88	34251393	Fungi Biodiversity	3				3		
			15						
		Basic Biology, Ecology, Multidisciplinary							
89	34251412	Human Biology	2		2				

No	Code	Course	Credits	1	2	3	4	5	6	7
90	34251132	Nutrition and Health Science	2			2				
91	34250442	EIA	2					2		
92	34252132	Population Genetics	2					2		
93	34250772	Limnology	2						2	
94	34251102	Biogeography	2						2	
95	34252113	Natural Resources and Environment Management	3						3	
96	34252032	Geographic Information System (GIS)	2							2
97	34250002	Marine Ecology	2							2
98	34252103	Tropical Forest Ecology	3							3
99	34251462	Basics of Bioinformatics	2							2
100	34251542	Proteomics	2							2
101	34250282	English II	2							2
			33							
E. Independent Campus Supporting Courses				**1**	**2**	**3**	**4**	**5**	**6**	**7**
	MK outside the study program									
102	34252192	Environmental Statistics	2						2	
	MK Outside University (E-learning Biology FMIPA UI - MBKM)									
103	34252093	Entomology 34250473	3					3		

No	Code	Course	Credit						
104		Endocrinology	3					3	
105	34252002	Conservation Biology	3					3	
106	34252172	Conservation Genetics	2					2	
107	34251112	Plant Ecophysiology	2						2
108	34252063	Marine Life Physiology	3						3
109		MBKM Permata Sakti	4						4
			20						
	FIELD WORK PRACTICE (INTERNSHIP)								
110	34252083	Field Work Practice (PKL)	3						3
		Center for Research on Biotechnology and Agricultural Genetic Resources (BB Biogen)							
		Agricultural Quarantine Standard Test Center (BBUSKP)							
		Research Institute for Medicinal Plants and Spices (Balittro)							
		Ornamental Plants Research Institute (Balithi)							
		Fish Quarantine Agency, Quality Control and Safety of Fishery Products (BKIPM)							
		Drug and Food Control Agency (BPOM)							

		Agency for the Assessment and Application of Technology (BPPT)										
		National Atomic Energy Agency (BATAN)										
		Indonesian Institute of Sciences (LIPI)										
		.... 20 Institutions in DKI & West Java Province										
		Center for Health Research and Development (Litbangkes)										
	COMMUNITY SERVICE PROGRAM		2									
		Choice of Community Service										
RESEARCH COOPERATION WITH OTHER PT or RESEARCH CENTER												
		UTM . Research Projects	6									
TOTAL			144	...	...	...	...	...	...	...	...	

Notes:

National Compulsory Courses (MKWN) each with a minimum weight of 2 credits:

a. Religion;

b. Pancasila;

c. Citizenship; and

d. Indonesia Language

LIST OF COURSES DISTRIBUTION EVERY SEMESTER

Table 6. List of courses per semester-I

No	MK code	Courses (MK)	Theory	Practice	Practice	Amount
SEMESTER I			Credits weight			
1		Religion	2			2
2	00051112	Pancasila	2			2
3	30050062	Indonesia Language	2			2
4	34251632	General biology	3			3
5	34251641	General Biology Practicum		1		1
6	32251012	Basic Physics	2			2
7	32251021	Basic Physics Practicum		1		1
8	34251512	K3 Biology Laboratory	2			2
9	34251652	Basic chemistry	2			2
10	34251661	Basic Chemistry Practicum		1		1
11	34250093	Basic mathematic	3			3
		Number of Semester I . Study Loads	18	3		21

Table 7. List of courses per semester-II

No	MK code	Courses (MK)	Theory	Practice	Practice	Amount
SEMESTER II						
			Credits weight			
1		Citizenship	2			2
2		Logic and Scientific Reasoning	2			2
3		Education Insights	2			2
4	34250862	English – Biology	2			2
5	34251673	Biochemistry and Organic Chemistry	3			3
6	34251681	Biochemistry and Organic Chemistry Practicum		1		1
7	34251693	Animal Structure and Development	3			3
8	34251701	practice. Animal Structure and Development		1		1
9	34251713	Plant Structure and Development	3			3
10	34251721	Practicum of Plant Structure and Development		1		1
Total Semester II Study Load			17	3		20

Table 8. List of courses per semester-III

No	MK code	Courses (MK)	Credits weight			
			Theory	Practice	Practice	Amount
1	00053172	Introduction to Programming and Big Data	2			2
2	34251732	Biodiversity and Cryptogamy Systematics	2			2
3	34251741	Biodiversity and Cryptogamy Systematics Practicum		1		1
4	34251752	Invertebrate Biodiversity and Systematics	2			2
5	34251761	Practicum on Biodiversity and Invertebrate Systematics		1		1
6	34250603	Cell Biology	3			3
7	34250013	Environmental Science	3			3
8	34250142	Basic Statistics	2			2
9		MK Choice	4			5
		Total Semester III Study Load	**18**	**2**		**20**

The table header "SEMESTER III" appears above the table.

Table 9. List of courses per semester-IV

No	MK code	Courses (MK)	Credits weight			
			Theory	Practice	Practice	Amount
1	34251772	Biodiversity and Phanerogamy Systematics	2			2
2	34251781	Biodiversity and Phanerogamy Systematics Practicum		1		1
3	34251842	Vertebrate Biodiversity and Systematics	2			2
4	34251851	Practicum on Biodiversity and Vertebrate Systematics		1		1
5	34251793	Genetics	3			3
6	34251801	Genetics Practicum		1		1
7	34251822	Microbiology	2			2
8	34251831	Microbiology Practicum		1		1
9	34251812	Biological Research Methods	2			2
10	34251373	Biology-Based Entrepreneurship	3			3
11		MK Choice	2			4
		Total Study Load for Semester IV	**16**	**4**		**20**

Table 10. List of Courses per semester-V

No	MK code	Courses (MK)	Credits weight			
			Theory	Practice	Practice	Amount
1	34250812	Experimental design	2			2
2	34251862	Molecular Biology	2			2
3	34252051	Molecular Biology Practicum		1		1
4	34251893	Animal physiology	3			3
5	34251901	Animal Physiology Practicum		1		1
6	34251913	Plant Physiology	3			3
7	34251921	Plant Physiology Practicum		1		1
8		MK Choice	7			7
		Total Study Load for Semester V	17	3		20

Table 11. List of Courses per semester-VI

No	MK code	Courses (MK)	Credits weight			
			Theory	Practice	Practice	Amount
1	34251873	Basic Ecology	3			3
2	34251881	Basic Ecology Practicum		1		1
3	34251932	Plant Tissue Culture	2			2
4	34251941	Plant Tissue Culture Practicum		1		1
5	34251092	Biotechnology	2			2
6	34250212	Evolution	2			2
7	34251952	Scientific Writing Techniques	2			2
8		MK Choice	8			8
		Total Study Load for Semester VI	19	2		21

SEMESTER VI

Table 12. List of courses per semester-VII

No	MK code	Courses (MK)	Credits weight			
			Theory	Practice	Practice	Amount
1	34251202	Field Work Lecture (KKL)			2	2
2	34250782	Field Work Practice (PKL)			6	6
3	30052072	Research Proposal Seminar	2			2
4		MK Choice	8			8
		Total Study Load for Semester VII				18

SEMESTER VII

Table 13. List of courses per semester-VIII

No	MK code	Courses (MK)	Credits weight			
			Theory	Practice	Practice	Amount
1	34251961	Biology Seminar (Research Results Seminar)				0
2	30052004	Essay			4	4
		Total VIII Semester Study Load			4	4

SEMESTER VIII

Implementation of Student Learning Rights for a Maximum of 3 Semesters
(Students' right to study for a maximum of 3 semesters, hereinafter referred to as Merdeka Learning – Merdeka Campus (MBKM))

<div align="center">

MBKM Implementation Model (example)
Table 14. MBKM Implementation Model

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Table 14. Development Plan Curriculum 2022

Semester 1-3	Semester 4-6	7th semester	Semester 8
MK must Univ. has been fulfilled (passed)	MK Mandatory PS has been fulfilled (passed) in smtr 6	MK Choice in other PS outside UNJ	ESSAY
The chosen MK in PS itself is taken in semester 3	MK Options in other PS outside UNJ (20-21 credits)	Field Work Practice / Internship in collaboration with other agencies	

Table 15. Distribution of credits in each semester

Smt-1	Smt-2	Smt-3	Smt-4	Smt-5	Smt-6	Smt-7	Smt-8
21 credits	20 credits	20 credits	20 credits	20 credits	21 credits	18 credits	4 credits
National Compulsor	National Compulsory	MKWU MK-Mandatory	MK-Mandatory Study	MK-Prodi inside &	MK-Prodi inside &	Off-campus learning	TA

Smt-1	Smt-2	Smt-3	Smt-4	Smt-5	Smt-6	Smt-7	Smt-8
y MK, University Compulsory MK	MK and University Compulsory MK	Study Program inside & outside the study program at the same PT	Program inside & outside the study program at the same PT	outside & Learning outside PT	outside the study program	activities: Internship/ KKNT	

I. COURSE DESCRIPTION

34251632	GENERAL BIOLOGY	Credits(KP) (3-1)
This course discusses the theory and concepts of biology as a whole, studying the position of biology as a science and its relation to other fields of science. The material covers the theory of the origin of life, plant and animal cells, plant and animal structure, physiology and reproduction, heredity, ecology and evolution as well as an introduction to the application of biology in human life.		
Lecturer Team		
Adisyahputra, Agung Sedayu, Atin Supiyani, Tri Handayani K., Elsa Lisanti., Vina Rizkawati, Rizky Priambodo, Rizhal Koen A., Pinta O. Pasaribu, Yulia Irnidayanti		

34251612	K3 BIOLOGY LABORATORY	Credits(KP) (2-0)
This course provides the ability to understand all work safety rules in the Biology laboratory. This course discusses the definition and understanding of K3 (Occupational Health and Safety) Biology Laboratory, types of basic laboratories-biosafety level 1 and 2; controlled laboratory-biosafety level 3; maximum level control laboratory for biosafety level 4; Equipment in the laboratory and the potential hazards of laboratory equipment; safe laboratory techniques; Types of hazards in the Biology laboratory include physical hazards, chemical hazards, radiation hazards, and biological hazards; Biological safety and recombinant DNA technology; personal protective equipment; waste management management; The practice of handling fire hazards and chemicals in the Biology laboratory (in collaboration with the firefighting		

team).

Lecturer Team:Dalia Sukmawati, Yulia Irnidayanti

34251713	PLANT DEVELOPMENT STRUCTURE	Credits(KP) (3-1)

This course discusses the external and internal structures of higher plants. Plant structure in primary and secondary growth, growth and development in the vegetative and generative phases. The material presented is in the form of the basic structure of plants, the structure and function of plant cells, the structure and function of tissues, the structure and function of roots, stems, leaves and the structure and function of the reproductive organs.

Lecturer Team:
Reni Indrayanti, Rizhal Koen. A., Eka Putri Azrai

34251693	ANIMAL DEVELOPMENT STRUCTURE	Credits(KP) (3-1)

This course discusses the histological structure of basic tissues and special tissues that make up an animal's organs and is able to explain the anatomical structures and processes of formation and development of various organ systems in vertebrates, namely the integumentary system, muscular system, skeletal system, circulatory system, respiratory system. , the urogenital system, the nervous system, the sensory system and the system, through the mechanism of cellular interaction, the role of the nucleus, cytoplasm, hormones in these various organ systems. In the process of organ formation in the body starting from the process of gametogenesis and fertilization, cleavage, blastulation, gastrulation, neurulation, extraembryonic membrane formation, implantation and type and formation

of the placenta, organogenesis mechanisms of several ectoderm derivatives, mesoderm derivatives, and endoderm derivatives.

Lecturer Team: Yulia Irnidayanti; Elsa Lisanti,

34250603	CELL BIOLOGY	Credits(KP) (3-0)

This course discusses various new approaches to studying cells in a social context (the surrounding environment) and instills the concept that cells are no longer considered as "the smallest unit of function" but instead emphasizes cells with a microenvironment, in this case cells. neighbours, extracellular matrix (ECM) and soluble mediators. The concept of "dynamic reciprocity" is mainly emphasized on cells in terms of regulating microcomposition which in turn determines cell function

Lecturer Team
Adisyahputra, Yulia Irnidayanti, Rini Puspitaningrum.

34251673	BIOCHEMISTRY AND ORGANIC CHEMISTRY	Credits(KP) (3-1)

This course discusses the structure and bonds in organic molecules, their general properties and stereochemical classification; physical properties, structure, reaction mechanism, nomenclature based on IUPAC and TRIVIAL, examples and functions and roles of alcohol, ether, benzene, alkane, alkene, alkyne, aldehyde and ketone in life; general properties, structure, function and classification along with examples and benefits in life for biomolecules: water, vitamins and minerals. Carbohydrates, lipids, proteins, enzymes, nucleic acids. Prerequisites: General Biology

Lecturer Team

Rini Puspitaningrum; Sri Rahayu; Tri Handayani K.,

3425173 2	BIODIVERSITY AND CRYPTOGAM SYSTEMS	Credits(KP) (2-1)

This course examines biodiversity, systematics, ecological aspects, utilization and conservation of cryptogamous plants. The material is given in the form of theory and practicum. The scope of theoretical material includes: basics of taxonomy, the Five Kingdoms of Life classification system, cryptogam polyphyleticism, Phycology, Mycology, Lichenology, Bryology and Pteridology; ecology, utilization and conservation of cryptogam group members. The scope of practicum material includes: microscopic algae, macroscopic algae, microscopic fungi, macroscopic fungi, lichens, mosses and ferns.

Prerequisite: Plant Development Structure

Lecturer Team

Agung Sedayu: Rizal Koen A.

3425177 2	BIODIVERSITY AND PHYNEROGAM SYSTEMS	Credits(KP) (2-1)

This course examines biodiversity, systematics, ecological aspects, utilization and conservation of seed plants. The material is given in the form of theory and practicum. The scope of theoretical material is the historical basis of taxonomy, the basis of botanical nomenclature, the basis of plant systematics, the modern classification system (APG) covering all seed plants from Gymnosperms to Monocotyledons, their ecology, distribution, use and conservation. The scope of practicum material includes Gymnosperms, Basal Clade, Magnoliid, Eudicotyledon (Ranunculaceae, Rosid, Asterid), and Monocotyledon

(Alismatid, Lilioid, Commeliniid).

<div align="right">Prerequisite: Biodiversity and Kryoptogamy Systematics</div>
<div align="right">Lecturer Team</div>
<div align="right">Agung Sedayu, Rizhal Koen A., Pinta O. Pasaribu.</div>

34251752	BIODIVERSITY AND AVERTEBRATE SYSTEMATIC	Credits(KP) (2-1)

Invertebrates describe the diversity of animals that do not have a backbone, where the ratio of the composition of invertebrate animals is 95% and the remaining 5% belongs to the vertebrate group. This course focuses on invertebrate phyla, most of which live in the sea and on land, from class to order, from simple single-celled organisms (protozoa) to the most complex (arthropods). The subject includes the exploration of the external and internal morphological and anatomical characteristics of various digestive and food systems, the nervous system, the respiratory system, the transportation system, the reproductive system and the way of life of invertebrate animals, the relationship between one animal and another, and its role in human life.

<div align="right">Prerequisite: Animal Structure and Development</div>
<div align="right">Lecturer Team:</div>
<div align="right">Yulia Irnidayanti, M. Isnin Noer; Vina Ryzkawaty Ratna</div>
<div align="right">Komala</div>

34251842	BIODIVERSITY AND VERTEBRATE SYSTEMS	Credits(KP) (2-1)

Vertebrates describe the diversity of animals that have a backbone, where the ratio of the composition of vertebrate animals is 5%. This course focuses on the phylum vertebrates, most of which live on land, from pisces, amphibians, reptiles, aves, mammals. The subject includes the exploration of the

external and internal morphological and anatomical characteristics of various digestive and food systems, the nervous system, the respiratory system, the transportation system, the reproductive system and the way of life of vertebrate animals, the relationship between one animal and another, and its role in human life, and laboratory practice which includes the examination of living and preserved specimens of taxa for classification.

Prerequisite: Animal Structure and Development
Lecturer Team: Yulia Irnidayanti, Ratna Komala

34251793	GENETICS	Credits(KP) (3-1)

MK Genetics studies the concept of genes, chromosomal theory, Mendelian crosses as the first step in discovering patterns of inheritance of living things and their development, including gene strung, crossing over, applying mathematical formulas to predict the possibility of inheritance from a marriage and proving traits or traits that appear from the result of the marriage due to genetic factors or not, studying deviations from Mendel's laws, studying the causes of changes in the number and structure of chromosomes and the resulting abnormalities, studying inheritance patterns outside the nucleus (extrachromosomal inheritance), applying laws Hardy-Weinberg to determine allele frequencies and genotype frequencies in the population and their changes.

Prerequisite: Cell Biology
Adisyahputra, Rizky Priambodo, Pinta O. Pasaribu

34250142	BASIC STATISTICS	Credits (KP) (2-0)

This course discusses various theories or concepts in basic

statistics and their implications in the implementation of learning and research. Description of Data, Probability and Random Variables, Distribution of Sampling, Inferencing of Large Samples, Inference of Small Samples, Comparison of Two Treatments Descriptive statistical translation, parametric and non-parametric tests.

Lecturer Team

Adisyahputra, Rizky Priambodo, Bagus Sumargo, Daniar Siregar

34251822	MICROBIOLOGY	Credits (KP) (2-0)

This course examines microorganisms as a group of organisms that are part of living systems. The material is given in the form of theory and practicum. The scope of the material provided theoretically includes the history of microbiology development, types of microorganisms: bacteria, fungi and viruses, basic microbiology laboratory techniques, nutrition and environmental factors that affect the growth of microorganisms, growth and reproduction, basic metabolism, genetics of microorganisms and the role of microorganisms in life. The scope of practicum material includes: Preparation of media and sterilization techniques, isolation of microorganisms from the environment, determination of bacterial growth, bacterial staining techniques, observation of fungal morphology (molds and yeasts),

Lecturer Team

Tri Handayani K., Dalia Sukmawati

34251812	BIOLOGICAL RESEARCH METHODS	Credits (KP) (2-0)

Research Methodology studies science and research concepts, basic concepts of research methodology, concepts and strategies, formulating hypotheses, sampling methods and design (population, samples and sampling techniques), basic principles of experimental design, hypothesis testing and assumption testing, research validity, data interpretation results, discussion strategies and drawing conclusions.

Prerequisite: Basic statistics

Lecturer Team: Reni Indrayanti, M. Isnin Noer

34250812	EXPERIMENTAL DESIGN	Credits (KP) (2-0)

This course discusses various theories or concepts in experimental/research designs and their implications in the implementation of learning and research. Basic Concepts of Experimental Design. Hypothesis Testing: two means and two variances. One Factor Trial: RAL, RAKL, RBSL. Two-Factor Experiment: Multifactorial, Split-plot, Strip-plot Design. Advanced Tests: LSD, Duncan, Tukey, Dunnett.

Prerequisite: Research Methods

Lecturer Team: Adisyahputra, Atin Supiyani; Pinta O. Pasaribu, Rizky Priambodo

34251373	BIOLOGY-BASED ENTREPRENEURSHIP	Credits (KP) (3-0)

This course discusses various theories or concepts in entrepreneurship and their implications in implementing learning and developing entrepreneurial spirit and behavior. The material presented is the Basic Concept of Entrepreneurship; Intrapreneurship; Basic Elements of Intrapreneurship; Entrepreneurial Ethics; Legal Structure in Entrepreneurship; Business Plans; Entrepreneurial Management

Lecturer: Atin Supiyani; Elsa Lisanti, Rizal Koen Asharo

34251893	ANIMAL PHYSIOLOGY	Credits (KP) (3-1)

This course discusses the life processes and activities that occur in animals, the mechanisms of physiological processes in cells, organs, 474systems and individuals, as well as the interrelationships between 474system that forms a whole 474system in animals, so that it becomes the basis for understanding the relationship between animal physiology and the internal and external environment of the animal body.

Prerequisites: SPH, Biochemistry, Biodiversity and Vertebrate Systematics

Lecturer Team

Atin Supiyani, Elsa Lisanti

34251913	PLANT PHYSIOLOGY	Credits (KP) (3-1)

This course discusses the physiological processes that occur in higher plants, studies the structure and function of bio-molecules in plant cells arranged in organelle compartments, the physical and chemical properties of water which play an important role in various plant physiological phenomena. The material discussed is living plant cells, biomolecules, compounds that make up plant cells, water and its relationship to plants, plant metabolism and enzymes, photosynthesis, cell respiration, nitrogen metabolism, plant growth regulators, fat metabolism, germination and dormancy, growth and development. plant development

Prerequisites: SPT, Biochemistry, Biodiversity and

34251932	PLANT NETWORK CULTURE	Credits (KP) (2-1)

This course focus on tissue structure and development in vitro. . Lecture material covers the basic principles of plant tissue culture techniques (in vitro culture), discusses the history of the development and benefits of tissue culture, equipment and aseptic techniques of in vitro culture, plant growth media and factors, inhibition and problems in in vitro culture, methods of propagation by in vitro (bud multiplication, organogenesis and embryogenesis), callus culture and cell suspension, proptoplast culture, superior plant assembly techniques through in vitro techniques (somaclonal variation and in vitro selection, mutagenesis, protoplasm fusion, haploid culture). Introducing the understanding of the function of tissue culture in modifying plants for the development of plant biotechnology

Prerequisite: SPT and Plant Physiology

Lecturers: Reni Indrayanti; Rizal Koen A.

34251952	MOLECULAR BIOLOGY	Credits (KP) (2-0)

This course discusses about Introduction about the concept of DNA, RNA, Nucleotides, genes, genomes, chromatin, chromatids, chromosomes, Cell Cycle : repDNA location, DNA repair; Genetic recombination: general genetic recombination, site specific recombination; Transcription from DNA to RNA: part of the DNA being transcribed, RNA type, RNA processing, transport out of nucleus, nucleolus of ribosome factory; Protein translation; the role of tRNA,

initiation, elongation and termination of protein synthesis; Control of gene expression in general and in bacteria: overview of gene expression control, operon ; Control of gene expression in eukaryotes and prokaryotes: control at the transcriptional stage, control at the post-transcriptional stage; Genome evolution: DNA duplication and mutation.Basic Molecular Technique – DNA Isolation. Genetic Markers (Hybridization, PCR, Sequence).

Lecturer Team: Yulia Irnidayanti; Rizky Priambodo

34251952	SCIENTIFIC WRITING TECHNIQUES	Credits (KP) (2-0)

This course discusses the techniques of writing scientific papers, systematic writing of scientific papers, good presentation methods with the aim of training students in writing scientific papers and scientific articles in the field of Biology. Equipping students in thesis writing and accustomed to expressing opinions and solving academic problems scientifically in academic communication forum seminars.

Lecturer Team
Atin Supiyani, Reni Indrayanti, Yulia Irnidayanti, Adisyahputra

34250212	EVOLUTION	Credits (KP) (2-0)

This course examines the mechanism of biodiversity diversification, and its implementation in the classification of living things as well as conservation aspects; given in theory. The scope of theoretical material is classical genetics, population genetics, mutation, genetic drift, gene flow and various dimensions of natural selection. Aspects of speciation, systematics, rate of evolution, biogeography and conservation.

Lecturer: Agung Sedayu; Rizky Priambodo

DESCRIPTION OF SUPPORTING CHOICE OF MK (SEMESTER 3-4)

34250822	ANIMAL BIOETICS	Credits (KP) (2-0)
This course discusses various theories or concepts in animal bioethics and their implications in the implementation of learning/education. This course material includes Basic Animal Bioethics; Animal Bioethics regulations and legislation; Animal Welfare Concepts and Regulations; Ethical Clearance Concept; The basic concept of the Institutional Animal Care and Used Committee (IACUC). Prerequisite: Animal Development Structure Lecturer: Atin Supiyani		

34251502	ANIMAL BEHAVIOR	Credits (KP) (2-0)
This course discusses various theories or concepts in animal behavior which includes the notion of behavior, physiological aspects of behavior, innate behavior, learned behavior and social animal behavior in animals which includes adaptive behavior in groups, mating behavior, navigation, migration, communication and organization. animal social. Prerequisite: Animal Development Structure Lecturer: Atin Supiyani		

34252162	PHYCOLOGY	Credits (KP) (3-0)
Students recognize and understand the characteristics and diversity of algae: cyanobacteria, green algae, brown algae, red algae, diatoms, and other types of algae; and the application of algae-based technologies: Harmful Algal Blooms (HABs), phycoremediation, macroalgae secondary		

metabolite bioactivity, algae as a source of biofuel, to algae cultivation

Prerequisite: Plant Development Structure

Reni Indrayanti, Rizal Koen Asharo, Pinta Omas Pasaribu

34251472	HORTICULTURAL BASICS	Credits (KP) (3-0)

This course discusses the theory and basic concepts of horticultural plants, the history of development, growth and development and production of horticultural crops in Indonesia. Horticultural crop classification, Horticultural plant growing environment (biology, soil, nutrition), horticultural plant growth and development, pruning, pollination, flowering and fruit formation, vegetative and generative plant propagation, harvesting and handling of post-harvest products. Planting systems and garden planning, weeds and pests of horticultural crops.

Prerequisite: Plant Development Structure

Reni Indrayanti, Vina RIzkawati

	PTERIDOLOGY	Credits (KP) (2-0)

Eyes of Pteridology explain aspects of the life of ferns (pteridophytes) and lycophytes; starting from systematics, evolution, development, morphogenesis, genetics, reproduction and ecology. Able to develop a scientific activity based on the seven basic themes in the nail communities that live around the urban areas of Jakarta.

Prerequisite: Biodiversity and Cryptogame Systematics

Great Sedayu

34251492	ANIMAL HISTOLOGY	Credits (KP) (2-0)
This course discusses the structure of human body tissue at the microscopic level which consists of 4 types of tissue, namely epithelial tissue, blood tissue, tissue, connective tissue, bone tissue, muscle tissue and nervous tissue. Organs are built from different tissues, so it is necessary to understand histology to provide an explanation of the structure, function and regenerating ability of organs. Prerequisite: Animal Development Structure Lecturer: Yulia Irnidayanti		

MK SUPPORTING OPTIONS (SEMESTER 5-6)

34251393	Fungal Biodiversity	Credits (KP) (3-0)
The Fungal Biodiversity course explains: Explanation of the meaning and objectives of the Fungal Biodiversity course; Introduction of fungi in nature and their potential; Rules for the collection of microorganism cultures and the master transfer agreement (MTA) for culture collection microbe; preservation and manufacture of fungal specimens; Fungal preservation techniques (soil, sand, silica gel, freezing, lyophilization, l-drying); Fungal biodiversity mapping; molecular methods for discriminating between taxa, monitoring species, and obtaining fungal diversity; Fungal biodiversity with fruit and plant substrates; collecting and describing macrofungi; Lichen fungi; Endophytic fungi; Biodiversity of saprophytic fungi from soil and in extreme environments; endomycorrhizal arbuscular mutualism; Yeast; Biodiversity of fungi from insect and arthropod substrates; Biodiversity of fungi as parasites, predators,		

nematodes and animal origin of invertebrates and vertebrates; Fungi in marine and freshwater waters; Lectures are accompanied by practical preservation techniques with freezing; soil and sand; L drying lyophilization method; and isolation of fungi from various substrates in nature.

Precondition; Biodiversity and Cryptogamy Systematics, Microbiology

Lecturer: Dalia Sukmawati

34250842	MICROOGRANISM BIOSYSTEMATICS	Credits (KP) (2-0)

Microorganism biosystematics course, understanding of biosystematics and its application in the identification and kinship of a microorganism, kinship between taxa and making classification systems, biosystematics microorganism course, also explained about Molecular Approaches in Phylogenic, Techniques for Obtaining Molecular Data, Phylogenetic Analysis Using Sequence Data, Molecular Identification of Fungi and Bacteria, Editing DNA Sequences and Blast Data Bases and Construction of Phylogenetic Trees of Microorganisms, Phylogenetic Analysis Using Multigenes, Introduction to Primary Design, DNA Barcodes and Its Implications, Practicum I Phylogenetic Analysis of Fungi (Mold, Yeast) and Bacteria, Practicum II software applications in phylogenetic analysis and data analysis.

Microbiology Prerequisites

Lecturer: Dalia Sukmawati

34251402	Yeast BIOLOGY	Credits (KP) (2-0)

Yeast Biology and Applications courses. Morphological and physiological characteristics of yeast; morphological, molecular

and biochemical testing of yeasts; yeast physiology in the form of physiology of carbon and nitrogen sources; Yeast application as yeast fermentation (making fermented sake, soy sauce, beer, wine); yeast as food and feed ingredient (enzymes, pigments, amino acids and organic acids); application of yeast as a biofluel agent (bioethanol); application of yeast biocatalysis (pharmaceutical, chemical intermediate); yeast as a source of protein (enzymes, hormones, vaccines and toxins); fundamentals of biological research (genome, molecular and cell biology); yeast as a biocontrol agent (crop protection, feed safety and probiotics); Yeast as a bioremediation agent (pollutants, degradation, and bioremediation).

Microbiology Prerequisites
Lecturer: Dalia Sukmawati

34250512	ANIMAL MICROTECHNIC	Credits (KP) (2-0)

The Microtechnical course provides students with skills in the technique of making microscopic animal preparations using the paraffin method. This course discusses: various fixatives, dehydration, clearing agents, embedding agents, coloring agents, mounting agents, preparation of animal tissue slices by embedding, perfusion techniques. Studying the use of microscopic measurement aids and Microphotography/photomicroscopy (photographing results), tissue collection methods. Make a simple preparation of plant tissue with the imprint method. Making preparations of organisms / plant parts as a whole. Make fresh plant preparations. Making permanent plant preparations.

Prerequisite: Animal Development Structure, Cell Biology

34251523	PLANT PATHOGEN MICROBIES	Credits (KP) (3-0)

This course describes the role of biological sciences, namely Microbiology, Structure of Plant Development, Plant Physiology and Plant Tissue Culture in the development of plant diseases. This course discusses the classification of diseases and the history of plant disease, abiotic and biotic plant diseases, discusses the concept of parasitism both obligate and non-obligate, the concept and importance of plant diseases, host and pathogen interactions, examines modes of transmission and the symptoms caused by infected plants. infected with fungi, viruses and bacteria. Characteristics of plant disease causation and disease development in plants.

Prerequisites: Microbiology, Structure of Plant Development

Lecturers: Reni Indrayanti; Rizal Koen A.

34250242	Hara's Science	Credits (KP) (3-0)

Nutrient Science courses cover the dynamics of nutrients in the soil, the process of absorption and entry of nutrients into the xylem, long-distance transport in the xylem and phloem and their control, the role and metabolism of nutrients and their practical applications.

Prerequisite: Cell Biology

Adisyahputra, Pinta O. Pasaribu

34250262	EXPERIMENTAL ANIMAL MANAGEMENT	Credits (KP) (2-0)

This course discusses the management of experimental animals which includes (1) procurement of animals, including the selection and selection of suitable animal species for the research material; (2) care and maintenance of animals during the research; (3) data collection; and (4) termination of experimental animals in the study.

Prerequisite: Animal Physiology

Atin Supiyani

34251422	ANIMAL REPRODUCTIVE BIOLOGY	Credits(KP) (2-0)

This course discusses various theories, methods and applications in animal reproductive biology and their implications in the implementation of learning/education. Structure/morphology of spermatozoa and ovum, followed by the formation process (folliculogenesis) in some animals (mammals: mice/rats, primates), and aves. The process of folliculogenesis involves cellular mechanisms, the role of the nucleus, cytoplasm, hormones in development and sequences in the formation of follicular cells. Factors affect spermatozoa, reproductive system (spermatogenesis and vitellogenesis) and pheromones in fish. Semen physiology and analysis, semen collection techniques and semen collection methods in livestock, microscopic and macroscopic evaluation of semen, spermatozoa. The processes of fertilization, implantation, pregnancy, and parturition and lactation in mammals. The growth process of embryogenesis, extra-embryonic membranes and placental physiology, endocrine physiology of pregnancy, and lactational parturition in mammals. Utilization of natural materials from fish and other animals for reproductive activities.

Prerequisite: Animal Physiology

34251192	TERATOLOGY	Credits (KP) (2-0)
This course discusses the basic principles of teratology, examples of developmental abnormalities, examples of the process of brain disorders, the process of spinal cord and spinal disorders, techniques for observing abnormalities in the bones-eyes-kidneys-reproductive organs-nervous-system. limbs, razor blade section technique, immunohistochemical technique, commet assay, basic research design. Prerequisite: Animal Physiology		
		Lecturer: Yulia Irnidayanti

	Plant Ecophysiology	Credits (KP) (2-0)
The scope of the material: the influence of stress factors such as salt, water, heavy metals, oxygen, the basic concepts of plant metabolism and the importance of plant adaptation related to the distribution and abundance of plants in nature, the relationship of water and nutrients, and the interaction between plants and the biotic and abiotic environment		
		Prerequisite: Cell Biology
		Plant Physiology and ecology
	Dr. Ratna Yuniati (UI); Adisyahputra. Pinta Omas Pasaribu (UNJ)	

34251172	IMMUNOLOGY	Credits (KP) (2-0)
This course discusses the immune system, components of immune cells, antibodies, antigens and antigen-recognition molecules, complement, cytokines, immune response mechanisms, mechanisms of elimination of infectious agents with the immune system; conjugation, isolation and manufacture of monoclonal antibodies and their applications; vaccines and vaccinations, the treatment of infectious diseases and diseases caused by the immune response such as autoimmune and hypersensitivity. Prerequisite: Cell Biology Lecturer: Atin Supiyani		

34250852	PLANT BIOTECHNOLOGY	Credits (KP) (2-0)
This course is an integration of basic biological sciences, namely Plant Development Structure, Biochemistry, Microbiology, Genetics, Plant Physiology and Plant Tissue Culture and Molecular Biology to apply technology from the capabilities of microorganisms and plant cell culture. Materials cover the basics of plant biotechnology, basic techniques of plant genetic engineering, plant genomes; organization of plant genes, transformation techniques in plants, applications in plant biotechnology, phenotypic identification of plant diversity (identification of morphology, anatomy and molecular markers).Applications in plant biotechnology and saving plant genetic resources. Prerequisite: Plant Tissue Culture		

	ANIMAL BIOTECHNOLOGY	Credits (KP) (2-0)
This course discusses various theories, methods and applications in animal biotechnology and their implications in the implementation of learning/education. Spermatozoa and embryo sexing. Estro Synchronization. Super ovulation / multiple ovulation. in vitro fertilization,Artificial insemination and cloning. Freshwater fish and marine fish fertilization, hormones and enzymes, embryo transfer and semen collection. Preparation of large cattle and poultry stud. How to shelter.Examination of the quality of cement eyakulat in the field. The volume of cement of various species, the standard of quality of cement of various species. Spermatozoa morphology normal, abnormal. Spermatozoa X and Y Morphology.Oocyte and embryo coagulation, frozen cement manufacturing process. Oestrus detection technology and early pregnancy detection. Embryo manipulation technology development.Reproductive technology including nuclear technology (DNA). Chimeras. ICSI Technique and Cloning Technique. Measurement and Analysis Techniques related to Reproduction		
Prerequisite: Animal Physiology Elsa Lisanti		

	Reproductive Physiology	Credits (KP) (3-0)
Reproduction of male and female animals through physiological aspects. The material provided relates to the subject of vertebrate animals and uses many illustrations of		

mammalian classes. The topics are as follows: Sexual differentiation & determination, Overview of mammalian male reproduction, Testicular function, Sperm transport, storage, and protection, Ejaculation and sperm capacitation, Male fertility and infertility, Puberty and menopause, Ovarian function, Menstrual and estrous cycle, Role of gonadal steroids in sexual behavior, Fertilization, pregnancy, and parturition

Precondition: Animal physiology
Dr. Luthfiralda Dr. Upi CN Dr. Fadullah (UI); Elsa Lisanti (UNJ)

	Marine Life Physiology	Credits (KP) (3-0)
The scope of the material: The physiological processes of animals and plants so that they can live and adapt in their habitats. The scope of what is taught is the process of adaptation, sensing, movement, excretion, osmoregulation, respiration, bioluminescence, buoyancy and symbiosis. 15. Endocrinology Scope of Material: Concept of endocrinology; vertebrate endocrine system; endocrine methodology; mechanism of action of hormones; pituitary hormones; hypothalamic hormones; melanotropic hormone; digestive and metabolic hormones; calcium regulating hormones; growth hormones; thyroid hormones; adrenal hormones; reproductive hormones; neurohormones		
Precondition: Animal Physiology, Plant Physiology Dr.rer.nat. Mufti P. Patria Titi Soedjiarti, SU(UI); Rizal Koen A.;Rizky Priambodo (UNJ)		

	Entomology	Credits (KP) (3-0)

Introduction (definition, purpose, and benefits of insects); Body integument, color and segmentation; Head, thorax, abdomen and appendages; Muscular system and nervous system; The organs of taste and perception; Digestive system and nutrition; Respiratory system, circulation, and tissues involved; Excretory and secretory organs; Reproduction system; Development and metamorphosis; Insect life modes; Insect ecology; Classification

Prerequisite: Cell Biology

Dr. Adi Basukriadi (UI); Yulia Irnidayanti; Vina Rizkawati (UNJ)

	Conservation Biology	Credits (KP) (3-0)

Studying the concepts and theories of conservation biology, especially those related to conservation issues in Indonesia, such as the value of biodiversity, habitat destruction, species extinction, populations, conservation areas, ecosystems, global climate change, in situ conservation efforts, restoration. Subjects : Understanding of biological conservation, global biodiversity: patterns and processes, threats to biodiversity, conservation values and ethics, economic value of ecology and nature conservation, habitat destruction and fragmentation, overexploitation, species invasion, biological impacts on climate change, genetics conservation, conservation with species and landscape approaches, ecosystem approaches, design of conservation areas, restoration of endangered ecosystems and populations, sustainable development.

Prerequisite: Cell Biology

UI Technician Team UNJ

	Conservation Genetics	Credits (KP) (2-0)

Objectives To understand the impact of various forms of disturbance on changes in the genetic composition of a population, the effects of these changes on the resilience of species, and the use of this information in species conservation. After completing this course, students are expected to be able to master the basic concepts of conservation genetics and the use of molecular techniques in species conservation. Measurement of genetic diversity in a population is able to provide information about the potential evolution of the species in the long term to its environment.

Prerequisite: Genetics

Dr. Noviar Andayani, MSc (UI); Adisyahputra: Rizky Priambodo

	Human Biology	Credits(KP) (2-0)

The Human Biology course contains the topics of Anatomy and Physiology of the human body, namely the integumentary system, bones, muscles, heart, blood vessels, nerves, autonomic nerves, digestion, respiration and kidneys.

Prerequisite: Animal Physiology

Sri Rahayu

J. DATA OF BIOLOGY STUDY PROGRAM LECTURER

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1	Dr. Adisyahputra, M.Si	0011116009 adisyahputra_bio@yahoo.com	081281487880
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MERDEKA CAMPUS CURRICULUM - INDEPENDENT LEARNING (KM-MB)
COMPUTER SCIENCE STUDY PROGRAM (S1) FMIPA
UNIVERSITAS NEGERI JAKARTA
FORCE 2021/2022

A. INTRODUCTION

The Computer Science Study Program of the Mathematics Faculty, Faculty of Mathematics and Natural Sciences, Universitas Negeri Jakarta was founded in 2013, originally named the Computer Systems Study Program. With the passage of time in 2016 the Computer System Study Program changed its name according to the nomenclature to become the Computer Science Study Program

1. Based on the Decree of the Minister of Education and Culture of the Republic of Indonesia Number: 82/E/O/2013 concerning Permits for the Implementation of the Computer Systems Study Program, Undergraduate Program (S-1) at the Universitas Negeri Jakarta in Jakarta

2. Based on the Decree of the Minister of Research, Technology, and Higher Education of the Republic of Indonesia Number: 138/KPT/I/2016 regarding the Change of Name of the Computer Systems Study Program Undergraduate Program to become a Computer Science Study Program Undergraduate Program at the Universitas Negeri Jakarta in Jakarta

B. VISION, MISSION and OBJECTIVES OF THE STUDY PROGRAM

1. Vision

To become a provider of Computer Science undergraduate (S1) education programs that excel in human resource development, research, innovation and development of Computer Science and by 2030 produce professional graduates and be able to compete nationally.

2. **Mission**
   a. Organizing educational and teaching activities to produce qualified, independent and responsible Computer Science graduates.
   b. Conduct studies and research that is useful and dignified for the development of disciplines in the field of Computer Science.
   c. Doing community service through various Computer Science applications to help create added value in people's lives.
   d. Creating a conducive academic culture and entrepreneurial skills to be able to compete in the free market era.
   e. Cooperating with other institutions in the field of information technology and computers

3. **Purpose**
   The objectives of organizing the Computer Science Study Program are:
   a. Produce Computer Science graduates and professionals who master the concepts, theories and practices in the field of Computers and Information Technology and in accordance with the demands of the times.

b. Produce graduates who are able to follow and utilize scientific developments in the field of computer science to provide solutions in the community and are able to develop entrepreneurship in the fields of Computer Science and Information Technology.

C. GRADUATE PROFILE

Graduates of the Computer Systems Study Program have a bachelor's degree in Computer Science and are expected to be able to work as:

GRADUATE PROFILE	GRADUATE PROFILE DESCRIPTION
1. Computer science practitioner	Covers all professions that apply computer science expertise in their work. This category is provided if there are other professions that cannot be included in the other 5 profiles.
2. Computer science consultant.	This profession provides consulting services to stakeholders in problem solving using a computer science-based approach. The service keyword in this profession is consulting services.
3. Information System Planner.	Provide Information System design services that solve certain problems including Information System implementation services if stakeholders wish.
4. Programmer	A profession whose activities include application development. Information System Planners can

GRADUATE PROFILE	GRADUATE PROFILE DESCRIPTION
	be categorized as Programmers, but not necessarily the applications developed are categorized as Information Systems.
5. Entrepreneurs based on Information Technology and Computers	These graduates do not work in certain business entities. However, conducting ICT-based entrepreneurial activities as potential income.
6 Researcher in computer science	A profession that focuses on scientific development in the field of Computer Science through research activities as measured by researcher publications as an indicator of Researcher performance. Lecturers are included in this profile.
7 Data Scientist	Professions that apply Artificial Intelligence in problem solving and involve mining and processing relatively large data.

D. GRADUATE DEGREE

Graduate degree from Computer Science Study Program is Bachelor of Computer (S.Kom)

E. STUDY PROGRAM ACCREDITATION

1. Based on the decision of the National Accreditation Board for Higher Education Number 483/SK/BAN-

PT/Akred/S/XII/2014, the Computer System Study Program received an accreditation rating of C.

2. Based on the decision of BAN-PT No. 1673/SK/BAN-PT/Akred/S/VII/2018 states that the Computer Science Study Program at the Universitas Negeri Jakarta Undergraduate Program, East Jakarta City, is accredited with a B rating

F. STUDY PROGRAM LEARNING ACHIEVEMENTS

ATTITUDE

S-1	Fear of God Almighty and able to show a religious attitude.
S-2	Upholding human values in carrying out duties based on religion, morals, and ethics.
S-3	Contribute to improving the quality of life in society, nation, state, and the progress of civilization based on Pancasila.
S-4	To act as citizens who are proud and love their homeland, have nationalism and a sense of responsibility to the country and nation.
S-5	Appreciate the diversity of cultures, views, religions and beliefs, as well as the opinions or original findings of others.
S-6	Work together and have social sensitivity and concern for society and the environment.
S-7	Obey the law and discipline in the life of society and the state;
S-8	Internalize academic values, norms, and ethics;
S-9	Demonstrate a responsible attitude towards work in their area of expertise independently.
S-10	Internalize the spirit of independence, struggle, and entrepreneurship.

| S-11 | Internalize the values of excellence, honesty, competitiveness, and leadership in various activities. |

GENERAL SKILLS

K-1	Able to apply logical, critical, systematic, and innovative thinking in the context of the development or implementation of science and technology that pays attention to and applies humanities values in accordance with their field of expertise.
K-2	Able to demonstrate independent, quality, and measurable performance.
K-3	Able to examine the implications of the development or implementation of science and technology that pays attention to and applies humanities values according to their expertise based on scientific rules, procedures and ethics in order to produce solutions, ideas, designs or art criticism, compose a scientific description of the results of their studies in the form of a thesis or final project report , and upload it on the college website.
K-4	Compile a scientific description of the results of the studies mentioned above in the form of a thesis or final project report, and upload it on the university's website.
K-5	Able to make appropriate decisions in the context of solving problems in their area of expertise, based on the results of analysis of information and data.
K-6	Able to maintain and develop a network with supervisors, colleagues, colleagues both inside

and outside the institution.

K-7 Able to be responsible for the achievement of group work results and supervise and evaluate the completion of work assigned to workers under their responsibility.

K-8 Able to carry out the process of self-evaluation of the work group under their responsibility, and able to manage learning independently.

K-9 Able to document, store, secure, and retrieve data to ensure validity and prevent plagiarism.

K-10 Have the ability (management) of team managerial and teamwork, self-management, able to communicate well both orally and in writing and able to make presentations.

K-11 Learn new models, techniques, technologies and tools to apply lifelong self-improvement effectivenessP-10

KNOWLEDGE

P-1 Mastering basic mathematical concepts to model and analyze computing systems.

P-2 Mastering the theories and concepts that underlie computer science.

P-3 Understand the basic theory of computer architecture, including computer hardware and network systems and data communications.

P-4 Mastering system development methodologies, including planning, analysis, design, implementation, testing and system maintenance.

P-5 Mastering at least one of the five focus areas of computer science knowledge (Artificial Intelligence, Computational Science, Graphic &

Visualization, Computer Networks and Information Management) and able to adapt to the development of science and technology.

P-6   Mastering theoretical concepts in the field of Computer Science/Informatics in general and theoretical concepts of special sections in the field of knowledge in depth, and able to formulate procedural problem solving.

P-7   Having adequate knowledge related to the workings of computer systems and able to design and develop various algorithms/methods to solve problems.

P-8   Have knowledge in developing algorithms/methods that are implemented in computer-based software.

P-9   Intellectual understanding and ability to apply basic mathematics and computer science theory

SPECIAL SKILL

KK-1   Able to apply basic mathematics, algorithmic principles and computer science theory in computer-based modeling and systems to solve real problems.

KK-2   Able to analyze, design and implement a computer-based system effectively and efficiently to solve a problem, using procedural and object-oriented programming.

KK-3   Able to build computer network systems and data communication and security systems.

KK-4   Able to build application software, at least one of five focus areas of computer science, namely: Artificial Intelligence, Computational Science, Graphic & Visualization, Computer Networks and

Information Management.

KK-5 Able to design and develop algorithms for various purposes such as Network Security, Data Compression Multimedia Technologies, Mobile Computing Intelligent Systems, Information Management, Algorithms and Complexity Human-Computer Interaction, Graphics and Visual Computing.

KK-6 Ability to have a critical and creative perspective in identifying and solving problems using computational thinking.

KK-7 Use relevant skills in studying areas of computer science to increase productivity.

KK-8 Demonstrate a commitment to ethical and professional behavior in the workplace and daily life.

KK-9 Able to communicate with stakeholders from various backgrounds with effective quality.

KK-10 Demonstrate interpersonal skills as part of a team in every regulation including leadership in delivering quality results/resolutions.

KK-11 Apply entrepreneurial skills in the field of information technology.

KK-12 Have the ability to define user or market requirements for performance (analyze, evaluate and develop) computer-based algorithms/methods.

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G. GRADUATION CRITERIA

Assessment of courses is carried out through process assessment, assignments, mid-semester examinations, end-of-semester examinations and practice. Meanwhile,

the scoring of student study results is based on the following criteria:

Mastery Level	Mark	Weight
86 – 100%	A	4
81 – 85 %	A-	3.7
76 – 80 %	B+	3.3
71 – 75%	B	3
66 – 70%	B-	2.7
61 – 65%	C+	2.3
56 – 60%	C	2
51 – 55%	C-	1.7
46 – 50%	D	1
0 – 45	E	0

H. CURRICULUM

1. Course Group

a. Group of Subjects and Weight of Curriculum Credits Without MBKM

No	Course Group	credits
Regular Curriculum (Without MBKM)		
1	University Courses	14
2	Basic Education Course	6
3	Course Characteristics of the Faculty	2
4	Study Program Courses	122
TOTAL		**144**

b. Groups of Courses and Curriculum Credit Weights With MBKM

No	Course Group	credits
Curriculum With MBKM		
1	University Courses (MKU)	13
2	Courses Outside the Study Program	18 - 24
3	Study Program Courses	90 – 104
4	Courses Outside Higher Education (MBKM)	18 - 20
TOTAL		

2. List of Courses

a. List of Courses Without MBKM

No	MK code	Subject	credits
(1)	(2)	(3)	(4)
University Courses			
1	0005-312-3	Religion	2
2	0005-112-2	Pancasila	2
3	3005-006-2	Indonesia Language	2
4	0005-321-2	Education Insights	2
5	0005-106-2	Nationality	2
6	0005-322-2	Data Raya and Programming	2
7	3005-004-2	English	2
8	0005-320-2	Logic and Scientific Reasoning	2
Basic Skills Course			
1	3145-101-3	Discrete Mathematics	3
2	3145-111-3	Statistics and Probability	3
3	3145-103-3	Differential Calculus	3
4	3145-104-3	Linear Algebra	3

5	3145-106-3	Integral Calculus	3
6	3145-109-3	Numerical Method	3
7	3145-411-3	Introduction to Graph Theory	3
8	3145-113-3	Programming Fundamentals	3
9	3145-314-3	Entrepreneurship	3
10	3145-112-2	Introduction to ICT	2
11	3145-203-3	Data Structures and Algorithms	3
Study Program Courses			
1	3145-110-3	Introduction to Digital Systems	3
2	3145-202-3	Introduction to Artificial Intelligence	3
3	3145-204-3	Database	3
4	3145-307-3	Human and Computer Interaction	3
5	3145-301-2	Computers and Society	2
6	3145-210-3	Web Design and Programming	3
7	3145-211-3	Object Oriented Design and Programming	3
8	3145-410-3	Declarative Programming	3
9	3145-212-3	Algorithm Design and Analysis	3
10	3145-213-3	Software engineering	3

11	3145-214-3	Operating system	3
12	3145-416-3	Information Theory	3
13	3145-206-3	Computer Organization	3
14	3145-310-3	Computer Graphics	3
15	3145-402-3	Mobile Computing	3
16	3145-316-3	Language Theory and Automata	3
17	3145-002-3	Machine Learning	3
18	3135 - 306-2	Research methods	2
19	3145 - 409-2	Field Work Program (PKL)	2
20	300 5- 401-2	Pre Thesis Seminar	2
21	3005 - 402-4	Essay	4
Specialization Study Program Courses			
Multimedia Specialization Courses			
1	3145-116-3	Text Processing	3
2	3145-000-3	Audio Processing	3
3	3145-001-3	Image processing	3
4	3145-002-3	Game Development	3
5	3145-003-3	Embedded System	3

6	3145-004-3	Computer Animation	3
7	3145-005-3	Programming Special Topics	3
8	3145-006-3	Game-Specific Topic	3
9	3145-007-3	Special Topic Text	3
10	3145-008-3	Audio Special Topic	3
11	3145-009-3	Image Special Topic	3
12	3145-010-3	Robotics	3
Specialization Courses Distance Learning			
1	3145-117-3	Semantic Network	3
2	3145-118-3	Data Mining	3
3	3145-119-3	Computer Assisted Teaching	3
4	3145-120-3	Human Language Processing	3
5	3145-121-3	Pervasive Computing	3
6	3145-122-3	Software Computing	3
7	3145-123-3	Formal Method	3
8	3145-124-3	Interaction System	3
9	3145-125-3	Software Quality Assurance	3
Specialization Courses E-Business			

1	3145-220-3	E-Commerce and Startups	3
2	3145-221-3	Management information System	3
3	3145-222-3	System Design and Analysis	3
4	3145-223-3	IT Security & Risk Management	3
5	3145-224-3	Supply Chain Management	3
6	3145-225-3	Cloud Computing	3
7	3145-226-3	Digital Signature	3
8	3145-227-3	Content Development	3
9	3145-228-3	Business communication	3
10	3145-229-3	Pervasive Computing	3
11	3145-230-3	E-business Infrastructure Technology	3
12	3145-231-3	Digital Marketing	3
13	3145-232-3	Information System Audit	3
Amount			**144 - 156**

b. List of Courses With MBKM

No	MK code	Subject	credits
(1)	(2)	(3)	(4)
University Courses			
1	0005-312-3	Religion	2
2	0005-112-2	Pancasila	2
3	3005-006-2	Indonesia Language	2
4	0005-321-2	Education Insights	2
5	0005-106-2	Nationality	2
6	0005-322-2	Data Raya and Programming	2
7	3005-004-2	English	2
8	0005-320-2	Logic and Scientific Reasoning	2
Faculty Courses			
1	3005-002-2	Philosophy of Mathematics and Natural Sciences	2
Study Program Subjects (Mandatory Major)			
1	3145-103-3	Differential Calculus	3
2	3145-104-3	Linear Algebra	3

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3	3145-106-3	Integral Calculus	3
4	3145-101-3	Discrete Mathematics	3
5	3145-111-3	Statistics and Probability	3
6	3145-109-3	Numerical Method	3
7	3145-411-3	Introduction to Graph Theory	3
8	3145-113-3	Programming Fundamentals	3
9	3145-314-3	Entrepreneurship	3
10	3145-112-2	Introduction to ICT	2
11	3145-203-3	Data Structures and Algorithms	3
12	3145-110-3	Introduction to Digital Systems	3
13	3145-202-3	Introduction to Artificial Intelligence	3
14	3145-204-3	Database	3
15	3145-307-3	Human and Computer Interaction	3
16	3145-301-2	Computers and Society	2
17	3145-210-3	Web Design and Programming	3
18	3145-211-3	Object Oriented Design and Programming	3
19	3145-410-3	Declarative Programming	3
20	3145-212-3	Algorithm Design and Analysis	3

21	3145-213-3	Software engineering	3
22	3145-214-3	Operating system	3
23	3145-416-3	Information Theory	3
24	3145-206-3	Computer Organization	3
25	3145-310-3	Computer Graphics	3
26	3145-402-3	Mobile Computing	3
27	3145-316-3	Language Theory and Automata	3
28	3145-002-3	Machine Learning	3
29	3135 - 306-2	Research methods	2
30	3005 - 401-2	Pre Thesis Seminar	2
31	3005 - 402-4	Essay	4
Study Program Courses (Minor Compulsory)			
Multimedia Specialization Courses			
1	3145-116-3	Text Processing	3
2	3145-000-3	Audio Processing	3
3	3145-001-3	Image processing	3
4	3145-002-3	Game Development	3
5	3145-003-3	Embedded System	3

6	3145-004-3	Computer Animation	3
7	3145-005-3	Programming Special Topics	3
8	3145-006-3	Game-Specific Topic	
9	3145-007-3	Special Topic Text	3
10	3145-008-3	Audio Special Topic	3
11	3145-009-3	Image Special Topic	3
12	3145-010-3	Robotics	3
Distance Learning Specialization Course			
1	3145-117-3	Semantic Network	3
2	3145-118-3	Data Mining	3
3	3145-119-3	Computer Assisted Teaching	3
4	3145-120-3	Human Language Processing	3
5	3145-121-3	Pervasive Computing	3
6	3145-122-3	Software Computing	3
7	3145-123-3	Formal Method	3
8	3145-124-3	Interaction System	3
9	3145-125-3	Software Quality Assurance	3
E-Business Specialization Course			

1	3145-220-3	E-Commerce and Startups	3
2	3145-221-3	Management information System	3
3	3145-222-3	System Design and Analysis	3
4	3145-223-3	IT Security & Risk Management	3
5	3145-224-3	Supply Chain Management	3
6	3145-225-3	Cloud Computing	3
7	3145-226-3	Digital Signature	3
8	3145-227-3	Content Development	3
9	3145-228-3	Business communication	3
10	3145-229-3	Pervasive Computing	3
11	3145-230-3	E-business Infrastructure Technology	3
12	3145-231-3	Digital Marketing	3
13	3145-232-3	Information System Audit	3
Courses Outside the University (MBKM)			
1	3145-409-2	Field Work Program	2
2		Lecture Intern	16 - 20
Amount			**144 - 156**

3. CURRICULUM STRUCTURE

Curriculum Structure Table

No	GROUP	credits
1.	Courses Outside the Study Program	28 - 31
2.	Study Program Courses	114 - 121
3.	Courses Outside College	2 - 4
Amount		**144 - 156**

a. Courses outside the Study Program

CODE	SUBJECT	credits	Semester								KET
			1	2	3	4	5	6	7	8	
3005-004-2	English	2	V								
3005-006-2	Indonesia Language	2	V								
0005-112-2	Pancasila	2	V								
0005-312-3	Religion	2		V							
0005-106-2	Citizenship	2		V							
0005-321-2	Education Insights	2		V							
0005-322-2	Data Raya and Programming	2			V						

Code	Subject									
0005-320-2	Logic and Scientific Reasoning	2			V					
3145-111-3	Statistics and Probability	3	V							
3135-103-3	Differential Calculus	3	V							
3135-104-3	Linear Algebra	3		V						
3135-106-3	Integral Calculus	3		V						
3135-314-3	Entrepreneurship	3				V				
3005-112-1	Olympics	1	V							
3005-002-2	Philosophy of Mathematics and Natural Sciences	2		V						
TOTAL		**28 -31**								

b. Study Program Courses

Code	Subject	credits	SEMESTER								KET
			1	2	3	4	5	6	7	8	
3135-207-2	Professional ethics	2			V						
3135-403-2	Project management	2							V		
3135-109-3	Numerical Method	3			V						

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3145-411-3	Introduction to Graph Theory	3		V						
3145-113-3	Programming Fundamentals	3	V							
3145-112-2	Introduction to ICT	2	V							
3135-203-3	Data Structures and Algorithms	3		V						
3135-110-3	Introduction to Digital Systems	3		V						
3135-202-3	Introduction to Artificial Intelligence	3				V				
3135-204-3	Database	3			V					
3135-307-3	Human and Computer Interaction	3			V					
3145-301-2	Computers and Society	2			V					
3135-210-3	Web Design and Programming	3			V					
3135-211-3	Object Oriented Design and Programming	3			V					
3145-410-3	Declarative Programming	3				V				

CODE	SUBJECT	credits	SEMESTER								KET
			1	2	3	4	5	6	7	8	
3135-212-3	Algorithm Design and Analysis	3				V					
3135-213-3	Software engineering	3				V					
3135-214-3	Operating system	3				V					
3135-310-3	Computer Graphics	3					V				
3135-402-3	Mobile Computing	3					V				
3135-316-2	Language Theory and Automata	3					V				
	Elective Course 1	3					V				
	Elective Course 2	3					V				
	Machine Learning	3						V			
3135-306-2	Research methods	2						V			
	Elective Course 3	3						V			
	Elective Course 4	3						V			
	Elective Course 5	3						V			
	Elective Course 6	3						V			

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	Elective Course 7	3							V			
3005-401-2	Pre Thesis Seminar	2								V		
	Elective Course 8	3								V		
	Elective Course 9	3								V		
	Elective Course 10	3								V		
	Elective Course 11	3								V		
3005-402-4	Essay	4									V	
Multimedia Specialization Courses												
	Text Processing	3										
	Audio Processing	3										
	Image processing	3										
	Game Development	3										
	Embedded System	3										
	Computer Animation	3										
	Programming Special Topics	3										
	Game-Specific Topic	3										
	Special Topic Text	3										
	Audio Special Topic	3										

	Image Special Topic	3									
	Robotics	3									
Elective Courses in Distance Learning											
	Semantic Network	3									
	Data Mining	3									
	Computer Assisted Teaching	3									
	Human Language Processing	3									
	Pervasive Computing	3									
	Software Computing	3									
	Formal Method	3									
	Interaction System	3									
	Software Quality Assurance	3									
E-Business Elective Courses											
	E-Commerce and Startups	3									
	Management information System	3									
	System Design and Analysis	3									

	IT Security & Risk Management	3										
	SupplayChain Management	3										
	Cloud Computing	3										
	Digital Signature	3										
	Content Development	3										
	Business communication	3										
	Pervasive Computing	3										
	E-business Infrastructure Technology	3										
	Digital Marketing	3										
	Information System Audit	3										
	Sub Quantity	**114 – 121**										

c. Courses outside of College

3135-312-2	Field practice	2							V		
	Community Service Program	2							V		
	Sub Quantity	**4**									
TOTAL		144-156									

Curriculum Map
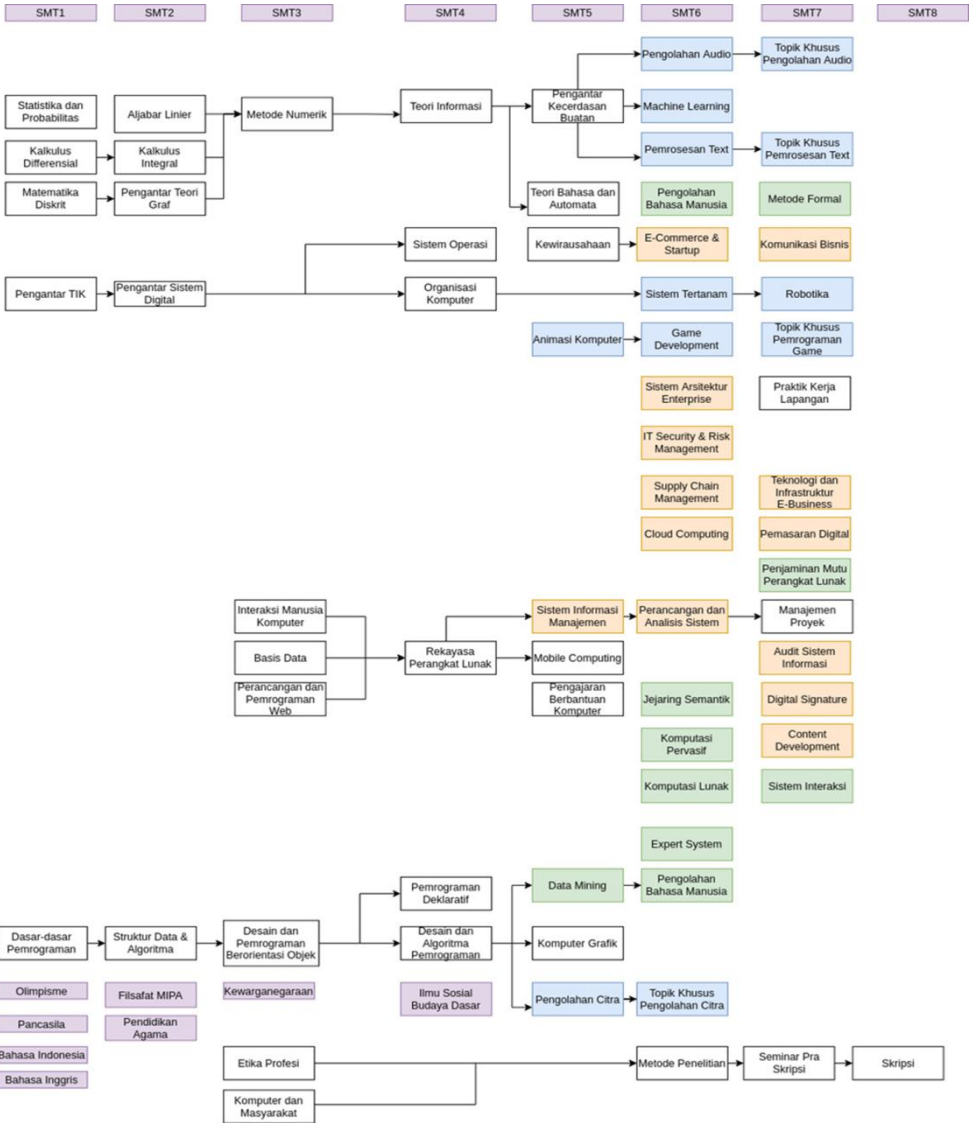
4. Distribution of Courses Each Semester

Semester 1

No.	Subject	credits
1.	Indonesia Language	2
2.	English	2
3.	Olympics	1
4.	Pancasila	2
5.	Statistics and Probability	3
6.	Differential Calculus	3
7.	Discrete Mathematics	3
8.	Introduction to ICT	2
9.	Programming Fundamentals	3
	Number of credits	**21**

Semester 2

No.	Subject	credits
1.	Religious education	2
2.	Philosophy of Mathematics and Natural Sciences	2
3.	Integral Calculus	3
4.	Data Structures and Algorithms	3
5.	Introduction to Graph Theory	3
6.	Introduction to Digital Systems	3
7.	Linear Algebra	3
8.	Citizenship	2
9.	Education Insights	2
	Number of credits	**23**

3rd semester

No.	Subject	credits

1.	Data Raya and Programming	2
2.	Web Design and Programming	3
3.	Numerical Method	3
4.	Human Interaction	3
5.	Computers and Society	2
6.	Object Oriented Design and Programming	3
7.	Database	3
8.	Professional ethics	2
	Number of credits	**21**

Semester 4

No.	Subject	credits
1.	Logic and Scientific Reasoning	2
2.	Declarative Programming	3
3.	Information Engineering	3
4.	Operating system	3
5.	Software engineering	3
6.	Programming Design and Algorithms	3
7.	Introduction to Computer Organization	3
	Number of credits	**20**

5th semester

No.	Subject	credits
1.	Computer Graphics	3
2.	Mobile Computing	3
3.	Introduction to Artificial Intelligence	3
4.	Language Theory and Automata	3

No.	Subject	credits
5.	Entrepreneurship	3
6.	Elective Course 1	3
7.	Elective Course 2	3
	Number of credits	**21**

6th semester

No.	Subject	credits
1.	Machine Learning	3
2.	Research methods	2
3.	Elective Course 3	3
4.	Elective Course 4	3
5.	Elective Course 5	3
6.	Elective Course 6	3
7.	Elective Course 7	3
	Minimum number of credits	**20**

7th semester

No.	Subject	credits
1.	Pre Thesis Seminar	2
2.	Project Management	2
3.	Field Work Practice (PKL)	2
4.	Elective Course 8	3
5.	Elective Course 9	3
6.	Elective Course 10	3
	Number of credits	**15**

Semester 8

No.	Subject	credits
1.	Essay	4
	Number of credits	**4**

5. **Course Description**

    Subject   **: Religious education**
    Credit Load   **: 3 credits**
    Course material   **:**
  a. Islam :
  Physical and spiritual balance in humans, human relations with Allah SWT, human relations with: themselves, fellow humans, other creatures and their environment. Faith in the Oneness of God Tawheed, the function and role of humans in the universe. The task of humans in building a world that is blessed by Allah SWT. The essence of the purpose of human life. The relationship between faith and righteous deeds. Humans after death, the true purpose of life.
  Precondition: -

  b. Christian :
  God in the world is christ. Christ in the world is the church. The church in the world is us. God's plan and creation. Prayer and redemption. His vocation church, rooted in the world. World apostolate and modern techniques. Walk with God, determined to succeed. Reflection of faith on actual problems in the world.
  Precondition:-

    Subject   **: Civic education**
    Credit Load   **: 2 credits**
    Course material **:**

Archipelago Insight, National Resilience, National Strategy Politics, HANKAMNAS Strategy Politics, HANKAMRATA System.
Precondition:-

Subject : English
Credit Load : 2 credits
Course material :
Word pronunciation, tenses, active and passive, voice argument, verbal and clause, vocabulary, reading and translation, give a question and answer a question.
Precondition:-

Subject : Differential Calculus
Credit Load : 3 credits
Course material :
Sets, properties of real numbers, Cartesian coordinates and polar coordinates, determinants and systems of linear equations, functions, sequences, limits and continuity, derivatives and their uses, interpretation of derivatives, Rolle's theorem, mean value theorem, L-Hospital's rule, theorem taylor, extreme values, maximum-minimum, graphs of functions and curves.
Precondition:

Subject : Introduction to Digital Systems
Credit Load : 3 credits
Course material :
Introducing the design of digital system hardware and digital computers. Topics that will be covered include: The binary number system; basic digital circuits: binary logic, logic gates, Boolean algebra, standard forms of Boolean

functions, representation, simplification and manipulation of Boolean functions with Karnaugh-Map; Combination circuit: arithmetic circuit, decoder, multiplexer; Sequential circuits: latch, flip-flop, characreristic table, excitation table, state table, state diagram, propagation delay, sequential circuit analysis and design; Register and counter circuit, Memory & Programmable Logic.
Precondition: -

Subject   : Integral Calculus
Credit Load   : 3 credits
Course material :
Indeterminate   integrals,   integration   methods: substitution, partials, rational fractions, goometric functions. Certain integrals: integrals as limiting quantities, certain integral properties, fundamental theorems of integral computation, improper integrals, the use of integrals: area of a plane, arc length, volume of rotating body, area of rotation, center of mass and moment of inertia. The double integral and its uses.
Prerequisite: Differential Calculus

Subject   : Algorithms and Programming
Credit Load   : 3 credits
Course material :
C program structure, C language elements, loop instructions, selection instructions, default functions, custom functions, variable types and relationships with RAM, arrays, strings, pointers, standard functions for string manipulation, structures, union and enumeration, preprocessor, files ,.
Precondition:

Subject   **: Discrete Mathematics 1**
Credit Load   **: 3 credits**
Course material   **:**
Propositional logic, Predicate logic, Set theory, Functions, Sequences, Series, Function growth, Algorithms, Complexity of algorithms, Number theory, Methods of proof, Mathematical Induction, Birdcage principle, Permutations, Combinations.
Precondition:

Subject   **: Discrete Mathematics 2**
Credit Load   **: 3 credits**
Course material   **:**
Relation and its properties and applications, Close relation, Equivalent relation, Partially ordered, Totally ordered, Recurrence relation, Generating function, Graph, Isomorphism of graph, Connectivity of graph, Component, Path, Circuit, Euler path and circuit, Hamilton path and circuit, Shortest Path, Planar Graph, Graph coloring, Tree, Forest, Spanning tree, Minimum spanning tree, cut set.
Precondition: Discrete Mathematics 1

Subject   **: Web Design and Programming**
Credit Load   **: 3 credits**
Course material   **:**
Main HTML elements: document header, body, paragraph, list, blockquote, preformatted text, address. Characters: logical formatting, physical formatting, special characters. Links: internal links, links with mailto, links to other documents, links to other computers, images, tables, frames, forms, introduction to css, properties in css, introduction to java script, introduction to java script,

javascript in HTML. PHP basics, control structures, advanced data, functions, input-output files, object oriented programming with PHP.
Precondition:

Subject   : Linear Algebra
Credit Load   : 3 credits
Course material :
Basic processing of matrices.Determinants, exponents of matrices, general inverse and inverse matrices, special matrices.Solution of systems of linear equations.Real vector spaces and Euclidean spaces.Linear transformations, characteristic vectors and characteristic roots of matrices, diagonalization of matrices.Bilinear and quadratic forms .
Precondition:

Subject   : Computer System Organization
Credit Load   : 3 credits
Course material :
Hardware and software architecture: basic operational concepts. assembly language. Data representation: binary to hexadecimal conversion, binary to decimal, signed numbers, unsigned numbers. PDP-11 machine addressing methods: immediate, absolute, direct, indirect, branch instructions. Motorola 68000 engine addressing method: immediate, basic relative, full relative. Processing Unit (CPU): basic concept, return words from memory, store words to memory. Micro Programming: microinstruction, control signal clustering, microprogram sequencing. I/O organization I/O device access, direct memory access, interrupt. Main memory basic concepts, Semiconductor

RAM memories, memory system considerations. Computer communication: communication with remote control terminal, fault control, dual terminal configuration. Secondary memory: physical and logical characteristics, disk types, disk formats, FAT. Macros: declare macros, pass parameters, nested macros, macros calling procedures.

Precondition: Introduction to Computer Organization

Subject : **Basic Statistics and Probability**
Credit Load : **3 credits**
Course material :
Understanding data, compiling and summarizing data graphically and numerically, measures of central tendency and dispersion. Conditional probabilities and probabilities, random variables, probability distributions, mathematical expectations, some discrete variable distributions: binomial, poison, hypergeometric. Continuous variable distribution: normal and approximation to normal distribution, Chi square distribution, t distribution, F distribution. Elementary sampling theory and central limit theorem. The concept of statistical inference: interpreting and testing the parameters of mean, proportion, variance for 1 and 2 populations. Regression analysis with least squares method, simple linear regression, multiple linear regression with two variables. One-way and two-way analysis of variance.
Precondition: -

Subject : **Intelligent System**
Credit Load : **3 credits**
Course material :

This course aims to introduce the basics of artificial intelligence (AI) and some basic AI programming techniques. Topics covered include: Introduction to Aid and the latest AI developments; problem solving: state space, basic search, heuristic search; basic knowledge representation in computers: propositional logic, first order logic, resolution; and knowledge representation: rule based systems, expert systems, semantic nets & frames.

Precondition: Algorithms and Programming, Discrete Mathematics II, Data Structures and Algorithms

Subject : **Neural Network**
Credit Load : **3 credits**
Course material :
This course discusses: Introduction to Artificial Neural Networks, Perceptrons, Discrete Hopfield Networks, Backpropagation Methods, Artificial Neural Network Applications, Artificial Neural Networks Applications, Artificial Neural Networks and integration strategies with expert systems.

Subject : **Language Theory and Automata**
Credit Load : **3 credits**
Course material :
Formal language, automata theory and automata hierarchy as language acceptors, introductions to computational complexity, use or application of language theory concepts such as regular expressions and context-free grammar in designing software such as text processors and compilers. Chomsky hierarchy (levels of grammar and the language represented), ambiguous

grammar (ambigious grammar), automata simplification and grammar to normal form, parsing techniques (top down and bottom-up).
Precondition: Discrete Mathematics 2

Subject   **: Data Structures and Algorithms**
Credit Load   **: 3 credits**
Course material   :
Data declaration and mapping to array, mapping to storage from array, triangular array and sparse array, record and mapping to storage from record stack, application stack, mapping to storage from stack and queue, how to put elements in queue and dequeue, priority queue, linked lists and linked lists in memory, declarations in linked lists and manipulation of linked lists, general trees, binary graph trees, and their applications.
Precondition: Algorithms and Programming

Subject   **: Applied Probability**
Credit Load   **: 3 credits**
Course material   :
Discusses probability theory and its application in computer science. The topics covered include Introduction: probability review, transformations: Stochastic processes: definition and classification, Poisson processes, Birth-and-Death processes, Markov chains; Queueing systems : equilibrium solution, Little's Theorem, M/M/1, m/M/Y, M/M/m, M/M/m/m, M/G/1.
Precondition: Basic Statistics

Subject   **: Algorithm Design and Analysis**
Credit Load   **: 3 credits**

Course material :
Mathematical basics (review), criteria for evaluating the goodness of algorithms, greedy algorithm techniques, divide and conquer algorithm techniques, dynamic programming techniques, backtracking techniques, tractable and intractable problems, approach algorithms.
Precondition: Data Structures and Algorithms, Discrete Mathematics 2

Subject   : Expert system
Credit Load   : 3 credits
Course material :
The position of expert systems on artificial intelligence. Definition, scope, characteristics and development of expert systems. The difference between expert system software and conventional software. An expert system development methodology. Characteristics of an expert. Knowledge acquisition, knowledge representation, inference methods. Uncertainty handling methods with certanty factor and fuzzy method and fuzzy expert system. Expert system developer software: Winexsys, PC-Plus, and similar software.
Precondition:

Subject   : Image processing
Credit Load   : 3 credits
Course material :
Artificial intelligence techniques applied to pattern recognition and image analysis include: receptors, heuristic procedures, discriminant theory. Elimination of effects: translation, dilation, rotation. Image analysis techniques, image representation and description.

Precondition: Data Structures and Algorithms, Integral Calculus

Subject   **: Operations Research**
Credit Load   **: 3 credits**
Course material   **:**
Operations research definition and description. Linear modeling. Simplex method. Sensitivity and duality analysis. Transportation and assignment problem formulation and solution. Multiple-purpose linear modeling. Queue and game model.
Precondition: Integral Calculus

Subject   **: Operating system**
Credit Load   **: 3 credits**
Course material   **:**
History of basic concepts and structures, process models, interprocessing and communication, process scheduling, memory management, swapping, virtual memory, page replacement, paging, working set and segmentation models, file systems, files and directories, implementation and security protection. Deadlocks and distributed systems.
Precondition: Data Structures and Algorithms, Introduction to Computer Organization

Subject   **: Software engineering**
Credit Load   **: 3 credits**
Course material   **:**

Software development methodology, computer aided software engineering (case) tools, software development project planning, analysis of user needs and problems, preparation of software specifications, basic principles of software design, design techniques oriented to data and object processes, problems in program writing , software quality assurance, software quality measures, software testing.

Precondition: Data Structures and Algorithms

Subject : **Computer network**
Credit Load : **3 credits**
Course material :
Introduction to Computer Networking, Multiplexing, Introduction of network types, network topology, internetworking, Medium access Sublayer, Network Layer, TCP / IP Protocol, IP Address and IP Subnetting, TCP/IP Protocol Application, Computer network management, computer network security, novell installation management netware, use of workstations, mobile networks.

Precondition: Introduction to Computer Organization

Subject : **Numerical Method**
Credit Load : **3 credits**
Course material :
Theories and methods of solving quantitative problems with the help of computers. Errors: definition of errors and relative errors, types of errors, how to reduce errors. Finding the roots of nonlinear equations: The bisector method, False position method, Fixed point iteration method, Newton-Raphson method, Secant method.

Interpolation: linear, quadratic and cubic using: Newtonian polynomials, Lagrange polynomials and interpolation using spline functions. Approximate functions: best approximation problem, Chebyshev polynomials. Numerical integration: rectangular rule, trapezoid rule and Simpson's rule. Numerical derivatives of functions: forward difference approximation, backward approximation difference, center difference approximation. Solution of a system of linear equations: back substitution method, Gauss elimination, LU factorization, Least Squares data fitting.
Precondition: Integral Calculus, Linear Algebra

Subject   **: Numerical Analysis**
Credit Load   **: 3 credits**
Course material **:**
This course discusses: Number systems and errors, Interpolation with polynomies, Solving nonlinear equations, matrices and systems of linear equations, Systems of equations and unconditional optimization, Approximation, Differentiation and integration, Solving differential equations, Limit value problems in ordinary differential equations

Subject   **: Formal Method**
Credit Load   **: 3 credits**
Course material **:**
In this lecture, a formal method of developing imperative programs will be discussed. The program development process begins with making program specifications, using formal rules in the development steps, and finally getting a ready-to-execute program. In addition, it will also discuss

writing specifications in the Z specification language or something similar. Topics to be discussed include Introduction: the role of formal program development, predicate calculus, Dijkstra's language of guarded commands; Refinements & programs; Specification; Type & declaration; local block; Logical constants & initial variables; Alternation; iteration; Invariant search strategy; Procedure & substitution; Recursion; Module; Data refinement; Specifications in Z-like form.

Precondition: Discrete Mathematics I, Data Structures and Algorithms

Subject   **: Introduction to Artificial Intelligence**
Credit Load   **: 3 credits**
Course material   :
Problem solving modeling with graph search. Graph search algorithms: BFS, DFS, Best-First. Knowledge representation with predicate logic. Frames, scripts, shopping algorithms. Advanced applications: expert systems, NLP, computer vision.
Precondition: Algorithms and Programming, Discrete Mathematics 2, Data Structures and Algorithms.

Subject   **: computer architecture**
Credit Load   **: 3 credits**
Course material   :
Introduction to computer architecture. Introduction to parallel processes: trend, microprocessor, STACK & FIFO. Memory: digital, virtual, cache memory, shell memory static, dynamic, associative memory. I/O subsystem: cache access, low level parallelism, FLYNN. Pipeline concept: SIMP, array processor. systolic. Relationship between

processor memory: loozly, titghly coupled, carnegiemelon. Multiprocessor architecture: IDC, RDBM. Data flow and control flow architecture: dependency graph, data driven, demand driven, LAU, MIT. Computer organization: program organization and machine organization.
Precondition:-

Subject : **Data communication**
Credit Load : **3 credits**
Course material :
Basic and general understanding of data communication. Introduction to data, signals and information. Error detection and correction. Knowing modulation techniques. Knowing communication protocols. data link layers. Network layer.Internet working, highlayer.Frame relay and atm. Mastering ISDN. Get to know the V-SAT.
Precondition:-

Subject : **Computer graphics**
Credit Load : **3 credits**
Course material :
Graphics systems, computer graphics programming, graph primitive function algorithms, promotive function attribute algorithms, windowing and clipping, 2D transformations, 3D transformations, 3D viewing, hidden surfaces and hidden lines, shading techniques and color models.
Precondition: Data Structures and Algorithms, Linear Algebra

Subject : **Database**
Credit Load : **3 credits**

Course material :
Principles of database modeling, design, and implementation. Topics discussed include: database system concepts and architecture, database development life cycle, conceptual database model using entity relationship diagrams, mapping conceptual models into relational tables, I-III normalization concepts, designing and defining data structures, discussion in-depth about Structured Query Language (SQL) to the use of triggers and stored procedures, determining the organization of data and indexes, as well as the practice of implementing databases using a relational database management system (RDBMS). Advanced normalization (4NF, 5NF, BCNF), relational algebra and query optimization, advanced file and index organization, transaction management and recovery, database monitoring and performance improvement,
Precondition: Data Structures and Algorithms

Subject   : Formal Method
Credit Load   : 3 credits
Course material :
The imperative program development method is discussed formally. The program development process begins with making program specifications, using formal rules in the development steps, and finally getting a ready-to-execute program. In addition, it will also discuss writing specifications in the Z specification language or something similar. Topics to be discussed include Introduction: the role of formal program development, predicate calculus, Dijkstra's language of guarded commands; Refinements & programs; Specification; Type & declaration; local block;

Logical constants & initial variables; Alternation; iteration; Invariant search strategy; Procedure & substitution; Recursion; Module; Data refinement; Specifications in Z-like form.
Precondition: Discrete Mathematics 1, Data Structures and Algorithms

Subject : **System Analysis and Design**
Credit Load : **3 credits**
Course material :
Discusses the aspects and techniques needed to analyze and design an information system. Materials that will be studied include the basics of system analysis and design: the form of a modern information system, the role of a systems analyst, systems development methodology, system development project management; Strategic planning of information systems: formulating a function model in the organization, analysis of organizational goals and problems, analysis of critical success factors, analysis of the impact of information technology; Information systems analysis: analysis activities, the ability of analysts to communicate, fact-finding techniques, formulate process & data system models, formulate system specifications; Information system design and prototypes: joint application development (JAD), file systems and databases, input and output systems,
Precondition:Database, Software Engineering

Subject : **Cryptography & Information Security**
Credit Load : **3 credits**
Course material :

Cryptography basics, including: block ciphers and DES (Data Encryption Standard), AES (Advanced Encryption Standard), public-key cryptosystems, key management, digital signatures, authentication protocols. Cryptographic applications for various aspects of information security.
Precondition:Discrete Mathematics 1 and 2, Applied Probability, Computer Networking

Subject   : Information Security Management
Credit Load   : 3 credits
Course material   :
Discuss about computer security. Topics covered include security management: information assets, policies, procedures, risk management; security model & level on : network, equipment, application, operating system; access control, security in application development; operational security; physical security; internet, network and telecommunications security; disaster recovery plan and business continuity plan ; computer crime, computer crime investigation.
Precondition: Discrete Mathematics 2, Computer Networks, Applied Probability

Subject   : Geographic Information System
Credit Load   : 3 credits
Course material   :
Understanding geographic information systems (GIS), background, history of development and applications. GIS elements, data, software and hardware. Raster and vector data structures. Database collection and compilation. Initial data processing: format conversion, data reduction, error detection and editing, merging,

rectification/registration. Spatial database management. Data processing and analysis: classification and aggregation, geometric and spatial operations, measurement, statistical analysis, modeling. Processing and types of output.

Precondition: Computer Graphics

Subject   : Management information System
Credit Load   : 3 credits
Course material :
Introduction to computer-based information systems, using information technology for a competitive advantage, using information technology to participate in commerce over electronic networks, use of computers in international markets, common systems models of companies, systems approach, systems life cycle methodology, basics computer processing, databases and database management systems, data communications, accounting information systems, management information systems, decision-making support systems, virtual offices.

Precondition:

Subject   : Research methodology
Credit Load   : 2 credits
Course material :
The role of research in the development of science. Research ethics and scientific writing. Procedures for scientific writing, scientific writing formats, research methodologies, data collection processes, measurement methods in various fields, analytical methods and interpretation of analysis results. Assignment to review scientific papers and journals in the computer field.

Precondition: Statistics, Applied Probability

Subject : **Object Oriented Design and Programming Credit Load** : **3 credits**
Course material :
The object orientation approach and its comparison with the structural approach, the basic principles and concepts of object orientation such as: ADT, encapsulation, inheritance, information hiding, polymorphism. Object-oriented software development techniques: object-oriented analysis, object-oriented design and implementation techniques with object-oriented language. Introduction and discussion of the JAVA language.
Precondition:

Subject : **Data Mining**
Credit Load : **3 credits**
Course material :
This course studies: Introduction to RDBMS; SQL; Introduction to Data Mining; Architecture and Data Mining Models: Decision Trees, Rule-Based Classifier, Bayesian Classifier, Support Vector Machine, Neural Networks, Cluster Analysis: Definition of Cluster Analysis, K-Means and Cluster Evaluation, Multidimensional Data Analysis, Data Visualization, Application Tools and Deep Trends Data Mining, Application of data mining in the world of business and industry

Subject : **Fuzzy Logic**
Credit Load : **3 credits**
Course material :

This course covers the basic concepts of fuzzy logic and its application in various fields. The basic concepts include fuzzy sets, intersection relations and unions for fuzzy decision making. Fuzzy logic is applied for the purposes of system analysis and modeling, system optimization and system control. hardware and software for the use of fuzzy logic in the control system.

Subject : **Introduction to Robotics**
Credit Load : **3 credits**
Course material :
This course studies:Introduction to the Disciplines of Robotics, Robotic Design Engineering, Robotic Control, Kinematics and Robot Dynamics: Basic Principles of Mathematical Modeling
In Robotic Systems, Kinematic Analysis of Holonomic Systems, Kinematic Analysis of Non-Holonomic Systems, Dynamic Analysis, Jacobian Theory, DDMR Dynamic Equations of Motion; One Joint Hand Robot, Two Joint Hand Robot.

Subject : **Entrepreneurship**
Credit Load : **3 credits**
This lecture aims to provide students with provisions regarding the regulation and marketing methods of products, especially IT products. In addition, this course is also expected to be able to foster the entrepreneurial spirit of students. Marketing Management covers: basic concepts of efficient and effective marketing, with case studies of marketing IT products. Entrepreneurship includes: to foster interest in entrepreneurship by providing knowledge and skills in starting new businesses.

Precondition: Research methodology

Subject   : Computational Mathematics Seminar
Credit Load   : 2 credits
Course material :
Seminar Course Computational Mathematicsaims to open students' horizons to the latest research publications in computer science and technology. This course is also expected to help students develop their skills in communicating both orally and in writing. Seminar CourseComputational Mathematicsit is research oriented. Seminar topics will be given at the beginning of the semester and each topic will cover one or more papers taken from scientific journals in the field of computer science.

Subject   : Project management
Credit Load   : 3 credits
Course material :
This course includes an introduction to software requirements, management of a project, project life cycle, project tasks and deliverables, determining projects and drafting project contracts, requirements analysis, cost estimation and cost/benefit analysis, project scheduling, activity network, critical path analysis, resource level, risk management, quality assurance, project management stages and project resources, project testing and delivery, post implementation review, human aspects, communication, teamwork, project leadership.
Precondition:-

Subject : Expert system
Credit Load : 3 credits
Course material :
This course discusses the definition and scope of expert systems, characteristics, expert system architecture, expert system components including user interface, knowledge base, inference engine, knowled acquisition facility and explanation facility, uncertainty theory which includes Bayes theory, certainty factor and fuzzy logic, expert system design which includes domain, objectives, DFD, and tables and their implementation

Subject : Mobile Computing
Credit Load : 3 credits
Course material :
Overview Wireless transmission: provides an overview of frequency, radio transmission, signal and propagation, multiplexing, modulation, medium access control on mobile and wireless networks, spread spectrum, cellular systems. Mobile communication systems: provides a description of the architecture and protocols of several mobile wireless communication technologies. LAN: describes the architecture and protocols of several wireless LAN technologies. Network and Transport Layer Protocols: provides a description of several network and transport layer protocols that support mobile and wireless communications. Mobile internet application: provides a description of several implementations and tools to support internet access via mobile and wireless devices.

Subject : Field practice
Credit Load : 2 credits
Course material :
This course can be followed by students who have passed all compulsory computer science courses. This practical work or research activity is carried out for two months in various government and private institutions that have a concern in the field of research and development of computer science. From this activity, it is possible for students to obtain scientific work writing materials as a student's final project. At the beginning of the activity, practical work / research briefings are held and at the end of the activity, students are required to make reports on practical work / research activities which also contain problems encountered in the field and solutions in terms of computer science.
Precondition:

Subject : Professional ethics
Credit Load : 2 credits
Course material :
This course discusses: Definition of Ethics, Profession and Professionalism; Crime modes in Information Technology; IT forensics; Rules and Regulations; Business aspects in the field of information technology; Professional standard development model; Certification of Expertise in the field IT; Code of ethics practices in the use of information technology.

Subject : Olympics
Credit Load : 1 credit
Course material :

This course aims to cultivate sports values (olympism) in an integrated and consistent manner. This course includes: Introduction to the philosophy and values of sports (Olympic), a combination of physical and spiritual balance, harmonization of the relationship between sport, culture and education, harmony of life based on happiness and noble endeavor, appreciation of the principles of universal ethics.

Subject   **: Prescription Seminar**
Credit Load   **: 2 credits**
Course material :
Seminar on research results / student's final project as a means to discuss the results of research / final project that has been carried out and get suggestions for improvement from seminar participants.
Precondition:

Subject   **: Essay**
Credit Load   **: 4 credits**
Course material :
The final project is presented in the form of a written paper as one of the requirements for graduation for undergraduate students in Computer Science. This paper is scientific in nature, can come from practical work / research material or in the form of software development (theory or application).

H. LIST OF TEACHING STAFF

NO	LECTURER CODE	NAME	EMAIL ADDRESS
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STUDY PROGRAM OF STATISTICS, FMIPA UNJ
MERDEKA LEARNING INDEPENDENT CAMPUS

A. INTRODUCTION

The Statistics Study Program is included in the mathematics group under the auspices of the Faculty of Mathematics and Natural Sciences, Universitas Negeri Jakarta (FMIPA UNJ). The opening of the Statistics Study Program for the Undergraduate Program at the Universitas Negeri Jakarta based on the Decree of the Minister of Research, Technology and Higher Education of the Republic of Indonesia Number 52/KPT/I/2016, January 20, 2016.

The Statistics Study Program curriculum refers to the agreement on the Statistical Study Program minimum curriculum issued by the Indonesian Statistics Higher Education Forum (FORSTAT), and also refers to the Statistics Study Program curriculum issued by the ASA (American Statistical Association). So that the core courses are arranged according to the determination of the scope of subject names and the minimum number of credits by the Indonesian Statistics Higher Education Forum (FORSTAT), as well as 5 (five) ASA foundations including Foundational Mathematics, Data Manipulation and Computation, Statistical Method and Theory,*Specific Courses,* and Statistical Practice.

Currently, UNJ makes 4 (four) components of Study Program curriculum development that are characteristic of UNJ which include 21st century skills (KA-21): 6 Cs, impact-based education Outcome Based Education (OBE), Digital Literacy, and MBKM produces curriculum documents which are relevant to the applicable regulations and the demands of current and future developments which are managed in an

ICT-based curriculum digital infrastructure called the Curriculum Information System (SIKUR). The Statistics Study Program, Faculty of Mathematics and Natural Sciences (FMIPA) is determined to support the realization and sustainability of the said SIKUR-UNJ.

Based on the explanation above, the Statistics Study Program which in 2018 was accredited B according to the BAN-PT Decree No. 877/SK/BAN-PT/Akred/S/III/2018 submitted a proposal for developing an information technology-based curriculum, so that it can produce graduates who compete in the digitalization era of the industrial revolution 4.0. Along with the development of the digitalization era of the industrial revolution 4.0, data is also growing rapidly which is now often called Big Data. Big data certainly has a high level of difficulty if the processing is done manually. Therefore, currently we need human resources who are experts in data science who are able to get patterns from Big Data to obtain information from the data.

In line with the government's policy regarding independent learning-independent campuses, where each student has the right to take credits outside of tertiary institutions for two semesters and can take credits in different study programs within the same university for one semester, the curriculum for Statistics Study Program UNJ also designed to support this policy. The preparation of the independent learning-campus curriculum for the UNJ Statistics Study Program is guided by the Decree of the Chancellor of the Universitas Negeri Jakarta, Number 638/UN39/TM.00.00/2020 dated June 20, 2020 regarding Guidelines for the Implementation of Free Learning at the Universitas Negeri Jakarta. In addition, the curriculum is designed by taking into account the vision, mission, goals, and objectives of the study program.

B. VISION, MISSION AND GOALS

1. **Vision**

   By 2030, become a quality study program capable of producing statistics graduates who are faithful and devoted, intelligent, skilled, have a high academic culture and entrepreneurial skills and are able to compete at the ASEAN level.

2. **Mission**

   a. Organizing quality education and teaching activities by utilizing information and communication technology to produce Statistics graduates that are in accordance with the needs of stakeholders and able to compete at the national and ASEAN levels.

   b. Creating a high academic culture, fostering entrepreneurial skills, and creating a religious atmosphere in every academic and non-academic activity.

   c. Organizing research and development activities in the field of Statistics in line with the development of science and technology.

   d. Organizing community service activities.

   e. Establish and develop cooperation with various institutions both at home and abroad.

3. **Purpose**

   a. Produce statistics graduates who are professional, able to utilize information and communication technology, have entrepreneurial skills, have faith and piety, according to stakeholder needs, and are able to compete at national and global levels.

b. Produce quality scientific works based on research results in the field of Statistics in accordance with the development of science and technology.
c. Provide services to the public by applying the field of Statistics according to their needs.
d. Have and run mutually beneficial cooperation with partner institutions both from within and outside the country, especially those related to the development of the Statistics Study Program.

C. GRADUATE PROFILE

	GRADUATE PROFILE	GRADUATE PROFILE DESCRIPTION
1	Survey coordinator.	Able to coordinate, plan, implement and handle data collection.
2	Data analyst, Data scientist, Research assistant.	Able to perform data management in such a way that it becomes data ready for further analysis.
3	Research analyst, Research executive, Data analyst, Marketing Researcher.	Able to analyze data to solve real problems and be able to communicate it orally and in writing.
4	Human research development, Test developer, Evaluator	Able to make and evaluate research instruments (tests or questionnaires) and able to measure (quantify) and analyze latent characteristics (latent traits).
5	Programmer	Have the expertise and skills to use several statistical software

		and be able to compose a computational program that supports the data analysis process.

D.COMPETENCE OF GRADUATES

1. Attitude

a. Fear of God Almighty and able to show a religious attitude;

b. Upholding human values in carrying out duties based on religion, morals, and ethics;

c. Contribute to improving the quality of life in society, nation, state, and the advancement of civilization based on Pancasila;

d. To act as citizens who are proud and love their homeland, have nationalism and a sense of responsibility to the state and nation;

e. Appreciate the diversity of cultures, views, religions, and beliefs, as well as the opinions or original findings of others;

f. Cooperate and have social sensitivity and concern for society and the environment;

g. Obey the law and discipline in the life of society and the state;

h. Internalize academic values, norms, and ethics;

i. Demonstrate a responsible attitude towards work in their area of expertise independently;

j. Internalize the spirit of independence, struggle, and entrepreneurship;

k. Showing concern in efforts to educate and dignify the nation through awareness of the strategic role of education, big ideas that have an influence in the world

of education, as well as issues and developments in the world of education.

2. **General Skills**
   a. Able to apply logical, critical, systematic, and innovative thinking in the context of the development or implementation of science and technology that pays attention to and applies humanities values in accordance with their field of expertise;
   b. Able to demonstrate independent, quality, and measurable performance;
   c. Able to study the implications of the development or implementation of science and technology that pays attention to and applies humanities values according to their expertise based on scientific principles, procedures and ethics in order to produce solutions, ideas, designs or art criticisms;
   d. Able to compile a scientific description of the results of the studies mentioned above in the form of a thesis or final project report, and upload it on the university's website;
   e. Able to make appropriate decisions in the context of solving problems in their area of expertise, based on the results of information and data analysis;
   f. Able to maintain and develop work networks with supervisors, colleagues, colleagues both inside and outside the institution;
   g. Able to be responsible for the achievement of group work results and supervise and evaluate the completion of work assigned to workers under their responsibility;

h. Able to carry out the process of self-evaluation of the work group under their responsibility, and able to manage learning independently; and

i. Able to document, store, secure, and retrieve data to ensure validity and prevent plagiarism

3. **Knowledge**
   a. Have in-depth knowledge of the basic concepts of statistical science, statistical theory and statistical analysis methods that can be applied to various applied fields.
   b. Familiar with standard and practical software relevant to statistics
   c. Able to identify and explain simple statistical problems.

4. **Special skill**
   A. Able to solve simple practical problems by applying statistical methods to produce useful information through efficient design/collection/generation of data in experiments/surveys/simulations
   B. Finding the implied meaning of the formal structure of a simple statement/model/statistical/mathematical problem
   C. Proving formally and correctly a simple mathematical statement/statistical theory with facts and methods that are already known to students.
   D. Mastering the basic strategies for transferring statistical methods/statistical analyzes to multidisciplinary sciences.
   E. Able to formulate appropriate analysis of the reliability of test items (tests), questionnaires and

other measurement instruments based on statistical and psychometric concepts.

F. Able to plan and formulate appropriate data management and analysis using statistical techniques with the help of software and present and communicate the results in oral and written form.

E. TITLE

Graduates of the Statistics Study Program are entitled to hold the title of S.Stat (Bachelor of Statistics).

F. ACCREDITATION

The Statistics Study Program is accredited B based on BAN-PT Decree No. 877/SK/BAN-PT/Akred/S/III/2018.

G. CURRICULUM

Group of Subjects and Curriculum Credit Weights

No	Course Group	credits
1	National Compulsory Courses	8
2	University Compulsory Courses	6
3	Course Characteristics of the Faculty	7
4	Study Program Compulsory Courses (PS Characteristics)	94
5	Course Characteristics of Study Program (Optional)	11
6	Courses Outside PS	18
TOTAL		**144**

*) Especially for Education Study Program

Type of Course	Description	Credit Distribution	
		# credits	%
Must	1. MKU	14	9.72
	2. MK Characteristics of FMIPA and UNJ	7	4.86
	3. MK Mandatory Study Program Characteristics *)	94	65.28
Choice	1. MK Choice of Study Program Characteristics in UNJ	11	7.64
	2. Outside PS	18	12.50
Number of Credits		**144**	**100**

Description :

*) Compulsory courses for the Study Program include basic
 skills courses that Statistics PS students must take, and

these courses are available in Mathematics and Computer Science courses at FMIPA UNJ.

No	Group	Credits
1.	MKU Compulsory Eyes + FMIPA Features + UNJ Features	**21**
2.	Elective courses	
	a. Inside UNJ[*)]	11
	b. Outside PS	18
	Amount	**29**
2	Compulsory course of study program	
	a. Basic courses of expertise (MKDK) **)	20
	b. Expertise Course (MKK)	62
	c. Study Program Characteristics Skills Course (MKP)	12
	Amount	**94**
	TOTAL	**144**

Description :

[*)] Elective courses that can be taken both from within and from outside the study program at UNJ

[**)] Basic Skills Courses (20 credits) must be taken by Statistics PS students and these courses are available in Mathematics and Computer Science courses at FMIPA UNJ.

3. **General Courses, Characteristics of the Faculty of Mathematics and Natural Sciences and Characteristics of UNJ**

The total credit load for compulsory courses outside the study program and within UNJ is 21 credits consisting of: MKU (14 credits) and FMIPA and UNJ feature courses (7 credits).

General Course (MKU)

No	Subject	credits
1	Indonesia Language	2
2	Pancasila	2
3	Citizenship	2
4	Religion	3
5	Logic and Scientific Reasoning	2
6	Data Raya and Programming	2
7	Education Insights	2
Total		**14**

Characteristics of FMIPA and UNJ Courses

No	Subject	credits
1	Philosophy of Mathematics and Natural Sciences	2
2	Olympics	1
3	Entrepreneurship	2
4	English	2
Total		**7**

4. **Study Program Compulsory Courses**

By referring to the agreement on the minimum curriculum for Statistics Study Program issued by the Indonesian Statistics Higher Education Forum (FORSTAT), and also

referring to the Statistics Study Program curriculum issued by the ASA (American Statistical Association), the compulsory subjects of the Statistics Study Program UNJ are divided into five groups. as follows :

No	Course group	credits
1	Mathematical Foundation (Foundational Mathematics)	14
2	Data manipulation and data computing (Data Manipulation and Computation)	15
3	Statistical methods and theories (Statistical Method and Theory)	42
4	Courses for identifying study programs (Specific Courses)	12
5	Application of Statistics (Statistical Practice)	11
Total		**94**

The list of courses for each course group is as follows:

Subject		credits
I.	**Foundational Mathematics (Foundational Mathematics)**	**14**
	1. Introduction to Basic Mathematics	2
	2. Differential Calculus	3
	3. Integral Calculus	3
	4. Multiple variable calculus	3
	5. Matrix Algebra	3
II.	**Data Manipulation and Computing Data (Data Manipulation and**	**15**

Subject	credits
Computation)	
1. Algorithms and Programming	3
2. Database	3
3. Statistical Computing	3
4. Numerical Method	3
5. Statistical Simulation Method	3
III. **Statistical Method and Theory (Statistical Method and Theory)**	**42**
1. Sampling Technique	3
2. Experimental design	3
3. Survey Design and Analysis	3
4. Basic Statistics	3
5. Mathematical Statistics I	3
6. Mathematical Statistics II	3
7. Explorative Data Analysis	3
8. Regression Analysis	3
9. Time Series Analysis	3
10. Categorical Data Analysis	3
11. Multiple Variable Analysis	3
12. Linear Model	3
13. Stochastic Process	3
14. Introduction to Data Science	3
IV. **Eye Study Program Characteristics Skills (Specific Courses)**	**12**
1. Item Response Theory I	3
2. Item II Response Theory	3
3. Structural Equation Model I	3
4. Structural Equation Model II	3

	Subject	credits
V.	**Application Statistics (Statistical Practice)**	11
	1. Field practice	2
	2. Research methods	3
	3. Pre Thesis Seminar	2
	4. Essay	4

Compulsory courses of study programs are taken from within and from outside the study program;
Compulsory courses taken from within the study program are subjects that include expertise courses (MKK), and study programs characterizing courses (MKP);
Compulsory courses taken from outside the study program are subjects that include basic skills courses (MKDK).

The details of the courses based on the MKDK, MKK, and MKP groups are as follows:

Basic Skills Course (MKDK)

No	Subject	credits
1	Introduction to Basic Mathematics	2
2	Differential Calculus	3
3	Integral Calculus	3
4	Multiple variable calculus	3
5	Numerical Method	3
6	Algorithms and Programming	3
7	Database	3
	Total	**20**

Expertise Course (MKK)

No	Subject	credits
1	Basic Statistics	3
2	Matrix Algebra	3
3	Sampling Technique	3
4	Experimental design	3
5	Survey Design and Analysis	3
6	Mathematical Statistics I	3
7	Mathematical Statistics II	3
8	Explorative Data Analysis	3
9	Regression Analysis	3
10	Time Series Analysis	3
11	Categorical Data Analysis	3
12	Multiple Variable Analysis	3
13	Linear Model	3
14	Stochastic Process	3
15	Introduction to Data Science	3
16	Statistical Computing	3
17	Statistical Simulation Method	3
18	Field practice	2
19	Research methods	3
20	Proposal Seminar	2
21	Essay	4
	Total	**62**

Characteristics Course (MKP)

No	Subject	credits
1	Item Response Theory I	3
2	Item II Response Theory	3
3	Structural Equation Model I	3
4	Structural Equation Model II	3
	Total	**12**

Learning Activities Outside the Study Program and Outside UNJ

No	8 Free Learning Activities	Credits
1	Not choosing or choosing in the form of courses	0 – 20
2	Student exchange	0 – 20
3	Internship/Work Practice (KKN)	0 – 20
4	Teaching Assistant in Education Unit	0 – 20
5	Research/Research	0 – 20
6	Humanitarian Project	0 – 20
7	Entrepreneurial Activities	0 – 20
8	Independent Study/Project	0 – 20
9	Building a Thematic Real Work Village/Lecture	1 – 20

5. Elective Courses in Unj

a. Elective courses at UNJ are courses that can be taken by students to complete specific skills/knowledge as enrichment, both from within the study program and from outside the study program.

b. Elective courses at UNJ will also be taken by students who do not choose all independent campus activities outside UNJ or

c. for those who have a credit load for independent campus activities outside UNJ is still less than 20 credits.

Below is a list of some of the elective courses provided, both inside and outside the Statistics Study Program. To obtain information on other elective courses outside the study program, you can look directly at the list of courses contained in other study programs within UNJ.

Elective courses :

Elective Courses (Elective PS Characteristics)			
		In Study Program	
DPS	13146653	Introduction to System Dynamics	3
DPS	13146563	Environmental Statistics	3
DPS		Introduction to Measuring Instrument Construction	3
DPS	13146092	Nonparametric Statistics	2
		Amount	11
Elective courses			
IDIC	13146453	Probability Theory	3
IDIC	13146013	Psychometric	3
IDIC	13146503	Econometrics	3

IDIC	13146633	Introduction to Economics	3
IDIC	13146093	Graphic Information System	3
IDIC	13146693	Machine Learning Techniques	3
IDIC	13146703	IT Automation	3
IDIC	13146713	Web Development	3
IDIC	13146723	Cloud Computing	3
IDIC	13146733	Deep Learning	3
IDIC	13146743	Mathematics for Machine Learning	3
IDIC	13146162	Quality Control Statistics	2
IDIC	13146623	Introduction to Artificial Intelligence	3
		Outside Study Program/Outside University	18
Total Number of Elective Courses/MBKM			<21

*) Prerequisite courses for courses taught by other than Statistics Study Program can be seen in the tutoring study program.

H. DISTRIBUTION OF COURSES PER SEMESTER

List of Courses per semester-I

No	MK code	Courses (MK)	Course Description	Credits weight			
				Theory	Practice	Practice	Amount
1	00051122	Pancasila	Personality development which aims to enable students to understand the concept/theory of Pancasila Education	2			2
2	13146011	Olympics	Character building for new students to have honest, sporty, superior, creative, and friendly characters	1			1
3	30050042	English	Learn about	2			2

No	MK code	Courses (MK)	Course Description	Credits weight			
				Theory	Practice	Practice	Amount
			descriptive texts in the form of vlogs about campus life, as well as news article texts				
4	30050062	Indonesia Language	conveying language skills in association and thinking in the form of scientific writing	2			2
5	13146383	Entrepreneurship	basic concepts of entrepreneurship, entrepreneurial values and behavior, ideas and opportunities, creativity, innovation and business planning	2			2
6	31150362	Introduction to	This course is a	2			2

No	MK code	Courses (MK)	Course Description	Credits weight			
				Theory	Practice	Practice	Amount
		Basic Mathematics	Microteaching course. This course forms leadership skills in teaching practice through peer teaching.				
7	13146023	Differential Calculus	formulate concepts and theories about limits, continuity and derivative functions and can apply them to mathematics and other fields of science	3			3
8	13146033	Basic Statistics	basic concepts of statistics, types of data, random variables, and some	3			3

No	MK code	Courses (MK)	Course Description	Credits weight			
				Theory	**Practice**	**Practice**	**Amount**
			types of distribution and its benefits in various fields, perform descriptive and inferential data analysis and interpretation				
9	31150713	Matrix Algebra	understand the concept of matrices, matrix operations and elementary row operations to solve systems of linear equations, understanding and properties of vectors in	3			3

No	MK code	Courses (MK)	Course Description	Credits weight			
				Theory	Practice	Practice	Amount
			Euclidean space Rn, vector mapping from Rn to Rm, as well as values and eigenvectors.				
Number of Semester I . Study Loads							20

List of courses per semester-II

No	MK code	Courses (MK)	Description of MK	Credits weight			
				Theory	Practice	Practice	Amount
1		Education Insights		2			2
2	00052033	Religion		3			2
3	13146053	Programming Algorithm	Implementing programs by mastering the Python programming language	2	1		3
4	13146063	Integral Calculus	Understand the concept of integrals, double and triple integrals and their applications	3			3
5	13146083	Explorative Data Analysis	Techniques for exploring, summarizing and visualizing data in such a way that the	3			3

No	MK code	Courses (MK)	Description of MK	Credits weight			
				Theory	Practice	Practice	Amount
			structure or pattern of the data to be analyzed can be identified				
6	13146153	Regression Analysis	Introduction to regression analysis, simple linear regression model, multiple linear regression model, criteria for selecting the best model, residual analysis, influential observation diagnostics, assumption deviation and transformation, detecting multicollinearity, non-	3			3

No	MK code	Courses (MK)	Description of MK	Credits weight			
				Theory	Practice	Practice	Amount
			linear regression.				
6	13146233	Sampling Technique	Sampling basics. Sampling is random, chance and systematic. The sampling design is simple, layered, gradual and clustered.	3			3
8	00051062	Citizenship	As a source of value in society, personality development so that they become fully Indonesian human beings	2			2
	Total Semester II Study Load						21

574

List of courses per semester-III

No	MK code	Courses (MK)	Course Description	Credits weight			
				Theory	Practice	Practice	Amount
1		Data Raya and Programming		2			2
2	13146173	Database	fundamental concepts related to the design, use and implementation of database systems	2	1		3
3	13146123	Multiple variable calculus	generalizing concepts to mathematics and applying learned knowledge to related problems.	3			3
4	31150443	Mathematical Statistics I	know the basics of probability theory and mathematical	3			3

No	MK code	Courses (MK)	Course Description	Credits weight			
				Theory	Practice	Practice	Amount
			statistics which include probability, random variables and their distributions, discrete distributions, continuous distributions, joint distributions, random variable functions, and limit distributions.				
5	30050022	Philosophy of Mathematics and Natural Sciences	the nature of science, logic, language and mathematics and science through ontology,	2			2

No	MK code	Courses (MK)	Course Description	Credits weight			
				Theory	Practice	Practice	Amount
			epistemology and axiology and their relation to cultural development.				
6	13146103	Experimental design	Principles and classification of experimental design, one and two factor experiments, comparison of treatment mean values and assumptions of analysis of variance.	3			3
7		*Elective Course Characteristics of*		3			3

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No	MK code	Courses (MK)	Course Description	Credits weight			
				Theory	Practice	Practice	Amount
		Study Program (Introduction to Test Equipment Construction)					
8		*MK Selection of PS Characteristics (Nonparametric Statistics)*					2
Total Semester III Study Load							21

List of courses per semester-IV

No	MK code	Courses (MK)	MK Description	Credits weight			
				Theory	Practice	Practice	Amount
1		Logic and scientific reasoning		2			2
2	13146112	Mathematical Statistics II	random variable limit theorem and its use in inference, point estimation and parameter intervals of a population, and hypothesis testing	3			3
3	13146263	Time Series Analysis	the basic concepts of time series analysis using the smoothing method, namely the moving average	3			3

No	MK code	Courses (MK)	MK Description	Credits weight			
				Theory	Practice	Practice	Amount
			smoothing method, the exponential smoothing method, and the winter method and modeling using the ARIMA Box-Jenkins approach for forecasting stationary, non-stationary and seasonal data.				
4	13146283	Categorical Data Analysis	analyze categorical data and can apply it in various fields.	3			3
5	13146304	Linear Model	linear models, both full-rank and non-full-rank models, can estimate and test hypotheses	3			3

No	MK code	Courses (MK)	MK Description	Credits weight			
				Theory	Practice	Practice	Amount
			about parameters and can be applied in everyday life.				
6	13146203	Statistical Computing	basic concepts of computer science and statistics and statistical software that are open source or licensed.	2	1		3
7		*Elective courses in study programs (Environmental Statistics)*		3			3
Total Study Load for Semester IV							20

List of Courses per semester-V

No	MK code	Courses (MK)	Description of MK	Credits weight			
				Theory	Practice	Practice	Amount
1	13146363	Structural Equation Model I	Structural equation modeling principles include theory and application	3			3
2	13146293	Item Response Theory I	the principles of item response theory and their application to the social/educational field	3			3
3	13146323	Statistical Simulation Method	simulation method for the development of statistical intuition. This course includes: root finding, numerical integration, optimization, parameter estimation, discrete and continuous random variables in R simulation: uniform sample,	2	1		3

No	MK code	Courses (MK)	Description of MK	Credits weight			
				Theory	Practice	Practice	Amount
			discrete random variable simulation, inversion and rejection methods on continuous random variables, simulation of normal distribution samples , and the Monte Carlo integral.				
4	31152153	Multiple Variable Analysis	Singular value decomposition, spectral decomposition, multiple variable data exploration, principal component analysis, biplot analysis, cluster analysis, discriminant analysis, biplot analysis, canonical correlation analysis, multiple dimensional scaling, canonical correlation	3			3

No	MK code	Courses (MK)	Description of MK	Theory	Practice	Practice	Amount
			analysis.				
5	13146213	Numerical Method	Design and analyze algorithms, understand the complexity of algorithms, data structures, introduction to graph algorithms and their analysis.	3			3
6	13146553	Introduction to Data Science	Learn data analysis techniques related to big data	2	1		3
7		*Elective courses outside PS (GIS)*	Definition of geographic information system (GIS), GIS elements, raster and vector data structures. Database collection and compilation, initial data	3			3

No	MK code	Courses (MK)	Description of MK	Credits weight			
				Theory	Practice	Practice	Amount
			processing, spatial database management, data processing and analysis, processing and types of output.				
Total Study Load for Semester V							20

List of Courses per semester-VI

No	MK code	Courses (MK)	Description of MK	Credits weight			
				Theory	Practice	Practice	Amount
1	13146663	Structural Equation Model II	Advanced analysis on the structural equation model (Structural Equation Modeling or SEM).	3			3

No	MK code	Courses (MK)	Description of MK	Credits weight			
				Theory	Practice	Practice	Amount
2	13146333	Item II Response Theory	Statistical method to model the response pattern of each individual observed to each test item as a function of one or more underlying properties	3			3
3	13146443	Research methods	Provide understanding to students about research methods in the field of mathematics.	3			3
4	13146273	Stochastic Process	Methods in the stochastic process and apply them to existing problems	3			3
5	13146392	Pre Thesis Seminar	Students carry out research proposal seminars openly			2	2
6	1314643	Survey	Theories and methods for	3			3

No	MK code	Courses (MK)	Description of MK	Credits weight			
				Theory	Practice	Practice	Amount
	3	Design and Analysis	conducting surveys, especially in the field of education/social, designing survey instruments, planning and analyzing survey results				
7		*Elective courses outside the study program (Financial Mathematics)*	Interest and its calculations, single payment calculations, annuities and their later values, annuities and their present value, amortization and reserve funds, bonds, cost-benefit analysis	3			3
Total Study Load for Semester VI							20

List of courses per semester-VII

No	MK code	MK Courses)	Description of MK	Credits weight			
				Theory	Practice	Practice	Amount
1	13146462	Field practice	Curricular activities that must be carried out by every student of the mathematics study program are based on the predetermined time rules for implementing street vendors			2	2
2		Independent Campus Activities					<20
Total Study Load for Semester VII							<22

List of courses per semester-VIII

No	MK code	Courses (MK)	Description of MK	Credits weight			
				Theory	Practice	Practice	Amount
1	13146474	Essay	Preparation of reports and accountability of research results	4			4
Total VIII Semester Study Load							4

H. LECTURER

The following are the names of the lecturers of the Statistics S1 Study Program, FMIPA UNJ

Name	Certificate		
	S1	S2	S3
Prof. Dr. Suyono, M.Si	Mathematics, Gadjah Mada University	Statiska, Gadjah Mada University	Statistics, Delft University of Technology, Netherlands
Dr. Ir. Bagus Sumargo, M.Si	Statistics, IPB University, Bogor	Statistics, IPB University, Bogor	Population and Environmental Education, UNJ
Dra. Widyanti Rahayu, M.Si	Mathematics, ITB Bandung	Statistics, IPB University, Bogor	
Dian Handayani, S.Si., M.Si	Statistics, IPB University, Bogor	Statistics, IPB University, Bogor	Doctoral Candidate
Vera Maya Santi, S.Si., M.Sc.	Mathematics, FMIPA Sriwijaya University, Palembang	Statistics, IPB University, Bogor	Doctoral Candidate
Siti Rohmah Rohimah, S.Pd, M.Si	Mathematics Education, UNJ Jakarta	Statistics, IPB University, Bogor	Doctoral Candidate
Dania Siregar,	Statistics, IPB University,	Statistics, IPB University,	

Name	Certificate		
	S1	S2	S3
S.Stat., M.Sc.	Bogor	Bogor	
Faroh Ladayya, M.Si.	Statistics, ITS	Statistics, Surabaya Institute of Technology, ITS	

BPA 2021
MASTER STUDY PROGRAM FOR MATHEMATICS EDUCATION
FMIPA UNJ

A. INTRODUCTION

The Universitas Negeri Jakarta Mathematics Education Master's Degree Study Program accepts students for the first timeIn 2012, until now, many alumni have graduated from various professional fields, both functional, structural and entrepreneurial. As an institution that continues to grow, since its inception, the Mathematics Education Study Program has made various changes for continuous improvement, in order to achieve its vision, mission and goals. Improvement of curriculum, improvement of lecture procedures, trial examination procedures, improvement of infrastructure and others. Cooperation is also carried out with all state universities that hold the Masters Program in Mathematics Education through the PPPMI and IndoMS organizations, and with several foreign universities in Asia, Australia and other regions.

B. VISION, MISSION AND GOALS

Vision:

The scientific vision of the Mathematics Education Masters Study Program is to become a center of excellence in human resource development, research, and innovation in mathematics education whose graduates are able to compete globally.

Mission:

1. Organizing effective, efficient management of educational and learning processes in a conducive,

responsible, accountable and transparent academic atmosphere to produce graduates who are professional and experts in the field of mathematics education both in theory and practice and able to compete globally.

2. Organizing research activities in collaboration with domestic and international institutions/institutions and producing innovations in mathematics learning whose results are disseminated in various national and international scientific forums.

3. Carry out community service activities so that mathematics education and learning in the community always improves quality.

Purpose :
The objectives of the Master of Mathematics Education Study Program are:

1. To produce graduates who are well versed in the theory of mathematics education and are able to practice it professionally at various levels and related fields.

2. Produce graduates who are able to conduct research to answer various cutting-edge problems, ideas, ideas, theories and new innovations in the field of mathematics education.

3. Produce graduates who are able to develop themselves to master mathematics learning technology according to global developments.

The target of the study program in implementing the program is to form the following graduate competencies:

1. Able to apply a learning system that refers to the principles, concepts, mathematical theories and learning comprehensively, both in formal, informal and non-formal education.

2. Able to develop more creative and innovative mathematics learning designs at the secondary and higher education levels.
3. Flexibility in responding, adapting and implementing learning following the development of the mathematics education curriculum.
4. Able to master and apply various evaluation and assessment techniques in the mathematics education process.
5. Able to conduct quantitative and qualitative research for the development of mathematics learning
6. Mastering, developing, and implementing a learning approach that is oriented towards the use of the daily environment of students.
7. Manage, develop, and apply Information and Communication Technology (ICT) in learning organizations.

C. PROFILE
Profile of graduates of the Master of Mathematics Education Study Program:
1. Professional Educator.
2. Mathematics Learning Researcher.
3. Edupreuners and Education Practitioners

D. Competence
Graduates of the Master of Mathematics Education Study Program have the following competencies:
1. Mastering well the theory of mathematics education and mathematics and able to practice it as a professional educator at various levels and related fields.

2. Able to conduct research to answer various cutting-edge problems, by creating new ideas, theories and innovations in the field of mathematics education.
3. Able to manage institutions or produce quality works that are able to play a role in improving the implementation of education in local, national or international communities, both formal, non-formal and informal.

E. TITLE

Graduates of the Master of Mathematics Education Study Program are entitled to a Master of Education degree and abbreviated as M.Pd.

F. ACCREDITATION

Accreditation of the Master of Mathematics Education Study Program based on BAN-PT Decree No: 2234/BAN-PT/Akred/M/VII/2017 accredited B, with continuous progress from the achievement of resources both lecturers, students, existing facilities and infrastructure are expected to be reaccredited in 2022 can be accredited UNGGUL.

G. CURRICULUM (STRUCTURE, DISTRIBUTION AND COURSE DESCRIPTION)

The curriculum is structured to achieve Graduate Competencies in accordance with a predetermined graduate profile. Based on the scientific vision, the goals and objectives of the Mathematics Education Masters Curriculum are formulated as follows:
1. **Graduate Learning Outcomes.**
   a. Attitudes and Values.

1) Fear of God Almighty and able to show a religious attitude.
2) Upholding human values in carrying out duties based on religion, morals, and ethics.
3) Contribute to improving the quality of life in society, nation, state, and the progress of civilization based on Pancasila.
4) To act as citizens who are proud and love their homeland, have nationalism and a sense of responsibility to the country and nation.
5) Appreciate the diversity of cultures, views, religions and beliefs, as well as the opinions or original findings of others.
6) Work together and have social sensitivity and concern for society and the environment.
7) Obey the law and discipline in social and state life.
8) Internalize academic values, norms, and ethics.
9) Demonstrate a responsible attitude towards work in their area of expertise independently.
10) Internalize the spirit of independence, struggle, and entrepreneurship.
11) Demonstrate the values of honesty, thoroughness and excellence.
12) Demonstrate leadership attitude and dare to compete in various activities.
13) Shows a hard working attitude and does not give up easily in solving problems.

b. Knowledge Mastery
   1) Implement a learning system that refers to the principles, concepts, mathematical theories and

learning in a comprehensive manner, both in formal, informal and non-formal education.

2) Develop more creative and innovative mathematics learning designs at secondary and higher education levels.

3) Flexibility in responding, adapting and implementing learning following the development of the mathematics education curriculum.

4) Able to master and apply various evaluation and assessment techniques in the mathematics education process.

5) Able to conduct quantitative and qualitative research for the development of Mathematics learning

6) Mastering, developing, and implementing a learning approach that is oriented towards the use of the daily environment of students.

7) Manage, develop, and apply Information and Communication Technology (ICT) in learning organizations

c. Special skill
   1) Mastering, developing, and applying Information and Communication Technology (ICT) in mathematics education research with an inter or multidisciplinary approach.
   2) Mastering, developing, and applying the existing environment as a medium in improving learning.

d. General Skills

1) Able to develop logical, critical, systematic, and creative thinking through scientific research, creation of designs or works of art in the field of science and technology that pays attention to and applies humanities values according to their field of expertise, compiles scientific conceptions and results of studies based on rules, procedures, and scientific ethics in the form of a thesis published in an accredited national scientific journal or a reputable international journal.
2) Able to carry out academic validation or studies according to their field of expertise in solving problems in the community or relevant industries through the development of their knowledge and expertise.
3) Able to compile ideas, thoughts, and scientific arguments responsibly and based on academic ethics, and communicate them to the academic community and the wider community.
4) Able to identify the scientific field that is the object of his research and position it into a research map developed through an interdisciplinary or multidisciplinary approach.
5) Able to draw conclusions in the context of solving science and technology development problems that pay attention to and apply humanities values based on studies, analysis or experiments on information and data.
6) Able to manage, develop, and maintain a network with colleagues within the institution and the wider community.

7) Able to increase learning capacity independently.
8) Able to document, store, secure, and rediscover research data in order to ensure validity and prevent plagiarism.
9) Able to carry out the evaluation process of working groups under his responsibility.

2. Courses and Distribution per Semester

CODE	SUBJECT	credits	Semesters & Credits			
			1	2	3	4
31360022	Abstract Algebra	2	V			
31362062	Mathematical Modeling*	2			V	
31362093	Mathematical Statistics	3		V		
31360012	Real Analysis	2	V			
31363082	Advanced Real Analysis	2		V		
31363092	Advanced Abstract Algebra	2		V		
31363022	Discrete Mathematics*	2			V	
31363012	Higher-Level Mathematical Thinking*	2			V	
31362032	Mathematics Learning Design	2	V			
31362052	Evaluation in Mathematics Learning	2	V			
31361012	A New Orientation in Educational Psychology	2	V			
31362022	Realistic Mathematics Learning*)	2		V		
31362042	Learning Mathematics	2			V	

CODE	SUBJECT	credits	Semesters & Credits			
			1	2	3	4
	in English*)					
31363052	Thesis Seminar	2			V	
31362013	Developments and Problems of Mathematics Education	3			V	
30060016	Thesis	6				V
31363032	Media and ICT in Learning	2		V		

COURSE DESCRIPTION

Philosophy of Science (2 credits)
This course aims to make students understand the nature of Science, Logic, Language and Mathematics Education as well as Mathematics and Natural Sciences through ontology, epistemology and axiology and their relation to the development of science and culture.

Research Methodology (3 credits)
This course aims to make students understand various research methods and their uses. Students are able to develop research designs using a certain research method. The course content includes research paradigms, quantitative and qualitative research, mixed methods. The learning methods used are expository, group and independent projects, and project assessment.

Education Statistics (3 credits)
This course aims to make students understand probability, random variables and their distributions, special discrete and continuous random variables, distribution with random variables, random variable transformations, random variable sequence limits, statistics and sampling distribution, point estimation, interval estimation, and hypothesis testing.

Mathematics Learning Design (3 credits)
This course aims to provide students with an understanding of the principles, methods, and implementation of mathematics learning designs. This course discusses learning design, psychological foundations of learning design, identification of learning needs, learning analysis,

analysis of student characteristics, formulating learning objectives, developing assessment instruments, developing learning strategies, developing learning materials, and evaluating learning. Learning will be carried out by applying a student-centered learning approach, which prioritizes student independence in seeking and finding knowledge and building the expected competencies. Learning is carried out online.

Abstract Algebra (2 credits)
Abstract Algebra course aims to improve the ability to understand mathematical concepts, especially those related to the concepts of groups and rings, as well as improve the ability to prove several propositions related to the concepts of groups and rings and their relationship to other concepts. The learning method is carried out through discussion, presentation of concept examples and presentation of proof of propositions/theorems. Using the stages of I do, we do and you do.

Advanced Abstract Algebra (2 credits)
After taking this course, students are expected to be able to understand the concepts of ring, sub-rink, integral area, division ring, field, ring homomorphism, ideal, maximum ideal, Euclidean ring, main ideal area, polynomial ring, and single factorization area, and can apply it to related problems.

Evaluation in Mathematics Learning (2 credits)
This course aims to prepare students to be able to understand the paradigm of classroom assessment in

making changes; the validity and reliability of the assessment results; apply authentic assessments; portfolio assessment and affective assessment, and develop the instrument; develop and analyze diagnostic assessments; compile evaluation, grading, and scoring of student progress development.

Discrete Mathematics (2 credits)
This course aims to prepare students to be able to understand the basic theory, application and development of discrete mathematical material which includes combinatorial problems, graphs, trees, planar graphs and graph coloring.

Learning Mathematics in English (2 credits)
This course aims to prepare students to be able to use English properly and correctly in the field of mathematics and understand texts related to mathematics and mathematics education. During lectures, students are introduced to mathematical terms in English, mathematics academic texts, and mathematics education journals, then can use these terms in analyzing the content of reading mathematics academic texts and making the essence of mathematics education journals in the form of summary and presentation. Written and performance tests are ways of evaluating the learning processes and outcomes that have been implemented. This course uses an adult or andragogic learning approach. Approaches and learning methods using active learning, inquiry,

Higher Level Mathematical Thinking (2 credits)

This course aims to make students able to understand and analyze major concepts of higher order thinking skills, theories related to learning and higher order thinking skills (HOTS), mathematics curriculum and HOTS, specific methods and strategies to enhance higher order thinking skills, related studies HOTS-based learning, development of HOTS-based learning, HOTS assessment instruments, HOTS assessment models, research related to HOTS assessment instruments, development of HOTS assessment instruments, affective aspects of HOTS, and research trends related to HOTS. The learning method used is discussion, presentation, and case study.

Mathematical Statistics (3 credits)

This course aims to make students understand probability, random variables and their distributions, special discrete and continuous random variables, distribution with random variables, random variable transformations, random variable sequence limits, statistics and sampling distribution, point estimation, interval estimation, and hypothesis testing.

Media and ICT in Mathematics Learning (2 credits)

This course aims to make students able to make good, valid, and appropriate ICT-based media to be used in learning mathematics. This ICT-based media is made using various information and communication technologies that are up-to-date and effective when used in learning mathematics in secondary schools or universities. The media created must be in accordance with the needs in the world of education, especially in learning mathematics.

New Orientation in Educational Psychology (2 credits)
This course aims to improve students' ability to analyze, evaluate the latest trends in educational psychology. The related topics are learning theories, affective in mathematics education, teacher and student beliefs, inclusive education, especially in learning mathematics, and equality in education. At the end of the lecture students are able to produce a paper on a topic of Educational psychology.

Indonesian Realistic Mathematics Education (2 credits)
The Indonesian Realistic Mathematics Education (PMRI) course discusses realistic and contextual mathematics learning in terms of theory and practice. This course study includes: (a) History of PMRI, (b) PMRI Theory includes: PMRI Principles and Characteristics of PMRI, (c) Design Research includes: Local Instructional Theory and Learning Path Hypothesis (HLB), (d) Realistic Mathematics Learning Analysis SMP/SMA in thesis and Thesis Design Research, (e) Formulating Topics in lesson plans using the PMRI Approach, and (f) Teaching Experiments using the PMRI Approach.

Development and Problematics of Mathematics Education (PPPM) (3 credits)
This course aims to enable students to produce literature papers. Students will also be equipped with identifying reputable journals and predatory journals, determining topics according to the latest research trends, finding gaps in the literature, writing arguments behind their papers, conveying developments, debates, and problems about a

topic in the literature systematically and logically, and recommending directions. future research around the topics studied in the literature.

Thesis Proposal Seminar (2 credits)

This course aims to provide students with knowledge regarding the selection of titles, preparation of background problems, problem formulation, theoretical studies, and research methods, so that students can produce thesis proposals. Graduates' competencies are expected to be able to find sources of writing in the form of scientific journals from various sources, understand plagiarism and how to avoid it, understand and apply how to make direct and indirect quotes, and understand and apply the reference manager. This course uses a Project-based learning approach.

Mathematical Modeling (2 credits)

This course aims to make students able to make mathematical models and their solutions. The first stage of modeling is to formulate a real problem into the model. Prior to that, assumptions were made to obtain a simpler model. The second stage is analyzing the model to determine the model solution. The next stage is making an interpretation of the model solution. The last stage is to check the solution to the real problem, whether it is in accordance with the problem or not, if it is not appropriate, it is necessary to review the assumptions used. The modeling cycle can be repeated more than once. Furthermore, several modeling examples are given by going through the modeling stages. Before carrying out the model analysis stage to determine the solution (mathematical

result), conducted a review of the theory to be used which includes calculus, differential equations, statistics, and numerical. At the end of the lecture, students will make a project to make a model of a real problem in groups to be solved by these stages.

Thesis (6 credits)
This course aims to make students able to find sources of writing in the form of scientific journals from various sources; identify problems,; drafting and improving proposals; presenting research results in the form of text, tables, graphs, etc.; Making interpretations of research results, discussions and conclusions; and able to present the thesis draft in front of the examiner lecturer.
This course is a Thesis course. This course examines the preparation of a thesis draft which includes selecting a title, preparing the background of the problem, problem formulation, theoretical studies, and research methods, so that students can produce thesis proposals.

I. Lecturer

All lecturers of the Master of Mathematics Education Study Program are experts in their respective fields, graduates from reputable universities in the country and abroad, all of whom are permanent lecturers in the Mathematics Faculty of Mathematics and Natural Sciences UNJ.

1) Prof. Dr. Suyono, M.Si.
2) Prof. Dr. Wardani Rahayu, M.Si.
3) Dr. Pinta Deniyanti Sampoerno, M.Si
4) Dr. Makmuri, M.Si.
5) Dr. Lukita Ambarwati, S.Pd., M.Sc.
6) Dr. Ellis Salsabila, M.Sc.
7) Dr. Meiliasari, M.Sc.
8) Dr. Lukman El Hakim, M.Pd.
9) Dr. Eti Dwi Wiraningsih, S.Pd., M.Sc.
10) Dr. Yudi Mahatma, M.Sc.
11) Dr. Ir. Bagus Sumargo, M.Si.
12) Tian Abdul Aziz, Ph.D.
13) Dr. Flavia Aurelia Hidajat, M.Pd.

ACADEMIC HANDBOOK FOR 2021/2022
PHYSICS EDUCATION MASTER STUDY PROGRAM

A. INTRODUCTION

The Master of Physics Education Study Program is under the Faculty of Mathematics and Natural Sciences, Universitas Negeri Jakarta and was established based on the Decree of the Director General of Higher Education of the Ministry of National Education of the Republic of Indonesia Number 384/E/O/2012. This study program is opened to meet the public's interest in improving their careers and professionalism through physics education at the master's level, both as educators and other professionals. Currently, lecture activities are carried out in a hybrid, offline and online manner, supported by lecturers who are doctoral graduates from various domestic and foreign universities in the fields of education, physics, and computer science. Learning facilities, in addition to lecture and practicum rooms, court rooms, and internet access, supporting facilities are also available, such as a library, Multimedia e-Learning System Lab, Computing and Data Analytics Lab, and others. In addition to learning, facilities are also provided to support research by students and lecturers, who are grouped into groups of interest: Design and Evaluation of Learning Physics (DEPF), Multimedia E-Learning System (MELS), Educational Physics Instrumentation (IFP), Educational Data Science (EDC), and Educational Physics Studies (SFP). The curriculum of the Master of Physics Education Study Program is designed dynamically, in line with global needs and developments, and can be completed within three to four semesters with a minimum study load of 39 credits. Graduates of the Study

Program have spread across various professional fields, both functional, structural and entrepreneurial, as educators, consultants, researchers, editors, heads of institutions/institutions, and other professionals.

B. VISION, MISSION, AND GOALS

1. **Vision:**
   "To become a center of excellence for science and skills in the field of physics education in the Asian region by 2025."
2. **Mission:**
   a. Develop superior education and graduates who are trained and qualified according to the needs of local, regional and international markets in the field of physics education;
   b. Develop cutting-edge research and quality publications to support 21st century innovation and skills in physics education;
   c. Develop community service for the development of local communities in physics education..
3. **Purpose:**
   a. Produce graduates with advanced knowledge in science, innovation, and technology in the field of physics education and its application so that they are able to develop themselves professionally;
   b. Produce graduates who are able to create innovative and tested work through the development of knowledge in the field of Physics education;
   c. Produce graduates who are able to conduct quality research, are recognized nationally and internationally, and are beneficial to society and science.

C. GRADUATE PROFILE

The Physics Education Masters Program is designed to produce graduates with profiles as physics educators, researchers, and physics education developers, both in terms of methods and supporting learning media.

D. COMPETENCE OF GRADUATES

The graduate profile as described above is achieved through a learning process that is directed to produce a bachelor's degree (S-2) with competencies based on the description of the IQF level 8, including: Attitudes and Values, General Skills, Knowledge Mastery, and Special Skills.

1. Attitudes and Values
   a. Faithful to God Almighty and able to show a religious attitude.
   b. Cooperate and have social sensitivity and concern for society and the environment, and respect the opinions or original findings of others.
   c. Demonstrate a responsible attitude towards work in the field of expertise independently through internalization of academic values, norms, and ethics, as well as a fighting spirit for the benefit of the community.
2. General Skills
   a. Able to develop logical, critical, systematic, and creative thinking through scientific research in the field of physics education.
   b. Able to carry out academic validation or studies according to their field of expertise in solving problems in the community or relevant industries through the development of their knowledge and expertise.
   c. Able to compile ideas, thoughts, and scientific arguments responsibly and based on academic ethics, and

communicate them through the media to the academic community and the wider community.

d. Able to increase learning capacity independently.
e. Able to document, store, secure, and rediscover research data in order to ensure validity and prevent plagiarism.

3. Knowledge Mastery
   a. Mastering the theoretical concepts of classical physics and modern physics in depth.
   b. Mastering the philosophy, concepts and theories of learning in physics education and their implications for learning.
   c. Mastering the issues and problems of physics education and various alternative solutions with an inter- or multidisciplinary approach.
   d. Mastering physics education research methodology quantitatively, qualitatively or mixed.

4. Special skill
   a. Able to develop knowledge and technology in the field of physics education through research so as to produce innovative and tested work.
   b. Able to design, manage and carry out research to solve physics education problems with quantitative and/or qualitative approaches and using various inter- or multidisciplinary approaches.
   c. Able to publish the results of research in physics education in national journals or proceedings of international seminars or international journals.
   d. Able to develop learning tools in accordance with curriculum dynamics and methods of assessment and evaluation of physics learning.

e. Able to apply Information and Communication Technology to support the implementation of tasks/jobs in their area of expertise.

E. TITLE

The graduate degree of the Master of Physics Education Study Program is Master of Education (M.Pd)

F. ACCREDITATION

The Master of Physics Education Study Program is accredited B from BANPT in 2019 in accordance with BAN-PT Decree No. 1351/SK/BAN-PT/Akred/M/V/2019

G. CURRICULUM (STRUCTURE, DISTRIBUTION, AND COURSE DESCRIPTION)

1. Curriculum Structure

The curriculum structure of the Master of Physics Education Study Program consists of 3 (three) groups of courses that can be completed within 3 (three) to 4 (four) semesters or a maximum of 8 (eight) semesters with a minimum number of credit units of 39 credits.

No.	Course Group	credits
1	General Course	8
2	Main Course	25
3	Elective courses	6-7*
	Minimum number of credit units	39
	*) Minimum number of credit units for elective courses	

2. Distribution of Courses

Code	Subject	credits	Semester 1	Semester 2	Semester 3	Semester 4
A. General Course						
30061012	Science philosophy	2	2			
30061033	Educational Research Methodology	3	3			
30062013	Education Statistics	3		3		
B. Main Course						
32363162	Physics Learning Curriculum and Design	2	2			
32363172	Physics Learning Innovation	2	2			
32363182	Physics Education Research Study	2		2		
32363192	Physics Learning Assessment	2		2		
32363113	IT and Physics Learning Multimedia Development	3		3		
32363202	Advanced Mechanics	2	2			
32363212	Advanced Electrodynamics	2	2			
32363152	Advanced Modern Physics	2		2		
30063032	Thesis Seminar	2		2		
30060016	Thesis	6				6

C. Elective Courses						
32363112	Scientific Article Writing Techniques*	2			2*	
32363063	Electronic Instrumentation for Physics Education*	3			3*	
32363232	Computer Simulation for Learning Physics*	2			2*	
32363242	Data Raya in Physics Education*	2			2*	
32363252	Advanced Thermodynamics*	2			2*	
32363142	Integrated Science and Environment*	2			2*	
32363122	English for Scientific Communication*	2			2*	
Number of Credits per Semester)			13	14	6-7	6
*) Students choose a minimum of three elective courses provided a) The total number of credits taken by students is at least 39 credits						

3. Course Description

30061052 - Philosophy of Science (2 credits)
The purpose of this course is to increase students' understanding of the philosophy of science. Topics discussed include: understanding philosophy, philosophy of science, understanding 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 of science to morals. Lectures will be conducted using an inquiry-based learning approach. Through this lecture, it is hoped that students will assist students in increasing their knowledge in the field of science and quality research.

30061033 - Educational Research Methodology (3 credits)
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 a thesis. Topics covered include: types of research, research development (R&D), research topic selection, problem formulation, research variables, population and sampling, data collection instruments and techniques, data analysis techniques, hypothesis testing, research proposal writing, research results writing in Thesis, reference writing techniques and bibliography, and the rules in writing research reports. At the end of the lecture, students are expected to be able to prepare a thesis research proposal.

30062013 Education Statistics (3 credits)

This course aims to discuss data analysis techniques using descriptive and inferential statistics and their interpretation. 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 the 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 carried out using a case-based learning approach. Mastery of this course material will assist students in conducting quality research.

32363162 Physics Learning Curriculum and Design (2 credits)

This course aims to discuss the general education curriculum, both nationally and internationally, and its implementation in designing the physics learning curriculum. Topics discussed in this course include: curriculum conception, certification and curriculum, principles of curriculum development, curriculum development methods, curriculum implementation in learning, curriculum as a scientific discipline, study of the National curriculum, International curriculum, and current issues. about curriculum development and design of learning physics. 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 carried out using a case-based learning approach.

32363172 Physics Learning Innovation (2 credits)

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) 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 carried out using 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.

32363192 Physics Learning Assessment (2 credits)

This course aims to discuss the concept of classroom-based evaluation and assessment, how to prepare and develop assessment plans, develop instruments, analyze, and interpret assessment results to make policies and improve the quality of physics learning in the classroom. Topics covered include: classroom assessment paradigms in making changes; the validity and reliability of the assessment results; bias in assessment, applying alternative assessments and developing instruments; develop and analyze diagnostic assessments; compiling,

administering, and improving assessments in the classroom; evaluation and grading of student development and assessment of student progress in class. Practically students will be trained in a guided project to design an assessment instrument for learning physics in the classroom. 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 their advanced knowledge in science and develop their professionalism in the field of physics education.

32363182 Research Studies on Physics Education (2 credits)
The purpose of this course is to develop students' ability to identify, analyze, and evaluate research results and problems in physics education based on reputable and latest national and international journals published in the last five years. Topics discussed include: the development of issues, trends, and problems in physics education as well as existing solutions based on the results of journal studies. The study was conducted from various aspects including curriculum, learning process, learning models/methods, assessment of learning outcomes, research, media, and the application of ICT-based learning, as well as government policies in the field of education. At the end of the lecture, students will be guided to produce a literature study paper on a topic in physics education.

32362033 IT and Multimedia Learning Development (3 credits)

This course aims to enrich knowledge in the field of Information and Communication Technology (ICT) in education and skills in building a multimedia system for learning physics. Topics of discussion include: (1) ICT in education: ICT infrastructure, e-learning systems, ICT-based educational technology; and (2) development of learning multimedia: multimedia introduction, multimedia content production, multimedia data representation, multimedia data storage and retrieval, multimedia networking, and multimedia distribution. Lectures are equipped with practicums to provide practical experience to students on how to design and produce multimedia according to student characteristics. Lectures will be carried out using a case- and project-based learning approach.

32363202 Advanced Mechanics (2 credits)

This course is a compulsory subject that discusses the essential concepts of classical mechanics and their application in depth. The study materials include 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 forces, dynamics of particle systems, motion in non-inertial frames, dynamics of rigid bodies, and continuous systems. : wave equation. Furthermore, to provide factual understanding, students will be given the latest topics on classical mechanics and issues in physics education. Lectures will be carried out using a case-based blended

learning approach. Mastery of this study will help students improve their knowledge, attend other related scientific lectures,

32363212 Advanced Electrodynamics (2 credits)

This course is a compulsory subject 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. In addition, it also discusses how it is applied in everyday life and today's technology. Lectures will be carried out using a case-based learning approach. Mastery of this study will help students improve their knowledge, attend other related scientific lectures, and develop themselves professionally in the field of physics education.

32363152 Advanced Modern Physics

This course is a compulsory subject 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, special relativity theory, 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 atom model and atomic spectroscopy, many-electron atoms, molecules, radioactivity, and their uses. Furthermore, to provide factual understanding, students will be given the latest topics related to research in the

field of modern physics. Lectures will be carried out using a case-based blended learning approach.

32363112 Scientific Article Writing Techniques

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; the use of grammar, spelling, and number writing; processing of images, tables and graphs; reference writing; code of ethics for writing and scientific publications; techniques for selecting reputable journals; and the journal publication process. In this lecture, 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. Practical experience in this lecture is expected to help students increase their knowledge and professionalism in quality research so that they are beneficial to society and science.

32363122 English for Scientific Communication

The purpose of this course 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. , getting to know chairing sessions and panel discussions in scientific forums, such as conferences or other scientific meetings. In addition, students will also learn 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.

32363063 Electronic Instrumentation for Physics Education

This course aims to enrich students' knowledge and skills in building educational aids using electronic instruments to produce teaching aids for physics. The topics of discussion cover various aspects in the development of electronic instruments, including the basic concepts of electronics, semiconductors, analog and digital circuits, sensors, microprocessors, microcontrollers, and interfaces, as well as their application in the development of teaching aids for physics education. Lectures are equipped with practicals so that students have practical experience on how to design and produce teaching aids instruments. Lectures will be carried out using a case- and project-based learning approach.

32363232 Computer Simulation for Physics Learning

In physics, computer simulation is now an integral part of basic physics and computation is as important as theory and experiment. 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 how to create interactive simulations, especially for the purpose of teaching and learning physics by using discrete computer simulation software. To achieve this goal, the lectures will be carried out using a case- and project-based learning approach.

32363242 Data Raya in Physics Education

This course aims to provide students with knowledge on how to extract data to find patterns and valuable information stored in the data. To achieve this goal, this course will discuss the basic concepts of highway data and various data mining methods/techniques, covering all aspects from data pre-processing to evaluation and analysis, as well as their use in physics education. Lectures will be carried out using a case-based learning approach. Mastery of this study will assist students in increasing scientific insight and developing themselves professionally in the field of physics education.

32363252 Advanced Thermodynamics

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 field of science and technology today. Lectures will be carried out using a case-based learning approach. Mastery of this study will help students improve their knowledge, attend other related scientific lectures, and develop themselves professionally in the field of physics education.

32363142 Integrated Science and Environment

This course aims to improve student competence in the field of integrated science and the environment which is an important subject in science learning in secondary schools. The lecture will discuss a number of topics, including the conception of the integration of science; fundamental concepts in the fields of physics, chemistry, biology, environment, astronomy, earth, and biotechnology; integrated science development; various problems and solving methods through integrated science, environmental studies from the perspective of the integrated concept of science, including issues of global warming, renewable energy, and sustainable environment. Lectures will be carried out using a case-based learning approach.

30063032 Thesis Proposal Seminar (2 credits)

The purpose 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 sections, including: background of the problem, 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 feasibility of the proposal will be tested in a thesis proposal seminar. Lectures are conducted using a project-based learning approach so that

it is expected to help students in conducting quality research.

30060016 Thesis (6 credits)

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 thesis writing reference follows the thesis writing guidebook from the university. The thesis that has been approved by the two supervisors is then submitted to be tested in the thesis examination trial. Through this course, it is hoped that students will be able to carry out quality research, be recognized nationally and internationally, and be beneficial to society and science.

H. LECTURER

Lecturers in charge of courses in the Master of Physics Education Study Program are permanent lecturers at the Universitas Negeri Jakarta.

Name	Certificate		
	S1	S2	S3
Prof. Dr. Yetti Supriyati, M.Pd	Physics Education IKIP Jakarta	IPA Education IKIP Bandung	Educational Research and Evaluation - IKIP Jakarta
Prof. Dr. I Made Astra, M.Si	Physics Education IKIP Jakarta	Physics UGM Yogyakarta	Environmental Education - IKIP Jakarta
Prof. Dr.	Physics	UI	Physics -

Name	Certificate		
	S1	S2	S3
Mangasi Alion Marpaung, M.Si	UGM Yogyakarta	Optoelectronics	University of Indonesia
Prof. Dr. Sunaryo, M. Si	Physics Education IKIP Jakarta	Physics UGM Yogyakarta	Environmental Education - IKIP Jakarta
Prof. Dr. Agus Setyo Budi, M.Sc	Physics Education IKIP Jakarta	Physics, Universiti Sains Malaysia (USM)	Materials Physics - Universiti Teknologi Malaysia (UTM)
Dr.rer.nat Bambang Heru Iswanto, M.Sc.	Physics Education IKIP Jakarta	Physics ITB Bandung	Artificial Intelligence - Technische Universitaet Berlin (TU Berlin), Germany
Dr. Ir. Vina Serevina, MM	Engineering Physics, ITB Bandung	Management, Univ. Indonesian Persada	Education Management – Universitas Negeri Jakarta
Dr. Firmanul Chess Wibowo, M.Si	Physics Education UNNES Semarang	Science Education UPI Bandung	Science Education - Indonesian University of Education, Bandung
Dr. Anggara Budi Susila,	Physics Education	Physics ITB Bandung	Material Physics -University of

Name	Certificate		
	S1	S2	S3
M.Sc.	IKIP Jakarta		Indonesia
Dr. Esmar Budi, MT	Physics Unpad Bandung	Physics ITB Bandung	Manufacturing Engineering - Universiti Teknikal Malaysia (UTeM)
Dr. Hadi Nasbey, M.Si	Physics Education UNJ Jakarta	Physics UGM Yogyakarta	Instrumentation Physics - Gunma University, Japan
Dr. Widyaningrum Indrasari, M.Si	Physics ITB Bandung	Physics ITB Bandung	Instrumentation Physics - ITB Bandung
Dr. Iwan Sugihartono, M.Si	UI Physics	UI Physics	Materials Physics - University of Indonesia
Dr. Mutia Delina, M.Si	Physics UNJ Jakarta	UI Physics	Computer Simulation - University of Groningen, Netherlands
Dr. Teguh Budi Prayitno, M.Si	Physics ITB Bandung	Physics ITB Bandung	Computing Materials - Kanazawa University, Japan

ACADEMIC HANDBOOK (CPA)
CHEMISTRY EDUCATION MASTER STUDY PROGRAM
YEAR 2021

A. INTRODUCTION

The National Standard for Higher Education (SNPT) mandates that the learning process in Study Programs, research activities, and community service activities (P2M) organized by universities in all jurisdictions of the Unitary State of the Republic of Indonesia to achieve quality must comply with the established criteria. Based on Permenristekdikti number 44 of 2015 concerning SN Dikti and Presidential Decree No. 8 of 2012, Law No. PT. 12 of 2012 and Regulation No. 49 of 2014 in curriculum development combined with the results of studies on the needs of stakeholders have an impact on curriculum development and improvement.

The Indonesian National Qualifications Framework (KKNI) which equates academic, vocational and professional abilities at the same level (level) must be addressed by actively participating in making improvements and curriculum development in universities. This equalization is a consideration for universities in formulating learning outcomes at each level of work ability, determining the breadth and depth of material according to KKNI Level 8.

The development of the Universitas Negeri Jakarta curriculum is carried out by referring to aspects related to the design of the ICT-based curriculum and the main aspects in the guidelines for developing higher education curriculum. The development of an ICT-based curriculum includes aspects of digital literacy infusion in learning, curriculum digital infrastructure in the form of a curriculum

information system, and the use of ICT in learning. These aspects are combined with aspects in the higher education curriculum guide so that they become the four main aspects of updating the UNJ curriculum. First, develop a curriculum oriented towards Outcome-Based Education (OBE). The second and third aspect is to infuse 21st Century skills and specifically add the key literacy in Industrial Age 4.0, namely Digital Literacy.

Based on the foregoing, the Masters Study Program for Chemistry Education FMIPA UNJ continues to rearrange the curriculum to comply with the demands of government regulations and in accordance with technological developments that continue to develop, as well as in accordance with international standard curriculum documents for the international accreditation process. The study program expresses its gratitude to all components that have assisted in the preparation of this BPA, namely lecturers, students, and other components. Hopefully this BPA will become our common reference in carrying out the educational process in the Chemistry Education Masters Study Program, FMIPA UNJ.

B. VISION, MISSION, AND GOALS

1. Vision of the Master's Program in Chemistry Education

To be a center for innovative ICT learning and development based on chemistry education research, multiculturalism, and sustainable goals

2. Mission of the Master of Chemistry Education Study Program

a. Organizing a quality Masters Program in Chemistry Education based on integrated service

professionalism in a conducive, responsible, accountable, and transparent academic atmosphere to produce graduates who are professional, and able to compete at the national level.

b. Prepare graduates who have professional, pedagogical, personality, and social competencies with character through education and original research of global quality.

c. Contribute ideas, ideas, research results, innovations and development of chemistry education to stakeholders for the advancement of chemistry education at various levels through community service activities.

d. Develop collaboration with various parties based on the principle of benefit and equality.

3. Study Objectives

a. Produce Masters in Chemistry Education who have in-depth knowledge and understanding of ICT development based on chemical Education research

b. Produce Masters in Chemistry Education who have a critical understanding in solving educational problems through the application of educational research methods and communicating the results of their research.

c. Produce Masters in Chemistry Education who can apply skills and understanding in carrying out activities in the community through creative and innovative educational programs.

d. Produce Masters in Chemistry Education who are able to carry out continuous professional development.

e. Understand and integrate technology issues in chemistry education and chemistry.

C. GRADUATE PROFILE
1. Become a professional educator at the secondary and higher education levels
2. Education Managers, Education Researchers, and Policy Holders who have a competitive advantage in global competition
3. Able to innovate in developing chemistry education at national and international levels.

Description of Graduate Profile or also known as Program Educational Objective (PEO) is described in the table below:

Graduate Profile		Description of Graduate Profile	Educational Objectives (PEO) Program
1	Become a professional educator at the secondary and higher education levels	Graduates of the Chemistry Education Study Program at the Masters of FMIPA UNJ are expected to become professional educators in public and private secondary	**PEO 1**

Graduate Profile		Description of Graduate Profile	Educational Objectives (PEO) Program
		schools and universities and receive awards as educators/ professional teacher	
2	Education Managers, Education Researchers , and Policy Holders who have a competitive advantage in global competition	Graduates of the Chemistry Education Study Program at the Masters of FMIPA UNJ are expected to become education managers in formal and non-formal schools such as tutoring or other forms. In addition, graduates are also expected to occupy strategic positions in government	**PEO 2**

Graduate Profile		Description of Graduate Profile	Educational Objectives (PEO) Program
		institutions or NGOs engaged in the world of education.	
3	Able to innovate in developing chemistry education at national and international levels	Graduates of the Chemistry Education Study Program at the Masters of FMIPA UNJ are expected to become researchers in the field of education to find and develop several educational models that can be applied at national and international levels. In addition, research results can be	PEO 3

Graduate Profile	Description of Graduate Profile	Educational Objectives (PEO) Program
	published at the national and international levels.	

D. COMPETENCE

1. Attitude

a. Fear of God Almighty and able to show a religious attitude;

b. Upholding human values in carrying out duties based on religion, morals, and ethics;

c. Contribute to improving the quality of life in society, nation, state, and the advancement of civilization based on Pancasila;

d. To act as citizens who are proud and love their homeland, have nationalism and a sense of responsibility to the state and nation;

e. Appreciate the diversity of cultures, views, religions, and beliefs, as well as the opinions or original findings of others;

f. Cooperate and have social sensitivity and concern for society and the environment;

g. Obey the law and discipline in the life of society and the state;

h. Internalize academic values, norms, and ethics;

i. Demonstrate a responsible attitude towards work in their area of expertise independently;

j. Internalize the spirit of independence, struggle, and entrepreneurship;
k. Fully understand himself as an educator (additional to SNPG).

2. **General Skills**
   a. Able to apply logical, critical, systematic, and innovative thinking in the context of the development or implementation of science and technology that pays attention to and applies humanities values in accordance with their field of expertise;
   b. Able to demonstrate independent, quality, and measurable performance;
   c. Able to study the implications of the development or implementation of science and technology that pays attention to and applies humanities values according to their expertise based on scientific principles, procedures and ethics in order to produce solutions, ideas, designs or art criticisms;
   d. Able to compile a scientific description of the results of scientific research studies in the form of a thesis or final project report, and publish research results in the form of articles published in accredited domestic and foreign scientific journals;
   e. Able to make appropriate decisions in the context of solving problems in their area of expertise, based on the results of information and data analysis;
   f. Able to maintain and develop working networks with supervisors, colleagues, colleagues both inside and outside the institution;
   g. Able to be responsible for the achievement of group work results and supervise and evaluate the

completion of work assigned to workers under their responsibility;

h. Able to carry out the process of self-evaluation of the work group under their responsibility, and able to manage learning independently; and

i. Able to document, store, secure, and retrieve data to ensure validity and prevent plagiarism

3. **Knowledge**
   a. Ability to analyze important chemical concepts, including: organic chemistry, biochemistry, analytical chemistry, physical chemistry, inorganic chemistry as a provision to be applied in secondary education.
   b. Ability to apply pedagogical concepts (learning and learning theories, both classical and modern, including behavioristic, cognitive, humasitic, and constructivist) in chemistry learning.
   c. Understanding student characteristics, which include talents, interests, intelligence, and learning styles, including multiple intelligences, as the basis for developing innovative learning.
   d. Understanding the latest developments in the field of learning and learning from various countries as a comparison material to develop modern learning, according to the development of science and technology

4. **Special skill**
   a. Able to design active, creative, effective, and fun chemistry learning with various approaches, strategies, methods, and media according to student

characteristics, subject matter, and learning objectives.

b. Able to design and manage chemistry laboratories for high school and college level in the context of basic chemistry learning

c. Able to develop chemistry learning by utilizing technology and laboratories, especially information technology and multimedia, which facilitates the development of multiple intelligences and high-level thinking skills (Technological Pedagogical Content Knowledge).

d. Able to evaluate chemistry learning continuously and comprehensively using a variety of modern techniques, to encourage a better learning process and determine learning success.

e. Able to take advantage of the results of the evaluation of chemistry learning to develop remedial and enrichment programs that vary by taking into account the various learning styles of students.

f. Able to innovate chemistry learning through research activities by utilizing modern technology and laboratory facilities.

g. Choosing the right research method in the field of chemistry education

h. Managing chemistry education at the level of educational units and educational institutions

i. Act on the basis of benefits for students, schools and communities.

j. Act in accordance with religious norms (faith and taqwa), honest, sincere and helpful.

k. Have an attitude and act consistently in accordance with applicable legal norms.

l. Have a behavior that has a positive effect and is respected by students.
m. Have the ability to innovate and follow the development of information in the field of chemistry and chemistry education as a basis for continuous self-development.
n. Have the ability to analyze research results through a multidisciplinary or interdisciplinary approach and develop learning models, management models both in the classroom and in the laboratory.
o. Able to develop effective communication both oral and written with students, administrative staff, fellow teachers, parents/guardians of students and the community around the school.
p. Skilled in analyzing the development of learning media and information technology in chemistry education and its application; Develop critical and creative thinking to produce innovative educational products using technology.

Based on the above competencies, the learning achievement of the master's degree program in chemistry education is formulated based on the qualification levels of KKNI and SN-DIKTI.In addition, the CPL formulated by the Chemistry Education Masters Study Program is also based on the results of graduate searches, input from stakeholders. It also sees the development of professional associations, in this case the Indonesian Chemical Association (HKI) the Chemical Education Division. Including looking at the trend of scientific/skilled development in the future, and from the results of curriculum evaluation. The CPL formulation

contains the capabilities needed in the industrial era 4.0 regarding data literacy, technological literacy, and human literacy, as well as the ability to see signs of development. Technological developments can be understood as human collaboration with intelligent systems based on the Internet of Things (IoT) or cyber physical systems, with the ability to utilize intelligent machines more efficiently with a more synergistic environment (Rada, 2017).

AREA	CODE	LEARNING OUTCOMES (PLO) PROGRAM	
Attitude (A)	A1	Upholding human, religious, moral and ethical values; contribute to improving the quality of people's lives based on Pancasila; and fully understand himself as an educator as well as a lifelong learner	**PLO 1**
General Skills (G)	G1	Able to apply logical, critical, systematic, innovative and collaborative thinking for the development or application of appropriate and applicable science and technology in society according to their scientific field	**PLO 2**

AREA	CODE	LEARNING OUTCOMES (PLO) PROGRAM	
	G2	Ability to design and conduct scientific research through a multidisciplinary or interdisciplinary approach to solving chemistry education problems and problems	**PLO 3**
Knowledge (K)	K1	Able to analyze important theoretical concepts, such as organic chemistry, biochemistry, analytical chemistry, physical chemistry, inorganic chemistry, as well as applications in high school and higher education	**PLO 4**
	K2	Able to apply pedagogical concepts (classical or modern theory of education, behavioristic, cognitive humanistic, and constructivism) in chemistry learning	**PLO 5**
Specific Skills (S)	S1	Ability to design and develop active, creative, effective, and fun chemistry learning using various approaches, strategies, methods, and media according to student characteristics, subject matter, and learning objectives towards the TPACK approach	**PLO 6**

AREA	CODE	LEARNING OUTCOMES (PLO) PROGRAM	
	S2	Ability to develop and evaluate chemical laboratory experiments for high school and university level	**PLO 7**
	S3	Able to write and communicate scientific reports based on research data effectively and publish them in reputable scientific publications	**PLO 8**

The Learning Outcome Program (PLO) which has been formulated in the CPL of the Chemistry Education Masters Study Program is then linked to the profiles of graduates of the Chemistry Education master's program which are contained in 3 types of PEO. The relationship between PEO and PLO illustrates how each PLO contributes to achieving the graduate profile contained in the 3 types of POE.

The relationship (matic) between PLO and PEO can be seen in the image below.

PEO 1 PEO 2 PEO 3

PLO 1

PLO 2

PLO 3

PLO 4

PLO 5

PLO 6

PLO 7

PLO 8
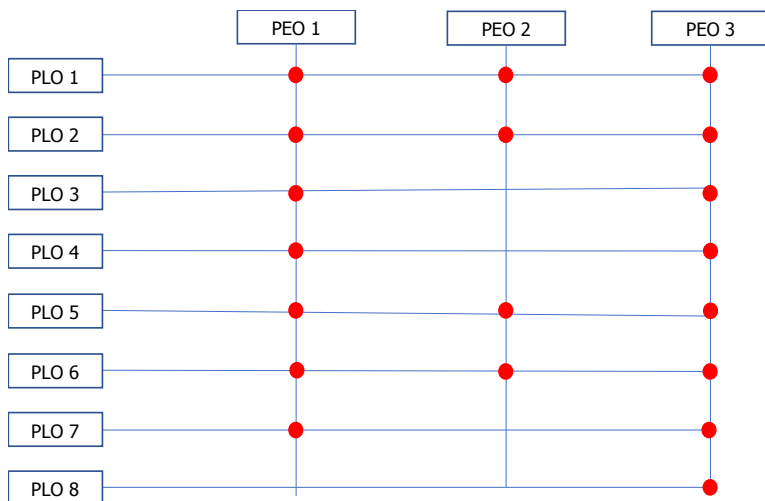
E. TITLE

Graduates of the Chemical Education Masters Study Program are entitled to hold a Masters Degree in Chemistry in the field of Chemistry, which is abbreviated to M.Pd.

F. ACCREDITATION

The Chemical Education Master's Study Program is accredited with grades B and No. The accreditation decree is 1933/SK/BAN-PT/Akred/M/VI/2017.

G. CURRICULUM (STRUCTURE, DISTRIBUTION, AND COURSE DESCRIPTION)

1. Curriculum Structure

The curriculum structure of the Chemistry Education Study Program at the Masters level consists of a group of General Courses (MKU), subjects in the field of expertise

with a range of 40-42 credit units. To become a Master in Chemistry Education, students are required to write a Thesis based on research in the field of chemistry education.

NO	GROUP	credits
1	General Course (MKU)	9
2	Expertise Course (MKK)	36
3	Elective Courses (MKP)	8
TOTAL		53

2. Distribution of Courses

No	MK code	Subject	credits
(1)	(2)	(3)	(4)
A. General Course			
1	30061013	Science phylosophy	3
2	30062023	Educational Research Methodology	3
3	33363103	Education Statistics	3
B. Expertise Course			
4	33361113	Chemistry Learning, Analysis, and Its Application	3
5	33361042	Current Issues in Chemistry Education	4
6	33361032	Information Technology in Chemistry Learning	2
7	33361042	New Orientation in	2

No	MK code	Subject	credits
(1)	(2)	(3)	(4)
		Education	
8	33362023	Chemistry Learning Evaluation	3
9	33362013	Chemistry Learning Design	3
10	33363063	Misconceptions in Chemistry Learning	3
11	33361082	Important Concepts in Biochemistry and Organic Chemistry	2
12	33361092	Important Concepts in Physical Chemistry and Inorganic Chemistry	2
13	33361102	Important Concepts in Analytical Chemistry and Environmental Chemistry	2
14	33363082	Thesis Seminar	2
15	33361122	Writing Chemical Education Scientific Papers	2
16	33363006	Thesis	6
C. Elective Courses			
17	33363052	Applied Chemistry	2
18	33361062	Green Chemistry	2
19	33363042	Instrument Chemistry	2
20	33361012	International Journal Studies	2
TOTAL			**53**

2. Course Description

Educational Research Methodology   3 credits
This course discusses the principles and procedures of scientific research as basic knowledge in thesis writing. Topics discussed include the nature of research, research variables, theoretical frameworks and research hypotheses, types and research designs, sampling techniques, preparation and development of research instruments, data collection and processing techniques, and rules for writing scientific reports. for chemical education research.

Education Statistics   3 credits
This course discusses statistical topics that are often used in research such as normality test, homogeneity test, mean difference test, regression analysis, analysis of variance, and path analysis.

Science phylosophy   3 credits
The Philosophy of Science course discusses ontology, epistemology, and axiology of science in the constellation of various other knowledges, as well as the development of scientific knowledge. The discussion on the ontology of science is focused on elements of empirical reality (empiricism) such as facts, data, and information without releasing them from rational reality (rationalism), as well as their position in scientific activities. Epistemology of science is focused on the scientific method and its operationalization in research methodology. Axiology of science discusses values

related to scientific activities and their uses both internally, externally, and socially.

New Orientation in Education   2 credits

This course includes an introduction, basic understanding and objects of psychology, various new streams such as behavioristic, cognitive, neuroscience, and learning psychology as well as various differences and similarities of learning psychology concepts. New issues and challenges for educational experts and psychologists in an effort to improve the quality of educational practices on the basis of the latest findings of scientific theories in the field of educational psychology. New approaches in educational psychology which are a blend of educational disciplines, cognitive, neuroscience, various aspects of the basics of science, and psychological theory and learning theory.

Chemistry Learning Design   3 credits

This course includes: Basic definitions, concepts and processes for developing a chemistry education curriculum. Philosophical and social aspects of the patterns of various different curricula, both the KTSP and the full block system (Europe) and the credit system (USA and Canada). Application of basic curriculum and basic curriculum patterns in chemistry education. KKNI analysis and its descriptors, competency analysis, learning analysis, and learning organization. Learning principles, planning and the importance of planning in chemistry education. Strategies for selecting teaching materials and organizing them.

Chemistry Learning, Analysis and Application   3 Credits

This course is designed to give students the opportunity to develop their critical understanding of learning in theory and practice related to chemistry education through content knowledge analysis. This course focuses on behaviorist, constructivist, and social learning theories with a particular emphasis on the implications of learning in chemistry learning. Specific instructional strategies that emerge from this theory will be discussed (pedagogical content knowledge). This course also includes the study of new approaches and strategies in chemistry education such as brain based learning, multiple representations, learning models and models, and self regulated learning strategies.

Information Technology in Chemistry Learning 2 Credits

This course is to develop students' skills in using knowledge of interactive learning models used in ICT-based learning and transferring this model to their own classrooms and Developing spreadsheet-based applications and database packages in explaining chemical phenomena, conducting design, evaluation, and selection of courseware .

Chemistry Learning Evaluation   3 credits

This course examines the role and importance of measurement and evaluation in chemistry education. Formative, summative assessment, placement, and diagnostic purposes. Assessment of standard norms and criteria. Development of test specifications. Basic test attributes: validity, reliability, and usability. Common assessment strategies used in chemistry education.

Class-based test development. Build objective test items: multiple choice, true/false, short answer, matching, and essay type items. Alternative assessment strategies: making rubrics for observations, interviews, performance appraisals, peer evaluations, attitude scales, and self-evaluations. Techniques for designing test items, marking techniques (grading) and reporting techniques. Statistical basis for item analysis. Construction of diagnostic tests and other measuring tools in testing cognitive development, psychomotor,

Misconceptions in Chemistry Learning   3 credits
Preconceptions, misconceptions and alternative conceptions in chemistry education. Strategies to identify students' misconceptions and alternative conceptions for students. Analysis of possible causes of misconceptions. Learning development to facilitate concept change through Posner, Drivers, Targans, Ebenezer & Gaskelis, Banet & Nunezs models, and synthesis models. Designing learning modules for chemistry topics that are considered difficult in school such as the concept of acid-base, the concept of oxidation-reduction, the concept of moles and the concept of chemical equilibrium.

Current Issues in Chemistry Education   3 credits
This course examines the results of research and innovations contained in chemical education journals (Journal of Chemical Education and Journal of Chemistry Education, etc.) chemistry learning. Each student is assigned to present the results of their studies in the form of panel presentations and cooperative discussions.

Important Concepts in Analytical Chemistry and Environmental Chemistry   **2 credits**
This course is designed to examine the history of green chemistry, 12 principles of green chemistry, green level analysis of chemical processes based on ecological scale values, soil chemistry and sources of soil pollution, remediation of soil contaminated with pesticides, heavy metal ions and petroleum, classification of water and water quality, water pollution and how to handle polluted water, air chemistry, and air pollution.

Important Concepts in Biochemistry and Organic Chemistry   **2 credits**
This course is designed to examine knowledge, essential concepts, and research trends in the field of organic chemistry, both natural and synthetic materials, as well as the field of biochemistry. In addition to the essential concepts in these two fields, this course also facilitates students to be creative and innovative in implementing the essential concepts spoken by Science Technology Engineering and Mathematics (STEM) for learning in schools so that students have comprehensive concepts.

Important Concepts in Physical Chemistry and Inorganic Chemistry   **2 credits**
This course is designed to study the kinetics, energy, shape and physical properties of substances as well as electrochemistry and crystal structures and chemical bonds and the synthesis of inorganic compounds.

Thesis Seminar   **2 credits**

This course is designed to conduct a literature search and analysis of problems in the field of chemistry education and plan research written in the form of a thesis proposal and in seminars.

Thesis   **6 credits**

The final project is written in the form of a scientific paper which is the result of students' independent work experience in planning and carrying out research in the field of chemistry education. The thesis can be carried out in collaboration with other institutions which are expected to result in joint research publications between institutions and can be published in reputable journals, both nationally and internationally.

Chemical Scientific Writing   **2 credits**

This lecture discusses various kinds of chemical scientific works found on a national and international scale, as well as the process of writing them according to the rules for these types of scientific works, both on a national and international scale.

Applied Chemistry*   **2 credits**

This lecture discusses the studies of applied chemistry and one of the topics discussed in this lecture is the topic of solid chemistry. The discussion of solid chemistry includes the definition of solids and the classification of solids based on their source, manufacture, and application. It also analyzes scientific articles about the chemistry of these solids.

Instrument Chemistry *   **2 credits**

This course discusses the basics of instrumental analysis, the working principles of the instrument and its main components and tries to interpret the data from the analysis of simple and advanced instruments.

Green Chemistry*   **2 credits**

History of green chemistry, principles of green chemistry, green level analysis of chemical processes based on eco-scale methods, green metrics and green stars, NADES as a green solvent, and green extraction techniques.

International Journal Studies*   **2 credits**

Identification of reputable and predatory international journals; literature search; writing bibliography, references, and checking plagiarism; visualization of research results; journal article writing; the process of submission, revision, and proofreading; select and access international journal articles; and article writing

Note: *) Elective courses

H. LECTURER

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BIOLOGY EDUCATION MASTER STUDY PROGRAM

A. INTRODUCTION

The Biology Education Masters Study Program is designed to produce a Biology Education Master's Degree with a level 8 qualification. mission, and the realization of the vision of the study program.

BPA contains curriculum, course descriptions that support the achievement of graduate competencies and provides flexibility for students to broaden their horizons and deepen their expertise according to their interests, syllabus, lesson plans and evaluations. BPA is also designed based on its relevance to the objectives, scope and depth of the material, organization that encourages the formation of hard skills and personality and behavioral skills (soft skills) that can be applied in various situations and conditions.

Improvements and developments continue to be carried out with the fulfillment of learning tools and Semester Lesson Plans for each subject. It is hoped that this BPA will be more precise and directed in delivering students to become Masters in Biology Education.

B. VISION, MISSION, AND GOALS

1. Study Program Vision:

The Biology Education Masters Study Program develops an academic vision "To become an excellent study program in the field of digital technology-based biology education and learning in the ASIA region.

2. **Study Program Mission:**

Based on this vision, the Master of Biology Education study program prepares the mission of the study program in the elaboration of the following points:

a. Organizing educational and learning activities through the use of technology, based on the dissemination of knowledge and research results in the fields of education and the latest Biology.

b. Manage and develop research to solve biology education problems through an inter or multidisciplinary approach

c. Organizing research-based community service in the field of biology education and learning that can be utilized by the community.

d. To produce a master of biology education who has integrity and competence in research, develops technology-based learning and has global competitiveness.

3. **Study Program Objectives:**

The purpose of the Biology Education Masters Study Program is to produce graduates with the following criteria:

a. able to design, implement, evaluate, and conduct assessments of biology learning based on local wisdom and digital technology.

b. able to design and carry out research in the field of biology and biology education and communicate it in various scientific forums.

c. able to design curriculum and management of education units as well as implement lifelong learning.

C. GRADUATE PROFILE.

Graduates Profiles of graduates of the Biology Education Masters Study Program are as follows:

1. Biology teacher or Biology Education Lecturer who is able to design, implement, and evaluate biology learning based on local wisdom and digital technology.
2. Researcher in the field of Biology Education who is able to design and carry out research in the field of biology and biology education and communicate it in various scientific forums.
3. Biology Education Consultant and Developer who has the ability to design curriculum, and manage education units and implement lifelong learning.

D. GRADUATE LEARNING OUTCOMES (CPL) = PROGRAME LEARNING OUTCOME (PLO)

The learning outcomes of graduates are described in the following table, with reference to the KKNI

Area	Code	Learning Outcome
Social Competences (Social Competence)	PLO1	Have integrity and professional ethics, self-development, and make innovations to improve the quality of education and lifelong learning for the community (PLO1).
	PLO2	Able to apply analytical, critical, innovative, and abstraction thinking skills in the field of biology education (PLO2).
	PLO3	Able to work together in multicultural groups and

Area	Code	Learning Outcome
		collaborate with various parties/stakeholders in solving a problem in the field of education (PLO3).
Specialist Competences (Special Competencies)	PLO4	able to analyze the basic philosophy and theory in the study of biology and biology learning (PLO4)
	PLO5	Able to design and manage biology learning based on classical, laboratory, natural surroundings and digital/virtual in education units (PLO6).
	PLO6	Able to design and publish a research through various approaches/methods to solve problems in the field of biology education (PLO5).
	PLO7	Able to manage and develop digital technology-based biology learning tools according to the characteristics of students (PLO6).
	PLO8	Able to design and conduct evaluations and assessments of learning in educational units (PLO7).
	PLO9	Able to improve mastery of biological material in the fields of plant and animal structure,

Area	Code	Learning Outcome
		environment, bioconservation, biomolecular, and biotechnology (PLO8).
	PLO10	Able to analyze and synthesize problem solutions in biology learning through interdisciplinary, transdisciplinary and multidisciplinary approaches

E. TITLE

Graduates of the Master of Biology Education Study Program are entitled to hold the title of Master of Biology Education which is abbreviated to M.Pd.

G. ACCREDITATION

Based on the Decree of BAN-PT No. 2030/SK/BAN-PT/Akred/M/VI/2017 The Masters Program in Biology Education, FMIPA, Universitas Negeri Jakarta has B accreditation with a validity period of up to 20 June 2022. Currently in the ASIIN international accreditation process.

H. CURRICULUM (STRUCTURE, DISTRIBUTION, AND COURSE DESCRIPTION)

1. Curriculum Structure

No	Course Group	credits
1	General Course (MKU)	9
2	Expertise Courses	35
3	Elective courses	2
TOTAL		46

2. Distribution of Courses
a. Compulsory Courses

No.		MK code	Course Group	Weight credits	Semester			
					1	2	3	4
A			**General Course**	**9**				
	1	30062013	Research Statistics	3		x		
	2	30061013	Science phylosophy	3	x			
	3	34362023	Educational Research Methodology	3		x		
B			**Courses in the Field of Expertise/Main Competence**	**35**				
	4	34361024	Biology Learning Design	4	x			
	5	34362014	Molecular Genetics and Biotechnology	4	x			
	6	34362024	Evaluation in Biology Learning	2		x		
	7	34363082	Structure, Development and Physiology of Animals	2		x		
	8	34363072	Plant Structure, Development and Physiology	2		x		
	9	34363012	Instructional Media	2			x	
	10	30062013	Ecology, Environment and Conservation	3	x			
	11		Option 1 *)	2	x			
	12		Choice 2 *)	2		x		
	13		Choice 3*)	2		x		
	14		Choice 4*)	2			x	
	15	30063032	Thesis Seminar	2			x	
	16	30064024	Thesis	6				X
C			**Supporting Courses**	**2**				

17	34362042	Contemporary Issues of Biology and Learning Biology	2		x		
TOTAL CREDITS			**46**	**16**	**18**	**6**	**6**

b. Elective courses

No.	MK code	Subject	credits	Semester
1	34363022	Neuroscience	2	Odd
2	34361022	Scientific Publications	2	Even
3	34261012	Bioinformatics in Biology Learning	2	Even
4	34363012	Information Technology in Biology Learning	2	Odd
5	34363052	School Based Management	2	Odd
6	34361032	Online Learning Development	2	Even
7	34361042	Applied Microbiology	2	Even

3. Course Description
a. Science phylosophy (3 credits)
Lecturer Team : Dr. Rusdi, M. Biomed. & Dr. Hanum Isfaeni, M.Sc.

Course Description:

This course discusses various aspects of general philosophy including the history of the development of science: understanding philosophy and philosophy of science, differences in knowledge and science, ontology,

epistemology and scientific axiology (single paradigm), various philosophical schools (multi-paradigm), philosophy of education in accordance with national education goals. , philosophy in accordance with the field of science and philosophy of education according to the field of science; logic and reasoning (deduction, induction), the concept of truth, the paradigm of mathematics and science.

b. Biology Learning Design (4 Credits)

Lecturer Team : Dr. Rizhal Hendi Ristanto, M.Pd. & Dr. Supriyatin, M.Si.

Course Description:

This Biology Learning Design course refers to one of the functions of educational technology (educational technology) which consists of creating, managing and using technological processes and resources in order to facilitate the achievement of learning and improving performance through ethical studies and practices in the field of biology.

c. Molecular Genetics and Biotechnology (4 Credit Points)

Lecturer Team : Dr. Rini Puspitaningrum, M. Biomed. & Dr. Tri Handayani Kurniati, M.Sc.

Course Description:

This course is divided into two study groups, namely molecular genetics and biotechnology. The material is given in the form of theory and practicum. Molecular genetic material discusses the history of the discovery of genetic material, the structure of genetic material (DNA and RNA), the process of DNA propagation (replication), gene function, gene expression (transcription and

translation), regulation of gene expression in prokaryotes and eukaryotes, and gene mutations, and Era of omics: genomics, transcriptomics, proteomics. Biotechnology material generally discusses the use of organisms through engineering and technology. The scope of the material includes the scope and development of Biotechnology, Principles and stages of Recombinant DNA Technology, Molecular Analysis Techniques: Extraction, Amplification and Visualization of DNA, Microbial Biotechnology: Fermentation, Single Cell Protein, Plant Biotechnology: Bacillus thuringiensis crops, Animal Biotechnology: Somatic Cell Nuclear Transfer/SCNT Techniques, Biotechnology Applications in Humans: Fingerprint DNA and Stem Cells, Environmental Biotechnology: Bioremediation, and Regulation and Safety of Biotechnology products. Practical materials given in this course include: Extraction of genomic DNA, DNA amplification (Polymerase Chain Reaction) and visualization of DNA by electrophoresis.

d. Ecology, Environment and Conservation (3 Credit Points)

Lecturer Team : Dr. Ratna Komala, M.Sc. & Dr. Diana Vivanti Sigit, M.Si.

Course Description:

After taking this course, students are able to master Ecological theories, recognize critical problems and issues in the environment, are able and skilled in conducting research, analyzing, planning, developing and implementing studies on the environment in problem solving and environmental conservation.

e. Structure, Development and Physiology of Animals (2 Credit Points)

Lecturer Team : Dr. Rusdi, M. Biomed.

Course Description:

This course discusses the cellular structure, development and physiology that occurs in the bodies of animals and humans. The developmental process of organisms discusses the pattern of development, developmental control mechanisms that include the role of cell substance (cell nucleus, cytoplasm) and the role of gene regulation during development, as well as the role of extracellular proteins in morphogenesis. Physiology discusses the mechanism of action of the body cellularly including bioelectricity, nerves, senses, hormones, muscles, bones, circulation, gastrointestinal, respiration, osmoregulation, excretion, and thermoregulation.

f. Structure, Development and Physiology of Plants (2 Credit Points)

Lecturer Team : Dr. Adisyahputra, MS.

Course Description:

This course discusses the cellular structure, development and physiology that occurs in plants. This course studies cell structure, organelle structure and function, cell wall structure and development, cell division processes; kinds and functions of tissues that make up plant organs, including young tissues (meristems) and mature tissues (ground tissues, protective tissues, strengthening tissues, transport tissues, and secretory tissues); anatomical structure and development of plant organs, including roots, stems, leaves, flowers, fruits and seeds; and secondary growth in plants.

g. Research Statistics (3 Credit Points)

Lecturer Team : Prof.Dr. I Made Putrawan

Course Description:

This course is a continuation of the statistics for the master's program that may have been obtained by students, but some tests are given again such as the concept of population and the nature of the hypothesis, some sampling distributions and hypothesis testing steps, and some simple & multiple regression analysis, as well as non-parametric statistical analysis.

h. Educational Research Methodology (3 Credits)

Lecturer Team : Prof.Dr. I Made Putrawan

Course Description:

This course contains a more in-depth scientific process related to understanding the formulation of scientific problems, the nature of hypotheses, surveys, experiments and ex post facto, population & sampling concepts, measurement and calibration, types of non-quantitative research, and thesis writing techniques.

i. Evaluation in Biology Learning (3 Credits)

Lecturer Team : Dr. Mieke Miarsyah, M.Si. & Dr. Rizhal Hendi Ristanto, M.Pd.

Course Description:

This course examines and discusses the classroom assessment paradigm in making changes; item validity and test reliability; apply authentic assessments and develop instruments; develop and analyze diagnostic assessments; compile evaluation and grading of student progress development.

j. Contemporary Issues in Biology Learning (2 credits)
Lecturer Team : Dr. Hanum Isfaeni, M.Sc.
Course Description:
After following this course, students can understand, design ways of thinking based on the actualization of modern biological concepts and apply them in biology learning. The topics covered include: selected topics based on the perspective of the development of modern biology, among others: Molecular and cellular developmental biology, biological regulation and metabolism, curriculum development, Generic Skills, multimedia in biology learning, higher order thinking skills.

k. Learning Media (2 credits)
Lecturer Team : Dr. Mieke Miarsyah, M.Si. & Dr. Rizhal Hendi Ristanto, M.Pd.
Course Description:
After attending the lecture, students are expected to be able to analyze the nature of media and their position, knowledge of the functions and uses of media, classification of learning media according to various expert perspectives and describe each type of media, knowledge and skills about media production mechanisms including pre, production and post-production of learning media by applying them. integrated manner.

l. School Based Management (2 credits)
Lecturer Team : Dr. Supriyatin, M.Si.
Course Description:
This MBS course discusses: the scope of SBM and society, the definition of SBM, the duties and functions of the principal, the role of the school committee, SBM as

opportunities and challenges, the development of management patterns and shifts in SBM, the objectives of SBM, the principles of SBM, the functions of SBM, the benefits of SBM , Components of SBM, characteristics of SBM, Implementation of SBM, impact of SBM, effectiveness of SBM implementation, SBM decentralization function to schools. Development of SBM and studies on the management of biology learning in schools.

m. Neurosciences (2 credits)
Lecturer Team : Prof.Dr. I Made Putrawan
Course Description:
This course is given in order to train students to listen independently related to PBM biology at various levels of education, especially concepts about behavioral neurosciences, related to the role of neurons in learning and behavior and present it scientifically through presentations and writing papers as a basis for students to prepare a thesis.

n. Biology Learning Informatics Technology (2 credits)
Lecturer Team : Dr. Hanum Isfaeni, M.Sc.
Course Description:
Applying the concept of information technology in biology learning, utilizing technology in developing media and learning resources in biology learning.

o. Scientific Publications (2 credits)
Lecturer Team : Dr. Rizhal Hendi Ristanto, M.Pd.
Course Description:

This course is a subject that discusses knowledge and skills in publishing research results in biology education. Topics discussed include the values obtained when writing, the nature of scientific publications, ethics of scientific publications, designing writing activities, writing titles, abstracts, introductions, research methods, presentation of research results (tables, graphs, photos, and pictures), discussion research results, giving thanks, writing reference lists, searching for scientific journal targets, categorizing scientific journals, submitting manuscripts, reviewing manuscripts, and revising manuscripts (how to deal with editors).

p. Bioinformatics in Learning Biology (2 credits)
Lecturer Team : Dr. Hanum Isfaeni, M.Sc.
Course Description:
This course covers the introduction of concepts, principles of information technology in the field of biology and learning biology. This course also examines current developments, application and research of bioinformatics in biology learning, ethical aspects of bioinformatics in education, research and development. Learning activities for this course are through face-to-face and mini projects.

q. Online Learning Development (2 credits)
Lecturer Team : Dr. Rizhal Hendi Ristanto, M.Pd.
Course Description:
This course is a subject that discusses the use of computer information technology in the biology learning process. The purpose of this course is that students can develop and create blended learning-based biology learning designs.

r. Microbiology Applied (2 credits)
Lecturer Team : Dr. Tri Handayani Kurniati, M.Sc.
Course Description:
This course examines the role of microorganisms in various aspects: food, environment, health and their application in life. The material is given in the form of theory and practicum. The scope of the material provided includes: The role of microorganisms in the life and development of applied microbiology, Microorganisms and the balance of nature: biogeochemical cycles. Applications in the food sector: fermented food products, Industrial applications: antibiotics, biofuels, Medical applications: Pathogens and infection mechanisms, Environmental applications: bioremediation of waste oil, Applications in agriculture: organic fertilizers Practical material is a combination of basic materials and applications that can be used in learning at school. Practical topics include: Isolation and observation of microorganisms from the environment,

s. Thesis Seminar (2 credits)
Lecturer Team : Dr. Mieke Miarsyah, M.Si. & Dr. Supriyatin, MSi.
Course Description:
This course is a special project course, in the form of extracting literature used by students to prepare thesis proposals. At the end of the lecture, the research proposal is completed. Lecture content includes: literature search and analysis, designing proposals, presenting proposals.

t. Thesis (6 credits)
Lecturer Team : Dr. Mieke Miarsyah, M.Si & Dr. Supriyatin, MSi.

Course Description:
The final project for students of the Biology Education Masters Study Program is in the form of a scientific report based on research conducted at research facilities owned by the Universitas Negeri Jakarta, the community, related agencies, or research projects by following the established procedures. The preparation of this thesis is the end of a series of activities that are passed by students including proposal seminars and research results seminars.

I. Lecturer of the Biology Education Masters Study Program

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