



MODULE HANDBOOK

YEARS 1

**UNDERGRADUATE
PROGRAM IN
PHYSICS**

**FACULTY OF MATHEMATICS
AND NATURAL SCIENCES
UNIVERSITAS PADJADJARAN
2025**

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| Academic Year | 2025/2026 |
| Code/ Semester | UNX01-001 / 1 st Semester |
| Course/ Credit points | Religion / 2 credits ~ 3.62 ECTS |
| Language | Indonesian |
| Responsible Person | Otong Nurhilal |
| Lecturer | Otong Nurhilal, Cukup Mulyana |
| Workload | 1. Lectures : 2 x 50 = 100 minutes per week. 2. Assignments : 2 x 60 = 120 minutes per week. 3. Private learning : 2 x 60 = 120 minutes per week. |
| Contents | The concept of man as a divine being, the role of religion in building civilization, implementation of Islamic teachings in family development, implementation of Islamic teachings in multicultural societies, Islamic concepts of state and government, Islamic concepts of the environment, concepts of hijrah, jihad, religious radicalism, and Islamic moderation, the role of religion in dealing with issues contemporary, Islam and information literacy and the development of an anti-corruption culture |
| Learning Objectives | <ul style="list-style-type: none"> • Mastering the concept of humans as godly beings; • Mastering the role of religion in building civilization; • Mastering the implementation of Islamic teachings in family development; • Mastering the implementation of Islamic teachings in a multicultural society; • Mastering the Islamic concept of state and government; • Mastering Islamic concepts about the environment; • Mastering the concepts of hijrah, jihad, religious radicalism, and Islamic moderation; • Mastering the role of religion in dealing with contemporary issues: Islam and information literacy and the development of an anti-corruption culture. |
| Course Method | Lectures are held by lecture and discussion methods. Giving assignments to test the accuracy of answering questions both in the form of concepts and problem solving. |
| Form of Examination | To be defined by the lecturer at the beginning of course |
| Prerequisites | - |
| Requirements according to the examination regulations | Registered in this course Minimum 80% attendance in this course |
| Reading list | 1. al-Khatib, Sulaiman, Al-Falsafah al-'Aammah wa al-Akhlaaq, Minia: Jami'ah Minia, Aman, Saifudin, Tren Spiritualitas Milenium Ketiga, Jakarta: Ruhama, 2013 2. Kailah, Salaamah, Al-Islaam fi Siyaaqihi at- Taariikhy, Beirut: Daar at- tanwiir, 2013 |
| Assessment Guidance | Assignment and quizzes (40%); final exam (20%); participatory rubric (40%) |

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| Academic Year | 2025/2026 |
| Code/ Semester | UNX01-002 / 1 st Semester |
| Course/ Credit points | Pancasila / 2 credits ~ 3.62 ECTS |
| Language | Indonesian |
| Responsible Person | Hadiyanto A. Rachim |
| Lecturer | Lecturers team from the university, Hadiyanto A. Rachim |
| Workload | 1. Lectures: 2 x 50 = 100 minutes per week. 2. Assignments: 2 x 60 = 120 minutes per week. 3. Individual study: 2 x 60 = 120 minutes per week. |
| Contents | <ul style="list-style-type: none"> National Identity and Integrity Constitutions of Republic Indonesia (UUD 1954) and examples of practical. Anti-corruption, Obligations, and rights of citizens Insight into the archipelago and national resilience. |
| Learning Objectives | <ul style="list-style-type: none"> Students able to recognize and have the national identity and integrity. Students able to recognize and apply the constituents of Republic Indonesia. Students able to perform anti-corruption attitudes, knowing and understanding the obligations and rights of citizens Republic of Indonesia. |
| Course Method | <ul style="list-style-type: none"> Lecture course: lecture presentation, interactive learning quizzes (discussion and sharing). Interactive learning: presentation (Focus Group Discussion), Homework/assignment: Problem based learning, Individual study |
| Form of Examination | To be defined by the lecturer at the beginning of course |
| Prerequisites | - |
| Requirements according to the examination regulations | Registered in this course Minimum 80% attendance in this course |
| Reading list | <ol style="list-style-type: none"> Kemenristekdikti. 2016. Modul Pendidikan Kewarganegaraan Untuk Perguruan Tinggi. Jakarta: Dirjen Belmawa Kemenristekdikti Pasha, MK. 2008. Pendidikan Kewarganegaraan (Civic Education). Yogyakarta. Citra Karsa Mandiri. Sunarso, dkk. 2006. Pendidikan Kewarganegaraan. Yogyakarta: UNY Press. |
| Assessment Guidance | Rubric focus group discussion (presentation) (20%); Homework/assignment (20%); middle exam (30%); final exam (30%) |

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| Academic Year | 2025/2026 |
| Code/ Semester | UNX01-003 / 1 st Semester |
| Course/ Credit points | Citizenship Education / 2 credits ~ 3.62 ECTS |
| Language | Indonesian |
| Responsible Person | Hadiyanto A. Rachim |
| Lecturer | Lecturers team from the university, Hadiyanto A. Rachim |
| Workload | 1. Lectures: 2 x 50 = 100 minutes per week. 2. Assignments: 2 x 60 = 120 minutes per week. 3. Individual study: 2 x 60 = 120 minutes per week. |
| Contents | <ul style="list-style-type: none"> National Identity and Integrity Anti-corruption, Obligations, and rights of citizens Insight into the archipelago and national resilience. |
| Learning Objectives | <ul style="list-style-type: none"> Students able to recognize and have the national identity and integrity. Students able to recognize and apply the constituents of Republic Indonesia. Students able to perform anti-corruption attitudes, knowing and understanding the obligations and rights of citizens Republic of Indonesia. |
| Course Method | <ul style="list-style-type: none"> Lecture course: lecture presentation, interactive learning quizzes (discussion and sharing). Interactive learning: presentation (Focus Group Discussion), Homework/assignment: Problem based learning, Individual study |
| Form of Examination | To be defined by the lecturer at the beginning of course |
| Prerequisites | - |
| Requirements according to the examination regulations | Registered in this course Minimum 80% attendance in this course |
| Reading list | <ol style="list-style-type: none"> Kemenristekdikti. 2016. Modul Pendidikan Kewarganegaraan Untuk Perguruan Tinggi. Jakarta Dirjen Belmawa Kemenristekdikti Pasha, MK. 2008. Pendidikan Kewarganegaraan (Civic Education). Yogyakarta. Citra Karsa Mandiri. Sunarso, dkk. 2006. Pendidikan Kewarganegaraan. Yogyakarta: UNY Press. |
| Assessment Guidance | Rubric focus group discussion (presentation) (20%); Homework/assignment (20%); middle exam (30%); final exam (30%) |

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| Academic Year | 2025/2026 |
| Code/ Semester | UNX01-004 / 1 st Semester |
| Course/ Credit points | Indonesian Language / 2 credits ~ 3.62 ECTS |
| Language | Indonesian |
| Responsible Person | Dr. Wahya, M.Hum |
| Lecturer | Lecturers team from the university, Dr. Wahya, M.Hum |
| Workload | 1. Lectures: 2 x 50 = 100 minutes per week. 2. Assignments: 2 x 60 = 120 minutes per week. 3. Individual study: 2 x 60 = 120 minutes per week. |
| Contents | <ul style="list-style-type: none"> • Scope of Indonesian Language and scientific communication • Structure and technical writing of scientific work • Recent issues in Indonesian Language • Exploring writing ideas and writing drafts • Popular and creative of scientific works • Presentation and public speaking • Introductory Creative digital media • Creative content based Indonesian Language. |
| Learning Objectives | <ul style="list-style-type: none"> • Students able to determine, analyze, and show the linguistic aspects contained on a variety of language. • Students able to determine, analyze and present the distinctive linguistic aspects contained in the variety of journalistic languages of culinary medicines, ceremonial buying and selling transactions. • Students able to determine, analyze and present the distinctive linguistic aspects contained in the variety of journalistic languages of religious business scientific law. |
| Course Method | <ul style="list-style-type: none"> • Lecture course: lecture presentation, interactive learning quizzes (discussion and sharing). • Interactive learning: presentation (Focus Group Discussion), homework/assignment. |
| Form of Examination | To be defined by the lecturer at the beginning of course |
| Prerequisites | - |
| Requirements according to the examination regulations | Registered in this course Minimum 80% attendance in this course |
| Reading list | <ol style="list-style-type: none"> 1. Sugono, Dendy. Berbahasa Indonesia dengan Benar. Pustaka Swara, 1994. 2. Moeliono, Anton M. and Lapoliwa, Hans and Alwi, Hasan and Tjatur, Sry Sattya and Sasangka, Wisnu and Sugiyono, Sugiyono (2017) Tata bahasa baku bahasa Indonesia. Edisi keempat. Badan Pengembangan dan Pembinaan Bahasa, Kementerian Pendidikan dan Kebudayaan, Jakarta |
| Assessment Guidance | Assignment and quizzes (40%); final exam (20%); participatory rubric (40%) |

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| Academic Year | 2025/2026 |
| Code/ Semester | UNX01-005 / 1 st Semester |
| Course/ Credit points | Creative Development and Entrepreneurship (OKK) / 3 credits ~ 5.43 ECTS |
| Language | Indonesian |
| Responsible Person | Dianne Amor |
| Lecturer | Lecturers team from the university, Dianne Amor |
| Workload | <ol style="list-style-type: none"> 1. Lectures: 3 x 50 = 100 minutes per week. 2. Assignments: 3 x 60 = 180 minutes per week. 3. Group/individual study: 3 x 60 = 180 minutes per week. |
| Contents | <ul style="list-style-type: none"> • Identity and culture • Intercultural dialogue • Local and global community • Conceptual in entrepreneurship • Social work planning • Development and continuing social work |
| Learning Objectives | <ul style="list-style-type: none"> • Students are able to determine, analyze, and show their identity and culture as Indonesian students. • Students are able to involve in intercultural dialogue. • Students are able to understand, be tolerant and involve in a local and global community. • Students are able to determine the conceptual work of entrepreneurship. • Students are able to involve the social work activity |
| Course Method | <ul style="list-style-type: none"> • Lecture course: (discussion and sharing). • Interactive learning: Project-based study, field work, (Focus Group Discussion), • Homework/assignment: Problem-based learning, Individual study |
| Form of Examination | To be defined by the lecturer at the beginning of course |
| Prerequisites | - |
| Requirements according to the examination regulations | Registered in this course Minimum 80% attendance in this course |
| Reading list | <ol style="list-style-type: none"> 1. Technical Guide of OKK, Team teaching of Universitas Padjadjaran, 2022. 2. Lecturer notes. |
| Assessment Guidance | Knowledge (Quizzes active citizens and entrepreneurship) (25%); Attitude (students activity, discipline, communication) (35%); Social work (creativity, planning, content, presentation, usefulness, reports, and video of social work) (40%). |

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|---|---|
| Academic Year | 2025/2026 |
| Code/ Semester | UND202511001 / 1 st Semester |
| Course/ Credit points | Fundamental Physics 1 / 3 credits ~ 5.43 ECTS |
| Language | Indonesian |
| Responsible Person | Camellia Panatarani |
| Lecturer | Camellia Panatarani, Lusi Safriani, Togar Saragi |
| Workload | 1. Lectures: 3 x 50 = 150 minutes per week. 2. Assignments: 3 x 60 = 180 minutes per week. 3. Individual study: 3 x 60 = 180 minutes per week |
| Contents | <ul style="list-style-type: none"> • Introduction: Science and Creativity, Quantity and Unit • Kinematics in One Dimension • Kinematics in Two Dimensions: Vectors • Dynamics, Circular Motion; Gravity • Work and Energy, Linear Momentum • Rotational Motion • Objects in Equilibrium: Elasticity and Fracture • Fluids, Heat and Thermodynamics |
| Learning Objectives | After taking Fundamental Physics I course, students are able to apply the basic principles and concepts of physics to find solutions to simple and practical physics problems in everyday life |
| Course Method | <ul style="list-style-type: none"> • Lecture course: lecture presentation, interactive learning quizzes (discussion and sharing). • Interactive learning: presentation (Focus Group Discussion and Small Group Discussion), Case- based learning, and problem-based learning • homework/assignment: Problem set, Individual study |
| Form of Examination | To be defined by the lecturer at the beginning of course |
| Prerequisites | - |
| Requirements according to the examination regulations | Registered in this course Minimum 80% attendance in this course |
| Reading list | 1. Serway Jewet, Physics For Scientists and Engineers, Ed.8 2. Tipler, Paul A. 1998. Fisika Untuk Sains dan Teknik Edisi Ketiga. Jakarta: Penerbit Erlangga. 3. Giancoli, Douglas C. 2001. Fisika Jilid 1 dan 2 Edisi Kelima. Jakarta: Penerbit Erlangga. 4. Halliday, David dan Robert Resnick. 1985. Fisika Jilid 1 dan 2. Jakarta: Penerbit Erlangga. 5. Jearl Walker, Halliday, David dan Robert Resnick, Fundamentals of physics ,10th Edition, 2014 |
| Assessment Guidance | Rubric focus group discussion (presentation)/ Quiz/Problem Set/assignment (90%); Comprehensive evaluation (10%) |

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|---|---|
| Academic Year | 2025/2026 |
| Code/ Semester | UND202511002 / 1 st Semester |
| Course/ Credit points | Fundamental Physics I Lab. Works/ 2 credits ~ 3.62 ECTS |
| Language | Indonesian |
| Responsible Person | Camellia Panatarani |
| Lecturer | Camellia Panatarani, Lusi Safriani, Togar Saragi |
| Workload | Lab Works: 2 x 160 = 320 minutes per week |
| Contents | The scope of this course includes basic measurements and uncertainty of measurement; least squares method, the viscosity of liquid, voltmeter and ampere meter, lens properties and shadow formation, Atwood machine, specific heat of solids, Wheatstone bridge |
| Learning Objectives | Able to carry out experiments to determine physical quantities in mechanics, electronics, and optics |
| Course Method | Lab. Works. |
| Form of Examination | Practical Examination |
| Prerequisites | - |
| Requirements according to the examination regulations | Registered in this course 100% attendance in this course |
| Reading list | <ol style="list-style-type: none"> 1. Modul Praktikum Fisika Dasar I, Laboratorium Fisika Dasar, FMIPA, Universitas Padjadjaran 2. Raymond A. Serway and John W. Jewett, Jr, Physics for Scientists and Engineers with Modern Physics, Eight Edition, 2010. 3. Tipler, Paul A and Gene Mosca, Physics for Scientists and Engineers, 6th Edition, 2007 4. Giancoli, Douglas C. Physics for Scientists & Engineers with Modern Physics, 5th Edition, Pearson Education Inc. USA 2020. |
| Assessment Guidance | Rubric final report (90%); Pre-test (10%) |

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| Academic Year | 2025/2026 |
| Code/ Semester | UND202511003 / 1 st Semester |
| Course/ Credit points | Mathematical Physics 1/ 2 credits ~ 3.62 ECTS |
| Language | Indonesian |
| Responsible Person | Lusi Safriani |
| Lecturer | Lusi Safriani, Annisa Aprilia |
| Workload | <ol style="list-style-type: none"> 1. Lectures: 2 x 50 = 100 minutes per week. 2. Assignments: 2 x 60 = 120 minutes per week 3. Individual study: 2 x 60 = 120 minutes per week. |
| Contents | <ul style="list-style-type: none"> • Basic calculus, Algebra of Complex Functions • Infinite series and Power Series, Vector Calculus |
| Learning Objectives | <ul style="list-style-type: none"> • Students are able to understand and use the basic mathematical tools covered in basic calculus material. • Students are able to perform algebraic manipulation of complex numbers in different representations correctly, solve complex equations and can apply them in analyzing physical phenomena correctly. • Students are able to describe certain functions in the appropriate series and can use the Fourier series description for harmonic analysis of periodic functions. • Students can use methods in vector calculus to solve Physics cases, including differential and integral of vector functions, Green's theorem and Stokes theorem to solve line integrals, surface integrals, and volume integrals. |
| Course Method | <ul style="list-style-type: none"> • Lecture course: lecture presentation, interactive learning quizzes (discussion and sharing), Collaborative based learning, problem-based learning, small group discussion • Interactive learning: exercise and presentation, Individual study: homework/assignment |
| Form of Examination | To be defined by lecturer at the beginning of course |
| Prerequisites | - |
| Requirements according to the examination regulations | Registered in this course Minimum 80% attendance in this course |
| Reading list | <ol style="list-style-type: none"> 1. Boas, M. L. (2006), Mathematical methods in the physical sciences, 3rd ed., John Wiley & Sons, New York. 2. Alexander Altland, Jan von Delft. (2019) Mathematics for Physicists: Introductory Concepts and Methods 1st Edition, Cambridge University Press |
| Assessment Guidance | Test/Homework/assignment (40%); Evaluation 1 (10%); Evaluation 2 (15%); Evaluation 3 (15%); Evaluation 2 (20%) |

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|---|--|
| Academic Year | 2025/2026 |
| Code/ Semester | UND202511004 / 1 st Semester |
| Course/ Credit points | Physics Programming Laboratory/ 2 credits ~ 3.62 ECTS |
| Language | Indonesian |
| Responsible Person | Sahrul Hidayat |
| Lecturer | Sahrul Hidayat, Ferry Faizal |
| Workload | Lab Works: 2 x 160 = 320 minutes per week |
| Contents | Algorithms and problem solving, algorithm design techniques, and types of problems in computing. Introduction to Python programming language. I/O Operators and Statements, Control Structures, Repetition, 1D Arrays, Functions, Graph Plots, N- Dimensional Arrays, Symbolic Math Operations and File Reading/Writing |
| Learning Objectives | <ul style="list-style-type: none"> • Have basic of programming using Python • Have basic of the syntax and semantics of the Python programming language, including variables, data types, control structures, functions, and modules • Able to analyze and solve problems using Python programming • Able to collaboratively and communicate effectively as part of a programming team |
| Course Method | Lab. Works. |
| Form of Examination | Practical Examination |
| Prerequisites | - |
| Requirements according to the examination regulations | Registered in this course 100% attendance in this course |
| Reading list | <ol style="list-style-type: none"> 1. Learn Python The Hard Way 3th Edition, Zed A. Shaw, Addison Wesley 2014 2. Tutorial Pemrograman Python 2. Sandy H.S. Hero, WCPL Press, Bandung 2017 |
| Assessment Guidance | Rubric final report (90%); Pre-test (10%) |

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|---|---|
| Academic Year | 2025/2026 |
| Code/ Semester | UND202512001 / 2 nd Semester |
| Course/ Credit points | Fundamental Physics 2/ 3 credits ~ 5.43 ECTS |
| Language | Indonesian |
| Responsible Person | Camellia Panatarani |
| Lecturer | Camellia Panatarani, Togar Saragi |
| Workload | <ol style="list-style-type: none"> 1. Lectures: 3 x 50 = 150 minutes per week. 2. Assignments: 3 x 60 = 180 minutes per week. 3. Individual study: 3 x 60 = 180 minutes per week |
| Contents | <ul style="list-style-type: none"> • Oscillation and Waves, Sound • Electric Charge and Electric Field • Electric Potential, Capacitance and Electric Energy • Electric Current, DC Circuits, Magnetism • Electromagnetic Induction and Faraday's Law • Alternating Current Circuits, Electromagnetic Waves • Light and Geometric Optics, Wave Properties of Light |
| Learning Objectives | After taking Fundamental Physics II course, students are able to apply the basic principles and concepts of physics to find solutions to simple and practical physics problems in everyday life |
| Course Method | <ul style="list-style-type: none"> • Lecture course: lecture presentation, interactive learning quizzes (discussion and sharing). • Interactive learning: presentation (Small Group Discussion), Case-based learning • homework/assignment: Problem set, Individual study |
| Form of Examination | To be defined by lecturer at the beginning of course |
| Prerequisites | - |
| Requirements according to the examination regulations | Registered in this course Minimum 80% attendance in this course |
| Reading list | <ol style="list-style-type: none"> 1. Serway Jewet, Physics For Scientists and Engineers, Ed.8 2. Tipler, Paul A. 1998. Fisika Untuk Sains dan Teknik Edisi Ketiga. Jakarta: Penerbit Erlangga. 3. Giancoli, Douglas C. 2001. Fisika, Jakarta: Erlangga. 4. Jearl Walker, Halliday, David dan Robert Resnick, Fundamentals of physics ,10th Edition, 2014 |
| Assessment Guidance | Rubric focus group discussion (presentation)/ Quiz/Problem Set/assignment (90%); Comprehensive evaluation (10%) |

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|---|--|
| Academic Year | 2025/2026 |
| Code/ Semester | UND202512002 / 2 nd Semester |
| Course/ Credit points | Fundamental Physics II Lab. Works / 2 credits ~ 3.62 ECTS |
| Language | Indonesian |
| Responsible Person | Camellia Panatarani |
| Lecturer | Camellia Panatarani, Togar Saragi |
| Workload | Lab Works: 2 x 160 = 320 minutes per week |
| Contents | The scope of this course includes characteristics of some electrical elements, determining the modulus of elasticity, moment of inertia of an object, physical pendulum, spring force and gravity constants, microscope, spectrometer, sound wave resonance, and oscilloscope |
| Learning Objectives | Able to carry out experiments to determine physical quantities in electrics and mechanics |
| Course Method | Lab. Works. |
| Form of Examination | Paperwork Presentation |
| Prerequisites | - |
| Requirements according to the examination regulations | Registered in this course 100% attendance in this course |
| Reading list | <ol style="list-style-type: none"> 1. Modul Praktikum Fisika Dasar I, Laboratorium Fisika Dasar, FMIPA, Universitas Padjadjaran 2. Raymond A. Serway and John W. Jewett, Jr, Physics for Scientists and Engineers with Modern Physics, 2010. 3. Tipler, Paul A and Gene Mosca, Physics for Scientists and Engineers, 6th Edition, 2007 4. Giancoli, Douglas C. Physics for Scientists & Engineers with Modern Physics, 5th Edition, Pearson Education Inc. USA 2020. |
| Assessment Guidance | Rubric final report (90%); Pre-test (10%) |

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|---|---|
| Academic Year | 2025/2026 |
| Code/ Semester | UND202512003 / 2 nd Semester |
| Course/ Credit points | Mathematical Physics 2 / 3 credits ~ 5.43 ECTS |
| Language | Indonesian |
| Responsible Person | Lusi Safriani |
| Lecturer | Lusi Safriani, Fitrilawati |
| Workload | <ol style="list-style-type: none"> 1. Lectures: 3 x 50 = 150 minutes per week. 2. Assignments: 3 x 60 = 180 minutes per week 3. Individual study: 3 x 60 = 180 minutes per week. |
| Contents | <ul style="list-style-type: none"> • Linier Algebra • Coordinate systems • Ordinary Differential Equation • Partial Differential Equation |
| Learning Objectives | <ul style="list-style-type: none"> • Students able to understand and solve matrix algebra and solve the linear equation. • Students able to understand and solve the physics phenomena relate to coordinate system. • Students able to identify the differential equation and establish the solution equation of the simple physical phenomena. • Students able to identify the partial differential equation and establish the solution equation of the simple physical phenomena. |
| Course Method | <ul style="list-style-type: none"> • Lecture course: lecture presentation, interactive learning quizzes (discussion and sharing). • Interactive learning: exercise and presentation, Individual study: homework/assignment |
| Form of Examination | To be defined by lecturer at the beginning of course |
| Prerequisites | <ul style="list-style-type: none"> • Mathematical Physics 1 • Fundamental Physics 1 |
| Requirements according to the examination regulations | Registered in this course Minimum 80% attendance in this course |
| Reading list | <ol style="list-style-type: none"> 1. Boas, M. L. (2006), Mathematical methods in the physical sciences, John Wiley & Sons, New York. 2. Riley, K. F., M. P. Hobson and S. J. Bence (2006), Mathematical Methods for Physics and Engineering 3rd edition, Cambridge University Press. 3. Alexander Altland, Jan von Delft. (2019) Mathematics for Physicists: Introductory Concepts and Methods 1st Edition, Cambridge University Press |
| Assessment Guidance | Quizzes (10%); Homework/assignment (20%); middle exam (35%); final exam (35%) |

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|---|---|
| Academic Year | 2025/2026 |
| Code/ Semester | UND202512004 / 2 nd Semester |
| Course/ Credit points | Modern Physics / 2 credits ~ 3.62 ECTS |
| Language | Indonesian |
| Responsible Person | Ayi Bahtiar |
| Lecturer | Ayi Bahtiar, Andri Abdurrachman |
| Workload | <ol style="list-style-type: none"> 1. Lectures: 2 x 50 = 100 minutes per week. 2. Assignments: 2 x 60 = 120 minutes per week 3. Individual study: 2 x 60 = 120 minutes per week. |
| Contents | Concepts of classical and modern physics, failure of classical physics concepts in modern physics, special theory of relativity and mechanical relativistic, basic concepts of quantum physics (particle like properties electromagnetic radiation and wavelike properties of particles), Heisenberg uncertainty, Model of Atoms, Schrodinger equation, Classical model of the Hydrogen atom, Quantum theory of the Hydrogen atom |
| Learning Objectives | <ul style="list-style-type: none"> • Able to explain the basic concepts of modern physics and their phenomena and experimental results in modern physics correctly, • Able to solve the Schrodinger equation in describing the interaction of waves with their environment (at the boundaries, confined/boxes, ladder potentials, quantum wells, tunneling, and harmonic oscillator) correctly, • Able to analyze the quantum quantities (set of numbers that characterize the energy levels and wave functions of the electron in the atom) in the Hydrogen atom correctly. |
| Course Method | At the beginning of the lecture for each topic, an explanation of the basic concepts is given and followed by working on problems that are done in the class and/or at home as homework and case study. |
| Form of Examination | To be defined by lecturer at the beginning of course |
| Prerequisites | Fundamental Physics |
| Requirements according to the examination regulations | Registered in this course Minimum 80% attendance in this course |
| Reading list | <ol style="list-style-type: none"> 1. Kenneth S. Krane, "Modern Physics", 4th Edition, Wiley, USA, 2020, 2. Arthur Beiser, Shobhit Mahajan and S. Rai Choudhury, "Concepts of Modern Physics", 7th Edition, Mc-Graw Hill, USA, 2017, |
| Assessment Guidance | Student work/assignments (30%); case study (20%), midterm exam (30%); final term exam (30%) |

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|---|---|
| Academic Year | 2025/2026 |
| Code/ Semester | UND202512005 / 2 nd Semester |
| Course/ Credit points | Numerical Computation / 2 credits ~ 3.62 ECTS |
| Language | Indonesian |
| Responsible Person | Sahrul Hidayat |
| Lecturer | Sahrul Hidayat, Ferry Faizal |
| Workload | <ol style="list-style-type: none"> 1. Lectures : 2 x 50 = 100 minutes per week. 2. Assignments : 2 x 60 = 120 minutes per week. 3. Private learning : 2 x 60 = 120 minutes per week. |
| Contents | Taylor series, roots of non-linear equations with bisection, false position and fixed point iteration approaches. System of linear equations with Gauss elimination method, Jacobi iteration and Gauss- Seidel iteration. Vectors and eigenvalues with power and inverse power method approaches. Curve matching with interpolation and linear regression approaches. Numerical integrals with Trapezoid, Simpson and Monte Carlo method approaches. The subject matter of ordinary differential equations with Taylor series approach, Euler method and Runge Kutta method |
| Learning Objectives | <ul style="list-style-type: none"> • Understanding of numerical methods and their applications in various fields. • Able to solve mathematical problems using numerical methods • Able to develop skills in programming using Python, to implement and analyze numerical algorithms • Have experience working with real-world problems that can be solved using numerical methods, and develop critical thinking and problem-solving skills. |
| Course Method | Lectures and case based study. |
| Form of Examination | Essay (case study) |
| Prerequisites | Physics Programming Laboratory |
| Requirements according to the examination regulations | Registered in this course Minimum 80% attendance in this course |
| Reading list | <ol style="list-style-type: none"> 1. Steven C. Chapra and Raymond P. Canale, Numerical Methods for Engineers 7th, , McGraw-Hill 2015 2. Rubin H Landau and Manuel Jose Paez, Computational Problems for Physics, , Taylor & Francis Group, 2018 |
| Assessment Guidance | Case based rubric (25); assignment (25%); midterm exam (25%); final exam (25%) |

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|---|--|
| Academic Year | 2025/2026 |
| Code/ Semester | UND202512006 / 2 nd Semester |
| Course/ Credit points | Numerical Computation Lab Work / 1 credits ~ 1.81 ECTS |
| Language | Indonesian |
| Responsible Person | Sahrul Hidayat |
| Lecturer | Sahrul Hidayat, Ferry Faizal |
| Workload | Lab Works: 1 x 160 = 160 minutes per week |
| Contents | Taylor series, roots of non-linear equations with bisection, false position and fixed-point iteration approaches. System of linear equations with Gauss elimination method, Jacobi iteration and Gauss- Seidel iteration. Vectors and eigenvalues with power and inverse power method approaches. Curve matching with interpolation and linear regression approaches. Numerical integrals with Trapezoid, Simpson and Monte Carlo method approaches. The subject matter of ordinary differential equations with Taylor series approach, Euler method and Runge Kutta method. |
| Learning Objectives | <ul style="list-style-type: none"> • Able to solve mathematical problems using numerical methods, including methods for finding roots of equations, system of linear equations, numerical integration, numerical differential, Eigen Value and solving differential equations. • Able to develop skills in programming using Python, to implement and analyze numerical algorithms |
| Course Method | Practicum in the lab |
| Form of Examination | Practical Examination |
| Prerequisites | Physics Programming Laboratory |
| Requirements according to the examination regulations | Registered in this course 100% attendance in this course |
| Reading list | <ol style="list-style-type: none"> 1. Steven C. Chapra and Raymond P. Canale, Numerical Methods for Engineers 7th, , McGraw-Hill 2015 2. Numerical Computation Practical Module, Undergraduate Study Program, Univ. Padjadjaran |
| Assessment Guidance | Pre-test (25%); final report (50%); final exam (25%) |

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| Academic Year | 2025/2026 |
| Code/ Semester | UND202512007 / 2 nd Semester |
| Course/ Credit points | Mechanics / 4 credits ~ 7.24 ECTs |
| Language | Indonesian |
| Responsible Person | Risdiana |
| Lecturer | Risdiana, Liu Kin Men |
| Workload | <ol style="list-style-type: none"> Lecturer: 4 x 50 = 200 minutes per week. Assignments: 4 x 60 = 240 minutes per week Individual study: 4 x 60 = 240 minutes per week. |
| Contents | <ul style="list-style-type: none"> Kinematics, Particle Dynamics Simple Harmonic Motion, Particle System Dynamics Rotational Motion of Rigid Bodies, Central Force System General Coordinate and General Momentum The D'Alembert Principle and the Lagrange Formulation Hamilton Formulation |
| Learning Objectives | <ul style="list-style-type: none"> Students are able to understand, explain, solve, and analyze the concepts of classical mechanics including Newtonian kinematics and dynamics, as well as the concepts of force and energy, Students are able to understand, explain, solve problems, and analyze the concept of analytic mechanics by using Lagrange and Hamilton formulation, as well as solve problems and analyze the motion of the central force and particle collisions. |
| Course Method | Students centered learning: Discovery learning, Small Group Discussion, and Contextual Instruction |
| Form of Examination | To be defined by lecturer at the beginning of course |
| Prerequisites | Fundamental Physics 1; Mathematical Physics 1 |
| Requirements according to the examination regulations | Registered in this course Minimum 80% attendance in this course |
| Reading list | <ol style="list-style-type: none"> Arya, A.P., An Introduction to Classical Mechanics, Prentice Hall, 1990. Fowles, G. R., Analytical Mechanics, Saunders College Publishing, 1986. Daniel Kleppner, Robert Kolenkow. 2013. An Introduction to Mechanics 2nd Edition, Cambridge University Press |
| Assessment Guidance | Quiz and Assignments (40%); Midterm Exam (30%), Final Exam (30%) |



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|---|---|
| Academic Year | 2025/2026 |
| Code/ Semester | UND202512008 / 2 nd Semester |
| Course/ Credit points | Thermodynamics / 3 credits ~ 5.43 ECTS |
| Language | Indonesian |
| Responsible Person | Otong Nurhilal |
| Lecturer | Otong Nurhilal, Sahrul Hidayat |
| Workload | 1. Lectures : 3 x 50 = 150 minutes per week. 2. Assignments : 3 x 60 = 180 minutes per week. 3. Private learning : 3 x 60 = 180 minutes per week. |
| Contents | Concepts and definitions of thermodynamics, energy and first law of thermodynamics, evaluation of properties, control volume energy analysis, second law of thermodynamics, entropy, exergy analysis and power plant systems. |
| Learning Objectives | <ul style="list-style-type: none">• Able to understand and apply the concept of energy and the first law of thermodynamics• Able to understand and apply the concept of evaluating the properties, concept of control volume energy analysis, concept of the second law of thermodynamics, concept of entropy, concept of exergy• Able to understand and apply the concept of power plant systems |
| Course Method | The learning process is carried out by lecture and discussion methods. Giving assignments for each subject is given to students to test their ability to master concepts and the accuracy of answering questions. |
| Form of Examination | To be defined by lecturer at the beginning of course |
| Prerequisites | Fundamental Physics 1; Mathematical Physics 1 |
| Requirements according to the examination regulations | Registered in this course Minimum 80% attendance in this course |
| Reading list | 1. Michael J. Moran, Howard N. Shapiro, Daisie D. Boettner Brigadier General (Retired), USA Margaret 2. B. Bailey Rochester Institute of Technology, Fundamentals of Engineering Thermodynamics, John Wiley & Sons, Inc. All rights reserved, 2018. |
| Assessment Guidance | Quiz and Assignments (40%); Midterm Exam (30%), Final Exam (30%) |



MODULE HANDBOOK

YEARS 2

**UNDERGRADUATE
PROGRAM IN
PHYSICS**

**FACULTY OF MATHEMATICS
AND NATURAL SCIENCES
UNIVERSITAS PADJADJARAN
2025**

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|---|---|
| Academic Year | 2025/2026 |
| Code/ Semester | UND202513001 / 3 rd Semester |
| Course/ Credit points | Electronics / 4 credits ~ 7.24 ECTS |
| Language | Indonesian |
| Responsible Person | Ferry Faizal |
| Lecturer | Ferry Faizal, Andri Abdurrochman, Setianto, Budi Adiperdana |
| Workload | <ol style="list-style-type: none"> 1. Lecturer: 4 x 50 = 200 minutes per week. 2. Assignments: 1 x 60 = 60 minutes per week 3. Lab. Work: 3 x 60 = 180 minutes 4. Individual study: 4 x 60 = 240 minutes per week. |
| Contents | Equivalent circuit, Transient current, Alternating current, Semiconductors, Diodes and Transistor, Amplifiers (Junction & FET), JFET dan MOSFET, Design and analysis of electronic circuit, Operational-Amplifier, Op-amp Circuit with Feedback, Oscillator circuit, Analog vs Digital information, Logic gates, Binary Code, BCD, Arithmetics Circuit, Flip-flop and Sequential logic, Examples of Digital circuit application: Mux-Demux, ALU, regiser etc. |
| Learning Objectives | <ul style="list-style-type: none"> • Students can understand and explain the concepts of analogue and digital's electronics • Students can recognize some of the components used in electronics • Students can understand the concept of DC-AC electric circuits in simple electronic circuits • Students can explain the concept of amplifier circuits, filter circuits and can analyze them • Students can explain the basic principles of oscillators and distinguish between types of oscillators. • Students can apply the concept of logic gates to flip-flop, register and counter circuits. |
| Course Method | Discussion, assignment, lab-practice. |
| Form of Examination | To be defined by lecturer at the beginning of course |
| Prerequisites | - |
| Requirements according to the examination regulations | Registered in this course Minimum 80% attendance in this course |
| Reading list | <ol style="list-style-type: none"> 1. Malvino, A.; David J Bates, Electronic Principles, McGraw-Hill, 2007 2. Dennis L. Eggleston, Basic Electronics for Scientists and engineers, Cambridge University Press, 2011 3. John Adler & Sutono. 2020. Elektronika Dasar. Informatika |
| Assessment Guidance | Quiz and Problem solving (40%); Rubric for presentation (30), Report for lab practice (30%) |

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| Academic Year | 2025/2026 |
| Code/ Semester | UND202513002 / 3 rd Semester |
| Course/ Credit points | Electronics Lab Work / 2 credits ~ 3.62 ECTS |
| Language | Indonesian |
| Responsible Person | Ferry Faizal |
| Lecturer | Ferry Faizal, Andri Abdurrochman |
| Workload | 1. Labwork: 4 x 50 = 200 minutes per week. 2. Private learning : 2 x 60 = 120 minutes per week. |
| Contents | Introduction, passive component characteristic, RC Circuit on AC and DC current sources, Diode and its application, Transistor, Operational Amplifier / OpAmp, Multistep Amplifier using OpAmp, Instrumentation Amplifier, Filter and Active Filter, Oscillator, Logic and Digital Electronic, Digital Arithmetic, Flip flop, Counter. |
| Learning Objectives | <ul style="list-style-type: none"> • Students are able to understand and explain the concepts of analog and digital electronics. • Students are able to understand the concept of DC-AC electric circuits in simple electronic circuits. • Students are able to explain semiconductor materials and explain the functions and characteristics of components of semiconductor materials. • Students are able to explain and analyze the concept of amplifier circuits and filter circuits • Students are able to explain the basic principles of oscillators and distinguish between types of oscillators • Students are able to apply the concept of logic gates to flip-flop, register and counter circuits |
| Course Method | Lab work |
| Form of Examination | Practical Examination |
| Prerequisites | - |
| Requirements according to the examination regulations | Registered in this course 100% attendance in this course |
| Reading list | <ol style="list-style-type: none"> 1. Malvino, A.; David J Bates, Electronic Principles, McGraw-Hill, 2007 2. Dennis L. Eggleston, Basic Electronics for Scientists and engineers, Cambridge University Press, 2011 3. Fundametal of Analog Circuits, Second Ed., Prentice Hall, John Adler 4. Sutono, 2020. Elektronika Dasar. Informatika |
| Assessment Guidance | Pre-test (25%); final report (50%); final exam (25%) |

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|---------------------------|--|
| Academic Year | 2025/2026 |
| Code/ Semester | UND202513003 / 3 rd Semester |
| Course/ Credit points | Electricity and Magnetism / 4 credits ~ 7.24 ECTS |
| Language | Indonesian |
| Responsible Person | Lusi Safriani |
| Lecturer | Lusi Safriani, Togar Saragi |
| Workload | <ol style="list-style-type: none"> 1. Lectures: 4 x 50 = 200 minutes per week. 2. Assignments: 4 x 60 = 240 minutes per week. 3. Individual study: 4 x 60 = 240 minutes per week. |
| Contents | <ul style="list-style-type: none"> • Review of Vector Analysis and Coordinate System • Electrostatic forces (Coulomb's Law) by discrete charges and their superposition • Static Electric Field due to discrete charges and their superpositions as well as by continuous charges • Electric flux, Gauss's Law and its applications • Electric Potential by discrete charges, superposition and by continuous charges. Potential due to dipoles, and Multipole Expansion. • Special techniques for solving electric potential (variable separation method and method of images) • Electric Polarization and Dielectric Materials • Capacitance, Electric Energy and Boundary Conditions. • Static Magnetic Field and Magnetic Force • Biot Savart's Law (steady/stationary current) • Divergence and Curl of magnetic field (Ampere's Law) • Magnetic Vector Potential • Magnetic Materials • Faraday's Law and Induced Current • Maxwell's equations in vacuum and materials • Electromagnetic Wave Equations in vacuum and materials |
| Learning Objectives | <ul style="list-style-type: none"> • Able to explain the fundamentals of force, electric field, and static electric potential accurately and effectively. • Able to determine electric potential using special techniques, and calculate electrical energy accurately. • Able to determine magnetic force, induced magnetic field, magnetic potential, magnetic materials, Faraday's law and induced current correctly. • Able to derive Maxwell's equations from electrostatics and magnetostatics to electrodynamics correctly. |
| Course Method | <ul style="list-style-type: none"> • Lecture course: lecture presentation, interactive learning quizzes (discussion and sharing). • Interactive learning: presentation (Focus Group Discussion and Small Group Discussion), Case- based learning, and problem-based learning • Homework/assignment: Problem set, Individual study |



UNPAD **PHYSICS**

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| Form of Examination | To be defined by lecturer at the beginning of course |
| Prerequisites | Fundamental Physics, Mathematical Physics 1 |
| Requirements according to the examination regulations | Registered in this course Minimum 80% attendance in this course |
| Reading list | <ol style="list-style-type: none">1. Reitz, J. R., Milford, F. J., and Christy, R. W., (1993), "Foundation of Electromagnet Theory": 4rd Edition, Addition-Wesley Publishing, Company Inc., USA.2. David J. Griffiths, Introduction to Electrodynamics, Prentice Hall, New Jersey, 1999.3. Saslow, W.M., "Electricity, Magnetism and Light", Thomson Learning Inc., Canada, 20024. Yohanes Surya, 2014. Listrik dan Magnet. Kandel |
| Assessment Guidance | Rubric focus group discussion (presentation)/ Homework/assignment (70%); midterm exam (15%); final exam (15%) |

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|---|--|
| Academic Year | 2025/2026 |
| Code/ Semester | UND202513004 / 3 rd Semester |
| Course/ Credit points | Physics Experiments / 2 credits ~ 7.24 ECTS |
| Language | Indonesian |
| Responsible Person | Annisa Aprilia |
| Lecturer | Annisa Aprilia, Sahrul Hidayat |
| Workload | 1. Labwork: 4 x 50 = 200 minutes per week. 2. Private learning : 2 x 60 = 120 minutes per week. |
| Contents | <ul style="list-style-type: none"> • Thermodynamics: anomaly of water • Optic: ABBE refractometer, reflection, and refraction of light, prism. • Wave: Standing waves, ripple tank, harmonic rotary • Electrodynamics: dielectric constants. Oscilloscope. |
| Learning Objectives | <ul style="list-style-type: none"> • Students able to plan and prepare several physics experiment in detailed. • Students able to take correlation between theory and experiments of several physical phenomena. |
| Course Method | Laboratory work: presentation (Group Discussion), Individual Study: plan and prepare logbook, final report. |
| Form of Examination | To be defined by lecturer at the beginning of course |
| Prerequisites | <ol style="list-style-type: none"> 1. Fundamental physics 1 2. Fundamental physics 2 3. Thermodynamic 4. Modern Physics |
| Requirements according to the examination regulations | Registered in this course 100% attendance in this course |
| Reading list | <ol style="list-style-type: none"> 1. Adrian C. Melissinos and Jim Napolitano, Experiment in Modern Physics, Academic Press, 2011 2. Jearl Walker, Halliday, David dan Robert Resnick, Fundamentals of physics ,10th Edition, 2014 |
| Assessment Guidance | Rubric activity laboratory work: Activity work (40%) ; Final report (35%); pre-test (10%); post-tes (15%) |

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|---|---|
| Academic Year | 2025/2026 |
| Code/ Semester | UND202513005 / 3 rd Semester |
| Course/ Credit points | Mathematical Physics 3/ 3 credits ~ 5.43 ECTS |
| Language | Indonesian |
| Responsible Person | Fitrilawati |
| Lecturer | Fitrilawati, Liu Kin Men |
| Workload | <ol style="list-style-type: none"> 1. Lectures: 3 x 50 = 150 minutes per week. 2. Assignments: 3 x 60 = 180 minutes per week. 3. Individual study: 3 x 60 = 180 minutes per week. |
| Contents | <ul style="list-style-type: none"> • Special Function • Function of Complex variable |
| Learning Objectives | <ul style="list-style-type: none"> • Students able to identify and operate integral of special function and establish the solution equation of differential equation. • Students able to describe the special function characteristics and applying to phenomena physical analyzes. |
| Course Method | <ul style="list-style-type: none"> • Lecture course: lecture presentation, interactive learning quizzes (discussion and sharing). • Interactive learning: exercise and presentation • Individual study: homework/assignment |
| Form of Examination | To be defined by lecturer at the beginning of course |
| Prerequisites | Mathematical Physics 2 |
| Requirements according to the examination regulations | Registered in this course Minimum 80% attendance in this course |
| Reading list | <ol style="list-style-type: none"> 1. Boas, M. L. (2006), Mathematical methods in the physical sciences, 3rd ed., John Wiley & Sons, New York. 2. Riley, K. F., M. P. Hobson and S. J. Bence (2006), Mathematical Methods for Physics and Engineering 3rd edition, Cambridge University Press. 3. Alexander Altland, Jan von Delft. (2019) Mathematics for Physicists: Introductory Concepts and Methods 1st Edition, Cambridge University Press |
| Assessment Guidance | Quizzes (10%); Homework/assignment (20%); middle exam (35%); final exam (35%) |

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|---|--|
| Academic Year | 2025/2026 |
| Code/ Semester | UND202513006 / 3 rd Semester |
| Course/ Credit points | Waves / 4 SKS ~ 7.24 ECTS |
| Language | Indonesian |
| Responsible Person | Togar Saragi |
| Lecturer | Togar Saragi, Otong Nurhilal. Setianto, Nowo Riveli |
| Workload | <ol style="list-style-type: none"> 1. Lectures: 4 x 50 = 200 minutes per week. 2. Assignments: 4 x 60 = 240 minutes per week. 3. Private learning: 4 x 60 = 240 minutes per week. |
| Contents | Simple and coupled oscillator, elastic waves (wave equation in string, energy propagation and impedance, sound wave, reflection and refraction of mechanical waves at the boundary, superposition of waves, Doppler effect), Fourier analysis and transform, Modulation of waves, electromagnetic wave, electromagnetic wave in structured media (layered media, waveguide, conducting tube and crystals). |
| Learning Objectives | <ul style="list-style-type: none"> • Able to explain the simple and coupled oscillator and their examples, propagation of mechanical waves and superposition of waves, • Able to apply the Fourier analysis and its transform in different waveforms, • Able to analyze the modulation techniques of waves and propagation of electromagnetic wave in different media, • Able to calculate analytically and numerically the reflectance and transmittance of electromagnetic wave at the boundary, • Able to analyze the electromagnetic wave in structured media |
| Course Method | At the beginning of the lecture for each topic, an explanation of the basic concepts is given and followed by working on problems that are done in the class and/or at home as homework and case study. |
| Form of Examination | To be defined by lecturer at the beginning of course |
| Prerequisites | <ol style="list-style-type: none"> 1. Fundamental Physics 2. Mathematical Physics |
| Requirements according to the examination regulations | Registered in this course Minimum 80% attendance in this course |
| Reading list | <ol style="list-style-type: none"> 1. Richard E Haskell, "Fourier Analysis By Example", Independently Published, 2020, 2. J. E. Houle and D. M. Sullivan, "Electromagnetic Simulation Using The FDTD Method with Phyton", 3rd Edition, John Wiley & Sons, Inc, 2020, |
| Assessment Guidance | Student work/assignments (40%); Case study (20%); Midterm exam (20%); Final term exam (20%) |

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|---|--|
| Academic Year | 2025/2026 |
| Code/ Semester | UND202513007 / 3 rd Semester |
| Course/ Credit points | Physics Research Proposal and Sainspreneur / 2 credits ~ 3.62 ECTS |
| Language | Indonesian |
| Responsible Person | Ayi Bahtiar |
| Lecturer | Ayi Bahtiar, Sahrul Hidayat |
| Workload | <ol style="list-style-type: none"> 1. Lectures : 2 x 50 = 100 minutes per week. 2. Assignments : 2 x 60 = 120 minutes per week. 3. Private learning : 2 x 60 = 120 minutes per week. |
| Contents | <ul style="list-style-type: none"> • Basic concepts of research design, research proposal writing techniques, presentation techniques and preparation of presentation materials, discussion techniques and peer review. • Science-Based Creativity and Innovation, Research Methodology for Product Development, Business Models and Business Planning |
| Learning Objectives | <ul style="list-style-type: none"> • Students are able to explain the basic concepts of research design from defining problems to determining research objectives to writing research proposals • Students are able to understand presentation techniques and techniques for preparing presentation material, practice presentation techniques, discussion techniques and techniques for conducting peer reviews |
| Course Method | Lecture, Discussion and Practice |
| Form of Examination | Presentation, quiz/assignment, test |
| Prerequisites | - |
| Requirements according to the examination regulations | Registered in this course Minimum 80% attendance in this course |
| Reading list | <ol style="list-style-type: none"> 1. Scott A. Gold (2016), "Research Methods in Science and Engineering", CRC Press. 2. Luis M. Camarinha-Matos, (2009). "Scientific Research Methodologies and Techniques Muller", Lecture Notes. |
| Assessment Guidance | Assignment (30%); participatory (30%); Final Project (40%) |

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|---|---|
| Academic Year | 2025/2026 |
| Code/ Semester | UNX10.050020 / 4 th Semester |
| Course/ Credit points | Community Service Course (KKN) / 3 credits ~ 5.43 ECTS |
| Language | Indonesian |
| Responsible Person | Sahrul Hidayat |
| Lecturer | Team teaching university, Sahrul Hidayat |
| Workload | Field Activity: 3 x 170 = 510 minutes per week |
| Contents | Community service in certain village relate with the research topic and community service of supporting lecturers (managed by University) |
| Learning Objectives | <ul style="list-style-type: none"> • Students have an experience to directly apply the physics knowledge to the public. • Students able to connect between physics knowledge and all aspect in the social public. • Students are able to socialize with community life to develop creativity and innovation. • Students have a sense of empathy for the village community and its problems. |
| Course Method | Interactive learning: presentation (Focus Group Discussion), Social work, activity field and teamwork. |
| Form of Examination | To be defined by lecturer at the beginning of course |
| Prerequisites | - |
| Requirements according to the examination regulations | Registered in this course Minimum 80% attendance in this course |
| Reading list | <ol style="list-style-type: none"> 1. Rhonda Phillips and Robert Pittman, "An Introduction to Community Development", Routledge USA, 2014 2. Community Service Guidelines Book, Universitas Padjadjaran |
| Assessment Guidance | Rubric focus group discussion (presentation) (20%); Student activity (20%); Final report (30%) |

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|---|--|
| Academic Year | 2025/2026 |
| Code/ Semester | UND202514001 / 4 th Semester |
| Course/ Credit points | Advanced Physics Experiments / 2 credits ~ 3.62 ECTS |
| Language | Indonesian |
| Responsible Person | Annisa Aprilia |
| Lecturer | Annisa Aprilia, Sahrul Hidayat |
| Workload | 1. Labwork: 4 x 50 = 200 minutes per week. 2. Private learning : 2 x 60 = 120 minutes per week. |
| Contents | Atomic physics (Balmer series), optics (diffraction of light), wave (elastic gas resonance), electrodynamics (electron in fine beam tube), modern physics (stefan-boltzman), electronics and instrumentation, energy conversion (solar cell) |
| Learning Objectives | <ul style="list-style-type: none"> • Students able to plan and prepare several physics experiment in detailed (atomic physics, modern physics, wave, optics, electronics) • Students able to take correlation between theory and experiments of several physical phenomena (atomic physics, modern physics, wave, optics, electronics) |
| Course Method | <ul style="list-style-type: none"> • Laboratory work: presentation (Focus Group Discussion), • Individual Study: plan and prepare logbook, final report. |
| Form of Examination | To be defined by lecturer at the beginning of course |
| Prerequisites | <ol style="list-style-type: none"> 1. Thermodynamic 2. Wave 3. Modern Physics |
| Requirements according to the examination regulations | Registered in this course Minimum 80% attendance in this course |
| Reading list | <ol style="list-style-type: none"> 1. Adrian C. Melissinos and Jim Napolitano, Experiment in Modern Physics, Academic Press, 2011 2. Steve Adams, Advanced Physics (Advanced Sciences) 2nd UK ed. Edition, Oxford University Press, USA, 2013 3. Advanced Physics Experiments Module, Padjadjaran University |
| Assessment Guidance | Rubric activity laboratory work: Activity work (40%) ; Final report (35%); pre-test (10%); post-tes (15%) |

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|---|---|
| Academic Year | 2025/2026 |
| Code/ Semester | UND202514002 / 4 th Semester |
| Course/ Credit points | Quantum Physics / 4 credits ~ 7.24 ECTS |
| Language | Indonesian |
| Responsible Person | Liu Kin Men |
| Lecturer | Liu Kin Men, Setianto, Nowo Riveli |
| Workload | <ol style="list-style-type: none"> Lecturer: 4 x 50 = 200 minutes per week. Assignments: 4 x 60 = 240 minutes per week Individual study: 4 x 60 = 240 minutes per week. |
| Contents | Introduction, Wave Functions, and Operators, Application of Schrodinger Equation, Angular Momentum, Hydrogen Atom, Perturbation Theory, Many Electrons Systems. |
| Learning Objectives | <ul style="list-style-type: none"> Students are able to explain the idea of the emergence of quantum theory correctly. Students are able to explain the principles of quantum theory and Schrodinger equation correctly. Students are able to explain the application of Schrodinger's equation correctly. Students are able to explain the concept of angular momentum, Hydrogen atom, perturbation theory and many electron system correctly. |
| Course Method | Lectures are held using lecture and discussion methods and use case-based study methods as support for application material from Quantum Physics. Video learning is used for the process of understanding the material. |
| Form of Examination | To be defined by lecturer at the beginning of course |
| Prerequisites | <ol style="list-style-type: none"> Mathematical physics Wave |
| Requirements according to the examination regulations | Registered in this course Minimum 80% attendance in this course |
| Reading list | <ol style="list-style-type: none"> R. E. Siregar (2018), Fisika Kuantum, Unpad Press, Bandung. David J. Griffiths, Darrell F. Schroeter (2018), Introduction to Quantum Mechanics 3rd edition, Cambridge University Press, UK |
| Assessment Guidance | Case study (40%); Midterm exam (30%); Final term exam (30%) |

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|---|--|
| Academic Year | 2025/2026 |
| Code/ Semester | UND202514003 / 4 th Semester |
| Course/ Credit points | Physics Computation and Simulation/2 credits ~ 3.62 ECTS |
| Language | Indonesian |
| Responsible Person | Sahrul Hidayat |
| Lecturer | Sahrul Hidayat, Budi Adiperdana |
| Workload | <ol style="list-style-type: none"> 1. Lectures : 2 x 50 = 100 minutes per week. 2. Assignments : 2 x 60 = 120 minutes per week. 3. Private learning : 2 x 60 = 120 minutes per week. |
| Contents | Review of numerical programming (Euler Method, Kuta Runge Method and Monte Carlo method). The physical cases of spring, damped spring, free fall motion, pendulum, bullet motion and RLC circuit solution are discussed. At an advanced stage, we will introduce the solution of PDE cases using the Finite Difference and Finite Difference Time Domian method. Examples casred of PDE solutions in the physical case of diffusion, Laplace and Poisson cases in temperature distribution and electric field, 1D wave propagation, and 2D wave propagation are discussed. |
| Learning Objectives | <ul style="list-style-type: none"> • Able to reconstruct physical cases and express them into mathematical language using a numerical approach • Able to create algorithms to obtain solutions to physical cases • Able to translate the case solution algorithm into python programming • Able to animate simple physical problems in the case of ODE and PDE • Able to analyze the suitability of physical case solutions based on the theory of physics |
| Course Method | Contextual Instruction and case based study |
| Form of Examination | Essay (case study) |
| Prerequisites | <ol style="list-style-type: none"> 1. Physics Programming Laboratory 2. Numerical Computation |
| Requirements according to the examination regulations | Registered in this course Minimum 80% attendance in this course |
| Reading list | <ol style="list-style-type: none"> 1. Rubin H Landau and Manuel Jose Paez, Computational Problems for Physics, Taylor & Francis Group, 2018 2. Nicholas J Giordano, Hisao Nakanishi, Computaional Physics with Matlab, 2012 |
| Assessment Guidance | Case based rubric (25%); assignment (25%); midterm exam (25%); final exam (25%) |

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|---|---|
| Academic Year | 2025/2026 |
| Code/ Semester | UND202514004 / 4 th Semester |
| Course/ Credit points | Physics Computation and Simulation Lab Work / 1 credits ~ 1.81 ECTS |
| Language | Indonesian |
| Responsible Person | Sahrul Hidayat |
| Lecturer | Sahrul Hidayat, Budi Adiperdana |
| Workload | Lab Works: 1 x 160 = 160 minutes per week |
| Contents | <ul style="list-style-type: none"> The physical cases of spring, damped spring, free fall motion, pendulum, bullet motion and RLC circuit solution are discussed. The solution of PDE cases using the Finite Difference and Finite Difference Time Domian method. Examples casded of PDE solutions in the physical case of diffusion, Laplace and Poisson cases in temperature distribution and electric field, 1D wave propagation, and 2D wave propagation |
| Learning Objectives | <ul style="list-style-type: none"> Able to translate the case solution algorithm into python programming in practice Able to animate simple physical problems in the case of ODE and PDE in practice Able to analyze the suitability of physical case solutions based on the theory of physics |
| Course Method | Lab. Works. |
| Form of Examination | Practical Examination |
| Prerequisites | <ol style="list-style-type: none"> Physics Programming Laboratory Numerical Computation |
| Requirements according to the examination regulations | Registered in this course 100% attendance in this course |
| Reading list | <ol style="list-style-type: none"> Rubin H Landau and Manuel Jose Paez, Computational Problems for Physics, Taylor & Francis Group, 2018 Physics Computation and Simulation Module, Padjadjaran University |
| Assessment Guidance | Rubric final report (90%); Pre-test (10%) |

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|---|---|
| Academic Year | 2025/2026 |
| Code/ Semester | UND202514005 / 4 th Semester |
| Course/ Credit points | Science and Technology-Based Entrepreneurship/2 credits ~ 3.62 ECTS |
| Language | Indonesian |
| Responsible Person | I Made Joni |
| Lecturer | I Made Joni, Andri Abdurrochman |
| Workload | 1. Lectures : 2 x 50 = 100 minutes per week. 2. Assignments : 2 x 60 = 120 minutes per week. 3. Private learning : 2 x 60 = 120 minutes per week. |
| Contents | <ul style="list-style-type: none"> • Role of entrepreneurship in science and technology • Case studies: Successful science-based startups • Validating ideas: Prototyping and feedback loops • From lab to market: Translating scientific inventions into products • Intellectual Property and Legal Aspects • Funding and Financial Planning |
| Learning Objectives | <ul style="list-style-type: none"> • Understand the principles of entrepreneurship in the context of science and technology. • Able to identify and evaluate entrepreneurial opportunities derived from scientific and technological innovation • Able to create a basic business plan including product development, market strategy, and financial forecasting |
| Course Method | Contextual Instruction and case based study |
| Form of Examination | To be defined by lecturer at the beginning of course |
| Prerequisites | - |
| Requirements according to the examination regulations | Registered in this course Minimum 80% attendance in this course |
| Reading list | Rudi Kurniawan, Strategi Technopreneurship, PT Mafy Media Literasi Indonesia, 2024 |
| Assessment Guidance | Student activity (25%); Project based rubric (50); assignment (25%) |

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|---|--|
| Academic Year | 2025/2026 |
| Code/ Semester | UND202514006 / 4 th Semester |
| Course/ Credit points | Introduction to Functional Materials and Advanced Materials / 2 credits ~ 3.62 ECTS |
| Language | Indonesian |
| Responsible Person | Fitrilawati |
| Lecturer | Fitrilawati, Annisa Aprilia |
| Workload | <ol style="list-style-type: none"> 1. Lectures : 2 x 50 = 100 minutes per week. 2. Assignments : 2 x 60 = 120 minutes per week. 3. Private learning : 2 x 60 = 120 minutes per week. |
| Contents | <ul style="list-style-type: none"> • Basic concept of material science: atomic, solid state • Characteristics and properties of Material: Electrical, optical, semiconductors, thermal, and mechanical. • Application of selected material in technology related to its characteristics and properties |
| Learning Objectives | <ul style="list-style-type: none"> • Students able to describe the atomic structure from some elements in periodic tables and classify the bonding type of molecule. • Students able to describe of materials structure and classify the materials based on their characteristics and properties. • Students able to describe the relation between material characteristics with technology and applications. |
| Course Method | <ul style="list-style-type: none"> • Lecture course: lecture presentation, interactive learning quizzes (discussion and sharing). • Interactive learning: presentation (Focus Group Discussion), • Homework/assignment: Problem based learning, Individual study |
| Form of Examination | To be defined by lecturer at the beginning of course |
| Prerequisites | - |
| Requirements according to the examination regulations | Registered in this course Minimum 80% attendance in this course |
| Reading list | <ol style="list-style-type: none"> 1. W. D. Callister, Materials Science and Engineering: An Introduction, John Wiley, Singapore 2007 2. S. M. Sze, Semiconductor Devices: Physics and Technology, John Wiley & Sons Ltd, New York. 1981 3. Mary Anne White. 2019. Physical Properties of Materials, Third Edition, CRC Press |
| Assessment Guidance | Rubric focus group discussion (presentation) (20%); Assignment (20%); middle exam (30%); final exam (30%) |

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|---|---|
| Academic Year | 2025/2026 |
| Code/ Semester | UND202514007 / 4 th Semester |
| Course/ Credit points | Introduction to Energy and Environmental Physics/2 credits ~ 3.62 ECTS |
| Language | Indonesian |
| Responsible Person | Otong Nurhilal |
| Lecturer | Otong Nurhilal, Sahrul Hidayat |
| Workload | 1. Lectures : 2 x 50 = 100 minutes per week. 2. Assignments : 2 x 60 = 120 minutes per week. 3. Private learning : 2 x 60 = 120 minutes per week. |
| Contents | Introduction, Mechanical Energy, energy conservation, heat and work, residential energy conservation and heat system control, solar energy, fossil energy, air pollution, global warming and thermal pollution, electricity, circuits and superconductors, electricity and magnetization, electricity from the sun, wind and water, atoms and nuclei, nuclear plants, fission reactions, effects of using radiation, fusion reactions (alternative future energy), biomass and geothermal |
| Learning Objectives | <ul style="list-style-type: none"> • Able to understand the basic principles of energy and Environmental • Able to understand the energy sources • Able to understand and analyze the energy resources and their utilization |
| Course Method | Lectures are held by lecture and discussion methods. Giving assignments to test the accuracy of answering questions both in the form of concepts and problem solving. |
| Form of Examination | To be defined by lecturer at the beginning of course |
| Prerequisites | - |
| Requirements according to the examination regulations | Registered in this course Minimum 80% attendance in this course |
| Reading list | Roger A. Hinrichs & Merlin Kleinbach (2013). Energy: Its Use and the Environment. Fifth Edition, Publisher Brooks/Cole: cengage Learning. |
| Assessment Guidance | Rubric focus group discussion (presentation) (30%); Assignment (30%); middle exam (20%); final exam (20%) |



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|---|---|
| Academic Year | 2025/2026 |
| Code/ Semester | UND202514008 / 4 th Semester |
| Course/ Credit points | Introduction to Smart Instrumentation and Data Science/2 credits ~ 3.62 ECTS |
| Language | Indonesian |
| Responsible Person | Andri Abdurrochman |
| Lecturer | Andri Abdurrochman, Ferry Faizal |
| Workload | 1. Lectures : 2 x 50 = 100 minutes per week. 2. Assignments : 2 x 60 = 120 minutes per week. 3. Private learning : 2 x 60 = 120 minutes per week. |
| Contents | <ul style="list-style-type: none">• Static characteristics and dynamic characteristics of instrumentation;• The working principle of sensors and transducers;• Analog and digital measurements; Microprocessor;• Signal/image conditioning and processing;• Communication and data transmission• Introduction to Data Science |
| Learning Objectives | <ul style="list-style-type: none">• Students can understand, be able to explain and classify the static and dynamic characteristics of instrumentation• Students can explain the working principles of sensors, transducers, and apply analog and digital measurement techniques.• Students can understand, explain and apply microprocessors, signal/image processing and communication and data transmission. |
| Course Method | Lecture, Discussion and Practice |
| Form of Examination | To be defined by lecturer at the beginning of course |
| Prerequisites | Electronics |
| Requirements according to the examination regulations | Registered in this course Minimum 80% attendance in this course |
| Reading list | 1. Mark, Melvin and Arthur R. Foster. 1979. Thermodynamics. New York: Allyn and Bacon, Inc 2. Analog and Digital Signal Processing (Ambardar, A., 1999, Brooks/Cole Publishing) 3. Digital Image Processing (Gonzales, 2002, Prentice-Hall Inc.) ' Microprocessor and Digital System (Hall, 1983, McGraw-Hill) |
| Assessment Guidance | Assignment (30%); Midterm Test (30%); Final Project/Test (40%) |

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|---|---|
| Academic Year | 2025/2026 |
| Code/ Semester | UND202514009 / 4 th Semester |
| Course/ Credit points | Introduction to Medical Physics and Imaging Science/2 credits ~ 3.62 ECTS |
| Language | Indonesian |
| Responsible Person | I Made Joni |
| Lecturer | I Made Joni, Andri Abdurrochman |
| Workload | <ol style="list-style-type: none"> 1. Lectures : 2 x 50 = 100 minutes per week. 2. Assignments : 2 x 60 = 120 minutes per week. 3. Private learning : 2 x 60 = 120 minutes per week. |
| Contents | <ul style="list-style-type: none"> • Principles behind diagnostic imaging (X-ray, CT, MRI, ultrasound, nuclear medicine) • Physics of radiation therapy and radiobiology • Basic human anatomy and physiology • Medical imaging and therapy • Medical devices (imaging and therapeutic) |
| Learning Objectives | <ul style="list-style-type: none"> • Able to explain physical principles behind diagnostic imaging (X-ray, CT, MRI, ultrasound, nuclear medicine). • Able to explain the physics of radiation therapy and radiobiology • Able to explain basic human anatomy and physiology relevant to medical imaging and therapy applications. • Able to explain the working principles and components of medical devices (imaging and therapeutic). |
| Course Method | Lecture, Discussion and Practice |
| Form of Examination | To be defined by lecturer at the beginning of course |
| Prerequisites | - |
| Requirements according to the examination regulations | Registered in this course Minimum 80% attendance in this course |
| Reading list | <ol style="list-style-type: none"> 1. Stephen Keevil, Renato Padovani, Introduction to Medical Physics, CRC Press 2022 2. Daniel Jirak, Frantisek Vitek, Basics of Medical Physics, Karolinum 2018 |
| Assessment Guidance | Assignment (30%); Midterm Test (30%); Final Project/Test (40%) |



MODULE HANDBOOK

YEARS 3

**UNDERGRADUATE
PROGRAM IN
PHYSICS**

**FACULTY OF MATHEMATICS
AND NATURAL SCIENCES
UNIVERSITAS PADJADJARAN
2025**

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|---|--|
| Academic Year | 2025/2026 |
| Code/ Semester | UND202515001 / 5 th Semester |
| Course/ Credit points | Physics Expertise Experiments / 2 credits ~ 3.62 ECTS |
| Language | Indonesian |
| Responsible Person | Annisa Aprilia |
| Lecturer | Annisa Aprilia, Otong Nurhilal |
| Workload | 1. Labwork: 4 x 50 = 200 minutes per week. 2. Private learning : 2 x 60 = 120 minutes per week. |
| Contents | <ul style="list-style-type: none"> • Conversion and conservation energy. • Thermoelectric • Electrodynamics: Magnetic, Hall effect • X-ray Diffraction • Electronics and Instrumentation |
| Learning Objectives | <ul style="list-style-type: none"> • Students able to plan and prepare several physics experiment in detailed. • Students able to take correlation between theory and experiments of several physical phenomena. |
| Course Method | <ul style="list-style-type: none"> • Laboratory work: presentation (Focus Group Discussion), • Individual Study: plan and prepare logbook, final report. |
| Form of Examination | To be defined by lecturer at the beginning of course |
| Prerequisites | <ul style="list-style-type: none"> • Experimental Physics • Electronics |
| Requirements according to the examination regulations | Registered in this course 100% attendance in this course |
| Reading list | <ol style="list-style-type: none"> 1. Adrian C. Melissinos and Jim Napolitano, Experiment in Modern Physics, Academic Press, 2011. 2. Electronics, Sutrisno, Penerbit ITB. 1986 3. Physics Expertise Experiments Module, Padjadjaran University |
| Assessment Guidance | Rubric activity laboratory work: Activity work (40%) ; Final report (35%); pre-test (10%); post-tes (15%) |

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|---|---|
| Academic Year | 2025/2026 |
| Code/ Semester | UND202515002 / 5 th Semester |
| Course/ Credit points | Introduction to Nuclear Physics /3 credits ~ 5.43 ECTS |
| Language | Indonesian |
| Responsible Person | Nowo Riveli |
| Lecturer | Nowo Riveli, Annisa Aprilia |
| Workload | <ol style="list-style-type: none"> 1. Lectures: 3 x 50 = 150 minutes per week. 2. Assignments: 3 x 60 = 180 minutes per week. 3. Individual study: 3 x 60 = 180 minutes per week. |
| Contents | <ul style="list-style-type: none"> • Nuclear Structure; • Concept of Quantum mechanics; • Radioactivity and nuclear decay; • Nuclear reaction; • Application of Radioactivity; • Application of Nuclear Physics in energy and medicine |
| Learning Objectives | <ul style="list-style-type: none"> • Students are able to describe the composition, characteristics, and physical principles applicable to the atomic nucleus. • Students are able to explain the dynamic phenomena of atomic nuclei and the underlying physical principles. Students are able to explain the technological applications of physical phenomena in nuclei. |
| Course Method | <ul style="list-style-type: none"> • Lecture course: lecture presentation, interactive learning, quizzes (discussion and sharing). • Interactive learning: presentation (Focus Group Discussion), Collaborative learning • Homework/assignment: Problem based learning, Individual study |
| Form of Examination | To be defined by lecturer at the beginning of course |
| Prerequisites | <ul style="list-style-type: none"> • Electricity and Magnetism • Modern Physics • Waves |
| Requirements according to the examination regulations | Registered in this course Minimum 80% attendance in this course |
| Reading list | <ol style="list-style-type: none"> 1. Kenneth S. Krane, Introductory Nuclear Physics (2008). 2. John Lilley, Nuclear Physics: Principles and Applications (2001). 3. J. Kenneth Shultis, Richard E. Faw, Douglas S. McGregor, (2016). Fundamentals of Nuclear Science and Engineering 3rd Edition. CRC Press. |
| Assessment Guidance | Rubric focus group discussion (presentation) (50%); Homework/assignment (10%); midterm exam (15%); final exam (25%) |

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|---|--|
| Academic Year | 2025/2026 |
| Code/ Semester | UND202515003 / 5 th Semester |
| Course/ Credit points | Statistical Physics /3 credits ~ 5.43 ECTS |
| Language | Indonesian |
| Responsible Person | I Made Joni |
| Lecturer | I Made Joni, Nowo Riveli |
| Workload | <ol style="list-style-type: none"> 1. Lectures: 3 x 50 = 150 minutes per week. 2. Assignments: 3 x 60 = 180 minutes per week. 3. Individual study: 3 x 60 = 180 minutes per week. |
| Contents | Macroscopic and Microscopic view of physical phenomena, N-Particle system and statistic, Ensemble of Physical system, Distribution of Particles Energy (Maxwell-Boltzmann, Fermi-Dirac, Bose Einstein) |
| Learning Objectives | <ul style="list-style-type: none"> • Students are able to correctly explain the position of the Physics of Statistics course and its relation to the Laws of Thermodynamics, probability theory, types of thermodynamic systems, kinetic theory of gases in statistical equilibrium systems in a classical view. • Able to correctly demonstrate the statistical mechanics equilibrium ensemble applied to Quantum-Mechanical systems on Fermion particles, Bosons, correctly and show and explain examples of its application. • Able to correctly compare Maxwell-Boltzmann, Bose-Einstein, Fermi-Dirac distributions and their application to various systems. |
| Course Method | Lecture, Discussion and Practice |
| Form of Examination | Presentation, quiz/assignment, test |
| Prerequisites | Thermodynamics and Quantum Physics |
| Requirements according to the examination regulations | Registered in this course Minimum 80% attendance in this course |
| Reading list | <ol style="list-style-type: none"> 1. Kerson Huang, 2001, "Statistical Physics" , Routledge 2. Landau, 2014, "Guide to Montecarlo in Statistical Physics" , Cambridge University Press |
| Assessment Guidance | Assignment (30%); Midterm Test (30%); Final Project (40%) |

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|---|--|
| Academic Year | 2025/2026 |
| Code/ Semester | UND202515004 / 5 th Semester |
| Course/ Credit points | Introduction to Solid State Physics / 4 credits ~ 7.24 ECTS |
| Language | English, Indonesian |
| Responsible Person | Risdiana |
| Lecturer | Risdiana, Otong Nurhilal |
| Workload | <ol style="list-style-type: none"> Lecturer: 4 x 50 = 200 minutes per week. Assignments: 4 x 60 = 240 minutes per week Individual study: 4 x 60 = 240 minutes per week. |
| Contents | <ul style="list-style-type: none"> The concept of crystal structure, The concept of bonding forces and bonds between atoms in crystals, Heat Capacity according to Einstein and Debye, Free electrons in a crystal, The energy band theory, Semiconductor materials, Electron dynamics in metals, The concept of magnetism and its applications. |
| Learning Objectives | Students are able to understand, explain and classify various crystal structures, understand and explain binding forces and atomic bonds in crystals and crystal lattice, understand and explain the concept of specific heat as a function of temperature according to Einstein and Debye, understand and explain the concept of free electrons in crystals, energy band theory and application of this energy band theory to semiconductor materials and linking energy band theory with electron dynamics in metals, understanding, explaining and classifying the concept of magnetism as well as various examples of magnetic materials and their applications. |
| Course Method | Student Center Learning, Problem-Based Learning |
| Form of Examination | To be defined by lecturer at the beginning of course |
| Prerequisites | Modern Physics, Quantum Physics, Wave |
| Requirements according to the examination regulations | Registered in this course Minimum 80% attendance in this course |
| Reading list | <ol style="list-style-type: none"> C. Kittel (2005), Introduction to Solid State Physics, John Wiley and Sons, Inc, 8th edition. G. Grosso, G.P Parravicini, Solid State Physics 2nd Edition, Academic Press, 2013 James D. Patterson, Bernard C. Bailey, Solid-State Physics, Introduction to the Theory, Springer, 2018 |
| Assessment Guidance | Rubric focus group discussion (presentation) (50%); Homework/assignment (10%); midterm exam (15%); final exam (25%) |

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|---|---|
| Academic Year | 2025/2026 |
| Code/ Semester | UND202515005 / 5 th Semester |
| Course/ Credit points | Modern optics / 2 SKS ~ 3.62 ECTS |
| Language | Indonesian |
| Responsible Person | Ayi Bahtiar |
| Lecturer | Ayi Bahtiar, Budi Adiperdana |
| Workload | <ol style="list-style-type: none"> 1. Lectures: 2 x 50 = 100 minutes per week. 2. Assignments: 2 x 60 = 120 minutes per week. 3. Private learning: 2 x 60 = 120 minutes per week. |
| Contents | Review the Electromagnetic (EM) wave equation in dielectric and metallic mediums and their boundary conditions, Refractive index of dielectric and metal (concept and measuring techniques), reflection and refraction at the dielectric-dielectric and metal- dielectric boundary, Attenuated Total Reflection (ATR) and Surface Plasmon, 1-Dimensional Layered Medium (multilayer 1D and Reflector Bragg), Waveguide (Planar waveguide and optical fiber), Integrated optical device for all-optical signal processing. |
| Learning Objectives | <ul style="list-style-type: none"> • Able to explain the refractive index of dielectric medium and metals and its measurement techniques and its consequences in the propagation of EM waves, • Able to calculate the transmittance and reflectance on a 1D periodic layered medium using analytical and numerical methods, • Able to analyze the propagation of EM waves on planar waveguides and optical fiber, • Able to design integrated optical devices for high-speed optical signal processing (all-optical signal processing). |
| Course Method | At the beginning of the lecture for each topic, an explanation of the basic concepts is given and followed by working on problems that are done in the class and/or at home as homework and case study |
| Form of Examination | To be defined by lecturer at the beginning of course |
| Prerequisites | Electricity and Magnetism, Waves, Numerical Computation |
| Requirements according to the examination regulations | Registered in this course Minimum 80% attendance in this course |
| Reading list | <ol style="list-style-type: none"> 1. J. E. Houle and D. M. Sullivan, "Electromagnetic Simulation Using The FDTD Method with Phyton", 3rd Edition, John Wiley & Sons, Inc, 2020, 2. B. E. A. Saleh and M. C. Teich, "Fundamental of Photonics", 3rd Edition, John Wiley & Sons Inc., 2019. |
| Assessment Guidance | Student work/assignments (30%); Case study (30%); Midterm exam (20%); Final term exam (20%) |

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|---|--|
| Academic Year | 2025/2026 |
| Code/ Semester | UND202515101 / 5 th Semester |
| Course/ Credit points | Environmental Physics / 2 SKS ~ 3.62 ECTS |
| Language | Indonesian |
| Responsible Person | Norman Syakir |
| Lecturer | Norman Syakir |
| Workload | <ol style="list-style-type: none"> 1. Lectures: 2 x 50 = 100 minutes per week. 2. Assignments: 2 x 60 = 120 minutes per week. 3. Individual study: 2 x 60 = 120 minutes per week. |
| Contents | <ul style="list-style-type: none"> • Environmental concept, characteristics, and quality of human environmental and its problems with a physical approach. • The nature of substance according to the transfer molecules, humidity, and temperature factors. • Concept of environmental radiation and its effect to the human livings. • The relevance of properties of noise, vibration, and sounds impact to the environment. • Apply the concept of significant impacts and alternatives for handle the impacts. |
| Learning Objectives | <ul style="list-style-type: none"> • Students able to understand and explain environmental problems in the life including the problem of sounds sources, physical quantities. • Students able to calculate the effect of temperature in the environment, explain the effect of radiation on humans and calculate the intensity of radiation. |
| Course Method | <ul style="list-style-type: none"> • Lecture course: lecture presentation, interactive learning quizzes (discussion and sharing). • Interactive learning: presentation (Focus Group Discussion), • Homework/assignment: Problem set, Individual study |
| Form of Examination | To be defined by lecturer at the beginning of course |
| Prerequisites | - |
| Requirements according to the examination regulations | Registered in this course, Minimum 80% attendance in this course |
| Reading list | <ol style="list-style-type: none"> 1. J.F., Gabriel, 2001, Fisika Lingkungan, Hipokrates, Jakarta 2. John Monteith, Mike Unsworth, Principles of Environment Physics 3. Sastrawijaya. 1991, Pencemaran lingkungan. Rineka Cipta. Jakarta 4. John L. Monteith and Mike H. Unsworth, 2014. Principles of Environmental Physics. Elsevier. |
| Assessment Guidance | Rubric focus group discussion(20%); Assignment (20%); middle exam (30%); final exam (30%) |

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| Academic Year | 2025/2026 |
| Code/ Semester | UND202515102 / 5 th Semester |
| Course/ Credit points | Energy Conversion / 2 SKS ~ 3.62 ECTS |
| Language | Indonesian |
| Responsible Person | Otong Nurhilal |
| Lecturer | Otong Nurhilal, Cukup Mulyana |
| Workload | <ol style="list-style-type: none"> 1. Lectures : 2 x 50 = 100 minutes per week. 2. Assignments : 2 x 60 = 120 minutes per week. 3. Private learning : 2 x 60 = 120 minutes per week. |
| Contents | Introduction, the basic principles of energy conversion, the main sources of energy conversion, thermal energy conversion, mechanical energy conversion, electrical energy conversion (generator, thermionic, thermoelectric), fuel cell energy conversion, battery and supercapacitor electrical energy conversion. |
| Learning Objectives | <ul style="list-style-type: none"> • Able to understand the basic principles of energy conversion • Able to understand and analyze the types of energy conversion |
| Course Method | Lectures are held by lecture and discussion methods. Giving assignments to test the accuracy of answering questions both in the form of concepts and problem solving. |
| Form of Examination | - |
| Prerequisites | Physics of energy |
| Requirements according to the examination regulations | Registered in this course Minimum 80% attendance in this course |
| Reading list | <ol style="list-style-type: none"> 1. Energy Conversion 2nd edition. D. Yogi Goswani and Frank Kreith. 2017 2. Energy Conversion. by Kenneth C. Weston 2000 |
| Assessment Guidance | Rubric focus group discussion(20%); Assignment (20%); middle exam (30%); final exam (30%) |



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|---|---|
| Academic Year | 2025/2026 |
| Code/ Semester | UND202515103 / 5 th Semester |
| Course/ Credit points | Heat Transfer / 2 SKS ~ 3.62 ECTS |
| Language | Indonesian |
| Responsible Person | Cukup Mulyana |
| Lecturer | Cukup Mulyana |
| Workload | 1. Lectures: 2 x 50 = 100 minutes per week. 2. Assignments: 2 x 60 = 120 minutes per week. 3. Private learning: 2 x 60 = 120 minutes per week. |
| Contents | Heat transfer courses explain heat transfer by conduction, convection and radiation. Followed by discussing heat transfer equipment. |
| Learning Objectives | <ul style="list-style-type: none">• Be able to understand the concept of 1D, 2D, steady and unsteady conduction heat transfer• Be able to understand the concept of forced and natural convection heat transfer• Be able to understand the concept of radiant heat transfer• Able to understand the working principle of heat transfer equipment |
| Course Method | Lectures are held by lecture and discussion methods. Giving assignments after each subject is finished is given to students to test their ability to master concepts and the accuracy of answering questions. |
| Form of Examination | - |
| Prerequisites | Fundamental Physics |
| Requirements according to the examination regulations | Registered in this course Minimum 80% attendance in this course |
| Reading list | 1. Holman, J.P. (2010). Heat transfer (10th ed.). New York McGraw-Hill, a business unit of the McGraw- Hill] 2. John H Lienhard IV, Dr. John H Lienhard V. 2019. A Heat Transfer Textbook. Dover Publications |
| Assessment Guidance | Rubric focus group discussion(20%); Assignment (20%); middle exam (30%); final exam (30%) |

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| Academic Year | 2025/2026 |
| Code/ Semester | UND202515104 / 5 th Semester |
| Course/ Credit points | Robotics / 2 SKS ~ 3.62 ECTS |
| Language | Indonesian |
| Responsible Person | I Made Joni |
| Lecturer | I Made Joni, Budi Adiperdana |
| Workload | <ol style="list-style-type: none"> Lectures: 2 x 50 = 100 minutes per week. Assignments: 2 x 60 = 120 minutes per week. Private learning: 2 x 60 = 120 minutes per week. |
| Contents | <ul style="list-style-type: none"> Classification of robots according to their functions Robot system hardware Software for Robot control systems Sensors and Actuators in Robots Review of the approach to Mathematical Models in Robots Functional Robot Manufacturing Project |
| Learning Objectives | <ul style="list-style-type: none"> Able to know and understand the workings of the types of robots according to their functions To understand how the components work in a robot, either independently or integrated, explain the use of each basic electronic component in a robot, and analyze the problems that can occur in these components To understand the use of a software to complete robot movements and be able to make commands in software language on robots. To explain the use of actuators and sensors and design according to the robot's functionalization To explain and make calculations and mathematical models needed in the design of intelligent robots To make proposals and design functional robotic systems |
| Course Method | Lecture, Discussion and Practice |
| Form of Examination | Presentation, quiz/assignment, test |
| Prerequisites | Microcontroller, Control System |
| Requirements according to the examination regulations | Registered in this course Minimum 80% attendance in this course |
| Reading list | <ol style="list-style-type: none"> Robotic: Fundamental Concept and Analysis, Oxford University Press, Second reprint, 2008 Bruno Siciliano and Oussama Khatib, Springer Handbook of Robotics, 1st Eds., 2008 Richard M. Murray, A Mathematical Introduction to Robotic Manipulation 1st Edition, 1994 - CRC Press |
| Assessment Guidance | Rubric focus group discussion(20%); Assignment (20%); middle exam (30%); final exam (30%) |

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|---|---|
| Academic Year | 2025/2026 |
| Code/ Semester | UND202515105 / 5 th Semester |
| Course/ Credit points | Data Science / 2 SKS ~ 3.62 ECTS |
| Language | Indonesian |
| Responsible Person | Ferry Faizal |
| Lecturer | Ferry Faizal |
| Workload | <ol style="list-style-type: none"> 1. Lectures: 2 x 50 = 100 minutes per week. 2. Assignments: 2 x 60 = 120 minutes per week. 3. Private learning: 2 x 60 = 120 minutes per week. |
| Contents | Data Science, Machine learning, Data analysis, Statistics, Virtual Private Server (VPS), Problem Statement, Data Collection, Cleaning Datasets (Data accuracy), Data Quality Issue (Mean, median and modus), Data Analysis, Data Modeling, Communication Result |
| Learning Objectives | <ul style="list-style-type: none"> • Creating a well-defined problem statement is the first and critical step in data science. • Data collection methods, with a systematic approach to gathering relevant information from various sources. • Data quality analysis that will produce accurate data that takes into account the mean, mode, and median values. • Modeling that formulates each step and gathers the necessary techniques to reach a solution. • Communicating the results, in a way that is easy to understand, so that stakeholders can make actionable plans. |
| Course Method | Lectures are conducted using lecture and discussion methods and use case-based study methods as support for application material from Quantum Physics. Learning videos are used for the process of understanding the material. |
| Form of Examination | To be defined by lecturer at the beginning of course |
| Prerequisites | Numerical computation |
| Requirements according to the examination regulations | Minimum 80% attendance in this course |
| Reading list | <ol style="list-style-type: none"> 1. David Donoho, 50 years of Data Science, Sept. 18, 2015. 2. Fionn Murtagh, and Keith Devlin, The Development of Data Science: Implications for Education, Employment, Research, and the Data Revolution for Sustainable Development, Big Data Cogn. Comput. 2018 |
| Assessment Guidance | Rubric focus group discussion(20%); Assignment (20%); middle exam (30%); final exam (30%) |

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| Academic Year | 2025/2026 |
| Code/ Semester | UND202515106 / 5 th Semester |
| Course/ Credit points | Introduction to Artificial Intelligence / 2 SKS ~ 3.62 ECTS |
| Language | Indonesian |
| Responsible Person | Budi Adiperdana |
| Lecturer | Budi Adiperdana |
| Workload | <ol style="list-style-type: none"> 1. Lectures: 2 x 50 = 100 minutes per week. 2. Assignments: 2 x 60 = 120 minutes per week. 3. Private learning: 2 x 60 = 120 minutes per week. |
| Contents | <ul style="list-style-type: none"> • Introduction to Artificial Intelligence (AI) • Search Methods, Machine Learning • Evolutionary Algorithm, Fuzzy Logic, Cellular Automata |
| Learning Objectives | <ul style="list-style-type: none"> • Students able to know history and development of AI, understand the concept of finding the best solutions, agent and their environment, and state space and search space. • Students able understand and applied informed and uninformed search methods to real life case. • Students able to understand the concept of pattern recognition through supervised and unsupervised machine learning concept. • Students able to understand and applied evolutionary algorithm to real cases. • Student able to understand and applied fuzzy logic concept to real cases. • Student able to understand and applied cellular automata concept. |
| Course Method | <ul style="list-style-type: none"> • Lecture course: lecture presentation, interactive learning quizzes (discussion and sharing). • Interactive learning: exercise and presentation • Individual study: homework/assignment and project |
| Form of Examination | To be defined by lecturer at the beginning of course |
| Prerequisites | Algorithm dan Programming, and Numerical Methods |
| Requirements according to the examination regulations | Minimum 80% attendance in this course |
| Reading list | <ol style="list-style-type: none"> 1. Russel, Norvig (2021). Artificial Intelligence: A Modern Approach, Global Edition 4th., Pearson. 2. Tim Jones (2008) Artificial Intelligence: A System Approach, Infinity Science Press. |
| Assessment Guidance | Rubric focus group discussion(20%); Assignment (20%); middle exam (30%); final exam (30%) |



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|---|---|
| Academic Year | 2025/2026 |
| Code/ Semester | UND202515107 / 5 th Semester |
| Course/ Credit points | Anatomy and Physiology Physics / 2 SKS ~ 3.62 ECTS |
| Language | Indonesian |
| Responsible Person | Norman Syakir |
| Lecturer | Norman Syakir |
| Workload | <ol style="list-style-type: none"> 1. Lectures: 2 x 50 = 100 minutes per week. 2. Assignments: 2 x 60 = 120 minutes per week. 3. Private learning: 2 x 60 = 120 minutes per week. |
| Contents | <ul style="list-style-type: none"> • Part I Structure of cells-tissues-organ-systems individual- electrical • Load and Potential, Potential gradient, Ionic charge distribution, Ionic concentration gradient • Cell anatomy and cell membrane Ionic channels in the cell membrane • Mathematical/electronic model of ionic channels Action Potential, models and simulations Network anatomy • Impulse Propagation, core-conductor models, cable equations electrical propagation in neural networks Organs and Organ Systems • Electricity in the Heart, Brain and Muscles Stimuli • DNA Structure and Genetic Information |
| Learning Objectives | <ul style="list-style-type: none"> • Students are able to understand the structural and functional/physiological levels of living things starting from the simplest level in terms of physical phenomena (electrical, mechanical, optical, informatics). • Students are able to simulate several models of physical phenomena that occur at the structural levels of living things and examine the results. |
| Course Method | <ul style="list-style-type: none"> • Lecture course: lecture presentation, interactive learning quizzes (discussion and sharing). • Interactive learning: exercise and presentation • Individual study: homework/assignment and project |
| Form of Examination | To be defined by lecturer at the beginning of course |
| Prerequisites | - |
| Requirements according to the examination regulations | Minimum 80% attendance in this course |
| Reading list | Irving P. Herman, Physics of the Human Body, Springer 2008 |
| Assessment Guidance | Rubric focus group discussion(20%); Assignment (20%); middle exam (30%); final exam (30%) |

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|---|---|
| Academic Year | 2025/2026 |
| Code/ Semester | UND202515108 / 5 th Semester |
| Course/ Credit points | Atmospheric Physics / 2 SKS ~ 3.62 ECTS |
| Language | Indonesian |
| Responsible Person | Nowo Riveli |
| Lecturer | Nowo Riveli |
| Workload | <ol style="list-style-type: none"> 1. Lectures: 2 x 50 = 100 minutes per week. 2. Assignments: 2 x 60 = 120 minutes per week. 3. Private learning: 2 x 60 = 120 minutes per week. |
| Contents | Structure and Characteristics of Earth's atmosphere, Thermodynamics of the atmosphere, Radiative process, Clouds, Climate, Atmospheric measurements model and instrumentation |
| Learning Objectives | <ul style="list-style-type: none"> • Able to understand the structure and characteristics of the Earth's atmosphere • Able to understand the application of thermodynamics on Earth's atmosphere • Able to understand the electromagnetic radiative processes on Earth's atmosphere • Able to understand the structure the concept of clouds • Able to understand the Earth's climate and it's changes • Able to understand models and measurements of atmospheric quantities |
| Course Method | Lectures and Discussions, with Demonstration Assignments consists of writing, problem solving, and observations/experiments. |
| Form of Examination | To be defined by lecturer at the beginning of course |
| Prerequisites | - |
| Requirements according to the examination regulations | Minimum 80% attendance in this course |
| Reading list | <ol style="list-style-type: none"> 1. Andrews, D. G., An Introduction to Atmospheric Physics, 2nd edn: Cambridge University Press, 2010 2. Robert Zakinyan, Arthur Zakinyan. (2022) Physics of the Atmosphere, Climatology and Environmental Monitoring. Springer. |
| Assessment Guidance | Rubric focus group discussion(20%); Assignment (20%); middle exam (30%); final exam (30%) |

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|---|---|
| Academic Year | 2025/2026 |
| Code/ Semester | UND202515109 / 5 th Semester |
| Course/ Credit points | Renewable Energy / 2 SKS ~ 3.62 ECTS |
| Language | Indonesian |
| Responsible Person | Cukup Mulyana |
| Lecturer | Cukup Mulyana |
| Workload | <ol style="list-style-type: none"> 1. Lectures: 2 x 50 = 100 minutes per week. 2. Assignments: 2 x 60 = 120 minutes per week. 3. Private learning: 2 x 60 = 120 minutes per week. |
| Contents | Renewable energy courses explain energy sources that come from wind energy, solar energy, water energy, geothermal energy, ocean wave energy, ocean energy. |
| Learning Objectives | <ul style="list-style-type: none"> • Be able to understand the concept of electrical energy from the wind • Be able to understand the concept of electrical energy from the sun • Be able to understand the concept of electrical energy from water • Be able to understand the concept of electrical energy from geothermal energy • Be able to understand the concept of electrical energy from ocean waves • Be able to understand the concept of electrical energy from the ocean |
| Course Method | Lectures are held by lecture and discussion methods. Giving assignments after each subject is finished is given to students to test their ability to master concepts and the accuracy of answering questions. |
| Form of Examination | To be defined by lecturer at the beginning of course |
| Prerequisites | - |
| Requirements according to the examination regulations | Minimum 80% attendance in this course |
| Reading list | <ol style="list-style-type: none"> 1. Renewable Energy Resources, John Twidell and Tiny Weir 3rd edition 2015 2. Power Plant Engineering, A.K. Raja, Amit P. Srivastava, Manish Dwivedi, 2006. |
| Assessment Guidance | Rubric focus group discussion(20%); Assignment (20%); middle exam (30%); final exam (30%) |

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| Academic Year | 2025/2026 |
| Code/ Semester | UND202516101/ 6 th Semester |
| Course/ Credit points | Nano-science / 2 credits ~ 3.62 ECTS |
| Language | Indonesian |
| Responsible Person | Camellia Panatarani |
| Lecturer | Camellia Panatarani |
| Workload | 1. Lectures: 2 x 50 = 100 minutes per week. 2. Assignments: 2 x 60 = 120 minutes per week. Individual study: 2 x 60 = 120 minutes per week. |
| Contents | 1. Introduction of the Course 2. Introduction to Nanoscience 3. Effect of Nanostructure/Size on Material Properties 4. The Physics of Nanoscale Synthesis and Characterization of Nanomaterials |
| Learning Objectives | Course Learning Outcomes(CLO): After completing the Nanoscience course, students are able to develop an understanding of the latest developments in nanoscience and apply nanoscience concepts in the fields of energy, environment or health with quality and measurability. |
| Course Method | 1. Lecture course: lecture presentation, interactive learning quizzes (discussion and sharing), Quiz. 2. Interactive learning: presentation (Focus Group Discussion and Small Group Discussion), Case-based learning, and problem-based learning 3 homework/assignment: Case Study, Individual study |
| Form of Examination | To be defined by lecturer at the beginning of course |
| Prerequisites | Solid State Physics |
| Requirements according to the examination regulations | Registered in this course, Minimum 80% attendance |
| Reading list | 1. Alain Nouailhat, An Introduction to Nanoscience and Nanotechnology, John Wiley & Sons, Inc., Hoboken, USA, 2008 2. C. Dupas P. Houdy M. Lahmani (Eds.), Nanoscience Nanotechnologies and Nanophysics, Springer-Verlag Berlin Heidelberg 2007 Wolfram Schommers. 2019. Basic Physics of Nanoscience. Elsevier. |
| Assessment Guidance | Assessment is on the basis of the assignment that have been done by students. The percentage of the achievement for Sub-CLO 2, 3, 4, 5 is 10% per Sub-CLO while Sub-CLO 6 and 7 is 30% for each Sub-CLO. |

Material Synthesis Method

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| Academic Year | 2025/2026 |
| Code/ Semester | UND202516102 / 6 th Semester |
| Course/ Credit points | Material Synthesis Method / 2 SKS ~ 3.62 ECTS |
| Language | English |
| Responsible Person | Togar Saragi |
| Lecturer | Togar Saragi |
| Workload | 1. Lectures: 2 x 50 = 100 minutes per week. 2. Assignments: 2 x 60 = 120 minutes per week. Individual study: 2 x 60 = 120 minutes per week. |
| Contents | 1. Organic and Inorganic, Polar and non-Polar solvents 2. Solid State Reaction Method, 3. Coprecipitation, Sol-Gel and Hydrothermal Method 4. Reflux and Colloidal Method Polymer Synthesis by Addition and Condensation method |
| Learning Objectives | Learning Goals: 1. Students will be able to know the process of synthesizing inorganic matter. 2. Students will be able to know the process of synthesizing organic matter. Students will be able to know the process of synthesizing polymer matter. |
| Course Method | 1. Lecture course: lecture presentation, interactive learning quizzes (discussion and sharing). 2. Interactive learning: exercise and presentation, Individual study: homework/assignment |
| Form of Examination | To be defined by lecturer at the beginning of course |
| Prerequisites | - |
| Requirements according to the examination regulations | Registered in this course, Minimum 80% attendance in this course |
| Reading list | 1. C. Barry Carter and M. Grant Norton, Ceramic_Materials_Science_and_Engineering, Springer, 2007 2. Eduardo Vivaldo-Lima and Enrique Saldivar- Guerra, Handbook of Polymer Synthesis, Characterization, and Processing, 1st Edition, John Wiley and Sons, Inc., 2013 |
| Assessment Guidance | Quizzes (10%); Homework/assignment (20%); middle exam (35%); final exam (35%) |



Digital Signal Processing

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|---|--|
| Academic Year | 2025/2026 |
| Code/ Semester | UND202516103/ 6 th Semester |
| Course/ Credit points | Digital Signal Processing/ 2 credits ~ 3.62 ECTS |
| Language | Indonesian |
| Responsible Person | Andri Abdurrochman |
| Lecturer | Andri Abdurrochman, I Made Joni |
| Workload | 1. Course: 4 x 50 = 200 minutes per week. Private learning : 2 x 60 = 120 minutes per week. |
| Contents | <ul style="list-style-type: none">• Analog-discrete (digital) transformation• Discrete Transformation & Z-Transform Convolution & Correlation• Digital filters: FIR and IIR• Spectrum estimation and analysis |
| Learning Objectives | Students can understand, explain, use and analyze electronic signal conditioning so that it can be processed quickly and accurately. |
| Course Method | Lecture, Discussion and Practice |
| Form of Examination | Presentation, quiz/assignment, test |
| Prerequisites | Mathematical Physics, Wave Physics |
| Requirements according to the examination regulations | Registered in this course minimum 80% attendance in this course |
| Reading list | <ul style="list-style-type: none">• Digital Signal Processing: A Practical Approach (Ifeachor & Jervis, 1995, Addison-Wesley)• Analog and Digital Signal Processing (Ambardar, A., 1999, Brooks/Cole Publishing)• Digital Signal Processing: Principles and Applications (Thomas Holton, 2021, Cambridge University Press) |
| Assessment Guidance | Assignment (30%); Midterm Test (30%); Final Project/Test (40%) |



Design of Electronic System and Microcontroller

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|---|---|
| Academic Year | 2025/2026 |
| Code/ Semester | UND202516104/ 6 th Semester |
| Course/ Credit points | Design of Electronic System and Microcontroller/ 2 credits ~ 3.62 ECTS |
| Language | Indonesian |
| Responsible Person | I Made Joni |
| Lecturer | I Made Joni, Ferry Faizal |
| Workload | Course: 4 x 50 = 200 minutes per week. Private learning : 2 x 60 = 120 minutes per week. |
| Contents | <ol style="list-style-type: none"> 1. System planning/design, instrumentation and control systems 2. Assembling circuits, testing and building systems using applications. 3. Simulation of analog and digital circuit planning for instrumentation and control systems. 4. Analysis of instrumentation system performance. 5. Integration of hardware and software. 6. Communication system planning and its application. |
| Learning Objectives | <ol style="list-style-type: none"> 1. Students are able to plan and design instrumentation and control systems. 2. Students are able to design and implement PCBs and simulate designs with the Simulink application. 3. Students are able to make analog and digital circuit planning simulations for instrumentation and control systems using software. 4. Students are able to make test instruments and determine test patterns. 5. Students are able to plan hardware & software integration with system interfaces (RS232/USB). 6. Students are able to design wireless data communication devices and integrate them with software. |
| Course Method | Lecture, Discussion and Practice |
| Form of Examination | Presentation, quiz/assignment, test |
| Prerequisites | Electronics |
| Requirements according to the examination regulations | Registered in this course Minimum 80% attendance in this course |
| Reading list | <ol style="list-style-type: none"> 1. Horowitz, P., Hill, W., 1995, The Art of Electronics, Cambridge. 2. Williams, T. , 2005 , The Circuit Designer's Companion, Newnes. Co 3. Cooper W. D. And Helfrick A. D.,1988, Electronic Instrumentation and Measurement Techniques. Prentice- Hall Inc. 4. Gupta B. R.,2003. Electronics and Instrumentation. S. |



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| | Chand & Company Ltd Khurana Rohit, 2015. Electronic Instrumentation and Measurement. Vikas Publishing House |
| Assessment Guidance | Assignment (30%); Midterm Test (30%); Final Project/Test (40%) |



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|---|---|
| Academic Year | 2025/2026 |
| Code/ Semester | D10C25.6205 / 6 th Semester |
| Course/ Credit points | Biomass / 2 SKS ~ 3.62 ECTS |
| Language | Indonesian |
| Responsible Person | Otong Nurhilal |
| Lecturer | Otong Nurhilal, Noto Susanto |
| Workload | 1. Lectures : 2 x 50 = 100 minutes per week. 2. Assignments : 2 x 60 = 120 minutes per week. 3. Private learning : 2 x 60 = 120 minutes per week. |
| Contents | Characteristics of biomass, briquetting, pyrolysis, torrefaction, gasification, carbon materials and characterization of carbon materials. |
| Objectives | 1. Able to understand the characteristics of biomass 2. Able to understand and apply the concept of biobriquette 3. Able to understand and apply the concept of pyrolysis 4. Able to understand and apply the concept of torrefaction 5. Able to understand and apply the concept of gasification 6. Be able to understand the properties of carbon materials Able to understand the characterization of carbon materials |
| Course Method | Lectures are held by lecture and discussion methods. Giving assignments to test the accuracy of answering questions both in the form of concepts and problem solving. |
| Prerequisites | Physics of energy |
| Requirements according to the examination regulations | Registered in this course Minimum 80% attendance in this course |
| Reading list | Prabir Basu. Biomass gasification and pyrolysis : practical design and theory. Elsevier, 2010 K R Hakeem, M Jawaid, U Rashid. Biomass and Bioenergy: Processing and Properties. Springer, 2014 |
| Assessment Guidance | Quiz (20%); Tasks (10%); MES (35%); FES (35%) |
| Academic Year | 2023/2024 |



Fluid Dynamics

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|---|--|
| Academic Year | 2025/2026 |
| Code/ Semester | UND202516106 / 6 th Semester |
| Course/ Credit points | Fluid Dynamics / 2 SKS ~ 3.62 ECTS |
| Language | Indonesian |
| Responsible Person | Budi Adiperdana |
| Lecturer | Budi Adiperdana, Cukup Mulyana |
| Workload | 1. Lectures: 2 x 50 = 100 minutes per week. 2. Assignments: 2 x 60 = 120 minutes per week. Private learning: 2 x 60 = 120 minutes per week. |
| Contents | Heat transfer courses explain Introduction and Basic Concepts, Properties Of Fluids, Pressure And Fluid Statics, Fluid Kinematics, Mass, Bernoulli, And Energy Equations, Momentum Analysis Of Flow Systems, Flow In Pipes, Dimensional Analysis And Modeling. |
| Objectives | 1. Be able to understand the Basic Concepts 2. Be able to understand the concept of Properties of Fluids 3. Be able to understand the concept of Fluid Kinematics 4. Be able to understand the concept of Flow in Pipes Be able to understand the concept of modelling |
| Course Method | Lectures are held by lecture and discussion methods. Giving assignments after each subject is finished is given to students to test their ability to master concepts and the accuracy of answering questions. |
| Prerequisites | Fundamental Physics |
| Requirements according to the examination regulations | Registered in this course Minimum 80% attendance in this course |
| Reading list | 1. Fluid mechanics: fundamentals and applications / Yunus A. Çengel, John M. Cimbala.-1st ed. p. cm.— (McGraw-Hill series in mechanical engineering). 2006 . 2. Peter S. Bernard, 2015 . Fluid Dynamics 1st Edition. Cambridge University Press. |
| Assessment Guidance | Quiz (20%); Tasks (10%); MES (35%); FES (35%) |



Sensor and Actuator

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|---|--|
| Academic Year | 2025/2026 |
| Code/ Semester | UND202516107/ 6 th Semester |
| Course/ Credit points | Sensor and Actuator/ 2 credits ~ 3.62 ECTS |
| Language | Indonesian |
| Responsible Person | Andri Abdurrochman |
| Lecturer | Andri Abdurrochman |
| Workload | 1. Course: 4 x 50 = 200 minutes per week. Private learning : 2 x 60 = 120 minutes per week. |
| Contents | Sensor characteristics, elements and characterization, sensor element domains, sensor basic principles, sensor electronics circuits, sensor calibration, actuators, electrical and mechanical actuators, pneumatics, hydraulics, and integration of sensor and actuator systems. |
| Learning Objectives | 1. Students can understand, explain, identify, implement/apply, the basic principles of sensors, types of sensors and their electronic circuits. 2. Students can understand, explain, identify, apply/apply actuator systems 3. Students can explain and apply to sensor and actuator system integration applications. |
| Course Method | Lecture, Discussion and Practice |
| Form of Examination | Presentation, quiz/assignment, test |
| Prerequisites | Fundamental Physics I&II, Electromagnetics, Electronics |
| Requirements according to the examination regulations | Registered in this course minimum 80% attendance in this course |
| Reading list | (1) Y.L. Lin, "Smart Sensors and Systems", Springer, 2015; (2) S. Soloman, "Sensors Handbood", 2nd, Mc Graw Hill, Newyork, 2009; (3) Jacob Fraden, "Handbook of Modern Sensors: Physics, Designs, and Applications", Fourth Edition, Springer, New York, 2010 |
| Assessment Guidance | Assignment (30%); Midterm Test (30%); Final Project/Test (40%) |



Radiation Physics and Dosimetry

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| Academic Year | 2025/2026 |
| Code/ Semester | UND202516108 / 6 th Semester |
| Course/ Credit points | Radiation Physics and Dosimetry / 2 SKS ~ 3.62 ECTS |
| Language | Indonesian |
| Responsible Person | Nowo Riveli |
| Lecturer | Nowo Riveli |
| Workload | 1. Lectures : 2 x 50 = 100 minutes per week. 2. Assignments : 2 x 60 = 120 minutes per week. Private learning : 2 x 60 = 120 minutes per week. |
| Contents | Types of radiations, nuclear and atomic radiation processes, interaction between radiation and matter, measurement of radiation quantities, radiation detector. |
| Learning Objectives | 1. Able to identify and understand types of radiation and its characteristics 2. Able to understand nuclear and atomic processes that produce radiation 3. Able to understand the interaction between radiation and matter 4. Able to understand the concepts of radiation measurements Able to understand the principle of radiation detectors |
| Course Method | Lectures and Discussions, with Demonstration. Assignments consists of writing, problem solving, and observations/experiments. |
| Form of Examination | To be defined by lecturer at the beginning of course |
| Prerequisites | - |
| Requirements according to the examination regulations | Registered in this course, Minimum 80% attendance in this course |
| Reading list | 1. Podgorsak, E. B. Radiation Physics for Medical Physicists, 2nd edn: Springer, 2010 2. Podgorsak, E. B. Radiation Oncology Physics: a Handbook for Teachers and Students: IAEA 2005 3. Mayles, P. et al. Handbook of Radiotherapy Physics: Theory and Practice: Taylor & Francis 2007 Bailey, D. L. Nuclear Medicine Physics, A Handbook for Teachers and Students: IAEA 2014 |
| Assessment Guidance | Quiz (20%); Assignments (10%); MES (35%); FES (35%) |



Power Plant Asset Management

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| Academic Year | 2025/2026 |
| Code/ Semester | UND202516109 / 6 th Semester |
| Course/ Credit points | Asset Integrity Management of Geothermal and Gas Power Plant Facilities / 3 SKS ~ 5.43 ECTS |
| Language | Indonesian |
| Responsible Person | Otong Nurhilal |
| Lecturer | Otong Nurhilal, Cukup Mulyana |
| Workload | 1. Lectures: 3 x 50 = 150 minutes per week. 2. Assignments: 3 x 60 = 180 minutes per week. Private learning: 3 x 60 = 180 minutes per week. |
| Contents | Power plants or power generation installations from both fossil (oil and gas, coal) and non-fossil energy (eg water, wind and geothermal) are very important and strategic assets in the economic and industrial life of a country, so to ensure a power plant operate safely, all equipment involved and used must have very high reliability and integrity to avoid failure or damage that leads to the risk of power black-out. With integrity management including understanding: Design concept, Metal damage mechanism, Inspection techniques, and Reliability study and engineering calculations, it is expected that the equipment can operate safely according to the design life. |
| Learning Objectives | <ol style="list-style-type: none">1. Be able to know the physics that underlies Power Plant facilities and Equipment2. Able to know the Power Plant Equipment Design Concept3. Able to understand the damage mechanism and equipment failure mode4. Able to understand the procedures for inspection and characterization of power plant equipment5. Able to perform calculation analysis and analyze the residual life and remaining strength of power plant equipment |
| Course Method | Lectures are held by lecture and discussion methods. Giving assignments to test the accuracy of answering questions both in the form of concepts and problem solving. |
| Form of Examination | Fundamental physics, Mathematical Physics |
| Prerequisites | 2023/2024 |
| Requirements according to the examination regulations | Registered in this course Minimum 80% attendance in this course |
| Reading list | <ol style="list-style-type: none">1. William J, Callister Jr & David G. Rethwisch, Materials Science and Engineering, An Introduction, John Wiley & Sons, Inc. 2018.2. Dr. Peter McClean Millar, Asset Integrity |



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| | Management Handbook (Free eBook).2015. |
| Assessment Guidance | Quiz (20%); Tasks (10%); MES (35%); FES (35%) |



Computational Physical System

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| Academic Year | 2025/2026 |
| Code/ Semester | UND202516110 / 6 th Semester |
| Course/ Credit points | Computational Physical System / 2 SKS ~ 3.62 ECTS |
| Language | Indonesian |
| Lecturer | Budi Adiperdana |
| Workload | 1. Lectures: 2 x 50 = 100 minutes per week. 2. Assignments: 2 x 60 = 120 minutes per week. Private learning: 2 x 60 = 120 minutes per week. |
| Contents | 1. Models, Mathematical Models and Modelling Physical System 2. SIR Model 3. Monte Carlo Approach 4. Lennard-Jones Model 5. Ising Model 6. Single and multi-Processing 7. Introduction to Density Functional Theory Methods Final Project |
| Learning Objectives | 1. Understand the concept of modelling, mathematical model and modelling a physical system 2. Able to design and analyze physical systems using differential equations in disease-spreading case 3. Able to understand, analyze and solve problems using Monte Carlo approach for complex system 4. Able to understand, analyze and solve computational problems using parallel processing 5. Able to understand, analyze and solve problems in computational material science using density functional theory for solids and molecules. Able to collaboratively and communicate effectively as part of a final project team |
| Course Method | Lectures, case-based study and final project |
| Form of Examination | To be defined by the lecturer at the beginning of course |
| Prerequisites | Algorithm and Programming, Numerical Methods, Computational Physics, Statistical Physics (recommended), Solid State Physics (recommended), Quantum Physics (recommended) |
| Requirements according to the examination regulations | Registered in this course Minimum 80% attendance in this course |
| Reading list | 1. Nicholas J Giordano, Hisao Nakanishi, Computational Physics with Matlab, 2012 1. Clayton & Hills, Statistical Models in Epidemiology, 2013 2. Werner Krauth, Statistical Mechanics: Algorithms and Computations. 2006 Peter W. Atkins, Ronald S. Friedman, Molecular Quantum Mechanics 5th Edition. 2010 Richard M. Martin, Electronic Structure: Basic Theory and Practical Methods 1st Edition. 2008 |



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Assessment Guidance

Assignment and quizzes (40%); case based (20%); final project (40%)



Thin Film Technology

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|---|---|
| Academic Year | 2025/2026 |
| Code/ Semester | UND202516111 / 6 th Semester |
| Course/ Credit points | Thin Film Technology / 3 SKS ~ 5.43 ECTS |
| Language | Indonesian |
| Responsible Person | Fitrilawati |
| Lecturer | Fitrilawati |
| Workload | 1. Lectures : 2 x 50 = 100 minutes per week. 2. Assignments : 2 x 60 = 120 minutes per week. Private learning : 2 x 60 = 120 minutes per week. |
| Contents | Introduction, Deposition techniques using Solution Method (solution casting, deep coating, spincoating, doctor blading, screen printing, spraycoating, electrospinning), Self Assembled Monolayer, Langmuir Blodgett Khunn, Electrochemical technique, Physical Vapor Deposition (PVD), Sputtering (RF, DC), Ion Sputtering, Pulsed Laser Deposition (PLD), Chemical Vapor Deposition (CVD): Molecular Organic-CVD (MOCVD), Plasma Enhanced CVD (PECVD), Molecular Beam Epitaxy (MBE) |
| Objectives | Students are able to explain the unique properties of thin films Students are able to explain basic deposition principle of organic using various solution techniques Students are able to explain the basic principle of self- assembled monolayer and Langmuir Blodgett Kuhn technique Students are able to explain the basic principle of physical vapour deposition techniques Students are able to explain the basic principle of chemical vapour deposition techniques Students are able to explain the basic principle molecular beam epitaxy |
| Course Method | Case based study , with help of visualization using video. reading list, hand outs of each topics provided by the lecture. |
| Form of Examination | To be defined by lecturer at the beginning of course |
| Prerequisites | Material Physics |
| Requirements according to the examination regulations | Registered in this course, Minimum 80% attendance in this course |
| Reading list | 1. M. C. Petty, Organic Thin Film Deposition Techniques in Encyclopedia of Nanoscience and Nanotechnology Volume 8 Number 1 (ed. H.S Nalwa) page 295, 2004 2. Hartmut Frey • Hamid R. Khan Editors, Handbook of Thin- Film Technology, Springer-Verlag Berlin Heidelberg 2015 |
| Assessment Guidance | Quiz (20); Problem Set of each topics (20%); Mid-test (30%); Final-test (30%) |

Material Characterization Technique

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|---|--|
| Academic Year | 2025/2026 |
| Code/ Semester | UND202516112/ 6 th Semester |
| Course/ Credit points | Material Characterization Technique/ 2 credits ~ 3.62 ECTS |
| Language | Indonesian |
| Responsible Person | Ayi Bahtiar |
| Lecturer | Ayi Bahtiar, Fitrilawati, Norman Syakir |
| Workload | 1. Course: 4 x 50 = 200 minutes per week. Private learning : 2 x 60 = 120 minutes per week. |
| Contents | UV-Vis and FTIR Spectroscopy Techniques, TEM and SEM Electron Microscopy Techniques, DTA and TGA thermal analysis techniques, Hall effect technique, EIS electrochemical impedance technique, Potentiostat and galvanostat techniques |
| Learning Objectives | <ol style="list-style-type: none"> 1. Students will be able to understand and know the right/required type of characterization as well as analyze the results of UV-Vis and FTIR spectroscopy characterization 2. Students will be able to understand and know the right/required type of characterization as well as analyze the results of the characterization of the TEM and SEM Electron Microscopy Techniques) 3. Students will be able to understand and know the right/required type of characterization as well as analyze the results of the spectroscopic characterization of DTA and TGA thermal analysis techniques 4. Students will be able to understand and know the right/required type of characterization as well as analyze the results of the Hall effect technique characterization 5. Students will be able to understand and know the right/required type of characterization as well as analyze the results of the EIS electrochemical impedance technique characterization 6. Students will be able to understand and know the right/required type of characterization as well as analyze the results of the potentiostat and galvanostat technique characterization |
| Course Method | Lecture, Discussion and Practice |
| Form of Examination | Presentation, quiz/assignment, test |
| Prerequisites | Material Physics |
| Requirements according to the examination regulations | Registered in this course Minimum 80% attendance in this course |
| Reading list | <ol style="list-style-type: none"> 1. Laurence M. Harwood, Timothy D.W. Claridge, 1997, Introduction to Organic Spectroscopy, Oxford University Press. 2. Mool Chand Gupta, 2001, Atomic and Molecular Spectroscopy, New Age International (P) Limited, Publishers Günter Gauglitz, David S. Moore. 2014. Handbook of Spectroscopy. Wiley. |



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Assessment Guidance

Assignment (30%); Midterm Test (30%); Final Project/Test (40%)



Optical Communication System

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|---|---|
| Academic Year | 2025/2026 |
| Code/ Semester | UND202516113/ 6 th Semester |
| Course/ Credit points | Optical Communication System / 2 SKS ~ 3.62 ECTS |
| Language | Indonesian |
| Responsible Person | Ayi Bahtiar |
| Lecturer | Ayi Bahtiar, Andri Abdurrachman |
| Workload | 1. Lectures: 2 x 50 = 100 minutes per week. 2. Assignments: 2 x 60 = 120 minutes per week. Private learning: 2 x 60 = 120 minutes per week. |
| Contents | Introduction to optical communication systems (OCS), Device components of OCS, Propagation of electromagnetic waves in optical fiber, Operational characteristics of OCS, High capacity and high-speed OCS and the latest development of future optical communication systems |
| Learning Objectives | 1. Able to analyze device components in OCS, 2. Able to analyze the operational characteristics and performance of OCS, 3. Able to design high-capacity and high-speed OCS, 4. Able to identify the future of optical system communication. |
| Course Method | At the beginning of the lecture, an explanation of the basic concept and working principle of optical system communication (OCS) and the needs for future OCS is given, followed by working on case study and assignments. The students must write the papers and present them in the class |
| Form of Examination | To be defined by lecturer at the beginning of course |
| Prerequisites | 1. Waves Optics |
| Requirements according to the examination regulations | Minimum 80% attendance in this course |
| Reading list | 1. M.O. Tjia dan R.E. Siregar, "Pengantar Sistem Komunikasi Serat Optik", Penerbit ITB, 2016. 2. Govind G. Agrawal, "Fiber-Optic Communication Systems", 5th Edition, Wiley, 2021. 3. R. Hui, "Introduction to Fiber-Optic Communications", Academic Press-Elsevier, UK, 2020. |
| Assessment Guidance | Student work/assignments (30%); Case study (30%); Midterm exam (20%); Final term exam (20%) |



Magnetic Materials and Superconductors

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| Academic Year | 2025/2026 |
| Code/ Semester | UND202516114 /6 th semester |
| Course/ Credit points | Magnetic Materials and Superconductors / 2 SKS ~ 3.62 ECTS |
| Language | Indonesian |
| Responsible Person | Togar Saragi |
| Lecturer | Togar Saragi |
| Workload | 1. Lecturer 2 x 50 = 100 minutes per week. 2. Assignments: 2 x 60 = 120 minutes per week. Individual study: 2 x 60 = 120 minutes per week. |
| Contents | 1. Magnetic field, Magnetic moment 2. Magnetic measurement 3. Properties, characteristics, and applications of magnetic materials Properties, characteristics, and applications of superconductor |
| Learning Objectives | 1. Students are able to analyze the structure, properties and behavior of spin in magnetic materials 2. Students are able to explain the concept of experiments and measurements of magnetic materials 3. Students are able to demonstrate the relationship between magnetic fields and moments with the properties and applications of magnetic and superconducting materials |
| Course Method | Student Center Learning, Problem-Based Learning |
| Form of Examination | To be defined by lecturer at the beginning of course |
| Prerequisites | Introduction to Solid State Physics |
| Requirements according to the examination regulations | Registered in this course, Minimum 80% attendance in this course |
| Reading list | 1. C. Kittel (2005), Introduction to Solid State Physics, John Wiley and Sons, Inc, 8th edition. 2. Mourachkine (2003), Room-Temperature Superconductivity, Cambridge. 3. S. Blundell (2003), Magnetism in Condensed Matter, Oxford University Press. Risdiana (2015), Superkonduktor, Sifat Dasar dan Karakteristiknya, Unpad Press |
| Assessment Guidance | Assignments in the form of exercises and discussions in the form of presentations. The stages of levels of difficulty of the questions correspond to the stages of understanding that must be achieved by students. The presentation and discussion of the mate |



Functional Materials

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|---|---|
| Academic Year | 2025/2026 |
| Code/ Semester | UND202516115 / 6 th Semester |
| Course/ Credit points | Functional Materials / 2 SKS ~ 3.62 ECTS |
| Language | Indonesian |
| Responsible Person | Annisa Aprilia |
| Lecturer | Annisa Aprilia |
| Workload | 1. Lectures: 2 x 50 = 100 minutes per week. 2. Assignments: 2 x 60 = 120 minutes per week. Individual study: 2 x 60 = 120 minutes per week. |
| Contents | 1. General Introduction in Functional materials: Application, Importance of Material Sciences, History, Principles to classify and Order, Structure-property- correlations, Phases and Crystals 2. Phenomenological properties of Functional Materials 3. Functional Materials and their applications; selected material |
| Learning Objectives | Learning Goals: 1. Students able to describe the properties of materials and its characteristics. 2. Students able to identify functional material for certain application by individual paper works. 3. Students able to analyze the multifunctional materials for application technology in accordance with its properties. |
| Course Method | 1. Lecture course: lecture presentation, interactive learning quizzes (discussion and sharing). 2. Interactive learning: presentation (Focus Group Discussion), 3. homework/assignment: Problem based learning, Individual study |
| Form of Examination | To be defined by lecturer at the beginning of course |
| Prerequisites | - |
| Requirements according to the examination regulations | Registered in this course, Minimum 80% attendance in this course |
| Reading list | 1. Hasse Frederiksson, Physics of Functional Material, John Wiley and Sons, Stockholm, 2008 2. S. Banerjee and A. K. Tyagi (Eds), Functional Materials: Preparation, Processing and Applications, Elsevier, Boston 2012. 3. Ewa Klodzinska. 2015. Functional Materials: Properties, Performance and Evaluation. Apple Academic Press. |
| Assessment Guidance | Quizzes (10%); Homework/assignment (20%); middle exam 4. (35%); final exam (35%) |



Particle Physics

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|---|---|
| Academic Year | 2025/2026 |
| Code/ Semester | UND202516116 / 6th Semester |
| Course/ Credit points | Particle Physics / 2 SKS ~ 3.62 ECTS |
| Language | Indonesian |
| Responsible Person | Liu Kin Men |
| Lecturer | Liu Kin Men |
| Workload | 1. Lectures : 2 x 50 = 100 minutes per week. 2. Assignments : 2 x 60 = 120 minutes per week. Private learning : 2 x 60 = 120 minutes per week. |
| Contents | Types of elementary particles, fundamental interactions, relativistic kinematics, symmetry and consevation laws, quantum electrodynamics. |
| Learning Objectives | 1. Able to understand the origin of elementary particles discoveries 2. Able to understand types if fundamental interactions. 3. Able to understand Special Relativity 4. Able to understand the symmetry principle. Able to understand Quantum Electrodynamics |
| Course Method | Lectures and Discussions, Problem solving Assignments |
| Form of Examination | To be defined by lecturer at the beginning of course |
| Prerequisites | - |
| Requirements according to the examination regulations | Registered in this course, Minimum 80% attendance in this course |
| Reading list | 1. David J. Griffiths, 2008, Introduction to Elementary Particles, 2nd edition, Wiley. 2. Francis Halzen, Alan D. Martin, 1984, Quarks and Leptons: An Introductory Course in Modern Particle Physics, 1st edition, Wiley. |
| Assessment Guidance | Quiz (20%); Assignments (10%); MES (35%); FES (35%) |



Battery System

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|---|--|
| Academic Year | 2025/2026 |
| Code/ Semester | UND202516117 / 6 th Semester |
| Course/ Credit points | Battery System / 2 SKS ~ 3.62 ECTS |
| Language | Indonesian |
| Responsible Person | Sahrul Hidayat |
| Lecturer | Sahrul Hidayat |
| Workload | 1. Lectures : 2 x 50 = 100 minutes per week. 2. Assignments : 2 x 60 = 120 minutes per week. Private learning : 2 x 60 = 120 minutes per week. |
| Contents | Basic concepts and classification of batteries, electrochemical principles of batteries, identifying factors affecting battery performance, battery standardization, design/construction for battery safety, research developments in Li-ion batteries, Li-Sulfur batteries, Lithium Nickel batteries as well as packaging design and battery safety security. |
| Learning Objectives | 1. Able to describe the basic principles of batteries in general 2. Able to write battery electrochemical reactions for commonly used battery types 3. Able to identify factors that affect battery performance 4. Able to analyze factors that affect battery safety 5. Know and be able to explain the development of research on Li-Ion batteries, Li-Sulfur, Li-Nickel etc |
| Course Method | <i>Contextual Instruction and Small Group Discussion</i> |
| Form of Examination | Essay |
| Prerequisites | - |
| Requirements according to the examination regulations | Registered in this course Minimum 80% attendance in this course |
| Reading list | 1. T.R. Crompton, Battery Reference Book 3th edition, Newnes 2000 Reiner Korthauer, Lithium-Ion Batteries: Basics and Applications , Springer 2018 |
| Assessment Guidance | SGD rubric (25); assignment (25%); midterm exam (25%); final exam (25%) |



Medical Instrumentation

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|---|---|
| Academic Year | 2025/2026 |
| Code/ Semester | UND202516118/ 6 th Semester |
| Course/ Credit points | Medical Instrumentation/ 2 credits ~ 3.62 ECTS |
| Language | Indonesian |
| Responsible Person | Andri Abdurrochman |
| Lecturer | Andri Abdurrochman |
| Workload | 1. Course: 4 x 50 = 200 minutes per week. Private learning : 2 x 60 = 120 minutes per week. |
| Contents | 1. Typical sensors used in Medical Instrumentation 2. Electrodes and biopotentials 3. Biopotential booster 4. Measurement of blood flow and respiratory system Biosensors and clinical laboratory instrumentation |
| Learning Objectives | Student are able to acquire knowledge on application of the principle of Instrumentation toward health aspect of human being. |
| Course Method | Lecture, Discussion and Practice |
| Form of Examination | Presentation, quiz/assignment, test |
| Prerequisites | Instrumentation of Physics, Electronics, Fundamental Physics, Physics of Anatomy and Physiology |
| Requirements according to the examination regulations | Registered in this course minimum 80% attendance in this course |
| Reading list | Medical Instrumentation: Application and Design (Webster, 1992, Houghton Mifflin) Biophysical Measurements (Strong, P., 1970, Tektronix) Handbook of Biomedical Instrumentation (Khandpur, 2014 MC Graw Hill India) |
| Assessment Guidance | Assignment (30%); Midterm Exam(30%); Final Project/Test (40%) |



Networking, Instrumentation & Data Logger

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|---|---|
| Academic Year | 2025/2026 |
| Code/ Semester | UND202516119/ 6 th Semester |
| Course/ Credit points | Networking, Instrumentation & Data Logger / 2 credits ~ 3.62 ECTS |
| Language | Indonesian |
| Responsible Person | Ferry Faizal |
| Lecturer | Ferry Faizal |
| Workload | 1. Course: 4 x 50 = 200 minutes per week. Private learning : 2 x 60 = 120 minutes per week. |
| Contents | Introduction to Network Systems, OSI & TCP/IP Reference Model and Wiring Techniques, Hardware and software instrumentation data acquisition system, Wireless data acquisition on local computer network-based instrumentation systems, Web-Based Instrumentation System (Hardware and Software), Proposal and Design of a Web-based Instrumentation System with a wireless data acquisition system |
| Learning Objectives | <p>Student are able to understand and know the OSI & TCP/IP reference model and make network cabling</p> <p>Student are able to understand and apply systematically and according to Hardware and Software Instrumentation data acquisition systems</p> <p>Student are able to understand and design systematically and suitable for wireless data acquisition on local computer network-based instrumentation systems</p> <p>Student are able to understand and design Web-Based Instrumentation systems (Hardware and Software)</p> <p>Student are able to make proposals and design Web-based Instrumentation Systems with wireless data acquisition systems</p> |
| Course Method | Lecture, Discussion and Practice |
| Form of Examination | Presentation, quiz/assignment, test |
| Prerequisites | Instrumentation of Physics |
| Requirements according to the examination regulations | Registered in this course Minimum 80% attendance in this course |
| Reading list | <ol style="list-style-type: none"> 1. John Park and Steve Mackay, Practical Data Acquisition for Instrumentation and Control Systems, Newnes , 2003, ISBN-10: 0750657960 2. Mathivanan, PC-based Instrumentation: Concepts and Practice, Prentice Hall of India; 1st edition (2007), ISBN-10: 8120330765 3. W. Stallings, Wireless Communications and Networks. Pearson Prentice Hall, 2002. 4. B. A. Forouzan, DATA COMMUNICATIONS AND NETWORKING, vol. 32. 2010 <p>Larry L. Peterson & Bruce S. Davie, "Computer Network A System Approach 6th edition", 2021</p> |
| Assessment Guidance | Assignment (30%); Midterm Exam (30%); Final Project/Test (40%) |



Bioelectric Signal Processing

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|---|---|
| Academic Year | 2025/2026 |
| Code/ Semester | UND202516120 / 6 th Semester |
| Course/ Credit points | Bioelectric Signal Processing / 2 SKS ~ 3.62 ECTS |
| Language | Indonesian |
| Responsible Person | Andri Abdurrochman |
| Lecturer | Andri Abdurrochman |
| Workload | 1. Lectures : 2 x 50 = 100 minutes per week. 2. Assignments : 2 x 60 = 120 minutes per week. Private learning : 2 x 60 = 120 minutes per week. |
| Contents | The course is initiated with the basis of bio-potential or bioelectric or bioelectric generator. It follows by methods of harvesting the bioelectric that need electrodes in i.e. bipolar, unipolar and their combinations. These methods are elaborated more in the following subjects: EEG, ECG, MEG, REG etc.; which are delivered by students in groups. Each and every group presents the basis and acquiring of bioelectric concerning their topic, including the Signal Processing applied in hardware and software. Through the rest of the course, students work in group in the workshop room to develop hardware and software needed to process the bioelectric Signal. Every week they must delivering the progress report. |
| Learning Objectives | <ol style="list-style-type: none"> 1. Able to understand and analyze bioelectric phenomenon based on Physics 2. Able to understand and analyze methods harvesting bioelectric using electrodes 3. Able to recreate the block diagram of any existing bioelectric Signal processing 4. Able to recreate and analyze Bioelectric Signal processing 5. Able to present and reporting the work of recreating Bioelectric Signal processing |
| Course Method | The first quarter of course delivered as theoretical lectures, then follow with workshops and presentation reports. |
| Form of Examination | |
| Prerequisites | <ol style="list-style-type: none"> 1. Electronics 2. Algorithm and Programing 3. The physics of anatomy and Physiology Instrumentation Physics |
| Requirements according to the examination regulations | Registered in this course Minimum 80% attendance in this course |
| Reading list | <ol style="list-style-type: none"> 1. Webb, Andrew G. 2018. Principles of Biomedical Instrumentation. Cambridge University Press. 2. Webster, John G., Eren, Halit. 2014. Measurement, Instrumentation, and Sensors Handbook 2nd Ed. CRC Press. Webste Nicholas r, John G., et. al. 2010. Medical Instrumentation Application and Design 4 th Ed. John Wiley & Sons, Inc. |
| Assessment Guidance | Rubric case based (25); Workshop (50%); Final Exam. (25%) |



MODULE HANDBOOK

YEARS 4

**UNDERGRADUATE
PROGRAM IN
PHYSICS**

**FACULTY OF MATHEMATICS
AND NATURAL SCIENCES
UNIVERSITAS PADJADJARAN
2025**



Technology of Optoelectronics

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|---|--|
| Academic Year | 2025/2026 |
| Code/ Semester | UND202517101/ 7 th Semester |
| Course/ Credit points | Technology of Optoelectronics / 2 SKS ~ 3.62 ECTS |
| Language | Indonesian |
| Responsible Person | Ayi Bahtiar |
| Lecturer | Ayi Bahtiar |
| Workload | 1. Lectures: 2 x 50 = 100 minutes per week. 2. Assignments: 2 x 60 = 120 minutes per week. Private learning: 2 x 60 = 120 minutes per week. |
| Contents | Roadmap of Technology development of optoelectronics beyond 2020, Light Emitting Diode (LED/OLED), Display, Photodetector, Thin Film Transistors, Solar Cells, Integrated optoelectronic devices and Printing technology for flexible optoelectronic devices (printed technology for optoelectronic devices) |
| Learning Objectives | 1. Able to analyze the structure and working principles of optoelectronic devices correctly, 2. Able to design integrated optoelectronic devices correctly, 3. Able to identify the latest technology in flexible optoelectronic devices correctly. |
| Course Method | At the beginning of the lecture, an explanation of the basic concept and working principle of optoelectronic devices is given, followed by working on case study and assignments. The students must write the papers and present them in the class. |
| Form of Examination | To be defined by lecturer at the beginning of course |
| Prerequisites | 1. Electronics Optics |
| Requirements according to the examination regulations | Minimum 80% attendance in this course |
| Reading list | 1. Simon M. Sze, Ming-Kwei Lee, "Semiconductor Devices: Physics and Technology- International Student Version", 3rd Edition, Wiley, 2012, 2. S.D. Brotherton, "Introduction to Thin Film Transistors: Physics and Technology of TFTs", Springer, 2013, 3. S. Ahmad, S. Kazim and M. Grätzel, "Perovskite Solar Cells: Materials, Processes, and Devices", Wiley-VCH Weinheim Germany, 2022, 4. Colin Tong, "Advanced Materials for Printed Flexible Electronics", Springer, 2022. |
| Assessment Guidance | Student work/assignments (30%); Case study (30%); Midterm exam (20%); Final term exam (20%) |



Biomaterial & Biosensor

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|---|---|
| Academic Year | 2025/2026 |
| Code/ Semester | UND202517102/ 7 th semester |
| Course/ Credit points | Biomaterial & Biosensor / 2 SKS ~ 3.62 ECTS |
| Language | Indonesian |
| Responsible Person | Ferry Faizal |
| Lecturer | Ferry Faizal |
| Workload | 1. Lecturer 2 x 50 = 150 minutes per week. 2. Assignments: 2 x 60 = 180 minutes per week. Individual study: 2 x 60 = 180 minutes |
| Contents | 1. Introduction, Implant & Biocompatibility 2. Material: Metal, Ceramics, Polymer, Composite as biomaterials 3. Review of material synthesis methods and their characterization 4. Sensing, transducer Material characterization and biosensors |
| Learning Objectives | Students can explain the importance of biomaterials for various applications, identify criteria and types, identify the essential characteristics of biomaterials, and report the results systematically. Students can examine the potential of a material as a biosensor material and apply the principles of measurement instrumentation to the properties of materials that have potential as biosensors (optical, electronic). |
| Course Method | Class discussion, quiz and project-presentation |
| Form of Examination | To be defined by lecturer at the beginning of course |
| Prerequisites | Solid State Physics, Instrumentation |
| Requirements according to the examination regulations | Registered in this course, Minimum 80% attendance in this course |
| Reading list | 1. Vasif Hasirci, Nesrin Hasirci (2018) Fundamental of Biomaterial, Springer NY 2. Chandran Karunakaran, Kalpana Bhargava, Robson Benjamin (2015) Biosensors and Bioelectronics, Elsevier |
| Assessment Guidance | rubric/peer assessment, quiz |

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|---|---|
| Academic Year | 2025/2026 |
| Code/ Semester | UND202517103 / 7 th Semester |
| Course/ Credit points | Solar Panels / 2 SKS ~ 3.62 ECTS |
| Language | Indonesian |
| Lecturer | Sahrul Hidayat (PIC), Noto Susanto Gultom |
| Workload | <ol style="list-style-type: none"> 1. Lectures : 2 x 50 = 100 minutes per week. 2. Assignments : 2 x 60 = 120 minutes per week. 3. Private learning : 2 x 60 = 120 minutes per week. |
| Contents | Principles of Solar Cells, Silicon Based Solar Cells, Solar Cells based on Thin Film Technology, Solar cells based on organic materials and Perovskite, Solar cells based on hybrid materials (organic/inorganic), Basics of Solar Panel Installation, Charge controller and Inverter, ON Grid Solar Panel System, Solar Panel Installation Project. |
| Learning Objectives | <ol style="list-style-type: none"> 1. Able to explain the physics concepts involved in solar cells and their working principles 2. Able to explain the development of solar panel technology, namely silicon-based, thin film technology-based and hybrid material-based 3. Able to install a simple solar panel system consisting of a solar panel module, charge controller, battery and electrical system 4. Able to test the performance of solar panels and are able to analyze them |
| Course Method | Lectures and project based learning |
| Form of Examination | Essay and project presentation |
| Prerequisites | - |
| Requirements according to the examination regulations | Registered in this course Minimum 80% attendance in this course |
| Reading list | <ol style="list-style-type: none"> 1. Physics of Solar Cells, From Basic Principles to Advanced Concepts, Peter Würfel and Uli Würfel, Wiley-VCH Verlag GmbH & Co, 2016 2. Aplikasi Sel Surya: Sistem Sel Surya Wearable, Fitria Hidayanti, LP_UNAS, 2021 |
| Assessment Guidance | project based rubric (25); assignment (25%); midterm exam (25%); final exam (25%) |



Polymer Material

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|---|---|
| Academic Year | 2025/2026 |
| Code/ Semester | UND202517104/ 7 th Semester |
| Course/ Credit points | Polymer Material / 2 SKS ~ 3.62 ECTS |
| Language | Indonesian |
| Responsible Person | Fitrilawati |
| Lecturer | Fitrilawati |
| Workload | 1. Lectures: 2 x 50 = 100 minutes per week. 2. Assignments: 2 x 60 = 120 minutes per week. Individual study: 2 x 60 = 120 minutes per week. |
| Contents | 1. Introduction: Polymers around us and some terminology 2. Polymer synthesis 3. Polymer characterization 4. Polymer structure and properties 5. Polymer processing Polymer Applications |
| Learning Objectives | 1. Students are able to explain some terminology in polymers and give examples of polymers around them. 2. Students are able to explain the polymer synthesis 3. Students are able to explain how to measure polymer characteristics and interpret the results. 4. Students are able to explain the correlation between polymer structure and its properties 5. Students are able to explain polymer processing methods Students are able to explain the application of polymers |
| Course Method | Lectures are carried out using the Case Based Learning method, where students are provided with instructional materials in the form of Learning Videos, Lecturer Notes and core Reference Books before the lecture. |
| Form of Examination | To be defined by lecturer at the beginning of course |
| Prerequisites | Material Physics |
| Requirements according to the examination regulations | Registered in this course Minimum 80% attendance in this course |
| Reading list | 1. W. D. Callister, Materials Science and Engineering: An Introduction (John Wiley 2018, 10th edition) 2. Cowie, J.M.G., Polymers Chemistry and Physics of Modern Materials (3rd. ed.), CRC Press, Boca Raton, 2008 Fitrilawati, Kimia Fisika Polimer, Lecture Notes |
| Assessment Guidance | Student work/assignments (25%); Quiz (5%); Midterm exam (35%); Final presentation (35%) |



Semiconductor

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| Academic Year | 2025/2026 |
| Code/ Semester | UND202517105/ 7 th Semester |
| Course/ Credit points | Semiconductor / 2 SKS ~ 3.62 ECTS |
| Language | Indonesian |
| Responsible Person | Ayi Bahtiar |
| Lecturer | Ayi Bahtiar |
| Workload | 1. Lectures: 2 x 50 = 100 minutes per week. 2. Assignments: 2 x 60 = 120 minutes per week. Individual study: 2 x 60 = 120 minutes per week. |
| Contents | Review of current development in devices and technology of semiconductors, energy band, and charge transport in semiconductor, transport phenomena, p-n junction, p-i-n junction, semiconductor-based devices (diode, transistor and solar cells). |
| Learning Objectives | 1. Able to describe the current development of semiconductor based devices and technology, 2. Able to analyze energy band and intrinsic-extrinsic charge carriers in semiconductors, 3. Able to analyze charge transport phenomena in semiconductor 4. Able to analyze semiconductor p-n , p-i-n junctions Able to compare the working principle in semiconductor based devices (diode, transistor and solar cells). |
| Course Method | The lecture method used this course is contextual instruction. At the beginning of the lecture for each topic, an explanation of the basic concepts is given and followed by working on problems that are done in the class and/or at home as homework and case study. The students discuss the working principles of semiconductor devices based on p-n/p-i-n connections, such as diodes, transistors and solar cells. |
| Form of Examination | To be defined by lecturer at the beginning of course |
| Prerequisites | NA |
| Requirements according to the examination regulations | Registered in this course Minimum 80% attendance in this course |
| Reading list | 1. Simon M. Sze, Ming-Kwei Lee, " <i>Semiconductor Devices: Physics and Technology</i> ", 3rd Edition, John Wiley & Sons Inc., 2012. 2. Donald A. Neamen, " <i>Semiconductor Physics and Devices: Basic Principles</i> ", 4th Edition, McGraw Hill, 2011. 3. S.D. Brotherton, " <i>Introduction to Thin Film Transistors: Physics and Technology of TFTs</i> ", Springer, 2013. Newest scientific related articles on semiconductor based optoelectronic devices. |
| Assessment Guidance | Student work/assignments (35%); Case study (25%); Midterm exam (20%); Comprehensive evaluation (20%) |



Scientific Writing

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|---|--|
| Academic Year | 2025/2026 |
| Code/ Semester | UND202517106 / 7 th Semester |
| Course/ Credit points | Scientific Writing / 2 credits ~ 3.62 ECTS |
| Language | Indonesian |
| Responsible Person | Camellia Panatarani |
| Lecturer | Camellia Panatarani |
| Workload | 1. Course: 4 x 50 = 200 minutes per week. Private learning : 2 x 60 = 120 minutes per week. |
| Contents | Introduction to the types of scientific work, Anatomy of Scientific Work, Anatomy of Advanced Scientific Work, Theme, outline and framework of scientific work, Major and Framework of Scientific Work, Word Choices, Effective Sentences, Write Scientific Work (Research objectives, problem formulation, research methods, results and discussion, and conclusions), Plagiarism. |
| Learning Objectives | Student are: 1. Able to plan processes and formulate lecture material with proper and appropriate procedures (psychomotor work skills) 2. Able to analyze lecture material based on good and correct procedures (knowledge mastery - cognitive) 3. Able to manage and be responsible (managerial ability) 4. Be ethical, creative, communicative; and cooperate. Can make a scientific work |
| Course Method | Lecture, Discussion and Practice |
| Form of Examination | Presentation, quiz/assignment, test |
| Prerequisites | - |
| Requirements according to the examination regulations | Registered in this course Minimum 80% attendance in this course |
| Reading list | Essentials of Scientific Writing, Publisher EIAR Editor: Abebe K, 2014. ISBN: 978-99944-53-98-6 Joseph Mugah, (2016) Essentials of Scientific Writing, Author House |
| Assessment Guidance | Assignment (30%); Midterm Test (30%); Final Project/Test (40%) |



Measurement Techniques and Devices

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|---------------------------|---|
| Academic Year | 2025/2026 |
| Code/ Semester | UND202517107/ 7 th Semester |
| Course/ Credit points | Measurement Techniques and Devices / 2 credits ~ 3.62 ECTS |
| Language | Indonesian |
| Responsible Person | Sahrul Hidayat |
| Lecturer | Sahrul Hidayat, Norman Syakir |
| Workload | 1. Course: 4 x 50 = 200 minutes per week. Private learning : 2 x 60 = 120 minutes per week. |
| Contents | Typical instruments for basic physical quantities and the basic principles of measurement; Accuracy and accuracy of measurement results; Basic principles of measuring instruments such as galvanometers and voltmeters; Basic principles of measuring instruments L(inductor) C(capacitor) R(resistor) meter; Spatial quantity sensor (displacement, thickness, position, location, altitude); Sensors of temporal magnitude (time and frequency); Sensor of mechanical quantities of solids (mass, density, strain, torque); Sensors for mechanical quantities of liquids (pressure, flow, viscosity, surface tension); Sensors for thermal properties of objects (temperature, thermal conductivity, heat flow, thermal imaging, energy); |
| Learning Objectives | Students are able: <ol style="list-style-type: none">1. To complete independent assignments and group assignments well so that a responsible attitude is formed in their field and academic ethical norms.2. To recognize the types of measuring instruments for basic physical quantities and the basic principles of measurement as well as the criteria for the accuracy and accuracy of measurements.3. To understand the basic principles of physics measuring instruments such as galvanometers, voltmeters and LCR meters.4. To understand and explain the basic principles of spatial and temporal measurement sensors and their implementation.5. To understand and explain the basic principles of sensors for measuring the magnitude of solid objects and their implementation.6. To understand and explain the basic principles of sensors for measuring the mechanical quantity of liquid objects and their implementation. To understand and explain the basic principles of thermal measurement sensors and their implementation. |
| Course Method | Lecture, Discussion and Practice |
| Form of Examination | Presentation, quiz/assignment, test |
| Prerequisites | Fundamental Physics I & II |
| Requirements according to | Registered in this course |



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| the examination regulations | Minimum 80% attendance in this course |
| Reading list | John G. Webster (2017) Measurement, Instrumentation, and Sensors Handbook. CRC Press |
| Assessment Guidance | Assignment (30%); Midterm Test (30%); Final Project/Test (40%) |



Designing and Modeling of Physical System

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|---|--|
| Academic Year | 2025/2026 |
| Code/ Semester | UND202517108/ 7 th Semester |
| Course/ Credit points | Designing and Modelling of Physical System / 2 credits ~ 3.62 ECTS |
| Language | Indonesian |
| Responsible Person | I Made Joni |
| Lecturer | I Made Joni |
| Workload | 1. Course: 4 x 50 = 200 minutes per week. Private learning : 2 x 60 = 120 minutes per week. |
| Contents | Fundamentals of Physical System Modeling, Analysis of Dynamic Physical Systems, Block Diagram and PID Control System Application Modeling, Block Diagram and Predictive Control System Application Modeling, Modeling of Multivariable Physical Systems, Physical system modeling for Buck and Boost control, Application of Buck and Boost Controller for DC- DC conversion of renewable energy. |
| Learning Objectives | <p>Student are:</p> <ol style="list-style-type: none"> 1. Able to create and apply mathematical equation models and transfer function models of a dynamic physical system 2. Able to analyze the stability and dynamic responses of physical systems/processes 3. Able to empirically determine the dynamics of the physical system process by testing the step response data 4. Mampu implemented various types of feedback control systems for physical process systems in the PID case study 5. Able to read and make physical process system block diagrams, create system designs and model feedback control, enactment, and predictive control. 6. Know and be able to model process systems and their interactions with multiple variables 7. Able to make mathematical models and models for Buck and Boost systems on DC-DC conversion systems, and use system modeling to design Buck-Boost Controllers for solar cell energy applications and windmill generators 8. Able to apply the MPPT control system to the Buck-boost system and process modeling, and able to use system modeling to design a Buck- Boost Controller for solar cell energy applications and windmill generators |
| Course Method | Lecture, Discussion and Practice |
| Form of Examination | Presentation, quiz/assignment, test |
| Prerequisites | Instrumentation of Physics, Control System |
| Requirements according to the examination regulations | Registered in this course Minimum 80% attendance in this course |
| Reading list | Johnson, C.D.(2006). "Process control instrumentation technology," Prentice-Hall, New Delhi Franklyn W. Kirk, Thomas A. Weedon, Phillip Kirk (2019) |



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| | Instrumentation and Process Control 7th Edition. American Technical Publishers |
| Assessment Guidance | Assignment (30%); Midterm Test (30%); Final Project/Test (40%) |



Energy Conservations

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|---|---|
| Academic Year | 2025/2026 |
| Code/ Semester | UND202517109 / 7 th Semester |
| Course/ Credit points | Energy Conservations / 2 SKS ~ 3.62 ECTS |
| Language | Indonesian |
| Responsible Person | Otong Nurhilal |
| Lecturer | Otong Nurhilal |
| Workload | 1. Lectures : 2 x 50 = 100 minutes per week. 2. Assignments : 2 x 60 = 120 minutes per week. Private learning : 2 x 60 = 120 minutes per week. |
| Contents | Introduction, the concept of energy conservation, building structures, heating systems, cooling systems, power systems, water distribution systems, electrical data systems, compressed air systems and energy audit methods. |
| Learning Objectives | 1. Able to understand the basic principles of energy conservation 2. Able to understand the structure and building system Able to understand and analyze the energy audits |
| Course Method | Lectures are held by lecture and discussion methods. Giving assignments to test the accuracy of answering questions both in the form of concepts and problem solving. |
| Form of Examination | - |
| Prerequisites | Registered in this course Minimum 80% attendance in this course |
| Requirements according to the examination regulations | Patrick, Dale R. et al, Energy Conservation Guidebook. Third edition 2014. |
| Reading list | Quiz (20%); Tasks (10%); MES (35%); FES (35%) |
| Assessment Guidance | 2023/2024 |



Geothermal Power Plant

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|---|--|
| Academic Year | 2025/2026 |
| Code/ Semester | UND202517110 / 7 th Semester |
| Course/ Credit points | Geothermal Power Plant / 2 SKS ~ 3.62 ECTS |
| Language | Indonesian |
| Responsible Person | Otong Nurhilal |
| Lecturer | Otong Nurhilal |
| Workload | 1. Lectures: 2 x 50 = 100 minutes per week. 2. Assignments: 2 x 60 = 120 minutes per week. Private learning: 2 x 60 = 120 minutes per week. |
| Contents | Fundamental of Power Plant, Non-Conventional Energy Resources and Utilization, Power Plant Economics and Variable Load Problem, Steam Power Plant, Steam Generator, Steam Turbine, Fuels and Combustion, Electrical System, Pollution and its Control. |
| Learning Objectives | 1. Able to understand the basic concept of steam generator 2. Able to understand the steam generator system Able to understand steam generator system equipment |
| Course Method | Lectures are held by lecture and discussion methods. Giving assignments to test the accuracy of answering questions both in the form of concepts and problem solving. |
| Form of Examination | To be defined by lecturer at the beginning of course |
| Prerequisites | Energy physics |
| Requirements according to the examination regulations | Registered in this course, Minimum 80% attendance in this course |
| Reading list | 1. A.K. Raja, Amit P. Srivastava, Manish Dwivedi, (2006) Power Plant Engineering, New Age International Publishers. 2. Zark Bedalov, (2020) Practical Power Plant Engineering. Wiley-IEEE Press. |
| Assessment Guidance | Quiz (20%); Tasks (10%); MES (35%); FES (35%) |

Measurement of Magnetic Properties

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|---|--|
| Academic Year | 2025/2026 |
| Code/ Semester | UND202517111 / 7 th Semester |
| Course/ Credit points | Measurement of Magnetic Properties / 2 SKS ~ 3.62 ECTS |
| Language | Indonesian |
| Responsible Person | Togar Saragi |
| Lecturer | Norman Syakir, Togar Saragi |
| Workload | 1. Lectures: 2 x 50 = 100 minutes per week. 2. Assignments: 2 x 60 = 120 minutes per week. Individual study: 2 x 60 = 120 minutes per week. |
| Contents | 1. Permagraph and VSM Characterization Technique 2. Josephson Junction and SQUID Characterization Technique 3. Data Processing Techniques M-H Loop, M-T Loop and M-t Loop NMR, AC-Susceptibility and MOKE Characterization Technique |
| Learning Objectives | Learning Goals: 1. Students are able to analyze and determine remanent magnetization (M_r), saturation magnetization (M_s), coercive field (H_c) and magnetic energy by measuring the M-H loop, analyze M-T and M-t Loop 2. Students are able to analyze time relaxation and magnetocrystalline anisotropy Students are able to analyze the dependence of Kerr rotation as a function of wavelength from MOKE measurements. |
| Course Method | 1. Lecture course: lecture presentation, interactive learning quizzes (discussion and sharing). 2. Interactive learning: exercise and presentation, Individual study: homework/assignment |
| Form of Examination | To be defined by lecturer at the beginning of course |
| Prerequisites | Introduction to Solid State Physics, Magnetic Materials and Superconductors |
| Requirements according to the examination regulations | Registered in this course, Minimum 80% attendance in this course |
| Reading list | 1. J.M.D. Coey, Magnetism_and_Magnetic Materials, Cambridge University Press, 2009. 2. M_David Jiles, Introduction to Magnetism and Magnetic, Springer, 1991 Neeraj Panwar (2018) Magnetism and Magnetic Materials. IntechOpen |
| Assessment Guidance | Assignment (30%); Midterm Test (30%); Final Project/Test (40%) |



Maintenance Management of Instrumentation System

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|---|---|
| Academic Year | 2025/2026 |
| Code/ Semester | D10C20.7207/ 7 th Semester |
| Course/ Credit points | Maintenance Management of Instrumentation System / 2 credits ~ 3.62 ECTS |
| Language | Indonesian |
| Responsible Person | I Made Joni |
| Lecturer | I Made Joni |
| Workload | 1. Course: 4 x 50 = 200 minutes per week. Private learning : 2 x 60 = 120 minutes per week. |
| Contents | Background and problems in maintenance of instrumentation system facilities, system maintenance activities and support, maintenance department organization, maintenance planning and control, supporting factors in the maintenance system, system reliability, issues related to control, maintainability, factors affecting smooth maintenance, maintenance costs , workshop management as a maintenance function, Total Productive Maintenance to carry out the necessary precautions in maintenance, RCM to ensure that the instrumentation/equipment system can operate properly, Case Study. |
| Learning Objectives | Students are: <ol style="list-style-type: none">1. Able to know and understand the background and problems in maintenance Industrial facility"2. Able to know and understand system maintenance activities and support.3. Able to understand and understand the organization of the maintenance department4. Able to know and understand compassion Able to analyze Total Productive Maintenance to carry out prevention and maintenance quality assurance |
| Course Method | Lecture, Discussion and Practice |
| Form of Examination | Presentation, quiz/test, assignment |
| Prerequisites | Instrumentation of Physics |
| Requirements according to the examination regulations | Registered in this course Minimum 80% attendance in this course |
| Reading list | Haroun et. Al. (2009) Handbook of Maintenance Management and Engineering, Springer-Verlag. Keith Mobley (2014) Maintenance Engineering Handbook, Eighth Edition 8th Edition, McGraw Hill. |
| Assessment Guidance | Assignment (30%); Midterm Test (30%); Final Project/Test (40%) |



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| Academic Year | 2025/2026 |
| Code/ Semester | UND202517112/ 7 th Semester |
| Course/ Credit points | Biophysics / 2 credits ~ 3.62 ECTS |
| Language | Indonesian |
| Responsible Person | Norman Syakir |
| Lecturer | Norman Syakir |
| Workload | 1. Course: 4 x 50 = 200 minutes per week. Private learning : 2 x 60 = 120 minutes per week. |
| Contents | Biomechanics, Biofluids, Bioelectricity, Bioacoustics, Biooptics, Radiobiology, Thermodynamics in Biological systems, Membrane Systems, Insect communication, Virus characteristics, structure and reproduction |
| Learning Objectives | Student are to: 1. Explains Biomechanics which includes the physical aspects of muscle work, the body's center of mass and its applications 2. Explains about Biofluids, about the concept of blood flow in the body and the physical aspects of the work of the lungs 3. Explains about bioelectricity, about the physical aspects of the emergence of electric pulses, their delivery to cells nerves. 4. Explains about Thermodynamics in Biological systems that discusses the principles of Thermodynamics 5. in Biological systems and can apply the Gibbs Energy Application of Human Metabolism. Gibbs 6. in biological systems. Explain about the membrane system that discusses the transport of molecules or ions in the membrane |
| Course Method | Discussion and Practice |
| Form of Examination | Test/Presentation |
| Prerequisites | Fundamental Physics I & II, Mathematical Physics |
| Requirements according to the examination regulations | Registered in this course Minimum 80% attendance in this course |
| Reading list | Biophysics, Dadan Rosana, Yogyakarta State University; 2. Wiliam Bialeck, Searching and Principle Biopysics, 2011. Mohammad Ashrafuzzaman, Jack Tuszynski. (2013) Membrane Biophysics, Springer. |
| Assessment Guidance | Assignment (30%); Midterm Test (30%); Final Project/Test (40%) |



Liquid Waste Treatment Plant

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| Academic Year | 2025/2026 |
| Code/ Semester | UND202517113 / 7 th Semester |
| Course/ Credit points | Liquid Waste Treatment Plant / 2 SKS ~ 3.62 ECTS |
| Language | Indonesian |
| Responsible Person | I Made Joni |
| Lecturer | I Made Joni |
| Workload | 1. Lectures: 2 x 50 = 100 minutes per week. 2. Assignments: 2 x 60 = 120 minutes per week. Private learning: 2 x 60 = 120 minutes per week. |
| Contents | 1. Suspended solids; 2. Organic (biodegradable) material; 3. Nutrients (nitrogen and phosphorous); 4. Pathogenic organisms (expressed as E. Coli) 5. Medicine residues, organic chemicals (POP's) Heavy metals |
| Learning Objectives | 1. Students can explain the basic principles of Liquid Waste Treatment 2. Students can identify the types of liquid waste 3. Students can explain the difference Suspended solids, Pathogenic organisms, Medicine residues and Heavy metals |
| Course Method | Lectures, case-based study and final project |
| Form of Examination | To be defined by the lecturer at the beginning of course |
| Prerequisites | - |
| Requirements according to the examination regulations | Registered in this course Minimum 80% attendance in this course |
| Reading list | Handbook of Water and Wastewater Treatment Technologies, Nicholas P. Cheremisinoff, Butterworth- Heinemann 2002 |
| Assessment Guidance | Assignment and quizzes (40%); case based (20%); final project (40%) |



Nanoparticle Imaging

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| Academic Year | 2025/2026 |
| Code/ Semester | UND202517114 / 7 th Semester |
| Course/ Credit points | Nanoparticle Imaging / 2 SKS ~ 3.62 ECTS |
| Language | Indonesian |
| Responsible Person | Ferry Faizal |
| Lecturer | Ferry Faizal |
| Workload | 1. Lectures: 2 x 50 = 100 minutes per week. 2. Assignments: 2 x 60 = 120 minutes per week. Private learning: 2 x 60 = 120 minutes per week. |
| Contents | 1. Introduction 2. Nanoparticles & Nanostructures 3. Nanoparticle Characteristics 4. Signal & Image Review 5. Optical and electron imaging 6. Morphology and sizing 7. Software usage 8. Nanoparticles as contrast agent/tracer (Opt) AI in Nanoparticle Imaging (Opt) |
| Learning Objectives | 1. Students can explain the basic principles of imaging techniques in the field of Nanotechnology 2. Students can identify the image data acquisition systems to micrometer and nanometer scale objects Students can use/create simple software to analyze example of images at the nanometer scale |
| Course Method | Lectures, case-based study and final project |
| Form of Examination | To be defined by the lecturer at the beginning of course |
| Prerequisites | - |
| Requirements according to the examination regulations | Registered in this course Minimum 80% attendance in this course |
| Reading list | 1. Dong ZhiLi - Fundamentals of Crystallography, Powder X-ray Diffraction, and Transmission Electron Microscopy for Materials Scientists-CRC Press (2022) 2. Nobuo Tanaka (auth.) - Electron Nano-Imaging_ Basics of Imaging and Diffraction for TEM and STEM (2017, Springer) Phil Kim-matlab Deep Learning With Machine Learning, Neural Networks And Artificial Intelligence-apress (2017) |
| Assessment Guidance | Assignment and quizzes (40%); case based (20%); final project (40%) |



Biomedical Materials

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|---|---|
| Academic Year | 2025/2026 |
| Code/ Semester | UND202517116/ 7 th Semester |
| Course/ Credit points | Biomedical Materials / 2 SKS ~ 3.62 ECTS |
| Language | Indonesian |
| Responsible Person | Risdiana |
| Lecturer | Risdiana |
| Workload | 1. Lectures: 2 x 50 = 100 minutes per week. 2. Assignments: 2 x 60 = 120 minutes per week. Individual study: 2 x 60 = 120 minutes per week. |
| Contents | 1. Concept of Biomedical Materials 2. Types of Biomedical Materials 3. Preparation techniques of biomedical materials Characterization analysis of biomedical materials |
| Learning Objectives | 1. Able to understand and explain the Concept of biomedical materials and its types 2. Able to understand, explain, and prepare biomedical materials Able to understand, explain, and analyze the characterization results of biomedical materials |
| Course Method | Lectures are conducted using the methods of Project based learning, Discovery Learning, Small Group Discussion, Contextual Instruction, and experiments. Before the lecture, students will be asked to study the upcoming lecture material and discuss it in groups. Furthermore, students are required to present it in front of the class to reach a collective conclusion. Students will also gain experience to synthesize biomedical materials, characterize and analyze the properties of these materials. |
| Form of Examination | To be defined by lecturer at the beginning of course |
| Prerequisites | Introduction to Solid-State Physics |
| Requirements according to the examination regulations | Registered in this course Minimum 80% attendance in this course |
| Reading list | 1. Barca, F. Caporossi, T. dan Rizzo, S. (2014) Silicone Oil : Different Physical Properties and Clinical Applications. <i>Journal of Biomedicine and Biotechnology</i> 2014. 2. Caramoy, A. Schröder, S. Fauser, S. dan Kirchhof, B. (2010). In Vitro Emulsification Assessment of New Silicone Oils. <i>Br. J. Ophthalmol.</i> ,94 (4), 509-512. 3. Swindle, K E. dan Ravi, N. (2007). Recent advances in polymeric vitreous substitutes. <i>Expert Rev. Ophthalmol.</i> 2 (2) 255- 265. 4. Fitrilawati, Fauza, A R. Atikah, A. Novianti, R M. Syakir, N. Kartasasmita, A. S. dan Risdiana. (2018). Effect of KOH Concentration on Characteristics of Polydimethylsiloxane Synthesized by Ring Opening Polymerization Method. <i>Journal of Physics: Conf. Series</i> 1080 012016. |
| Assessment Guidance | Student work/assignments/presentation/Quiz (60%); Midterm Exam |



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| | (30%); Final Exam (30%) |
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Preparation and Characterization of Superconducting Materials

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| Academic Year | 2025/2026 |
| Code/ Semester | UND2025171117/ 7 th Semester |
| Course/ Credit points | Preparation and Characterization of Superconducting Materials / 2 SKS ~ 3.62 ECTS |
| Language | English , Indonesian |
| Responsible Person | Risdiana |
| Lecturer | Risdiana |
| Workload | 1. Lectures: 2 x 50 = 100 minutes per week. 2. Assignments: 2 x 60 = 120 minutes per week. Individual study: 2 x 60 = 120 minutes per week. |
| Contents | 1. Concept of Superconductivity 2. Types of superconducting materials 3. Preparation techniques of superconducting materials Characterization analysis of superconducting materials |
| Learning Objectives | 1. Able to explain the Concept of Superconductivity 2. Able to explain and analyze the types of superconducting materials 3. Understand superconducting material preparation techniques 4. Able to perform superconducting material preparation Able to analyze the characteristics of superconducting materials |
| Course Method | Lectures are conducted using the methods of Discovery Learning, Small Group Discussion, Contextual Instruction, and experiments. Before the lecture, students will be asked to study the upcoming lecture material and discuss it in groups. Furthermore, students are required to present it in front of the class to reach a collective conclusion. Students will also gain experience to synthesize superconducting materials and analyze the properties of these materials. |
| Form of Examination | To be defined by lecturer at the beginning of course |
| Prerequisites | Introduction to Solid State Physics |
| Requirements according to the examination regulations | Registered in this course Minimum 80% attendance in this course |
| Reading list | 1. Risdiana, <i>Pengenalan Bahan Superkonduktor Sifat Dasar dan Karakteristiknya</i> . Sumedang: Unpad Press, 2015. 2. E.W. Carlson, V.J. Emery, S.A. Kivelson, and D. Orgad, <i>Concept in High-Temperature Superconductivity</i> , <i>Cond-mat/0206217v1</i> , arXiv:cond-mat/0206217v1 [cond-mat.supr-con] 12 Jun 2002 N. P. Armitage, P. Fournier, and R. L. Greene, "Progress and perspectives on electron-doped cuprates," <i>Rev. Mod. Phys.</i> , vol. 82, no. 3, pp. 2421–2487, 2010. |
| Assessment Guidance | Student work/assignments/presentation/Quiz (70%); Evaluation 1 (10%) Evaluation 2 (10%), Evaluation 3 (10%) |



Luminescence Material

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| Academic Year | 2025/2026 |
| Code/ Semester | UND202517118/ 7 th Semester |
| Course/ Credit points | Luminescence Material / 2 SKS ~ 3.62 ECTS |
| Language | Indonesian |
| Responsible Person | Camellia Panatarani |
| Lecturer | Camellia Panatarani |
| Workload | 1. Lectures: 2 x 50 = 100 minutes per week. 2. Assignments: 2 x 60 = 120 minutes per week. Individual study: 2 x 60 = 120 minutes per week. |
| Contents | 1. Introduction: General introduction to luminescent materials 2. How do Luminescent Materials Absorb Excitation Energy? 3. Emission: Radiative Return of Electrons to Ground State 4. Non-Radiative Transition 5. Energy Transfer 6. Characterization methods of luminescent materials 7. Synthesis method of luminescent materials 8. Applications of luminescent materials Challenges and recent developments |
| Learning Objectives | 1. Able to explain the description and learning objectives, carry out the lecture contract to obtain the expected final ability, and can follow the Luminous Material learning system using the REGULAR LIVE platform with a responsible attitude. 2. Able to explain the basic concepts of luminescent materials and luminescence principles accurately. 3. Able to explain the relationship between physical characteristics and properties of luminescent materials accurately. 4. Able to operate luminance characterization tools, process data and interpret the results with a responsible attitude. 5. Able to synthesize one type of luminescent material. 6. Able to evaluate the performance of luminescent materials for applications in the fields of energy, environment and health with quality, measurable and valid reference sources. |
| Course Method | Learning is managed using the Regular Live platform with synchronous and asynchronous learning, both in-person and online. Learning is carried out for 16 weeks with a total of one in-person session per week. Student success is evaluated by assessing their participations throughout the course and practicum, including attendance, class discussions, and presentations. |
| Form of Examination | To be defined by lecturer at the beginning of course |
| Prerequisites | Material Physics, Introduction to Solid State Physics |
| Requirements according to the examination regulations | Registered in this course Minimum 80% attendance in this course |
| Reading list | 1. G. Blasse, B.B.Grabmaier, Luminescent Materials, Springer Berlin, Heidelberg, 1994; 2. Camellia Panatarani, Ilmu dan Teknologi material luminisensi, Unpad |



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| | <p>Press, Bandung, 2016.</p> <p>3. William M. Yen, Shigeo Shionoya, Hajime Yamamoto (Eds), Phosphor handbook, 2nd ed., The CRC Press Laser and Optical Science and Technology Series, CRC Press Taylor & Francis Group, Boca Raton, 2007</p> <p>Luminescence: From Theory to Applications. Edited by Cees Ronda, 2008 WILEY-VCH Verlag GmbH & Co. KGaA, Weinheim ISBN: 978-3-527-31402-7</p> |
| Assessment Guidance | Student work/assignments (30%); Reports/Presentations (70%) |



Particle Transport System

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| Academic Year | 2025/2026 |
| Code/ Semester | UND202517115 / 7 th Semester |
| Course/ Credit points | Particle Transport System / 2 SKS ~ 3.62 ECTS |
| Language | Indonesian |
| Responsible Person | Togar Saragi |
| Lecturer | Togar Saragi |
| Workload | 1. Lectures : 2 x 50 = 100 minutes per week. 2. Assignments : 2 x 60 = 120 minutes per week. Private learning : 2 x 60 = 120 minutes per week. |
| Contents | 1. Review of nanomagnetic 2. Spinel and inverse spinel, Lewis's acids and bases, ligands 3. Amphiphilic, hydrophilic and hydrophobic compounds 4. Surface modification, and encapsulation 5. Analysis of magnetic characteristics, relaxation time, FTIR and Raman 6. Biomedical applications: catalysts, and drug delivery Project based: Laboratory experimental studies |
| Learning Objectives | Learning Outcomes of Bachelor Program: 1. Students are able to analyze simple and practical problems in one of the fields of theoretical, computational or experimental physics for energy, environmental and health physics (CPL3) 2. Students are able to work on scientific tasks that are clearly defined and able to explain the results orally and in writing, in the fields of theoretical physics, applied physics, computation or experimentation, and their application in the fields of energy, environment and health (CPL4) 3. Students are able to use the principles of lifelong learning to increase knowledge and current issues about physics in the fields of energy, environment and health (CPL5) Learning Goals: 1. Students are able to explain Lewis's acids and bases, ligands, and bonds between oxide materials and amphiphilic compounds and encapsulation. 2. Students are able to analyze FTIR, Raman or NMR on magnetic nanocore structure, surface modification and encapsulation. 3. Students are able to conclude the principle of magnetic nanoparticle nanocore as a biomedical application. |
| Course Method | 1. Lecture course: lecture presentation, interactive learning quizzes (discussion and sharing). 2. Interactive learning: exercise and presentation, Small Group Discussion (SGD), dan Discover Learning (DL). 3. Individual study: homework/assignment |
| Form of Examination | |
| Prerequisites | Material Synthesis Methods, Magnetic Properties Measurement |



UNPAD **PHYSICS**

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| Requirements according to the examination regulations | Registered in this course Minimum 80% attendance in this course |
| Reading list | <ol style="list-style-type: none">1. Handbook of Magnetic Materials: Synthesis, Properties and Application of Magnetic nanoparticles. Ed. K.H.j. Buschow, Elsevier Press).2. Composite Materials: Processing, Application, Characterization. Springer. |
| Assessment Guidance | Case base Quizzes (10%); Homework/assignment (20%); middle exam (35%); final exam (35%) |



Thesis/Final Project

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| Academic Year | 2025/2026 |
| Code/ Semester | UND202518101/ 8th Semester |
| Course/ Credit points | Thesis (Final Project) / 6 SKS ~ 10.86 ECTS |
| Language | Indonesian |
| Responsible Person | Sahrul Hidayat |
| Lecturer | Sahrul Hidayat, Annisa Aprilia, Otong Nurhilal, Ferry Faizal |
| Workload | 1. Lab Work: 6 x 120 = 720 minutes per week. Private learning : 6 x 30 = 180 minutes per week. |
| Contents | Introduction to the types of scientific work, Anatomy of Scientific Work, Anatomy of Advanced Scientific Work, Theme, outline and framework of scientific work, Major and Framework of Scientific Work, Word Choices, Effective Sentences, Write Scientific Work (Research objectives, problem formulation, research methods, results and discussion, and conclusions), Plagiarism. |
| Learning Objectives | Student are: 1. Able to plan processes and formulate lecture material with proper and appropriate procedures (psychomotor work skills) 2. Able to analyze lecture material based on good and correct procedures (knowledge mastery - cognitive) 3. Able to manage and be responsible (managerial ability) 4. Be ethical, creative, communicative; and cooperate. 5. Can make a scientific work Can write scientific papers |
| Course Method | Practice in the lab, discussion and presentation |
| Form of Examination | Progress Presentation, assignment, seminar thesis |
| Prerequisites | - |
| Requirements according to the examination regulations | Registered in this course Must have taken at least 120 credits (217.2 ECTS) |
| Reading list | Essentials of Scientific Writing, Publisher EIAR Editor: Abebe K, ISBN: 978-99944-53-98-6 |
| Assessment Guidance | Progress presentation (30%); Final Project/Test (30%); Seminar thesis (40%) |