UNIVERSITAS INDONESIA

Veritas, Probitas, Iustitia

FAKULTAS MATEMATIKA DAN ILMU PENGETAHUAN ALAM

Department of Physics

Master Programme

in Materials Science

MODULE HANDBOOK

http://physics.ui.ac.id

UPDATED MAY 2023

UNIVERSITAS INDONESIA
Faculty of Mathematics and Natural Sciences
Master Program of Materials Science

Building F, Kampus UI Depok 16424
Telp: (+62)021-78849008, Email: sekretariat@fisika.ui.ac.id
website: www.physics.ui.ac.id

List of Modules

UNIVERSITAS INDONESIA
Faculty of Mathematics and Natural Sciences
Master Program of Materials Science

Building F, Kampus UI Depok 16424
Telp: (+62)021-78849008, Email: sekretariat@fisika.ui.ac.id
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MODULE HANDBOOK

Module name	*Literature Review 1*
Module level, if applicable	*Graduate program*
Code, if applicable	*SCPH801001*
Subtitle, if applicable	-
Courses, if applicable	-
Semester(s) in which the module is taught	*1st Semester*
Person responsible for the module	*Team*
Lecturer	*Thesis Advisor*
Language	*Indonesian*
Relation to curriculum	*Compulsory Course*
Type of teaching, contact hours	*Flipped Class and Problem-Based Learning*
Teaching methods	*Student Center Learning, Presentation, Discussion, Self-studying*
Workload (incl. contact hours, self-study hours)	*Lectures: 4x50=200 minutes per week* *Exercise and assignments: 4x60=240 minutes per week* *Independent study: 4x60=240 minutes per week*
Credit points	*4*
Requirements according to the examination regulations	*A student must have attended at least 75% of the lectures to sit in the exam*
Recommended prerequisites	-

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Module objectives/intended learning outcomes	1. *Students are able to review scientific literature* 2. *Students are able to analyze existing facts in determining the topic and thesis of their study* 3. *Students are able to write and compile background and references of their study, conduct literature research according to the topic of study, and write synthesis of reputable scientific publications* 4. *Students are able to integrate various facts and data as well as processing, classifying, and compiling it in scientific paper* 5. *Students are able to edit and rewrite their scientific paper in the form of presentation material and demonstrating their ability to defend it by showing the validity of the content* 6. *Students are able to compile scientific paper in the correct format as well as presentate and maintain their ideas and results of their studies in the form of written or oral presentation*
Content	● *Literature according to research topic* ● *Systematic and format of scientific literature* ● *Thesis topic in scientific research* ● *Research background, objectives and problems* ● *Citing previous research* ● *Research methodology* ● *Written and oral presentation techniques*
Study and examination requirements and form of examination	*The final score is the composition of mid-test scores, quizzes, and assignments with the following weight:* *Assignment : 35 %* *Class Participation: 15 %* *Presentation : 50 %* *Total : 100 %* ***Mark*** — ***Grade*** *85—100* — *A*

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	80—<85	*A*
	75—<80	*B+*
	70—<75	*B*
	65—<70	*B*
	60—<65	*C+*
	55—<60	*C*
	40—<55	*D*
	<40	*E*
Media employed	-	
Reading List	1. *Hanburry Brown, AC, FRS. (1986). The Wisdom of Science : its relevance to Culture and Reigion. London : Cambridge University Press.* 2. *Hawryszkiewycz, I,T. (1984). Database Analysis and Design. Chicago: SRA,INC.* 3. *Geoff, P and Judy, P. (2004). Key Concepts in Social Research. London: Sage.* 4. *Sandra lach, A. (1995). Practical Handbook of Spatial Statistics. New York: CRC Press*	

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MODULE HANDBOOK

Module name	*Literature Review 2*
Module level, if applicable	*Graduate program*
Code, if applicable	*SCPH801002*
Subtitle, if applicable	-
Courses, if applicable	-
Semester(s) in which the module is taught	*1st Semester*
Person responsible for the module	*Team*
Lecturer	*Thesis Advisor*
Language	*Indonesian*
Relation to curriculum	*Compulsory Course*
Type of teaching, contact hours	*Flipped Class and Problem-Based Learning*
Teaching methods	*Student Center Learning, Presentation, Discussion, Self-studying*
Workload (incl. contact hours, self-study hours)	*Lectures: 4x50=200 minutes per week* *Exercise and assignments: 4x60=240 minutes per week* *Independent study: 4x60=240 minutes per week*

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Credit points	*4*
Requirements according to the examination regulations	*A student must have attended at least 75% of the lectures to sit in the exam*
Recommended prerequisites	-
Module objectives/intended learning outcomes	1. *Students are able to produce paper literature review and present it to the examiners* 2. *Students are able to analyze facts and break it down in sections to be used as elements of scientific literature* 3. *Students are able to integrate various facts and data as well as processing, classifying, and compiling it in scientific literature in the form of reputable publication* 4. *Students are able to edit and rewrite their scientific paper in the form of presentation material and demonstrating their ability to defend it by showing the validity of the content*
Content	● *Systematic and format of scientific literature* ● *Synthesize content from various literature as reference* ● *Citation methods* ● *Compiling scientific paper in the form of reviewing reputable sources* ● *Written and oral presentation techniques*

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<table>
<tr>
<td>Study and examination requirements and form of examination</td>
<td>
The final score is the composition of mid-test scores, quizzes, and assignments with the following weight:
Assignment : 35 %
Class Participation: 15 %
Presentation : 50 %
Total : 100 %

<table>
<tr><th>Mark</th><th>Grade</th></tr>
<tr><td>85—100</td><td>A</td></tr>
<tr><td>80—<85</td><td>A</td></tr>
<tr><td>75—<80</td><td>B+</td></tr>
<tr><td>70—<75</td><td>B</td></tr>
<tr><td>65—<70</td><td>B</td></tr>
<tr><td>60—<65</td><td>C+</td></tr>
<tr><td>55—<60</td><td>C</td></tr>
<tr><td>40—<55</td><td>D</td></tr>
<tr><td><40</td><td>E</td></tr>
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<tr>
<td>Media employed</td>
<td>-</td>
</tr>
<tr>
<td>Reading List</td>
<td>
1. Hanburry Brown, AC, FRS. (1986). The Wisdom of Science : its relevance to Culture and Reigion. London : Cambridge University Press.
2. Hawryszkiewycz, I,T. (1984). Database Analysis and Design. Chicago: SRA,INC.
3. Geoff, P and Judy, P. (2004). Key Concepts in Social Research. London: Sage.
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MODULE HANDBOOK

Module name	*Research Proposal*
Module level, if applicable	*Graduate Program*
Code, if applicable	*SCMS801203*
Subtitle, if applicable	-
Courses, if applicable	-
Semester(s) in which the module is taught	*1st semester*
Person responsible for the module	*Team*
Lecturer	*Thesis Advisor*
Language	*Indonesian*
Relation to curriculum	*Compulsory Course*
Type of teaching, contact hours	-
Teaching methods	*Asynchronous: Independent Learning, Discussion Forum* *Synchronous: Google Meet*
Workload (incl. contact hours, self-study hours)	*Lectures: 4x50=200 minutes per week* *Exercise and assignments: 4x60=240 minutes per week* *Independent study: 4x60=240 minutes per week*

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Credit points	*4*
Requirements according to the examination regulations	-
Recommended prerequisties	-
Module objectives/intended learning outcomes	1. *Select, organize, and evaluate most recent scientific information sources* 2. *Create and design materials, processing methods, techniques in analyzing newest material or material product innovation with the scientific method* 3. *Correlate the relation between structures, properties, processing, and material system performance* 4. *Create hand-written report and communicate effectively in scientific groups, industry, and public* 5. *Detailing general and specific problems in the field of Material Science* 6. *Create a complete work plan and evaluate material characterization data* 7. *Apply academic ethics, environmental safety, and socio-economic impact* 8. *Show an increase in independent learning capacity* 9. *Manage research data in order to guarantee validity and prevent plagiarism* 10. *Select, organize, and evaluate most recent scientific information sources*

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Content	• *Scientific Writing Format and Systematics* • *Topics and Thesis in Scientific Research* • *Backgrounds, Objectives, and Problems in Research* • *Literature Review, Writing, Citation, and Previous Research* • *Research Methodology- Research Site Selection* • *Research Methodology- Respondent Determination* • *Research Methodology- Research Sampling* • *Research Methodology- Processing Techniques* • *Research Methodology- Analyzing Techniques* • *Written and Oral Presentation Techniques*
Study and examination requirements and form of examination	*The final score is the composition of mid-test scores, quizzes, and assignments with the following weight:* *Assignents : 40 %* *Discussion : 15 %* *Mid-test : 15 %* *Final Test : 30 %* *Total : 100 %* ***Mark*** — ***Grade*** *85—100* — *A* *80—<85* — *A* *75—<80* — *B+* *70—<75* — *B* *65—<70* — *B* *60—<65* — *C+* *55—<60* — *C* *40—<55* — *D* <*40* — *E*

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Media employed	-
Reading List	1. *On Being a Scientist: A Guide to Responsible Conduct in Research, Third Edition, National Academy of Sciences, USA, 2009.*

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MODULE HANDBOOK

Module name	*Scientific Publication 1*
Module level, if applicable	*Graduate Program*
Code, if applicable	*SCMS802201*
Subtitle, if applicable	-
Courses, if applicable	-
Semester(s) in which the module is taught	*3rd Semester*
Person responsible for the module	*Special course*
Lecturer	*Special course*
Language	*Indonesian*
Relation to curriculum	*Compulsory course*
Type of teaching, contact hours	*Flipped class and problem based learning*
Teaching methods	*Flipped class and problem based learning*
Workload (incl. contact hours, self-study hours)	*Lectures: 2x50 = 100 minutes per week* *Exercise and assignments: 2x60 = 120 minutes per week* *Independent study: 2x60 = 120 minutes per week*

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Credit points	*2*
Requirements according to the examination regulations	*A student must have attended at least 75% of the lectures to sit in the exam*
Recommended prerequisties	*Research Proposal*
Module objectives/intended learning outcomes	1. *Able to select, organize and critically evaluate the latest sources of scientific information.* 2. *Able to create and design materials, processing methods, new material analysis techniques or material product innovations with the correct scientific method.* 3. *Able to draw relationships between structure, properties, processing and performance of material systems.* 4. *Able to carry out various fabrication techniques and material characterization or material modelling.* 5. *Able to make written reports and communicate effectively orally in scientific groups, industry and the general public.* 6. *Able to detailing general and specific problems in the field of materials science.* 7. *Able to make a complete work plan and able to evaluate data from material characterization results.* 8. *Able to apply the main rules of other disciplines.* 9. *Able to apply academic ethics, environmental safety and socio-economic impact.* 10. *Able to function as an effective team member together to create a collaborative and inclusive*

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	environment in achieving common goals. 11. *Able to show increased learning capacity independently.* 12. *Able to process research data in order to ensure validity and prevent plagiarism.*
Content	● *The Systematics and Format of Scientific Writing* ● *Topics and Thesis in Scientific Research* ● *Research Background, Objectives and Research Problems* ● *Literature review, writing, citations and preceding research* ● *Research Methodology: Selection of Research Sites* ● *Research Methodology: Determination of Respondents* ● *Research Methodology: Research Sampling* ● *Research Methodology : Processing Techniques* ● *Research Methodology : Analysis Techniques*
Study and examination requirements and form of examination	*The final score is the composition of mid-test scores, quizzes, and assignments with the following weight:* *Assignment : 100 %* *Total : 100 %* ***Mark*** — ***Grade*** *85—100* — *A* *80—<85* — *A* *75—<80* — *B+* *70—<75* — *B*

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	65—<70	*B*
	60—<65	*C+*
	55—<60	*C*
	40—<55	*D*
	<40	*E*
Media employed	*EMAS*	
Reading List	● *On Being a Scientist: A Guide to Responsible Conduct in Research, Third Edition, National Academy of Sciences, USA, 2009.* ● *Pedoman Publikasi Ilmiah, Lukman, Suminar Setiadi Ahmadi, Wasmen Manalu, Deden Sumirat Hidayat, Kementerian Riset, Teknologi, dan Pendidikan Tinggi Direktorat Jenderal Penguatan Riset dan Pengembangan, 2017.* ● *Related digital library resources.*	

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MODULE HANDBOOK

Module name	*Scientific Publication II*
Module level, if applicable	*Graduate Program*
Code, if applicable	*SCMS801204*
Subtitle, if applicable	-
Courses, if applicable	-
Semester(s) in which the module is taught	*4th semester*
Person responsible for the module	*Special course*
Lecturer	*Special course*
Language	*Indonesian*
Relation to curriculum	*Compulsory Course*
Type of teaching, contact hours	*problem based learning*
Teaching methods	*problem based learning*
Workload (incl. contact hours, self-study hours)	*Lectures: 2x50 = 100 minutes per week* *Exercise and assignments: 2x60 = 120 minutes per week* *Independent study: 2x60 = 120 minutes per week*

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Credit points	*8*
Requirements according to the examination regulations	-
Recommended prerequisties	-
Module objectives/intended learning outcomes	1. *Critically select, organize, and evaluate most recent scientific information sources* 2. *Create and design materials, processing methods, material analysis techniques or material product innovation with scientific method* 3. *Correlate the relation between structures, properties, processing, and material system performance* 4. *Detail general and specific problems in the filed of Material Science* 5. *Write report and communicate effectively in a scientific group, industry, and public* 6. *Detail general and specific problems in the field of Material Science* 7. *Create a complete work plan and evaluate material characterization data* 8. *Apply the principles of other disclipines* 9. *Apply academic ethics, environmental safety, and socio-economic impact* 10. *Work in a team effectively to create a collaborative and inclusive environment to obtain common goals* 11. *Demonstrate an increasing capacity in independent learning* 12. *Process research data in order to guarantee*

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	validity and prevent plagiarism
Content	• *Scientific Writing Format and Systematics* • *Topics and Thesis in Scientific Research* • *Background, Objectives, and Problems in Research* • *Literature Review, Writing, Citation, and Previous Research* • *Research Methodology- Research Site Selection* • *Research Methodology- Respondent Determination* • *Research Methodology- Research Sampling* • *Research Methodology- Processing Techniques* • *Research Methodology- Analyzing Techniques*
Study and examination requirements and form of examination	*The final score is the composition of mid-test scores, quizzes, and assignments with the following weight:* *Assignment : 100 %* *Total : 100 %* ***Mark*** — ***Grade*** *85—100* — *A* *80—<85* — *A* *75—<80* — *B+* *70—<75* — *B*

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	65—<70	*B*
	60—<65	*C+*
	55—<60	*C*
	40—<55	*D*
	<40	*E*
Media employed		
Reading List	1. *On Being a Scientist: A Guide to Responsible Conduct in Research, Third Edition, National Academy of Sciences, USA, 2009.*	

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MODULE HANDBOOK

Module name	*Material Structure*
Module level, if applicable	*Graduate Program*
Code, if applicable	*SCMS801205*
Subtitle, if applicable	-
Courses, if applicable	-
Semester(s) in which the module is taught	*1st semester*
Person responsible for the module	*Dr. Suhardjo Poertajdi* *Dr. Azwar Manaf* *Ariadne L. Juwono, M.Eng., Ph.D*
Lecturer	*Dr. Suhardjo Poertajdi* *Dr. Azwar Manaf* *Ariadne L. Juwono, M.Eng., Ph.D*
Language	*Indonesian*
Relation to curriculum	*Elective Course*
Type of teaching, contact hours	*Flipped Class and Problem-Based Learning*
Teaching methods	*Synchronous and Asynchronous Lecture*

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Workload (incl. contact hours, self-study hours)	*1. Lectures: 4 x 50 minutes per week* *2. Exercises and assignments: 4 x 60 = 240 minutes per week* *3. Independent study: 4 x 60 = 240 minutes per week*
Credit points	*4*
Requirements according to the examination regulations	*A student must have attended at least 75% of the lectures to sit in the exam*
Recommended prerequisties	-
Module objectives/intended learning outcomes	*Examine the fundamentals of crystallography and relate it to a wide variety of metals, ceramics, polimer, and composites appropiately*
Content	• *Electronical Configuration inside atoms and molecules* • *Ceramic Fabrication* • *Plastic Deformation* • *Phase Diagram* • *Types of Metal Alloy* • *Hydrocarbon Molecules*

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<table>
<tr>
<td>Study and examination requirements and form of examination</td>
<td>
The final score is the composition of mid-test scores, quizzes, and assignments with the following weight:
Quiz : 5 %
Discussion : 5 %
Presentation : 5 %
Assignments : 5 %
Mid-test : 75 %
Total : 100 %

<table>
<tr><th>Mark</th><th>Grade</th></tr>
<tr><td>85—100</td><td>A</td></tr>
<tr><td>80—<85</td><td>A</td></tr>
<tr><td>75—<80</td><td>B+</td></tr>
<tr><td>70—<75</td><td>B</td></tr>
<tr><td>65—<70</td><td>B</td></tr>
<tr><td>60—<65</td><td>C+</td></tr>
<tr><td>55—<60</td><td>C</td></tr>
<tr><td>40—<55</td><td>D</td></tr>
<tr><td><40</td><td>E</td></tr>
</table>
</td>
</tr>
<tr>
<td>Media employed</td>
<td>-</td>
</tr>
<tr>
<td>Reading List</td>
<td>William D. Callister. Jr., Materials Science and Engineering, an Introduction, John Wiley and Sons, 7th edition, 2007.</td>
</tr>
</table>

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MODULE HANDBOOK

Module name	*Material Properties and Performance*
Module level, if applicable	*Graduate Program*
Code, if applicable	*SCMS801206*
Subtitle, if applicable	-
Courses, if applicable	-
Semester(s) in which the module is taught	*1st semester*
Person responsible for the module	*Dr. Vivi Fauzia* *Ariadne L. Juwono, M.Eng., Ph.D.* *Dr. Dede Djuhana* *Dr. Anawati*
Lecturer	*Dr. Vivi Fauzia* *Ariadne L. Juwono, M.Eng., Ph.D.* *Dr. Dede Djuhana* *Dr. Anawati*
Language	*Indonesian*
Relation to curriculum	*Elective Course*
Type of teaching, contact hours	*Flipped Class and Problem-Based Learning*
Teaching methods	*Discussion and Presentation*

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Workload (incl. contact hours, self-study hours)	*1. Lectures: 4 x 50 minutes per week* *2. Exercises and assignments: 4 x 60 = 240 minutes per week* *3. Independent study: 4 x 60 = 240 minutes per week*
Credit points	*4*
Requirements according to the examination regulations	*A student must have attended at least 75% of the lectures to sit in the exam*
Recommended prerequisties	-
Module objectives/intended learning outcomes	*Identify and study material characteristics as well as metal corrosion and material degradation*
Content	● *Mechanical Characteristics: Elastic and Plastic Deformation, Deformation due to Tensile Force, and Pressure Force* ● *Electrical and Optical Characteristics: Ohm's Law, Electronic and Ionic Conduction, Lorentz's Model, Drude's Model, and Applications of Optoelectronic Materials* ● *Thermal and Magnetic Characteristics: Magnetic Phenomenon, Magnetic Domain and Hysteresis Curve, Ordinary and Anisotropic Magnetoresistance, Thermal Conductivity, and Thermal Expansion* ● *Metal Corrosion and Degradation: Electrochemistry Reaction, Corrosion Thermodynamics, and Ceramics Degradation*

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<table>
<tr>
<td>Study and examination requirements and form of examination</td>
<td>
The final score is the composition of mid-test scores, quizzes, and assignments with the following weight:
Assignments : 41 %
Discussion : 17 %
Presentation : 33 %
Examination : 9 %
Total : 100 %

<table>
<tr><th>Mark</th><th>Grade</th></tr>
<tr><td>85—100</td><td>A</td></tr>
<tr><td>80—<85</td><td>A</td></tr>
<tr><td>75—<80</td><td>B+</td></tr>
<tr><td>70—<75</td><td>B</td></tr>
<tr><td>65—<70</td><td>B</td></tr>
<tr><td>60—<65</td><td>C+</td></tr>
<tr><td>55—<60</td><td>C</td></tr>
<tr><td>40—<55</td><td>D</td></tr>
<tr><td><40</td><td>E</td></tr>
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<tr>
<td>Media employed</td>
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</tr>
<tr>
<td>Reading List</td>
<td>
1. William D. Callister. Jr., Materials Science and Engineering, an Introduction, John Wiley and Sons, 7th & 8th edition, 2007
2. Fulay, Pradeep P.; Lee, Jung-Kun, Electronic, magnetic, and optical materials, Taylor & Francis, CRC, 2017
3. R J. Naumann, Introduction to Physics and Chemistry of Materials, Taylor & Francis, CRC, 2008,
</td>
</tr>
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MODULE HANDBOOK

Module name	*Thermodynamics and Kinetics of Material*
Module level, if applicable	*Graduate Program*
Code, if applicable	*SCMS801207*
Subtitle, if applicable	-
Courses, if applicable	-
Semester(s) in which the module is taught	*1st semester*
Person responsible for the module	*Dr. Azwar Manaf, M.Met* *Dr. Anawati, M.Sc* *Dr. Nurlely, M.Si*
Lecturer	*Dr. Azwar Manaf, M.Met* *Dr. Anawati, M.Sc* *Dr. Nurlely, M.Si*
Language	*Indonesian*
Relation to curriculum	*Compulsory Course*
Type of teaching, contact hours	*Flipped Class and Problem-Based Learning*
Teaching methods	*Online Lecture via MS Teams and Discussion*

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Workload (incl. contact hours, self-study hours)	*1. Lectures: 4 x 50 minutes per week* *2. Exercises and assignments: 4 x 60 = 240 minutes per week* *3. Independent study: 4 x 60 = 240 minutes per week*
Credit points	*4*
Requirements according to the examination regulations	*A student must have attended at least 75% of the lectures to sit in the exam*
Recommended prerequisties	-
Module objectives/intended learning outcomes	*Designing thermal treatment profiles to be applied to materials according to thermodynamic and kinetic principles appropiately*
Content	● *Laws of Thermodynamics* ● *Chemical Equilibrium on Thermodynamic Parameters* ● *Statistical Thermodynamics* ● *Applications of thermodynamics to Liquid-Solid Phase Transformation* ● *Binary System Phase Diagram* ● *Diffusion Coefficient, Error Function, and Effects of Temperature on Diffusivity* ● *Gas Characteristics* ● *Electrochemistry*

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Study and examination requirements and form of examination	*The final score is the composition of mid-test scores, quizzes, and assignments with the following weight:* *Progress Test : 80 %* *Assignments : 10 %* *Summary : 10 %* *Total : 100 %* ***Mark*** — ***Grade*** *85—100* — *A* *80—<85* — *A* *75—<80* — *B+* *70—<75* — *B* *65—<70* — *B* *60—<65* — *C+* *55—<60* — *C* *40—<55* — *D* <*40* — *E*
Media employed	-
Reading List	1. *David V. Ragone, Thermodynamics of Materials, Volume I & II, John Wiley & Sons, 1995.* 2. *David R. Gaskell, Introduction to Thermodynamics of Materials, Fourth Edition, Newyork, London: Taylor & Francis 2003.* 3. *Gaskel, Introduction to Metallurgical Thermodynamics, 3rd ed., London: Taylor & Francis, 1995* 4. *D.A. Porter and K.E. Easterling, Phase Transformations in Metals and Alloys, Van Nostrand Reinhold, New York, 1981* 5. *DeHoff, Thermodynamics in Materials Science, 2nd Ed, London: Taylor&Francis, 2006.*

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MODULE HANDBOOK

Module name	*Material's Characterization and Analysis*
Module level, if applicable	*Graduate Program*
Code, if applicable	*SCMS801208*
Subtitle, if applicable	-
Courses, if applicable	-
Semester(s) in which the module is taught	*1st Semester*
Person responsible for the module	*Dr. Budhy Kurniawan (Coordinator)* *Dr. Bambang Soegijono* *Ariadne L. Juwono, M.Eng., Ph.D.* *Dr. Cuk Imawan*
Lecturer	*Dr. Budhy Kurniawan* *Dr. Bambang Soegijono* *Ariadne L. Juwono, M.Eng., Ph.D.*
Language	*Indonesian*
Relation to curriculum	*Elective course*
Type of teaching, contact hours	*Flipped class and problem based learning*
Teaching methods	*Flipped class-room, cooperative learning, case study, and focus group discussion.*

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Workload (incl. contact hours, self-study hours)	*Lectures: 4x50 = 200 minutes per week* *Exercise and assignments: 4x60=240 minutes per week* *Independent study: 4x60=240 minutes per week*
Credit points	*4*
Requirements according to the examination regulations	*A student must have attended at least 75% of the lectures to sit in the exam*
Recommended prerequisties	-
Module objectives/intended learning outcomes	1. *Able to devise and implement experimental research methods and mathematical modeling that are responsible for academic ethics, analyze data critically and systematically and draw conclusions.* 2. *Able to identify and analyze problems in the field of materials science and be able to formulate solutions that are scientifically responsible, while still taking into account ethics, environment, and socio-economics.*
Content	● *Basic concepts of electricity and magnetism, magnetic moment, and magnetic dipole* ● *Field intensity measurement (Fluxmeter Hall effect)* ● *Diamagnetic and Paramagnetic* ● *Ferromagnetic* ● *Antiferomagenic and Ferrimagnetic* ● *Magnetic anisotropy* ● *Domain and magnetization process*

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	• *Magnetic materials in the form of particles and thin layers* • *Magnetization dynamics* • *Soft magnetic material* • *Hard magnetic material* • *Magnetic materials for recording and computers* • *Properties of magnetic materials*
Study and examination requirements and form of examination	*The final score is the composition of mid-test scores, quizzes, and assignments with the following weight:* *Test : 60 %* *Presentation : 10 %* *Discussion : 10 %* *Assignment : 20 %* *Total : 100 %* ***Mark*** — ***Grade*** *85—100* — *A* *80—<85* — *A* *75—<80* — *B+* *70—<75* — *B* *65—<70* — *B* *60—<65* — *C+* *55—<60* — *C* *40—<55* — *D* *<40* — *E*
Media employed	*EMAS*
Reading List	*Required:* • *William D. Callister. Jr., Materials Science and Engineering, an Introduction, John Wiley and Sons, 7th edition, 2007.* • *Charles-Kittel, Introduction to Solid State Physics, John Wiley and Sons, 8th-Edition, 2005.*

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	Addition: ● *CN Banwell and EM Mc Cash, Fundamentals of Molecular Spectroscopy, McGraw Hill Company, 3rd edition, 1983. (Chapter 3 and 4).* ● *B.D.Cullity and C.D. Graham, Introduction to Magnetic Materials, John Wiley and Sons, 2nd-Edition, 2009* ● *Yves Jannot and Alain Degiovanni, Thermal Properties Measurement of Materials, John Wiley and Sons, 1st-Edition, 2018* ● *Dieter K. Schroder, Semiconductor material and device characterization, John Wiley & Sons, 2006.* ● *Jai Singh, Optical properties of materials and their applications, John Wiley & Sons, 2020.*

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MODULE HANDBOOK

Module name	*Scientific Literacy*
Module level, if applicable	*Graduate Program*
Code, if applicable	*SCMS802201*
Subtitle, if applicable	-
Courses, if applicable	-
Semester(s) in which the module is taught	*1st Semester*
Person responsible for the module	*Dr. Vivi Fauzia*
Lecturer	*Dr. Vivi Fauzia*
Language	*Indonesian*
Relation to curriculum	*Compulsory courses*
Type of teaching, contact hours	*Flipped class and problem based learning*
Teaching methods	*Flipped classroom, Cooperative Learning*
Workload (incl. contact hours, self-study hours)	*Lecture: 1x50 = 50 minutes per week* *Exercise and assignments: 1x60 = 60 minutes per week*

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	Independent study: 1x60 = 60 minutes per week
Credit points	*1*
Requirements according to the examination regulations	*A student must have attended at least 75% of the lectures to sit in the exam*
Recommended prerequisties	-
Module objectives/intended learning outcomes	*Able to design and implement experimental research methods and mathematical modeling that are responsible for academic ethics, analyze data critically and systematically and draw conclusions.*
Content	*Ethics and sources of knowledge, publication ethics, classification and mapping of national and international publications, study and reference organization, identity and performance of authors, and scientific writing techniques.*
Study and examination requirements and form of examination	*The final score is the composition of mid-test scores, quizzes, and assignments with the following weight:* *Paper and presentation : 100 %* *Total : 100 %* ***Mark*** — ***Grade*** *85—100* — *A* *80—<85* — *A* *75—<80* — *B+* *70—<75* — *B* *65—<70* — *B* *60—<65* — *C+*

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	55—<60 *C* *40—<55* *D* *<40* *E*
Media employed	*EMAS*
Reading List	● *On Being a Scientist: A Guide to Responsible Conduct in Research, Third Edition, National Academy of Sciences, USA, 2009.* ● *Pedoman Publikasi Ilmiah, Lukman, Suminar Setiadi Ahmadi, Wasmen Manalu, Deden Sumirat Hidayat, Kementerian Riset, Teknologi, dan Pendidikan Tinggi Direktorat Jenderal Penguatan Riset dan Pengembangan, 2017.* ● *Related digital library resources.*

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MODULE HANDBOOK

Module name	*Research Result Exam*
Module level, if applicable	*Graduate Program*
Code, if applicable	*SCMS802202*
Subtitle, if applicable	-
Courses, if applicable	-
Semester(s) in which the module is taught	*2nd Semester*
Person responsible for the module	*Special course*
Lecturer	*Special course*
Language	*Indonesian*
Relation to curriculum	*Compulsory course*
Type of teaching, contact hours	*Flipped class and problem based learning*
Teaching methods	*Flipped class and problem based learning*
Workload (incl. contact hours, self-study hours)	*6x170 minutes = 1020 minutes per week*
Credit points	*6*
Requirements according to the examination regulations	*A student must have attended at least 75% of the lectures to sit in the exam*
Recommended prerequisties	*Research Proposal*

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Module objectives/intended learning outcomes	1. *Able to select, organize and critically evaluate the latest sources of scientific information.* 2. *Able to create and design materials, processing methods, new material analysis techniques or material product innovations with the correct scientific method.* 3. *Able to draw relationships between structure, properties, processing and performance of material systems.* 4. *Able to carry out various fabrication techniques and material characterization or material modelling.* 5. *Able to make written reports and communicate effectively orally in scientific groups, industry and the general public.* 6. *Able to detailing general and specific problems in the field of materials science.* 7. *Able to make a complete work plan and able to evaluate data from material characterization results.* 8. *Able to apply the main rules of other disciplines.* 9. *Able to apply academic ethics, environmental safety and socio-economic impact.* 10. *Able to function as an effective team member together to create a collaborative and inclusive environment in achieving common goals.* 11. *Able to show increased learning capacity independently.* 12. *Able to process research data in order to ensure validity and prevent plagiarism.*

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<table>
<tr><td>Content</td><td>

- *The Systematics and Format of Scientific Writing*
- *Topics and Thesis in Scientific Research*
- *Research Background, Objectives and Research Problems*
- *Literature review, writing, citations and preceding research*
- *Research Methodology: Selection of Research Sites*
- *Research Methodology: Determination of Respondents*
- *Research Methodology: Research Sampling*
- *Research Methodology : Processing Techniques*
- *Research Methodology : Analysis Techniques*

</td></tr>
<tr><td>Study and examination requirements and form of examination</td><td>

The final score is the composition of mid-test scores, quizzes, and assignments with the following weight:

Assignment : 100 %
Total : 100 %

Mark	***Grade***
85—100	*A*
80—<85	*A*
75—<80	*B+*
70—<75	*B*
65—<70	*B*
60—<65	*C+*
55—<60	*C*
40—<55	*D*
<40	*E*

</td></tr>
<tr><td>Media employed</td><td>*Microsoft Teams*</td></tr>
</table>

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Reading List	• *On Being a Scientist: A Guide to Responsible Conduct in Research, Third Edition, National Academy of Sciences, USA, 2009.* • *Pedoman Publikasi Ilmiah, Lukman, Suminar Setiadi Ahmadi, Wasmen Manalu, Deden Sumirat Hidayat, Kementerian Riset, Teknologi, dan Pendidikan Tinggi Direktorat Jenderal Penguatan Riset dan Pengembangan, 2017.* • *Related digital library resources.*

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MODULE HANDBOOK

Module name	*Thesis*
Module level, if applicable	*Graduate Program*
Code, if applicable	*SCMS802203*
Subtitle, if applicable	-
Courses, if applicable	-
Semester(s) in which the module is taught	*4th semester*
Person responsible for the module	*Team*
Lecturer	*Thesis Advisor*
Language	*Indonesian*
Relation to curriculum	*Compulsory Course*
Type of teaching, contact hours	*Independent study*
Teaching methods	*Interactive Lecture and Independent Learning*
Workload (incl. contact hours, self-study hours)	*8x170=1360 minutes per week*

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Credit points	*8*
Requirements according to the examination regulations	-
Recommended prerequisties	-
Module objectives/intended learning outcomes	1. *Select, organize, and critically evaluate most recent scientific source* 2. *Create and design materials, processing method, material analysis techniques or material product innovation with appropriate scientific method* 3. *Correlate the relation between structure, characteristics, processing, and material system performance* 4. *Conduct various fabrication techniques and material characterization or material modelling* 5. *Write a report and communicate effectively in a scientific group, industry, and public* 6. *Specify general and specific problems in the field of Material Science* 7. *Create a complete work plan and evaluate material characterization data* 8. *Apply the main fundamentals of other disciplines* 9. *Apply academic ethics, environmental safety, and socio-economic impacts* 10. *Work effectively in a team to create a collaborative and inclusive environment to obtain common goals* 11. *Demonstrate an increasing capacity in independent learning* 12. *Process research data in order to guarantee validity and prevent plagiarism*

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Content	• *Scientific Writing Format and Systematics* • *Topics dan Thesis in Scientific Research* • *Background, Objectives, and Problems in Research* • *Literature Review, Writing, Citation, and Previous Research* • *Research Methodology- Research Site Selection* • *Research Methodology- Respondent Determination* • *Research Methodology- Research Sampling* • *Research Methodology- Processing Techniques* • *Research Methodology- Analyzing Techniques*
Study and examination requirements and form of examination	*The final score is the composition of mid-test scores, quizzes, and assignments with the following weight:* *Assignments : 100 %* *Total : 100 %* ***Mark*** — ***Grade*** *85—100* — *A* *80—<85* — *A* *75—<80* — *B+* *70—<75* — *B* *65—<70* — *B* *60—<65* — *C+* *55—<60* — *C* *40—<55* — *D* <*40* — *E*
Media employed	

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Reading List	1. *On Being a Scientist: A Guide to Responsible Conduct in Research, Third Edition, National Academy of Sciences, USA, 2009*

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MODULE HANDBOOK

Module name	*Advanced Laboratory Work*
Module level, if applicable	*Graduate Program*
Code, if applicable	*SCMS802204*
Subtitle, if applicable	-
Courses, if applicable	-
Semester(s) in which the module is taught	*2nd semester*
Person responsible for the module	*Prof. Dr. Azwar Manaf* *Dr. Wisnu Ari Adi*
Lecturer	*Prof. Dr. Azwar Manaf*
Language	*Indonesian*
Relation to curriculum	*Compulsory Course*
Type of teaching, contact hours	*Flipped Class and Problem-Based Learning*
Teaching methods	*Interactive Lecture*
Workload (incl. contact hours, self-study hours)	*1. Lectures: 3 x 50 minutes per week* *2. Exercises and assignments: 3 x 60 = 180 minutes per week*

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	3. Independent study: 3 x 60 = 180 minutes per week
Credit points	*3*
Requirements according to the examination regulations	*A student must have attended at least 75% of the lectures to sit in the exam*
Recommended prerequisties	-
Module objectives/intended learning outcomes	*Designing laboratory work to improve knowledge and analytical skills and using GSAS material analysis techniques for qualitative and quantitative analysis of material phases*
Content	● *Material Structure* ● *Material Crystallography* ● *Material Structure Analyzer Device* ● *Material Characterization with XRF and XRD* ● *Material Characterization Methods and Analytical Instruments: VSM, SQUID, Four point Probe, LCR Meter, VNA* ● *Material Characterization Methods and Analytical Instruments: Calorimeter (TGA, DTA, DSC)*

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<table>
<tr>
<td>Study and examination requirements and form of examination</td>
<td>
The final score is the composition of mid-test scores, quizzes, and assignments with the following weight:
Assignmentes : 20 %
Presentation : 20 %
Mid-test : 30 %
Final Test : 30 %
Total : 100 %

<table>
<tr><th>Mark</th><th>Grade</th></tr>
<tr><td>85—100</td><td>A</td></tr>
<tr><td>80—<85</td><td>A</td></tr>
<tr><td>75—<80</td><td>B+</td></tr>
<tr><td>70—<75</td><td>B</td></tr>
<tr><td>65—<70</td><td>B</td></tr>
<tr><td>60—<65</td><td>C+</td></tr>
<tr><td>55—<60</td><td>C</td></tr>
<tr><td>40—<55</td><td>D</td></tr>
<tr><td><40</td><td>E</td></tr>
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</tr>
<tr>
<td>Media employed</td>
<td>-</td>
</tr>
<tr>
<td>Reading List</td>
<td>
1. Cullity, B. D., 1978, Elements of X-Ray Diffraction, Addison-Wesley, Reading, Massachusset
2. Izumi, F., 1996. A Rietveld-Refinement Program RIETAN-94 for Angle-Dispersive X-Ray and Neutron Powder Diffraction", National Institute for Research in Inorganic Materials 1-1 Namiki, Tsukuba, Ibaraki 305, Japan
3. L. B. McCusker et al., Rietveld Refinement Guidelines, J. Appl. Cryst., **32**, 36-50, 1999
4. Suryanarayana, G. Norton, X-ray diffraction a practical approach, Plenum press, New York 1998.
5. H.H. Willard, L.I. Merrett Jr., J.A. Dean dan F.A. Settle Jr., Instrumental Methods of Analysis, Wadsworth Publishing Company, Belmont, 1988
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</table>

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	6. *Robert D. Braun, Introduction to Instrumental Analysis, McGraw-Hill Editions, 1987*

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MODULE HANDBOOK

Module name	*Magnetic Material Physics*
Module level, if applicable	*Graduate Program*
Code, if applicable	*SCMS802205*
Subtitle, if applicable	-
Courses, if applicable	-
Semester(s) in which the module is taught	*2nd Semester*
Person responsible for the module	*Dr. Budhy Kurniawan* *Dede Djuhana, Ph.D* *Prof. Dr. Azwar Manaf, M.Met*
Lecturer	*Dr. Budhy Kurniawan* *Dede Djuhana, Ph.D* *Prof. Dr. Azwar Manaf, M.Met*
Language	*Indonesian*
Relation to curriculum	*Elective course*
Type of teaching, contact hours	*Flipped class and problem based learning*
Teaching methods	*Interactive lecture and discussion*

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Workload (incl. contact hours, self-study hours)	*Lectures: 3x50 = 150 minutes per week* *Exercise and assignments: 3x60 = 180 minutes per week* *Independent study: 3x60 = 180 minutes per week*
Credit points	*3*
Requirements according to the examination regulations	*A student must have attended at least 75% of the lectures to sit in the exam*
Recommended prerequisties	-
Module objectives/intended learning outcomes	1. *Able to identify and analyze problems in the field of materials science and be able to formulate solutions that are scientifically responsible while taking into account ethics, environment and socio-economics* 2. *Identifying and analyzing magnetic materials in daily applications, magnetic measurements in closed loop, magnetic types, properties of magnetic materials, and the application of soft and hard hard magnetic.*
Content	● *Basic concepts of electricity and magnetism, magnetic moment, and magnetic dipole* ● *Field intensity measurement (Fluxmeter Hall effect)* ● *Diamagnetic and Paramagnetic* ● *Ferromagnetic* ● *Antiferomagenic and Ferrimagnetic* ● *Magnetic anisotropy* ● *Domain and magnetization process* ● *Magnetic materials in the form of particles*

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and thin layers

- *Magnetization dynamics*
- *Soft magnetic material*
- *Hard magnetic material*
- *Magnetic materials for recording and computers*
- *Properties of magnetic materials*

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<tr><td>Study and examination requirements and form of examination</td><td>

The final score is the composition of mid-test scores, quizzes, and assignments with the following weight:

Mid-test	*: 40 %*
Final test	*: 40 %*
Assignment/exercise	*: 20 %*
Total	*: 100 %*

Mark	***Grade***
85—100	*A*
80—<85	*A*
75—<80	*B+*
70—<75	*B*
65—<70	*B*
60—<65	*C+*
55—<60	*C*
40—<55	*D*
<40	*E*

</td></tr>
<tr><td>Media employed</td><td>*EMAS/EMAS2*</td></tr>
<tr><td>Reading List</td><td>

- *B. D. Cullity dan C. D. Graham, Introduction Magnetic Material, 2nd Edition, John, Wiley & Sons, Inc. Publication, 2009.*
- *J. M. D. Coey, Magnetism and Magnetic Materials, Cambridge Univ. Press, 2009*
- *S. Chikazumi, Physics of Ferromagnetism, 2nd Edition, Oxford Science Publications, 1997.*
- *C. Kittel, Introduction to Solid State Physics, 8th Edition, John Wiley & Sons, 2005.*

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MODULE HANDBOOK

Module name	*Permanent Magnet*
Module level, if applicable	*Postgraduate program*
Code, if applicable	*SCMS802206*
Subtitle, if applicable	-
Courses, if applicable	-
Semester(s) in which the module is taught	*2nd Semester*
Person responsible for the module	*Prof. Azwar Manaf, M.Met* *Dede Djuhana, Ph.D*
Lecturer	*Prof. Azwar Manaf, M.Met* *Dede Djuhana, Ph.D*
Language	*Indonesia*
Relation to curriculum	*Compulsory course*
Type of teaching, contact hours	
Teaching methods	*Lecture and group discussion*
Workload (incl. contact hours, self-study hours)	*Lectures: 3x50=150 minutes per week* *Exercise and assignments: 3x60=180 minutes per week* *Independent study: 3x60=180 minutes per week*
Credit points	*3 credit points*

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Requirements according to the examination regulations	*A student must have attended at least 75% of the lectures to sit in the exam*
Recommended prerequisties	-
Module objectives/intended learning	*After receiving this course, students are expected to be able to analyze magnetic phenomenon, changes in magnetic structure, and various phases of permanent magnet*
Content	● *Permanent magnet processing and characteristics* ● *Classifications and magnetic phenomenon* ● *Magnetic anisotropy* ● *Magnetic domain and magnetization process* ● *The definitions and characteristics of permanent magnet* ● *Stoner-Wohlfarth theory* ● *S-W theory in hysteresis computation* ● *Processing technology I and II* ● *Permanent magnet lab preparation and demonstration* ● *Methods of magnetism testing* ● *Nd-Fe-B permanent magnet* ● *1st micromagnetic model in magnetization computation* ● *2nd micromagnetic model in magnetization computation*

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<table>
<tr>
<td>Study and examination requirements and form of examination</td>
<td>
The final score is the composition of mid-test scores, quizzes, and assignments with the following weight:
Assignments : 20 %
Mid-test : 30%
Final-test : 50%
Total : 100 %

<table>
<tr><th>Mark</th><th>Grade</th></tr>
<tr><td>85—100</td><td>A</td></tr>
<tr><td>80—<85</td><td>A</td></tr>
<tr><td>75—<80</td><td>B+</td></tr>
<tr><td>70—<75</td><td>B</td></tr>
<tr><td>65—<70</td><td>B</td></tr>
<tr><td>60—<65</td><td>C+</td></tr>
<tr><td>55—<60</td><td>C</td></tr>
<tr><td>40—<55</td><td>D</td></tr>
<tr><td><40</td><td>E</td></tr>
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<tr>
<td>Media employed</td>
<td>Powerpoint presentation (PPT), Microsoft Teams, e-Learning Management System (EMAS)</td>
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<td>Reading List</td>
<td>
1. K.H.J. Buschow and F.R. De Boer, Physics Magnetism and Magnetic Materials, ©2004 Kluwer Academic Publishers, New York, Boston, Dordrecht, London, Moscow (eBook ISBN: 0-306-48408-0; Print ISBN: 0-306-47421-2)

2. B.D. Cullity, Introduction to Magnetic Materials, Addison-Wesley Series in Metallurgy and Materials (ISBN 0-201-01218-9)

3. Malcolm McCaig, Alan G Clegg, Permanent magnets in theory and practice, Pentech Press, (ISBN-13: 978-0727316042)

4. C. Suryanarayana, Mechanical Alloying and Milling, 2004, Marcel Dekker, USA (ISBN: 0-8247-4103-x)

5. Scientific articles related.
</td>
</tr>
</table>

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Master Program of Materials Science

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MODULE HANDBOOK

Module name	*Applied Ceramics*
Module level, if applicable	*Graduate Program*
Code, if applicable	*SCMS802207*
Subtitle, if applicable	-
Courses, if applicable	-
Semester(s) in which the module is taught	*2nd semester*
Person responsible for the module	*Dr. Budhy Kurniawan*
Lecturer	*Dr. Budhy Kurniawan*
Language	*Indonesian*
Relation to curriculum	*Elective Course*
Type of teaching, contact hours	*Flipped Class and Problem-Based Learning*
Teaching methods	*Interactive Lecture and Discussion*
Workload (incl. contact hours, self-study hours)	*1. Lectures: 2 x 50 minutes per week* *2. Exercises and assignments: 2 x 60 = 120 minutes per week* *3. Independent study: 2 x 60 = 120 minutes per week*

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Credit points	*2*
Requirements according to the examination regulations	*A student must have attended at least 75% of the lectures to sit in the exam*
Recommended prerequisties	-
Module objectives/intended learning outcomes	*Analyze materials, properties, classification of ceramic materials in various applications*
Content	1. *Introduction, Classification, and Application of Ceramics* 2. *Crystal Structures of Principle Applied Ceramics* 3. *Oxide Ceramics* 4. *Nitride Ceramics* 5. *Boride and Carbide Ceramics* 6. *Glass-Ceramics* 7. *High Temperature Engineering Ceramics* 8. *Ceramic Superionic Conductors* 9. *Ferroelectric Ceramics* 10. *Ferrimagnetic Ceramics* 11. *Semiconducting Polycrystalline Ceramics* 12. *Oxide Superconductors*
Study and examination requirements and form of examination	*The final score is the composition of mid-test scores, quizzes, and assignments with the following weight:* *Assignments : 20 %* *Presentation : 20 %* *Mid-test : 30 %* *Final Test : 30 %* *Total : 100 %* ***Mark*** — ***Grade*** *85—100* — *A* *80—<85* — *A*

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	75—<80	*B+*
	70—<75	*B*
	65—<70	*B*
	60—<65	*C+*
	55—<60	*C*
	40—<55	*D*
	<40	*E*
Media employed	-	
Reading List	1. *Charles A. Harper , Handbook of ceramics, glasses, and diamonds, , Copyright © 2001 by The McGraw-Hill Companies* 2. *Narottam P. Ban sal J. P. Singh . Processing and Properties of Advanced Ceramics and Composites Copyright © 2009 by The American Ceramic Society. All rights reserved* 3. *J. M. Xue, Z. H. Zhou, J. Wang , Nanocrystalline Ceramics by Mechanical Activation, Encyclopedia of Nanoscience and Nanotechnology Edited by H. S. Nalwa Volume 6: Pages (417–433)*	

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MODULE HANDBOOK

Module name	*Polymer Material*
Module level, if applicable	*Graduate program*
Code, if applicable	*SCMS802208*
Subtitle, if applicable	-
Courses, if applicable	-
Semester(s) in which the module is taught	*2nd semester*
Person responsible for the module	*Ariadne L. Juwono, M.Eng., Ph.D.* *Dr. rer. nat. Noverra M. Nizardo*
Lecturer	*Ariadne L. Juwono, M.Eng., Ph.D.* *Dr. rer. nat. Noverra M. Nizardo*
Language	*Indonesian*
Relation to curriculum	*Elective Course*
Type of teaching, contact hours	*Flipped Class and Problem-Based Learning*
Teaching methods	*Cooperative Learning and Study Case*

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Workload (incl. contact hours, self-study hours)	*Lectures: 3x50=150 minutes per week* *Exercise and assignments: 3x60=180 minutes per week* *Independent study: 3x60=180 minutes per week*
Credit points	*3*
Requirements according to the examination regulations	*A student must have attended at least 75% of the lectures to sit in the exam*
Recommended prerequisties	*Material Structure, Material Properties and Performance, Material Thermodynamics and Kinetics, Material Characterization and Analysis*
Module objectives/intended learning outcomes	*Able to identify various polymerization and its characteristics as well as examine its rheology, mechanical properties, fabrication and applications*
Content	● *Polymer classification* ● *Step Growth Polymerization* ● *Chain Growth Polymerization* ● *Conductive polymer synthesis* ● *Metal catalyst polymerization & metathesis* ● *Polymer characterization (degradation, amorphous, and crystallinity)* ● *Rheology* ● *Mechanical properties of polymer*

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<table>
<tr><td></td><td>

- *Relation between structure and properties of polymer*
- *Polymer fabrication*
- *Polymer application*
- *Relation of polymer and composite*

</td></tr>
<tr><td>Study and examination requirements and form of examination</td><td>

The final score is the composition of mid-test scores, quizzes, and assignments with the following weight:

Assignment : 20 %
Case study : 5%
Group discussion : 5 %
Mid-test : 30 %
Final test : 30 %
Total : 100 %

Mark	***Grade***
85—100	*A*
80—<85	*A*
75—<80	*B+*
70—<75	*B*
65—<70	*B*
60—<65	*C+*
55—<60	*C*
40—<55	*D*
<40	*E*

</td></tr>
<tr><td>Media employed</td><td>*E-learning Management System (EMAS), Microsoft Teams*</td></tr>
<tr><td>Reading List</td><td>

1. *Malcolm P. Stevens, Polymer Chemistry: An Introduction, USA: Oxford University Press*
2. *George Odian, Principles of Polymerization, USA: John Wiley & Sons Inc.*
3. *Krzysztof Matyjaszewski, Wade Braunecker. 2007. Controlled/ Living Radical Polymerization. Progress Polymer Science. 32*
4. *I.M. Ward, J. Sweeney, Mechanical Properties of*

</td></tr>
</table>

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	Solid Polymers: Third Edition, John Wiley & Sons, 2012 5. *Fred W. Billmeyer, Jr., Textbook of polymer science, 3rd ed., Wiley- Interscience, New York, 1984* 6. *Ashby MF, Jones DRH. Engineering Materials 2. Pergamon. chapters 21- 24* 7. *Brent Strong. Plastics - Materials and Processing*

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MODULE HANDBOOK

Module name	*Biomedical Composites*
Module level, if applicable	*Graduate Program*
Code, if applicable	*SCMS801205*
Subtitle, if applicable	-
Courses, if applicable	-
Semester(s) in which the module is taught	*2nd Semester*
Person responsible for the module	*Dr. Bambang Soegijono* *Dr. Nurlely* *Ariadne L. Juwono, M.Eng., Ph.D.* *Dr. Anawati*
Lecturer	*Dr. Bambang Soegijono* *Dr. Nurlely* *Ariadne L. Juwono, M.Eng., Ph.D.* *Dr. Anawati*
Language	*Indonesian*
Relation to curriculum	*Elective course*
Type of teaching, contact hours	*Flipped class and problem based learning*
Teaching methods	*Flipped class-room, cooperative learning, and case study.*

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Workload (incl. contact hours, self-study hours)	*Lecture: 4x50 = 200 minutes per week* *Exercise and assignments: 4x60 = 240 minutes per week* *Independent study: 4x60 = 240 minutes per week*
Credit points	*4*
Requirements according to the examination regulations	*A student must have attended at least 75% of the lectures to sit in the exam*
Recommended prerequisties	*General Materials Science*
Module objectives/intended learning outcomes	*Able to analyze in an integrated manner regarding the structure, properties, processing, and performance of material systems critically in order to keep up with the latest developments in materials science and technology.*
Content	• *Electronic configuration in atoms and molecules, chemical bonds between atoms (metallic, covalent, ionic and hydrogen), near and far range regularities, crystallographic fundamentals, material impurities, dislocations, and defects.* • *Ceramic materials: structure and mechanical properties, various types and applications of ceramics, ceramic fabrication.* • *Line defect (dislocation) and plastic deformation (permanent): description of line defects/dislocations, characteristics of dislocations, slip system, slip on single crystal, plastic deformation, and poly-crystalline material.*

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	• *Reinforcement Mechanism in Metals: Increased strength through reduction of grain size, strengthening by means of a solid solution of substitutional atoms, and hardening strain (interaction between dislocation and strain).* • *Phenomenon of Recovery, Recrystallization and Grain Growth: explanation of recovery phenomena, changes in the microstructure and mechanical characteristics of the recrystallization process, and the phenomenon of grain size growth.* • *Phase Diagram: explanation of terminology definitions regarding: material systems; solubility limit; phase; solidus; liquidus; solvus; microstructure; phase equilibrium; components, single component phase diagrams.* • *Two-component (binary) phase diagram: Explanation of binary phase diagrams, diagrams of isomorphous alloys, microstructure development of isomorphous alloys systems, mechanical properties of isomorphous alloys, phase diagrams have eutectic; eutectic microstructure; intermediate phase; eutectoid and peritectic reactions, introduction to phase diagrams of ternary systems.* • *Types of metal alloys: Ferrous and non-ferrous based alloys; steel or steel; cast iron (its microstructure and mechanical characteristics); recognize various types of non-ferrous based alloys (physical and mechanical properties); use of non-ferrous alloys.*

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	• *Iron based alloy fabrication: metal forming processes through plastic deformation such as forging, rolling, extrusion and drawing; explanation of casting process.* • *Heat treatment process: explanation of the purpose of heat treatment processes such as annealing, stress relief annealing, normalizing, sphroidizing; heat treatment to increase the hardness of metal alloys; construct heat treatment profiles for specific purposes related to phase diagrams; heat treatment to increase hardness through precipitation hardening or plastic deformation mechanism.* • *Polymer materials: hydrocarbon molecules, various types of polymers; polymer mechanical properties, polymer deformation and strengthening mechanisms, thermal properties.* • *Composite materials: particle-reinforced composites, fiber-reinforced composites, structural composites.*
Study and examination requirements and form of examination	*The final score is the composition of mid-test scores, quizzes, and assignments with the following weight:* *Test : 75 %* *Presentation : 5 %* *Quiz : 5 %* *Discussion : 5 %* *Assignment : 5 %* *Total : 100 %* ***Mark*** — ***Grade*** *85—100* — *A* *80—<85* — *A* *75—<80* — *B+*

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	70—<75	*B*
	65—<70	*B*
	60—<65	*C+*
	55—<60	*C*
	40—<55	*D*
	<40	*E*
Media employed	*EMAS*	
Reading List	*Required:* ● *William D. Callister. Jr., Materials Science and Engineering, an Introduction, John Wiley and Sons, 7th Edition, 2007.* *Addition:* ● *Charles-Kittel, Introduction to Solid State Physics, John Wiley and Sons, 8th-Edition, 2005.* ● *Van Vlack, Materials Science for Engineers, Addison Wesley.* ● *J. F. Nye, Physical Properties of Crystals, Oxford at the Clarendon Press.* ● *Alan Cottrell, An Introduction to Metallurgy, Edward Arnold Ltd, Second Edition, 1975.*	

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MODULE HANDBOOK

Module name	*Nanomaterial Properties and Applications*
Module level, if applicable	*Graduate program*
Code, if applicable	*SCMS802210*
Subtitle, if applicable	-
Courses, if applicable	-
Semester(s) in which the module is taught	*2nd semester*
Person responsible for the module	*Ariadne L. Juwono, M.Eng., Ph.D.* *Dr. Vivi Fauzia*
Lecturer	*Ariadne L. Juwono, M.Eng., Ph.D.* *Dr. Vivi Fauzia*
Language	*Indonesian*
Relation to curriculum	*Elective Course*
Type of teaching, contact hours	*Flipped Class and Problem-Based Learning*
Teaching methods	*Lecture and discussion*
Workload (incl. contact hours, self-study hours)	*Lectures: 3x50=150 minutes per week* *Exercise and assignments: 3x60=180 minutes per week*

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	Independent study: 3x60=180 minutes per week
Credit points	*3*
Requirements according to the examination regulations	*A student must have attended at least 75% of the lectures to sit in the exam*
Recommended prerequisites	-
Module objectives/intended learning outcomes	*Identify unique properties of nanomaterial as well as differentiate various types of nanomaterials and their characteristics & applications correctly*
Content	● *Introduction* ● *Unique physical and chemical properties* ● *Self-Assembled and supramolecular nanomaterials* ● *Semiconductor nanoparticles* ● *Metal oxide nanoparticles* ● *Nobel metal nanoparticles* ● *Optical properties of composite nanostructure* ● *Carbon-based nanomaterials* ● *Nanocomposite nanoparticles* ● *Nanoparticle interactions with biomolecules and*

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Study and examination requirements and form of examination	*The final score is the composition of mid-test scores, quizzes, and assignments with the following weight:* *Wiki Written Assignment : 30 %* *Paper : 40 %* *Presentation : 20 %* *Discussion : 10 %* *Total : 100 %* ***Mark*** — ***Grade*** *85—100* — *A* *80—<85* — *A* *75—<80* — *B+* *70—<75* — *B* *65—<70* — *B* *60—<65* — *C+* *55—<60* — *C* *40—<55* — *D* <*40* — *E*
Media employed	*E-learning Management System (EMAS), Microsoft Teams*
Reading List	1. *Narendra. Kumar, Essentials in nanoscience and nanotechnology, Wiley, 2016* 2. *Edelstein, Nanomaterials,: Synthesis, Properties and Application, IPP, 1996* 3. *R. Jelinek, Nanoparticles, Gruyter 2015* 4. *Jin Jzhong, Zang, Optical Properties and Spectroscopy of Nanomaterials, World Scientific, 2005*

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MODULE HANDBOOK

Module name	*Advanced Composite Material*
Module level, if applicable	*Graduate Program*
Code, if applicable	*SCMS802211*
Subtitle, if applicable	-
Courses, if applicable	-
Semester(s) in which the module is taught	*2nd Semester*
Person responsible for the module	*Ariadne L. Juwono, M.Eng., Ph.D*
Lecturer	*Ariadne L. Juwono, M.Eng., Ph.D*
Language	*Indonesian*
Relation to curriculum	*Elective course*
Type of teaching, contact hours	*Flipped class and problem based learning*
Teaching methods	*Flipped classroom, Cooperative Learning*
Workload (incl. contact hours, self-study hours)	*Lectures: 3x50 = 150 minutes per week* *Exercise and assignments: 3x60 = 180 minutes per week*

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	Independent study: 3x60 = 180 minutes per week
Credit points	*3*
Requirements according to the examination regulations	*A student must have attended at least 75% of the lectures to sit in the exam*
Recommended prerequisties	*Structure, Properties, and Performance of Materials*
Module objectives/intended learning outcomes	1. *Able to identify and analyze problems in the field of materials science and be able to formulate solutions that are scientifically responsible, while taking into account ethics, environment, and socio-economics.* 2. *Able to apply material science concepts in solving complex material industrial application problems through a multidisciplinary approach that pays attention to safety, social and ethical aspects.*
Content	● *Preliminary* ● *The basic concept of composite materials* ● *Particle-reinforced composites and fiber-reinforced composites* ● *Composite and nanocomposite fabrication techniques* ● *Introduction to laminate and laminate theory* ● *Stress–strain relationship: modulus, symmetry properties, isotropic & orthotropic, isotropic & orthotropic* ● *Mohr's circle and its application*

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<table>
<tr>
<td>Study and examination requirements and form of examination</td>
<td>
The final score is the composition of mid-test scores, quizzes, and assignments with the following weight:
Assignment : 20 %
Presentation : 10 %
Discussion : 10 %
Mid-test : 30 %
Final test : 30 %
Total : 100 %

<table>
<tr><th>Mark</th><th>Grade</th></tr>
<tr><td>85—100</td><td>A</td></tr>
<tr><td>80—<85</td><td>A</td></tr>
<tr><td>75—<80</td><td>B+</td></tr>
<tr><td>70—<75</td><td>B</td></tr>
<tr><td>65—<70</td><td>B</td></tr>
<tr><td>60—<65</td><td>C+</td></tr>
<tr><td>55—<60</td><td>C</td></tr>
<tr><td>40—<55</td><td>D</td></tr>
<tr><td><40</td><td>E</td></tr>
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<tr>
<td>Media employed</td>
<td>EMAS</td>
</tr>
<tr>
<td>Reading List</td>
<td>

R. F. Gibson, Principle of Composite Material Mechanics, McGraw-Hill Book Co., Int. Ed, 1994, Chapter 1-4.
• D. Hull, An Introduction to Composite Materials, Cambridge University Press, 6th. Ed., 1992, Chapter 1-6.
• Callister Jr, W.D., Materials Science and Engineering: An Introduction, 7th. Ed., John Wiley & Sons. Inc., 2007, Chapter 16.
Scientific publications regarding composites.

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MODULE HANDBOOK

Module name	*Corrosion and Material Protection*
Module level, if applicable	*Graduate Program*
Code, if applicable	*SCMS801107*
Subtitle, if applicable	-
Courses, if applicable	-
Semester(s) in which the module is taught	*3rd Semester*
Person responsible for the module	*Anawati, Ph.D.*
Lecturer	*Anawati, Ph.D.*
Language	*Indonesian*
Relation to curriculum	*Elective course*
Type of teaching, contact hours	*Flipped class and problem based learning*
Teaching methods	*Question-based learning, case-based learning*
Workload (incl. contact hours, self-study hours)	*Lectures: 3x50 = 150 minutes per week* *Exercise and assignments: 3x60 = 180 minutes per week*

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	Independent study: 3x60 = 180 minutes per week
Credit points	*3*
Requirements according to the examination regulations	*A student must have attended at least 75% of the lectures to sit in the exam*
Recommended prerequisties	*General Material Science*
Module objectives/intended learning outcomes	1. *Able to recommend appropriate corrosion control methods.* 2. *Determine the principles and factors that cause corrosion, apply the principles of electrochemical corrosion, do the corrosion thermodynamic calculations, create a graph of Pourbaix diagram, pick out the correct corrosion rate prediction method, analyze the principle of reaction kinetics, illustrate the corrosion mechanism for each corrosion type, designing corrosion monitoring techniques, and designing appropriate corrosion protection methods.*
Content	1. *The principle of corrosion* 2. *Electrochemical aspects* 3. *Corrosion thermodynamics* 4. *Pourbaix Diagram* 5. *Corrosion rate determination method* 6. *Corrosion kinetics* 7. *Corrosion mechanism*

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<table>
<tr><td></td><td>8. Corrosion monitoring method
9. Corrosion protection method</td></tr>
<tr><td>Study and examination requirements and form of examination</td><td>The final score is the composition of mid-test scores, quizzes, and assignments with the following weight:
Individual assignment : 10 %
Group assignment : 10 %
Discussion : 10 %
Presentation : 10 %
Mid-test : 30 %
Final test : 30 %
Total : 100 %

Mark — Grade
85—100 — A
80—<85 — A
75—<80 — B+
70—<75 — B
65—<70 — B
60—<65 — C+
55—<60 — C
40—<55 — D
<40 — E</td></tr>
<tr><td>Media employed</td><td>EMAS</td></tr>
<tr><td>Reading List</td><td>● Fontana, Mars. 1986. Corrosion Engineering, Mac Graw Hill, Singapore.
● Landolt, Dieter. 2007. Corrosion and Surface Chemistry of Metals, EPFL Press, Italy.
● Jones, Denny. 1992. Principles and Prevention of Corrosion, Macmallian Publishing Company, New York.</td></tr>
</table>

	● *Newman, John. 1991. Electrochemical System, 2nd Prentice Hall Int. Eds., Singapore.* ● *Callister, William. Materials Science and Engineering: An Introduction, 7th Edition, USA, John Wiley & Sons, Inc., 2007.*

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MODULE HANDBOOK

Module name	*High Temperature Metal Oxidation*
Module level, if applicable	*Graduate Program*
Code, if applicable	*SCMS802213*
Subtitle, if applicable	-
Courses, if applicable	-
Semester(s) in which the module is taught	*2nd semester*
Person responsible for the module	*Anawati, Ph.D*
Lecturer	*Anawati, Ph.D*
Language	*Indonesian*
Relation to curriculum	*Elective Course*
Type of teaching, contact hours	*Flipped Class and Problem-Based Learning*
Teaching methods	*150 Minutes Synchronous Lecture*
Workload (incl. contact hours, self-study hours)	*1. Lectures: 3 x 50 minutes per week* *2. Exercises and assignments: 3 x 60 = 180 minutes per week* *3. Independent study: 3 x 60 = 180 minutes per week*

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Credit points	*3*
Requirements according to the examination regulations	*A student must have attended at least 75% of the lectures to sit in the exam*
Recommended prerequisties	-
Module objectives/intended learning outcomes	*Examine the mechanism of metal oxidation reaction on high temperature and predict the oxidation product*
Content	• *Oxidation Thermodynamics* • *Pure Metal Oxidation* • *Oxidation in Alloys: Single-phase Scale* • *Internal Oxidation in Alloys* • *Internal Oxidation under Corrosion Layer Surface* • *Water Vapor Effect on the Oxidation Process* • *Anodization* • *Electrochemistry Plasma Electrolysis* • *Valve Metal* • *Pourbaix Diagram* • *Voltage versus Time Diagram Analysis* • *Formation Energy* • *Plasma Physics* • *Process Parameter Effects* • *In-Situ Study of Electrolysis Plasma Process* • *Morphology of Electrolysis Plasma Crust Layer* • *Kinetics of Electrolysis Plasma Reaction* • *Dielectric Properties of Electrolysis Plasma Crust* • *Mechanical Properties of Electrolysis Plasma Crust* • *Corrosion Properties of Electrolysis Plasma*

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	Crust
Study and examination requirements and form of examination	*The final score is the composition of mid-test scores, quizzes, and assignments with the following weight:* *Individual assignment : 10 %* *Group assignment : 10 %* *Discussion : 10 %* *Presentation : 10 %* *Mid-test : 30 %* *Final test : 30 %* *Total : 100 %* ***Mark** — **Grade*** *85—100 — A* *80—<85 — A* *75—<80 — B+* *70—<75 — B* *65—<70 — B* *60—<65 — C+* *55—<60 — C* *40—<55 — D* <40 — E*
Media employed	
Reading List	1. *High temperature oxidation and corrosion of metals, David Young, Elsevier, 2008* 2. *Plasma Physics, R. J. Goldston, P. H Rutherford, Taylor and Francis, 2000*

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MODULE HANDBOOK

Module name	*Functional Material*
Module level, if applicable	*Graduate program*
Code, if applicable	*SCMS802214*
Subtitle, if applicable	-
Courses, if applicable	-
Semester(s) in which the module is taught	*2nd semester*
Person responsible for the module	*Dr. Vivi Fauzia, M.Si.*
Lecturer	*Dr. Vivi Fauzia, M.Si.* *Dr. Aminah* *Dr. Munawar Khalil*
Language	*Indonesian*
Relation to curriculum	*Elective Course*
Type of teaching, contact hours	*Flipped Class and Problem-Based Learning*
Teaching methods	*Presentation*

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Workload (incl. contact hours, self-study hours)	*Lectures: 3x50=150 minutes per week* *Exercise and assignments: 3x60=180 minutes per week* *Independent study: 3x60=180 minutes per week*
Credit points	*3*
Requirements according to the examination regulations	*A student must have attended at least 75% of the lectures to sit in the exam*
Recommended prerequisties	-
Module objectives/intended learning outcomes	1. *Able to select, organize and evaluate the latest scientific sources regarding functional material in a critical manner* 2. *Able to make a connection between the structure, properties, process and performance of functional material with its application in energy and environmental sectors*
Content	1. *Photodetector & solar cells* 2. *Thermoelectric & photothermal* 3. *Hazardous substance/gas sensor* 4. *Fuel cell & photocatalyst* 5. *Anti-bacteria* 6. *Heavy metal sensor*

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Presentation : 100 %
Total : 100 %

<table><tr><th>Mark</th><th>Grade</th></tr><tr><td>85—100</td><td>A</td></tr><tr><td>80—<85</td><td>A</td></tr><tr><td>75—<80</td><td>B+</td></tr><tr><td>70—<75</td><td>B</td></tr><tr><td>65—<70</td><td>B</td></tr><tr><td>60—<65</td><td>C+</td></tr><tr><td>55—<60</td><td>C</td></tr><tr><td>40—<55</td><td>D</td></tr><tr><td><40</td><td>E</td></tr></table></td>
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<td>Media employed</td>
<td>Microsoft Teams</td>
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<td>Reading List</td>
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MODULE HANDBOOK

Module name	*Synthesis and Characterization of Nanomaterials*
Module level, if applicable	*Graduate Program*
Code, if applicable	*SCMS802216*
Subtitle, if applicable	-
Courses, if applicable	-
Semester(s) in which the module is taught	*2nd semester*
Person responsible for the module	*Dr. Budhy Kurniawan*
Lecturer	*Dr. Budhy Kurniawan*
Language	*Indonesian*
Relation to curriculum	*Elective Course*
Type of teaching, contact hours	*A student must have attended at least 75% of the lectures to sit in the exam*
Teaching methods	*Interactive Lecture and Discussion*

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Workload (incl. contact hours, self-study hours)	*Lectures: 4 x 50 minutes per week* *Exercises and assignments: 4 x 60 = 240 minutes per week* *Independent study: 4 x 60 = 240 minutes per week*
Credit points	*4*
Requirements according to the examination regulations	*A student must have attended at least 75% of the lectures to sit in the exam*
Recommended prerequisties	-
Module objectives/intended learning outcomes	1. *Conduct the synthesis of nanomaterials* 2. *Analyze structural characterization data, material properties and performance* 3. *Write a report on laboratory work*
Content	● *Hydrothermal and Biosynthesis* ● *Deposition method: Spincoating Danultrasonic Spray Pyrolysis* ● *Nanomaterial Characterization I: SEM, TEM XRD* ● *Nanomaterial Characterization II: Raman, XPS, UV-vis, and PL*

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Assignments : 20 %
Presentation 1 : 40 %
Presentation 2 : 40 %
Total : 100 %

<table>
<tr><th>Mark</th><th>Grade</th></tr>
<tr><td>85—100</td><td>A</td></tr>
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<tr>
<td>Reading List</td>
<td>
1. Jin Zhong Zhang , OPTICAL PROPERTIES AND SPECTROSCOPY OF NANOMATERIALS , World Scientific Publishing Co. Pte. Ltd.2009.
2. Bhat, A.H., et.al., Nanomaterials for Healthcare, Energy and Environment, Springer 2019.
</td>
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MODULE HANDBOOK

Module name	*Numerical Methods for Material Science*
Module level, if applicable	*Graduate Program*
Code, if applicable	*SCMS802217*
Subtitle, if applicable	-
Courses, if applicable	-
Semester(s) in which the module is taught	*2nd semester*
Person responsible for the module	*Dede Djuhana, Ph.D*
Lecturer	*Dede Djuhana, Ph.D*
Language	*Indonesian*
Relation to curriculum	*Elective Course*
Type of teaching, contact hours	*Flipped Class and Problem-Based Learning*
Teaching methods	*Cooperative learning and study case*
Workload (incl. contact hours, self-study hours)	*Lectures: 3x50=150 minutes per week* *Exercise and assignments: 3x60=180 minutes per week*

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	Individual study: 3x60=180 minutes per week
Credit points	*3*
Requirements according to the examination regulations	*A student must have attended at least 75% of the lectures to sit in the exam*
Recommended prerequisties	*SCMS801205*
Module objectives/intended learning outcomes	*Identify and analyze various numerical methods in material science*
Content	● *Introduction and scope of numerical methods usage in material science* ● *System of linear equations* ● *Regression method* ● *Interpolation method* ● *Numerical differentiation and integration method* ● *Ordinary Differential Equation* ● *Partial Differential Equation* ● *Fast Fourier Transform* ● *Random numbers*
Study and examination requirements and form of examination	*The final score is the composition of mid-test scores, quizzes, and assignments with the following weight:* *Assignment : 20 %* *Mid-test : 40 %* *Final test : 40 %* *Total : 100 %* ***Mark*** — ***Grade*** *85—100* — *A*

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	80—<85	*A*
	75—<80	*B+*
	70—<75	*B*
	65—<70	*B*
	60—<65	*C+*
	55—<60	*C*
	40—<55	*D*
	<40	*E*
Media employed	-	
Reading List	1. *Steven C. Chapra, Applied Numerical Methodes with MATLAB for Engineering and Scientist, Third Edition,McGraw-Hill 2012 (Ebook)* 2. *John H. Mathews and Kurtis D. Fink, Numerical Methods Using Matlab, Fourth Edition, Prentice Hall 2014 (Ebook)* 3. *S. R. Otto and J. P Denier, An Introduction to Programming and Numerical Methods in Matlab, Springer-Verlag 2005 (Ebook)* 4. *Brian R. Hunt, Ronald L. Lipsman, and Jonathan M. Rosenberg with Kevin R. Coombes, John E. Orborn, and Garrett J Stuck, A Guide*	

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MODULE HANDBOOK

Module name	*Independent Project*
Module level, if applicable	*Graduate Program*
Code, if applicable	*SCMS802219*
Subtitle, if applicable	-
Courses, if applicable	-
Semester(s) in which the module is taught	*2nd semester*
Person responsible for the module	*Dr Budhy Kurniawan*
Lecturer	*Dr Budhy Kurniawan*
Language	*Indonesian*
Relation to curriculum	*Elective Course*
Type of teaching, contact hours	*Problem-Based Learning and Independent Learning*
Teaching methods	*Cooperative learning and study case*
Workload (incl. contact hours, self-study hours)	*Lectures and discussion : 1x50=50 minutes per week* *Independent study : 3 x 50 = 150 minetes per week* *Exercise and assignments: 4x60=240 minutes per*

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	week
Credit points	*4*
Requirements according to the examination regulations	*A student must have done at least 75% of the self study to sit in the exam*
Recommended prerequisties	-
Module objectives/intended learning outcomes	1. *By having an integrated understanding of the structure, properties, processing, and performance of material systems and being able to critically examine the latest developments in materials science and technology* 2. *Able to carry out experimental research methods that are academically responsible, analyze data critically and systematically and draw conclusions.* 3. *Able to identify and analyze problems in the field of materials science and be able to compile solutions that are scientifically responsible, with due regard for ethics, environmental and socio-economic* 4. *Able to create and design materials, processing methods and material analysis techniques new materials and material product innovations by paying attention to humanities values that are beneficial to development of materials science, industry and society in general.* 5. *Able to apply material science concepts in*

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	solving material industry application problems complex through a multidisciplinary approach that pays attention to safety, social aspects and ethics.
Content	1. Systematics and Format of Scientific Writing 2. Topics and Theses in Scientific Research 3. Research Background, Objectives and Research Problems 4. Literature review, writing, citations and previous research 5. Research Methodology- Selection of Research Locations 6. Research Methodology-Determination of Respondents 7. Research Methodology- Research Sampling 8. Research Methodology- Processing Techniques 9. Research Methodology-Analytic Techniques
Study and examination requirements and form of examination	*The final score is the composition of examinations with the following weight:* *Regular Presentation : 50 %* *Scientific paper draft : 50 %* *Total : 100 %* ***Mark*** — ***Grade*** *85—100* — *A* *80—<85* — *A* *75—<80* — *B+* *70—<75* — *B*

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	65—<70	*B*
	60—<65	*C+*
	55—<60	*C*
	40—<55	*D*
	<40	*E*
Media employed	*EMAS, MS TEAMS. ZOOM*	
Reading List	[1] *On Being a Scientist: A Guide to Responsible Conduct in Research*, Third Edition, National Academy of Sciences, USA, 2009. [2] Pedoman Publikasi Ilmiah, Lukman, Suminar Setiadi Ahmadi, Wasmen Manalu, Deden Sumirat Hidayat, Kementerian Riset, Teknologi, dan Pendidikan Tinggi Direktorat Jenderal Penguatan Riset dan Pengembangan, 2017 [3] any others digital sources	

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MODULE HANDBOOK

Module name	*Engineering Economics*
Module level, if applicable	*Graduate Program*
Code, if applicable	*SCMS802218*
Subtitle, if applicable	-
Courses, if applicable	-
Semester(s) in which the module is taught	*2nd semester*
Person responsible for the module	*Adi Waskito, MM*
Lecturer	*Adi Waskito, MM*
Language	*Indonesian*
Relation to curriculum	*Elective Course*
Type of teaching, contact hours	*Flipped Class and Problem-Based Learning*
Teaching methods	*Cooperative learning and study case*
Workload (incl. contact hours, self-study hours)	*Lectures: 2x50=100 minutes per week* *Exercise and assignments: 2x60=120 minutes per week*

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	Independent study: 2x60=120 minutes per week
Credit points	*2*
Requirements according to the examination regulations	*A student must have attended at least 75% of the lectures to sit in the exam*
Recommended prerequisties	-
Module objectives/intended learning outcomes	• *Identify the concept of high tech entrepreneurs, DISRUPT and the concept of Business Model Canvas (C4)* • *Analyzing the concept of customer persona, product market fit, and lean startup approach (C4)* • *Identify the concept of building innovation, developing and protecting IPR (C4)* • *Analyze marketing and sales, profit and harvest the financial plan (C4)* • *Able to make a business plan related to materials science (C6).*
Content	*1. High-tech entrepreneurs* *2. DISRUPT concept* *3. Business Model Canvas, value proposition canvas and problem solution fit* *4. Profile identification with customer persona* *5. Product market fit and lean startup approach* *6. The concept of competitive strategy, marketing and sales* *7. Preparation of business plans*

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Presentation 1 : 40 %
Presentation 2 : 40 %
Total : 100 %

Mark — Grade
85—100 — A
80—<85 — A
75—<80 — B+
70—<75 — B
65—<70 — B
60—<65 — C+
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<td>[1] Duening, T. N., Hisrich, R. D., & Lechter, M. A. (2021). Technology entrepreneurship: Taking innovation to the Marketplace. (DHL)
[2] Byers, T., Dorf, R. C., & Nelson, A. J. (2015). Technology ventures: From idea to enterprise. McGraw-Hill. (BDN
[3] Olsen, D. (2015). The lean product playbook: How to innovate with minimum viable products and rapid customer feedback. Wiley. (OL)
[4] Hisrich, R. D., Peters, M. P., & Shepherd, D. A. (2016). Entrepreneurship. McGraw-Hill Education.</td>
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