SILABUS KURIKULUM PENYELENGGARAAN PENDIDIKAN
PROGRAM STUDI MAGISTER (S2) TEKNIK KIMIA
FAKULTAS TEKNIK UNIVERSITAS SRIWIJAYA
TAHUN 2014/2015

A. The Curricullum of Double Master Degree Program on Energy/Enviromental Technology and Management

1st Semester

No	Code	Core Courses	Credits	Semester
1.	DDE 50114	Seminar for M.Eng / M.Sc (Energy or Environmental Technology & Management)	1	1
2.	DDE 50214	Research Methodology	2	1
3.	DDE 50314	Energy and Environmental Economics and Policy	3	1
4.	DDE 50414	Energy and Environmental Management and Planning	3	1
5.	DDE 50514	Project Implementation and Control	1	1
6.	DDE 50614	Energy Technology	2	1
7.	DDE 50714	Rewenable Energy Technologies	3	1
Total			**15**	

2nd Semester

A. For Energy Technology and Management

No	Code	Core Courses	Credits	Semester
1	DDE 50814	Fuels and Combustion	3	2
2	DDE 50914	Energy System Analysis and Engineering	3	2
Elective Course				
A. Technology-oriented courses (at least one course must be selected from following list)				
1	DDE 51014	Computational fluid dynamics	3	2
2	DDE 51114	Power Plant Engineering	3	2
3	DDE 51214	Clean technology for solid fuels	3	2
4	DDE 51314	Advanced Transport Phenomena	3	2
5	DDE 51414	Natural Gas Utilization Technology	3	2
6	DDE 51514	Energy from Biomass	3	2
7	DDE 51614	Hydrogen and fuel cell technologies	3	2
8	DDE 51714	Catalytics processes and reaction engineering	3	2
9	DDE 51814	Renewable Energy technologies	3	2
10	DDE 51914	Selected topics in energy and environment 1	3	2
11	DDE 52014	Energy Management in Building	3	2
12	DDE 52114	Enviromental Pollution Control Technology	3	2
B. Management Oriented Course (at least one course must be selected from following list)				
1	DDE 52214	Project Management	3	2
2	DDE 52314	Energy Management in Industry	3	2
3	DDE 52414	Energy Management in transportation	3	2
C. Elective				
		Elective As Recommended by Advisor	3	2
Total			**15**	

B. For Enviromental Technology and Management

No	Code	Core Courses	Credits	Semester
	DDE 52514	Atmospheric Science	3	2
	DDE 52614	Life cycle Assesment	3	2
	DDE 52714	Biotechnology for energy and environment	3	2
	DDE 52814	Biogheochemistry	3	2
Elective Course				
A. Technology-oriented courses (at least one course must be selected from following list)				
	DDE 52914	Sustainable Bio-energy Technologies	3	2
	DDE 53014	Atmospheric Boundary Layer Science	3	2
	DDE 53114	Atmospheric Dynamics	3	2
	DDE 53214	Air Pollution Control	3	2
	DDE 53314	Air Pollution Modeling	3	2
	DDE 53414	Enviromental Modeling	3	2
	DDE 53514	Waste Treatment Technology	3	2
	DDE 53614	GIS and Remote Sensing	3	2
	DDE 53714	Climate Change and The Ecosistem	3	2
	DDE 53814	Biotechnology for Energy and Environment	3	2
	DDE 53914	Climate Change Policy	3	2
B. Management Oriented Course (at least one course must be selected from following list)				
	DDE 52214	Project Management	3	2
	DDE 52314	Energy Management in Industry	3	2
	DDE 52414	Energy Management in transportation	3	2
C. Elective				
		Elective As Recommended by advisor	3	2
Total			**15**	

3rd Semester

No	Code	Core Courses	Credits	Semester
PLAN A				
	PDE 69911	Thesis (Energy or Enviromental Technologies & Management)	6	3
PLAN B				
	PDE 69911	Internship	6	3
	PDE 69911	International Internship	6	3
Total			**6**	

4th Semester

No	Code	Core Courses	Credits	Semester
PLAN A				
	PDE 69911	Thesis (Energy or Enviromental Technologies & Management)	6	3
PLAN B				
	PDE 69911	Research Study	6	3
Total			**6**	

A. DOUBLE MASTER DEGREE ENERGY/ENVIROMENTAL TECHNOLOGI AND MANAGEMENT

a.1. Core Courses syllabus

DDE 50114 Seminar for M.Eng/M.Sc 1 Credit

The objective of the course is to enhance the capabilities of students to extract the main points from technical papers and reports, as well as writing skills and oral presentation skills. At the beginning of the course, introductory sessions are devoted to guidelines for extracting and analyzing information obtained from research papers and reports as well as techniques for technical paper writing and oral presentation. Students will be required to work independently, as well as to interact with other students, researchers and academic staff as part of a process of exchange of ideas and information

DDE 50214 Research Methodology 2 Credits

The course aims to give the students experience in the general skills needed in scientific and technical research. The general skills to be covered will include: searching for information in the literature, reviewing previous research, making proposals for new research, measurements and the analysis of data, describing equipment and experimental methods, good practice and ethics in research

DDE 50314 Energy and Enviromental Economics and Policy 3 Credits

The objective of this course is to develop an understanding of rational analysis, as well as decision making in issues concerning energy and environmental economics and policy, taking into account the environmental impacts. Roles of energy in economic development and interrelationship between energy consumption and economic growth, physical aspects of energy transformation and economic sectors. Economic concepts of energy supply and demand: market mechanism and price theory, fossil energy resources' scarcity and national energy security, policy instruments for efficient energy uses and resource allocations, case studies. Concept of externality of environmental impacts, market failure, social cost and benefit analysis, concept of environmental protection and policy instruments related to energy supply and consumption, environmental pollution control and abatement, case studies. Contemporary issues of energy and environment at domestic, regional and international level: public participation and environmental concerns, acid rain, Montreal Protocol, UNFCCC and Kyoto Protocol.

DDE 50414 Energy and Enviromental Management and Planning 3 Credits

The objective of this course is to develop planning and analytical skills, and capacity building in management related to energy and environmental issues. Concept of physical transformation of energy: sources of energy to end uses, drives of energy program initiative, analysis of rational energy uses and basic of energy audit, identification of energy conservation opportunities, economic analysis and project evaluation, state of a energy program reporting. Concept of natural resources and environment, effects of anthropogenic cause to environment: principle of sustainability development, environmental impact assessment tools and indicators: LCA and environmental standards, state of environmental assessment reporting and its applications. Energy and environmental planning and decision making supporting tools, project implementation, execution, monitoring and control, case studies.

DDE 50514 Project Implementation and Control 1 Credit

The objective of this course is to enable the students to learn the basics of project management. It will explain how to design and implement a project, like definition, objectives, characteristics, and phases of projects as well as execution plans, cost/schedule estimation and control. It will end with project evaluation.

DDE 50614 Energy Technology 2 Credits

The objective of the course is to provide a sound knowledge to evaluate all major energy systems. In this course the principles of thermal energy conversion systems will be presented. It will start with an overview about

the current energy situation, its demand and supply and the characteristics of the conventional and renewable energy resources. All major energy conversion systems will be introduced and the specifics in their application explained. In addition necessary instrumentation and measurement techniques are presented to monitor and evaluate energy systems

DDE 50714 Rewenable Energy Technologies 2 Credits

The objective of this course is to give students an understanding of the nature and characteristics of renewable energy resources, renewable energy technologies and their limitations, economic aspects, and environmental impacts. To develop analytical skills for resource assessment. Renewable energy resources and technologies to be covered are solar thermal and photovoltaic, wind, biomass and small hydro.

DDE 50814 Fuels and Combustion 3 Credits

The objective of the course is to provide the student with the basic concepts of combustion processes. Classification of fuels. Properties and characterization of gaseous, liquid and solid fuels. Characteristics of the combustion flame. Stoichiometry. Thermodynamics of combustion. Chemical kinetics of combustion. Energy balance and furnace efficiency. Overview on major combustion technologies for solid, liquid and gaseous fuels

DDE 50914 Energy System Analysis and Engineering 3 Credits

The objective of the course is for students to understand how the energy system works and how to design the process system used in industries. In this course, the concept of energy analysis and system design will be presented. First, the basic concepts of mass and energy balances for the energy systems, and the analysis of thermodynamic processes and cycles will be discussed, followed by the basics of system engineering, analysis and measurement methods. Later, the design of typical workable system will be discussed, as well as the basics of some important equipment and instruments used in industries, such as piping systems, pumps, and heat exchangers with some case studies describing optimal systems.

DDE 69914 Thesis (Energy or Enviromental Technologies & Management) 3 Credits

The Students are required to undertake research or development studies under supervision of a member of the faculty. The thesis should be completed within two semesters.

DDE 69914 Internship 6 Credits

The aim of the course is to enable the student to gain professional experience. The students who choose the internship option are required to work on an internship in industry for 20 consecutive weeks. The internship will be supervised by an instructor. The Guidelines for the Internship Program describe the procedures for the selection of suitable companies and tasks for the internship, as well as the selection of the industrial supervisors and the required reporting..

DDE 69914 International Internship 6 Credits

The aim of the course is to enable the student to gain professional experience in an international environment and to learn how to work in a different cultural environment. The students who are selected for this internship option will work on an internship in industry for 20 consecutive weeks. The internship will be supervised by an instructor. The Guidelines for the Internship Program describe the procedures for the selection of suitable companies and tasks for the internship, as well as the selection of the industrial supervisors and the required reporting.

This international internship program is reserved for the best students of each year. The JGSEE will provide possibilities to participate in an international internship program in Europe, US or Japan individually organized by the JGSEE. The institutions selected will be internationally recognized applied research institutions and international companies

DDE 69914 Research Study 6 Credits

The students are required to undertake short research or development projects under supervision of a member of the faculty. The research study should be completed within one semester

a.2. Elective Courses syllabus

DDE 51014 Computational Fluid Dynamics 3 Credit

The objective of this course is for students to develop a sound knowledge of how to solve fluid flow and heat transfer problems with the numerical methods. The course will present several important topics: the basic concept of fluid flow, introduction to numerical methods, finite difference methods, finite volume methods, and solution of linear equation system. The basic knowledge will be applied to typical Computational Fluid Dynamics problems, such as the wave equation, heat equation, Laplace 's equation, Burgers' equation (inviscid/viscous), and simple form of the Navier-Stokes equation. Finally an introduction to the use of commercial software will be presented

DDE 51114 Power Plant Engineering 3 Credit

The aim of the course is to provide students an overview of various types of power plants and their components. Basic concepts for fuels and combustion processes, Analysis of steam cycles and combined cycle power generation, Steam generators and turbines, Condenser, feed water and circulating water systems, Diesel engine and gas turbine power plants, Energy storage, emission control and flue gas treatment. Economics of power generation.

DDE 51214 Clean Technology for Solid Fuels 3 Credit

The objective of this course is to provide the student basic concepts of clean technologies for solid fuels. Classification of solid fuels: coal, biomass and waste. Chemical and physical properties of solid fuels. Pyrolysis, gasification and liquefaction of solid fuels. Combustion processes and environmental considerations. Special attention is given to domestic lignite and biomass and the development of clean coal technologies and co-firing.

DDE 51314 Advanced Transport Phenomena 3 Credit

The objective of the course is to give students a sound knowledge of the mechanism of multi-phase flow and energy analysis. The course will firstly introduce the concept of mass, energy and momentum conservation. Emphasis will then be put on the analysis of differential fluid element in laminar flow and turbulent flow, friction loss and flow measurement. Secondly, the fundamentals of heat transfer and the differential equations of heat transfer will be presented. The steady-state conduction and unsteady-state conduction will be compared. Lastly, the two-phase flow mechanism focusing on the gas-solid behavior will be discussed.

DDE 51414 Natural Gas Utilization Technology 3 Credit

The objective of the course is to give students an understanding of the natural gas utilization technologies. Natural gas properties. Reserves and uses. Natural gas processes and transportation. Liquefied Natural Gas (LNG) and Compressed Natural Gas (CNG). Thermoacoustic liquefaction: methane reforming, partial oxidation, and hydrogen production. Fischer Tropsch process, Gas-to-Liquid plants, and direct conversion of natural gas. Ammonia, methanol, and dimethylether synthesises. Combustion fundamentals. Use of natural gas in reciprocal engines and as catalytic pollutant control. The application of gas in gas turbines and power plants as well as in fuel cells. Environmental and economic considerations, as well as life-cycle assessment.

DDE 51514 Energy from Biomass 3 Credit

The objective of the course is for students to understand the advantages of bio-energy production and various technologies for biomass conversion for heat and power. Biomass handling and processing: charcoal and biomass briquette preparation, biofuel and biogas production. Thermal and thermochemical conversion

processes: Pyrolysis, gasification and combustion. Finally, the impact on environment and the policy framework for biomass utilization will be discussed.

DDE 51614 Hydrogen and Fuel Cell Technologies **3 Credit**

The aim of the course is to give students an understanding of current and promising technologies for hydrogen production and fuel cells. Characteristics of fuels for hydrogen production. Hydrogen production technologies: thermal, thermochemical and bio-chemical processes. Hydrogen purification, storage, and transportation. Introduction to fuel cells. Types of fuel cells. Materials and designs of fuel cells. Operations of fuel cells. Current situation and the future trend of hydrogen and fuel cell technologies.

DDE 51714 Catalytics Processes and Reaction Engineering **3 Credit**

The objective of the course is to provide students an understanding of the catalytic processes involved in fuel processing and emission reduction. Manufacturing, testing and uses of catalysts in industry. Types of catalytic reactors: fixed bed reactors, fluidized bed reactors and multiphase reactors. Catalytic processes for feedstock purification and flue gas treatments. Important catalytic reactions: steam reforming, water-gas shift reaction, methanation, ammonia synthesis, DME (Dimethylether) and methanol synthesis.

DDE 51814 Renewable Energy Technologies **3 Credit**

The objective of this course is to give students an understanding of the nature and characteristics of renewable energy resources, renewable energy technologies and their limitations, economic aspects, and environmental impacts. To develop analytical skills for resource assessment. Renewable energy resources and technologies to be covered are solar thermal and photovoltaic, wind, biomass and small hydro.

DDE 51914 Selected Topics in Energy and Environment **3 Credit**

The aim of the course is to introduce the students to selected current topics in energy and environment. The students have the opportunity to learn about actual problems in order to expand their vision of local and global challenges. The subjects can vary in each academic year

DDE 52014 Energy Management in Building **3 Credit**

The objective of this course is for students to learn how to evaluate the energy supply and consumption in buildings, and to plan and implement energy management programs in building complexes. In this course, the technical and economic aspects of energy management methods will be presented and applied to case studies. First the issue of human comfort and cooling requirements are introduced, including indoor air quality. Following this, the calculation of building energy load and the thermal behavior of buildings will be introduced, including solar gains and shading aspects. Then principles of the measurement, monitoring and control of the energy flow in buildings will be presented. Finally, options for improving the energy balance and reducing the cooling load and the electrical load of buildings will be introduced.

DDE 52114 Enviromental Pollution Control Technology **3 Credit**

The objective of this course is to provide a broad based introduction to aspects of environmental pollution and control in air, water and soil media. The course will introduce environmental monitoring and analysis techniques and environmental impact assessment. The course will include an introduction to pollutants present in aqueous systems, the fate and transport of these pollutants, and an introduction to water and waste water treatment processes. The course will include an introduction to the sources, fate and transport of air pollutants, and an introduction to air pollution control technology. It will also include an introduction to solid and hazardous wastes, their fate and interactions with other media, and handling, control and treatment technologies

DDE 52214 Project Management 3 Credit

The objective of the course is to enable students to understand and apply project management functions. Identification and formulation, feasibility analysis and economic evaluation. The course includes project appraisal, implementation as well as scheduling and cost control, commissioning and project evaluation after completion of projects. Case studies and software applications.

DDE 52314 Energy Management in Industry 3 Credit

The objective of this course is for students to develop a sound knowledge of how to plan and to implement energy management programs in industrial complexes. In this course, the technical and economic aspects of energy management will be presented and applied to case studies in industry. First, the principles of energy management, including management programs, organizational set up, energy auditing, establishing an energy balance for industrial complexes will be explained, followed by the introduction of tools and methods to increase the efficiency of industrial energy systems. Later, energy efficient technologies and systems will be presented.

DDE 52414 Energy Management in Transportation 3 Credit

The aim of this course is to develop an understanding of traffic management for efficient energy use and pollution control. Urban growth and traffic demand. Transportation modes: motorized and non-motorized. Comparison of transportation modes: mobility, energy uses, environmental and economic impacts. Transportation management, the solution of transportation problems, efficient energy use in transportation systems, and air and noise pollution controls. Case studies.

DDE 52914 Sustanable Bio-energy Technologies 3 Credit

This course aims to provide an understanding of both conventional and advanced technologies for sustainable bio-energy. Basic concepts of sustainability. Technologies based on thermochemical, chemical and biological processes. Impacts and regulations of bioenergy. Conventional and advanced biotechnologies for sustainable biofuels production, such as postgenomic technologies, molecular tools for microbial monitoring, bioprocesses for biofuel production and microbial fuel cells

DDE 53014 Atmospheric Boundary Layer Science 3 Credit

This course aims to give students an understanding of the processes in the atmospheric boundary layer, with emphasis on those that are important in the human environment. Atmospheric thermodynamics. Radiation processes in the lower atmosphere. Energy and mass balances. Boundary layer micro-meteorology. Boundary layer processes and surface interactions. Modeling of the boundary layer. Environmental effects on the boundary layer. Turbulence. Diffusion processes and modeling. Boundary layer measurements

DDE 53114 Atmospheric Dynamics 3 Credit

This course gives a comprehensive survey of atmospheric dynamics which students will need to understand the processes involved in atmospheric modeling. Basic physical and mathematical concepts; the fundamental and apparent forces. Momentum, continuity and thermodynamic equations; spherical coordinates; scale analysis, isobaric coordinates, balanced flow, trajectory and streamlines; thermal wind; vertical motion; surface pressure tendency. The circulation theorem; the vorticity equation, the barotropic and baroclinic potential vorticity equations. Atmospheric turbulence; turbulent kinetic energy; boundary layer momentum equation; secondary circulation and spin-down. Quasi-geostrophic approximation and prediction diagnostic of vertical motion; baroclinic disturbance. The perturbation method; simple wave types; gravity waves; Rossby waves. Filtering meteorological noise; the finite difference method; the spectral method; primitive equation models; data assimilation.

DDE 53214 Air Pollution Control 3 Credit

The course aims to provide an overview of air pollution control technologies. Air pollution sources and effects of air pollutants. Applications of meteorological data in air pollution control. Automobile and industrial emission control technologies. Measurement and analysis of air pollutants, ambient air quality monitoring, air quality standards and criteria setting.

DDE 53314 Air Pollution Modelling 3 Credit

The objective of the course is to enable students to understand and apply air pollution modeling techniques. General description of existing problems in air pollution. Mathematical principles and conceptual tools for investigating the transport and chemical evolution processes of atmospheric trace gases and aerosols in the troposphere. Planetary boundary layer theory. Numerical methods for simulating the boundary layer structure and local terrain-induced circulations, and for modeling transport and diffusion of trace gases and aerosols in the troposphere with Eulerian and Lagrangian approaches. Applications and software.

DDE 53414 Enviromental Modelling 3 Credit

The objective of the course is to introduce students to the application of mathematical modeling to environmental systems – air, water, soil and the ecosystem. Mass and energy balances, transport phenomena – advection, dispersion/diffusion, reactor types and reaction kinetics. Air: introduction to atmospheric chemistry, plume models, short and long distance transport of air pollutants. Water: contaminant fate and transport in lakes, rivers, groundwater. Ecological modeling: Ecological processes – photosynthesis, algal growth, fish growth and single population growth; modeling population dynamics – growth models, interactions between populations

DDE 53514 Waste Treatment Technologies 3 Credit

The objective of the course is to introduce students to pollution treatment technologies for wastewater, solid and hazardous waste. Wastewater treatment: Characterization – physical, chemical and biological; physicochemical unit operations – screening, filtration, size/volume reduction, mixing, sedimentation, flotation, flocculation, adsorption, disinfection; reactor types and modeling – batch and continuous stirring tank reactor (CSTR) kinetics; biological processes – microbial kinetics, suspended and attached growth systems, aerobic and anaerobic treatment systems. Solid waste treatment: Solid waste generation and characterization; waste separation and preliminary mechanical-biological treatment; waste treatment – recycling, landfill composting, incineration. Hazardous waste treatment: Characterization of hazardous wastes and legislation; risk assessment; processing and treatment methods – physicochemical, biological, stabilization and solidification, thermal treatment, secure landfilling; remediation of contaminated sites.

DDE 53614 GIS and Remote Sensing 3 Credit

This course describes the concepts and the applications of GIS and Remote Sensing as a tool in environmental management and planning. Principles of remote sensing. Physical background in electromagnetic wave theory. Propagation of electromagnetic radiation and its interaction with matter. Spectral signature, data acquisition, and digital image processing techniques. Image classification. Accuracy assessment. Geographic Information Systems (GIS). Characteristics of spatial information database. Mapping concepts and data structure. Data management techniques. Data acquisition, manipulation and analysis. Map output generation. Application of GIS and remote sensing in environmental management and planning.

DDE 53714 Climate Change and The Ecosistem 3 Credit

This course aims to provide an understanding of what causes climate change and how it affects the ecosystem. Overview of climate change science. Energy balance and radiative transfer. Greenhouse effect and global warming. Natural causes of climate change: solar and terrestrial causes. Paleoclimate and future climate changes. Assessment of climate change induced by anthropogenic causes. Exchanges, sources and sinks of greenhouse gases in the Ecosystem. Introduction to the impact of climate change on the Ecosystem. Adaptation and vulnerability of the Ecosystem

DDE 53814 Biotechnology for Energy and Environment **3 Credit**

The aim of this course is to provide both fundamental and advanced concepts concerning biotechnology for energy and environment. The important basics of microbiology, biochemistry and enzymology will be included. Technologies necessary for the biotechnological applications in the four major areas i.e. bioconversion of biomasses to energy, biomonitoring, biotreatment and bioremediation will be taught. Practical aspects such as biogas production from wastewater and solid wastes, biosensors, cellular and molecular tools, anaerobic and aerobic water treatment, microbial leaching of heavy metals, subsurface microbiology, environmental genomics and proteomics, nanotechnology for studying microbes as well as microbes and energy will be taught.

DDE 53914 Climate Change Policy **3 Credit**

The objective of this course is to understand the current climate change policies driven by anthropogenic causes. Policy formulation and its implementation. Climate and principles of climate change. Natural and anthropogenic causes. Sources of emission. Emission factors and control of emissions. Principles and essence of United Nations Framework Convention on Climate Change (UNFCCC) and Montreal convention: Intergovernmental Panel on Climate Change (IPCC) and its assessment reports. Scenario of emissions (SRES) model. International agreements and standards involved in Greenhouse gas (GHG) reduction. Kyoto protocol and its instruments: joint implementation, emission trading, clean development mechanism and related national policies.

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