SYLLABUS

MASTER STUDY PROGRAM (S2)

ITS CURRICULUM 2023 – 2028

CHEMICAL ENGINEERING DEPARTMENT
INDUSTRIAL TECHNOLOGY FACULTY
SEPULUH NOPEMBER INSTITUTE OF TECHNOLOGY
SURABAYA 2023

Study program	Chemical Engineering
Educational level	Master (S2)

Code	Description Achievements Learning Graduate (CPL)
CPL-1	CPL-1 ITS in aspect attitude Able to show attitudes and character that reflect: piety to God Almighty, ethics and integrity, virtuous character, sensitivity and caring to problem social and environmental, respect for different cultures and diversity, upholding tall enforcement law, takes precedence interest nation and society broad, through creativity and innovation, excellence, strong leadership, synergy and other potential for reach maximum result.
CPL-2	CPL-2 ITS in KU aspects are appropriate with the level of education Able to develop and problem with knowledge and technology in field science through research with inter or approach multidisciplinary until produce work innovative and tested in the form of theses and papers that have been accepted in the journal Scientific National accredited or accepted into international seminars reputable
CPL-3	CPL-3 ITS in the KU aspect Able to manage learning self yourself, and develop self as a personal learner throughout life For compete on a level national, as well as international, in frame contribute real For finish problem with implementing technology information and communication and paying attention principle continuity.

CPL-4	CPL in KK aspects are defined by the Study Program (number more than 1) **Capable of deepening or expanding science** in the field of processes, systems processing, and necessary equipment For change material standards become products that have a high value with the process chemistry, physics, and biology For give original and tested contributions through research in a way independent ;
CPL-5	CPL in KK aspects are defined by the Study Program (number more than 1) **Able to formulate new ideas (new research questions)** from results of research carried out For development science and technology in the field of processes, systems processing, and necessary equipment become products that have higher value with the process chemistry, physics, and biology.
CPL-6	CPL in aspect Knowledge defined by the Study Program (amount more than 1) **Mastering** science and engineering theory, design engineering, the latest, methods and techniques needed for analysis and design of processes, processing systems, and equipment needed to convert raw materials into value-added products

LIST OF MASTER PROGRAM COURSES

No	MK Code	Courses (MK)	Number of credits
Semester I			
1	TK 235101	Advanced Chemical Engineering Thermodynamics	4
2	TK 235102	Advanced Chemical Engineering Mathematics	4
3	TK 235103	Option I: Advanced Process Synthesis	3
Total semester I credits			11
Semester II			
1	TK 235201	Advanced Transport Phenomena	4

2	TK 235202	Advanced Chemical Reaction Engineering	4
3	TK 235xxx	Option II	3
Total semester II credits			11
Semester III			
1	TK 235xxx	Option III	3
2	TK 235xxx	Option IV	3
Total semester III credits			6
Semester IV			
1	TK 235401	Thesis	8
Total semester IV credits			8
Total number of credits			**36**

Thesis TK185401

No	Semester	Description	SKS
1	II	Proposals	
2	III	Report Progress	
3	IV	Reputable International Seminar	
4		Exam end	
Total thesis credits			**8**

LIST OF OPTIONAL COURSES

No.	MK Code	Course Name (MK)	SKS
1	TK235103	Separation Process	3
2	TK235104	Technology Particle	3
3	TK235105	Analysis System Thermal	3
4	TK235203	Reactor Biochemistry	3
5	TK 23 5204	Management Waste Advanced Industry	3
6	TK 23 5205	Computational Fluid Dynamics	3
7	TK235301	Technology Membrane	3
8	TK235302	Coal Processing and Utilization	3
9	TK235303	Reaction Engineering Electrochemistry	3
10	TK235304	Catalyst Heterogeneous	3
11	TK235305	Aerosol Technology	3
12	TK235306	Natural Gas Processing	3
13	TK235307	Combustion Process	3
14	TK235308	Technology Polymer	3
15	TK235309	Methodology Study	3
16	TK235310	Multi-Variable Control	3
17	TK235311	Advanced Chemical Engineering Mathematics	3

Subject	Course Name	:	**ADVANCED CHEMICAL ENGINEERING**
	Course Code	:	TK235101
	Credit	:	4 credits
	Semester	:	I

COURSE DESCRIPTION

This course studies the theory/model of related state principles and group contributions to the application of estimating pure properties such as critical properties, normal boiling point, vapor pressure, etc.; understand mixing theory and its application to equations of state in determining the PVT of binary and multicomponent systems; apply solution theory in solving problems in Phase Equilibria; get to know the development of thermodynamic models in calculating Phase Equilibria; understand component constants, thermodynamic properties of ideal gases, PVP relationships: gases and liquids, mixtures.

LEARNING OUTCOMES OF GRADUATES CHARGED BY COURSES

CPL-4

Able to deepen or expand knowledge in the field of processes, processing systems, and equipment needed to convert raw materials into products that have added value using chemical, physical, and biological processes to provide original and tested contributions through independent research;

CPL-5

Able to formulate new ideas (new research questions) from the results of research carried out for the development of science and technology in the fields of processes, processing systems, and equipment needed to convert raw materials into products that have added value using chemical, physical and biological processes

CPL-6

Understand science and engineering theory, design engineering, the latest methods and techniques needed for analysis and design of processes, processing systems, and equipment needed to convert raw materials into value-added products

COURSE LEARNING OUTCOMES

CPMK-1	Students understand the theory/model of related state principles and group contributions to applications estimating pure properties such as critical properties, normal boiling point, vapor pressure, etc.;
CPMK-2	Students can explain the concept of solution theory and its application in calculating the fugacity coefficient and activity coefficient
CPMK-3	Students can explain and calculate VLE for multi-component systems
CPMK-4	Students can calculate activity coefficients for multicomponent systems using the UNIQUAC and UNIFAC models
CPMK-5	Students can calculate VLE using cubic equation models (EoS) and an introduction to applications in supercritical technology
CPMK-6	Students can calculate LLE for multi-component systems
CPMK-7	Students can explain and calculate reaction coordinates, equilibrium criteria, and equilibrium constants as well as their relationship with composition and conversion in chemical reactions.
CPMK-8	Students can calculate process efficiency in processes in the Chemical Industry

SUBJECT

1. Deep methods/models estimate property pure like property critical, normal boiling point, pressure steam, etc.
2. The connection between property thermodynamics.
3. quality circumstances For prediction and correlation components pure and mixe
4. Application laws I and II for calculation process efficiency or loss of work in processes in the Chemical Industry
5. Solution Theory.
6. Analyze the equations For coefficient activity.
7. Calculation equilibrium with method coefficient activity and equality circumstances.
8. Equilibrium reaction chemistry
9. Thermodynamics For supercritical and containing mixtures of polymer

PRECONDITION

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REFERENCES

1. BE Poling, JM Prausnitz, JP O'Connell, The Properties of Gases and Liquids, Fifth ed., McGraw-Hill International Editions, Singapore (2001).
2. JM Smith, HC Van Ness, MM Abbott, Introduction to Chemical Engineering Thermodynamics, 6th ed., McGwaw -Hill Co-Singapore (2001).3.
3. SM Walas, Phase Equibrilium in Chemical Engineering, Butterworth Publisher, USA (1985).
4. M. Modell and RC Reid, Thermodynamics and Its Applications, Prentice-Hall, Inc., Englewood Cliffs, New Jersey, 1974.
5. SI Sandler, Models for Thermodynamic and Phase Equilibria Calculations, Marcel Dekker, Inc., New York, 1994.

Subject	Course Name	: **ADVANCED PROCESS SYNTHESIS**
	Course Code	: TK185102
	Credit	: 3 credits
	Semester	: I

COURSE DESCRIPTION

- The main purpose of this course is to create a profitable efficient process and encourage the usage of natural resources (energy and materials) to the minimum value. Between business the is deepened again theory and application integration heat applied to various equipment like reactor, evaporator, distillation and tools separator o and cooing systems also have a big influence use nature resource, therefore steam and cooling management including deepened water circulation. Causes and prevention of emission substance polluter to the environment, so are the causes happen fire explosions and spread of material discussed For more awaken health and safety work in the environment factory.
- Simulation with commercial software such as ASPEN PLUS, ASPEN HYSYS, GAMS, and MATLAB are easy tools. For knowing process efficiency has been designed.

LEARNING OUTCOMES OF GRADUATES CHARGED BY COURSES

CPL-4

Able to identify and formulate problem techniques, doing studies for designing systems processes for finish problem-based based on principle technique chemistry (change material standard become products that have high value through physical, chemical and biological processes in a way safe in facet legal, economic, environmental, social, political, health and safety, sustainability) as well. To recognize and/ or utilize potency source Power local and national with global insight.

CPL-5

Able to design and implement experiment laboratory and or field with utilize method, device techniques, and instruments manipulation modern, as well as analyze and evaluate the result in finish problem chemical engineering.

CPL-6

Understand the principles of mathematics, physics, chemistry, and biology For can role as power expert (sub-professional) who handles problem technique chemistry

CPL-7

Understand the principles and methods of chemical engineering, energy, principles economics, and ecological processes For can role as power expert (sub-professional) who handles problem technique chemistry in a way effective and optimal

COURSE LEARNING OUTCOMES

CPMK-1	Students understand the importance of efficient energy and resources Power natural
CPMK-2	Students understand the method of efficiently using energy in network exchanger hot
CPMK-3	Students understand theory networking tool tool industry chemistry and its applications.
CPMK-4	Students understand management use of steam and cogeneration
CPMK-5	Students understand the theory of system cooling and water circulation as well as the application
CPMK-6	Students understand source pollution air and ways to prevention
CPMK-7	Students understand the importance of health and safety Work
CPMK-8	Simulates continuous processes with ASPEN PLUS, ASPEN HYSYS and MATLAB

SUBJECT

Networking tool exchanger hot.

Identify flow data.

Application integration heat in the reactor, column distillation, evaporator,

and tools dryer.

Production system water vapor and its distribution.

System cooling and refrigeration.

Environmental design For emission substance polluter to air.

system design.

Aspect security and safety Work.

Clean Process Technology.

PRECONDITION
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REFERENCES

1. Robin Smith, “Chemical Process Design and Integration”, John Wiley and Son, 2005
2. Warren D. Seider, Daniel R. Lewin, JD Seader, Soemantri Widagdo, Rafiqul Gani, Ka Ming Ng,” Product and Process Design Principles, 4th ed., John Wiley, Singapore, 2017.
3. R. Handogo et al," Evaluation of CO2 Transport Design via Pipeline in the CCS System with Various Distance Combinations", ECS Transactions, 107 (1) 8593, 2022.
4. A. Mualim et al.," Pinch-Based Approach Graphical Targeting for Multi-Period of Carbo Capture Storage and Utilization", Conf. On Broad Exposure to Science and Technology 2021 (BEST 2021), pp 8-15.
5. A. Mualim et al.," Evaluation of multiple time carbon capture and storage network with capital carbon trade-off", Journal of Cleaner Production", 291,125710, 2021.

Subject	Course Name	:	**ADVANCED CHEMICAL ENGINEERING MATHEMATICS**
	Course Code	:	TK235102
	Credit	:	4 credits
	Semester	:	I

COURSE DESCRIPTION

- the main purpose of eye studying is to apply theory basics and theory technique chemistry to develop mathematical models of a related chemical process with change standard become a product

LEARNING OUTCOMES OF GRADUATES CHARGED BY COURSES

CPL-4

Capable of deepening or expanding science in the field of processes, systems processing, and necessary equipment For change material standards become products that have high value with the process chemistry, physics, and biology For give original and tested contributions through research in a way independent ;

CPL-5

Able to formulate new ideas (new research questions) from results of research carried out For development science and technology in the field of processes, systems processing, and necessary equipment For change material standards become products that have high value with the process chemistry, physics and biology.

CPL-6

Control theory science and engineering, engineering design, methods and techniques latest required For analysis and design of processes, systems processing, and necessary equipment For change material standard become product worth plus

COURSE LEARNING OUTCOMES

CPMK-1	Students capable of applying theory basics and theory technique chemistry To develop mathematical models of a related chemical process with change standard become product

CPMK-2	Students capable of applying method analytic approach For completed regular PD and acquired partial PD from formulation mathematics of physical and chemical processes
CPMK-3	Students capable of applying method numeric For completed regular PD and acquired partial PD from formulation mathematics of physical and chemical processes
CPMK-4	Students capable of designing experiments and processing the data obtained from experiments For problem determination equality empirical, semi-empirical or determine optimum conditions of a process
CPMK-5	Students capable of formulating problem process optimization and can determine optimum process conditions mathematically For problem optimization not constrained and constrained

SUBJECT

1. Mathematical Formulation of Chemical Engineering Systems
2. Approximate solution method of ODE and PDE: Perturbation and Polynomial Approximation method
3. Numerical solution of ODE and PDE
4. Experimental Design
5. Mathematical Optimization Techniques

PRECONDITION

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REFERENCES

1. Rice, RG and Do, DD, Applied Mathematics and Modeling for Chemical Engineers, John Wiley & Sons (1995).
2. Davis, ME, Numerical Methods and Modeling for Chemical Engineers, John Wiley & Sons (1984).
3. Edgar, TF and Himmelblau, DM, Optimization of Chemical Processes, 2nd ed, Mc Graw Hill, New York (2001)
4. Linus Schrage, Optimization Modeling with Lingo, Lindo Systems Inc (1999)
5. GEP Box, W. G. Hunter and JS Hunter, Statistics for Experimenters, Second Edition, John Wiley, 2005

Subject	Course Name	:	**Advanced Transport Phenomena**
	Course Code	:	TK235201
	Credit	:	3 credits
	Semester	:	II

COURSE DESCRIPTION
Studying This is a study at the designed graduate level For reviewing the momentum, energy, and mass equations that apply in the continuum of levels For students who have obtained transport phenomena courses at the undergraduate level. Draft draft base will outlined through its application to the paradigm classic and practical in transport phenomena. Students will learn method analytics and approach asymptotic For study and complete steady and unsteady transport problems with and without convection. Students also study the theory of boundary layers for finish transportation problems near boundary surfaces. Method learning covers lectures, class discussions, assignments at home, chores project groups, and exams (UTS and UAS).
LEARNING OUTCOMES OF GRADUATES CHARGED BY COURSES
CPL-4 Capable of deepening or expanding science in the field of processes, systems processing, and necessary equipment For change material standards become products that have high value with the process chemistry, physics, and biology For give original and tested contributions through research in a way independent ; **CPL-5** Able to formulate new ideas (new research questions) from results of research carried out For development science and technology in the field of processes, systems processing, and necessary equipment For change material standards become products that have high value with the process chemistry, physics and biology. **CPL-6** Control theory science and engineering, engineering design, methods and techniques latest required For analysis and design of processes, systems processing, and necessary equipment For change material standard become product worth plus
COURSE LEARNING OUTCOMES
CPMK-1 Students capable of explaining differential property balance for certain properties including momentum, energy, and mass of

	the species with take into account in a way exact flux property convection and diffuse (molecular) also with review property generation
CPMK-2	Students are capable of writing equality continuity, Navier Stokes, energy equations, and equations continuity of species and simplifying it in a way appropriate For certain transportation problems. Student capable of writing applicable boundary conditions For something specific transportation issues and affordability complete and complete physique interpret problem Genre fluid viscus One system steady state dimensions isothermal
CPMK-3	Students capable doing scaling or analysis dimensions from transportation problems using analysis For help simplification Aratau increases understanding of the transfer process that occurs
CPMK-4	Students capable of complete and complete physique interpret solution problem conduction and diffusion species One dimension and internal steady state rectangular, cylindrical and spherical geometry with and without generation order one or zero-order and settlement problem Genre fluid isothermal viscus with two independent variables (steady state two-dimensional flow and flow One unsteady state dimensions) using method similarity, separation of variables, concept of stream function (creeping flow)
CPMK-5	Students capable of completing and interpreting solution problems of two-dimensional inviscid flow (potential flow) steady state and solution problem Genre steady state two-dimensional fluid using theory boundary layer
CPMK-6	Students are capable of using the method separation of variables to complete and interpret solutions in a way physique from problem two- dimensional conduction and diffusion. Students capable of using method similarity and interpreting in a way physique solution problem unsteady state conduction and diffusion in the unbounded region (open region)
CPMK-7	Students are capable of using the finite Fourier Transform method to complete and interpret solution problems for unsteady state conduction and diffusion in a closed region. Students capable of completing and interpreting in a way physique solution problem convection and diffusion (conduction) respectively simultaneously covers interaction

	thermal boundary layer nor concentration with form profile speed or with profile speed already There is
CPMK-8	Students capable of completing and interpreting solution problem displacement multi-component mass use Stefan-Maxwell equation

SUBJECT

1. Basic Concepts (Shell Balance, Eq Change)
2. Problem Genre Fluid One Dimensional Unsteady State Isothermal
3. Problem One- Dimensional Steady State Conduction and Diffusion
4. Problem Genre One Dimensional Unsteady State Fluid (closed and open regions)
5. Problem Genre Steady State Two- Two-Dimensional Fluid (Creeping flow, potential flow, theory laminar boundary layer)
6. Problem Two- Dimensional Conduction and Diffusion
7. Problem Conduction and Diffusion with Two- Dimensional Convection (Approximation Asymptotic)
8. Problem Multi- component Mass Transfer

PRECONDITION

Basic Knowledge of Mechanics Fluids , heat and mass transfer , vector analysis , and equations differential

REFERENCES

1. R. Byron Bird, Waren E. Stewart, Edwin N. Lightfoot, Transport Phenomena, second edition, Wiley (2002)
2. L. Gary Leal, Advanced Transport Phenomena, Cambridge University Press (2010)
3. Ali Altway , Sugeng Winardi , Heru Seyawan , Transfer Process , ITS Press, Surabaya, 2012
4. William M. Deen, Analysis of Transport Phenomena, Oxford University Press (2012).
5. Truskey, Yuan and Katz, Transport Phenomena in Biological Systems, Pearson Prentice Hall (2009).

Subject	Course Name	:	**ADVANCED CHEMICAL REACTION ENGINEERING**
	Course Code	:	TK185202
	Credit	:	4 credits
	Semester	:	II

COURSE DESCRIPTION

- Courses that discuss the application of engineering sciences concepts, Non-Isothermal reactions, Isothermal/Non-Isothermal system reactor design, Internal Transport, Diffusion and Kinetics, Catalytic Reactors,

LEARNING OUTCOMES OF GRADUATES CHARGED BY COURSES

CPL-3

Able to manage learning self yourself , and develop self as personal learner throughout life For compete on a level national , as well as international , in frame contribute real For finish problem with implement technology information and communication and paying attention principle continuity as well as understand entrepreneurship based technology .

CPL-4

Able to identify and formulate problem technique , doing studies For designing something system or process for finish problem based on principle technique chemistry (change material standard become products that have high value through physical , chemical and biological processes in a way safe in facet legal , economic , environmental , social , political , health and safety , sustainability) as well For recognize and/ or utilise potency source Power local and national with global insight .

CPL-7

Control principles and methods chemical engineering , energy , principles economics and ecological processes For can role as power expert (sub professional) who handles it problem technique chemistry in a way effective and optimal

COURSE LEARNING OUTCOMES

CPMK-1	Understand Non-isothermal operations in Reactors
CPMK-2	Implementing the principles of mixed flow reactor stability in reactor design

CPMK-3	Explains the basic techniques for designing isothermal and non-isothermal reactor systems
CPMK-4	Explains the concept of diffusion and reaction
CPMK-5	Examines kinetic/mass transfer regimes in solid catalysts
CPMK-6	Designing a reactor design with heat transfer evaluation
CPMK-7	Apply chemical engineering concepts in catalyst engineering and heterogeneous catalytic reactions
CPMK-8	Apply the basics of reactor design to biochemical reactor systems

SUBJECT

1. Non- Isothermal Reactions
2. Design Reactor system Isothermal /Non- Isothermal
3. Internal Transport , Diffusion and reactions
4. Reactor Catalytic
5. System Reactor Biochemistry with enzymes and cells life

PRECONDITION

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REFERENCES

1. Fogler, “Elements of Chemical Reaction Engineering”, 3rd Ed, Prentice-Hall, 1999
2. JMSmith, “Reaction Kinetics” 3rd ed, McGraw-Hill, 1982
3. Octave Levenspiel, "Chemical Reaction Engineering" 3rd Ed. McGraw Hill, 2000.

Subject	Course Name	: **PARTICLE TECHNOLOGY**
	Course Code	: TK235104
	Credit	: 3 credits
	Semester	: X

COURSE DESCRIPTION

Subject This learn basics and applications technology particles in fields / industries that require it knowledge for processing and handling particles and powder.

LEARNING OUTCOMES OF GRADUATES CHARGED BY COURSES

CPL-4

CPL in KK aspects are defined by the Study Program (number more from 1)

Able to identify and formulate problem technique , doing studies For designing something system or process for finish problem based on principle technique chemistry (change material standard become products that have high value through physical , chemical and biological processes in a way safe in facet legal , economic , environmental , social , political , health and safety , sustainability) as well For recognize and/ or utilise potency source Power local and national with global insight .

CPL-5

CPL in KK aspects are defined by the Study Program (number more from 1)

Able to design and implement experiment laboratory and or field with utilise method , device techniques and instruments modern engineering , as well analyze and evaluate the result in finish problem chemical engineering .

CPL-6

CPL in aspect Knowledge defined by the Study Program (amount more from 1)

Control principles mathematics , physics , chemistry , and biology For can role as power expert (sub professional) who handles it problem technique chemistry

COURSE LEARNING OUTCOMES

CPMK-1 Students explain characterization article (C2)

CPMK-2	Students explain processing particles (mixing and segregation , granulation , deposition) (C2)
CPMK-3	Students explain Formation particles (reduction and enlargement size , granulation) (C2)
CPMK-4	Students explain Transportation particles (flow multiphase , displacement pneumatic , bed fluidized) (C2)
CPMK-5	Students explain Separation fluid-particle (filtration , settling , cyclone) (C2)
CPMK-6	Students analyze explosion safety dust (C4)

SUBJECT

1. Characterization Particle
2. Processing particles (mixing and segregation, granulation, deposition)
3. Formation particles (reduction and enlargement size, granulation)
4. Transportation particles (flow multiphase , displacement pneumatic , bed fluidized)
5. Separation fluid-particle (filtration , settling , cyclone)
6. Security (explosion dust)

PRECONDITION

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REFERENCES

1. Rhodes, M., “Introduction to Particle Technology”, 2nd edition , John Wiley & Sons, Ltd., 2008.
2. Masuda, H., Higashitani , K., and Yoshida, H., “Powder Technology Handbook”, 3 rd edition, Taylor & Francis Group , LLC., 2006.

Subject	Course Name	:	**THERMAL SYSTEM ANALYSIS**
	Course Code	:	TK235105
	Credit	:	3 credits
	Semester	:	2

COURSE DESCRIPTION
• Subject This is eye study at master's level for finish energy and exergy problems . Student will introduced with theory basic exergy.
LEARNING OUTCOMES OF GRADUATES CHARGED BY COURSES
CPL-4 CPL in KK aspects are defined by the Study Program (number more from 1) Capable of doing deepening or expansion science in the field of processes, systems processing , and necessary equipment For change material standard become products that have high value with the process chemistry , physics and biology For give original and tested contributions through research in a way independent ; **CPL-5** CPL in KK aspects are defined by the Study Program (number more from 1) Able to formulate new ideas (new research questions) from results research carried out For development science and technology in the field of processes, systems processing , and necessary equipment For change material standard become products that have high value with the process chemistry , physics and biology . **CPL-6** CPL in aspect Knowledge defined by the Study Program (amount more from 1) Control theory science and engineering , engineering design , methods and techniques latest required For analysis and design of processes, systems processing , and necessary equipment For change material standard become product worth plus
COURSE LEARNING OUTCOMES
CPMK-1 Students capable explain development exergy method as tool analysis energy

CPMK-2	Students capable explain example profits obtained with exergy method .
CPMK-3	Students capable explain example application exergy method on the system individual technique chemistry .
CPMK-4	Students capable explain method block from exergy analysis
CPMK-5	Students capable implement exergy analysis for system complex
CPMK-6	Students capable hook exergy analysis for simple processes
CPMK-7	Students capable explain example thermal and chemical plant analysis
CPMK-8	Students capable explain application thermoeconomics

SUBJECT

1. Concepts and formulations of energy and exergy.
2. Development of the exergy method as an energy analysis tool
3. Examples of profits obtained with the exergy method.
4. Examples of application of exergy methods to individual chemical engineering systems.
5. Block method of exergy analysis
6. Application of exergy analysis to complex systems
7. Exergy analysis for simple processes
8. Examples of thermal and chemical plant analysis
9. Application thermoeconomics

PRECONDITION

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REFERENCES

1. Michael J. Moran, Howard N. Sapiro, “Fundamentals of Engineering Thermodynamics”, 5 th edition, John Wiley & Sons, New York, 2006
2. TJ Kotas, “The Exergy Method of Thermal Plant Analysis, 2 nd edition, Krieger Publishing Company, New York, 1995.

Subject	Course Name	: **BIOCHEMICAL REACTORS**
	Course Code	: TK235203
	Credit	: 3 credits
	Semester	: X

COURSE DESCRIPTION

- Subject This learn application biotechnology in industry food : Introduction Food Biotechnology , Development Biotechnology in the Field Carbohydrates , Development Biotechnology in the Field of Proteins and Enzymes , Development Biotechnology in the Field of Lipids, Applications Microbiology Molecular in Food Processes, Food Process Bioreactor Design, Development Technology Latest in the field Food Biotechnology

LEARNING OUTCOMES OF GRADUATES CHARGED BY COURSES

CPL-4

Able to identify and formulate problem technique , doing studies For designing something system or process for finish problem based on principle technique chemistry (change material standard become products that have high value through physical , chemical and biological processes in a way safe in facet legal , economic , environmental , social , political , health and safety , sustainability) as well For recognize and/ or utilise potency source Power local and national with global insight .

CPL-6

Control principles mathematics , physics , chemistry , and biology For can role as power expert (sub professional) who handles it problem technique chemistry

CPL-7

Control principles and methods chemical engineering , energy , principles economics and ecological processes For can role as power expert (sub professional) who handles it problem technique chemistry in a way effective and optimal

COURSE LEARNING OUTCOMES

CPMK-1 Development Biotechnology in the Field Carbohydrate
CPMK-2 Development Biotechnology in the Field of Proteins and Enzymes
CPMK-3 Development Biotechnology in the Field of Lipids

CPMK-4 Food Process Bioreactor Design
CPMK-5 Development Technology Latest in the field Food Biotechnology

SUBJECT

1. Introduction Food Biotechnology
2. Development Biotechnology in the Field Carbohydrate
3. Development Biotechnology in the Field of Proteins and Enzymes
4. Development Biotechnology in the Field of Lipids
5. Application Microbiology Molecular In Food Processes
6. Food Process Bioreactor Design

Development Technology Latest in the field Food Biotechnology

PRECONDITION

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REFERENCES

1. Food Science and Food Biotechnology, edited by Gustavo F. Gutiérrez-López and Gustavo V. Barbosa- Cánovas , CRC PRESS, 2003
2. Food Biotechnology, 2 ed, edited by Kalidas Shetty, Gopinadhan Paliyath , Anthony Pometto , Robert E. Levin, CRC PRESS, 2006
3. James M. Lee: Biochemical Engineering, Prentice Hall International series, 1992
4. Octave Levenspiel , "Chemical Reaction Engineering" 3rd Ed. McGraw Hill, 2000

Subject	Course Name	: **COMPUTATIONAL FLUID DYNAMICS**
	Course Code	: **TK235205**
	Credit	: **3 credits**
	Semester	: **X**

COURSE DESCRIPTION

- Subject This explain and practice basics Skills For demonstrate expertise in the field process simulation in particular tool industry chemistry CFD based and presenting results meaningful simulation .

LEARNING OUTCOMES OF GRADUATES CHARGED BY COURSES

CPL-4

CPL in KK aspects are defined by the Study Program (number more from 1) Able to identify and formulate problem technique , doing studies For designing something system or process for finish problem based on principle technique chemistry (change material standard become products that have high value through physical , chemical and biological processes in a way safe in facet legal , economic , environmental , social , political , health and safety , sustainability) as well For recognize and/ or utilise potency source Power local and national with global insight .

CPL-5

CPL in KK aspects are defined by the Study Program (number more from 1) Able to design and implement experiment laboratory and or field with utilise method , device techniques and instruments modern engineering , as well analyze and evaluate the result in finish problem chemical engineering .

CPL-6

CPL in aspect Knowledge defined by the Study Program (amount more from 1)

Control principles mathematics , physics , chemistry , and biology For can role as power expert (sub professional) who handles it problem technique chemistry

COURSE LEARNING OUTCOMES

CPMK-1	Students capable explain definition of Computational Fluid Dynamics (CFD)
CPMK-2	Students capable implement equations common in CFD methods
CPMK-3	Students capable explain Three CFD stages (pre-processor, solver, and post-processor)
CPMK-4	Students capable demonstrate simulation Genre fluid
CPMK-5	Students capable demonstrate separation process simulation
CPMK-6	Students capable demonstrate combustion process simulation homogeneous
CPMK-7	Students capable demonstrate combustion process simulation heterogeneous

SUBJECT

1. CFD Definition
2. Equations common in CFD methods
3. Three CFD stages (pre-processor, solver, and post-processor)
4. Simulation Genre fluid
5. Simulation of the separation process
6. Combustion process simulation homogeneous
7. Combustion process simulation heterogeneous

PRECONDITION

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REFERENCES

1. Versteeg, H.K., Malalasekera, W. (200 7). *An Introduction to Computational Fluid Dynamics* (2 ed.). Pearson, Prentice Hall.
2. Fluent User's Guide .
3. Related scientific journals

Subject	Course Name	: **MEMBRANE TECHNOLOGY**
	Course Code	: TK235301
	Credit	: 3 credits
	Semester	: X

COURSE DESCRIPTION

Subject This learn introduction and selection of membrane materials , manufacturing process and characterization membrane , phenomenon displacement specifically mass on the membrane as well as application membrane in industry . With method learning covers lectures , discussions , studies case , learning based problems , Written exams , (includes quizzes , assignments and EAS)

LEARNING OUTCOMES OF GRADUATES CHARGED BY COURSES

CPL-4

Capable of doing deepening or expansion science in the field of processes, systems processing , and necessary equipment For change material standard become products that have high value with the process chemistry , physics and biology For give original and tested contributions through research in a way independent ;

CPL-6

Control theory science and engineering , engineering design , methods and techniques latest required For analysis and design of processes, systems processing , and necessary equipment For change material standard become product worth plus

COURSE LEARNING OUTCOMES

CPMK-1	Students capable explain base membrane material selection (C2)
CPMK-2	Students capable describes the manufacturing process and methods characterization membrane (C4)
CPMK-3	Students capable implement theory phenomenon displacement during the separation process membrane (C3)
CPMK-4	Students capable show it application inner membrane industry (C2)

SUBJECT
1. • Introduction and selection membrane material properties 2. • Membrane manufacturing process 3. • Membrane characterization 4. • Phenomenon displacement in the membrane 5. • Application membrane
PRECONDITION
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REFERENCES
1. Kucera, J., “Reverse Osmosis: Industrial Applications and Processes”, Wiley VCH, 2010 2. Mulder, M., “Basic Principles of Membrane Technology”, 2nd edition, Kluwer Academic Publishers, 1996 3. MC Porter (ed), “Handbook of Industrial Membrane Technology”, Noyes Publication, New York, 1990. 4. Geankoplis , SJ, "Transport Process and Unit Operation", 3rd edition. 1993. 5. Drioli , E. and Giorno, L., “Membrane Operations: Innovative Separations and Transformations”, Wiley VCH, 2009

Subject	Course Name	:	**Coal Processing and Utilization**
	Course Code	:	TK235302
	Credit	:	3 credits
	Semester	:	X

COURSE DESCRIPTION
Subject This explain about setup coal For used as material burn direct nor converted become material other includes the processes of formation , mining , preparation and processing as well as transportation coal , Coal analysis , Coal for electricity : steam turbine/pulverized coal combustion, integrated gasification combined cycle, and fluidized bed combustion, coal for material burn liquid , as well Utilization product side processing coal .

LEARNING OUTCOMES OF GRADUATES CHARGED BY COURSES
CPL-4 Capable of doing deepening or expansion science in the field of processes, systems processing , and necessary equipment For change material standard become products that have high value with the process chemistry , physics and biology For give original and tested contributions through research in a way independent **CPL-5** Able to formulate new ideas (new research questions) from results research carried out For development science and technology in the field of processes, systems processing , and necessary equipment For change material standard become products that have high value with the process chemistry , physics and biology **CPL-6** Control theory science and engineering , engineering design , methods and techniques latest required For analysis and design of processes, systems processing , and necessary equipment For change material standard become product worth plus

COURSE LEARNING OUTCOMES	
CP MK-1	Student capable explains the preparation process coal that will used as material burn direct nor will converted become material other

CP MK-2	Student capable utilize and analyze coal For know quality coal
CP MK-3	Students capable analyze and evaluate processing and utilization processes coal For electricity , materials burn liquid , and materials chemistry other
CP MK-4	Student capable develop processes/ technology For reduce negative effects on processing and utilization coal

SUBJECT

1. Setup coal For used as material burn direct nor converted become material other includes the processes of formation , mining , preparation and processing as well as transportation coal .
2. Coal analysis
3. Coal for electricity : steam turbine/pulverized coal combustion, integrated gasification combined cycle, and fluidized bed combustion.
4. Coal for material burn liquid
5. Utilization product side processing coal

PRECONDITION

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REFERENCES

1. The Coal Handbook Volume 2: Towards Cleaner Coal Utilization 2nd Edition - March 15, 2023
2. Handbook of Coal Analysis, Wiley- Interscience ; 1st edition (April 27, 2005

Subject	Course Name	: **ELECTROCHEMICAL REACTION ENGINEERING**
	Course Code	: TK235303
	Credit	: 3 credits
	Semester	: X

COURSE DESCRIPTION

Subject This discuss about technique electrochemistry with scope of the fundamentals that include thermodynamics , kinetics and displacement and their applications . Materials also discussed in fundamentals include structure electrode and one technique electronicalytics . The application will discussed Can chosen ari a number of topic including batteries , cells material burn , capacitor layer double , system storage energy For vehicle , electrodeposition , alactrolysis industry , electrodes semiconductors , and corrosion .

LEARNING OUTCOMES OF GRADUATES CHARGED BY COURSES

CPL-4

Capable of doing deepening or expansion science in the field of processes, systems processing , and necessary equipment For change material standard become products that have high value with the process chemistry , physics and biology For give original and tested contributions through research in a way independent .

CPL-5

Able to formulate new ideas (new research questions) from results research carried out For development science and technology in the field of processes, systems processing , and necessary equipment For change material standard become products that have high value with the process chemistry , physics and biology .

CPL-6

Control theory science and engineering , engineering design , methods and techniques latest required For analysis and design of processes, systems processing , and necessary equipment For change material standard become product worth plus .

COURSE LEARNING OUTCOMES

CPMK-1 Students master the fundamentals of system electrochemistry

CPMK-2	Students capable integrate application key technique electrochemistry with fundamentals relevant .
CPMK-3	Students understand structure electrodes and techniques electroanalytics and able choose system suitable electrochemistry For application certain ..
CPMK-4	Students understand application system electrochemistry in industry and capable know characteristics key a number of including (for example : battery and applications industry electrolysis).

SUBJECT

Electrochemical cells and characteristics reaction the chemistry ; potential cells and thermodynamics ; kinetics electrochemistry ; transportation; structure electrodes and configuration ; technique electroanalytics and analysis system electrochemistry ; application technique electrochemistry .

PRECONDITION

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REFERENCES

1. Bard, AJ and Faulkner, L.R., “Electrochemical Methods, Fundamentals and Applications”, 2 nd edition, John Wiley & Sons, Inc., 2001
2. Perez, N., “Electrochemistry and Corrosion Science”, Kluwer Academic Publishers, 2004
3. Goodridge, F. and Scott, K., “Electrochemical Process Engineering”, Plenum Press, New York, 1995

Subject	Course Name	: **AEROSOL TECHNOLOGY**
	Course Code	: TK235305
	Credit	: 3 credits
	Semester	: 3

COURSE DESCRIPTION

- Subject This learn properties and characterization of aerosols, instruments tool measure aerosols, particle motion of aerosols, atmospheric aerosols, adhesion of particles, methods aerosol fabrication , as well aerosol applications in industrial processes and aerosol applications in various field other .

LEARNING OUTCOMES OF GRADUATES CHARGED BY COURSES

CPL-4

Capable of doing deepening or expansion science in the field of processes, systems processing , and necessary equipment For change material standard become products that have high value with the process chemistry , physics and biology For give original and tested contributions through research in a way independent .

CPL-5

Able to formulate new ideas (new research questions) from results research carried out For development science and technology in the field of processes, systems processing , and necessary equipment For change material standard become products that have high value with the process chemistry , physics and biology .

CPL-6

Control theory science and engineering , engineering design , methods and techniques latest required For analysis and design of processes, systems processing , and necessary equipment For change material standard become product worth plus .

COURSE LEARNING OUTCOMES

1. CPMK-1 Students understand properties and characterization of aerosols
2. CPMK-2 Students understand movement particle
3. CPMK-3 Students understand aerosol application at level industry

SUBJECT

1. Definition and characterization of aerosols
2. Instrument tool measure aerosols
3. Spread of aerosols in the atmosphere
4. Aerosol fabrication method
5. Aerosols in industrial processes

PRECONDITION

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REFERENCES

1. Hinds, WC, Aerosol Technology: Properties, Behavior, and Measurement of Airborne Particles, John Wiley & Sons, 2nd ed. (1999).
2. latest articles that are relevant and have been published in journals reputable international

Subject	Course Name	: **NATURAL GAS PROCESSING**
	Course Code	: TK235306
	Credit	: 3 credits
	Semester	: 3

COURSE DESCRIPTION

- This course studies the important role of phase behavior in natural gas processing; study important properties used to characterize natural gas and condensate.

LEARNING OUTCOMES OF GRADUATES CHARGED BY COURSES

CPL-4

Capable of doing deepening or expansion science in the field of processes, systems processing , and necessary equipment For change material standard become products that have high value with the process chemistry , physics and biology For give original and tested contributions through research in a way independent .

CPL-5

Able to formulate new ideas (new research questions) from results research carried out For development science and technology in the field of processes, systems processing , and necessary equipment For change material standard become products that have high value with the process chemistry , physics and biology .

CPL-6

Control theory science and engineering , engineering design , methods and techniques latest required For analysis and design of processes, systems processing , and necessary equipment For change material standard become product worth plus .

COURSE LEARNING OUTCOMES

CPMK-1	Students understand the use of natural gas
CPMK-2	Students understand the thermodynamics of natural gas
CPMK-3	Students understand the basic design of natural gas processes
CPMK-4	Students understand natural gas production

SUBJECT

1. Natural gas reserves and utilization
2. Thermodynamic properties of natural gas

3. Technology and basic design of natural gas processing
4. Natural gas products and specifications
5. Natural gas transmission system

PRECONDITION

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REFERENCES

1. Gas Processors Suppliers Association , Engineering Data Book, 12th Ed ., 2004.
2. Kidnay , Athur J. and Parrish , William R., Fundamentals of Natural Gas processing, CRC Press, 2006.
3. Campbell , John Morgan , Gas conditioning and processing (Campbell Petroleum Series) , 3rd Ed ., Campbell Petroleum; 1974.
4. Mokhatab, Saeid ; Poe , William ; Mak , John , Handbook of Natural Gas Transmission and Processing, 3rd Ed., Gulf Professional Publishing , 2015 .
5. Poling , Bruce E .; Prausnitz , John M. ; O' Connell , John , The Properties of Gases and Liquids , 5 th Ed., McGraw-Hill Education, 2001 .

Subject	Course Name	:	**Technology Polymer**
	Course Code	:	TK235308
	Credit	:	3 credits
	Semester	:	X

COURSE DESCRIPTION

Study the basics of polymers, the relationship between properties and structure and process behavior.

LEARNING OUTCOMES OF GRADUATES CHARGED BY COURSES

CPL-4

CPL in KK aspects are defined by the Study Program (number more from 1)
Able to identify and formulate problem technique , doing studies For designing something system or process for finish problem based on principle technique chemistry (change material standard become products that have high value through physical , chemical and biological processes in a way safe in facet legal , economic , environmental , social , political , health and safety , sustainability) as well For recognize and/ or utilise potency source Power local and national with global insight .

CPL-5

CPL in KK aspects are defined by the Study Program (number more from 1)
Able to design and implement experiment laboratory and or field with utilise method , device techniques and instruments modern engineering , as well analyze and evaluate the result in finish problem chemical engineering .

CPL-6

CPL in aspect Knowledge defined by the Study Program (amount more from 1)
Control principles mathematics , physics , chemistry , and biology For can role as power expert (sub professional) who handles it problem technique chemistry

COURSE LEARNING OUTCOMES

CPMK-1	Students capable explain Draft polymers , their classification , structure and processing ; fundamentals and kinetics polymerization
CPMK-2	Students capable explain Copolymerization and techniques polymerization ; examples and discussion industry polymer commercial
CPMK-3	Students capable calculate and predict thermal properties (Cp, k, r) of a polymer
CPMK-4	Students capable implement PVP concepts , PVT estimates and data, solubility polymer , processing polymers and their types
CPMK-5	Students capable implement draft Tg , Tm and their characterization in processing polymer

CPMK-6	Students capable examine characteristic polymer from facet heavy molecules , DSC, SEM, TEM, FTIR and others

SUBJECT

The concept of polymers, their classification, structure and processing; basics and kinetics of polymerization. Copolymerization and polymerization techniques; examples and discussion of the commercial polymer industry; thermal properties (Cp, k, r), and their predictions, PVP concept, PVP estimation and data, polymer solubility, polymer processing and its types; the concept of Tg, Tm and their characterization. Packaging and recycling. Polymer characterization; molecular weight, DSC, SEM, TEM, FTIR and others.

PRECONDITION

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REFERENCES

1. Jean-François Agassant , Pierre Avenas , Bruno Vergnes , Michel Vincent and Pierre Carreau. ”Polymer Processing. Principles and Modelling”. Carl Hanser Verlag, Munich. , Year: 2016
2. Billmeyer. FW Jr., "Textbook of Polymer Science". Wilcy , New York, 1971.
3. Griskey , R.G. "Polymer Process Engineering", Chapman & Hall, New York, 1995.
4. Fried, J.R., “Polymer Science and Technology”, Prentice Hall, New Jersey, 1995.

Subject	Course Name	:	**Methodology Study**
	Course Code	:	TK235309
	Credit	:	3 credits
	Semester	:	X

COURSE DESCRIPTION
Subject This explain about basics technology catalyst heterogeneous , including : method preparation , technique characterization , technique finishing production as well as deactivation catalyst

LEARNING OUTCOMES OF GRADUATES CHARGED BY COURSES
CPL-4 Capable of doing deepening or expansion science in the field of processes, systems processing , and necessary equipment For change material standard become products that have high value with the process chemistry , physics and biology For give original and tested contributions through research in a way independent . **CPL-5** Able to formulate new ideas (new research questions) from results research carried out For development science and technology in the field of processes, systems processing , and necessary equipment For change material standard become products that have high value with the process chemistry , physics and biology . **CPL-6** Control theory science and engineering , engineering design , methods and techniques latest required For analysis and design of processes, systems processing , and necessary equipment For change material standard become product worth plus .

COURSE LEARNING OUTCOMES	
CPMK-1	Able to explain basics research (C2)
CPMK-2	Able to explain stages research (C2)
CPMK-3	Able to carry out literature review (C3)
CPMK-4	Mamapu does data collection and analysis (C3)
CPMK-5	Able to create document proposals research (C6)

SUBJECT
- Basics and stages study - Literature review

- Data collection and analysis
- Research proposal

PRECONDITION

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REFERENCES

1. Guidelines ITS Postgraduate Thesis Writing
2. Catherine Dawson, 2006, A Practical Guide to Research Methods: A User-Friendly Manual for Mastering Research Techniques and Projects, How To Books Ltd., UK.
3. Uwe Flick, 2013, Introduction Research Methodology: A Beginner's Guide to Doing a Research Project, SAGE Publication
4. John W. Creswell, 2014, Research Design: Qualitative, Quantitative, and Mixed Methods Approaches, fourth ed., Sage Publication Inc., USA.

Subject	Course Name	:	**Multi Variable Control**
	Course Code	:	TK235310
	Credit	:	3 credits
	Semester	:	X

COURSE DESCRIPTION

Subject This is eye study at master's level for finish problem lots of control applied in the chemical and oil and gas industry . Review of conventional feedback control . Student will introduced with multi variable control . Introduction theory linear system . Limitations on performance SISO and MIMO systems . Limitations caused by time delays and RHP-poles and zeros. Limitations caused by input constraints , corners phase and uncertainty . Analysis robust performance and stability . Planning system control . Planning structure control . Model reduction . Method learning consists from tasks individual and group , quiz midterms and exams end of semester.

LEARNING OUTCOMES OF GRADUATES CHARGED BY COURSES

CPL-4

CPL in KK aspects are defined by the Study Program (number more from 1)

Able to identify and formulate problem technique , doing studies For designing something system or process for finish problem based on principle technique chemistry (change material standard become products that have high value through physical , chemical and biological processes in a way safe in facet legal , economic , environmental , social , political , health and safety , sustainability) as well For recognize and/ or utilise potency source Power local and national with global insight .

CPL-5

CPL in KK aspects are defined by the Study Program (number more from 1)

Able to design and implement experiment laboratory and or field with utilise method , device techniques and instruments modern engineering , as well analyze and evaluate the result in finish problem chemical engineering .

CPL-6

CPL in aspect Knowledge defined by the Study Program (amount more from 1)

Control principles mathematics , physics , chemistry , and biology For can role as power expert (sub professional) who handles it problem technique chemistry

COURSE LEARNING OUTCOMES

CPMK-1	Students explain system control and limitations performance SISO and MIMO systems . (C2)
CPMK-2	Students explain limitations caused by time delays, RHP-poles and zeros. (C2)
CPMK-3	Students explain robust stability and performance system control . (C2)
CPMK-4	Students designing system control and structure control . (C6)
CPMK-5	Students capable count matrix transfer function MIMO system and capable controlling the MIMO process. (C3)
CPMK-6	Students explains the robustness and stability of the MIMO process. (C2)
CPMK-7	Students capable do analysis controllability , analysis robust performance and stability . (C3)
CPMK-8	Students capable designing systems and structures MIMO control (C6). Student capable do model reduction . (C3)

SUBJECT

1. System Review Conventional Feedback Control .
2. Introduction Control Multivariable .
3. Element theory linear system .
4. Limitations on performance in SISO system
5. Limitations on performance in MIMO system
6. SISO and MIMO Stability and Robust Performance
7. Planning System Control and Structure Control .
8. Model Reduction

PRECONDITION

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REFERENCES

1. Dale E. Seborg, Thomas F. Edgar, Duncan A. Mellichamp, Francis J. Doyle III, “Process Dynamics and Control”, 4 th ed . , John Wiley & Sons, New. York., 2016.
2. Sigurd Skogestad , Ian Postlethwaite," Multivariable Feedback Control", 2 nd edition, John Wiley & Sons, New York, 2005.

Subject	Course Name	:	**Thesis I**
	Course Code	:	TK235206
	Credit	:	4 credits
	Semester	:	II

COURSE DESCRIPTION

Subject This containing activity implementation research , consisting from : carry out studies experiment / simulation initial , report progress research , processing research data , discussing results research , as well make proposal and exam reports proposal presentation .

LEARNING OUTCOMES OF GRADUATES CHARGED BY COURSES

CPL-1

Able to show attitudes and character that reflect : piety to God Almighty, ethics and integrity , virtuous character noble , sensitive and caring to problem social and environmental , respect difference culture and diversity , upholding tall enforcement law , takes precedence interest nation and society broad , through creativity and innovation , excellence , strong leadership , synergy and other potential For reach maximum result .

CPL-2

Able to develop and solve problem knowledge knowledge and technology in field science his through research with inter or approach multidisciplinary until produce work innovative and tested in form theses and papers that have been accepted in the journal scientific national accredited or accepted into international seminars reputable

CPL-3

Able to manage learning self yourself , and develop self as personal learner throughout life For compete on a level national , as well as international , in frame contribute real For finish problem with implement technology information and communication and paying attention principle continuity .

CPL-4

Capable of doing deepening or expansion science in the field of processes, systems processing , and necessary equipment For change material standard become products that have high value with the process chemistry , physics and biology For give original and tested contributions through research in a way independent

CPL-5

Able to formulate new ideas (new research questions) from results research carried out For development science and technology in the field of processes, systems processing , and necessary equipment For change material standard become products that have high value with the process chemistry , physics and biology

CPL-6

Control theory science and engineering , engineering design , methods and techniques latest required For analysis and design of processes, systems processing , and necessary equipment For change material standard become product worth plus

COURSE LEARNING OUTCOMES

CPMK-1 Students control theory , science and engineering along with application with aspect technical , economic and social

CPMK-2 Students capable solve problem engineering and technology and designing processes

CPMK-3 Students capable formulate idea new from results research carried out

CPMK-4 Students capable develop thinking logical , critical , systematic , and creative through study scientific , creation design or work art in field knowledge knowledge and technology and writing in report scientific and reporting thesis

SUBJECT

1. Background
2. Purpose and objectives
3. Overview References
4. Methodology
5. Results and Discussion
6. Research conclusions

PRECONDITION

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REFERENCES

1. ITS Postgraduate Program Quality Standards Guidebook
2. Guidelines ITS Postgraduate Thesis Writing

Subject	Course Name	:	**Thesis II**
	Course Code	:	TK 235313
	Credit	:	6 credits
	Semester	:	III

COURSE DESCRIPTION
Subject This containing activity implementation research , consisting from : carry out studies experiment / simulation initial , report progress research , processing research data , discussing results research , as well make proposal and exam reports proposal presentation .

LEARNING OUTCOMES OF GRADUATES CHARGED BY COURSES
CPL-1 Able to show attitudes and character that reflect : piety to God Almighty, ethics and integrity , virtuous character noble , sensitive and caring to problem social and environmental , respect difference culture and diversity , upholding tall enforcement law , takes precedence interest nation and society broad , through creativity and innovation , excellence , strong leadership , synergy and other potential For reach maximum result . **CPL-2** Able to develop and solve problem knowledge knowledge and technology in field science his through research with inter or approach multidisciplinary until produce work innovative and tested in form theses and papers that have been accepted in the journal scientific national accredited or accepted into international seminars reputable **CPL-3** Able to manage learning self yourself , and develop self as personal learner throughout life For compete on a level national , as well as international , in frame contribute real For finish problem with implement technology information and communication and paying attention principle continuity . CPL-4 Capable of doing deepening or expansion science in the field of processes, systems processing , and necessary equipment For change material standard become products that have high value with the process chemistry , physics and biology For give original and tested contributions through research in a way independent

CPL-5

Able to formulate new ideas (new research questions) from results research carried out For development science and technology in the field of processes, systems processing , and necessary equipment For change material standard become products that have high value with the process chemistry , physics and biology

CPL-6

Control theory science and engineering , engineering design , methods and techniques latest required For analysis and design of processes, systems processing , and necessary equipment For change material standard become product worth plus

COURSE LEARNING OUTCOMES

CPMK-1 Students control theory , science and engineering along with application with aspect technical , economic and social

CPMK-2 Students capable solve problem engineering and technology and designing processes

CPMK-3 Students capable formulate idea new from results research carried out

CPMK-4 Students capable develop thinking logical , critical , systematic , and creative through study scientific , creation design or work art in field knowledge knowledge and technology and writing in report scientific and reporting thesis

SUBJECT

1. Background
2. Purpose and objectives
3. Overview References
4. Methodology
5. Results and Discussion
6. Research conclusions

PRECONDITION

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REFERENCES

3. ITS Postgraduate Program Quality Standards Guidebook
4. Guidelines ITS Postgraduate Thesis Writing