

SYLLABUS
DOCTORAL STUDY PROGRAM (S3)
ITS CURRICULUM 2023 – 2028



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

Study program	Chemical Engineering
Educational level	Doctoral Program (S3)

Code	Description Achievements Learning Graduate (CPL)
CPL-1	<p>CPL-1 ITS in aspect attitude</p> <p>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 .</p>
CPL-2	<p>CPL-2 ITS in KU aspects are appropriate with level education</p> <p>Able to develop theory / conception / idea new and solving problem knowledge knowledge and/ or technology in field science his through research with inter, multi and transdisciplinary approaches until produce work creative , original and tested in form dissertations and papers that have been published in journals international reputable</p>
CPL-3	<p>CPL-3 ITS in KU aspect</p> <p>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</p>

CPL-4	<p>CPL in KK aspects are defined by the Study Program (number more from 1)</p> <p>Able to solve problem engineering and technology in the field of processes, systems processing , and necessary equipment For change material standard become products that have mark plus with the process chemistry , physics and biology through approach interdisciplinary , multidisciplinary or transdisciplinary with notice factors economy , health and safety public , cultural , social and environmental</p>
CPL-5	<p>CPL in KK aspects are defined by the Study Program (number more from 1)</p> <p>Able to develop knowledge and/ or technology new through research in the field of processes, systems processing , and necessary equipment For change material standard become products that have mark plus with the process chemistry , physics and biology until produce work creative , original and tested</p>
CPL-6	<p>CPL in KK aspects are defined by the Study Program (number more from 1)</p> <p>Able to conceptualize , design and implement research in the field of processes, systems processing , and necessary equipment For change material standard become products that have mark plus with the process chemistry , physics and biology For produce knowledge , technology or draft new and cutting- edge useful</p>
CPL-7	<p>CPL in aspect Knowledge defined by the Study Program (amount more from 1)</p> <p>Able to understand and apply philosophy knowledge science engineering , engineering design , methods and techniques</p>

	latest required For analysis and design of processes, systems processing , and necessary equipment For change material standard become products that have mark plus with the process chemistry , physics and biology
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LIST OF DOCTORAL PROGRAM COURSES

No	MK Code	Courses (MK)	Number of credits
Semester I			
1	TK 23610x	Capita Selecta	3
2	TK 236104	Writing Scientific Articles	2
3	TK 236105	Science phylosophy	3
4	TK 236xxx	Option I	3
Total semester I credits			11
Semester II			
1	TK 236xxx	Option II	3
2	TK 236201	Dissertation 1	4
Total semester II credits			7

Semester III			
1	TK 236301	Dissertation 2	3
2	TK 236302	Publication 1	3
Total semester III credits			6
Semester IV			
1	TK 236401	Dissertation 3	3
2	TK 236402	Publication 2	3
Total semester IV credits			6
Semester VI			
1	TK 236501	Dissertation 4	3
2	TK 236502	Publication 3	3
Total semester V credits			6
Semester VI			
1	TK 236601	Dissertation 5	6
Total Semester VI credits			6
Total number of credits			42

Course : Capita Selecta

No.	MK CODE	Course Name (MK)	SKS
SEMESETER I			

1	TK186101	Principle Principles of Chemical Engineering	3
2	TK186102	Management Manipulation Environment	3
3	TK186103	Analysis Methods and Instrumentation	3

Course : Dissertation

No	Semester	Description	SKS
1	II	Dissertation 1	4
2	III	Dissertation 2	3
		Publication 1	3
3	IV	Dissertation 3	3
		Publication 2	3
4	V	Dissertation 4	3
6		Publication 3	3
7	VI	Dissertation 5	6
Total Dissertation Credits			28

LIST OF OPTIONAL COURSES

No.	MK Code	Course Name (MK)	SKS
1	TK236105	Separation Process	3
2	TK236106	Technology Particle	3
3	TK236107	Analysis System Thermal	3
4	TK236108	Reactor Biochemistry	3
5	TK236109	Processing Waste Industry Carry on	3
6	TK236110	Computational Fluid Dynamics	3
7	TK236201	Technology Membrane	3
8	TK236202	Coal Processing and Utilization	3
9	TK236203	Reaction Engineering Electrochemistry	3
10	TK236204	Catalyst Heterogeneous	3
11	TK236205	Aerosol Technology	3
12	TK236206	Natural Gas Processing	3
13	TK236207	Combustion Process	3
14	TK236208	Technology Polymer	3
15	TK236209	Control Multivariable	3

Subject	Course Name	: Capita Selecta Chemical Engineering- Principles Principles of Chemical Engineering
	Course Code	: TK236101
	Credit	: 3 credits
	Semester	: I

COURSE DESCRIPTION

Studying This is college level designed doctorate For discuss a number of problem carry on in field technique chemistry . There are some Selected topics : transport phenomena (in particular heat and mass transfer) and problems technique reaction chemistry . On the eyes studying This outlined a number of problem further and methods the solution for phene transport (eg conduction / diffusion accompanied convection with more from one independent variable , displacement heat and mass in a way concurrent and displacement multi- component mass) and for technique reaction chemistry (eg design , optimization and stability of the reactor under non- isothermal conditions) .

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 mark plus with the process chemistry , physics and biology For give original and tested contributions through research in a way independent ;

CPL-7

Philosophy knowledge science engineering , engineering design , methods and techniques latest required For analysis and design of processes, systems processing , and necessary equipment For change material standard become products that have mark plus with the process chemistry , physics and biology

COURSE LEARNING OUTCOMES

- CPMK-1 Students capable control principle displacement hot conduction and convection
- CPMK-2 Students capable control principle displacement mass diffusion and convection
- CPMK-3 Students capable control reactions isothermal and non- isothermal

CPMK-4 Students capable control prisnip design reactor isothermal and non - isothermal
SUBJECT
<ol style="list-style-type: none"> 1. Conduction Heat Transfer accompanied convection 2. Diffusion Mass Transfer accompanied convection 3. Simultaneous Mass and Heat Transfer 4. component Mass Transfer 5. Operation Isothermal and Non- isothermal 6. Condition stability in a mixed flow reactor 7. Non- isothermal reactor design , optimum temperature profile
PRECONDITION
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REFERENCES
<ol style="list-style-type: none"> 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. William M. Deen, Analysis of Transport Phenomena, Oxford University Press (2012). 4. H. Scott Fogler, Elements of Chemical Reaction Engineering, 5th ed., Prentice-Hall, 2016 5. Octave Levenspiel , Chemical Reaction Engineering, 3rd ed., Wiley, 1999

Subject	Course Name	: Writing Scientific Articles
	Course Code	: TK236104
	Credit	: 2 credits
	Semester	: I

COURSE DESCRIPTION

Subject This learn criteria article quality , type publication scientific , structure articles , how to send article and answer review results . Expected with follow subject This student can write article quality .

LEARNING OUTCOMES OF GRADUATES CHARGED BY COURSES

CPL-4

Able to develop knowledge and/ or technology new through research in the field of processes, systems processing , and necessary equipment For change material standard become products that have mark plus with the process chemistry , physics and biology until produce work creative , original and tested

CPL-7

Philosophy knowledge science engineering , engineering design , methods and techniques latest required For analysis and design of processes, systems processing , and necessary equipment For change material standard become products that have mark plus with the process chemistry , physics and biology

COURSE LEARNING OUTCOMES

- CPMK-1 Students capable apply criteria article quality in the articles he prepares (C3)
- CPMK-2 Students capable examine various type publication scientific (C4)
- CPMK-3 Students capable apply structure good and correct articles in the articles he wrote (C3)
- CPMK-4 Students capable send articles he wrote

SUBJECT

1. Student capable apply criteria article quality in the articles he prepares
2. Student capable sort various type publication scientific
3. Student capable apply structure good and correct articles in the articles he wrote

4. Student capable send articles he wrote
PRECONDITION
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REFERENCES
<ol style="list-style-type: none">1. Englander, K., “Writing and Publishing Science Research Papers in English, A Global Perspective”, Springer, 20142. Jalongo , MR and Saracho, ON, “Writing for Publication, Transitions and Tools that Support Scholars' Success”, Springer International Publishing, Switzerland, 20163. Wallwork, A., English for Writing Research Papers”, 2nd edition, Springer International Publishing, Switzerland, 2016



Subject	Course Name	: Philosophy Knowledge
	Course Code	: TK 236105
	Credit	: 3 credits
	Semester	: I

COURSE DESCRIPTION

Subject This learn criteria article quality , type publication scientific , structure articles , how to send article and answer review results . Expected with follow subject This student can write article quality .

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 study and utilize knowledge knowledge and technology in frame apply it to the field technique chemistry , as well capable take decision in a way appropriate from results Work Alone nor Work group in form report task end or form activity other learning outcomes equivalent with task end through thinking logical , critical , systematic and innovative .

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-7

Philosophy knowledge science engineering , engineering design , methods and techniques latest required For analysis and design of processes, systems processing , and necessary equipment For change material standard become products that have mark plus with the process chemistry , physics and biology

COURSE LEARNING OUTCOMES	
CPMK-1	Able to understand draft Philosophy Knowledge
CPMK-2	Able to think logical and analytical
CPMK-3	Capable of searching source knowledge in a way proportional
CPMK-4	Able to understand criteria truth coherence , correspondence and pragmatics
CPMK-5	Able to differentiate relation science and norms
CPMK-6	Able to create draft not quite enough answer social and scientific
CPMK-7	Able to explain history knowledge engineering chemistry and its applications in industry
SUBJECT	
Draft philosophy knowledge . Thinking logical and analytical . Sources knowledge knowledge Not quite enough answer social . Structure knowledge scientific . Relation science and norms. Criteria truth . History of science chemical engineering .	
PRECONDITION	
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REFERENCES	
1. A. Heris Hermawan, " Philosophy Science ", Edition 1, Human Independent , Bandung, 2011. 2. SD Kirkpatrick , " The Chemical Process Industries: McGraw Hill series in Chemical Engineering", 2nd ed, Kogakusha , Tokyo, 1956. 3. JT Davies , " Chemical Engineering: How did it Begin and Develop? doi : 10.1021/ba-1980-0190.ch002	



Subject	Course Name	: Dissertation 1
	Course Code	: TK 236201
	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

Able to solve problem engineering and technology in the field of processes, systems processing , and necessary equipment For change material standard become products that have mark plus with the process chemistry , physics and biology through approach interdisciplinary , multidisciplinary or transdisciplinary with notice factors economy , health and safety public , cultural , social and environmental .

CPL-5

Able to develop knowledge and/ or technology new through research in the field of processes, systems processing , and necessary equipment For change material standard become products that have mark plus with the process chemistry , physics and biology until produce work creative , original and tested

CPL-6

Able to conceptualize , design and implement research in the field of processes, systems processing , and necessary equipment For change material standard become products that have mark plus with the process chemistry , physics and biology For produce knowledge , technology or draft new and cutting- edge useful

CPL-7

Philosophy knowledge science engineering , engineering design , methods and techniques latest required For analysis and design of processes, systems processing , and necessary equipment For change material standard become products that have mark plus with the process chemistry , physics and biology

COURSE LEARNING OUTCOMES

- CPMK-1 Student 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 Writing Dissertation ITS Postgraduate



Subject	Course Name	: Dissertation 2
	Course Code	: TK 236301
	Credit	: 4 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

Able to solve problem engineering and technology in the field of processes, systems processing , and necessary equipment For change material standard become products that have mark plus with the process chemistry , physics and biology through approach interdisciplinary , multidisciplinary or transdisciplinary with notice factors economy , health and safety public , cultural , social and environmental .

CPL-5

Able to develop knowledge and/ or technology new through research in the field of processes, systems processing , and necessary equipment For change material standard become products that have mark plus with the process chemistry , physics and biology until produce work creative , original and tested

CPL-6

Able to conceptualize , design and implement research in the field of processes, systems processing , and necessary equipment For change material standard become products that have mark plus with the process chemistry , physics and biology For produce knowledge , technology or draft new and cutting- edge useful

CPL-7

Philosophy knowledge science engineering , engineering design , methods and techniques latest required For analysis and design of processes, systems processing , and necessary equipment For change material standard become products that have mark plus with the process chemistry , physics and biology

COURSE LEARNING OUTCOMES

- CPMK-1 Student 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 Writing Dissertation ITS Postgraduate



Subject	Course Name	: Publication 1
	Course Code	: TK 236302
	Credit	: 4 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

Able to solve problem engineering and technology in the field of processes, systems processing , and necessary equipment For change material standard become products that have mark plus with the process chemistry , physics and biology through approach interdisciplinary , multidisciplinary or transdisciplinary with notice factors economy , health and safety public , cultural , social and environmental .

CPL-5

Able to develop knowledge and/ or technology new through research in the field of processes, systems processing , and necessary equipment For change material standard become products that have mark plus with the process chemistry , physics and biology until produce work creative , original and tested

CPL-6

Able to conceptualize , design and implement research in the field of processes, systems processing , and necessary equipment For change material standard become products that have mark plus with the process chemistry , physics and biology For produce knowledge , technology or draft new and cutting- edge useful

CPL-7

Philosophy knowledge science engineering , engineering design , methods and techniques latest required For analysis and design of processes, systems processing , and necessary equipment For change material standard become products that have mark plus with the process chemistry , physics and biology

COURSE LEARNING OUTCOMES

- CPMK-1 Student 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 Writing Dissertation ITS Postgraduate

Subject	Course Name	: Dissertation 3
	Course Code	: TK 236401
	Credit	: 3 credits
	Semester	: IV

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

Able to solve problem engineering and technology in the field of processes, systems processing , and necessary equipment For change material standard become products that have mark plus with the process chemistry , physics and biology through approach interdisciplinary , multidisciplinary or transdisciplinary with notice factors economy , health and safety public , cultural , social and environmental .

CPL-5

Able to develop knowledge and/ or technology new through research in the field of processes, systems processing , and necessary equipment For change material standard become products that have mark plus with the process chemistry , physics and biology until produce work creative , original and tested

CPL-6

Able to conceptualize , design and implement research in the field of processes, systems processing , and necessary equipment For change material standard become products that have mark plus with the process chemistry , physics and biology For produce knowledge , technology or draft new and cutting- edge useful

CPL-7

Philosophy knowledge science engineering , engineering design , methods and techniques latest required For analysis and design of processes, systems processing , and necessary equipment For change material standard become products that have mark plus with the process chemistry , physics and biology

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 Writing Dissertation ITS Postgraduate

Subject	Course Name	: Publication 2
	Course Code	: TK 236402
	Credit	: 3 credits
	Semester	: IV

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

Able to solve problem engineering and technology in the field of processes, systems processing , and necessary equipment For change material standard become products that have mark plus with the process chemistry , physics and biology through approach interdisciplinary , multidisciplinary or transdisciplinary with notice factors economy , health and safety public , cultural , social and environmental .

CPL-5

Able to develop knowledge and/ or technology new through research in the field of processes, systems processing , and necessary equipment For change material standard become products that have mark plus with the process chemistry , physics and biology until produce work creative , original and tested

CPL-6

Able to conceptualize , design and implement research in the field of processes, systems processing , and necessary equipment For change material standard become products that have mark plus with the process chemistry , physics and biology For produce knowledge , technology or draft new and cutting- edge useful

CPL-7

Philosophy knowledge science engineering , engineering design , methods and techniques latest required For analysis and design of processes, systems processing , and necessary equipment For change material standard become products that have mark plus with the process chemistry , physics and biology

COURSE LEARNING OUTCOMES

- CPMK-1 Student 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 Writing Dissertation ITS Postgraduate



Subject	Course Name	: Dissertation 4
	Course Code	: TK 236501
	Credit	: 4 credits
	Semester	: V

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

Able to solve problem engineering and technology in the field of processes, systems processing , and necessary equipment For change material standard become products that have mark plus with the process chemistry , physics and biology through approach interdisciplinary , multidisciplinary or transdisciplinary with notice factors economy , health and safety public , cultural , social and environmental .

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CPL-6

Able to conceptualize , design and implement research in the field of processes, systems processing , and necessary equipment For change material standard become products that have mark plus with the process chemistry , physics and biology For produce knowledge , technology or draft new and cutting- edge useful

CPL-7

Philosophy knowledge science engineering , engineering design , methods and techniques latest required For analysis and design of processes, systems processing , and necessary equipment For change material standard become products that have mark plus with the process chemistry , physics and biology

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
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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 Writing Dissertation ITS Postgraduate



Subject	Course Name	: Publication 3
	Course Code	: TK 236502
	Credit	: 3 credits
	Semester	: V

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

Able to solve problem engineering and technology in the field of processes, systems processing , and necessary equipment For change material standard become products that have mark plus with the process chemistry , physics and biology through approach interdisciplinary , multidisciplinary or transdisciplinary with notice factors economy , health and safety public , cultural , social and environmental .

CPL-5

Able to develop knowledge and/ or technology new through research in the field of processes, systems processing , and necessary equipment For change material standard become products that have mark plus with the process chemistry , physics and biology until produce work creative , original and tested

CPL-6

Able to conceptualize , design and implement research in the field of processes, systems processing , and necessary equipment For change material standard become products that have mark plus with the process chemistry , physics and biology For produce knowledge , technology or draft new and cutting- edge useful

CPL-7

Philosophy knowledge science engineering , engineering design , methods and techniques latest required For analysis and design of processes, systems processing , and necessary equipment For change material standard become products that have mark plus with the process chemistry , physics and biology

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

-

REFERENCES

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



Subject	Course Name	: Dissertation 6
	Course Code	: TK 236601
	Credit	: 6 credits
	Semester	: VI

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

Able to solve problem engineering and technology in the field of processes, systems processing , and necessary equipment For change material standard become products that have mark plus with the process chemistry , physics and biology through approach interdisciplinary , multidisciplinary or transdisciplinary with notice factors economy , health and safety public , cultural , social and environmental .

CPL-5

Able to develop knowledge and/ or technology new through research in the field of processes, systems processing , and necessary equipment For change material standard become products that have mark plus with the process chemistry , physics and biology until produce work creative , original and tested

CPL-6

Able to conceptualize , design and implement research in the field of processes, systems processing , and necessary equipment For change material standard become products that have mark plus with the process chemistry , physics and biology For produce knowledge , technology or draft new and cutting- edge useful

CPL-7

Philosophy knowledge science engineering , engineering design , methods and techniques latest required For analysis and design of processes, systems processing , and necessary equipment For change material standard become products that have mark plus with the process chemistry , physics and biology

COURSE LEARNING OUTCOMES

- CPMK-1 Student 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

-

REFERENCES

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



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
<p>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 mark plus 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 .</p> <p>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 .</p> <p>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</p>
COURSE LEARNING OUTCOMES
CPMK-1 Student 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	
	<ol style="list-style-type: none"> 5. Characterization Particle 6. Processing particles (mixing and segregation , granulation , deposition) 7. Formation particles (reduction and enlargement size , granulation) 8. Transportation particles (flow multiphase , displacement pneumatic , bed fluidized) 9. Separation fluid-particle (filtration , settling , cyclone) 10. Security (explosion dust)
PRECONDITION	
-	
REFERENCES	
	<ol style="list-style-type: none"> 4. Rhodes, M., "Introduction to Particle Technology", 2nd^{edition}, John Wiley & Sons, Ltd., 2008. 5. Masuda, H., Higashitani, K., and Yoshida, H., "Powder Technology Handbook", 3rd edition, Taylor & Francis Group, LLC., 2006.

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

COURSE DESCRIPTION	
<ul style="list-style-type: none"> • 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	
<p>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 mark plus with the process chemistry , physics and biology For give original and tested contributions through research in a way independent ;</p>	
CPL-5	
<p>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 mark plus with the process chemistry , physics and biology .</p>	
CPL-6	
<p>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</p>	
COURSE LEARNING OUTCOMES	
CPMK-1	Student 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	
<ol style="list-style-type: none"> 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	
-	
REFERENCES	
<ol style="list-style-type: none"> 1. Michael J. Moran, Howard N. Sapiro, “Fundamentals of Engineering Thermodynamics”, 5th edition, John Wiley & Sons, New York, 2006 2. TJ Kotas, “The Exergy Method of Thermal Plant Analysis, 2nd 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 mark plus 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 mark plus 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	
	<ol style="list-style-type: none"> 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	
-	
REFERENCES	
	<ol style="list-style-type: none"> 1. Versteeg, H.K., Malalasekera, W. (200 7). <i>An Introduction to Computational Fluid Dynamics</i> (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



<p>membrane in industry . With method learning covers lectures , discussions , studies case , learning based problems , Written exams , (includes quizzes , assignments and EAS)</p>
<p>LEARNING OUTCOMES OF GRADUATES CHARGED BY COURSES</p>
<p>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 mark plus with the process chemistry , physics and biology For give original and tested contributions through research in a way independent ;</p>
<p>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</p>
<p>COURSE LEARNING OUTCOMES</p>
<p>CPMK-1 Students capable explain base membrane material selection (C2)</p>
<p>CPMK-2 Students capable describes the manufacturing process and methods characterization membrane (C4)</p>
<p>CPMK-3 Students capable implement theory phenomenon displacement during the separation process membrane (C3)</p>
<p>CPMK-4 Students capable show it application inner membrane industry (C2)</p>
<p>SUBJECT</p>
<ol style="list-style-type: none"> 1. • Introduction and selection membrane material properties 2. • Membrane manufacturing process 3. • Membrane characterization 4. • Phenomenon displacement in the membrane 5. • Application membrane
<p>PRECONDITION</p>
<p>-</p>
<p>REFERENCES</p>
<ol style="list-style-type: none"> 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 mark plus 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 mark plus 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		
	<ol style="list-style-type: none"> 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		
-		
REFERENCES		
	<ol style="list-style-type: none"> 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
<p>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 electrolytics . 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 .</p>
LEARNING OUTCOMES OF GRADUATES CHARGED BY COURSES
<p>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 mark plus with the process chemistry , physics and biology For give original and tested contributions through research in a way independent .</p>
<p>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 mark plus with the process chemistry , physics and biology .</p>
<p>CPL-6 Control theory science and engineering , engineering design , methods and techniques latest required For analysis and design of processes, systems</p>

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	
<ol style="list-style-type: none"> 1. Bard, AJ and Faulkner, L.R., “Electrochemical Methods, Fundamentals and Applications”, 2nd 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 mark plus 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 mark plus 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	
<ul style="list-style-type: none"> 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	
<p>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 mark plus with the process chemistry , physics and biology For give original and tested contributions through research in a way independent .</p> <p>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 mark plus with the process chemistry , physics and biology .</p> <p>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 .</p>	
COURSE LEARNING OUTCOMES	
<p>CPMK-1 Students understand the use of natural gas</p> <p>CPMK-2 Students understand the thermodynamics of natural gas</p> <p>CPMK-3 Students understand the basic design of natural gas processes</p> <p>CPMK-4 Students understand natural gas production</p>	
SUBJECT	
<ol style="list-style-type: none"> Natural gas reserves and utilization 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 , 5th Ed., McGraw-Hill Education, 2001 .



Subject	Course Name : Technology Polymer
	Course Code : TK235308
	Credit : 3 credits
	Semester : X
COURSE DESCRIPTION	
Learn basics polymer , relationship between characteristic with structure and behavior the process .	
LEARNING OUTCOMES OF GRADUATES CHARGED BY COURSES	
<p>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 mark plus 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 .</p> <p>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 .</p> <p>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</p>	
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	
Draft polymers , their classification , structure and processing ; fundamentals and kinetics polymerization . Copolymerization and techniques polymerization ; examples and discussion industry polymer commercial ; thermal properties (Cp, k, r), and their predictions , PVP concept , PVP estimation and data, solubility polymer , processing polymers and their types ; draft Tg , Tm and their characterization . Packaging and recycling. Characterization polymer ; heavy molecules , DSC, SEM, TEM, FTIR and others.	
PRECONDITION	
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REFERENCES	
<ol style="list-style-type: none"> 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 mark plus 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 mark plus 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 Carry on
	Course Code : TK235310
	Credit : 3 credits
	Semester : X
COURSE DESCRIPTION	
<p>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.</p>	
LEARNING OUTCOMES OF GRADUATES CHARGED BY COURSES	
<p>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 mark plus 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 .</p>	
<p>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 .</p>	
<p>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</p>	

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	
<ol style="list-style-type: none"> 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	
<ol style="list-style-type: none"> 1. Dale E. Seborg, Thomas F. Edgar, Duncan A. Mellichamp, Francis J. Doyle III, "Process Dynamics and Control", 4th ed . , John Wiley & Sons, New. York., 2016. 2. Sigurd Skogestad , Ian Postlethwaite, " Multivariable Feedback Control", 2nd edition, John Wiley & Sons, New York, 2005. 	