CourseSylabus

Program	**Industrial Engineering**
Degree	**Undergraduate (Bachelor ofEngineering)**

Program Educational Objectives

The program educational objectives for the Bachelor in Industrial Engineering areto provide graduates with:
PEO 1. *Graduates are recognized as effective **problem solvers** indicated by theirskills in using holistic and integrated approaches to address complex industrial problems in their workplaces.*

This PEO includes the skills to:

- identify, formulate, analyze, and solve engineering problems for both service and manufacturing industry.
- plan, design, and control integrated system on both service and manufacturing industry.
- allocate resources and apply current principles and methods of engineering analysis and design that suitable for conducting system engineering activities while considering the constraints.

PEO 2. *Graduates are competently able to apply **analytical tools**, computers, and industrial engineering methodologies to address practical problems.*

This PEO includes the skills to:

- comprehend basic quantitative science, especially mathematicsand statistics.
- comprehend basic engineering to support industrial engineeringknowledge.
- comprehend basic management and economics.
- comprehend in detail industrial engineering knowledge.
- comprehend system theory (including: analysis, design, dynamics, engineering, methodology and system control) and
  application of up-to-dated engineering mathematics.

PEO 3. *Graduates can assume **managerial and leadership** roles in their chosenprofessional careers.*

This PEO includes the skills to:

- work in multidisciplinary team.
- plan, execute, and control activities in the situation of limitedresources.
- make a decision or support decision making properly based oninformation, analysis, and engineering methods.

PEO 4. *Graduates are effectively **adapt** to changing demands in the workplace and engage in **lifelong learning**.*

This PEO includes the skills to:

- manage her/himself and to behave professionally in workingenvironment.
- work in team proportionally in accordance with working demand
- communicate idea systematically in the context of oral, written, and electronic media using both Bahasa Indonesia and English
- be aware to environmental and sustainability issues and to accommodate those

issues in analysis, design, and decisionmaking.

- be creative and innovative in some aspects of living, especially to those related to his/her profession.

Each PEO is supported by several skills and breaken down into detail as shown inthe Table 1

Table 1. Program Education Objectives in Detail

Program Education Objectives in Detail		
PEO 1	1.1	To be able to identify, formulate, analyze, and solve engineering problems for both service and manufacturing industry.
	1.2	To be able to plan, design, and control integrated system on both service and manufacturing industry
	1.3	To be able to allocate resources and apply current principles andmethods of engineering analysis and design that suitable for conducting system engineering activities while onsidering the constraints.
PEO 2	2.1	To comprehend basic quantitative science, especially mathematics and statistics.
	2.2	To comprehend basic engineering to support industrial engineering knowledge.
	2.3	To comprehend basic management and economics.
	2.4	To comprehend in detail industrial engineering knowledge.
	2.5	To comprehend system theory (including: analysis, design, dynamics,engineering, methodology and system control) and application of up-to-dated engineering Mathematics.
PEO 3	3.1	To be able to work in multidisciplinary team
	3.2	To be able to plan, execute, and control activities in the situation of limited resources.
	3.3	To be able to make a decision or support decision making properly based on information, analysis, and engineering methods.
PEO 4	4.1	To be able to manage his/herself and to behave professionally in working environment.
	4.2	To be able to work in team proportionally in accordance with working demand.
	4.3	To be able to communicate idea systematically in the context of oral, written, and electronic media using both Bahasa Indonesia and English.
	4.4	To be aware to environmental and sustainability issues and to accommodate those issues in analysis, design, and decision making.
	4.5	To be creative and innovative in some aspects of living, especially to those related to his/her profession.

List of Compulsory Courses

No	Code	Course Name	Credits
SEMESTER 1			
1	UG1849xx	Religion Studies	2
2	UG184912	Bahasa Indonesia	2
3	SF184101	Physics 1	4
4	UG184913	Civics	2
5	SK184101	Chemistry 1	3
6	KM184101	Mathematics 1	3
7	TI184101	Introduction to Industrial and System Engineering	2
Total credits			18
SEMESTER 3			
1	TI184305	Introduction to Economics	2
2	TI184306	Engineering Statistics 2	3
3	TI184307	Cost Analysis and Estimation	3
4	TI184308	Manufacturing Process	3
5	TI184309	Ergonomics	4
6	TI194310	Operation Research 1	3
Total credits			18
SEMESTER 5			
1	TI184517	Quality Control Techniques	3
2	TI184518	Production Planning and	3

No	Code	Course Name	Credits
SEMESTER 2			
1	UG184914	English	2
2	SF184202	Physics 2	3
3	KM184201	Mathematics 2	3
4	TI184202	Engineering Drawing	2
5	UG184911	Pancasila	2
6	TI184204	Engineering Materials	3
7	TI184203	Engineering Statistics 1	3
Total credits			18
SEMESTER 4			
1	TI184411	Algorithm and Computer Programming	3
2	TI184412	Industrial Automation	3
3	TI184413	Method Engineering and Work Measurement	3
4	TI184414	Manufacturing System	3
5	TI184415	Engineering Economy	3
6	TI184416	Operation Research 2	3
Total credits			18
SEMESTER 6			
1	TI184623	Maintenance and Reliability Engineering	3
2	TI184624	Facility Planning	3

		Inventory Control	
3	TI184519	Basic Mechanical Engineering	3
4	TI184520	Product Design and Development	3
5	TI184521	Organization and Human Resource Management	3
6	TI184522	Industrial System Simulation	3
Total credits			18
SEMESTER 7			
1	TI184727	Industrial Ecology	2
2	TI184728	Supply Chain Management	3
3	TI184729	Industrial Planning	4
4	UG184916	Concept of Technology	3
5	TI1849XX	Elective Course 3	3
6		Enrichment Course (Interdepartmental course)	3
Total credits			18

3	TI184625	System Modeling	3
4	TI184626	Logistics System	3
5	TI1849XX	Elective Course 1	3
6	TI1849XX	Elective Course 2	3
Total credits			18
SEMESTER 8			
1	TI184830	Project Management	2
2	TI184831	Business Information System Design	3
3	TI184832	Practical Work	2
4	UG184915	Technopreneurship	2
5	TI1849XX	Elective Course 4	3
6	TI184833	Final Project	6
Total credits			18

List of Elective Courses

No	Code	Course Name	Credits
1	TI184901	Productivity Analysis	3
2	TI184902	Computer Integrated Manufacturing	3
3	TI184903	Concurrent Engineering	3
4	TI184904	Technology Management	3
5	TI184905	Six Sigma	3

No	Code	Course Name	Credits
6	TI184906	Sustainable Manufacturing	3
7	TI184907	Industrial Environmental Management	3
8	TI184908	Quality Management	3
9	TI184909	Experiment Design	3
10	TI184910	Quality	3

11	TI184911	Value Engineering	3
12	TI184912	Multi Criteria Decision Making	3
13	TI184918	Industrial Ergonomics Applications	3
14	TI184919	Ergo Safety *	3
15	TI184920	Ergonomic Macro	3
16	TI184921	Design of Method and Work Studio	3
17	TI184922	Physiology and Work Biomenikanika	3
18	TI184923	Human Factors in Product Design	3
19	TI184924	Visual Ergonomics	3
20	TI184925	Human Reliability	3
21	TI184926	Cognitive Ergonomics	3
22	TI184927	Office Ergonomics	3
23	TI184933	Large-Scale Optimization	3
24	TI184934	Data Mining	3
25	TI184935	Metaheuristic Optimization	3
26	TI184936	Production Scheduling	3
27	TI184937	System Dynamics Methodology	3
28	TI184938	Facility Layout Modelling	3
29	TI184939	Constraint	3

		Engineering	
30	TI184940	Game Theory	3
31	TI184941	Analysis Decision	3
32	TI184947	Service Management	3
33	TI184948	Work management	3
34	TI184949	Knowledge Management	3
35	TI184950	Corporate Strategy	3
36	TI184951	Financial management	3
37	TI184952	Managerial Accounting	3
38	TI184953	Organizational Behaviour	3
39	TI184954	Corporate Risk Management	3
40	TI184955	Industrial Cluster	3
41	TI184956	e-Business and e-Commerce	3
42	TI184957	Industrial Economics	3
43	TI184958	Agent Based Modelling	3
44	TI184959	Business Valuation	3
45	TI184965	Enterprise Resource Planning (ERP)	3
46	TI184966	Material Management and Procurement	3
47	TI184967	Air Transport Management	3
48	TI184968	Distribution	3

		Theory	
49	TI184969	Business Process Engineering	3
50	TI184975	Industrial Internship I	3

		Management	
51	TI184976	Industrial Internship II	3

Elective Courses

No.	Code	Course Name	Coordinator (Laboratory)	Credits
1	TI184901	Applied Ergonomics	EPSK	3
2	TI184902	Ergo Safety	EPSK	3
3	TI184903	Macro Ergonomics	EPSK	3
4	TI184904	Methods and Work System Design	EPSK	3
5	TI184905	Physiology and Work Biomechanics	EPSK	3
6	TI184906	Human Factors in Product Design*	EPSK	3
7	TI184907	Visual Ergonomics*	EPSK	3
8	TI184908	Human Reliability	EPSK	3
9	TI184909	Cognitive Ergonomics	EPSK	3
10	TI184910	Office Ergonomics*	EPSK	3
11	TI184921	Productivity Analysis	SISMAN	3
12	TI184922	Computer Integrated Manufacturing	SISMAN	3
13	TI184923	Concurrent Engineering	SISMAN	3
14	TI184924	Technology Management*	SISMAN	3
15	TI184925	Six Sigma	SISMAN	3
16	TI184926	Sustainable Manufacturing	SISMAN	3
17	TI184927	Industrial Environmental Management	SISMAN	3
18	TI184928	Quality Management*	SISMAN	3
19	TI184929	Experimental Design*	SISMAN	3
20	TI184930	Quality Engineering Learning Design	SISMAN	3
21	TI184931	Value Engineering*	SISMAN	3
22	TI184932	Process Capability Analysis*	SISMAN	3
23	TI184933	Lean Concept & Its Applications	SISMAN	3
24	TI184941	Multi Criteria Decision Making	QMIPA	3
25	TI184942	Large Scale Optimization*	QMIPA	3
26	TI184943	Data Mining	QMIPA	3
27	TI184944	Metaheuristics Optimization	QMIPA	3
28	TI184945	Production Scheduling*	QMIPA	3
29	TI184946	System Dynamics Methodology	QMIPA	3
30	TI184947	Facility Layout Modeling*	QMIPA	3
31	TI184948	Constraint Theory*	QMIPA	3
32	TI184949	Game Theory	QMIPA	3
33	TI184951	Decision Analysis	QMIPA	3
34	TI184952	Applied Discrete Event Simulation	QMIPA	3
35	TI184962	Enterprise Resource Planning	LSCM	3
36	TI184963	Procurement and Material Management	LSCM	3

No.	Code	Course Name	Coordinator (Laboratory)	Credits
37	TI184964	Air Transportation Management	LSCM	3
38	TI184965	Distribution Management	LSCM	3
39	TI184970	Supply Chain Engineering*	LSCM	3
40	TI184966	Retail Supply Chain Management	LSCM	3
41	TI184971	Business Process Re-Engineering	PSMI	3
42	TI184972	Service Management	PSMI	3
43	TI184973	Performance Management	PSMI	3
44	TI184974	Knowledge Management	PSMI	3
45	TI184975	Corporate Strategy*	PSMI	3
46	TI184976	Financial Management	PSMI	3
47	TI184977	Managerial Accounting*	PSMI	3
48	TI184978	Organizational Behavior*	PSMI	3
49	TI184979	Corporate Risk Management	PSMI	3
50	TI184980	Industrial Cluster	PSMI	3
51	TI184981	E-Business and E-Commerce*	PSMI	3
52	TI184982	Industrial Economics*	PSMI	3
53	TI184983	Agent-Based Modelling	PSMI	3
54	TI184984	Business Valuation*	PSMI	3
55	TI184985	Marketing Management*	PSMI	3
56	TI184986	Strategic Management	PSMI	3

Note:

- EPSK : The Ergonomics and Work System Design Laboratory
- SISMAN : The Manufacturing Systems Laboratory
- QMIPA : The Quantitative Modelling and Industrial Policy Analysis Laboratory
- PSMI : The Logistic and Supply Chain ManagementLaboratory

A course with an asterisk symbol (*) is not offered in the last two (2) years, and its learning plan is not included in this document.

Sylabus – Compulsory Courses

COURSE	**UG1849xx**	**: RELIGION STUDIES (For example: ISLAM)**
	Credit	: 2 credits
	Semester	: 1

COURSE DESCRIPTION

In this course, students will learn about Islam and its teachings that include theology, syari'ah, Islamic morals and insight in order to have a comprehensive ability to synergize the development and utilization of science and technology in order to bring benefit to mankind. Lectures will be conducted in the classroom in the form of materials, tasks, and discussions, as well as outside the classroom in the form of case studies and outdoor lectures, so that students are able to think and act based on Islamic values and upholding justice and truth. In the end, students have the character of an honest, trustworthy, communicative, intelligent and social sensitivity in performing a harmonious relationship to manifest piety and social rituals.

COURSE'S LEARNING OUTCOME

- Students are able to explain Islam and its teachings properly
- Students are able to understand human nature and responsibilities as a human being
- Students are able to make the creed of Islam as the foundation of thinking and attitude
- Students are able to implement a noble character in life
- Students have a sense of justice and ready to enforce the law and human rights in society
- Students have tolerant and able to realize harmony.
- Students are able to understand the concept of science and technology in Islam and are able to integrate faith, science and charity as well as having an attitude of responsibility as scientists
- Students are able to distinguish between Islamic teachings and cultures
- Students are able to be democratic, and understand political discourse in the Islamic perspective
- Students have a civil character and ready to become a part of modern society, and can be implemented in reality

MAIN REFERENCES

- Ahmad, HA. Malik, TauhidMembina Pribadi Muslim dan Masyarakat, Jakarta: al- Hidayah, 1980.
- Al-Ghazali, Ihya' Ulumuddin, terjemahan Ismail Ya'qub, Jakarta: CV. Faizan, 1988.
- Depag RI, Materi Instruksional Pendidikan Agama Islam di Perguruan Tinggi Umum, Jakarta, 2004.
- Iberani, Jamal Syarif dan MM. Hidayat, Mengenal Islam, Jakarta: El-Kahfi, 2003
- Imarah, Muhammad, Islam dan Pluralitas: Perbedaan dan Kemajemukan dalam Bingkai
- Persatuan, Jakarta: Gema Insani,1999.
- Muhibbin, Zainul dkk, Pendidikan Agama Islam Membangun Karakter Madani, Surabaya: ITS Press, 2012
- Muslim Nurdin, KH., dkk, Moral dan Kognisi Islam, Bandung: Alfabeta, 1995.
- Mutahhari, Murtadha, Perspektif Al-Qur'an tentangManusiadan Agama, Bandung: Mizan, 1984.
- Razaq, Nasaruddin, Dinnul Islam, Bandung: Al-Ma'arif, 1998
- Shihab, Muhammad Quraish, Membumikan al-Qur'an,Bandung: Mizan, 1996
- Wahyuddin dkk, Pendidikan Agama Islam untukPerguruanTinggi, Jakarta:Grasindo, 2009

COURSE	UG184912	: BAHASA INDONESIA
	Credit	: 2 credits
	Semester	: 1

COURSE DESCRIPTION

This course is one of the general/national compulsory courses. Students will explore course material including (a) proper academic ethics and differences in the types and systematics of KTI, (b) the formulation of the Indonesian language used in KTI with due observance of the principles of grammar, PUEBI, and KBBI principles, (c) references related to KTI, (d) the accuracy of the Indonesian language formulation in writing KTI, (e) the correct and correct use of Indonesian formulations in the preparation of KTI, (f) skilled in conveying the results
of ideas/ideas verbally.

COURSE'S LEARNING OUTCOME

- Students can understand academic ethics and the differences in the types andsystematics of scientific writing (KTI) appropriately.
- Students can understand the Indonesian formulation used in KTI according togrammar, PUEBI, and KBBI principles.
- Students can understand the references related to KTI.
- Students can understand the Indonesian language formulation in writing KTI.
- Students can use Indonesian formulations properly and correctly in preparation.
- Students can convey their ideas/ideas verbally.

MAIN REFERENCES

- Dirjen Pembelajaran dan Kemahasiswaan Kemenristekdikti, Bahasa Indonesia untukPerguruan Tinggi, Jakarta, Dirjen Belmawa, 2016.
- Kamus Besar Bahasa Indonesia (daring atau luring), Kemdikbud RI.
- Hasan Alwi dkk. Tata Bahasa Baku Bahasa Indonesia. Edisi Ketiga., Balai Pustaka.
- Pedoman Umum Ejaan Bahasa Indonesia (PUEBI).

COURSE	SF184101	: Physics 1
	Credit	: 4 credits
	Semester	: 1

COURSE DESCRIPTION

Physics 1 is designed to provide fundamental tools for students in understanding various natural characteristics as well as introducing numerous laws of physics. This course will describe the basic physics theory of motion, vibration and wave, and fluid in a basic mathematical form, followed by exercises and their applications. By attending this course, students are expected to be able to apply various physics approach to solve various physics-related real-life problems.

COURSE'S LEARNING OUTCOME

- Students can use various basic laws of physics about mechanical, fluid, and heat
- Ability to solve various physics-related problems
- Keep up with contemporary development in science and technology
- Able to apply basic laws of physics in other aspects

MAIN REFERENCES

1. Halliday & Resnic; 'Fundamental of Physics'. John Wiley and Sons, New York, 1987
2. Tim Dosen, "Diktat Fisika I", "Soal-soal Fisika I", Fisika FMIPA-ITS

COURSE	UG184913	: Civics
	Credit	: 2 credits
	Semester	: 1

COURSE DESCRIPTION

In this course, students acquire knowledge and learning experiences to increase understanding and awareness about: a sense of nationalism and patriotism, civilized democratic, become citizens who are competitive, disciplined and actively participated in building a peaceful life based on system of values of Pancasila. After this course, students are expected to be able to realize themselves into good citizens who capable of supporting the nation, democratic citizens, namely citizens who are intelligent, civilized and responsible for the survival of Indonesia in practice the ability of science, technology and art holds.

COURSE'S LEARNING OUTCOME

- Students are able to utilize science and technology according to the principles of sustainable development to support the achievement of the welfare and prosperity of Indonesian people
- Students have comprehensive knowledge to synergize the utility of science and technology with national elements including Pancasila, the 1945 Constitution, Legal System and Governance, Human Rights, Democracy, Geopolitics and Geo- strategy
- Students are able to take the right decision to prioritize national interests, upholding human rights and fair international relationship
- Students uphold the attitudes and values: respect the unity in diversity, able to work in a team, has the nature of trust, social sensitivity and high passion for the community and for Indonesia

MAIN REFERENCES

- Winarno, Paradigma Baru Pendidikan Kewarganegaraan, Penerbit Bumi Aksara
- Soedarso, Filsafat Pancasila Identitas Indonesia, Penerbit Pustaka Radja
- Hasan Alwi, Bahasa Baku Bahasa Indonesia, Penerbit Balai Pustaka
- Ir. Sukarno, editor H Amin Arjoso, SH, Tjamkan Pancasila Dasar Falsafah Negara, Penerbit Panitia Nasional Peringatan Lahirnya Pancasila 1 Juni 1945 – 1 Juni 1964 Jakarta
- Prof.Dr. Moh. Mahfud M.D., Dasar dan Struktur Ketatanegaraan Indonesia, Penerbit PT Rineka Cipta.
- Magnis-Suseno, Etika Politik: Prinsip-prinsip Moral Dasar Kenegaraan Modern, Penerbit Gramedia Pustaka Utama
- Inu Kencana Syafiie & Andi Azikin, Perbandingan Pemerintahan, Penerbit PT Refika Aditama
- Gunawan Sumodiningrat, Mewujudkan Kesejahteraan Bangsa, Penerbit PT Elex Media Komputindo

COURSE	SK184101	: Chemistry 1
	Credit	: 3 credits
	Semester	: 1

COURSE DESCRIPTION

This course focuses on the basic principles of chemistry as prerequisite knowledge of more advanced sciences related to chemistry. The material presented includes atomic theory, chemical bonding, stoichiometry, substance forms and phase changes, acid-base theory, ionic equilibrium in solution, chemical thermodynamics, chemical kinetics and electrochemistry. Data are valuable resources, and the amount of information available is exploding.

COURSE'S LEARNING OUTCOME

- Students can use the basic principles of chemistry as a basis for studying sciencerelated to chemistry.
- Students can perform basic chemical calculations.

MAIN REFERENCES

- *Tim Dosen Departemen Kimia, (2019). "Kimia 1", edisi kedua, Media Bersaudara, Surabaya.*

COURSE	KM184101	: Mathematics 1
	Credit	: 3 credits
	Semester	: 1

COURSE DESCRIPTION

In this course, the student will learn concepts, characteristics, and solving technique of function, differentiation, and integration. This course covers the concept of mathematical thinking in solving various problems on engineering, modelling, and other problems that related to the application of differentiation and integration
Course materials are including the system of real numbers, function and limit, derivation and its applications, Integral with elementary functions Learning methods: lecture, discussion, computation & problem interpretation exercises

COURSE'S LEARNING OUTCOME

- Able to solve an inequality, determine the domain and range.
- Able to understand and calculate function of limit and determine function continuity.
- Able to derive mathematical functions and applies on an optimization functions
- Able to make a graph that contatins asymptotes, utilizing derivation test to determine extreme point, increasing / decreasing function, and concavity-convexity
- Able to calculate uncertain caluculus with substitution problem

MAIN REFERENCES

1. Tim Dosen Jurusan Matematika ITS, *Buku Ajar Kalkulus I* , Edisi ke-4 JurusanMatematika ITS, 2012
2. Anton, H. dkk, *Calculus,* 10-th edition, John Wiley & Sons, New York, 2012

COURSE	TI184101	: Introduction To Industrial and System Engineering
	Credit	: 2 credits
	Semester	: 1

COURSE DESCRIPTION

An overview of the profile, profession, employment opportunities and competencies that would be possessed by a graduate of Industrial Engineering is initial foundation that need to be understood by industrial engineering students. Introduction to Industrial and Systems Engineering gives that overview both hard skill and soft skill, an initial understanding of a system and their interactions, understanding of business systems and business processes
occurring within the company in general and the way it is managed, the interaction between the company, as well as an overview of the curriculum and courses that exist in the Industrial Engineering Department. After attending this course, students are expected to understand and be able to explain the basic framework of science in Industrial Engineering, to understand the concept of the system and their interactions, as well as understanding the structure and linkage of Industrial Engineering courses. This course will introduce a variety of teaching methods based on Student-Centered-Learning (SCL) that student actively involved in learning process.

COURSE'S LEARNING OUTCOME

- Students understand and are able to explain the basic framework of science inIndustrial Engineering
- Students understand and are able to explain the definition of system and its content
- Students understand, own and are able to explain the systems thinking
- Students have the basic analytical ability in understanding systems and simplebusiness processes
- Students understand the curriculum structure and interrelationships between thecourses
- Students have team working ability to do simple assignments
- Students have basic learning skills include searching, reading, extracting, andpresenting information and ideas orally and in writing

MAIN REFERENCES

1. Wignjosoebroto, S. (2003) *Pengantar Teknik dan Manajemen Industri*, Guna Widya,Surabaya.
2. Turner, W. (1993) *Introduction to Industrial and System Engineering*, Prentice Hall,New York.
3. Hicks, P. E. (1994) *Industrial Engineering and Management: A New Perspective*,McGraw-Hill, Tokyo.
4. Daellenbach, H. G. & McNickle, D. C. (2005) *Management Science: Decision Makingthrough Systems Thinking*, Palgrave Macmillan, New York

COURSE	UG184914	: English
	Credit	: 2 credits
	Semester	: 2

COURSE DESCRIPTION

In this course, students will learn about the basic concepts of language skills including listening skills, speaking, reading and writing. In addition, students apply the basic conceptsof the language skills to express ideas and thoughts in oral and in written in the academic life as well as empirical insights especially related to science and technology.

COURSE'S LEARNING OUTCOME

- Students are able to understand material course delivered by lecture in english
- Students are able to speak and to provide opinion, argumentation, question, answer, and interruption which is appropriate to the context
- Students are able to read actively and critically while understanding reading contents (content aspects, text features, as well as author attitudes: tone and purpose)
- Students are able to write by developing sentences, paragraphs, and essay based on writing types (narrative, descriptive, and argumentative); as well as ideas development regarding unity and coherency aspects.
- Students are able to work in a team while discussing problem
- Students are able to present ideas and work results well in english

MAIN REFERENCES

1. Becker Lucinda & Joan Van Emden, "Presentation Skills for Students, Palgrave, Macmillan, 2010
2. Bonamy David, "Technical English," Pearson Education, New York, 2011
3. Fellag Linda Robinson, "College Reading," Houghton Mifflin Company, 2006
4. Fuchs Marjorie & Bonner Margaret, " Focus on Grammar; An Integrated Skills Approach," Pearson Education, Inc, 2006
5. Hague Ann, " First Steps in Academic Writing," Addison Wesley Publishing Company,1996
6. Hogue Ann, Oshima Alice, "Introduction to Academic Writing", Longman,1997
7. Hockly Nicky & Dudeney Gavin, "How to Teach English with Technology, Pearson Education Limited, 2007
8. Johnston Susan S, Zukowski Jean/Faust, "Steps to Academic Reading," Heinle, Canada, 2002.
9. Mikulecky, Beatrice S, "Advanced Reading Power", Pearson Education, New York, 2007.
10. Preiss Sherry, "NorthStar: Listening and Speaking," Pearson Education, New York 2009.
11. Root Christine & Blanchard Karen, " Ready to Read Now, Pearson Education, New York, 2005

COURSE	SF184202	: PHYSICS 2
	Credit	: 2 credits
	Semester	: 2

COURSE DESCRIPTION

This course is designed to provide an understanding of natural circumstances and the law of physics on electricity and magnetism to enrolled students. This course is supposed to give an understanding of various principles and basic physics concepts that related to electricity and magnetism, to solve basic physics problem through theoretical and experimental studies. The explanation would be provided in a simple mathematical form, followed by exercises and their applications. This course contains lab practice so that students can measure physical magnitude correctly, able to analyze lab practice data, and able to describe the lab practice results in scientific writings. After attending this course, students are expected to be able to analyze electricity and magnetism phenomena by utilizing various laws of physics, as well as analyzing an electrical circuit.

COURSE'S LEARNING OUTCOME

- Students can explain and utilizing laws of physics that correspond to electricity andmagnetism
- Ability to solve problems
- Keep up with contemporary development in science and technology
- Able to apply basic laws of physics that correspond to electricity and magnetism inother aspects

MAIN REFERENCES

1. Halliday & Resnic; 'Fundamental of Physics'. John Wiley and Sons, New York, 1987
2. Tim Dosen, "Diktat Fisika I", "Soal-soal Fisika I", Fisika FMIPA-ITS
3. "Petunjuk Praktikum Fisika Dasar ", Fisika, MIPA-ITS

COURSE	KM184201	: Mathematics 2
	Credit	: 2 credits
	Semester	: 2

COURSE DESCRIPTION

In this course, students will learn about the theory and solving technique towards integral and row, the concept of mathematical thinking so that he/she is ready to learn further, especially materials that related to integration, convergence and its application.
Materials that are covered in this course: various simple integration technique, application of integral, row and its application.
Learning method: lecture, discussion, and independent and group exercises.

COURSE'S LEARNING OUTCOME

- Students can understand the concept of integration and solve a problem with asuitable method
- Students can apply integration technique on problems related to geometry
- Students can understand concepts of function on polar coordinate and parametricequality
- Students can understand concepts of convergence from infinite row
- Students can understand and utilize row (MacLaurin dan Taylor, Binomial) from a function

MAIN REFERENCES

1. Tim Dosen Jurusan Matematika ITS, *Buku Ajar Kalkulus 2* , Edisi ke-5 JurusanMatematika ITS, 2014
2. Anton, H, et. al, *Calculus,* 10-th edition, John Wiley & Sons, New York, 2012

COURSE	TI184202	: ENGINEERING DRAWING
	Credit	: 2 credits
	Semester	: 2

COURSE DESCRIPTION

Engineering Drawing is one of the important activity in manufacturing system, which engineer tranform their design or ideas into product visualization. This course provides knowledge about engineering tools, how to read and understand an engineering drawing, also some basic principles of engineering drawing that used to produce and develop tangible products.

COURSE'S LEARNING OUTCOME

Students able to read an engineering drawing, and able to make visual design of products that is good and communicative.

MAIN REFERENCES

Gupta, BVR and M Raja Roy. Engineering Drawing. New Delhi: I.K. International Publishing House Pvt Ltd. 2008

COURSE	UG184911	: PANCASILA
	Credit	: 2 credits
	Semester	: 2

COURSE DESCRIPTION

The course is one of the general/national compulsory courses. In this course, students will gain knowledge and learning experiences to increase understanding and awareness of a sense of nationality and love for the country through insight into Pancasila so that they become citizens who have competitiveness, are highly disciplined and actively participate in building a peaceful life based on the Pancasila value system. Upon the completion of thiscourse, students are expected to manifest themselves into good citizens who can support their nation and state. Students become civilized and responsible citizens for the survival of the Indonesian state in exercising their skills in science, technology and the arts.

COURSE'S LEARNING OUTCOME

- Students can understand the importance of history to strengthen national identityand Indonesian national identity.
- Students can analyze national factual problems based on the Pancasila perspective.
- Students can analyze the concept of developing science and technology based on thevalues of Pancasila.
- Students can practice social sensitivity, environmental awareness and love for thecountry.

MAIN REFERENCES

Kemenristekdikti. 2016. Pendidikan Pancasila Untuk Perguruan Tinggi. Jakarta: Dirjen Belmawa Kementerian Dikti

COURSE	**TI184204**	**: ENGINEERING MATERIALS**
	Credit	: 3 credits
	Semester	: 2

COURSE DESCRIPTION

Knowledge of materials is needed to be able to analyze the production system and application of a material in the industrial world. Technical material knowledge discusses the material classification, material mechanical properties, testing the mechanical properties of materials, iron-iron carbide phase diagrams, the process of making iron and steel, non-ferrous metals, corrosion and corrosion prevention. It is expected that at the end of the lecture students will be able to understand the material classification and application of several types of material, know the testing mechanism and calculate the results of the test of the mechanical properties of the material which includes tensile properties, hardness properties, properties, impacts, fatigue properties and creep properties, understand the concept of iron phase diagrams - carbide iron, understand the mechanism of making iron and steel with several types of melting reactors, understand the classification and properties of non ferrous metals, understand the corrosion behaviour of the material and understand the mechanism of corrosion prevention on the material.

COURSE'S LEARNING OUTCOME

- Explaining the materials classifications
- Analyzing the mechanical properties of materials
- Explaining the concept of the iron carbide phase diagram
- Explaining the process of making iron and steel
- Explaining the classification of non-ferrous metals nad their applications
- Explaining the basic concepts of corrosion in materials
- Explaining corrosion prevention

MAIN REFERENCES

- William D. Calister, Jr, "An Introduction Material Science and Engineering", 7 th edition, John Willey & Sons, Inc, USA
- Wahid Suherman, "Pengetahuan Bahan Teknik", Institut Teknologi Sepuluh Nopember Teknik Material dan Metalurgi, Surabaya, Indonesia

COURSE	**TI184203**	**: ENGINEERING STATISTICS 1**
	Credit	: 3 credits
	Semester	: 2

COURSE DESCRIPTION

Industrial statistics 1 discusses statistical methods that can be used to solve industrial problems. Topics covered include types of data, descriptive statistics (numeric and graphic), probability distribution (discrete and continuous), sampling distributions, sampling methods, parameter estimation and confidence interval.

COURSE'S LEARNING OUTCOME

- able to use descriptive statistics to analyze data
- able to use some inferential statistics methods (probability distribution,sampling, point estimate and confidence interval) to solve industrial problem
- able to use statistical software.

MAIN REFERENCES

David F. Groebner, Patrick W. Shannon, Phillip C.Fry dan Kent D. Smith, "business Statistics : A Decission Making Approach", Prentice Hall, 8th Edition,2010.

COURSE	**TI184305**	**: INTRODUCTION TO ECONOMICS**
	Credit	: 2 credits
	Semester	: 3
COURSE DESCRIPTION		
Introduction to Economic is not to introduce to Economics but is to draw important part from it for engineering design in industrial engineering perspective. The important part of economic that will be drawn include some topics of micro and macro- economics that have strong relevancy with importance for design, development, and installation of integrated system of part or product industrial business that gain economic profit sustainability.		
COURSE'S LEARNING OUTCOME		
Student able to understand principles of economics (micro and macro) for design,development, and installation optimal integrated system of parts of transformation process in level of work station, enterprise, and industry.		
MAIN REFERENCES		
Lipsey, R, Crystal, A, 2011, Economics, 12 th, Oxford University Press Inc., New York.		

COURSE	**TI184306**	**: ENGINEERING STATISTICS 2**
	Credit	: 3 credits
	Semester	: 3
COURSE DESCRIPTION		
Data analysis is absolutely needed to solve industrial problems. To give solution to this problem, students need strong analytical skill. Industrial Statistics I and II give understanding and set up comprehensive ability to fulfill this need. Industrial Statistics II is a continuation of its predecessor Industrial Statistics I. Industrial Statistics II mainly emphasizes on comprehending inferential statistics including hypothesis test, analysis of variance, correlation analysis, regression analysis, goodness of fit, contingency table and non-parametric statistics. By mastering these topics, students are expected to have sufficient knowledge and strong analytical skill especially in inferential process (how to estimate population parameter based on sample data) in the shake of completing their further courses, on job training, or undergraduate thesis.		
COURSE'S LEARNING OUTCOME		
Able to apply inferential statistics based on hypothesis test, analysis of variance, regression, and non-parametric statistics norms.		
MAIN REFERENCES		
David F. Groebner, Patrick W. Shannon, Phillip C.Fry dan Kent D. Smith, "Bussiness Statistics : A Decission Making Approach", Prentice Hall, 8th Edition,2010.		

COURSE	**TI184307**	**: COST ANALYSIS AND ESTIMATION**
	Credit	: 3 credits
	Semester	: 3
COURSE DESCRIPTION		
Students are expected to have a thorough understanding on accumulated cost during various types of manufacture and service industry and able to perform an estimation and calculation of production cost, record it according a generally accepted accounting system and review it based on report produced.		
COURSE'S LEARNING OUTCOME		
• To understand the relationship of industrial activities cycle and accounting process. • To provide knowledge and skills in recording, classifying, reporting and analysis of financial report. • To understand cost management systems in varios type of industry.		

- To identify and calculate various product cost type.
- To understand job order osting, process-costing and activity based costing.
- To understand full costing dan direct costing methods.
- To understand product cost estimation.
- To understand profit planning and control system.

MAIN REFERENCES

Warren et al., Accounting 21th , Thomson Learning, 2010.

COURSE	TI184308	: MANUFACTURING PROCESS
	Credit	: 3 credits
	Semester	: 3

COURSE DESCRIPTION

Manufacturing is a process to make a product from raw material through production activities involving technologies. An Industrial Engineer has to understand manufacturing process that common used in industries, analyze the process, and design an improvement for existing condition. This course provides an understanding about manufacturing
processes especially to produce discrete part and product components, also design for manufacture for getting better process to increase process efficiency and high productivity.

COURSE'S LEARNING OUTCOME

Students understand basic principles of manufacturing and production process both traditional and modern technologies. Moreover students are able to analyze process and technical aspects through transforming product design into finished good.

MAIN REFERENCES

Groover, M.P. (2002). *Fundamentals of Modern Manufacturing*, Prentice Hall

COURSE	TI184309	: ERGONOMICS
	Credit	: 3 credits
	Semester	: 3

COURSE DESCRIPTION

Industrial ergonomics aims to design the working interactions for higher industrial productivity by considering effectiveness, efficiency, safety, and comfortness. This course isdesigned to provide knowledge and ability for student in order to improve the processes orwork equipment fit to Ergonomics principles. The object of discussion will related to improvement of human interaction quality by considering humans, machines, labor, environment, systems and organizations. Industrial ergonomics notice various human abilities, advantages and disadvantages in improving the work interaction.

COURSE'S LEARNING OUTCOME

- able to explain the basic concept and data of Ergonomics study
- able to analyze human body posture and working mechanism
- able to analyze the human interaction in work system
- able to analyze human abilities and limitations in avoiding the error
- able to analyze the environmental factors in work system

MAIN REFERENCES

Tayyari, Fariborz and Smith, James L. (1997). *Occupational Ergonomics: Principles and Applications.* Chapman & Hall, London.

COURSE	TI184310	: OPERATIONS RESEARCH 1
	Credit	: 3 credits
	Semester	: 3

COURSE DESCRIPTION

Every business and industry naturally seeks the best design and operation under scarce resource allocations. Thus, the decision making process is critical to find the best solution. This course deals on the scientific approach to decision making which involves the use of mathematical models. This course discusses the theoretical background and formulation ofthe mathematical models and the solution method, such as graphical method, simplex method as well as sensitivity analysis. The applications of the model in solving business andindustry problems are also presented and discussed, such as transportation and network models.

COURSE'S LEARNING OUTCOME

- Students can identify the decision variables, objective function and constraints as mathematical models of varies business and industrial problems.
- Students can use optimization software such as Lindo, Lingo, or GAMS for solving the mathematical model and interpret the results.

MAIN REFERENCES

Wayne L Winston, "Operations Research: Applications and Algorithms", Indiana University, 4th edition, 2004

COURSE	TI184411	: COMPUTER ALGORITHMS AND PROGRAMMING
	Credit	: 3 credits
	Semester	: 4

COURSE DESCRIPTION

Teach and discuss how to solve problems using algorithms, build algorithm and then implementing using programming language

COURSE'S LEARNING OUTCOME

Understand how to build algorithms , solving problem using algorithms and how toimplement the algorithms through high level programming language (C,C++, VB)

MAIN REFERENCES

Thomas H. Cormen, Charles E. Leiserson, Ronald L. Rivest, Clifford Stein, "Introduction to Algorithm", The MIT Press, Cambridge, Massachusetts London, England

COURSE	TI184412	: INDUSTRIAL AUTOMATION
	Credit	: 3 credits
	Semester	: 4

COURSE DESCRIPTION

A modern industry always develop not only its technology, but also human resources. In this globalization, both manufacturing and service industries have to make some innovations in term of the use of technology, starting from manual process happened in the past, to fully automated system. An engineers as its human resources should have the ability to operate automated tools and equipment, moreover they are able to design an aoutomated system especially in shop floor. This course provides an understanding about automation functions and implementation for industries.

COURSE'S LEARNING OUTCOME

Students are able to identify the need of technical and non technical aspects, analyze and make an improvement automation design for industries.
MAIN REFERENCES
Groover, MP 2001, Automation, Production Systems, and Computer – Integrated Manufacturing, 2nd edition, Prentice Hall, New Jersey

COURSE	**TI184413**	**: METHOD STUDY AND WORK MEASUREMENT**
	Credit	: 3 credits
	Semester	: 4
COURSE DESCRIPTION		
"There is always a better working method" of each operation process. This principle is the basis of continuous improvement in the production floor. Increasing the process effectiveness and efficiency become the focus of improvement, which will ultimately increase productivity. The improving process begins by defining overall production system and waste identification. The waste may occurs are overproduction, inventory, transportation, motion, defect, time and process. Method study, including motion and work study was conducted in order to get better working method and minimize waste. Motion study will study motion study arrangement to get effective and efficient working method based on human strengths and weaknesses. While time study was conducted through work measurement. Various work measurement was studied, both direct and indirect in order to be properly applied to various problems. Further analysis of work measurement result was conducted to provide recommendation for productivity improvement.		
COURSE'S LEARNING OUTCOME		
• Have knowledge of various work measurement, both direct and indirect. • Able to analyze work measurement result to provide recommendation for productivityimprovement.		
MAIN REFERENCES		
Barnes, M.R., *Motion and Time Study : Design and Measurement of Work*, 7th edition, New York : John Wiley and Sons, 1980.		

COURSE	**TI184414**	**: MANUFACTURING SYSTEM**
	Credit	: 4 credits
	Semester	: 4
COURSE DESCRIPTION		
Manufacturing system as a part of company system have to be designed and well controlled, so that the company can fulfill all customer needs, produce qualified products with short time delivery. Furthermore company has longer life time and high developed. Anindustrial engineer is prepared to solve real problems both in manufacturing and service industries. Manufacturing system course is designed for giving that competences to the graduates. This course aim to make students understand about the components of a manufacturing system, manufacturing operations and steps to make some improvements.		
COURSE'S LEARNING OUTCOME		
Students are able to analyze manufacturing system including manufacturing process,material handling system, inventory control, inspections, packaging and non physical activities that support manufacturing operations.		
MAIN REFERENCES		
Groover, M.P 2001, Automation, Production Systems, and Computer Integrated Manufacturing, Prentice Hall		

COURSE	TI184415	: ENGINEERING ECONOMICS
	Credit	: 3 credits
	Semester	: 4

COURSE DESCRIPTION

Engineering economics aims to study and analyze the economic impact of the engineering solutions or decision makings. The economic analysis includes the calculation and comparison between benefit and cost that incurred in the implementation of engineering solutions. The solution is economic valuable when the benefit is higher than its cost. The commercial and non-commercial institution will select the solution that has the best economic value. Engineering economics course will equip the student with the ability to conduct economic analysis through delivering concepts and methods in analyzing the economic value of the engineering decision.

COURSE'S LEARNING OUTCOME

- Students able to understand and explain the concepts of value, cost, and time value ofmoney
- Students able to model the cash flow of engineering decisions
- Students able to understand the interest concept and use interest table and formulato calculate the economic equivalence of engineering decisions
- Students able to understand and explain the impact of inflation in the economicequivalence calculation
- Students able to understand and use the methods for calculating and comparing theeconomic value of engineering decisions
- Students able to conduct sensitivity and risk analysis for analyzing the impact ofuncertainty to the feasibility of engineering decision
- Students able to understand the concept of depreciation and its impact to financialcash flow and calculate the depreciation cost by using the appropriate method
- Students able to understand the impact of tax rate to the financial cash flow ofengineering decisions
- Students able to understand the concept of replacement analysis for engineeringassets
- Students able to use software application or excel functions to calculate economicvalue of engineering decisions

MAIN REFERENCES

Engineering Economic Analysis by Donald G. Newnan, Ted G. Eschenbach and Jerome P. Lavelle (Feb 26, 2004)

COURSE	TI184416	: OPERATIONS RESEARCH 2
	Credit	: 3 credits
	Semester	: 4

COURSE DESCRIPTION

This course is the second series which gives the lecture in introduction to optimization modelling in decision making. Unlike the first series which focus on the deterministicparameters, this course also focusses on stochastic parameters and applies it on the industrial and business problems. Topics discussed are Integer Programming, Non-linear Programming, Game Theory, Dynamic Programming, Markov Chain, Queuing Theory and Montecarlo Simulation.

COURSE'S LEARNING OUTCOME

- Students can explain the concepts of integer, nonlinear, dan dynamic programming, aswell as game theory, markov chain, queuing theory and monte carlo simulation
- Students can formulate those deterministic and stochastic models
- Students can use optimization software to solve those deterministic and stochasticmodels and interpret the results.

MAIN REFERENCES

Wayne L Winston, "Operations Research: Applications and Algorithms", Indiana University, 4th edition, 2004

COURSE	TI184417	: QUALITY CONTROL TECHNIQUES
	Credit	: 3 credits
	Semester	: 5

COURSE DESCRIPTION

Quality control is one of important activities in manufacturing industry to make sure that the products fill the minimum requirement both from customer and producer. Quality control consist of involving entities to analyze production factors. This course provides knowledge about many techniques to produce high qualified and robust products.

COURSE'S LEARNING OUTCOME

Students understand and able to implement some techniques that used to control product and process quality. Moreover, students are able to analyze and design a quality assurance system.

MAIN REFERENCES

Montgomery, Douglas C. (2005). *Introduction to Statistical Quality Control*. New York: John Wiley & Sons Corp.

COURSE	TI184418	: PRODUCTION PLANNING AND INVENTORY CONTROL
	Credit	: 4 credits
	Semester	: 5

COURSE DESCRIPTION

Production planning and control is a central fungtion in any manufacturing company. It deals with optimizing the use of production resources in order to satisfy customers' demand. The objective of this course is to introduce to students various concepts, techniques, methods, and practical issues related to production planning and control.

COURSE'S LEARNING OUTCOME

Students are capable of understanding various methods to plan and control production as well as to solve various problems related to production planning and control.

MAIN REFERENCES

Fogarty, D. W., Blackstone, J. H., and Hoffmann, T. R. (1991). *Production and Inventory Management* 2nd Ed., South Western Publishing.

COURSE	TI184419	: BASIC ENGINEERING MECHANICS
	Credit	: 3 credits
	Semester	: 5

COURSE DESCRIPTION

This course is intended the students to develop the ability, in the engineering student, tounderstand, formulate, and solve a given problem in a logical manner and to apply it to solve a few basic problems in engineering mechanics.

COURSE'S LEARNING OUTCOME

- Students are able to understand and use physics basic laws (Newton Law I, II and III)
- Students are able to calculate and analysis basic vector forces and several staticequilibrium of particles and rigid bodies
- Students are able to calculate the dynamic equilibrium of particles and rigid bodies

MAIN REFERENCES
• Mekanika Teknik: Statika Jilid 1. RC Hibbeler. 1997. • Mekanika Teknik: Statika Jilid 2. RC Hibbeler. 1997. • Schaum's Outline of Theory and Problems Of Engineering Mechanics - Statics AndDynamics. Fifth Edition. E.W. Nelson, C.L. Best, W.G. McLean. McGraw-Hill. 1998.

COURSE	**TI184420**	**: PRODUCTS DESIGN AND DEVELOPMENT**
	Credit	: 3 credits
	Semester	: 5

COURSE DESCRIPTION
The design and development of product is a core business process for most companies. A specialized, knowledgeable and high skilled human resource is required in managing the design and development of products (P3) in order to produce a high quality product. The purpose of this course, therefore, is to provide basic theoretical and practical understanding of customer drive product design and development process which enable student to design product which not only technically reliable, high quality, but also marketable. Product concepts, design processes, methods/techniques and current issues on product design and development are discussed, along with economic implications of design. Students will gain an understanding of product design and development processes as well as useful tools/techniques..

COURSE'S LEARNING OUTCOME
• Student able to explain the scope of industrial product design and development • Student able to explain the differences between product core component and support component • Student able to define, to synthesize, to evaluate new business opportunities of innovative product development. • Student able to use methods for identifying the voice of customers (VOC) and translating VOC to the final product. • Student able to conduct product design and development process from Phase-0 to Phase-5. • Student able to analyze and explain the trade-off between cost and quality on product specification.

MAIN REFERENCES
• Ulrich, K.T, Eppinger, S.D., *Product Design & Development*, 2nd Edition, McGraw-Hill, 2000

COURSE	**TI184421**	**: ORGANIZATIONAL AND HUMAN RESOURCEMANAGEMENT (OHRM)**
	Credit	: 3 credits
	Semester	: 5

COURSE DESCRIPTION
Human Resource Management needs to be tailored to the organization's strategic choice of design. While the design of the organization must be aligned with the strategy of the company or organization. Organizational and Human Resoureces Management (OHRM) course more emphasis on organizational strategy, organizational design and management of human resource management from recruitment to development of human resources. Through OHRM course students are expected to have an understanding and be able to manage human resources efficiently and effectively.

COURSE'S LEARNING OUTCOME
• Students are able to explain the relationship between strategy , organizational design and human resource management • Students are able to create a draft vision and mission statement • Students are able to draw conclusions about the characteristics of a good vision andmission • Students are able to choose an appropriate generic strategy (product leadership , excellent operational , customer intimacy) • Students are able to explain the definition of authority (vertical and horizontal differentiation) and control (span of control) • Students are able to mention the types of organizational structure and the advantages / shortcomings masing2 • Students are able to design in accordance with the organization 's business strategy of an organization

- Students are able to design human resource management strategies derived from the organization's strategy
- Students are able to explain the 8 main pillar in HRM
- Students are able to do a simple job analysis
- Students are able to explain a variety of employee performance appraisal tools
- Students can design a compensation system according to organizational design and business strategy

MAIN REFERENCES

1. Dessler, Gary. Human Resource Management, 13th ed. Pearson Prentice Hall: 2013
2. Jones, Gareth R. Organizational Theory, design, and Change, 7th ed. Prentice Hall: 2013

COURSE	TI184522	: INDUSTRIAL SYSTEM SIMULATION
	Credit	: 3 credits
	Semester	: 5

COURSE DESCRIPTION

Simulation is defined as a technique to imitate process/operation by using computer from a complex system which is difficult to model (cannot be modelled) as mathematical formulation. Simulation model is designed to be used for studying system by conducting experiments to achieve the desired objectives/performance measurements. This course deals on how to design the right simulation model. So that when the students have finishedstudied, they are able to develop valid simulation models and conduct experiments by using these models. The learning activities consist of lecturing which discusses simulation concept and simulation modelling techniques as well as assigning a real case study which will be presented at the end of the period.

COURSE'S LEARNING OUTCOME

Students are able to develop valid simulation models and conduct experiments by using these models.

MAIN REFERENCES

1. Kelton, W., Sadowski, R., and Swets, N., Simulation with Arena, , 5th edition, McGraw-HillEducation, 2009
2. Harrell, Ghosh, Bowden, *Simulation Using Promodel*, McGrawHill, 2004

COURSE	TI184623	: MAINTENANCE AND RELIABILITY TECHNIQUES
	Credit	: 3 credits
	Semester	: 6

COURSE DESCRIPTION

Maintenance and care of the machine play an important role in manufacturing systems. These activities support the sustainability of the process, where in case of damage of the engine then it would impede the course of manufacturing activity. Industrial engineering graduates are prepared to be able to overcome these problems. This course provides explanation about maintenance system in a company, any aspects and tools which need to be maintained, some maintenance techniques with its advantages and disadvantages, the relation between maintenance and other business functions, also how to design efficient maintenance management. This course describes reliability of machines and tools, how to assess it, also how to manage various process condition and/or complex system.

COURSE'S LEARNING OUTCOME

Students understand any techniques and maintenance methods, analyze reliability of machines and equipments, also able to identify the need of maintenance in a companywith its relation to other business functions.

MAIN REFERENCES

Lewis, E. E. 1987. Introduction to Reliability Engineering, John Wiley & Sons, USA.

COURSE	TI184624	: FACILITY PLANNING
	Credit	: 3 credits
	Semester	: 6

COURSE DESCRIPTION

Facility Planning in one of the important and complex stages in enterprise strategic planning. This course will discuss several stages in facility planning i.e.: facility location analysis, material flow design, warehouse facility planning, facility layout design and framework, material handling, and planning for supporting facilities. Facility arrangement in layout and its optimization will be discussed as the main objectives of this course.

COURSE'S LEARNING OUTCOME

- Able to explain the basic concept and data in facility planning
- Able to apply the location analysis method using qualitative and quantitativeapproaches
- Able to design the material flow and handling in plant facilities
- Able to design and evaluate the facility layout using qualitative and quantitativeapproaches.
- Able to specify the supporting facilities in facilities planning
- Able to model the layout in 2d and 3d presentation

MAIN REFERENCES

Wignjosoebroto,S. (1996). Tata Letak Pabrik dan Pemindahan Bahan. PT. Gunawidya

COURSE	TI184625	: SYSTEM MODELING
	Credit	: 3 credits
	Semester	: 6

COURSE DESCRIPTION

This course is trying to give knowledge and ability to utilize the concept of System Thinking and System Approach to deal with many practical situations in scope of Industrial Engineering and Management cases. Within studying this course, you will learn how to identify and formulate a problem, identify and set a correct objective and system relevant, utilize a correct System Diagram, and solve the problem by using a proven Management Sciences Methodology.

COURSE'S LEARNING OUTCOME

- Provide an understanding of the basic concepts of system modeling, identification of problems, and the development of system relevant and system diagrams
- Provide an understanding the techniques of the hard systems and soft systems methodology methodology
- Ability to define problems (real and theoretical) that are relevant to the areas of industrial engineering and describe the implementation the concept of System Thinking, System Approach, and System Modeling to variety of real world and theoritical case studies.
- Provide the ability to develop models, analyze and validate the model from a system relevant

MAIN REFERENCES

- Daellenbach, H. G. and D.C. McNickle. (2005), Management Science: Decision Makingthrough System Thinking, Pallgrave Macmillan, United Kingdom.
- Murthy, D.N.P., Page, M.W., and Rodin,E.Y., Mathematical Modelling, Pergamon Press,1990.
- Clement, Robert T. (1997). Making Hard Decisions: An Introduction to Decision Analysis, 2nd Edition., Duxbury Press.

COURSE	TI184626	: LOGISTICS SYSTEM
	Credit	: 3 credits
	Semester	: 6

COURSE DESCRIPTION

This subject is a mandatory course discussing logistics functions for individual companies or supply chains. The purpose of this course is to give knowledge and skills for students to understand the concepts and models in logistics management and their application in real cases. Students should also be able to use related logistics application softwares.
Combining the ability to understand cases of logistics, to translate them into models and to select and determine the solution methods, students are expected to have comprehensive
knowledge on logistics management.

COURSE'S LEARNING OUTCOME

- Students are able to explain scope, main functions and main functions of Logistics Management, including the role of ICT logistics
- Students are able to understand the logistics management models including Network Distribution, Transportation, and Warehousing Models. Students are able to implement the models using related softwares
- Students are able to perform an analysis of the application of logistics management to deal with the real situation

MAIN REFERENCES

Ballou, Ronald. H. (2004) Business Logistics Management, Prentice Hall International, Inc., USA

COURSE	TI184727	: INDUSTRIAL ECOLOGY
	Credit	: 2 credits
	Semester	: 7

COURSE DESCRIPTION

This course provides an understanding about interrelation among human activities, industries, technological aspect, social system and natural resources. So that students have the important role and function to keep environment sustainability, able to adapt and give a solution consider to environmental aspect for any kind of industrial activities.

COURSE'S LEARNING OUTCOME

Students understand about intterelation among human activities, waste and environment impacts. Also understand about sustainable design consider to environment aspect.

MAIN REFERENCES

Miller.G.T. (2004).Living in the Environment Principles, Connections and Solution.13th, Thomson Learning.

COURSE	TI184728	: SUPPLY CHAIN MANAGEMENT
	Credit	: 3 credits
	Semester	: 7

COURSE DESCRIPTION

Supply Chain Management is concerned with an integrated approach to managing the flow of materials (raw materials and products), information, and money that occurs internally in the company as well as within the interconnected group of companies known as the supplychain. In this course, students learn various concepts, methods, and tools to increase the competitiveness of companies in tight competition.

COURSE'S LEARNING OUTCOME

- Explain the role of supply chain management in increasing company competitiveness
- Explain various strategy in managing supply chains
- Explain important supply chain considerations in product design

- Describe the nature of network design in the supply chain and use different models indesigning a supply chain network
- Explain the impact of demand pattern on supply chains
- Explain the strategic role of procurement in supply chains
- Explain how to manage inventory in supply chains by using an integrated perspective
- Explain the importance of managing information in supply chains
- Explain supply chain performance measurements for several product categories

MAIN REFERENCES

Chopra, S., and Meindl, P. (2015). Supply chain management: Strategy, planning, and operations, 6th Edition. Pearson Education.

COURSE	TI184729	: INDUSTRIAL PLANNING
	Credit	: 3 credits
	Semester	: 7

COURSE DESCRIPTION

This course is an integrated course of many previous courses which is aimed for giving the understanding and skills for students in the establishment and development plans of comprehensive business. Students are required to be able to prepare a business feasibility analysis for the establishment and development plans of business. This course is a serial
course and will be continued by Business Design Analysis courses in semester 7.

COURSE'S LEARNING OUTCOME

- Students are able to compose a complete / comprehensive and integrated feasibility analysis for the establishment and development plans of manufacturing-based businesses, which in detail:
- Students are able to design the establishment or development plans of integrated business, include: opportunities identification, strategic design, product design, manufacturing process design, design and operation of production systems, supply chain design, layout design, business location selection and design of organization and human resources
- Students are able to compose the business plan in a good, rational, and professional feasibility study
- Students are able to communicate / present their work outcomes well
- Students are able to cooperate with other team members in performing design and analysis of business

MAIN REFERENCES

Maria Anityasari & Naning Aranti Wessiani, "Analisa Kelayakan Usaha: Dilengkapi Kajian Manajemen Resiko", Gunawidya, 2011

COURSE	UG184916	: CONCEPT OF TECHNOLOGY (Basic Knowledge danApplication)
	Credit	: 3 credits
	Semester	: 7

COURSE DESCRIPTION

This course will expose students to science, technology and innovation and their applications in society and the environment. As citizens, students will be able to have skills and creativity in comprehensively utilizing technology. During the course, students can develop systematic and constructive thinking based on information transformation thinking models. The process includes problem observation, problems exploration, and solution formulation. Finally, students can optimally design a Real Work Lecture (KKN) proposal based on field facts.

COURSE'S LEARNING OUTCOME

- Students understand the outline of the lecture from the beginning to the implementation of KKN.
- Students can transform information into something simpler to comprehend.
- Students can make a Logframe Matrix.
- Students have insight and can implement the principles of sustainable development according to their area of expertise in solving problems in the community and the surrounding environment.
- Students can understand the basics of using technology by optimizing information and communication technology in solving problems in society and its environment.

- Students can use open source-based information technology to create agency websites.
- Students can use applied information technology to solve practical problems in society.
- Students can develop a cooperative attitude and have social sensitivity and concern for society and the environment.
- Students can be part of the solution to problems that exist in community groups.
- Students can use technology appropriately and have creativity in solving problems that exist in society and the environment.

MAIN REFERENCES

- *Buku Transformasi Informasi, Dr.techn. Pujo Aji, ST.MT., ITS Pres., 2016*
- *Arahan Pelaksanaan Tujuan Pembangunan, Alamat Kontak: Website :*
- *sdgs.bappenas.go.id*
- Alfred Watkins and Michel Ehst, "Science, Technology and Innovation: Capacity
- Building for Sustainable Growth and Poverty Reduction", The International Bank for
- Reconstruction and Development, Washington DC, 2008.
- Frieder Meyer Krahmer, "Innovation and Sustainable Development-Lesson for Innovation Policies, " A Springer-Verlag Company, Heidelberg, 1998.

COURSE	TI184830	: PROJECT MANAGEMENT
	Credit	: 2 credits
	Semester	: 8

COURSE DESCRIPTION

Currently, project management is getting more important. Planning, execute and controlling a project is relatively difficult due to its complexity of various aspects such as time, cost, resources, goal achievement measurement, and many more. This lecture will provide students with understanding on planning, scheduling, organizing and project control on product development projects, constructions, system information, new business and other important events. The focus will be on project's management processes and important tools use to manage a project.
The understanding on project management concepts and techniques will provide students with a competitive advantage to compete in engineering fields of work and/or other fields.

COURSE'S LEARNING OUTCOME

- To understand the main processes in project management and the importance ofintegration between the organizational strategy with project management .
- To understand the sub-systems in a project management system that determines thesuccess of the project management.
- To understand the concepts and techniques detailed work breakdown structures as abasis for planning and controlling project.
- To understand the project planning and designing project control instruments.
- To understand the valuation of project.
- To understand the sources of funding available for the project and choose the best sources for engineering project.
- To understand the concepts, techniques and decision-making tools available for managing projects.
- To understand the risk factors faced by the project and choose the model of analysis,evaluation and management of project risks.
- To recognize potential conflicts and problems that can occur on the project.
- To identify critical aspects of human behavior that determine the success of theproject management .
- To Use computer-based information system for managing projects effectively andefficiently .

MAIN REFERENCES

Clifford Gray and Erik Larson, Project Management: The Managerial Process 5th, Clifford Gray and Erik Larson, McGraw-Hill, 2010.

COURSE	TI184831	: DESIGN OF BUSINESS INFORMATION SYSTEMS
	Credit	: 3 credits
	Semester	: 8

COURSE DESCRIPTION

A company or organization will face the challenges of the complexity of the issue and the larger volumes of data, especially when the company has grown and are in a competitive situation. Therefore, in order to survive and be competitive, we need an information system that can support decision making efficiently and effectively. This lecture will provide insight to students related to the design of information systems within the scope of the company or business. Emphasis is on the basic concepts of material information systems both manual and computer-based, enterprise system basic concepts related functions and levels of management, process / design stage of information systems, business information systems applications design. Understanding of the concept and design of the information system will provide supplies for students to be able to design information systems and applications within the scope of the business

COURSE'S LEARNING OUTCOME

- Students understand the relationship of subjects within the scope industrial engineering
- Students understand the basic concepts of information systems both manual andcomputer-based
- Students understand the relationship of information systems with the functions andlevels of management within the scope of the company
- Students understand the system as an alternative solution approach in designingbusiness information systems
- Students understand the framework or model of problem solving (problem solver)
- Students understand the stages in the design of business information systems
- Students are able to model the real case in the framework of information systems designin the form of a data flow diagram
- Students are able to identify the needs of entities and attributes in accordance with thepurpose why information systems need to be designed
- Students are able to design information systems in the form of relationships betweenentities (entity relationship diagram)
- Students are able to design an application system based on the design of the relationshipbetween entities
- Students were able to convince the presentation of the design of information systems through the application system that has been created .

MAIN REFERENCES

McLeod Jr. Management Information System,., Prentice Hall, 2004.

COURSE	TI184832	: INTERNSHIP/PRACTICAL WORK
	Credit	: 2 credits
	Semester	: 8

COURSE DESCRIPTION

Internship is designed to introduce students in applying industrial engineering concept and to prepare students for working in the area that the industrial engineer used to works in a company. Also, internship is aimed for the students to understand and apply how to use industrial engineering method in solving the industrial problems comprehensively.

COURSE'S LEARNING OUTCOME

- Students are able to communicate both speaking and writing well.
- Students understand industrial engineering functions.
- Students have experiences to solve industrial problems with industrial engineeringfunctions.

COURSE	UG184915	: TECHNOPRENEURSHIP
	Credit	: 3 credits
	Semester	: 8

COURSE DESCRIPTION

This course provides an understanding and skills for students to be able to identify and evaluate technology-based business opportunities in accordance with the areas of expertise of students, and to develop business opportunities. This course combines theory and practice of introduction of direct (hands-on experience) is integrated in developing ideas and business opportunities. In the end, students are expected to pour into the business opportunities of effective business plans.

COURSE'S LEARNING OUTCOME

- Students are able to apply their expertise, innovation and creativity to produce a business draft /market oriented products by using science and technology to generate an entrepreneurial opportunity
- Students are able to adapt to the situation and survive in conditions of uncertainty
- Students are able to take risks with precise calculation
- Students are responsible for own work and can be held accountable for the achievement of the result of teamwork by promoting business ethics
- Students are able to speak Indonesian well and fluent in spoken language and writtenfor entrepreneurship as well as daily life.

MAIN REFERENCES

- Barringer, B. R., & Ireland, R. D. (2010). Entrepreneurship: Successfully launching newventures. Upper Saddle River, N.J: Prentice Hall.
- International Labor Organization, Generate Your Business Idea
- International Labor Organization, Memulai Bisnis
- Osterwalder, A., Pigneur, Y., & Clark, T. (2010). Business model generation: Ahandbook
- for visionaries, game changers, and challengers. Hoboken, NJ: Wiley.
- William, B. K., Sawyer, S. C., Berston, S., (2013). Business: A Practical Introduction. Upper Saddle River, N.J: Prentice Hall

COURSE	**TI184833**	**: FINAL PROJECT**
	Credit	: 6 credits
	Semester	: 8

COURSE DESCRIPTION

Students are designed to develop their ability to continue study in graduate level or to work. This final project gives students to have experiences in solving industrial problems. Topics in this final project can be a case study in a company by applying theory, hypothesis testing based on survey data or interview, or a methodology development which can be used in solving industrial problems.

COURSE'S LEARNING OUTCOME

- Students are able to think critical and analysis.
- Students are able to apply industrial engineering theory in solving industrial problems.
- Students can develop their ability in solving problems individually.
- Students are able to communicate both speaking and writing well, also to develop *interpersonal skills.*

Sylabus – Elective Courses

COURSE	TI184901	: APPLIED ERGONOMICS
	Credit	: 3 credits
	Semester	: 7

COURSE DESCRIPTION

The interaction between humans with other entities in a working system will be discussed in this course to enhance the quality of work and to design the work system to be better. Some case studies about five main interactions of humans in Ergonomics i.e .: human-machine, human-computer, human-system, human-environment, and human-organization will be analyzed by the student in interactive group exploration. This course will discuss the evaluation and improvement of the working system by considering the advantages and limitations of humans following the principle of Ergonomics. As the final evaluation, a student must be designed and proposed an improvement to solve a small real problem in their group project.

COURSE'S LEARNING OUTCOME

- Participants are able to apply the concept and principle of Ergonomics in several human-interactions.
- Participants are able to explain the problem or phenomenon related with Ergonomics in the specific field of real applications.
- Participants are able to analyze the reliability and limitations of human beings to manage the errors.
- Participants are able to evaluate the weakness of a certain work system which does not meet the Ergonomics standard.
- Participants are able to propose the improvement of the work system based on the Ergonomics approaches to make the system more effective, efficient, safe, and comfortable.
- Participants are able to communicate effectively, work together in working environment and have professional attitude

MAIN REFERENCES

- Bridger, R. . (2018). Introduction to Human Factors and Ergonomics (fourth edi). New York: CRC Taylor & Francis Group.
- Hedge, A. (Ed.). (2017). Eergonomic Workplace Design for Health, Wellness, and Productivity. CRC Press.
- Kroemer, K. H. E. (2008). Fitting the Human. Fitting the Human.
- MacLeod, D. (2006). The Ergonomics Kit for General Industry. In The Ergonomics Kit for General Industry (2nd ed.). CRC Taylor & Francis Group.
- McKeown, C. (2019). Office Ergonomics and Human Factors. CRC Press.
- Niu, S., & Kogi, K. (Eds.). (2010). Ergonomics Checkpoints (2nd ed.). International

COURSE	TI184902	: ERGO SAFETY
	Credit	: 3 credits
	Semester	: Elective

COURSE DESCRIPTION

Occupational Safety and Health (OSH) is an important topic in both manufacturing and service industries. The effort to create a safe, comfortable and healthy workplace needs to be prioritized and is currently mandatory for the Government. Not only from the security side of company property, but more than that, the main thing is from the human side.

The Ergo Safety course provides an understanding of the importance of safety and ergonomics aspects, and how to identify existing hazards. Furthermore, students are expected to be able to assess and take precautions against potential hazards in order to minimize the chance of accidents and minimize losses due to accidents. This course also describes the safety relationship in industry 4.0.

COURSE'S LEARNING OUTCOME

- Students are able to understand the concept and principal of Ergo Safety.
- Students are able to apply hazard identification technique analysis.
- Students are able to apply safety risk assessment techniques and propose improvements.
- Students are able to understand Safety Management Systems and Safety Data Management
- Students are able to understand quantitative and qualitative safety tools analysis.
- Students are able to apply the knowledge of Ergo Safety to evaluate work systems and solve problems through effective teamwork and have professional attitude.

MAIN REFERENCES

- Geotsch, L.D., 1999, Occupational Safety and Health for Technologists, Engineers, and Managers, Prentice Hall.
- Artikel dari jurnal ilmiah dengan topik Ergonomics dan Human Factors.

COURSE	TI184903	: MACRO ERGONOMICS
	Credit	: 3 credits
	Semester	: Elective

COURSE DESCRIPTION

Macro-ergonomics is a field of science that deals with the analysis, design and evaluation of a work system. The work system is a system that involves humans in their interactions with organizations, jobs, technology / machines / work tools, and work environment. The purpose of macroergonomics is to harmonize work systems at both the macro and micro-ergonomic levels to increase productivity, job satisfaction, health and safety, and employee commitment. This goal is achieved by analyzing the entire system, arranging each element of the work system to "fit" one another, and considering various aspects of work before making a change.

COURSE'S LEARNING OUTCOME

- Students are able to understand the role of Macro Ergonomics in improving the performance / improvement of the work system and explain the basic concepts of Macro Ergonomics.
- Students are able to understand the importance of human interaction with organizations, systems, and technology and the factors that influence socio-technological interactions.
- Students are able to analyze the importance of participation in managing interactions more effectively and efficiently
- Students are able to apply Macro Ergonomics concepts in the real world
- Students are able to understand and apply Macro Ergonomics methods / approaches in evaluating and improving macro work systems.

MAIN REFERENCES

- Hendrick & Kleiner, Macroergonomics (200) Theory, Methods, and Aplications, Lawrenze Earlbaum Association.
- Hendrick, H. W. (1991). Ergonomics in organizational design and management. Ergonomics, 34(6), 743-756.
- Kluge, A. (2014). The Acquisition of Knowledge and Skills for Taskwork and Teamwork to Control Complex Technical Systems - A Cognitive and Macroergonomics Perspective.
- Vargaz, et al. (2018) Macroergonomics for Manufacturing Systems.
- Hollnagel (2014) Safety–I and Safety–II The Past and Future of Safety Management
- Karltun et al. (2017) HTO e A complementary ergonomics approach
- Salvendy, G. (2012). Handbook of Human Factors and Ergonomics, 4th edition, John Willey and Sons.
- Pulat, Mustafa. (1992). Fundamentals of Industrial Ergonomics. New Jersey : Prentice Hall.Kroemer, K.H.E. (2009). Fitting the Human : Introduction to Ergonomics, 6th edition. CRC Press.
- Artikel dari jurnal ilmiah dengan topik Ergonomics dan Human Factors

COURSE	TI184904	: METHODS AND WORK SYSTEM DESIGN
	Credit	: 3 credits
	Semester	: Elective

COURSE DESCRIPTION

Method and work system design is a course that studies the principles and techniques for getting the best design of a work system. By using the knowledge obtained in this course, students can apply the techniques of methods analysis for designing the integrated work system. The design of the work system by taking into account the technology aspect, psychology and work physiology can optimize overall human/ worker well being.

COURSE'S LEARNING OUTCOME

- Students understand various methods in designing work systems and are able to analyze and evaluate the existing work system.
- Students can identify factors that influence work design.
- Students can classify methods of analysis and work system design.
- Students can evaluate work systems which focus toward human capabilities and limitations.
- Students can design a strategy of productivity improvement through method and work station improvement.
- Students can design more effective and efficient work systems.

MAIN REFERENCES

- Barnes, Ralph M., Motion and Time Study : Design and Measurement of Work, 7th edition, New York : John Wiley and Sons

COURSE	TI184905	: PHYSIOLOGY AND WORK BIOMECHANICS
	Credit	: 3 credits
	Semester	: Elective

COURSE DESCRIPTION

Product and work system design that pays attention to human characteristics (human abilities and weaknesses) are essential because the unsuitable method will eventually cause various problems, especially in human performance and health. This course will discuss issues related to the physical requirements, program design, the measurement of physical demands, and factors related to fatigue and injury in the workplace from a physiological and biomechanical perspective. It will also discuss issues related to safety and completion of job-specific tasks in the workplace. Through this course, students are expected to be able to know and apply techniques of analysis and evaluation of physiology and biomechanics by understanding the human body structure and mechanism.

COURSE'S LEARNING OUTCOME

- Students are able to understand the basics of occupational physiology and biomechanics, including the musculoskeletal systems.
- Students are able to understand the concept of blood circulation and respiratory system which are related to occupational physiology.
- Students are able to evaluate a worker's physical work capacity, the energy consumption, and the physical workload.
- Students are able to understand the concept of fatigue and sleepiness, and how to manage them in the workplace.
- Students are able to understand the principles of biomechanics and anthropometry parameters which are employed in biomechanical analysis.
- Students are able to evaluate the work postures/movements by employing appropriate biomechanical models.
- Students are able to understand the relationship of mechanical work, energy and power.
- Students are able to evaluate the work movements/postures employing RULA/REBA, NIOSH RWL, and ManneQuin Software.

MAIN REFERENCES

- Rodahl, K., The Physiology of Work, Taylor and Francis, 2005.
- Astrand, P., Rodahl, K., Dahl, H.A., Stromme, S.B., Textbook of Work Physiology : Physiological Bases of Exercise. Fourth Edition, 2003
- Chaffin, D.B, Anderson, G.B.J, Martin, B.J.,Occupational Biomechanics, John Willey & Son, 4th ed., 2006
- Winter, David A. Biomechanics and motor control of human movement. John Wiley & Sons, 2009.
- Hall, Susan J. Basic Biomechanics. 6th ed. McGraw Hill. 2012
- Cheng-Kung Cheng, Savio L-Y. Woo, Frontiers in Orthopaedic Biomechanics,Springer Singapore, 2020.

COURSE	TI184908	: HUMAN RELIABILITY
	Credit	: 3 credits
	Semester	: Elective

COURSE DESCRIPTION

Human reliability is to find credible ways of helping designers, management, operators, and authorities to be able to help increase the safety and profitability of technological systems. Human reliability coupled with probabilistic risk/safety assessment introduces people to a thought process to perceive risks in operation and help define ways in which the risk can be reduced. During the course, participants will acquire the theory and practical application of human reliability. Several methods will be studied in order to predict, anticipate, and investigate the possibility of human error in the various areas of work.

COURSE'S LEARNING OUTCOME

- Students are able to explain the basic concept and the influenced factors of human reliability
- Students are able to measure, calculate, and predict the reliability of human in working process
- Students are able to analyze the reliability and limitations of human beings to manage errors.
- Students are able to evaluate an observed object of study by considering the human reliability aspects.
- Students are able to communicate effectively, work together in working environment and have professional attitude

MAIN REFERENCES

- Spurgin, A. (2010). Human Reliability Assessment, Theory and Practice. CNC Press, New York
- Dhillon, B.S. (2009). Human Reliability, Error,and Human Factors in Engineering Maintenance, CRC Press, New York
- Duffey, R.B., and Saull, J.W. (2008). Managing Risk: The Human Element, John Wiley & Sons, Ltd, United Kingdom
- Wickens,C.D., Gordon,S,E., Liu, Y., (2003). An introduction to Human Factors Engineering. Pearson, 2nd edition, Pearson Ltd.

COURSE	TI184909	: COGNITIVE ERGONOMICS
	Credit	: 3 credits
	Semester	: Elective

COURSE DESCRIPTION

The effectiveness of human interaction in a work system is influenced by cognitive aspects in processing input from a display or information. Cognitive aspects need to be considered in designing work systems so that mistakes or mistakes in carrying out a work procedure can be avoided. Cognitive ergonomics is a course designed to provide an understanding of human interactions with the work system that surrounds them based on a cognitive overview. The main discussion in cognitive ergonomics lies in the design of the interface between humans and the work system that considers the advantages and limitations of human cognitive aspects which include the input process (perceptual stage), procentral processes (cognitive stage, for example: problem solving), and motor processes (action). stage).

COURSE'S LEARNING OUTCOME

- Students are able to explain the general concept of cognitive ergonomics
- Students are able to explain the limitation and strength of human cognitive aspect
- Students are able to analyse human interaction with system based on cognitive aspect
- Students are able to implement the concept and evaluation method of cognitive
- ergonomics to improve work system design.
- Students are able to apply the develop propose work system design that consider
- the limitation and strength of human cognitive aspect

MAIN REFERENCES

- Wickens,C.D., Gordon,S,E., Liu, Y., (2003). An introduction to Human Factors Engineering.Pearson, 2nd edition, Pearson Ltd
- Sanders, M.S. and McCormick, E.J. (1992). Human Factors in Engineering and Design. McGraw-Hill Inc.

- Salvendy, G. (2012). Handbook of Human Factors and Ergonomics, 4th edition, John Willey andSons
- Stanton, N. et al. (2005) Handbook of Human Factors and Ergonomics Methods. CRC Press, US.
- Andrews, K. (2009) Human Computer Interaction Lecture Notes. Graz University of Technology.
- Anshel, J. (2005) Visual Ergonomics Handbook. CRC Press.
- Moray, N. (1979) Mental Workload : Its Theory and MEasurement.
- Harris D. (2007) Engineering Psychology and Cognitive Ergonomics. 7th InternationalConference, EPCE 2007. Springer, Germany.
- Hollnagel, E. (2003) Handbook of Cognitive Task Design. Lawrence Erlbaum Associates, New Jersey.
- Long J. And Whitefield A. (1989) Cognitive Ergonomics and HumanPortfolio MK - 5 Computer Interaction.Cambridge University Press, New York.

COURSE	TI184921	: PRODUCTIVITY ANALYSIS
	Credit	: 3 credits
	Semester	: 6/7/8 (elective)

COURSE DESCRIPTION

The Productivity Analysis course teaches the productivity management process in the production system, especially in a manufacturing company environment. This subject also explains the productivity cycle, several productivity models and examples of productivity applications in several companies. The productivity cycle which consists of measuring productivity, evaluating productivity, planning productivity, improving productivity and maintaining productivity. After taking this course, students are expected to understand and be able to analyze the production system and suggest some improvements to increase the productivity ratio. This course will introduce various Student-Centered-Learning (SCL) based learning methods where students are actively involved in the learning process.

COURSE'S LEARNING OUTCOME

- Students understand the concepts and basics of productivity management.
- Students understand and know the requirements of the productivity cycle: measuring, evaluating, planning, increasing and maintaining productivity.
- Students understand and master productivity management in manufacturing and service companies.
- Students are able to use various techniques to increase productivity.

MAIN REFERENCES

- . Sumanth, D.J., 1985, Productivity Engineering and Management, McGraw Hill Book, Singapore.

COURSE	TI184922	: COMPUTER INTEGRATED MANUFACTURING
	Credit	: 3 credits
	Semester	: 6/7/8 (elective)

COURSE DESCRIPTION

Computer Integrated Manufacturing is a manufacturing system that has integration between its physical devices, data processing and business function through a particular computer framework. The real time monitoring and review is urgently required in current advanced industries. This will ensure the achievement of great availability, quality and productivity. This course will addresses some issues to review production information starting from caption and alteration until sortation and delivery. Further, it implements a particular method to synchronize manufacturing system components or sub process such as inspection system, manufacturing process, packaging, storage and material handling

COURSE'S LEARNING OUTCOME

- Students understand the concept of Computer Integrated Manufacturing.
- Students are able to define the integration components of planning, production process, inspection, and packaging.
- Students are able to define integration strategy in the framework of upgrade or full implementation.
- Students are able to conduct an integration evaluation.
- Students are able to design a computer integrated manufacturing system in particular industry.

MAIN REFERENCES

- Ang, C.L. 1898. *Planning and Implementing Computer Integrated Manufacturing, Computers in Industry* 12, 131-140
- Groover, Mikell. P. 2001. *Automation, Production system, and Computer-Integrated Manufacturing*, 2nd edition, Prentice Hall, New Jesery
- Hannam, Roger 1996. Computer Integrated Manufacturing: from concepts to realisation, Addison-Wesley, Harlow-England
- Waldner, Jean-Baptiste 1992. Principles of Computer-Integrated Manufacturing, John Wiley & Sons, ISBN 047193450X
- Kumar, K.D,et.al. 2005. *Computers in Manufacturing: towards successful implementation of integrated automation system*, Technovation 25,477-488
- Lindsrom, V & Winroth, M. 2010. *Aligning manufacturing Strategy and Levels of Automation: A case study, Journal of Engineering and Technology Management* 27, 148-159
- Singh, Nanua 1996. Computer Integrated Design & Manufacturing, John Wiley & Sons Inc.
- Scheer, August-Wilhelm Computer Integrated Manufacturing: Towards the Factory of the Future, 2nd ed., Springer-Verlaq, 1991
- Singh, V 1997. The Cim Debacle: Methodologies to Facilitate Software Interoperability. Springer. ISBN 9813083212.
- Korem, Yoram 1983. Computer Control of Manufacturing Systems, McGraw Hill Inc. pp 287, ISBN 0-07-035341-7.

COURSE	TI184923	: CONCURRENT ENGINEERING
	Credit	: 3 credits
	Semester	: 6/7/8 (elective)

COURSE DESCRIPTION

The length of time required to traditionally design new products is an issue that the Concurrent Engineering (CE) approach can improve it. New product development through the CE method such as designing products and production process can be run parallel, consider the entire product lofe cycle from concept to product completion, is used and worked on by teams from different departments or divisions including suppliers and customers. This elective course equips students with knowledge about collaborative development of new products using the CE approach, including the elements needed to implement CE in a company. In addition, students also understand the tools that are important in CE such as, Design for X (DfX) and Design for Manufacture and Assembly (DfMA), also can use DfMA software ti design new products.

COURSE'S LEARNING OUTCOME

- Students are able to understand the basic concept of concurrent engineering.
- Students are able to understand the elements in concurrent engineering.
- Students are able to understand the concept of design for x.
- Students are able to understand DFM concept and DFM applications.
- Students are able to use the DFMA software.
- Students are able to understand variations of design for X (example: design for logistic, etc.)
- Students are able to develop alternative design development based on DFMA concept.
- Students are able to understand the basic concept of Lean Product Development..

MAIN REFERENCES

- T. A. Salomone, What Every Engineer Should Know about Concurrent Engineering: Marcel Dekker, 1998.
- G. Boothroyd, P. Dewhurst, and W. Knight, Product Design for Manufacture and Assembly. Basel, Switzerland: Marcel Dekker AG, 2002
- Modul DFMA, Laboratorium Sistem Manufaktur, 2014
- G. Q. Huang (1996) Design for X, Concurrent Engineering Imperatives, First Edition, Chapman & Hall, London, UK
- Product design and development, by K.T. Ulrich and S.D. Eppinger, Tata McGraw Hill
- The Toyota Product Development System: Integrating People, Process And Technology. 1st Edition by James M. Morgan, Jeffrey K. Liker.

	TI184925	: SIX SIGMA

COURSE	Credit	: 3 credits
	Semester	: 6/7/8 (elective)

COURSE DESCRIPTION

Six Sigma helps solve problems in various systems that have a view to continuous process improvement. Topics covered include: the concept of continuous process improvement, sigma measurement, organization-leadership belt, DMAIC methodology, DMADV, six sigma programs used to solve problems encountered both in the production and service system environments.

COURSE'S LEARNING OUTCOME

- Students are able to understand the six sigma concept and methodology and quality improvement.
- Students are able to understand the main issues that can explain the target of quality improvement based on real problems, consumer voices and market voices.
- Students are able to understand and can choose potential / critical factors that influence the quality characteristics.
- Students are able to understanding improvement targets in the form of statistics (data collection, descriptive and hypothetical and process capabilities) and converting in the form of DPMO and sigma values.
- Students are able to work together with a team to complete tasks and present ideas and group work results.
- Students are able to analyze the results of the selected alternative improvement solutions

MAIN REFERENCES

- James W. Matin. 2006. Lean Six Sigma for Supply Chain Management. Mc Graw Hill.
- Thomas pyzdek. 2009. The Six Sigma Handbook, Third Edition. USA : Mc Graw Hill.
- Vincent Gasperz. 2007. Lean Six Sigma for Manufacturing and Service Industries.

COURSE	**TI184926**	**: SUSTAINABLE MANUFACTURING**
	Credit	: 3 credits
	Semester	: 6/7/8 (elective)

COURSE DESCRIPTION

This is an elective course for undergraduate students at the Department of Industrial Engineering ITS. This course is designed to provide students with an understanding of macro sustainability issues, concepts and scope of Sustainable Manufacturing (SM), strategies in SM, management approaches in SM, and tools commonly used in SM. Additionally, a case study on Zero Waste Stores will be explored thoroughly. In the current situation, there is no doubt that integrating sustainability into business process will enhance business's total performance and competitiveness. Skills developed and knowledge acquired from this course will prepare students to be environmentally conscious engineers who are sensitive to environmentally related problems and capable to solve those problems and enhance total performance of industries.

COURSE'S LEARNING OUTCOME

- Students understand the reasons, the history, the concept, the principles, the international movements, the progress of regulations/laws related to sustainable development and sustainable manufacturing at international, regional, national, and local levels.
- Students are able to recognize and identify problems related to sustainability at macro and micro levels.
- Students are able to implement sustainability principles in business processes.
- Students develop sensitivity and care to environmental related problems surround them.
- Students are able to communicate their ideas and thoughts verbally and in writing.

MAIN REFERENCES

- Anityasari, M. (2009) *An Integrated Assessment Model for Reuse Strategy: Technical, Social, Environmental, and Economic Aspects*, VDM Verlag
- Curran, M.A. (1996) *Environmental Life-Cycle Assessment*, McGraw-Hill
- Lewis, H., Gertsakis, J., Grant, T., Morelli, N., Sweatman, A. (2001) *Design+ Environment*, Greenleaf Publishing
- Dornfeld, D.A. (2013) *Green Manufacturing*, Springer
- Kementerian Perindustrian Republik Indonesia (2014), Industri Hijau (Green Industry)
- Selected international journals & articles (materials will be provided).

COURSE	TI184927	: INDUSTRIAL ENVIRONMENTAL MANAGEMENT
	Credit	: 3 credits
	Semester	: 6/7/8 (elective)

COURSE DESCRIPTION

Industrial environmental management is an elective course specially designed for Industrial Engineering students. This subject studies the principles of management related to the strategic issues of environmental aspects in the organizations, corporations and industries. Industrial environmental management subject also explain about environmental management systems, the principle of integration of environmental aspects for production planning, production process, consumption and end of product management, that get the integration of operational systems and organizations that have environmentally friendly and better eco efficiency. This subject equips students to understand and be able to identify and implement the principles of auditing and environmental performance measurement for industries and organizations.

COURSE'S LEARNING OUTCOME

- Students are able to understand the important of environmental aspects and be able to explain the importance of "sustainability" concept int the corporate context and industrial strategies, also be able to recognize aspects of environmental impacts in the use of natural resources.
- Students are able to understand and explain the relationship between environmental management needs in business development strategies and production processes.
- Students are able to explain the importance of environmental aspects in the design, planning, operation, and control of an environmentally friendly production system.
- Students are able to explain and apply several auditing concepts and environmental impact analysis and understand how to measure environmental performance.
- Students are able to identify environmental impacts and assess the significance of a business process activity impact.
- Students are able to simulate an organization or industry towards an better "eco-efficiency" of organization or industry.
- Students are able to implement the basic principles and technique of environmental management: environmental quality control, starting from the planning, monitoring, controlling, analysis and evaluation stages.

MAIN REFERENCES

- Dixon, J.A And M. Hufschmidt. Economic Valuation Techniques For The Environment: A Case Workbook. The Joint Hopkins University Press, 1991.
- Annonyme. Iso Dan Ban, Implementaing Iso 14000. Environmental Management Systems According To Iso 14001.
- Ulhoi J.P. Corporate Resources And Environmental Management: What, Why, And What ?. Tims Xxxii Conference, Alaska, 1995.
- Allenby, B., Graedel Te. (2010). Industrial Ecology, Prentice Hall. New York
- Soemarwoto, O. *Analisis Dampak Lingkungan*.Gadjah Mada University Press; Jogjakarta. 1990.
- North, K. Environmental Business Management. Management Development Series, 2005.
- Annoy. *Business Strategy And The Environment*. Vol.No.1, March 2006, Joint Wiley & Sons.
- Tietennberg T. *Environmental And Natural Resource Economics*. Scot, Foresman And Company, Boston,1988.
- Hotenfenbeck,W. The Green Management Revolution: Lessons In Environmental Excellence. Prentice Hall.1992.
- DE SIMONE L AND F.POPOFF. ECO EFFICIENCY.THE BUSINESS LINK TO SUSTAINABLE DEVELOPMENT. THE MIT PRES.1997.

COURSE	TI184930	: QUALITY ENGINEERING LEARNING DESIGN
	Credit	: 3 credits
	Semester	: 6/7/8 (elective)

COURSE DESCRIPTION

The ability to continuously improve quality is one of the company's needs that must be met. This Quality Engineering course is aimed at guiding and training students in understanding the concept of quality improvement, managing quality improvement activities, and practicing quality improvement techniques. Team work is an essential foundation in implementing quality improvement programs. Identify factors that affect quality and make quality improvement alternatives. Alternative quality improvement is done by striving for the selected product parameters or process parameters to produce robust product or process quality. Students will also learn techniques to determine tolerance of the parameters of the product or process

COURSE'S LEARNING OUTCOME

- Students are able to understand the concept of Quality Improvement
- Students understand the factors that influence the success of quality improvement programs.
- Students are able to understand, implement, and manage quality improvement programs.
- Students are able to understand and use quality improvement techniques

MAIN REFERENCES

- Peace G., Stuart, *Taguchi Methods a Hands-on Approach*, Addison-Wesley Publishing Company, Inc., Canada, 1995
- Amitava M, ***Fundamentals of Quality Control and Improvement***, Macmilan Publishing Company, New York, 1998.
- AIAG, *Measurement System Analysis Reference Manual,* Crysler Corporation, 1995.

COURSE	**TI184933**	**: LEAN CONCEPT & ITS APPLICATIONS**
	Credit	: 3 credits
	Semester	: 6/7/8 (elective)

COURSE DESCRIPTION

Industrial and System engineers should be responsible for continuously improving operational performance, develop systems that are fast, flexible, focus to their customers. This course will introduce undergraduate and graduate students to Lean thinking principles and its implementations. This course provides students with an introduction to Lean concept, Lean production and Lean services starting from describing the background behind its development and how evaluations and assessments of enterprise systems are performed and then initiate an improvement project. Some of Lean tools and techniques will be described and in some cases demonstrated in simulation exercises. The issues relating to employee involvement, improvement teams, training and culture, also examples of applications in manufacturing and business processes will be presented.

COURSE'S LEARNING OUTCOME

- Ability to understand the Lean thinking concept.
- Ability to apply Lean Concept.
- Ability to analyze a manufacturing system using Lean Manufacturing tools.
- Ability to criticize the applications of Lean thinking in production system and service sectors.
- Ability to construct an improvement plan using Lean Concept

MAIN REFERENCES

- *Lean* Thinking, James Womack and Daniel Jones, Free Press, Revised Edition, 2003.
- *Lean* Production Simplified, Pascal Dennis, Productivity Press, 2007.
- The Toyota Way Field-book, Jeffrey Liker and David Meier, McGraw-Hill, 2006.
- Going *Lean*: How the Best Companies Apply *Lean* Manufacturing Principles to Shatter Uncertainty, Drive Innovation, and Maximize Profi t, Stephen A. Ruffa, Amacom, 2008.

COURSE	**TI184941**	**: MULTI CRITERIA DECISION MAKING**
	Credit	: 3 credits
	Semester	: 6/7/8 (elective)

COURSE DESCRIPTION

Multi Criteria Decision Making (MCDM) Course is an elective course for undergraduate students at the Department of Industrial Engineering ITS. This course is concerned with structuring and solving decision and planning problem involving multiple criteria and multi objective environment. The aim this course to provide students with an understanding of decision making process and to explain the conflicting criteria and objective facing in real system decision. This course will prepare the student to be able to implement the technique of MCDM to analysis the decision problem facing in industries, corporate, organization unit or any kind of decision level where are considred as problem os multi objective or else multicriteria.

COURSE'S LEARNING OUTCOME

- Students understand the decision environment and situation in which tradisional concept of "optimal" is non existent in nature due to complex or riel problem of decision making.
- Students are able to recognize and identify problems related paradigm of conflicting criteria or objective taking into account, satisfied solution and compromise as well as bounded rationality.
- Students are able to implement/apply several and out ranking technique for measurement preference of the related decision making in conflicting criteria and considering the multiple objective.
- Students are understanding and able to utilize various of MCDM/MODM algorithm and techniques to solve simple to appropriate complexity decision problems.
- Students are able to develop mathematical model for solving problem multicriteria/multiobjective environment and to analyse the trade off of the compromise solution.
- Students are able to communicate their ideas and thoughts verbally and in writing.

MAIN REFERENCES

- Bana E Costa, C.A (1996). *Readings In Multiple Criteria Decision Aid*, Springer Verlag, Berlin.
- Goicoechea, A., D.R. Hansen And L. Duckstein. *Multiobjective Decision Analysis With Engineering And Business Applications*. Joint Wiley And Sons, 1982.
- Maystre L.Y., J.Pictet Dan J. Simos. *Methode Multicritere Electre*, Presses Polytechniques Et Universitqires Romandes, Lausanne, 1995
- Tabucanon, M.T.Multipile Criteria Decision Making In Industry, Elsevier, 1992
- SAATY,T.L, FUNDAMENTAL OF DECISION MAKING IN PRIORITY THEORY. RWS PUBLICATIONS, 1994.

COURSE	TI184943	: DATA MINING
	Credit	: 3 credits
	Semester	: Elective

COURSE DESCRIPTION

Data Mining Course consists of concepts, processes, and the use of data mining. Through this course, students are instructed and being given insights to be able to extract beneficial information or knowledge from a big scale data set through data mining tools. Data mining tools such as clustering, classification, regression, and association will be introduced until the ways to implement it by using software. Data preprocessing will be introduced before data mining tools can be imposed toward a data set.

COURSE'S LEARNING OUTCOME

- Students understand the concept, process, why, what is data mining, data, data quality, types of variables.
- Students understand the concept of learning, supervised, unsupervised learning.
- Students are able to explain data mining tasks: classification, regression, computing, association, social networks, text mining, descriptive, predictive, prescriptive.
- Students understand the concept and implement data mining algorithms: clustering, KNN, SVM, LDA
- Students are able to do data preprocessing: cleaning, scaling, normalization
- Students are able to use the R software or Matlab
- Students are able to apply data mining tools to perform data mining tasks
- Students are able to evaluate the otput of data mining experiments
- Students are able to present and analyse of data mining output

MAIN REFERENCES

- Data Mining terapan dengan matlab (budi santosa, 2007)
- J. Han, M. Kamber, and J. Pei, Data Mining: Concepts and Techniques. Morgan Kaufmann, 3rd ed. , 2011
- 3. P.-N. Tan, M. Steinbach and V. Kumar, Introduction to Data Mining, Wiley, 2005.

COURSE	TI184944	: METAHEURISTICS OPTIMIZATION
	Credit	: 3 credits
	Semester	: Elective

COURSE DESCRIPTION

Metaheuristics are typically high-level problem-independent strategies which guide an underlying more problem specific heuristic to increase their performance in finding the optimal solution. They are general purpose tools but have to be tailored to a specific problem. Since many real-world problems can be solved with metaheuristics, it is not possible to cover too many of them in one semester. As a compromise, a few problems will be chosen (such as function optimization, single machine scheduling, and traveling salesman problem) to show the use of these metaheuristics in the class

COURSE'S LEARNING OUTCOME

- Understand and explain class of optimization, optimization techniques, basic concept of metaheurisrics, advantages of metaheuristics
- Understand and apply metaheuristics for simple and complex cases using software
- Hybridize two or more metaheuristics and or heuristics techniques

MAIN REFERENCES

- Metaheuristik: konsep dan implementasi Budi santosa, Paul Willy, 2011
- Modern Heuristic Optimization Techniques, Theory and Applications to Power Systems, Wiley Interscience, Kwang Y Lee and Mohamed A Sharkawi,

COURSE	TI184946	: SYSTEM DYNAMICS METHODOLOGY
	Credit	: 3 credits
	Semester	: Elective

COURSE DESCRIPTION

System Dynamics Methodology is an approach based on the "Systems Thinking" paradigm in seeing a problem comprehensively and related to other problems as a complex systemic relationship. The problems referred to in this lecture are not limited to engineering problems, but also involve broader issues, including: social, economic and environmental issues. By looking at the problems comprehensively, students are expected to be able to design and build the relationship between problems with one another in the form of a cause and effect diagram. This cause-and-effect diagram is the first step in modeling in order to fully represent the reality of the problem. Furthermore, students follow up by developing a causal diagram into a computer simulation model in the form of a flow chart with the help of STELLA or VENTANA software and simulate the model. Based on the simulation results, students must be able to validate and verify the model that has been developed as a benchmark for the validity of the model. On the basis of a model that has proven its validity, students are trained to be able to use and compile treatment scenarios as well as to analyze the behavior of the model representing the real world. Learning activities consist of lectures that discuss systems thinking paradigms, system modeling using STELLA or VENTANA software. The next step is to perform simulation and analysis of behavioral scenarios on the model that has been developed. In this lecture, students are required to complete individual and group assignments related to the development of a dynamic system model.

COURSE'S LEARNING OUTCOME

- Be able to understand about: what, why and how the concept and paradigm of systems thinking in seeing a problem comprehensively and providing examples of a problem that is related to other problems and does not stand alone, as a systemic linkage.
- Be able to understand the scope and scale of thought and examples: micro-systems, meso-systems and macro-systems in seeing a problem reality.
- Be able to understand about the positive and negative systemic relationship between problems with one another from various problems, both in the industrial, economic, social and environmental sectors.
- Skills in developing a series of positive and negative causal linkages logically and completely, and identifying the existence of closed positive and negative feedback loops in a cause-and-effect diagram.
- Be able to understand the notion of: logical relationships of informational relationships and material relationships in a cause-and-effect relationship , stock, rate, converter and constants for a systemic problem.
- Be able to categorize the relationship between problems as a material or informational relationship as well as to

categorize problems or entity variables in the causal diagram as stocks, rates, converters and constants.
- Be able to use one Dynamic System application software is in between two, namely STELLA or VENTANA to build flowcharts, carry out experiments through simulations, validate and verify the results of the development of the model being built and can interpret the output of simulation experiments.
- Be able to make policy scenarios on the model by changing the model parameter magnitude or changing the model structure as well as seeing the future behavior of the model towards the scenario changes and then selecting it as the best alternative scenario.
- Be able to form and work in teamwork to build and develop a Dynamic System model of a real case in accordance with their interests in the fields of industry, economy, social and the environment.

MAIN REFERENCES

- Sterman, J. D., Business Dynamics : System Thinking and Modeling for Complex World; McGraw-Hill Higher Education, 2000.
- Bala, B. K., Arshad, F. M., Noh, K. H., System Dynamics : Modelling and Sumulation, Springer, 2017..

COURSE	TI184949	: GAME THEORY
	Credit	: 3 credits
	Semester	: Elective

COURSE DESCRIPTION

Game theory discusses mathematical-based techniques for multi-player decision making problems. Topics covered include scope and type of games, its formalization, techniques to find the solution, and some interesting issues in game theory application in industrial cases. This course is intended to equip bachelor students with close-to-reality decision making through systematic and analytical approaches.

COURSE'S LEARNING OUTCOME

- Be able To understand the concepts, basics and types of multi player decision making (game) and its application in industry.
- Be able to construct the model and to solve non cooperative games especially the two-player zero-sum games.
- Be able to construct the model and to solve the two-player zero-sum games.
- Be able to operate game theory software application for both non-cooperative and cooperative games.
- Be able to recognize the updated game theory implementation in industrial cases as lifelong study.

MAIN REFERENCES

- Dutta, P.K., Strategies and games: Theory and practice, MIT Press, 1999.

COURSE	TI184951	: DECISION ANALYSIS
	Credit	: 3 credits
	Semester	: Elective

COURSE DESCRIPTION

This course provides another perspective on engineering-industrial problem solving. If students have previously studied optimization mathematical problems, Decision Analysis is more focused on the process of structuring the problem, thinking creatively to produce alternative decisions, then proceed with the search for the best alternative using solution techniques that have been learned in previous courses. . Accommodating the uncertainty factors and decision maker preferences also become an integral part that is also studied in this course.

COURSE'S LEARNING OUTCOME

- Understand the basic concepts and paradigms of decision problems.
- Be able to perform analysis and selection of the best alternatives according to the criteria and models used
- Understand how to do decision structuring by modeling problem decisions that are commonly used
- Be able to accommodate uncertainty in decision modeling

- Be able to consider decision maker preferences in analyzing decision making

MAIN REFERENCES

- Clement, Robert T. (1996). Making Hard Decisions: An Introduction to Decision Analysis, 2nd Edition., Duxbury Press.

COURSE	TI184952	: APPLIED DISCRETE EVENT SIMULATION
	Credit	: 3 credits
	Semester	: Elective

COURSE DESCRIPTION

Business and industrial problems now becomes complex. The complexity of the problem can be seen from the uncertain conditions which whom they face. For example, they cannot even predict their future product demands or the availability of their resources, such as raw materials, manpowers, or machines. The interdependencies between sub-system also make the problem more complex. The decreasing demand with steady production will make the inventory level increase, as one of the interdependency. Thus, discrete event simulation is appropriate tools to be used to solve these kinds of problems.

This course is advanced discrete event simulation course. As the continuation of the first series, industrial system simulation, this course is intended to teach students who needs to enrich their basic skills in Discrete Event Simulation by developing, implementing, and applying advanced simulation methods. This course will focus on the use of advanced moduls of simulation software and apply them on operational business decisions. For example, we will use simulation to determine optimal inventory policies, either under backorder or lost sale conditions. Some recent problems either taken from the final projects/thesis or jurnal/conference papers also are under studied to enhance the skills of the students.

COURSE'S LEARNING OUTCOME

- Be able to define, formulate, construct and resolve various complex systems facing by industrial and business by using simulation models
- Be able to identify the inputs of and Interpret outputs from a simulation model
- Be able to use and apply the advanced modules of simulation software
- Be able to disseminate results, defend the choices of model structure and data inputs by means of an interactive oral presentation and examination
- Be able to describe the limitations of simulation analyses

MAIN REFERENCES

- Benjamin Melamed and Tayfur Altiok, "Simulation Modeling and Analysis with ARENA", Elsevier Inc, 2007.
- Alan Pritsker and Jean J. O'Reilly, "Simulation with Visual SLAM and AweSim", Wiley, 1999
- W. David Kelton, Randall P. Sadowski, "Simulation with Arena", McGraw-Hill Education, 2014.

COURSE	TI184962	: ENTERPRISE RESOURCE PLANNING
	Credit	: 3 credits
	Semester	: 6/7/8 (elective)

COURSE DESCRIPTION

Enterprise resource planning (ERP) is operations and supply chain management software used bu companies to coordinate information in business areas. The objective of this course is to introduce the ERP concepts, ERP modules and ERP practical case.

COURSE'S LEARNING OUTCOME

- Students are able to explain the definition, history, function, benefits, modules, and practical case of ERP
- Students are able to explain business process re-engineering in ERP, method of BPR in ERP and how BPR applied in ERP

- Students are able to explain planning, design and implemention of ERP
- Students are able to understand and apply sales and marketing module in ERP Software (SAP, Oracle and Odoo)
- Students are able to understand and apply production/supply chain management module in ERP software
- Students are able to understand and apply accounting and financial module in ERP
- Students are able to understand and apply human resources module in ERP

MAIN REFERENCES

- Monk, E and Wagner, B (2009) Concepts in Enterprise Resource Planning, 3st editions, Course Technology

COURSE	TI184963	: PROCUREMENT AND MATERIAL MANAGEMENT
	Credit	: 3 credits
	Semester	: 6/7/8 (elective)

COURSE DESCRIPTION

Procurement and Materials Management equips students with a master's degree program the ability to develop models of basic supplies and apply it, as well as provide the capability for analyzing models of more complex supply system for problem solving and research. Topics covered include: the scope of the inventory system, the basic models of inventory systems, procurement systems , and suppliers selection.

COURSE'S LEARNING OUTCOME

- Students understand the concepts and basics of procurement and material management and related activities.
- Students understand and able to analyze the development and applications of inventory system models in real life systems.
- Students are able to analyze and design systems related to inventory management problems and related areas.
- Students are able to understand the basic of procurement / purchasing strategy, sourcing strategy and sourcing strategy process.
- Students are able to present the development of inventory system models and applications, supply management and related subject from selected journals as a group of students.

MAIN REFERENCES

- Tersine, Richard J.,(1994), Principle of Inventory and Materials Management, Forth Edition, Prentice Hall Inc.,.

COURSE	TI184964	: AIR TRANSPORTATION MANAGEMENT
	Credit	: 3 credits
	Semester	: 6/7/8 (elective)

COURSE DESCRIPTION

This course gives a comprehensive understanding to Industrial Engineering Undergraduate Students about the decision making process in air transportation management. This course focuses in the development of planning optimization models along with the best exact also heuristic solutions for flight scheduling, flight routes and operational flight execution that covers revenue management, crew scheduling and fleet assignment.

COURSE'S LEARNING OUTCOME

- Students are able to understand and explain about the scope of Air Transportation Management including Airline Business and its competition.
- Students are able to understand and develop airline management system basic models : Airline Planning and Operations in different decision levels
- Students are able to understand and develop man power planning related to air transportation : cabin crew and pilots, and maintenance and ground handling officers
- Students are able to analyze the roles of Revenue Management in Airlines including pricing and seat inventory strategy

- Students are able to analyze the problems occurred in Airport Operations and Planning
- Students are able to apply air transportation models for practical cases with specific algorithm and conduct an analysis of the application
- students can develop the ability to form a simple heuristic algorithm in solving problems

MAIN REFERENCES

- Bazargan, Massoud (2010). Airline Operation and Scheduling, 1st Edition., Ashgate Publishing Limited
- Norman J Ashford, Pierre Coutu , John R. Beasley (2013). Airport Operations (Third Edition), McGrawHill.

COURSE	TI184965	: DISTRIBUTION MANAGEMENT
	Credit	: 3 credits
	Semester	: 6/7/8 (elective)

COURSE DESCRIPTION

Distribution Management is an elective course for Industrial Engineering undergraduate students. This course gives an overview of mathematical models in transportation and distribution system planning, and the correlation between advanced theories and simple computer applications. Students attending this course are expected to have basic skills in programming and operational research. This course is designed to provide student with modeling problem and forming both exact and heuristic algorithms to solve transportation and distribution problems. This course will introduce a variety of teaching methods based on Student-Centered-Learning (SCL) that students actively involved in learning process. The students are required to learn Visual Basic Applications for Microsoft Excel (VBA Excel) independently after taking a session of Introduction to VBA Excel during this course. In the end of this lecture, the students will be assigned with a VBA Excel based final project related to transportation and distribution systems.

COURSE'S LEARNING OUTCOME

- Students are able to recognize and identify problems related to distribution network and transportation
- Students are able to understand mathematical modeling techniques for solving distribution network and transportation planning problems
- Students are able to apply distribution network models for real cases with specific algorithm and conduct an analysis of the application
- Students are able to apply transportation models for real cases with specific algorithm and conduct an analysis of the application
- Students can develop the ability to form a simple heuristic algorithm in solving problems
- Students have basic skills in programming using Visual Basic for Application for Microsoft Excel

MAIN REFERENCES

- Daskin, Mark S. (2013). Network and Discrete Location: Models, Algorithms, and Applications. New York: John Wiley and Sons, Ltd. 2nd Edition
- Paolo Toth and Daniele Vigo (Eds). (2014) The Vehicle Routing Problem. Monographs on Discrete Mathematics and Applications. S.I.A.M., Philadelpia. 2nd Edition

COURSE	TI184966	: RETAIL SUPPLY CHAIN MANAGEMENT
	Credit	: 3 credits
	Semester	: 6/7/8 (elective)

COURSE DESCRIPTION

This course aims to provide students with knowledge about retail supply chain management, which includes understanding the strategic planning in retail, retail types, product classification, market selection, and coordination between supplier-warehouse - store. This course also assists the students to understand how to manage supply chain management for retail businesses through several small projects related to real cases. Several issues addressed are consumer behavior, pricing strategies, store layout, space allocation and retailing for special products. These projects also help the students to have an experience in designing a supply chain in a real mini case. In the end of this course, the students are expected to have a comprehensive knowledge and basic design skills on the retail supply chain.

COURSE'S LEARNING OUTCOME

- Explain process in developing strategic plan in retail
- Understand the product category and relate it with the type of retailer
- Use analytical tools in designing retail supply chain.
- Explain the different policies in pricing.
- Understand how shopping behavior and product layout affects retail performance
- Understand the impotance of coordination between supplier-warehouse-retail store
- Describe several alternatives of technology that can be used to manage data related to retail

MAIN REFERENCES

- Barry Berman, Joel R. Evans - Retail Management A Strategic Approach (13th Edition), Pearson (2018)

COURSE	TI184971	: BUSINESS PROCESS RE-ENGINEERING
	Credit	: 3 credits
	Semester	: 6/7/8 (elective)

COURSE DESCRIPTION

Business process re-engineering is a process approach to improve business performance that combines methodologies and information technology. The objective of this course is to introduce the concepts, models, techniques, methods and practical case in business process re-engineering.

COURSE'S LEARNING OUTCOME

- Ability to explain BPR concepts and the relationship business strategy and business processes
- Ability to apply the generic business process models
- Ability to explain the business process in ERP system
- Ability to apply the methods/techniques for business process mapping
- Ability to analysis process for simple and complex problems
- Ability to apply process mining techniques to re-inviting business processes
- Ability to understand and apply process improvement using process mining software

MAIN REFERENCES

- Anupindi, R., Chopra, S., Deshmukh, S. D., Van Mieghem, J. A., & Zemel, E. (2006). Managing business process flows: Pearson Higher Ed.
- Weske, M (2007), Business process management: concepts, languages and architecture, Springer
- Vanany (2016) Business process re-engineering, Sinar Gamedia

COURSE	TI184972	: SERVICE MANAGEMENT
	Credit	: 3 credits
	Semester	: 7

COURSE DESCRIPTION

As a continuously increasing global economy, providing services is believed as a new strategy that could give more competitive advantages for the industry to survive in today's market. In line with this fact, it becomes more relevant for Industrial Engineers to understand all aspects related to service management. Through this course, students will obtain a comprehensive understanding of how to manage a service company, including a theoretical understanding of how to design services, how to execute the service design and how to evaluate the service implementation and give improvement recommendations. Students will work in a team as well to analyse and evaluate a real service industry or case study to sharpen their practical understanding.

COURSE'S LEARNING OUTCOME

- Students can describe the role of services in global economics.
- Students can explain the basic concept of service, including its characteristics.
- Students can design a service base on four steps.
- Students can implement the result of the design base on four steps.
- Students can identify recommendations to improve the performance of a service company.

- Students can present the discovery learning of service design and management in a specific context in the real world.

MAIN REFERENCES

- Ramaswamy, R. 1996. Design and management of service processes: keeping customers for life: Addison-Wesley.
- Fitzsimmons, J.A. and Fitzsimmons, M.J. 2014. Service management: operations, strategy, and information technology: Irwin/McGraw-Hill. Eighth edition.

COURSE	TI184973	: PERFORMANCE MANAGEMENT
	Credit	: 3 credits
	Semester	: Elective

COURSE DESCRIPTION

Performance Management aims to provide the students with the knowledge of the strategic roles of performance management in corporate. The objects of study cover the basic concept of integrated performance management, the traditional and modern models of performance management such as Balanced Scorecard, Performance Prism, Excellence Model, and employee performance measurement.

COURSE'S LEARNING OUTCOME

- Students are able to understand the basic concept of integrated performance management
- Students are able to understand and use the model of performance management
- Students are able to understand the concept of employee performance management
- Students are able to design integrated framework of corporate performance management

MAIN REFERENCES

- Hakes, Chris, 2007. The EFQM Excellence Model to Assess Organizational Performance - A Management Guide (Best Practice), 1st Edition, Van Haren Publishing.
- Kaplan, Robert S. and David P. Norton, 1996. The Balanced Scorecard: Translating Strategy into Action, 1st Edition, Harvard Business Review Press.
- Kaplan, Robert S. and David P. Norton, 2000. The Strategy-Focused Organization, 1st Edition, Harvard Business Review Press.
- Kaplan, Robert S. and David P. Norton, 2004. Strategy Maps: Converting Intangible Assets into Tangible Outcomes, 1st Edition, Harvard Business Review Press.
- Kaplan, Robert S. and David P. Norton, 2006. Alignment: Using the Balanced Scorecard to Create Corporate Synergies, 1st Edition, Harvard Business Review Press.
- Kaplan, Robert S. and David P. Norton, 2008. The Execution Premium: Linking Strategy to Operations for Competitive Advantage, 1st Edition, Harvard Business Review Press.
- Neely, Andi, 2002. Business Performance Measurement, 1st Edition, Cambridge University Press.
- Neely, Andi, Chris Adams, and Mike Kennerley, 2002. The Performance Prism: The Scorecard for Measuring and Managing Business Success, 1st Edition, Financial Times Prentice Hall.
- Verweire, Kurt and Lutgart Van Den Berghe, 2004. Integrated Performance Management: A Guide to Strategy Implementation, 1st Edition, Sage Publications.

COURSE	TI184974	: KNOWLEDGE MANAGEMENT
	Credit	: 3 credits
	Semester	: 8

COURSE DESCRIPTION

In this course, students will be directed to understand the conception and methodology of knowledge management which includes the creation of knowledge, knowledge architecture, codification of knowledge, and analytical tools needed for knowledge management and the development of knowledge portals and audits, acquisitions, transfer and sharing of knowledge in order to achieve the company's competitive advantage.

COURSE'S LEARNING OUTCOME
• Students understand the conception of knowledge and knowledge management. • Students understand the techniques and tools, as well as the framework that can be used to carry out management of knowledge. • Students understand and are able to use KM Tools and Knowledge Portals in the process of managing corporate knowledge. • Students understand and are able to implement the knowledge management and learning of corporate organizations to produce innovation.
MAIN REFERENCES
• K. Dalkir, *Knowledge management in theory and practice*. Amsterdam; Boston: Elsevier/Butterworth Heinemann, 2005. • Elias M. Awad, Hassan M. Ghaziri, *Knowledge Management*, Pearson Education Inc., Prentice Hall, 2004.

COURSE	TI184976	: FINANCIAL MANAGEMENT
	Credit	: 3 credits
	Semester	: 8
COURSE DESCRIPTION		
In the middle of increasingly industrial competition, an Industrial Engineer is expected to play a role in the creation of company / industry value. To achieve this goal, an important competency that must be possessed is the ability to conduct analysis from a stronger financial perspective, enabling them to make decisions that better reflect the needs of the industry. This course will provide concepts and decisions in financial management, especially those related to corporate finance. The discussion in this lecture is divided into 4 main parts. Part one will introduce the basic concepts of financial management, the second part will explain the valuation of financial assets, the third part discusses in detail the investment decisions on long-term assets and the last part discusses the capital structure and dividend policy of company. Students will complete several assignments and exercises to strengthen their understanding of the topics discussed during lectures.		
COURSE'S LEARNING OUTCOME		
• Students are able to understand finance and the scope and problems faced in financial management. • Students understand how to value financial assets. • Students understand investing in long-term assets and make an assessment of investments in those long-term assets. • Students understand the theories related to funding structures and can determine the optimal funding structure and dividend policy. • Students understand how to manage working capital efficiently and effectively. • Students can identify, analyze, evaluate and manage financial risks.		
MAIN REFERENCES		
• Titman, Keown et al, "Financial Management: Principles and Applications 12/E", Pearson, 2014. • Berk, DeMarco et al, "Fundamentals of Corporate Finance", Prentice Hall, 2012. • Crundwell F.K., "Finance for Engineers: Evaluation and Funding of Capital Projects", Springer-Verlag, London, 2008.		

COURSE	TI184979	: CORPORATE RISK MANAGEMENT
	Credit	: 3 credits
	Semester	: 3
COURSE DESCRIPTION		

Risk Management is the election course that aims to provide the students with the knowledge of the important risk management incorporate. The objects of study cover risk standards, framework, and processes that include risk identification, assessment, and prioritizing. Students will also learn to use several risk management quantitative tools such as Strategic Objective at Risk (SOAR), Failure Mode Effect and Analysis (FMEA), Fault Tree Analysis (FTA), Value at Risk (VAR), and Monte Carlo Simulation.

COURSE'S LEARNING OUTCOME

- Students can understand the risk concept and the important aspects of corporate risk management.
- Students can understand and use quantitative methods to identify and assess risks.
- Students can understand and design risk profile, mitigation strategies and risk management audit.
- Students can develop their critical, analytical thinking, and communication skill by conducting case study analysis.

MAIN REFERENCES

- Dempster, M.A.H. 2002. Risk Management: Value at Risk and Beyond. 1st Edition. Cambridge University Press.
- McDermott, Robin E, Raymond J. Mikulak, and Michael E. Beauregard. 2009. The Basics of FMEA. 2nd Edition. Taylor & Francis Group.
- Merna, Tony and Faisal Al-Thani, 2008. Corporate Risk Management. 2nd Edition. John Wiley & Sons.
- Monahan, Gregory, 2008. Enterprise Risk Management: A Methodology for Achieving Strategic Objective. 1st Edition. John Wiley & Sons.
- Olson, David L. and Desheng Wu. 2020. Enterprise Risk Management Models. 3rd Edition. Springer

COURSE	**TI184980**	**: INDUSTRIAL CLUSTER**
	Credit	: 3 credits
	Semester	: 5

COURSE DESCRIPTION

The Industrial Cluster Course is a subject that focuses on providing knowledge about an effective industrial development strategy used to improve industrial performance and to have a positive impact on the regional economy, both locally, regionally and nationally. This course is designed to introduce the concept of industrial clusters, their rationale and approaches used in their development. Students will also learn about several methods to analyze the effectiveness of an industrial cluster. At the end of the lecture, students will have the ability to design an applicable industrial cluster development model and have the ability to become industrial cluster facilitators in minimal areas for micro, small and medium scale enterprises.

COURSE'S LEARNING OUTCOME

- Students can create a production chain map and identify specific industrial cluster stakeholders.
- Students can identify stakeholder needs in an industrial cluster.
- Students can elaborate information and data to analyze the completeness of components and functional effectiveness of an industrial cluster.
- Students can design a predetermined industrial cluster development model concerning the sustainability of competitiveness.
- Students can use relevant software to analyze the dynamics of an industrial cluster.
- Students can become a facilitator in the development of industrial clusters at least on a small and medium industrial scale.

MAIN REFERENCES

- Porter M.E. 1998. Clusters and the New Economic of Competetion. Harvard Business Review
- Porter, M. 1980. Competitive Strategy : Techniques for Analyzing Industries and Competitors : With a New Introduction : The Free Press

COURSE	**TI184986**	**: AGENT-BASED MODELLING**
	Credit	: 3 credits
	Semester	: Elective

COURSE DESCRIPTION

This course provides a new approach in system modeling, particularly in the context of Industrial Engineering. The agent-based system modeling (ABSM) approach applies a bottom-up approach in general, which means it focuses on interactions between agents to understand an emergent behavior in a system. The approach also has an ability to generate information for anticipating the possible effects of business decisions on a market and industries. At the completion, students are expected to understand why agent-based modeling is needed, what the foundation of ABSM is, why ABSM is useful and used, and how the approach works. Students are also required to be able to develop agent-based models for several case studies in the Industrial Engineering context. As for the platform, this course uses NetLogo because it is easy to acquire (i.e. freeware) and has been proven supports complexity education. This course will introduce a variety of teaching methods based on Student-Centered-Learning (SCL) that give students opportunity to actively get involved in the learning process.

COURSE'S LEARNING OUTCOME

- Students understand the concept of agent-based system modeling
- Students understand the agent's characteristics, attributes, and behavior
- Students understand and demonstrate the agent-based modeling approach for system modeling
- Student understand and are able to apply the conceptual modeling approach for agent-based system modeling
- Students are able to be proficient in NetLogo
- Students are capable to test the validity and verify the model
- Students are able to design and implement experiments and analyze the results

MAIN REFERENCES

- Railsback, S. F., and Grimm, V., 2012, Agent-based and individual-based modeling: A practical introduction. Princeton: Princeton University Press.
- Wilensky, U., 2014, NetLogo 5.1.0 User Manual. http://ccl.northwestern.edu/netlogo/. Center for Connected Learning and Computer-Based Modeling, Northwestern University, Evanston, IL.
- North, M. J. and Macal, C. M., 2007, Managing Business Complexity: Discovering Strategic Solutions with Agent-based Modeling and Simulation, Oxford University Press.
- Robinson, S., 2014, Simulation: The practice of model development and use, Palgrave Macmillan.
- Robertson, D.A., and Caldart, A.A., 2009, The dynamics of strategy: Mastering strategic landscapes of the firm, Oxford University Press.

COURSE	**TI184986**	**: STRATEGIC MANAGEMENT**
	Credit	: 3 credits
	Semester	: 7

COURSE DESCRIPTION