UNDERGRADUATE CURRICULUM DOCUMENTS OF 2018 – 2023 DEPARTMENT OF MECHANICAL ENGINEERING

FACULTY OF INDUTRIAL TECHNOLOGY
INSTITUT TEKNOLOGI SEPULUH NOPEMBER

FACULTY OF INDUSTRIAL TECHNOLOGY

Department	**MECHANICAL ENGINEERING**
Program	**UNDERGRADUATE**

	Learning Outcomes		
Attitude	LO1	1.	Believing in the oneness of God and able to demonstrate religious attitude.
		2.	Upholding the value of humanity in undertaking the task based on religion, morality and ethics.
		3.	Contributing in improving the quality of community life, nation and state and the advance of civilization based on Pancasila.
		4.	Playing a role as a proud citizen who loves his/her homeland, having a nationalism and responsibility to the country and nation.
		5.	Appreciating the diversity of cultures, point of view, religion and belief as well as opinion or the original findings of others.
		6.	Working together, having social sensitivity and caring for community and environment.
		7.	Law abiding and displaced in community and state life.
		8.	Internalizing values, norms and academic ethics.
		9.	Demonstrating attitude of responsibility on work in his/her field of expertsei independently.
		10.	Internalizing spirit of independence, struggle and entrepreneurship.
		11.	Trying his/her best to achive perfect results.
		12.	Working together to be able to make the most of his/her potential.

General Skill	LO2	1.	Being able to apply logical, critical, systematic and innovative thinking in the context of implementation of science and technology that concerns and implements the value of humanities in accordance with their area of expertise.
		2.	Being able to demonstrate independent performance, quality, and measurable.
		3.	Being able to examine the implications of the development or implementation of the science of technology which concerns and implements the value of humanities in accordance with its expertise based on rules, procedures and scientific ethics in order to produce solutions, ideas, designs or art criticism, compile scientific descriptions of the study results in the form of thesis or final project report, and upload it in the college page.
		4.	Arrange the scientific description of the results of the above study in the form of a thesis or final project report, and upload it on the college page.
		5.	Being able to take decisions appropriately in the context of problem solving in the area of expertise based on the results of information and data analysis.
		6.	Being able to maintain an expanded network with mentors, colleagues, colleagues both inside and outside the institution.
		7.	Being able to take responsibility for the achievement of group work and supervise and evaluate the work completion assigned to the worker under his/her responsibility.
		8.	Being able to conduct self-evaluation process to work group under his/her responsibility, and able to manage learning independently.
		9.	Being able to document, store, secure and recover data to ensure validity and prevent plagiarism.
	LO3	1.	Being able to develop themselves and compete in national and international level.
		2.	Being able to implement sustainability principles abd develop knowledge.

	LO4	1.	Being able to implement information and communication technology (ICT) in the context of implementation of his/her work.
		2.	Being able to apply entrepreneurship and understand technology-based entrepreneurship.
Knowledge	LO5		Understand the basic science and mathematics.
	LO6		Understand the engineering principles in mechanical system to identify, formulate and solve the problem of mechanical engineering.
	LO7		Understand and follow the most updated technology and the future of mechanical system, as well as its impacts to the economy, social and environment.
Specific Skill	LO8		Able to implement mathematics, science and engineering principles to solve engineering problems in mechanical systems.
	LO9		Able to find the source of engineering problems in mechanical system through research that includes identification, formulation, analysis, data interpretation based on engineering principles.
	LO10		Able to formulate the solution of engineering problem in mechanical system by considering economy, safety, environment and energy conservation.
	LO11		Able to design mechanical system and the necessary components through analytical approach based on science and technology by considering technical standard and reliability.

COURSES

No.	Code	Courses	Credits
SEMESTER I			
1	UG184912	BAHASA INDONESIA	2
2	UG18490[1-6]	RELIGION	2
3	KM184101	MATHEMATICS I	3
4	SF184101	BASIC PHYSICS I	4
5	UG184913	NATIONALISM INSIGHT	2
6	SK184101	CHEMICAL	3
7	TM184101	INTRODUCTION TO MECHANICAL ENGINEERING	2
		Total credits	**18**
SEMESTER II			
1	UG184911	PANCASILA	2
2	UG184914	ENGLISH	2
3	KM184201	MATHEMATICS II	3
4	SF184202	BASIC PHYSICS II	3
5	TM184202	COMPUTER PROGRAMMING	2
6	TM184203	ENGINEERING DRAWING	3
7	TM184204	STATICS	3
		Total credits	**18**
SEMESTER III			
1	TM184305	ENGINEERING MATHEMATICS	3
2	TM184306	THERMODYNAMICS I	3
3	TM184307	BASIC FLUID MECHANICS I	2
4	TM184308	MATERIAL STRENGTH	3
5	TM184309	KINEMATICS AND DYNAMICS	4
6	TM184310	METALURGY I	3
		Total credits	**18**
SEMESTER IV			
1	TM184411	INSTRUMENTATION AND MEASUREMENT	4
2	TM184412	THERMODYNAMICS II	2
3	TM184413	BASIC FLUID MECHANICS II	3
4	TM184414	MACHINE ELEMENT I	3
5	TM184415	METALURGY II	3
6	TM184416	MECHANICS OF VIBRATION	3
		Total credits	**18**
SEMESTER V			
1	TM184517	NUMERICAL ANALYSIS	3
2	TM184518	MANUFACTURING PROCESS I	3
3	TM184519	INDUSTRIAL METROLOGY	3
4	TM184520	HEAT EXCHANGER	4
5	TM184521	DYNAMICS SYSTEM AND CONTROL	4
6	TM184522	MACHINE ELEMENTS II	3
		Total credits	**20**

SEMESTER VI			
1	TM184623	MANUFACTURING PROCESS II	3
2	TM184624	ENERGY CONSERVATION DEVICES	3
3	TM184625	STATISTICS & EXPERIMENTAL DESIGN	4
4	TM184626	MECHATRONICS	4
5	TM184627	DESIGN OF MACHINE ELEMENTS	2
6	UG184915	TECHNOPRENEURSHIP	2
		Total credits	**18**

SEMESTER VII			
1	UG184916	TECHNOLOGICAL INSIGHT AND APPLICATION	3
2	TM184728	MAINTENANCE ENGINEERING AND MANAGEMENT	3
3	TM184729	OPERATIONAL MANAGEMENT	4
4	TM1847xx	ELECTIVE COURSE I	3
5	TM1847xx	ELECTIVE COURSE II	3
6	TM184730	PROPOSAL OF FINAL PROJECT	2
		Total credits	**18**

SEMESTER VIII			
1	TM184831	INTERNSHIP	2
2	TMxxxxxx	ELECTIVE GENERAL EDUCATION COURSE	3
3	TM1848xx	ELECTIVE COURSE III	3
4	TM1848xx	ELECTIVE COURSE IV	3
5	TM184835	FINAL PROJECT	5
		Total credits	**16**

ELECTIVE GENERAL EDUCATION COURSE

No.	Code	Courses	Credits
1	TM184832*	ENERGY RESOURCES	3
2	TM184833*	MANUFACTURING PROCESS	3
3	TM184834*	MATERIAL HANDLING	3

ELECTIVE COURSE

No.	Code	Courses	Credits
1	TM184840	MATRIX METHODOLOGY FOR STRUCTURAL ANALYSIS	3
2	TM184841	ADVANCED STRENGTH OF MATERIAL	3
3	TM184842	VIBRATION OF MECHANICAL SYSTEM	3
4	TM184843	MATERIAL HANDLING	3
5	TM184844	AUTOMOTIVE TECHNOLOGY AND CONSTRUCTION	3
6	TM184845	PLATE AND SHELL CONSTRUCTION	3
7	TM184846	TRIBOLOGY & MACHINE FRICTION THEORY	3
8	TM184847	ENERGY RECOVERY TECHNOLOGY	3
9	TM184848	VIBRATION-BASED FAILURE ANALYSIS	3
10	TM184849	POWER AND DRIVE TRAIN VEHICLE	3
11	TM184750	VEHICLE DYNAMICS AND CONTROL	3
12	TM184751	FLUID MECHANICS	3
13	TM184752	COMPRESSIBLE FLUID MACHINE	3
14	TM184753	INTERNAL COMBUSTION ENGINE	3
15	TM184754	REFRIGERANT AND AIR CONDITIONING	3
16	TM184755	SOLAR ENERGY	3
17	TM184756	ENERGY MANAGEMENT AND ECONOMY	3
18	TM184757	METHODOLOGY OF FLUID COMPUTATION	3
19	TM184758	HYDRAULIC AND PNEUMATIC SYSTEM	3
20	TM184759	AIR POLLUTION	3
21	TM184860	AERODYNAMICS	3
22	TM184861	COMBUSTION AND FUELS	3
23	TM184862	BIOENERGY	3
24	TM184863	POWER GENERATION SYSTEM	3
25	TM184864	RENEWABLE ENERGY	3
26	TM184865	MOULD DESIGN	3
27	TM184866	INDUSTRIAL MANUFACTURING SYSTEM	3
28	TM184867	SIMULATION OF DYNAMICS SYSTEM	3
29	TM184868	MACHINERY DESIGN	3
30	TM184869	QUALITY ENGINEERING	3
31	TM184770	PRODUCT DESIGN AND DEVELOPMENT	3
32	TM184771	MACHINERY VIBRATION	3
33	TM184772	GEOMETRY TOLERANCE	3
34	TM184773	MACHINING PROCESS	3
35	TM184774	PRECISION MEASUREMENT	3
36	TM184775	INDUSTRIAL AUTOMATION	3
37	TM184776	ROBOT MECHSNISMS	3
38	TM184777	CNC MACHINERY	3
39	TM184778	INCOMPRESSIBLE FLUID MACHINE	3
40	TM184779	HEAT EXCHANGER DEVICE	3
41	TM184880	WELDING	3
42	TM184881	CASTING	3
43	TM184882	HEAT TEATMENT	3
44	TM184883	THERMODYNAMICS OF METAL	3
45	TM184884	INDUTRIAL ALLOY	3

46	TM184885	POLYMER AND COMPOSITE	3
47	TM184886	MATERIAL FAILURE	3
48	TM184887	CORROSION	3
49	TM184888	FRACTURE MECHANICS	3
50	TM184889	OPERATIONAL RESEARCH	3
51	TM184790	PROJECT MANAGEMENT	3
52	TM184791	COMPUTER AIDED DESIGN (CAD)	3
53	TM184792	AUTOMOTIVE CONTROL SYSTEM	3
54	TM184793	LINEAR CONTROL SYSTEM	3
55	TM184794	PIPING SYSTEM	3
56	TM184795	DYNAMIC SYSTEM	3
57	TM184796	FUEL INJECTION SYSTEM	3
58	TM184797	INTRODUCTION OF THE HUMAN RIGHTS	3

SYLLABUS CURRICULUM

COURSE	**Course Name : MATHEMATIC I**
	Course Code : KM184101
	Credit : 3 sks
	Semester : I

COURSE DESCRIPTION

LEARNING OUTCOMES

LO5	Understand the basic science and mathematics.

COURSE LEARNING OUTCOMES

Students are able to explain real function concepts, limits, differentiation, integration, and also solve related problems.

MAIN SUBJECT

The focus of this course are as follows:

- **Basic Concept real number**: definition of absolute value, inequalities, line, distance between two point, circle, parabolic
- **Concept of function, limit**: Domain, range, linear function, quadratic, and trigonometric, graph of function, limit function and continuous function.
- **Differentiation:** definition of differentiation, differentiation rules, the chain rule and differentiation of implicit function.
- **Application of differentiation:** related rates, up/down interval, concavity curve, draw a graph that has asymptote, maximum/minimum, approximation, extreme value, and another applications.
- **Indefinite integral and definite integral:** definition of integral, infinite limits, Riemann equation, plane surface area, fundamental theorm of calculus.

PREREQUISITES

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REFERENCE

1. Tim Dosen Jurusan Matematika ITS,"Buku Ajar Kalkulus I" Edisi ke-4 Jurusan Matematika ITS, 2012
2. Anton, H. dkk, *Calculus,* 10-th edition, John Wiley & Sons, New York, 2012
3. Kreyzig, E, *Advanced Engineering Mathematics*, 10-th edition, John Wiley & Sons, Singapore, 2011
4. Purcell, J, E, Rigdon, S., E., *Calculus,* 9-th edition, Prentice-Hall, New Jersey, 2006

5. James Stewart , Calculus, ed.7, Brooks/cole, 2012

SYLLABUS CURRICULUM

COURSE	**Course Name : Fundamental Physics I**
	Course Code : SF184101
	Credit : 4 sks
	Semester : I

COURSE DESCRIPTION	
LEARNING OUTCOMES	
LO5	Understand the basic science and mathematics.
COURSE LEARNING OUTCOMES	
MAIN SUBJECT	

The focus of this course are as follows:
- **Magnitude and vector**;
- **particle kinematic**: veocity, acceleration, linear motion, parabolic motion, circular motion;
- **Dynamic particel**: newton's laws, friction force;
- **work and energy**: work concept, kinetic energy, potential energy, constancy mechanical energy ,
- **Momentum and collision**;
- **rotational motion**: velocity dan angular velocity, moment dan moment inertia, rolling motion;
- **vibration** : simple harmonic motion, harmonic vibration combination;
- **fluids mechanics**: hidrostatic, hidrodynamic.

PREREQUISITES

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REFERENCE

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
4. Alonso & Finn,"Fundamental University Physics", Addison Wesley Pub Comp Inc,13`.ed, Calf, 1990
5. Tipler, PA,(ted. L Prasetio dan R.W.Adi), "Fisika : untuk Sains dan Teknik, Jilid 1", Erlangga, Jakarta, 1998

6. Giancoli, DC., (terj, Yuhilza H), 'Fisika, jilid 1', Erlangga, Jakarta, 2001

SYLLABUS CURRICULUM

COURSE	**Course Name : English**
	Course Code : UG184914
	Credit : 2 sks
	Semester : II

COURSE DESCRIPTION	
LEARNING OUTCOMES	
LO3	Able to develop self-capability and carry out lifelong learing process.
LO6	Understand the engineering principles in mechanical system to identify, formulate and solve the problem of mechanical engineering.
LO9	Able to find the source of engineering problems in mechanical system through research that includes identification, formulation, analysis, data interpretation based on engineering principles.
LO10	Able to formulate the solution of engineering problem in mechanical system by considering economy, safety, environment and energy conservation.
COURSE LEARNING OUTCOMES	
Students are able to show proficiency in English by analyzing the information content of spoken and written discourse and responding to the environmental situation by implementing procedures and learning strategies are determined by activity of listening, speaking, reading and writing in academic communication and insightful empirical science and technology	
MAIN SUBJECT	
The focus of this course are as follows: - Intensive and Extensive Reading related to Science and Technology Issues (Previewing, Making Inferences, Understanding Paragraphs, Patterns of Organization, Skimming and Scanning, Summarizing, Critical Reading - Speaking and academic presentation related to Science and Technology (Expressing and soliciting opinions, Agree and disagree with opinions, Academic Presentations: Understanding audience, Brainstorming, Organizing, Delivering, Communicating Visually, Handling questions) - Listening of Various Genres (Listen to daily talks, Listen to academic talks and lectures) - Writing of Various Genres (Building good sentences, Building paragraphs, Building academic essays: narative, descriptive, argumentative)	

PREREQUISITES
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REFERENCE

1. Hogue Ann, Oshima Alice, “Introduction to Academic Writing”, Longman,1997
2. Johnston Susan S, Zukowski Jean/Faust, “Steps to Academic Reading,” heinle, Canada, 2002
3. Mikulecky, Beatrice S, “Advanced Reading Power”, Pearson Education, New York, 2007
4. Preiss Sherry, “NorthStar: Listening and Speaking,” Pearson Education, New York 2009
5. Becker Lucinda & Joan Van Emden, “Presentation Skills for Students, Palgrave, Macmillan, 2010
6. Bonamy David, “Technical English,” Pearson Education, New York, 2011
7. Fellag Linda Robinson, “College Reading,” Houghton Mifflin Company, 2006
8. Fuchs Marjorie & Bonner Margaret, “ Focus on Grammar; An Integrated Skills Approach,” Pearson Education, Inc, 2006
9. Hague Ann, “ First Steps in Academic Writing,” Addison Wesley Publishing Company, 1996
10. Hockly Nicky & Dudeney Gavin, “How to Teach English with Technology, Pearson Education Limited, 2007
11. Phillipd Deborah, “ Longman Preparation Course for the TOEFL Test,” Pearson Education, Inc, 2003
12. Root Christine & Blanchard Karen, “ Ready to Read Now, Pearson Education, New York, 2005
13. Root Christine & Blanchard Karen, “ Ready to Write, Pearson Education, New York, 2003
14. Weissman Jerry, “Presenting to Win, the Art of Telling Your Story, Prentice Hall, 2006

SYLLABUS CURRICULUM

COURSE	**Course Name : MATHEMATICS II**
	Course Code : KM184201
	Credit : 3 sks
	Semester : II

COURSE DESCRIPTION

LEARNING OUTCOMES

LO5	Understand the basic science and mathematics.

COURSE LEARNING OUTCOMES

Students are able to understand and know about techniques of integration and be able to applicate it in surface plane area, volume of revolution, area of a surface of revolution and center of gravity, polar coordinates, parametric function form and also analyze convergence infinite series.

MAIN SUBJECT

The focus of this course are as follows:
- Techniques of integration: partial integral, integral of trigonometric function, integral of partial fractions function.
- Numerical integration and Improper Integrals: numerical integration, Simpson rule, improper integral.
- Applications of definite integral: plane surface area, volume and area of a surface of revolution, center of gravity and physics application.
- Polar Coordinates: draw polar coordinates of a function in parametric form and be able to applicate techniques of integration in polar coordinates, parametric function.
- Sequence and infinite series: infinite sequence, infinite series, convergence test, Tayor series, Maclaurin series

PREREQUISITES

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REFERENCE

1. Tim Dosen Jurusan Matematika ITS,"Buku Ajar Kalkulus II" Edisi ke-5 Jurusan Matematika ITS, 2013
2. Anton, H. dkk, *Calculus,* 10-th edition, John Wiley & Sons, New York, 2012
3. Kreyzig, E, *Advanced Engineering Mathematics*, 10-th edition, John Wiley & Sons,

Singapore, 2011
4. Purcell, J, E, Rigdon, S., E., *Calculus,* 9-th edition, Prentice-Hall, New Jersey, 2006
5. James Stewart , Calculus, ed.7, Brooks/cole, 2012

SYLLABUS CURRICULUM

COURSE	**Course Name : Fundamental Physics II**
	Course Code : SF184202
	Credit : 3 sks
	Semester : II

COURSE DESCRIPTION

LEARNING OUTCOMES

LO5	Understand the basic science and mathematics.

COURSE LEARNING OUTCOMES

MAIN SUBJECT

The focus of this course are as follows:

- **Coulomb laws and electric field** : coulomb laws, electric fields, Gauss's laws;
- **potential electrical and capacitors**: Integral strong electric field lines, potential energy and electric potential, capacitance and capacitors;
- **power lines** : power lines and current density, conductivity and resistivity, heat arising in the resistor, relationship series, parallel to the resistor;
- **Magnetic field**: magnetic induction and magnetic flux, motion cargo in magnetic field coil in a magnetic field, use of magnetic field, an electric measuring instrument and the properties of magnetic materials, magnetic inducton calculation by an electric current;
- **motion style electric induction** : Faraday discovery, GGL induced by a conductor moving in magnet field, EMF induced by a time varying current, mutual inductance, magnetic power in the inductor, Len's laws;
- **Flow round robin**: Induction transient, resistance, inductance and capacitance in alternating current, impedance diagrams, circuit alternating current.

PREREQUISITES

Fundamental Physics I

REFERENCE

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
4. Alonso & Finn,"Fundamental University Physics", Addison Wesley Pub Comp Inc,13`.ed, Calf, 1990

5. Tipler, PA,(ted. L Prasetio dan R.W.Adi), "Fisika : untuk Sains dan Teknik, Jilid 1", Erlangga, Jakarta, 1998
6. Giancoli, DC., (terj, Yuhilza H), 'Fisika, jilid 1', Erlangga, Jakarta, 2001

SYLLABUS CURRICULUM

COURSE	**Course Name : Engineering Drawing**
	Course Code : TM184203
	Credit : 3 sks
	Semester : II

COURSE DESCRIPTION

LEARNING OUTCOMES

LO6	Understand the engineering principles in mechanical system to identify, formulate and solve the problem of mechanical engineering.

COURSE LEARNING OUTCOMES

Student be able to explain engineering drawing purpose in mechanical engineering, show errors in drawing based on engineering drawing standard and be able to draw and analyze a mechanical system worksheet.

MAIN SUBJECT

The focus of this course are as follows:
- Purpose, shape, and using drawing, drawing tools and utility and engineering drawing standard (normalization).
- Presentation of object in single drawing view or 3D drawing, such as isometric projection, dimetric projection and parallel projection.
- Presentation of object in orthogonal projection either by First-Angle projection system or Third-Angle projection system.
- Convention and methods of drawing dimensioning.
- Presentation of section drawing.
- Presentation of sketch drawing, detail drawing and assembly drawing.
- Standard component drawing, spring drawing and gears drawing in detail drawing or assembly drawing
- Introduction and application of manufacturing mark, tolerance, fitting
- Introduction of welding symbol

PREREQUISITES

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REFERENCE

1. Ir.Ohan Juhana, M Suratman S.Pd., ”Menggambar Teknik Mesin Menurut Standar ISO“
2. G. Takeshi Sato, N Sugiarto Hartanto, ”Menggambar Mesin Menurut standar ISO“

3. Modul Kelas AutoCAD
4. La Hey, “Ilmu Menggambar Bangunan Mesin”.
5. ISO Standard Hand Book 12, “ Technical Drawing”

SYLLABUS CURRICULUM

COURSE	**Course Name : Statics**
	Course Code : TM184204
	Credit : 3 sks
	Semester : II

COURSE DESCRIPTION	
LEARNING OUTCOMES	
LO6	Understand the engineering principles in mechanical system to identify, formulate and solve the problem of mechanical engineering.
LO9	Able to find the source of engineering problems in mechanical system through research that includes identification, formulation, analysis, data interpretation based on engineering principles.

COURSE LEARNING OUTCOMES

Students can conduct analysis on particle and structure equilibriums, arrange free-body diagrams of rigid-body equilibriums based on acting forces, and evaluate stresses and strains resulting from various axial, torsional, bending, shear, and combined load.

MAIN SUBJECT

The focus of this course are as follows:

- Static particle equilibrium: force vector and force system resultant on 2D and 3D Cartesian coordinates
- Static rigid-body equilibrium: types of connection, distributed load, free-body diagram and internal moment
- Structural analysis: method of joints and method of sections
- Stress-strain due to axial load, torsion, bending moment, shear force, and combined load

PREREQUISITES

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REFERENCE

1. Russel C. Hibbeler, Engineering Mechanics: Statics, 12th edition, Prentice Hall
2. Russel C. Hibbeler, Mechanics of Materials, 8th edition, Prentice Hall
3. F. P. Beer and E. R. Johnston Jr., Vector Mechanics for Engineers: Statics, SI Metric Edition, 9th Edition, McGraw-Hill,
4. F. P. Beer and E. R. Johnston Jr., Mechanics of Materials, 6th Edition, McGraw-Hill

SYLLABUS CURRICULUM

COURSE	**Course Name : Engineering Mathematics**
	Course Code : TM184305
	Credit : 3 sks
	Semester : III

COURSE DESCRIPTION

In this course students are able to complete various mathematical problems related to science in mechanical engineering such as: Control, Vibration, Continuum Mechanics, Finite element method, etc.

LEARNING OUTCOMES

LO5	Understand the basic science and mathematics.
LO8	Able to implement mathematics, science and engineering principles to solve engineering problems in mechanical systems.

COURSE LEARNING OUTCOMES

Students are able to understand about ordinary differential equations and partial differential equations, theory of scalar and vector fields, and use the transformation of Laplace, Fourier and Taylor series for technical problems either individually or together in a group.

MAIN SUBJECT

The focus of this course are as follows:
- ordinary differential equations
- Laplace transform, transformation Z
- Partial Differential Equations
- Scalar and vector field theory (Divergence, gradient, curl, Line integrals, Green's theorem)
- Fast Fourier series and Fourier Transform
- Taylor series and Laurent series

PREREQUISITES

- Calculus 1
- Calculus 2

REFERENCE

1. Kreyzig, Advanced Engineering Mathematics, 7th, Ed. John Wiley & Sons, 1993.
2. Michael D Greenberg, Advanced Engineering Mathematics 2nd ed.

SYLLABUS CURRICULUM

COURSE	**Course Name : Mechanics of Material**
	Course Code : TM184308
	Credit : 3 sks
	Semester : III

COURSE DESCRIPTION	
LEARNING OUTCOMES	
LO6	Understand the engineering principles in mechanical system to identify, formulate and solve the problem of mechanical engineering.
LO9	Able to find the source of engineering problems in mechanical system through research that includes identification, formulation, analysis, data interpretation based on engineering principles.

COURSE LEARNING OUTCOMES

Student is able to make transformation diagram of 2D stress – strain in alalitical and graphic, choose static failure theories materials that suite with the materials condition, analyze strength, deflection, and certain and uncertain static buckling structure, also able to understand the use of energy method for material design,both individually and group.

MAIN SUBJECT

The focus of this course are as follows:
- Stress – Strain transformation and failure theories with its application.
- Design principal of material that cover : strength, deflection, and buckling.
- Energy method and virtual load

PREREQUISITES

Statics

REFERENCE

1. Russel C. Hibbeler, Mechanics of Materials, 8th edition, Prentice Hall
2. F. P. Beer and E. R. Johnston Jr., Mechanics of Materials, 6th Edition, McGraw-Hill
3. J. M. Gere and B. J. Goodno, Mechanics of Materials Brief, SI Edition, 2012, Cencage Learning

SYLLABUS CURRICULUM

COURSE	**Course Name : THERMODYNAMICS I**	
	Course Code	**:** TM184306
	Credit	**:** 3 sks
	Semester	**:** III

COURSE DESCRIPTION

Thermodynamics is a science that deals with concepts, dynamics, changes in shape, and energy transfer through work and heat and its applications in thermal power, cooling, and thermal pump systems. The thermodynamic course of Technique I discusses the definitions, basic concepts, and laws of Thermodynamics I and II, the nature and state of a single simple and compressible substance. In this course also discussed the application of techniques that include energy analysis, engineering systems, entropy and steam power systems. This course is taught through lectures in class, response / case study and laboratory practice. Students are expected to apply the concept and law of thermodynamics in engineering analysis.

LEARNING OUTCOMES

LO6	Understand the engineering principles in mechanical system to identify, formulate and solve the problem of mechanical engineering.
LO9	Able to find the source of engineering problems in mechanical system through research that includes identification, formulation, analysis, data interpretation based on engineering principles.
LO10	Able to formulate the solution of engineering problem in mechanical system by considering economy, safety, environment and energy conservation.

COURSE LEARNING OUTCOMES

- Able to understand and analyze basic concepts of thermodynamics, which include forms of energy, nature, state level (single phase, mixture and ideal gas), processes and cycles.
- Able to apply the laws of Thermodynamics I and II on a set of volumes and a set of masses to solve the problems of temodynamics.
- Able to understand, analyze and solve problems of steam power system.

MAIN SUBJECT

- Basic definitions and concepts of thermodynamics
- System dimensions & units
- The nature and state of a single simple compressible substance and ideal gas,
- The Law of Thermodynamics I, and energy analysis on the set and volume adjusted masses,
- Law of Thermodynamics II, analysis of entropy balance

- Analysis of engineering systems and steam power systems.

PREREQUISITES

Fundamental Physics I & II

REFERENCE

1. Moran J. Michael & Howard N. Saphiro, “Fundamental of Engineering Thermodynamics”, Sixth Edition, John Wiley and Sons Inc., New York, 2000.
2. Yunus A. Cengel & Michael E. Boles, “Thermodynamics: An engineering approach”, Fifth Edition, Mc-Graw Hill, 2004.
3. Reynold Perkins, “Engineering Thermodynamics”, Edisi ketiga, Airlangga, Jakarta, 1994.
4. J. P. Holman, “Thermodynamics”, Mc-Graw Hill, 2004.

SYLLABUS CURRICULUM

COURSE	**Course Name : BASIC FLUID MECHANICS I**	
	Course Code	**:** TM184307
	Credit	**:** 3 sks
	Semester	**:** III

COURSE DESCRIPTION

Application of fluid mechanics is very often we encounter in everyday life. Various natural phenomena are related to fluid mechanics, where their properties and characteristics depend on the properties of fluid flow. Given the basic concept and proper engineering, we can utilize fluid flow to produce the desired force or power, such as wing airfoil and pump or compressor.

This course discusses basic concepts of fluid mechanics, among others fluid types and classifications, the scope of fluid mechanics, fluid statics, and approaches by developing mathematical modeling in integral form for regulated volumes, and the analysis of dimensions, likenesses, and study model. With the learning in the classroom and practicum, students get the opportunity to apply the theory obtained directly in the laboratory.

With this course, students are expected to be able to understand the basic concepts of fluid mechanics and be able to analyze and apply the basic equations of fluid mechanics, which will then be used as a basis for studying the Basic Mechanics course of Fluid II.

LEARNING OUTCOMES

LO6	Understand the engineering principles in mechanical system to identify, formulate and solve the problem of mechanical engineering.
LO9	Able to find the source of engineering problems in mechanical system through research that includes identification, formulation, analysis, data interpretation based on engineering principles.
LO10	Able to formulate the solution of engineering problem in mechanical system by considering economy, safety, environment and energy conservation.

COURSE LEARNING OUTCOMES

- Able to understand the basic concepts of fluid mechanics, flow classification, velocity field and shear stress.
- Ability to reason and analyze pressure and force variations within the static fluid, and analysis of dimensionless numbers and model studies.
- Able to apply the basic equations of fluid mechanics with a volume analysis method set.

MAIN SUBJECT

- Concepts about fluids, systems and volumes arranged, analysis of differential and integral, Euler and Lagrange descriptions
- System dimensions and units
- Basic concepts of fluid mechanics (Newtonian and Non-Newtonian fluids, surface tension, fluid flow classification)
- Statics fluid
- Basic equations in integral form for set volume
- Introduction to dimensional analysis and likeness

PREREQUISITES

Fundamental Physics I & II

REFERENCE

1. Robert W. Fox, Alan T. McDonald, and P. J. Pritchard, “Introduction to Fluid Mechanics", Seventh Edition, John Wiley & Sons Inc., New York, 2010.
2. Bruce R. Munson, Donald F. Young, and Theodore H. Okiishi, “Fundamentals of Fluid Mechanics”, Fourth edition, John Wiley & Sons Inc., New York, 2002.
3. Frank M. White, “Fluid Mechanics”, Seventh edition, McGraw-Hill, 2009.
4. Robert L. Mott, “Applied Fluid Mechanics”, Sixth edition, Prentice Hall, 2005.

SYLLABUS CURRICULUM

COURSE	**Course Name : KINEMATICS & DYNAMICS**
	Course Code : TM184309
	Credit : 4 sks
	Semester : III

COURSE DESCRIPTION

LEARNING OUTCOMES

LO6	Understand the engineering principles in mechanical system to identify, formulate and solve the problem of mechanical engineering.
LO9	Able to find the source of engineering problems in mechanical system through research that includes identification, formulation, analysis, data interpretation based on engineering principles.
LO10	Able to formulate the solution of engineering problem in mechanical system by considering economy, safety, environment and energy conservation.

COURSE LEARNING OUTCOMES

Students can develop a mathematical model from dynamics problems [C4, A3, P3] comprising the principles of work and energy, impulse and momentum, forces, and the relationship between velocity, displacement and time, construct [C5, A4, P4] free body diagrams from particle- and rigid body-equilibriums problems, and apply mechanical concepts to analyze and solve [C5, A4, P4] practical problems such as balancing, flywheel, gyroscope, and load/moment acting on a mechanism.

MAIN SUBJECT

The focus of this course are as follows:
- Equation of motion for a system of particles and rigid body
- The principles of work and energy
- The principles of impulse and momentum
- The principles of virtual work
- Practical problems: balancing, flywheel, gyroscope

  Mechanism of forces

PREREQUISITES

Kinematics of Mechanisms

REFERENCE

1. R. C. Hibbeler, "Engineering Mechanics: Dynamics", 13th Edition, Prentice Hall Inc. 1997.

2. J. L. Meriam, L. G. Kraige, "Engineering Mechanics, Dynamics", 2nd Edition, John Wiley and Sons, Inc. 1987.
3. Ferdinand p. Beer, E. Russell Johnston Jr. "Vector Mechanics for Engineers, Dynamics", 9th Edition, McGraw-Hill, 2010.

SYLLABUS CURRICULUM

COURSE	**Course Name : ELEMENT OF MACHINE I**
	Course Code : TM184414
	Credit : 3 sks
	Semester : IV

COURSE DESCRIPTION

In this course students will learn to understand the concepts and stages in the design of machine elements ranging from ideas to become products. After that the students are taught how to procedure in designing the machine element which includes the connection of rivet, weld, bolt and designing the shaft with pegs and clutch. In addition, the students also learned to analyze the material strength of various engine elements that have been designed. To know the depth of understanding of the concept of design and the strength of machine elements, students will present examples of cases of failure due to improper design.

LEARNING OUTCOMES

LO6	Understand the engineering principles in mechanical system to identify, formulate and solve the problem of mechanical engineering.
LO9	Able to find the source of engineering problems in mechanical system through research that includes identification, formulation, analysis, data interpretation based on engineering principles.
LO10	Able to formulate the solution of engineering problem in mechanical system by considering economy, safety, environment and energy conservation.

COURSE LEARNING OUTCOMES

Students are able to understand well design and engineering concept, analyze joint elements, shaft and its components as well as the failure probability due to static-dynamic load, design joint elements, shaft and its components as well as the failure probability due to static-dynamic load applied, and understand the characteristics of various types of spring, either individually or together in a group.

MAIN SUBJECT

The focus of this course are as follows:

- Design and engineering concept
- Dynamic stress-strain analysis
- Theorem of static – dynamic load failure
- Joint elements analysis: rivet, weld, bolt, and nut
- Shaft and its components analysis
- Characteristics of key and spring

PREREQUISITES
Material engineering and science, and mechanical of material strength
REFERENCE
1. Shigley, Joseph E., Mechanical Engineering Design, 10th Edition, Mc Graw Hill 2014

SYLLABUS CURRICULUM

COURSE	**Course Name : Mechanical of vibration**
	Course Code : TM184416
	Credit : 3 sks
	Semester : IV

COURSE DESCRIPTION

In this course, students will learn about mechanical vibration in 1 DoF and 2 DoF systems. Students will learn the basic concepts of vibration, mathematical modeling of vibration systems, formulate equations of motion, solve equations of motion to analyze vibration system response. Various mechanical vibration conditions are discussed in this course, among others, the response of the vibration of the system is not muffled and damped in the free condition of excitation or by force with various excitation. The vibration practice on the rotating shaft is also provided as a material support. The goal is that students have the ability and experience to model and analyze mechanical vibration problems especially in the field of mechanical engineering, as well as learn to think critically about utilization in various other fields so as to provide the right decision.

LEARNING OUTCOMES

LO6	Understand the engineering principles in mechanical system to identify, formulate and solve the problem of mechanical engineering.
LO9	Able to find the source of engineering problems in mechanical system through research that includes identification, formulation, analysis, data interpretation based on engineering principles.
LO10	Able to formulate the solution of engineering problem in mechanical system by considering economy, safety, environment and energy conservation.

COURSE LEARNING OUTCOMES

Students are able to analyze mechanical vibration on 1 dof and 2 dof system. Student able to explain basic concept of free body diagram and vibration mathematice model system, formulate movement equation and analyze vibration respond from undamped and damped in free and forced excitation with various excitation.

MAIN SUBJECT

The focus of this course are as follows:
- basic concept of mechanical,
- Degree of freedom meaning,
- movement equation,
- langrange equation,
- free undamped vibration respond,

- free damped vibration responds,
- forced vibration,
- base motion, transmissibility,
- harmonic excitation, impulse, periodic excitation.

PREREQUISITES

Kinematics of mechanism
Dynamics

REFERENCE

1. Rao, Singiresu S., “Mechanical Vibrations”, 5th Edition, Prentice Hall, 2013.
2. Kelly, S. Graham, “Mechanical Vibrations: Theory and Applications”, SI Edition, Cengage Learning, 2011.
3. Timoshenko, S. , "Vibration Problems in Engineering", Fifth Edition, John Wiley & Sons, Inc, 1990
4. Leonard Meirovitch, "Elements Of Vibration Analysis", International Edition, McGraw-Hill, 1986
5. Inman, D. J. “Engineering Vibration”, 3rd Edition, Pearson Prentice Hall, 2008.

SYLLABUS CURRICULUM

COURSE	**Course Name : Manufacturing Process 1**
	Course Code : TM184518
	Credit : 3 sks
	Semester : V

COURSE DESCRIPTION

This course discusses the basic concepts of conventional manufacturing processes and their classification. In this course is also discussed about the determination and selection of product manufacturing process parameters commonly used in the world of manufacturing industry, so that students can analyze and design the product manufacturing process

LEARNING OUTCOMES

LO6	Understand the engineering principles in mechanical system to identify, formulate and solve the problem of mechanical engineering.
LO9	Able to find the source of engineering problems in mechanical system through research that includes identification, formulation, analysis, data interpretation based on engineering principles.
LO10	Able to formulate the solution of engineering problem in mechanical system by considering economy, safety, environment and energy conservation.

COURSE LEARNING OUTCOMES

Students are able to understand the processes of making common products used in manufacturing industry, determine and select parameters of manufacturing process to analyse and design the product creation process, laboratory experiments and analyze the result, and have the ability of giving a question, opinion, and the answer, also good teamwork.

MAIN SUBJECT

The focus of this course are as follows:
- Conventional machining processes consist of lathe, drill, frais, and grinding.
- Metal forming process consist of rolling, forging, extrusion, drawing, plate forming and powder metallurgy

PREREQUISITES

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REFERENCE

1. Kalpakjian, Serope and Schmid, Steven R., Manufacturing Processes for Engineering Materials, 5th Edition, Prentice Hall, 2007
2. Schey, John A., Introduction to Manufacturing Processes, 3rd Edition, Mc Graw-Hill, 1999
3. Kalpakjian, Serope and Schmid, Steven R., Manufacturing Engineering & Technology, 7th Edition, Prentice Hall, 2013
4. De Garmo, Paul E., Material and Processes in Manufacturing, 7th Edition, Mc Millan Publishing Co, New York, 1988

SYLLABUS CURRICULUM

COURSE	**Course Name : ELEMENT OF MACHINE II**
	Course Code : TM184522
	Credit : 3 sks
	Semester : 5

COURSE DESCRIPTION

In this course the student will how the procedure in designing various kinds of power generation with revolving round which includes spur gear, helical gear, worm gear, and bevel gera. In addition, the students also studied flexible power transfer design procedures which included belt, chain, and rope. After that the students are taught how to understand the characteristics of lubricants and lubrication system, choose the appropriate type of bearing, and analyze the material strength of the selected power transfer and bearings. To know the depth of understanding of the concept of design and the power of machine elements, students will present the examples of design cases and failures that occur due to improper design procedures.

LEARNING OUTCOMES

LO6	Understand the engineering principles in mechanical system to identify, formulate and solve the problem of mechanical engineering.
LO9	Able to find the source of engineering problems in mechanical system through research that includes identification, formulation, analysis, data interpretation based on engineering principles.
LO10	Able to formulate the solution of engineering problem in mechanical system by considering economy, safety, environment and energy conservation.

COURSE LEARNING OUTCOMES

Students are able to analyze various types of gear transmission system and flexible transmission system, able to design transmission system based on its velocity ratio and its material strength, as well as determine appropriate bearing type, and able to understand the characteristics of clutch, brake, continuous variable transmission, lubricants and lubrication system, either individually or together in a group.

MAIN SUBJECT

The focus of this course are as follows:
- The characteristics of bearing, clutch, and brake
- The movement and strength of gears (spur, helical, worm, and bevel gear)
- The movement and strength of flexible power transfer (belt, chain, and rope)
- The characteristics of Continuous Variable Transmission (CVT)
- The design of machine elements lubrication

PREREQUISITES
Elements of Machine I
REFERENCE
1. Shigley, Joseph E., Mechanical Engineering Design, 10th Edition, Mc Graw Hill 2014

SYLLABUS CURRICULUM

COURSE	**Course Name : Manufacturing Process II**
	Course Code : TM184623
	Credit : 3 sks
	Semester : VI

COURSE DESCRIPTION

This course discusses the basic concepts of non-conventional manufacturing processes and their classification. In this course is also discussed about the determination and selection of product manufacturing process parameters commonly used in the world of manufacturing industry, so that students can analyze and design the process of making products.

LEARNING OUTCOMES

LO6	Understand the engineering principles in mechanical system to identify, formulate and solve the problem of mechanical engineering.
LO9	Able to find the source of engineering problems in mechanical system through research that includes identification, formulation, analysis, data interpretation based on engineering principles.
LO10	Able to formulate the solution of engineering problem in mechanical system by considering economy, safety, environment and energy conservation.

COURSE LEARNING OUTCOMES

Students are able to understand the processes of making common products used in manufacturing industry, determine and select parameters of manufacturing process to analyse and design the product creation process, laboratory experiments and analyze the result, and have the ability of giving a question, opinion, and the answer, also good teamwork.

MAIN SUBJECT

The focus of this course are as follows:

- Non-conventional machining processes: abrasive process and water jet machining (AJM and WJM), electric discharge machining (EDM), electrochemical machining (ECM), electrochemical grinding (ECG), chemical machining (CHM) and rapid prototyping.
- Welding processes: shield metal arc welding (SMAW), acetylene gas welding (AGW), resistance welding (RW), brazing and soldering (B&S), tungsten inert gas (TIG), submerge arc welding (SAW), and plasma arc welding (PAW).
- Polymers and manufacturing process: extruction, injection and blow molding.
- Casting processes: sand casting, centrifugal casting, die casting, and continuous casting.

PREREQUISITES
Manufacturing Process I

REFERENCE
1. Kalpakjian, Serope and Schmid, Steven R., Manufacturing Processes for Engineering Materials, 5th Edition, Prentice Hall, 2007 2. Pandey, P. C, Modern Machining Processes, Tata McGraw-Hill Publishing Company Limited, New Delhi, 1980. 3. Schey, John A., Introduction to Manufacturing Processes, 3rd Edition, Mc Graw-Hill, 1999 4. Groover, Mikell P, Fundamental of Modern Manufacturing, 4th Edition, John Wiley & Sons, Inc, 2010 5. McGeough, J.A., Advanced Methods of Machining, Chapman and Hall, 1988 6. Kalpakjian, Serope and Schmid, Steven R., Manufacturing Engineering & Technology, 7th Edition, Prentice Hall, 2013 7. De Garmo, Paul E., Material and Processes in Manufacturing, 7th Edition, Mc Millan Publishing Co, New York, 1988

SYLLABUS CURRICULUM

COURSE	**Course Name : Maintenance Engineering and Management**
	Course Code : TM184728
	Credit : 3 sks
	Semester : VII

COURSE DESCRIPTION

Equipment / machinery requires proper maintenance to maintain performance and avoid possible damage. The course of Engineering & Maintenance Management discusses the principles of maintenance techniques, methods and measuring tools used in the treatment of various equipment / machines. Learning includes lectures in the classroom and practicum.

With this course, students are expected to be able to use measuring instruments in condition monitoring and able to translate the measurement results to diagnose the damage of engine components. It is also capable of applying various methods in maintenance techniques to evaluate the reability, availability and diagnosis of equipment / machine damage.

LEARNING OUTCOMES

LO7	Understand and follow the most updated technology and the future of mechanical system, as well as its impacts to the economy, social and environment
LO9	Able to find the source of engineering problems in mechanical system through research that includes identification, formulation, analysis, data interpretation based on engineering principles.
LO10	Able to formulate the solution of engineering problem in mechanical system by considering economy, safety, environment and energy conservation.

COURSE LEARNING OUTCOMES

Students are able to explain principle and maintenance function (PM, PdM, RM) and classify equipments based on methods/ type of maintenance. Students are able to explain roles of measuring equipments used in condition monitoring (vibration, lubricant analysis, NDT) and possessing basic competence in operating measuring equipment and interpreting measurement result. Students are able to calculate practical and evaluate MBTF, reliability & availability of equipments and components. Students are able to explain and implement RCM method, TPM, RBI in maintenance. Students are able to explain and evaluate failure of equipment based on RCFA & FMEA, performance of maintenance based on KPI.

MAIN SUBJECT

The focus of this course are as follows:

- Purpose of Preventive, Predictive, Corrective Maintenance (PM, PdM, CM) and free maintenance
- Planning and scheduling.
- Measurement equipment in condition monitoring (vibration, lubricant analysis, NDT. Measurement principle and result interpretation.
- MBTF principles, reliability, availability and maintainability of equipment and component.
- Methods and implementation of RCM, TPM, RBI in industrial
- Equipment failure evaluation and components (RCFA & FMEA) of maintenance function equipment based on KPI and identify potential problem.
- Vibration diagnosis such as unbalance, misallignment, bearing fault diagnosis, gearmess frequency, loosen component, crack shaft.
- Alignment and balancing method.
- Cathodic protection for stationary equipment.

PREREQUISITES

- Energy Conversion Machinery
- Mechanical Vibration

REFERENCE

1. Sullivan, GP., 2004, Operations & Maintenance Best Practices, Department of Energy (DOE).
2. Scheffer, C., 2004, Practical Machinery Vibration Analysis & Predictive Maintenance, Burlington, Elsevier.
3. Smith, AM., 2004, RCM: Gateway to World Class Maintenance, Elsevier.
4. --, 2000, RCM Guide for Facilities and Collateral Equipment, Washington, NASA.
5. Benbow, DW., 2009, The Certified Reliability Engineer Handbook, ASQ.
6. Bloch, H P., 2006, A practical Guide to Compressor Tech., John Wiley & Sons.
7. Hyatt, N., 2003, Guidelines for Process Hazards Analysis, Hazards Identification & Risk Analysis, CRC Press.
8. Karrassik, Igor J., 2006, Pump Handbook, McGraw-Hill.
9. Mitchell, JS., 1993, Intro. to Machinery Analysis and Monitoring, Pennwell book.
10. Newbold, D., 2005, A Practical Approach to Motor Vehicle Eng. and Mtce, Elsevier.

SYLLABUS CURRICULUM

COURSE	**Course Name : Materials Handling**	
	Course Code	**:** TM184843
	Credit	**:** 3 sks
	Semester	**:** Optional

COURSE DESCRIPTION

In this course gives the ability to select the material transferers in accordance with the condition and situation of the location and the ability of the design of the material transfer plane.

LEARNING OUTCOMES

LO8	Able to implement mathematics, science and engineering principles to solve engineering problems in mechanical systems.
LO9	Able to find the source of engineering problems in mechanical system through research that includes identification, formulation, analysis, data interpretation based on engineering principles.
LO10	Able to formulate the solution of engineering problem in mechanical system by considering economy, safety, environment and energy conservation.
LO11	Able to design mechanical system and the necessary components through analytical approach based on science and technology by considering technical standard and reliability.

COURSE LEARNING OUTCOMES

Students can define various kinds of materials and their properties, investigate the most suitable equipment based on the properties and movement of materials handled, analyze the power requirement of material handling equipment, and design a system of material handling based on required output capacity.

MAIN SUBJECT

The focus of this course are as follows:
- Principles of material handling
- Material classification and properties
- Material-handling equipment for unit material and bulk handling, pulley system, hoisting gear, and lifting vehicle.
- Power and capacity analysis

PREREQUISITES

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REFERENCE
1. Raymond A. Kulwiec, “Material Handling Handbook”, 2nd Edition, John Wiley and Sons, ASME, USA.
2. Siddhartha Ray, “Introduction to Materials Handling”, New Age International Publisher, New Delhi.

SYLLABUS CURRICULUM

COURSE	**Course Name : Vehicle Dynamics and Control**
	Course Code : TM184750
	Credit : 3 sks
	Semester : Optional

COURSE DESCRIPTION

In this course students will learn the basic dynamics of vehicle and control. Students will learn to formulate vehicle dynamics models in lateral, longitudinal and vertical directions (driving quality). Students will get an overview of the vehicle's active safety system that includes basic concepts and terminology, State-of-the art active safety system development and basic principles of: yaw control, roller stability control, ABS system, traction control, semi suspension system -active and active as well as dynamic stability control system.

LEARNING OUTCOMES

LO8	Able to implement mathematics, science and engineering principles to solve engineering problems in mechanical systems.
LO9	Able to find the source of engineering problems in mechanical system through research that includes identification, formulation, analysis, data interpretation based on engineering principles.
LO10	Able to formulate the solution of engineering problem in mechanical system by considering economy, safety, environment and energy conservation.
LO11	Able to design mechanical system and the necessary components through analytical approach based on science and technology by considering technical standard and reliability.

COURSE LEARNING OUTCOMES

Students are able to formulate accurate simple dynamic model for vehicle dynamics, students are able to apply feedback control principles and analyze vehicle dynamics control system through simulation, students are able to utilize Computer-Aided Control System Design and Analysis Tool to analyze and design vehicle dynamics control system, students are able to possessing basic understanding in modern active safety system in vehicle.

MAIN SUBJECT

The focus of this course are as follows:
- Vehicle dynamics in lateral, longitudinal and vertical direction
- Vehicle dynamics control in lateral direction (yaw and roll stability control)
- Vehicle dynamics control in longitudinal direction (cruise control, traction control, ABS)
- Vehicle dynamics control in vertical direction (semi-active and active suspension)

PREREQUISITES

- Engineering Dynamics
- Mechanical Vibration
- Dynamic System and Control

REFERENCE

1. W. Chen, H. Xiao, Q. Wang, L. Zhao and M. Zhu, Integrated Vehicle Dynamics and Control, John Wiley & Sons, 2016
2. J. P. Pauwelussen, Essential of Vehicle Dynamics, Elsevier Ltd. 2015
3. R. Rajamani, Vehicle Dynamics and Control, 2nd Edition, Springer, 2012
4. M. Meywerk, Vehicle Dynamics, John Wiley & Sons, 2015

SYLLABUS CURRICULUM

COURSE	**Course Name : Bioenergy**
	Course Code : TM184862
	Credit : 3 sks
	Semester : choosed

COURSE DESCRIPTION

Provide an overview and understanding to students about the potential and assessment of bioenergy sources, bioenergy engineering technology and application of bioenergy products.
Provides an overview of the opportunities and challenges of bioenergy engineering development in terms of energy availability and the influence of bioenergy on the environment.

LEARNING OUTCOMES

LO8	Able to implement mathematics, science and engineering principles to solve engineering problems in mechanical systems.
LO9	Able to find the source of engineering problems in mechanical system through research that includes identification, formulation, analysis, data interpretation based on engineering principles.
LO10	Able to formulate the solution of engineering problem in mechanical system by considering economy, safety, environment and energy conservation.
LO11	Able to design mechanical system and the necessary components through analytical approach based on science and technology by considering technical standard and reliability.

COURSE LEARNING OUTCOMES

Student can understand well numerical basic concept, alghorithm and error, able to understand well various kinds of numerical methods, be able to explain the character various kinds of numerical methods, and skilled applying the right numerical method solving engineering problems, both individually and group work.

MAIN SUBJECT

The focus of this course are as follows:
- Basics concept of numerical and error.
- Looking for the root equation with open and close method.
- System of linear algebraic equations.
- Curve fitting.
- Numerical integration.
- Ordinal and partial differential equation.

PREREQUISITES
-
REFERENCE
1. Steven C. Chapra dan Raymond P. Canale, 'Numerical Methods for Engineers", 6th Ed., McGraw-Hill, Singapore, 2010

SYLLABUS CURRICULUM

COURSE	**Course Name : Design And Product Development**
	Course Code : TM184770
	Credit : 3 sks
	Semester : Optional

COURSE DESCRIPTION

Provides knowledge of methods and ways of designing and developing products from aspects of quality, manufacture, assembly, and production costs, as well as ergonomic aspects.

LEARNING OUTCOMES

LO8	Able to implement mathematics, science and engineering principles to solve engineering problems in mechanical systems.
LO9	Able to find the source of engineering problems in mechanical system through research that includes identification, formulation, analysis, data interpretation based on engineering principles.
LO10	Able to formulate the solution of engineering problem in mechanical system by considering economy, safety, environment and energy conservation.
LO11	Able to design mechanical system and the necessary components through analytical approach based on science and technology by considering technical standard and reliability.

COURSE LEARNING OUTCOMES

The students are able to understand the design process and able to develop the product, from the aspect of design, ergonomics, manufacture, assembly, and arrange the product design development and analyze the forces and stresses that occur at the time the product is used, plan the manufacture process and the engine is used, and analyze product assembly method.

MAIN SUBJECT

The focus of this course are as follows:
- Design process : cognitive, persuasive, and deductive design process
- Product function : structure function, main function, additional function for a product
- Concept development : list of needs, making process and concept selection
- Component design : embodiment, economical component design, manufacture design and assembly
- Product ergonomic : RULA method, the benefit and the application in design and product development

- Product development : development concept of product function, quality function deployment

PREREQUISITES

-

REFERENCE

1. Batan, I Made Londen, Desain Produk Ediisi 1, Guna Widya, 2012, Surabaya
2. Bralla, James G., Design for Manufacturability Handbook, Mc Graw-Hill, 1999.
3. Mc-Atamney, Lynn and Corlett, E Nigel; RULA: a survey method for investigation of work-related upper limb disorders, Institute for Occupational Ergonomics, University of Nothingham.
4. Otto, Kevin N. and Wood, Kristin L., Product Design – Techniques in Reverse Engineering and New Product Development, Printice Hall, 2000.
5. Urlich, Karl T.; Eppinger, Steven D., Product Design and Development. Mc Graw-Hill, Inc., 2000.
6. Boothroyd, Geoffrey; Peter, Dewhurst and Winston, Knight, Product Design For Manufacture and Assembly, 2nd ed, 2002.

SYLLABUS CURRICULUM

COURSE	**Course Name : ROBOT MECHANISM**
	Course Code : TM184776
	Credit : 3 sks
	Semester : 7 or 8

COURSE DESCRIPTION

LEARNING OUTCOMES

LO8	Able to implement mathematics, science and engineering principles to solve engineering problems in mechanical systems.
LO9	Able to find the source of engineering problems in mechanical system through research that includes identification, formulation, analysis, data interpretation based on engineering principles.
LO10	Able to formulate the solution of engineering problem in mechanical system by considering economy, safety, environment and energy conservation.
LO11	Able to design mechanical system and the necessary components through analytical approach based on science and technology by considering technical standard and reliability.

COURSE LEARNING OUTCOMES

Student be able to show position and serial and parallel robot transfer, show the relation between Jacobian matrix with singularity of a robotic configuration, and design a parallel robotic structure that satisfies required degree of freedom.

MAIN SUBJECT

The focus of this course are as follows:
- Robotic type and its development : industrial robot, humanoid robot, mobile robot
- Analysis of position and transfer : degree of freedom, coordinate transformation, position and orientation
- Jacobian Matrix and singularity : singularity types based by Jacobian Matrix
- Robotic design : Screw theory, constraint types in various joint.
- Computation : computational analysis of position calculation and transfer

PREREQUISITES

-

REFERENCE

1. Lung-Wen Tsai. Robot Analysis: The Mechanics of Serial and Parallel Manipulators. John Wiley and Sons, Inc, 1999.

2. Xianwen Kong and Clément Gosselin. Type Synthesis of Parallel Mechanisms. Springer Verlag Berli Heidelberg, Vol. 33. 2007.
3. Jorge Angeles. Fundamentals of Robotic Mechanical Systems: Theory, Methods and Algorithm. Springer Verlag New York, 2nd edition. 2003.

SYLLABUS CURRICULUM

COURSE	**Course Name : Incompressible Fluid Machinery**
	Course Code : TM 184778
	Credit : 3 sks
	Semester : 7

COURSE DESCRIPTION

This course contains principles on pipeline system analysis, code standardization, strength analysis and pipeline system design, and transient pipeline network analysis.

LEARNING OUTCOMES

LO8	Able to implement mathematics, science and engineering principles to solve engineering problems in mechanical systems.
LO9	Able to find the source of engineering problems in mechanical system through research that includes identification, formulation, analysis, data interpretation based on engineering principles.
LO10	Able to formulate the solution of engineering problem in mechanical system by considering economy, safety, environment and energy conservation.
LO11	Able to design mechanical system and the necessary components through analytical approach based on science and technology by considering technical standard and reliability.

COURSE LEARNING OUTCOMES

Student is able to explain classification, components, mechanism and application of incompressible fluid machinery on the field/industry. Student is able to distinguish different characteristics and make the selection of pump & turbines in accordance with optimum efficiency. Student is able to perform basic designing of incompressible fluid machinery. Student is able to measure & calculate the performance of incompressible fluid machinery (Head, capacity, power and efficiency). Student is able to explain about operation, maintenance basics & trouble shooting of incompressible fluid machinery.

MAIN SUBJECT

The focus of this course are as follows:

- Introduction : Classification, components, mechanism and application of incompressible fluida machinery on industry
- Review of fluid mechanics : Energy equation, Euler equation in fluid machinery ; Performance calculation : Effective head pump, capacity, power and efficiency produced by pump; specific speed.

- Positive displacement pump : Pump classification (screw, vane, gear, reciprocating) and mechanism. The characteristics work, main and second component.
- Dynamics pump : Classification pump (axial & sentrifugal) and mechanism, specific speed, pump selection.
- Basics of pump impeller designing : Speed triangle, Head produced by pump, the effect of angle to the head and curve head-capacity.
- Pump characteristic : main characteristic, work characteristic, universal characteristic, combined series & parallel, complex circuit.
- Pump operation : Balanced axial force, Unstable operation(surging), basics maintenance of centrifugal pump.
- Water turbine : Classification (impuls & reaction, pelton, francis, kaplan), components, mechanism and application of turbine.
- Basics designing of water turbine impeller : speed triangle analysis.
  Experiment of pump and water turbine.

PREREQUISITES

- Thermodynamics
- Fluid Mechanics

REFERENCE

1. M. Khetagurov, 1954 ,"*Marine Auxiliary Machinery and Systems*", Peace Publishers Moscow,.
2. Robert, W Fox & Alan T. McDonald (2010),"*Introduction to Fluid Mechanics* 7th, John Wiley & Sons, Inc, Asia
3. Kothandaraman C.P, 2007, " Fluid Mechanics and Machinery", 2th edition, New Age International Publisher, New Delhi
4. Igor Karassik,"*Pump Handbook"*. 3th, McGraw Hill, New York, 2001.
5. Lazarkiewicz, Stephen and Troskolanski, A.T., "*Impeller Pump"*. New York, Pergamon Press, 1965.
6. Nourbakhsh, Ahmad, Turbo pumps and Pumping Systems, Springer-Verlag, 2008.
7. Wagner, H.J, Introduction to HydroEnergy Systems,Springer-Verlag, 2011

SYLLABUS CURRICULUM

COURSE	**Course Name : Polymer and Composite**
	Course Code : TM184885
	Credit : 3 sks
	Semester : Optional

COURSE DESCRIPTION

This course provides material on the relationship between the structure and the mechanical properties of the composite polymer material, the method of analyzing the mechanical properties of the composite polymer material as well as the production technique. By following this course, students are expected to have the ability to choose and fabricate composite materials for specific purposes in an industry.

LEARNING OUTCOMES

LO8	Able to implement mathematics, science and engineering principles to solve engineering problems in mechanical systems.
LO9	Able to find the source of engineering problems in mechanical system through research that includes identification, formulation, analysis, data interpretation based on engineering principles.
LO10	Able to formulate the solution of engineering problem in mechanical system by considering economy, safety, environment and energy conservation.
LO11	Able to design mechanical system and the necessary components through analytical approach based on science and technology by considering technical standard and reliability.

COURSE LEARNING OUTCOMES

Student be able to analyze relation between structure and mechanics characteristics of polymer and composite material, analyze the production technique of polymer and composite material, understanding and using method of analyzing mechanics characteristics of composite material, and be able to choose and engineer laminate shaped of composite material.

MAIN SUBJECT

The focus of this course are as follows:
- mechanics characteristic of fiber material and compiler matrix of composite material,
- production technique of composite material,
- analyze the micromechanics and macromechanics of composite material.
- anisotropic material concept,
- laminate shaped of composite material,

- micromechanics and macromechanics constant elastic analysis,
- failure analysis of composite material.

PREREQUISITES

Metallurgy

REFERENCE

1. D.Hull, An Introduction to Composite Materials, 1st Ed., Cambridge University Press, 1981
2. N.G. McCrum, C.P. Buckley and C.B. Bucknall, Principles of Polymer Engineering, 1st Ed., Oxford University Press, 1988
3. R.F. Gibson, Principles of Composite Material Mechanics, McGraw-Hill, Inc., 1994
4. G.Z. Voiadjis, P.I. Kattan, Mechanics of Composite Materials with MATLAB, Springer, 2005
5. S.K. Mazumdar, Composite Manufacturing, CRC Press, 2002
6. P.K. Mallick, Fibre Reinforced Composites: Materials, Manufacturing and Design , CRC Press, 2007

SYLLABUS CURRICULUM

COURSE	**Course Name : FRACTURE MECHANICS**
	Course Code : TM184888
	Credit : 3 sks
	Semester : Optional

COURSE DESCRIPTION

Fracture Mechanics course provides understanding and understanding of the mechanisms of fractures on brittle and ductile materials and their relation to the stress / strain distribution around the defective part of the static load, and provides understanding and understanding of the propagation process cracks due to dynamic loads, and can apply the concept of fault mechanics in the planning and analysis of construction failures.

LEARNING OUTCOMES

LO8	Able to implement mathematics, science and engineering principles to solve engineering problems in mechanical systems.
LO9	Able to find the source of engineering problems in mechanical system through research that includes identification, formulation, analysis, data interpretation based on engineering principles.
LO10	Able to formulate the solution of engineering problem in mechanical system by considering economy, safety, environment and energy conservation.
LO11	Able to design mechanical system and the necessary components through analytical approach based on science and technology by considering technical standard and reliability.

COURSE LEARNING OUTCOMES

Students will be able to understand the mechanism of fracture in brittle and ductile materials. Students are also expected to relate mechanism of failure with stress-strain distribution around the defective parts due to static load. Students are expected to probide insight about crack propagation due to dynamic load and apply the concept of fracture mechanics in the construction planning and its failure analysis.

MAIN SUBJECT

Main topics in this course are :

- Fundamentals of Linear-Elastic Fracture, Elastic-Plastic Fracture, Dynamic Fracture, and Time-Dependent Fracture
- Fracture Mechanism in Metal and Non-Metal and its application in Fracture Testing
- Fatigue Crack Propagation
- Cracking in Metals

- Computational Fracture Mechanics

And the sub-topics are :

- Tensile response of materials
- Theoritical cohesive strength
- Stress concentration factor
- Crack theory in brittle and ductile material
- Analysis of stress at the crack tip; Stress intensity factor (K) and Effective stress intensity factor (Kef)
- Plastic area prediction in crack tip
- Fracture toughness (KC)
- Fatigue crack propagation, the mechanism of initial cracks, and crack propagation models.
- Environmental influence on material fatigue
- Crack stress corossion

PREREQUISITES

- Metalurgy
- Mechanics of Material

REFERENCE

1. T.L. Anderson, Ph.D., Fracture Mechanics-Fundamentals and Applications, Third Edition, CRC Press LLC, Florida, 2005.
2. George E. Dieter, Mechanical Metallurgy, Second Edition, Mc Graw Hill Int. Book Company, Tokyo, 1981.
3. Rischard W. Hertzberg, Deformation and Fracture Mechanics of Engineering Materials, John Wiley & Sons, Inc. New York, 1989.
4. Ralph I. Stephens, Ali Fatemi, Robert R. Stephens, Henry O. Fuchs, Metal Fatigue in Engineering, Second Edition, John Wiley & Sons, Inc. New York, 2001.

SYLLABUS CURRICULUM

COURSE	**Course Name : Operational Research**
	Course Code : TM184889
	Credit : 3 sks
	Semester : Optional

COURSE DESCRIPTION	
LEARNING OUTCOMES	
LO8	Able to implement mathematics, science and engineering principles to solve engineering problems in mechanical systems.
LO9	Able to find the source of engineering problems in mechanical system through research that includes identification, formulation, analysis, data interpretation based on engineering principles.
LO10	Able to formulate the solution of engineering problem in mechanical system by considering economy, safety, environment and energy conservation.
LO11	Able to design mechanical system and the necessary components through analytical approach based on science and technology by considering technical standard and reliability.

COURSE LEARNING OUTCOMES

Students are able to understand quantitative techniques for decision making, identify problematic components in a problem, analyze real world problems and express in mathematical abstraction, solve objective optimization problems under constrains, utilize software for decision making problem solving, model and solve daily real problems examples and making presentation

MAIN SUBJECT

The focus of this course are as follows:
- Decision making theory;
- Problematic elements in problems;
- Linear Programming Model;
- Typical models in Linear Programming;
- Graphical solution;
- Impact analysis in objective function and constrain parameter change;
- Simplex method;
- Software introduction;
- Integer programming;
- Models in integer programming;
- Binary Integer Programming;

- Multiple objectives and goal programming;
- Dynamic programming;
- Project management modeling; CPM-PERT;
- Resource Leveling;
- Queue theory introduction and simulation.

PREREQUISITES

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REFERENCE

1. Wayne Winston: Operations Research
2. Hamdy Taha: Operation Research
3. Ronald Rardin :Optimization in Operations Research
4. Bernard W. Taylor: Introduction to Managemet Science
5. Hillier Lieberman: Operations research