SYLLABUS
CURRICULUM 2018-2023
DEPARTMENT OF OCEAN ENGINEERING

DEPARTMENT OF OCEAN ENGINEERING
FACULTY OF MARINE TECHNOLOGY
INSTITUT TEKNOLOGI SEPULUH NOPEMBER
2018

Table of Contents

Physics 1 - SF18-4102

COURSE	Course Name: **Physics 1**
	Course Code : SF184102
	Credit : 4 sks
	Semester : I

DESCRIPTION of COURSE

Lecture physics the basis of 1 including lecture in the department of maritime ftk-its technique.Lecture this basic teach. Basic such as the scale of physics and factor, kinematics and dynamics particles, work and energy, motion and rotation, and fluid mechanics. Material such matter will be used as associated or base of lecture other marine techniques.

LEARNING OUTCOME

1. Believing in the oneness of God and able to demonstrate religious attitude (S1)
2. Working together, having social sensitivity and caring for community and environment (S6)
3. Trying his/her best to achieve perfect results (S11)
4. Working together to be able to make the most of his/her potential (S12)
5. Mastering the theoretical concepts of natural science and the principle of application of engineering mathematics in general (P1)
6. Mastering the theoretical concepts of engineering sciences, engineering principles, and engineering design required in the field of ocean engineering in depth (P2)
7. Mastering the concept of academic integrity in general, among others, able to understand the meaning and concept of plagiarism specifically, in terms of the type of plagiarism, the consequences of violations and prevention efforts (P8)
8. Competent to apply mathematics, science and engineering principles to create or modify models in the field of ocean engineering (KK1)
9. Competent to solve ocean engineering problems related to coastal structures, ports and offshore structures based on ocean engineering principles, by considering economic, security, public safety and environmental sustainability factors, including the ability to:
    a. identify, formulate, analyze, and finding the problem sources in ocean engineering;
    b. proposing the best solution for solving ocean engineering problems; and
    c. select resources and utilize the most appropriate, effective, and efficient designing and engineering design tools in solving ocean engineering problems (KK3)
10. Being able to apply logical, critical, systematic and innovative thinking in the context of development or implementation of science and technology that concerns and implements the value of humanities in accordance with their area of expertise (KU1)
11. Being able to demonstrate independent performance, quality, and measurable (KU2)
12. 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 (KU5)

COURSE LEARNING OUTCOME

- students can distinguish between magnitudes and (s12 factor , kk1 , kk2)

- students can explain kinematics particles (s11 , kk1 , kk3)
- students can explained and performing calculations the dynamics of particles (s6 , p1 , kk1 , kk5)
- students can explained and performing calculations work and energy (s1 , p1 , kk2)
- students can explained and performing calculations motion rotation (s11 , p2 , kk1, kk5)
- students can explained and performing calculations vibration (s6 , p2 , kk1)
- students can explained and performing calculations fluid mechanics (s6 , p2 , kk1 , kk5)

MAIN SUBJECT

In the eyes of the lecture students will learn pokok-pokok subjects of following:

- magnitudes and vector
- kinematics particles: speed, acceleration, motion straight, motion dish, a circular
- the dynamics of particles: newton laws, style scratch
- work and energy: the concept of work, kinetic energy, potential energy, eternity mechanical energy, momentum and grind
- motion rotation: speed and angular acceleration, the style and moments of inertia, motion rolling
- vibration: motion harmonious simple, combined vibration aligned
- fluid mechanics: hydrostatics, hydrodynamics.

PREREQUISITES

-

REFERENCES

1. Halliday & Resnick; “Fundamental of Physics”. John Wiley and Sons, New York, 1987
2. Alonso & Finn,“Fundamental University Physics”, Addison Wesley Pub Comp Inc,1st.ed, Calf, 1990
3. Tipler, P.A.,(terj. L. Prasetio dan R.W.Adi), “Fisika : untuk Sains dan Teknik, Jilid 1”, Erlangga, Jakarta, 1998
4. Giancoli, DC., (terj, Yuhilza H), ”Fisika, jilid 1”, Erlangga, Jakarta, 2001
5. Tim Dosen, “Diktat Fisika I”, ”Soal-soal Fisika I”, Fisika FMIPA-ITS
6. --, "Petunjuk Praktikum Fisika Dasar", Fisika, MIPA-ITS

Mathematics 1 - KM18-4101

COURSE	Course Name : **Mathematics 1**
	Course Code : KM184101
	Credit : 3 sks
	Semester : 1

DESCRIPTION of COURSE

Engineering mathematics I is the first basic mathematic course in Ocean Engineeering Departement, FTK, ITS. This course is prepared to contain the first part of fundamental of higher mathematics needed to strengthen the other subjects in the department which are mostly described and expressed in mathematical terms.

LEARNING OUTCOME

1. Trying his/her best to achieve perfect results (S 1.11)
2. Mastering the theoretical concepts of natural science and the principle of application of engineering mathematics in general; (P 2.1)
3. Mastering the theoretical concepts of engineering sciences, engineering principles, and engineering design required in the field of ocean engineering in depth (P 2.2)
4. Competent to apply mathematics, science and engineering principles to create or modify models in the field of ocean engineering (KK 3.1)
5. Being able to apply logical, critical, systematic and innovative thinking in the context of development or implementation of science and technology that concerns and implements the value of humanities in accordance with their area of expertise (KU 4.1)
6. Being able to demonstrate independent performance, quality, and measurable; (KU 4.2)

COURSE LEARNING OUTCOME

- Student understand the basic of mathematics
- Student understand and capable to explain mathematics and its applications
- Student capable to analyze and having strong intuition toward higher mathematical expression creatively
- Student capable to explain the applied mathematical modelling in several subjects of ocean engineering and present them

MAIN SUBJECT

Engineering Mathematics 1 consists of:

1. **Numbers and Algebra** comprise: algebra, logarithmic and exponential functions, hyperbolic function, binomial and mcLaurin series, solving multiple equations.
2. **Geometry dan Trigonometry** comprise: trigonometry equations, Cartesian and polar coordinates, circle and its characters, trigonometrt graphics, trigoometry eqation and identity, relation betweem trigonometrt and hiperbolic functions.
3. **Graphics**: function and curves.
4. **Geometry vector**: phasor vector and graphic forms, scalar and vector multiplications.
5. **Complex numbers**: complex number concept, Cartesian and polar forms, d'moivre theorem.
6. **Matrices and determinant:** introduction and basic theory, solution of simultant

equations.

7. **Differensial Calculus:** differential methods and applications, differential of parametric equations, differential of implicit functions, differential of logarithmic, hyperbolic, differential of trigonometric and hyperbolic inverse functions, partial differential, macsimum and minimum values and saddle point.
8. **Integral Calkulus:** standar and application of integral, integral with algebra substitutions, integral with trigonometric and hyperboliv substitutions, integral with partial fraction, reduction formulas, numerical integration.

PREREQUISITES

-

REFERENCES

Main Book :

1. D. Kee, P. N. Kaloni,"Advanced Mathematics for Engineering and science", World Scientific, 2003
2. D. Valberg, E. Purcell,"Calculus", 2000

Supporting books :

1. D. Murray,"Differential and Integral Calculus", 1980
2. E. Landau,"Differential and Integral Calculus", 1980

Islamic Studies - UG18-4901

COURSE	Course Name	: Islamic studies
	Course Code	: UG184901
	Credit	: 2 SKS
	Semester	: I

DESCRIPTION of COURSE

The course of Islamic Education is intended to study of Human and Religion, Islamic principles and it's practice in life, society, nation, and in the work. This course is also intended to encourage students to strengthen their faith and character and to make Islamic teaching as the foundation of thinking and behaving in creating and developing profession with Quran as a way of live.

LEARNING OUTCOME

1. Mastering the scientific field of Social Humanities covering Islamic Religion, for the development of character, soft skills, humanity and religiosity
2. Able to think and be ethical-religious
3. Able to work in teams and have human nature
4. Have a work ethic and professional responsibilities (professional)

COURSE LEARNING OUTCOME

1. Students are able to explain the nature of human beings as religious beings who have strength faith (iman and taqwa), able to practice it with good morals as well as Islamic thinking/behaving in the work according to the field of expertise,
2. Have a religious attitude and innovative skills both on individual performance and teamwork in the profession.
3. Understand the belief and attitude that the Qur'an is the source of modern Science and Technology

MAIN SUBJECT

1. Islamic Religion and its Teachings
2. Human Nature according to Islam
3. The concept of God in Islam
4. Morals in the Islamic Teachings
5. Law and Human Rights in Islam
6. Interreligious harmony
7. Islam and Culture
8. Democracy and Politics in Islam
9. Civil Society and People's Welfare
10. Science in the perspective of Al Quran, with the following themes:
    a. Al Qur'an and Ocean Engineering
    b. Al Qur'an and Naval Architecture and Engineering
    c. Al Qur'an and Oceanography
    d. AL Qur'an and Iron as Structural Materials
    e. Al Qur'an and the Creation of the Universe
    f. Al Qur'an and the Creation of Man

g. Al Qur'an and the Creation of Animlas
h. Al Qur'an and the Creation of the Mountain

11. etc

PREREQUISITES

-

REFERENCES

1. Muhibbin, Zainul, dkk, *Pendidikan Agama Islam Membangun Karakter Madani*,Surabayaa, ITS Press, 2012.
2. Wahyuddin dkk, *Pendidikan Agama Islam untuk Perguruan Tinggi*, Jakarta: Grasindo, 2009.
3. Depag RI, *Materi Instruksional Pendidikan Agama Islam di Perguruan Tinggi Umum*, Jakarta, 2004.
4. Shihab, Muhammad Quraish, *Membumikan al-Qur'an*, Cetakan ke 12, Bandung : Mizan, 1996.
5. Kementrian Agama RI, *Seri Tafsir Ilmy*, Jakarta: Lajnah Pentashihan Mushaf Al Qur'an, 2010
6. An-Najr, Zaglul dan Kahil, Abdul Daim. *Ensiklopedia Mukjizat Ilmiah Al Qur'an dan Hadis*, Jakarta: Lentera Abadi, 2012
7. Djamil, Agus. *Al Quran Menyelami Rahasia Lautan*, Bandung: Mizan, 2012
8. Purwanto, Agus. Nalar Ayat-Ayat Semesta: Menjadikan al Qur'an Sebagai Basis Konstruksi Ilmu Pengetahuan, Bandung: Mizan, 2012.
9. Bagir, H. dan Z. Abidin. "Filsafat Sains Islami: Kenyataan atau Khayalan?" dalam *Filsafat Sain Menurut Al Qur'an*, Bandung: Mizan, 1989.
10. Anshari, F. Rahman, A. Ahmad dan R. Graudy, *Islam dan Peradaban Barat Moderen*, Bandung: Penerbit Risalah Bandung, 1986.

Physics 2 - SF18-4202

COURSE	Course Name : Physics 2
	Course Code : SF184202
	Credit : 3 sks
	Semester : II

DESCRIPTION of COURSE

This Marine Physics course discusses some advanced materials from Basic Physics subjects so that students gain additional knowledge to be able to explain the physical phenomena and use the basic laws of physics in marine engineering. Marine physics includes motion kinematics: one dimensional, two-dimensional, circular and Newton's Law application; Energy; Momentum; Rotation; Static balance and elasticity; Basics of fluid mechanics; as well as oscillation and mechanical wave motion.

LEARNING OUTCOMES

1. Believing in the oneness of God and able to demonstrate religious attitude. (S 1.1)
2. *Working together, having social sensitivity and caring for community and environment* (S 1.6)
3. Trying his/her best to achieve perfect results, and (S 1.11)
4. Working together to be able to make the most of his/her potential (S 1.12)
5. Mastering the theoretical concepts of natural science and the principle of application of engineering mathematics in general (P 2.1)
6. Mastering the theoretical concepts of engineering sciences, engineering principles, and engineering design required in the field of ocean engineering in depth (P2.2)
7. Mastering the concept of academic integrity in general, among others, able to understand the meaning and concept of plagiarism specifically, in terms of the type of plagiarism, the consequences of violations and prevention efforts (P2.8)
8. Competent to apply mathematics, science and engineering principles to create or modify models in the field of ocean engineering (KK 3.1)
9. Competent to follow and understand the latest technological developments in the field of ocean technology in the framework of lifelong learning (KK 3.5)
10. Being able to apply logical, critical, systematic and innovative thinking in the context of development or implementation of science and technology that concerns and implements the value of humanities in accordance with their area of expertise (KU 4.1)
11. Being able to demonstrate independent performance, quality, and measurable (KU 4.2)
12. 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 (KU 4.5)

COURSE LEARNING OUTCOME

- Students can apply various energy methods for movement of objects (S 1.6, S 1.12, P 2.1, KK 3.1)
- Students understand the basic concepts of fluid interactions and structures (S 1.6, P 2.2, KK 3.3)
- Students can solve motion problems with analytical, semi-analytical and other

related methods (S 1.11, P 2.8, KK 3.2)
- Students can understand the random movement and its relation of its fatality impact on the structure (S 1.12, P 2.1, KK 3.1)
- Students can understand the concept of damping and various properties of damping (S 1.6, KK 3.1, KK 3.3)
- Students can understand the basic properties of gas as well as the basic laws of thermodynamics I and II (S 1.11, S 1.12, P 2.2, KK 3.1, KK 3.3)

MAIN SUBJECT

In this course students will study the following subjects:

- Fundamentals of the motion energy method: Rayleigh method, virtual and Lagrange work, linear and nonlinear systems, free response and forced response, time domain respons
- Basic concepts of fluid-structure interaction: Morison's equations, drag force and inertia, floating / droplets equation, diffraction and radiation
- Random Vibration: Gauss distribution, power spectrum, frequency response, fatique: Rayleigh, S-N curve.
- Damping: viscous damping, linear / non-linear damping
- Settlement Method: analytical method: Laplace transform, Duhamel integral, semi analytical method: impulse response method, Euler method, center difference method, Runga-Kutta, Eigenvalues and Eigenvector, Fourier transform
- Thermodynamics: law I thermodynamics, internal energy, specific heat and calorimeter, latent heat, work and energy transfer, isobaric, isovolumic, isothermal, adiabatic processes, heat engines, reversible and irreversible processes, carnot and diesel engines, entropy and alterations, molecules and molar specific heat of the ideal gas, adiabatic process, equipartition energy, Boltzman's law
- Basic Definition of Control System: basic component of system control, open / closed loop control system, feedback and influence to process variable
- Impulse Response: characteristic equation, multivariable system, stability, stability determination method: criterion Routh-Hurwitz, root-locus analysis Artificial Intelligence fuzzy, Neural Network, Genetic Algorithm

PREREQUISITES

Basic physic I

REFERENCES

- Tim Dosen, “Diktat Fisika I”, ”Soal-soal Fisika I”, Fisika FMIPA-ITS
- Tipler, P.A.,(terj. L. PrasetiodanR.W.Adi), “Fisika : untukSainsdanTeknik, Jilid 1”, Erlangga, Jakarta, 1998
- Halliday & Resnick; “Fundamental of Physics”. John Wiley and Sons, New York, 1987
- Alonso & Finn,“Fundamental University Physics”, Addison Wesley Pub Comp Inc,1st.ed, Calf, 1990
- Giancoli, DC., (terj, Yuhilza H), ”Fisika, jilid 1”, Erlangga, Jakarta,2001
- Lewis, R.I,”Principle of Naval Architecture I, II, III”, Willey and Son, New York, 1990

Mathematics 2 - KM18-4201

COURSE	Course Name : Mathematics 2
	Course Code : KM184201
	Credit : 3sks
	Semester : 2

DESCRIPTION of COURSE

Engineering mathematicsII is the secondbasic mathematic course in Ocean Engineeering Departement, FTK, ITS. This course is prepared to contain the second part offundamental of higher mathematics needed to strengthen the other subjects in the department which are mostly described and expressed in mathematical terms.

LEARNING OUTCOME

1. Demonstrating attitude of responsibility on work in his/her field of expertsei independently; (S 1.9)
2. Mastering the theoretical concepts of engineering sciences, engineering principles, and engineering design required in the field of ocean engineering in depth; (P 2.2)
3. Mastering the theoretical concepts of natural science and the principle of application of engineering mathematics in general; (P2.1)
4. Mastering the concept and principles of environmental conservation; (P2.4)
5. Being able to apply logical, critical, systematic and innovative thinking in the context of development or implementation of science and technology that concerns and implements the value of humanities in accordance with their area of expertise; (KU 4.1)
6. Competent to apply mathematics, science and engineering principles to create or modify models in the field of ocean engineering; (KK 3.1)

COURSE LEARNING OUTCOME

- Student understand the basic of mathematics
- Student understand and capable to explain mathematics and its applications
- Student capable to analyze and having strong intuition toward higher mathematical expression creatively
- Student capable to explain the applied mathematical modelling in several subjects of ocean engineering and present them

MAIN SUBJECT

Engineering Mathematics II consists of:

1. **Differential Equation** (DE) comprise: DE orde 1, DE orde 1 (homogen), DE 1 orde 1 (linear), DE orde1 (numerical), DE orde2 (homogen), DE orde 2 (non-homogen) dan DE(parsial).
2. **Laplace Transforms** (LT): introduction, properties of LT, Inverse LT, solution of DEwith LT, solution of simutaneous DE with LT.
3. **Fourier Series** (FS): FSfor periodic and non-periodic functions, FS for odd and even functions, numerical method for harmonic analysis, FS in complex and exponential forms.
4. **Special functions**: Bessel function, Legendre function, Laplace equation, Gamma function, Error function, Monte-Carlo approach

PREREQUISITES

-

REFERENCES

Main Book :

1. D. Kee, P. N. Kaloni,"*Advanced Mathematics for Engineering and science",* World Scientific, 2003
2. D. Valberg, E. Purcell,"*Calculus", 2000*

Supporting books :

1. D. Murray,"*Differential and Integral Calculus", 1980*
2. E. Landau,"*Differential and Integral Calculus", 1980*

Theory of Floating Structure I - MO18-4203

COURSE	Course title	: Theory of floating structure I
	Course code	: MO18-4203
	Credit	: 2 credits
	Semester	: 2

COURSE DESCRIPTION

Theory of floating structure is a basic knowledge for every student in Department of offshore engineering – FTK ITS Surabaya. Theory of floating structure l disucesses basic engineering of offshore structure dan its connection with anothers science discipline in ocean technology. The course is mandatory for offshore structural and engineering design. The basic of floating structural design and engineering is to know and understand flaoting structure parts and main parts, design parameters and calculate structure volume and center of weight.

LEARNING OUTCOMES

1. Trying his/her best to achieve perfect results, and (S 1.11)
2. Working together to be able to make the most of his/her potential (S 1.12)
3. Mastering the principles and methods of application required for ocean engineering covering coastal structures, ports and offshore structures for the management of marine resources and activities (P2.3)
4. Mastering the theoretical concepts of engineering sciences, engineering principles, and engineering design required in the field of ocean engineering in depth (P 2.2)
5. Competent to apply mathematics, science and engineering principles to create or modify models in the field of ocean engineering (KK 3.1)
6. Competent to design ocean structures that include coastal structures, ports and offshore structures for manageming of marine resources and activities by considering the applied standards, codes and regulations and taking account of economic, security, public safety and environmental sustainability factors. (KK 3.2)
7. Being able to apply logical, critical, systematic and innovative thinking in the context of development or implementation of science and technology that concerns and implements the value of humanities in accordance with their area of expertise (KU 4.1)
8. Being able to implement information and communication technology (ICT) in the context of implementation of his/her work (KU 4.12)
9. Being able to demonstrate independent performance, quality, and measurable; (KU 4.2)

COURSE LEARNING OUTCOMES

CP-MK :

1. Student able to apply theory of floating structure I in volume and area calculations related to volume and center of gravity of floating structure; (P 2.3,P 2.2, KK 3.1, KK 3.2)
2. Student able to apply theory of floating structure I in a design process of floating structure in accordance of principles and safety regulations (P 2.1, KU 4.1, S 1.12, KU 4.12)
3. Student able to analyze and employ instinct to have creativity for solving in basic calculation in ship design ; (S 1.1, S 1.11, P 2.1, P 2.2, KU 4.1)

4. Student able to explain and presenting the basic design of floating structure and its applications in various offshore engineering. (S 1.11, P 2.1, P2.2, KK 3.1, KU 4.1, KU 4.12)

SUBJECTS

During this course, student will learn subjects as follows :

- Ocean floating structure parts (FPSO, FSO, drilling ships, semisubmersible, tanker, dll),
- Main dimensions, coefficient of body, weight components Ukuran-ukuran utama, koefisien-koefisien bentuk, komponen-komponen berat,
- Center of gravity, center of buoyancy, metacenter, radius of metacenter, metacenter height
- Moment inertia (area and volume) and its calculations,
- Simpson, Trapezoidal & Chebeychev methods
- Area calculation,
- Volume calculation,
- Weight components of floating structure calculation,
- Basic concept of lines plan.

REQUIREMENT

-

BIBLIOGRAPHY

Main :

1. Munro Smith, R., “Applied Naval Architecture,” Longmans, 1967.
2. Comstock,J.P (ed), “Principles of Naval Architecture,” SNAME, 1988.
3. Brian, AB, “Ship Hydrostatic & Stability”, Butter Worth-Heinemann, Elsevier, UK, 2003
4. Barrass.B And Derret, D.R, “Ship Stability”, Elsevier, UK, 2006
5. Dokkum, Dkk, “Ship Stability”, Dokmar, Netherlands, 2008
6. Rawson, K.J, Dkk, “Basic Ship Theory”, Longnan, UK, 1978

Supporting :

All books, papers and technical informations available as well as digital source (internet) that related to theory of floating structure I

Engineering Statistic - MO18-4301

COURSE	Course Name : Engineering Statistic
	Course Code : MO184301
	Credit : 2 sks
	Semester : 3

DESCRIPTION of COURSE

Engineering statistic is a member of basic engineering courses of Ocean Engineeering Departement, FTK, ITS. This course discuss about the basic of statistic and probability concept which is very important in ocean engineering modellinng. This course is the basic of reliability modelling.

LEARNING OUTCOME

1. Believing in the oneness of God and able to demonstrate religious attitude.
2. Working together, having social sensitivity and caring for community and environment
3. Trying his/her best to achieve perfect results,
4. Working together to be able to make the most of his/her potential.
5. Mastering the theoretical concepts of natural science and the principle of application of engineering mathematics in general;
6. Mastering the concept of academic integrity in general, among others, able to understand the meaning and concept of plagiarism specifically, in terms of the type of plagiarism, the consequences of violations and prevention efforts.
7. Competent to apply mathematics, science and engineering principles to create or modify models in the field of ocean engineering;
8. Competent to follow and understand the latest technological developments in the field of ocean technology in the framework of lifelong learning.
9. Being able to apply logical, critical, systematic and innovative thinking in the context of development or implementation of science and technology that concerns and implements the value of humanities in accordance with their area of expertise
10. Being able to demonstrate independent performance, quality, and measurable
11. 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

COURSE LEARNING OUTCOME

- Student understand the basic of statistics
- Student understand probability concept
- Student be able to use theoretical distribution to show ocean phenomena
- Student understand the sampling concept
- Student be able to analyze some samples
- Student understand the application of statistic in ocean engineering

MAIN SUBJECT

- Statistic descriptif
- Probability concepts
- Probability distribution
- Discrit and contiue theorical distribution
- Sampling distribution
- Estimation

- Hypotetical analysis
- Inferensial analysis
- Regression and correlation
- Statistic application in ocean engineering

PREREQUISITES

-

REFERENCES

Main Book :

1. Harinaldi, Prinsip – Prinsip Statistik Untuk Teknik dan Sains, Erlangga, Jakarta, 2005

Supporting books :

1. Bhattacharya, Gouri and Johsons, R.A,"Statisical Concept and Methods", John Willey and Sons, New York, 1977
2. Walpole, R.E and Myers, R.H." Probality and Statistics for Scientist and Engineers", Macmillan, New York, 1978
3. Devore, J.L. "Probability and Statistics for Engineering and the Sciences", 4th edition, Duxbury, 1995
4. Kattegoda, N.T. and Rosso, R. "Statistics, Probability and Reliability for Civil and Environmental Engineers", MCGraw-Hill, 1997
5. Devore, J.L. "Probability and Statistics for Engineering and the Sciences", 4th edition, Duxbury, 1995

Numerical Modelling and Analysis - MO18-4302

COURSE	Course Name : Numerical Modelling and Analysis
	Course Code : MO18-4302
	Credit : 3+1 sks
	Semester : 3

DESCRIPTION of COURSE

Numerical Method and Computer Programming is a part of engineering basic courses in Department of Ocean Engineering, FTK, ITS. This course discuss about the basic consepts of numerical method and the application in computer programming. This course will be the basic of knowledge to do analysis and computation in Ocean Engineering field.

LEARNING OUTCOME

1. Believing in the oneness of God and able to demonstrate religious attitude.
2. Working together, having social sensitivity and caring for community and environment
3. Trying his/her best to achieve perfect results,
4. Working together to be able to make the most of his/her potential.
5. Mastering the theoretical concepts of natural science and the principle of application of engineering mathematics in general;
6. Mastering the concept of academic integrity in general, among others, able to understand the meaning and concept of plagiarism specifically, in terms of the type of plagiarism, the consequences of violations and prevention efforts.
7. Competent to apply mathematics, science and engineering principles to create or modify models in the field of ocean engineering;
8. to apply logical, critical, systematic and innovative thinking in the context of development or implementation of science and technology that concerns and implements the value of humanities in accordance with their area of expertise
9. Being able to demonstrate independent performance, quality, and measurable
10. 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

COURSE LEARNING OUTCOME

- Students understand the concept of solving root square from various equations by using numerical method and make a computer coding
- Students could solve equations system in form of matrix and make a computer coding
- Students understand *curve fitting concept* and make a computer coding
- Students could solve differential equation and make a computer coding
- Students understand integral concept by using numerical method and make a computer coding
- Students could solve ordinary differential equations by using numerical methods and make a computer coding
- Students know the basic concept of finite element method and the application in Ocean Engineering field and make a computer coding

MAIN SUBJECT

1. Root equations : closed method, open method, roots of polynomial equation
2. Linear equation system
3. Nonlinear equation system

4. Regression
5. Interpolation
6. Lagrange and newton Gregory differential method
7. Newton cotes integral
8. Range kutta, multi steps
9. Basic of finite elemen method

PREREQUISITES

Engineering Mathematics 2

REFERENCES

Main Book :

1. Numerical method for engineer, Steven C. Chapra & Raymond P. Canale, sixth edition, 2010

Supporting books :

1. Faires, J.D. and Burden, R.L., 1998, Numerical Analysis (2nd ed.), Brooks/Cole.
2. Griffiths, D.V. and Smith, I.M., 1991, Numerical Methods for Engineers, Blackwell.
3. Hahn, B.D., 1994, Fortran 90 For Scientists and Engineers, Arnold.

Oceanography - MO18-4303

COURSE	Name	: OCEANOGRAPHY
	Code	: MO18-4303
	Credit	: 3 sks
	Semester	: III

DESCRIPTION of COURSE

Oceanography is the study of the physical properties, conditions, and processes of the ocean. This includes the motion of ocean waters, chemical properties of water, tidal circulation, and how the ocean and atmosphere affect each other.

LEARNING OUTCOME

Student should be able to:

1. Demonstrating attitude of responsibility on work in his/her field of expertsei independently
2. Mastering the theoretical concepts of natural science and the principle of application of engineering mathematics in general;
3. Mastering the theoretical concepts of engineering sciences, engineering principles, and engineering design required in the field of ocean engineering in depth;
4. Mastering the concept and principles of environmental conservation;
5. Competent to apply mathematics, science and engineering principles to create or modify models in the field of ocean engineering;
6. Competent to follow and understand the latest technological developments in the field of ocean technology in the framework of lifelong learning.
7. Being able to apply logical, critical, systematic and innovative thinking in the context of development or implementation of science and technology that concerns and implements the value of humanities in accordance with their area of expertise
8. Being able to demonstrate independent performance, quality, and measurable

COURSE LEARNING OUTCOME

Student should be able to:

1. explain the basic characteristics of the oceans and its impact on human activities and ocean engineering;
2. explain the origins of ocean basins, mainly the Indian Ocean, and the associated tectonic plates theory, and regional earthquakes and marine geo-hazards;
3. explain the global and regional wind and ocean circulation processes, and associated impacts in the Indonesian climate;
4. explain the origin and generation of tides, understand the tide generating forces, and to describe the analysis and prediction of tides, and understand tidal currents;
5. explain the climate change and global warming, driving mechanism, its influences to the ocean, sea level rise, its impact on ocean engineering and human being;
6. explain the basic concept of hydro-oceanographic surveys, collect and process hydro-oceanographic data and use it as an environmental parameter input for ocean/coastal structural design.

MAIN SUBJECT

1. Oceanography & the growth of Oceanography;
2. Origins of ocean basins & Plate Tectonics;

3. Earthquakes, Tsunami and marine geo-hazards;
4. Physics, chemistry, and biology of the oceans;
5. Atmosphere and ocean circulation;
6. Tides;
7. Global climate change and the oceans;
8. Marine Surveying and Hydro-Oeanography

PREREQUISITES

-

REFERENCES

Main Book:

1. Invitation to Oceanography, Paul R. Pinet, ed, Jones & Bartlett
2. Introduction to physical Oceanography, R. H. Stewart

Supporting books:

1. Wahyudi, 2018 (dalam persiapan). Oseanografi untuk Rekayasa Kelautan, Penerbit ITS.
2. Satake, K., 2005. Tsunamis: Case Studies and Recent Developments, Springer, Dordrecht, NL.
3. Ghosh, S.N., 1999. Tidal Hydraulic Engineeriong. A.A. Balkema, Rotterdam, NL.
4. Wind, H.G. (Ed), 1987. Impact of Sea Level Rise on Society, A.A. Balkema, Rotterdam, NL.
5. Bearman, G. (Ed.), 1993. Ocean Circulation. Pergamon Press Oxford & Open University.
6. Bearman, G. (Ed.), 1993. Waves, Tides, and Shallow Water Processes. Pergamon Press Oxford & Open University.
7. Hayes, F.Ch., 1978. Guidance for Hydrographic and Hydrometric Surveys. Publication No. 200, May 1978.
8. Keller, F.A., Pinter, N., 1996. Active Tectonic: Earthquake, Uplift, and Landscape. Prentice-Hall Inc, New Jersey.

Theory of Floating Structures 2 - MO18-4304

COURSE	Course Name : Theory of Floating Structures 2
	Course Code : MO18-4304
	Credit : 3 sks
	Semester : 3

DESCRIPTION of COURSE

Floating Structure Theory 2 is a member of hydrodinamics courses of Ocean engineering Department, FTK, ITS. This course discuss any forces which is subjected to floating structure and its movement impacts. The students are expected in getting an enough knowledge to analyze the basic hydrostatic charcteristic of floating structure.

LEARNING OUTCOME

1. Believing in the oneness of God and able to demonstrate religious attitude.
2. Working together, having social sensitivity and caring for community and environment
3. Trying his/her best to achieve perfect results,
4. Working together to be able to make the most of his/her potential.
5. Mastering the theoretical concepts of engineering sciences, engineering principles, and engineering design required in the field of ocean engineering in depth;
6. Mastering the concept of academic integrity in general, among others, able to understand the meaning and concept of plagiarism specifically, in terms of the type of plagiarism, the consequences of violations and prevention efforts.
7. Competent to apply mathematics, science and engineering principles to create or modify models in the field of ocean engineering;
8. Competent to solve ocean engineering problems related to coastal structures, ports and offshore structures based on ocean engineering principles, by considering economic, security, public safety and environmental sustainability factors, including the ability to:
    a. identify, formulate, analyze, and finding the problem sources in ocean engineering;
    b. proposing the best solution for solving ocean engineering problems; and
    c. select resources and utilize the most appropriate, effective, and efficient designing and engineering design tools in solving ocean engineering problems;
9. Competent to follow and understand the latest technological developments in the field of ocean technology in the framework of lifelong learning.
10. Being able to apply logical, critical, systematic and innovative thinking in the context of development or implementation of science and technology that concerns and implements the value of humanities in accordance with their area of expertise
11. Being able to demonstrate independent performance, quality, and measurable
12. 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

COURSE LEARNING OUTCOME

- Students be able to assess the stability of floating structure
- Students be able to design floating structure using the appropriate codes and rules
- Students be able to calculate the floating structure stabilities in longitudinal as well

as transversal

MAIN SUBJECT

- Floating structure stability in transversal and longitudinal
- IMO regulation, DnV, ABS and BKI
- Shifting weight
- Loading and unloading weight
- The effet of Wind in ship stability
- The effect of Liquid charge in ship stability
- Launching
- Inclining test
- Barge stability due to jacket load out
- Damage stability
- Overview of hydrostatic and bonjean curve

PREREQUISITES

Floating Structure Theory 1

REFERENCES

Main Book :

1. Brian, AB, “Ship Hydrostatic & Stability”, Butter Worth-Heinemann, Elsevier, UK, 2003

Supporting books :

1. Munro Smith, R., “Applied Naval Architecture,” Longmans, 1967.
2. Comstock,J.P (ed), “Principles of Naval Architecture,” SNAME, 1988.
3. Barrass.B And Derret, D.R, “Ship Stability”, Elsevier, UK, 2006
4. Dokkum, Dkk, “Ship Stability”, Dokmar, Netherlands, 2008
5. Rawson, K.J, Dkk, “Basic Ship Theory”, Longnan, UK, 1978
6. IMO 2002, Code on Intact Stability, For All Types of Ships Covered by IM Instruments.
7. Related Code and standards such as : ABS, DNV, LR, BKI,

Engineering Mechanic 2 - MO18-4305

COURSE	Course Name : Engineering Mechanic 2
	Course Code : MO18-4305
	Credit : 3 sks
	Semester : 3

DESCRIPTION of COURSE

Engineering Mechanic 2 is a part of structural analysis group of courses in Ocean Engineering Department, FTK ITS. This course discusses about the basic of static structural analysis and stress concept. The knowledge will be a fundamental for Ocean Engineer to construct both shore and offshore structures.

LEARNING OUTCOME

1. Believing in the oneness of God and able to demonstrate religious attitude.
2. Working together, having social sensitivity and caring for community and environment
3. Trying his/her best to achieve perfect results,
4. Working together to be able to make the most of his/her potential.
5. Mastering the theoretical concepts of natural science and the principle of application of engineering mathematics in general;
6. Mastering the theoretical concepts of engineering sciences, engineering principles, and engineering design required in the field of ocean engineering in depth;
7. Mastering the concept of academic integrity in general, among others, able to understand the meaning and concept of plagiarism specifically, in terms of the type of plagiarism, the consequences of violations and prevention efforts.
8. Competent to apply mathematics, science and engineering principles to create or modify models in the field of ocean engineering;
9. Competent to solve ocean engineering problems related to coastal structures, ports and offshore structures based on ocean engineering principles, by considering economic, security, public safety and environmental sustainability factors, including the ability to:
   - identify, formulate, analyze, and finding the problem sources in ocean engineering;
   - proposing the best solution for solving ocean engineering problems; and
   - select resources and utilize the most appropriate, effective, and efficient designing and engineering design tools in solving ocean engineering problems;
10. Competent to follow and understand the latest technological developments in the field of ocean technology in the framework of lifelong learning.
11. Being able to apply logical, critical, systematic and innovative thinking in the context of development or implementation of science and technology that concerns and implements the value of humanities in accordance with their area of expertise
12. Being able to demonstrate independent performance, quality, and measurable
13. 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

COURSE LEARNING OUTCOME

- Student understand and solve stress analysis problem due to axial, moment and torsion loading
- Student understand stress concentration due to central load and geometrical variance

- Student can design beam profile as the acting load
- Student can solve 2 dimensional stress problem : principal stress, maximum shear stress, Mohr circle and compression vessel stress
- Student can apply failure principles theory : Mohr, Tresca and Von Mises
- Student understand structural stability principal : Euler theory
- Student can apply column design : pure axial, beam-column (including : eccentricity)

MAIN SUBJECT

1. Stress-strain principles, poisson ratio and hooke law
2. Normal stress in axial and bending moment
3. Moment of inertia and Polar moment of inertia, and surface modulus of beams
4. Stress concentration, central loads and structural geometry
5. Shear stress, shear force and and torsion
6. Combine stress : normal stress and shear stress
7. Beam design based on strength criteria
8. Plane stress analysis : compression vessel and failure theory
9. Theory and column design : stability concept, euler theory

PREREQUISITES

- Engineering Mechanic 1
- Engineering Mechanic 2

REFERENCES

Main book :

1. Popov, E.P. (1996), “Mekanika Teknik”, Edisi Kedua (versi S1), Penerbit Erlangga.

Supporting books :

1. Popov, E.P., “Engineering Mechanics of Solids”, Prentice-Hall, 1990.
2. R.L. Brockenbrough, F.S. Merritt, Structural Steel Designer’s Handbook, Mc-Graw-Hill, 1999.
3. IIT, “Structural Analysis”, 2nd ed., IIT Kharagpur, 2008.
4. Gere, J.M. and Timoshenko, S.P., “Mechanics of Materials”, 3rd ed., Chapman & Hall, 1991.

Fluid Mechanics - MO18-4306

COURSE	Course Name : Fluid Mechanics
	Course Code : MO18-4306
	Credit : 3 sks
	Semester : 3

DESCRIPTION of COURSE

Fluid Mechanics is about static and dynamic of fluids discusses basic concept and fluid properties, applied analysis approaches, involved its basic equations, characteristics of fluid flows and regimes, in unlimited and limited domains. Fluid mechanics is a pre-requisites subject for hydridtatic and hydrodynamic theories, floating body motion, sluid-structure interaction, wave mechanics and coastal process

LEARNING OUTCOME

1. Demonstrating attitude of responsibility on work in his/her field of expertsei independently
2. Mastering the theoretical concepts of natural science and the principle of application of engineering mathematics in general;
3. Mastering the theoretical concepts of engineering sciences, engineering principles, and engineering design required in the field of ocean engineering in depth;
4. Competent to solve ocean engineering problems related to coastal structures, ports and offshore structures based on ocean engineering principles, by considering economic, security, public safety and environmental sustainability factors, including the ability to:
    a. identify, formulate, analyze, and finding the problem sources in ocean engineering;
    b. proposing the best solution for solving ocean engineering problems; and
    c. select resources and utilize the most appropriate, effective, and efficient designing and engineering design tools in solving ocean engineering problems;
5. Being able to demonstrate independent performance, quality, and measurable

COURSE LEARNING OUTCOME

- Student understand the basic concept of fluid mechanics
- Student understand and capable to differentiate between fluid statics and dynamics and its applications
- Student capable to analyze and having strong intuition toward higher fluid mechanics creatively
- Student capable to explain the applied mathematical modelling in several subjects of ocean engineering and present them
- Student capable to comprehend the basic theory and carry out physical experiment

MAIN SUBJECT

Fluid Mechanics consists of:

1. **Introduction** and scope, basic concepts and fluid properties, units, dluid mechanics and nature.
2. **Fluid Statics**: hydrostatic pressure and cjaracteristics, *compressible* and *incompressible fluids,* atmosphere, standard measurement devices, Archimedes principle, stability, linear and rotational motions.

3. **Fundametal fluid dynamic**: Newton II law, *pathlines, streamlines, streaklines,* Bernoulli law, compressibility effect, *unsteady and rotasi.*
4. ***Fluid Kinematics**:* Velocity and acceleration fields, Lagrange and Euler approaches, steady and unsteady flows, streamline coordinates, control volume, material derivative.
5. **Differential Analysis of fluid flows**: particle deformation of fluid flow, rectangular and polar coordinates, continuity equation, mass conservation, linear momentum conservation, stream fuction and velocity potential, rotational and irrotasional flows, Navier-Stokes equarion.
6. **Similitude, Dimensional Analysis and Modelling**: dimension analysis, Buckingham pi theorem, physical experiment theory

PREREQUISITES

-

REFERENCES

Main Book :

1. D. Kee, P. N. Kaloni,"*Advanced Mathematics for Engineering and science",* World Scientific, 2003
2. D. Valberg, E. Purcell,"*Calculus", 2000*

Supporting books :

1. D. Murray,"*Differential and Integral Calculus", 1980*
2. E. Landau,"*Differential and Integral Calculus", 1980*

Coastal Processes - MO18-4403

COURSE	Name	: Coastal Processes
	Code	: MO18-4403
	Credit	: 3 sks
	Semester	: III

DESCRIPTION of COURSE

This subject explaining the proccesses that occur in coastal and strategy development for overcoming the erosion problems.This processes include coastal zone hydrodynamic such as storm surge, waves, low-freq moves on the nearshore and surf zone, coastal responses about the coastal profile equilibrium and sediment transport, simple application like erosion mitigation, beach nourishment, tidal inlet and management of the coastline students Studentsare expected to recognize and overcoming all the processes on beaches is primarily attributed to shoreline erosion.

LEARNING OUTCOME

Student should be able to:

1. Demonstrating attitude of responsibility on work in his/her field of expertise independently; (S9)
2. Mastering the theoretical concepts of natural science and the principle of application of engineering mathematics in general; (P1)
3. Mastering the theoretical concepts of engineering sciences, engineering principles, and engineering design required in the field of ocean engineering in depth; (P2)
4. Mastering the concept and principles of environmental conservation; (P4)
5. Being able to apply logical, critical, systematic and innovative thinking in the context of development or implementation of science and technology that concerns and implements the value of humanities in accordance with their area of expertise; (KU1)
6. Being able to demonstrate independent performance, quality, and measurable; (KU2)
7. Mampu menerapkan matematika, sains, dan prinsip rekayasa (*engineering principles*) untuk membuat atau memodifikasi model di bidang rekayasa kelautan; (KK1)
8. Competent to follow and understand the latest technological developments in the field of ocean technology in the framework of lifelong learning; (KK5)

COURSE LEARNING OUTCOME

At the end of this course the students should be able to:

1. Explain coastal erosion and sedimentation processes, at present and future time, and to make predictions for sediment transport.
2. Describe mitigation processes to interrupt erosion and sediment transport processes.
3. Describe and use properly the coastal terminology related, namely, to beach and coast classification, types of sediment, long term and short term processes, coastal hazards.
4. Explain the climate system and the principles of climate change and its impacts on coastal areas, including climate adaptation measures.
5. Use simple analytical and numerical models of beach and shoreline changes

MAIN SUBJECT

1. Introduction: Goals, Grading, and General instructions.
2. Definition and terminology of coastal areas, morphology and its profiles.
3. Sediment classification: Sediment properties; Sediment classification; Fall velocity; Sediment sampling

4. Tides and storm surges: storm surge mechanism and storm surges in tropical areas and in Indonesia
5. Water wave mechanics in coastal areas: Wave induced currents (along-shore and cross-shore); Near-shore circulation; Rip-currents; Swash processes
6. Sediment transport: Mud and sediment (cohesive and non-cohesive) transport; Along- and cross-shore sediment transport; Bed and suspended sediment transport; Constructive and destructive forces acting on the coast and on the beach
7. Beach and coastal erosion; Beach and shoreline classification; Equilibrium beach profile; Wave impact on beach and coastal erosion; Nourishment processes
8. Modeling of the coast line; Modeling of beach and shoreline changes; Analytical and numerical modeling
9. Climate change impact coastal areas: The climate system; Impacts of climate change; Climate change and adaptation
10. 10. Field visits

PREREQUISITES

Oceanography
Fluid mechanics

REFERENCES

Main Book:

1. Dean, R.G. and R.A. Dalrymple, 2004. Coastal processes with engineering applications, Cambridge Univ. Press. Cambridge, UK.
2. Shibayama, T., 2009. Coastal Processes, World Scientific Publishing Co. Pte. Ltd. Singapore.
3. Horikawa, K., 1978. Coastal Engineering, Univ. Of Toyo Press.

Supporting books:

1. Invitation to Oceanography, Paul R. Pinet, ed, Jones & Bartlett
2. Coastal Engineering Manual - Part II, III and IV, ed. U.S. Army Corps of Engineers
3. Introduction to nearshore hydrodynamics, I.A. Svendsen, ed. World Scientific

Basic Design of Floating Structures - MO18-4404

COURSE	Course Name : Basic Design of Floating Structures
	Course Code : MO18-4404
	Credit : 3 sks
	Semester : IV

DESCRIPTION of COURSE

The course material is divided into three discussion groups. First is about the basic and application drawing techniques. Included are the importance of engineering drawing as a communication tool for the design and operation of engineering systems, the use of lines, geometry drawing, projection, isometry and image scaling. The second is to do the calculation and draw ship hull lines plan, following standard methods and procedures. The third is to calculate and draw the curves of the ship's hydrostatic parameters of the ship lines as established earlier. In addition, there is also a drawing of the Bonjean curve to be composed as a supporting document to the hydrostatic curves and to be used in the subsequent design process.

LEARNING OUTCOME

1. Demonstrating attitude of responsibility on work in his/her field of expertise independently (S9);
2. Mastering the theoretical concepts of natural science and the principle of application of engineering mathematics in general (P1);
3. Mastering the theoretical concepts of engineering sciences, engineering principles, and engineering design required in the field of ocean engineering in depth (P2);
4. Mastering the principles and methods of application required for ocean engineering covering coastal structures, ports and offshore structures for the management of marine resources and activities (P3);
5. Mastering the concepts and principles of occupational safety and health in the laboratory and in the field (P5);
6. Having the insight into the latest technology development in the field of ocean engineering (P7);
7. Competent to apply mathematics, science and engineering principles to create or modify models in the field of ocean engineering (KK1);
8. Competent to design ocean structures that include coastal structures, ports and offshore structures for manageming of marine resources and activities by considering the applied standards, codes and regulations and taking account of economic, security, public safety and environmental sustainability factors (KK2) ;
9. Competent to solve ocean engineering problems related to coastal structures, ports and offshore structures based on ocean engineering principles, by considering economic, security, public safety and environmental sustainability factors, including the ability to:
   1) identify, formulate, analyze, and finding the problem sources in ocean engineering;
   2) proposing the best solution for solving ocean engineering problems; and
   3) select resources and utilize the most appropriate, effective, and efficient designing and engineering design tools in solving ocean engineering problems

(KK3);
10. Competent to follow and understand the latest technological developments in the field of ocean technology in the framework of lifelong learning (KK5);
11. Being able to apply logical, critical, systematic and innovative thinking in the context of development or implementation of science and technology that concerns and implements the value of humanities in accordance with their area of expertise (KU1);
12. Being able to demonstrate independent performance, quality, and measurable (KU2);

COURSE LEARNING OUTCOME

1. Students are able to understand the importance of drawing techniques as communication engineering design tools (S9, P1, P2, KK1);
2. Students are able to understand and apply the rules of line drawing, geometry, projection and isometric, scaling, including ways of writing the measurements and descriptions in the technical drawings (S9, P1, P2, KK1, KU2);
3. Students are able to understand and apply standard calculation procedures in the design of ship lines plan (S9, P1, P2, P3, KK1, KK2, KU2);
4. Students are able to arrange and make drawing of ship lines plan referring to standard rules of drawing technique (S9, P1, P2, P3, KK1, KK2, KU2);
5. Students are able to understand and apply standard calculation procedures in determining the hydrostatic parameters of vessels and measures of the cross-sectional area using the integration method (S9, P1, P2, P3, KK1, KK2, KU2);
6. Students are able to arrange and create drawings of hydrostatic and Bonjean curves according to applicable standards (S9, P1, P2, P3, KK1, KK2, KU2).

MAIN SUBJECT

1. Explanation on the importance of technical drawing as a communication medium in engineering design and operation;
2. Paper size for technical drawing, , line types and uses, drawing scales, geometry drawing, section, projection and isometry, size and description writing in engineering drawings;
3. The calculation phases to produce ship lines plan data;
4. Preparation of drawing lines plan, including body plan, half breadth plan and sheer plan;
5. Calculation phases for obtaining hydrostatic parameter data (displacements, KB, TKM, LKM, etc.) and the extent of each station cross sectional area of the vessel derived from the previously established lines plan;
6. Preparation and drawing of the hydrostatic and Bonjean curves.

PREREQUISITES

Theory of Floating Structure I (MO18-4201)

REFERENCES

Main:

1. Spencer, H.C, Dygdon, J.T. and Novak, J.E., *Basic Technical Drawing* 8th Ed., McGraw-Hill/Geloncoe, New York, 2003
2. Gill, P.S., *Engineering Drawing (Geometrical Drawing)*, S.K. Kataria & Sons, New Delhi, 2009
3. Lamb, T. (ed), *Ship Design and Construction* Vol. II, SNAME, Jersey City, 2004
4. Rawson, K.J. and Tupper, E.C., *Basic Ship Theory* Vol. I, Butterworth-Heinemann, Woburn, 2002

5. Lewis, E.V. (ed), *Principles of Naval Architecture, Vol. I – Stability and Strength*, SNAME, Jersey City, 1988
6. Papanikolaou, A., *Ship Design – Methodologies of Preliminary Design*, Springer, New York, 2014

Additional:

1. Any text books, scientific papers, and technical information obtainable from internet related to Basic Design of Floating Structures.

Ocean Wave Mechanics - MO18-4406

COURSE	Course Name: Ocean Wave Mechanics
	Course Code : MO18-4406
	Credit : 3 sks
	Semester : IV

DESCRIPTION of COURSE

The first part of this course discusses the types and mechanisms of sea wave formation, especially as a result of the wind action, taking into account the geographical conditions as well as the fetch length and its damping and propagation processes. Furthermore, it is proposed on the theories of the regular wave and its region of validity for deep, intermediate and shallow waters. The regular wave mathematical formulations are conveyed with reference to theories of Airy and Stokes Order-2, -3 and -5. The second section presents the stochastic theory of random waves, by raising aspects of short-term wave analysis, long-term wave analysis and wave spectra formulation. The third section deals with the mechanism and behavior of coastal waves, as well as the related mathematical theories and formulations.

LEARNING OUTCOME

1. Demonstrating attitude of responsibility on work in his/her field of expertise independently (S9);
2. Mastering the theoretical concepts of natural science and the principles of application of engineering mathematics in general (P1);
3. Mastering the theoretical concepts of science-engineering (engineering sciences), engineering principles, and engineering design required in the field of marine engineering in depth (P2);
4. Mastering the principles and methods of application required for marine engineering covering coastal buildings, ports and offshore structures for management of marine resources and activities (P3);
5. Mastering the concepts and principles of occupational safety and health in the laboratory and in the field (P5);
6. Having the insight into the latest technology development in the field of ocean engineering (P7);
7. Competent to apply mathematics, science and engineering principles to create or modify models in the field of ocean engineering (KK1);
8. Competent to design ocean structures that include coastal structures, ports and offshore structures for manageming of marine resources and activities by considering the applied standards, codes and regulations and taking account of economic, security, public safety and environmental sustainability factors (KK2) ;
9. Competent to solve ocean engineering problems related to coastal structures, ports and offshore structures based on ocean engineering principles, by considering economic, security, public safety and environmental sustainability factors, including the ability to:
   a. identify, formulate, analyze, and finding the problem sources in ocean engineering;
   b. proposing the best solution for solving ocean engineering problems; and
   c. select resources and utilize the most appropriate, effective, and efficient designing

and engineering design tools in solving ocean engineering problems (KK3);
10. Competent to follow and understand the latest technological developments in the field of ocean technology in the framework of lifelong learning (KK5);
11. Being able to apply logical, critical, systematic and innovative thinking in the context of development or implementation of science and technology that concerns and implements the value of humanities in accordance with their area of expertise (KU1);
12. Being able to demonstrate independent performance, quality, and measurable (KU2);

COURSE LEARNING OUTCOME

1. Students are able to understand the types of ocean waves, the mechanism of wave formation by wind action, geographical factors, propagation and its damping mechanisms, as well as sea state classification (P1, P2);
2. Students are able to understand the region of validity area in the application of a number of wave theories for marine structure design (P1, P2, KK1);
3. Students are able to understand the theoretical concepts, mathematical formulations and their application in modeling the regular sea waves according to Airy's theory as well as Stokes Order-2, -3 and 5 (S9, P1, P2, P3, P7, KK1, KK2, KK3);
4. Students are able to understand the concept of random waves, random wave mathematical formulations as the superposition of regular waves, the application of statistical methods in the short- and long-term random wave analyses (S9, P1, P2, P3, P7, KK1, KK2, KK3);
5. Students are able to understand the concept, analysis and formulation of wave spectra, and its application in the design of marine structures (S9, P1, P2, P3, P5, P7, KK1, KK2, KK3, KK5);
6. Students are able to understand the concept and computation of extreme waves for marine structure design by applying stochastic theory with random wave analysis of short time span and long period of time (S9, P1, P2, P3, P7, KK1, KK2, KK3, KU1, KU2) ;
7. Students are able to understand the phenomena and characteristics of coastal waves (P1, P2, KK1);
8. Students are able to understand the concepts, mathematical formulations and their application in modeling and predicting coastal waves, including surf zone, swash zone, wave shoaling, wave breaking, refraction, diffraction and reflection (S9, P1, P2, P3, P5, P7, KK1, KK2, KK3, KK5, KU1, KU2);
9. Students understand the concepts, mathematical formulations, modeling and prediction of extreme waves to be applied in the design of coastal structures (S9, P1, P2, P3, P5, P7, KK1, KK2, KK3, KK5, KU1, KU2);

MAIN SUBJECT

1. Types of ocean waves, their formation mechanisms, the damping and propagation of ocean waves, the classification of sea state;
2. Regular wave parameters and the region of validity of wave theories;
3. Airy wave theory, covering the calculation and description of parameters, profile, celerity, velocity and acceleration of the wave;
4. The wave theory of Stokes Order-2, -3 and -5, along with the calculation and description of the parameters, , celerity, profile, velocity, and the acceleration of the wave;
5. Random wave theory, random wave time history and short term analysis, Fourier series, wave spectra, wave scatter data and long term wave analysis, prediction of extreme

wave with short time analysis and long period of time for offshore design;

6. Coastal wave theory, surf zone, swash zone, wave shoaling, waveform deformation (refraction, diffraction, reflection), breaking waves, extreme wave prediction for coastal structure design.

PREREQUISITES

1. Oceanography (MO18-4303)
2. Fluid Mechanics (MO18-4306)

REFERENCES

1. Valentine, H.R., *Applied Hydrodynamics,* Butterworth, London, 1969
2. McCormick, M.E., *Ocean Engineering Wave Mechanics*, John Wiley & Sons Inc., New York, 1973
3. Lé Méhauté, B., *An Introduction to Hydrodynamics and Water Waves*, Springer Verlag, Berlin, 1976
4. Sharpkaya, T. and Issacson, M., *Mechanics of Wave Forces on Offshore Structures*, Van Nostrand Reinhold, 1981
5. Chakrabari, S.K., *Hydrodynamics of Offshore Structures*, Springer-Verlag, Berlin, 1990
6. Djatmiko, E.B., *Perilaku dan Operabilitas Bangunan Laut di Atas Gelombang Acak*, ITS Press, Surabaya, 2012
7. Pratikto, W.A., Armono, H.D. dan Suntoyo, *Perencanaan Fasilitas Pantai dan Laut*, BPFE, Yogyakarta, 1997
8. Sorensen, R.M., *Basic Wave Mechanics: For Coastal and Ocean Engineers*, John Wiley & Sons Ltd., Chichester, 1993
9. Nielsen, P., *Coastal and Estuarine Processes*, World Scientific Publishing Co. Pte. Ltd., 2012
10. Holthujsen, L.H., *Waves in Oceanic and Coastal Waters* 1st Ed., Cambridge University Press, Cambridge, UK, 2007
11. Huang, H., *Dynamics of Surface Waves in Coastal Waters,* Springer, Dordrecht, 2009
12. Goda, Y., *Random Seas and Design of Maritime Structures* 2nd Ed., World Scientific Publishing Co. Pte. Ltd., Singapore, 1999
13. Sundar, V., *Ocean Wave Mechanics: Application on Marine Structures*, John Wiley & Sons Ltd., Chichester, 2016
14. Hudspeth, R.T., *Waves and Wave Forces On Coastal and Ocean Structures*, World Scientific Publishing Co. Pte. Ltd., Singapore, 2006
15. U.S. Army Corps of Engineers, Coastal Engineering Manual: Water Wave Mechanics, Washington D.C., 2008
16. Kamphuis, J.W., *Introduction to Coastal Engineering and Management*, World Scientific Publishing Co. Pte. Ltd., Singapore, 2002

Coastal Structures - MO18-4501

COURSE	Course Name **:** Coastal Structures
	Corse Code : MO18-4501
	Credit : 3 SKS
	Semester : 5 (Fifth)
DESCRIPTION OF COURSE	
Coastal Structures discuss the various type of coastal protection structures. The definition of coastal structures are structures to protect shorelines from future damage such as due to erosion and wave attack. The students are expected to know the proper coastal protection measures and select appropriate structure in reducing erosion with the available environmental data.	
COURSE LEARNING OUTCOMES	
ATTITUDE	1. Internalizing values, norms and academic ethics; (S8) 2. Demonstrating attitude of responsibility on work in his/her field of expertsei independently (S9); 3. Trying his/her best to achieve perfect results (S11); 4. Working together to be able to make the most of his/her potential. (S12);
KNOWLEDGE	1. Mastering the theoretical concepts of engineering sciences, engineering principles, and engineering design required in the field of ocean engineering in depth (P2); 2. Mastering the principles and methods of application required for ocean engineering covering coastal structures, ports and offshore structures for the management of marine resources and activities (P3); 3. Mastering the concept and principles of environmental conservation; (P4) 4. Mastering general concepts, principles, and communication techniques for specific purposes; (P6) 5. Having the insight into the latest technology development in the field of ocean engineering (P7); 6. Mastering the concept of academic integrity in general, among others, able to understand the meaning and concept of plagiarism specifically, in terms of the type of plagiarism, the consequences of violations and prevention efforts (P8)
SPECIAL SKILL	1. Competent to apply mathematics, science and engineering principles to create or modify models in the field of ocean engineering; (KK1) 2. Competent to design ocean structures that include coastal structures, ports and offshore structures for management of marine resources and activities by considering the applied standards, codes and regulations and taking account of economic, security, public safety and environmental sustainability factors (KK2) ; 3. Competent to solve ocean engineering problems related to coastal structures, ports and offshore structures based on ocean engineering principles, by considering economic, security, public safety and environmental sustainability factors, including the ability to:

	4. identify, formulate, analyze, and finding the problem sources in ocean engineering; 5. proposing the best solution for solving ocean engineering problems; and 6. select resources and utilize the most appropriate, effective, and efficient designing and engineering design tools in solving ocean engineering problems (KK3); 7. Competent to follow and understand the latest technological developments in the field of ocean technology in the framework of lifelong learning (KK5);
GENERAL SKILL	1. Being able to apply logical, critical, systematic and innovative thinking in the context of development or implementation of science and technology that concerns and implements the value of humanities in accordance with their area of expertise (KU1); 2. Being able to demonstrate independent performance, quality, and measurable (KU2); 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 uploaded it in the college page (KU3) 4. 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 (KU5) 5. Being able to maintain an expanded network with mentors, colleagues, colleagues both inside and outside the institution (KU6) 6. 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 (KU7) 7. Being able to conduct self-evaluation process to work group under his/her responsibility, and able to manage learning independently; (KU8) 8. Being able to document, store, secure and recover data to ensure validity and prevent plagiarism; (KU9) 9. Competent to understand and realize academic integrity in general and prevent plagiarism; (KU11) 10. Being able to implement information and communication technology (ICT) in the context of implementation of his/her work; (KU12) 11. Being able to develop themselves and compete in national and international level (KU14) 12. Being able to implement sustainability principles and develop knowledge (KU15) 13. Competent to implement information and communication technology in the field (KU16)
COURSE LEARNING OUTCOME	
1. **Goal :**	

- Making students able to understand, explain and design of various coastal structures.

2. **Competencies:**
   - Students are able to understand and implement the codes & standard in designing of coastal structures
   - Students are able to understand, explain and design the concept and layout of coastal structures.
   - Students are able to understand, explain, and perform the design and analysis of coastal structures.
   - Students are able to make scientific reports and technical drawings using CAD
   - Students are able to work together in a team work and communicate effectively.

MAIN SUBJECT

- Guidelines, Standard & codes in designing of coastal structures
- Wave Mechanics Review : Wave Theory, Run-up and Wave Overtopping, Transformasion, Reflection and Transmission
- Short Term and Long Term Wave Analsysis
- Coastal Protection Measures
  - Hard Engineering Approach
  - Soft Engineering Approach / Building With Nature
- Coastal Structures
  - Slope Structures (Revetments, Groin, Jetty Breakwaters)
  - Vertical Structures (Bulkheads, Seawalls, Breakwaters, Quays)
- Method of Construction
- Coastal Management

PREREQUISITES

1. Wave Mechanics (MO18-4406)
2. Soil Mechanics and Foundation Design (MO18-4402)
3. Wave Mechanics (MO18-4406)
4. Coastal Processes (MO18-4403)

MAIN REFERENCES

1. Kampuhuis, JW (2000): Introduction to Coastal Engineering and Management
2. Goda (2000): Random seas and design of maritime structures
3. Verhagen (2007), Revetment, Sea-Dikes and river Levees
4. Van de Meer (2007), Breakwater Design

ADDITIONAL REFERENCES

- US Army Corps of Engineers (2001): Coastal Engineering Manual. (CEM)
- RM. Hassan (2005), Coastline Management

Design of Coastal Structures - MO18-4503

COURSE	Course Name **:** Design of Coastal Structures
	Corse Code : MO18-4503
	Credit : 3 SKS
	Semester : 5 (Fifth)
DESCRIPTION OF COURSE	
Design of Coastal Structures is a capstone course, combining the students knowledge and skill from previous course such as, Engineering Drawing, Wave Mechanics, Fluid Mechanics, Soil Mechanics and Foundation, Coastal Processes, Oceanography, and Coastal Structures. This course assigned students to work in a group to solve the coastal erosion related problem by proposing appropriate coastal structures as solution.	
COURSE LEARNING OUTCOMES	
ATTITUDE	1. Internalizing values, norms and academic ethics; (S8) 2. Demonstrating attitude of responsibility on work in his/her field of expertsei independently (S9); 3. Trying his/her best to achieve perfect results (S11); 4. Working together to be able to make the most of his/her potential. (S12);
KNOWLEDGE	1. Mastering the theoretical concepts of engineering sciences, engineering principles, and engineering design required in the field of ocean engineering in depth (P2); 2. Mastering the principles and methods of application required for ocean engineering covering coastal structures, ports and offshore structures for the management of marine resources and activities (P3); 3. Mastering the concept and principles of environmental conservation; (P4) 4. Mastering general concepts, principles, and communication techniques for specific purposes; (P6) 5. Having the insight into the latest technology development in the field of ocean engineering (P7); 6. Mastering the concept of academic integrity in general, among others, able to understand the meaning and concept of plagiarism specifically, in terms of the type of plagiarism, the consequences of violations and prevention efforts (P8)
SPECIAL SKILL	1. Competent to apply mathematics, science and engineering principles to create or modify models in the field of ocean engineering; (KK1) 2. Competent to design ocean structures that include coastal structures, ports and offshore structures for management of marine resources and activities by considering the applied standards, codes and regulations and taking account of economic, security, public safety and environmental sustainability factors (KK2) ; 3. Competent to solve ocean engineering problems related to coastal structures, ports and offshore structures based on ocean engineering principles, by considering economic, security, public safety and environmental sustainability factors, including the ability to:

	4. identify, formulate, analyze, and finding the problem sources in ocean engineering; 5. proposing the best solution for solving ocean engineering problems; and 6. select resources and utilize the most appropriate, effective, and efficient designing and engineering design tools in solving ocean engineering problems (KK3); 7. Competent to follow and understand the latest technological developments in the field of ocean technology in the framework of lifelong learning (KK5);
GENERAL SKILL	1. Being able to apply logical, critical, systematic and innovative thinking in the context of development or implementation of science and technology that concerns and implements the value of humanities in accordance with their area of expertise (KU1); 2. Being able to demonstrate independent performance, quality, and measurable (KU2); 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 uploaded it in the college page (KU3) 4. 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 (KU5) 5. Being able to maintain an expanded network with mentors, colleagues, colleagues both inside and outside the institution (KU6) 6. 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 (KU7) 7. Being able to conduct self-evaluation process to work group under his/her responsibility, and able to manage learning independently; (KU8) 8. Being able to document, store, secure and recover data to ensure validity and prevent plagiarism; (KU9) 9. Competent to understand and realize academic integrity in general and prevent plagiarism; (KU11) 10. Being able to implement information and communication technology (ICT) in the context of implementation of his/her work; (KU12) 11. Being able to develop themselves and compete in national and international level (KU14) 12. Being able to implement sustainability principles and develop knowledge (KU15) 13. Competent to implement information and communication technology in the field (KU16)
COURSE LEARNING OUTCOME	

- GOAL :
    - Making a group of students to propose a design of coastal structure to solve particular coastal engineering problem
- Competencies:
    - Students are able to understand and implement the codes & standard in designing of coastal structures
    - Students are able to understand, explain and design the concept and layout of coastal structures.
    - Students are able to understand, explain, and perform the design and analysis of coastal structures.
    - Students are able to make scientific reports and technical drawings using CAD
    - Students are able to work together in a team work and communicate effectively.

MAIN SUBJECT

- Guidelines, Standard & codes in designing of coastal structures
- Wave Hindcasting and Wave Analysis
- Coastal Management
- Coastal Protection Measures
    - Hard Engineering Approach
    - Soft Engineering Approach:
- Coastal Structures
    - Slope Structures (Revetments, Groin, Jetty Breakwaters)
    - Vertical Structures (Bulkheads, Seawalls, Breakwaters, Quays)

PREREQUISITES

1. Wave Mechanics (MO18-4406)
2. Soil Mechanics and Foundation Design (MO18-4402)
3. Wave Mechanics (MO18-4406)
4. Coastal Processes (MO18-4403)
5. Coastal Structures (MO18-4501)

MAIN REFERENCES

- Kampuhuis, JW (2000): Introduction to Coastal Engineering and Management
- Goda (2000): Random seas and design of maritime structures
- Verhagen (2007), Revetment, Sea-Dikes and river Levees
- Van de Meer (2007), Breakwater Design

ADDITIONAL REFERENCES

- US Army Corps of Engineers (2001): Coastal Engineering Manual. (CEM)
- RM. Hassan (2005), Coastline Management

Fatigue and Fracture Mechanics - MO18-4504

COURSE	Course Name : Fatigue and Fracture Mechanics
	Course Code : MO18-4504
	Credit : 3 sks
	Semester : V

DESCRIPTION of COURSE

This course begins with the introduction of structural damage mechanisms due to fatigue, fatigue case on steel structure of marine facilities, fatigue experiment, S-N curve, stress concentration, crack initiation. Then followed by a discussion of the accumulation of structural damage due to fatigue with the Palmgren-Miner hypothesis, the calculation of stress distribution and fatigue with deterministic approach, calculation of stress distribution and fatigue with spectral method, and calculation of fatigue failure with the application of closed form fatigue equation. The next section was introduced on the foundations of fracture mechanics, crack propagation, stress intensity factors, Paris-Erdogan law, final damage by applying constant and variable amplitude load methods, tubular fatigue, and summary calculations of fatigue life of marine structures.

LEARNING OUTCOME

1. Demonstrating attitude of responsibility on work in his/her field of expertsei independently (S9);
2. Mastering the theoretical concepts of natural science and the principle of application of engineering mathematics in general (P1);
3. Mastering the theoretical concepts of engineering sciences, engineering principles, and engineering design required in the field of ocean engineering in depth (P2);
4. Mastering the principles and methods of application required for ocean engineering covering coastal structures, ports and offshore structures for the management of marine resources and activities (P3);
5. Mastering the concepts and principles of occupational safety and health in the laboratory and in the field (P5);
6. Has an insight into the development of cutting-edge technology in marine engineering (P7);
7. Competent to apply mathematics, science and engineering principles to create or modify models in the field of ocean engineering (KK1);
8. Competent to design ocean structures that include coastal structures, ports and offshore structures for manageming of marine resources and activities by considering the applied standards, codes and regulations and taking account of economic, security, public safety and environmental sustainability factors (KK2) ;
9. Competent to solve ocean engineering problems related to coastal structures, ports and offshore structures based on ocean engineering principles, by considering economic, security, public safety and environmental sustainability factors, including the ability to:
   1) identify, formulate, analyze, and finding the problem sources in ocean engineering;
   2) proposing the best solution for solving ocean engineering problems; and
   3) select resources and utilize the most appropriate, effective, and efficient designing and engineering design tools in solving ocean engineering problems (KK3);

10. Competent to follow and understand the latest technological developments in the field of ocean technology in the framework of lifelong learning (KK5);
11. Being able to apply logical, critical, systematic and innovative thinking in the context of development or implementation of science and technology that concerns and implements the value of humanities in accordance with their area of expertise (KU1);
12. Being able to demonstrate independent performance, quality, and measurable (KU2);

COURSE LEARNING OUTCOME

1. Students are able to understand and explain the basic principles of structural damage mechanism (sea) due to fatigue (P1, P2, KK1);
2. Students are able to understand the procedure and can calculate the fatigue life of the structure by applying the method of deterministic wave load and random (spectral) random loads based on Palmgren-Miner law (S9, P3, P5, KK2, KK3, KK5, KU1, KU2);
3. Students are able to understand and explain the basic principles of structural damage mechanism in the form of fracture (P1, P2, KK1);
4. Students are able to understand the procedure and can calculate the period of crack propagation and structure breakdown by applying constant amplitude load method and variable based on Paris-Erdogan law (S9, P3, P5, KK2, KK3, KK5, KU1, KU2).

MAIN SUBJECT

1. Load cycles as a source of excitation of fatigue and breakdown of marine structures;
2. S-N curves and their equations for plate and tubular structures;
3. Nominal stress, hot spot stress and Stress Concentration Factor (SCF);
4. Calculation of sea structure fatigue by deterministic method;
5. Calculation of sea structure fatigue by spectral method;
6. Closed-form fatigue equation;
7. Factors that affect structural breakdown;
8. Determination of Stress Intensity Factor (SIF) and its equations;
9. Paris-Erdogan equations and crack propagation curves;
10. Fractional calculation of marine structures by the method of accumulation of deterministic wave load cycles;
11. Fractional calculation of marine structures by method of accumulation of random wave load cycle.

PREREQUISITES

1. Engineering Mechanics I (MO18-4202)
2. Engineering Mechanics II (MO18-4305)
3. Finite Element Method (MO18-4405)
4. Ocean Wave Mechanics (MO18-4406)

REFERENCES

Main:

1. Knott, J.F., “Fundamental of Fracture Mechanics”, Butterworth & Co. Publ. Ltd., 1973
2. Broek, D., “Elementary Engineering Fracture Mechanics”, Noordhoff Int. Publ., 1974.
3. Rolfe, N.E. and Barson, J.M., “Fracture and Fatigue Control in Structures”, Prentice-Hall Inc., 1977.
4. Fuchs, H.O. and Stephens, R.I., “Metal Fatigue in Engineering”, Jon Wiley & Sons, Inc., 1980
5. Hellan, K. 1984, *Introduction to Fracture Mechanics*, McGraw-Hill, New York, 1984

6. Almar-Næss, A. (Ed), “Fatigue Handbook : Offshore Steel Structure”, Tapir, Trondheim, 1985.
7. Dover, W.D. and Glinka, G., *Fatigue of Offshore Structures,* EMASBOOKS: Offshore Structures Series, London, UK, 1988
8. DNV-RP-C203, *Fatigue Design of Offshore Structures*, Norway, 1988
9. API-RP2A LRFD, *Recommended Practice for Planning, Designing & Constructing Fixed Offshore Platforms – Load & Resistance Factor Design,* 1st Ed, USA, 1993
10. ASM Handbook Volume 19: *Fatigue and Fracture*, USA, 1996
11. Etube, L., *Fatigue and Fracture of Offshore Structures*, Gulf Publishing Company, USA, 2001
12. API-RP2A WSD, Recommended Practice for Planning, Designing & Constructing Fixed Offshore Platforms – Working Stress Design, 21st Ed, USA, 2001
13. Anderson, T.L, “Fracture Mechanics, Fundamental and Applications 3rd Ed.”, Taylor & Francis, 2005
14. DNV-RP-C206, Fatigue Methodology for Offshore Ships of Offshore Structures, Norway, 2007

Additional:

2. 15th International Ship and Offshore Structures Congress (ISSC) 2003, “Fatigue Strength Assessment, Vol. 1, 2 & 3, Special Task Committee VI.2”, San Diego, 2003
3. 15th International Ship and Offshore Structures Congress (ISSC) 2003, “Fatigue and Fracture, Vol. 1, 2 & 3, Special Task Committee III.2”, San Diego, 2003
4. Lassen, T. & Recho, N, “Fatigue Life Analyses of Welded Structures”, IEST, London, 2006
5. Any text books, scientific papers, and technical information obtainable from internet related to fatigue and fracture mechanics of marine structures.

Design and Construction of Offshore Structures 1 - MO18-4505

COURSE	Course Name **:** Design and Construction of Offshore Structures 1
	Course Code : MO18-4505
	Credit : 3 sks
	Semester : V
DESCRIPTION of COURSE	
The course of Design and Construction of Offshore Structure I invites students to understand the principles of the design of offshore structures. Students will be introduced to the types of offshore structures, construction sections and also fabrication processes also offshore installation processes. The course subject also includes understanding of offshore structure design concepts, determining design criteria including environmental analysis and loadings. Modeling of computer-based offshore steel structures. Analysis of static strength of steel platform jacket structure, earthquake analysis, fatigue analysis, tubular joints analysis and some other materials will be support for students to perform complete fixed offshore structural calculation and analysis.	
LEARNING OUTCOME	
ATTITUDE	1. Internalizing values, norms and academic ethics; (S8) 2. Demonstrating attitude of responsibility on work in his/her field of expertsei independently (S9); 3. Trying his/her best to achieve perfect results (S11); 4. Working together to be able to make the most of his/her potential (S12);
KNOWLEDGE	1. Mastering the theoretical concepts of engineering sciences, engineering principles, and engineering design required in the field of ocean engineering in depth (P2); 2. Mastering the principles and methods of application required for ocean engineering covering coastal structures, ports and offshore structures for the management of marine resources and activities (P3); 3. Mastering the concept and principles of environmental conservation (P4) 4. Having the insight into the latest technology development in the field of ocean engineering (P7); 5. Mastering the concept of academic integrity in general, among others, able to understand the meaning and concept of plagiarism specifically, in terms of the type of plagiarism, the consequences of violations and prevention efforts (P8)
SPECIAL SKILL	1. Competent to design ocean structures that include coastal structures, ports and offshore structures for manageming of marine resources and activities by considering the applied standards, codes and regulations and taking account of economic, security, public safety and environmental sustainability factors (KK2) ; 2. Competent to solve ocean engineering problems related to coastal structures, ports and offshore structures based on ocean engineering principles, by considering economic, security, public safety and environmental sustainability factors, including the ability to:

	1) identify, formulate, analyze, and finding the problem sources in ocean engineering; 2) proposing the best solution for solving ocean engineering problems; and 3) select resources and utilize the most appropriate, effective, and efficient designing and engineering design tools in solving ocean engineering problems; (KK3); 3. Competent to follow and understand the latest technological developments in the field of ocean technology in the framework of lifelong learning (KK5);
GENERAL SKILL	1. Being able to apply logical, critical, systematic and innovative thinking in the context of development or implementation of science and technology that concerns and implements the value of humanities in accordance with their area of expertise (KU1); 2. Being able to demonstrate independent performance, quality, and measurable performance (KU2); 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 uploaded it in the college page, (KU3) 4. 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; (KU7) 5. Being able to conduct self-evaluation process to work group under his/her responsibility, and able to manage learning independently (KU8) 6. Competent to understand and realize academic integrity in general and prevent plagiarism; (KU11) 7. Being able to implement information and communication technology (ICT) in the context of implementation of his/her work; (KU12) 8. Being able to develop themselves and compete in national and international level; (KU14) 9. Being able to implement sustainability principles and develop knowledge; (KU15) 10. Competent to implement information and communication technology in the field (KU16)
COURSE LEARING OUTCOME	
• **Goal :** – Making students understand the principles of structural design and able to perform structural analysis of fixed offshore structures. • **Competencies:** – Students are able to understand the types and construction of fixed offshore	

structures
- Students are able to understand the methods and processes in designing of fixed offshore structures.
- Students are able to understand the methods of structural analysis of fixed offshore structures.
- Students are able to perform structural analysis of fixed offshore structures.

MAIN SUBJECT

- Introduction in technology and process equipment of offshore oil and gas sector: Drilling equipment, processing equipment, oil and gas transport system (pipeline, tanker carrier) and terminal (FPSO, FLNG, FSRU, SPM, jetty & Storage facilities).
- Overview Marine operations:
- Jenis anjungan lepas pantai, Sistem bangunan lepas pantai, komponen-2 bangunan lepas pantai jenis terpancang (jenis jacket): Substruktur utama anjungan jacket, appurtenances, system perangkaan deck dan jacket, pondasi tiang pancang.
- Types of offshore platforms, system of offshore platforms, types of components such as super structure, jacket structures, appurtenances, deck structures and jacket framing systems, pile foundation
- Regulatory authorities, classification societies, safety of marine systems, International codes & standard/ API, ISO, BS; Classification Standard/ DnV-LR, ABS, BKI.
- Offshore field development; Design spiral, Design requirements/ basisDesign Constrain/ physical limitation, Conceptual design, Preliminary design, Contract design, Detail design, FEED, EPC.
- Design criteria: Operating criteria, construction criteria, Environmental criteria
- Beban-beban pada struktur BLP: jenis-jenis beban, beban operasional, beban lingkungan (beban angin, beban arus dan beban gelombang), teori morison: beban pada struktur tegak, dan pada struktur miring, Beban gelombang teori difraksi & strip teori.
- Loading on fixed offshore structures: types of load, operating loads, environmental loads (wind loads, current loads and wave loads), morison's theory: wave loads on vertical, and diagonal structures, wave diffraction and strip theory.
- Tubular joint: characteristics, *Stress Concentration factor (Efthymiou, Kuang, Smedley, etc*), punching shear stress calculation
- Offshore fixed structures modeling using computer programs
- Theory of In-place analysis of offshore fixed structures;
- Theory of Seismic analysis of offshore fixed structures;
- Theory of fatigue analysis of offshore fixed structures;

PREREQUISITES

1. Mechanics of Material 1 (MO18-4202)
2. Mechanics of Material 2 (MO18-4305)
3. Finite Element Method (MO18-4405)
4. Mechanics of Sea Wave (MO18-4406)

REFERENCES

- Bai, Yong, Marine Structural Design, Elsevier, NY, 2003
- Graff, W.J., "Introduction to Offshore Structures," Gulf Publisher, London, 1981.
- McClelland, B. and Reifel, M.D., "Planning and Design of Fixed Offshore Platforms," Van

Nostrand Reinhold Co., New York, 1986.
- Hsu, T. H., "Applied Offshore Structural Engineering," Gulf Publishing Co., 1984 .
- Wardenier, J. et.al. “Offshore and Hydraulic Steel Strucures Vol 1 & 2”, X3CT2, Faculteit Civiele Techniek en Gewetenschappen, Delft Univeristy of Technology, Delft, The Netherlands, 1985.
- Dawson, T.H., "Offshore Structural Engineering," Prentice-Hall, Inc., New Jersey, 1983.
- Djatmiko, E.B. dan Murdjito, "Diktat of Marine Structures," FT. Kelautan ITS, 1995.
- Gerwick, Ben C., “Construction of Marine and Offshore Structures”, 2nd Edition, CRC Press, 2000
- Baltrop, N.D.P, et all: “ Dynamics of Fixed Marine Structures”, 3th edition, Butterworth-Heinemann Ltd, 1991
- Clauss, G. T. et al: "Offshore Structures, Vol 1 - Conceptual Design and Hydromechanics", Springer, London 1992.
- Subrata K. Chakrabarti:Handbook of Ocean Engineering, Elsevier, London, 2005.
- Subrata K. Chakrabarti: Hydrodynamics of Offshore Structures, Springer-Verlag, berlin, 1987
- El-Reedy, Muhammed A., “Offshore Structures: Design, Construction and Maintenance”, Elsevier, Amsterdam,2012

ADDITIONAL REFERENCES

- API RP 2A WSD 21st Edition, Recommended Practice for Planning, Designing and Constructing Fixed Offshore Platforms—Working Stress Design, 2010
- DOE-OG, "Offshore Installation: Guidance on Design and Construction", U.K., Dept. of Energy, London 1985.
- DET NORSKE VERITAS, Offshore standard: structural design of offshore units (WSD method), APRIL 2002, DNV-OS-C201
- BS6235, "Code of Practice for Fixed Offshore Structures", British Standards Institution, London, 1982.
- API RP 2 SIM “Structural Integrity Management of Fixed Offshore Structures”, 2014
- ISO 19902, “Petroleum and natural gas industries - Fixed steel offshore structures”, Switzerland, 2007

Engineering Economics and Project Management - MO18-4601

COURSE	Course Name : Engineering Economics and Project Management (EEPM)
	Course Code : MO18-4601
	Credit : 3 sks
	Semester : 6

DESCRIPTION of COURSE

The Engineering Economics and Project Management (EEPM) course includes a cluster of Marine Building Production courses at the Marine Engineering Department of FTK-ITS. Understand the basic concepts, theories, formulas, and techniques of economic analysis related to the technical aspects of a production system (operation of systems / equipment / machines), products and services. Able to evaluate the feasibility of several technical proposals in relation to the value dimension (worth) and cost (cost), and able to make economic decisions and understand the economic risks / impacts of a technical application problem in an industry. Able to schedule projects with appropriate methods for project development and simulate them with Ms software. Project.

LEARNING OUTCOME

1. Demonstrating attitude of responsibility on work in his/her field of expertsei independently; (S1.9)
2. Mastering the theoretical concepts of natural science and the principle of application of engineering mathematics in general; (P2.1)
3. Mastering the principles and methods of application required for ocean engineering covering coastal structures, ports and offshore structures for the management of marine resources and activities; (P2.3)
4. Competent to apply mathematics, science and engineering principles to create or modify models in the field of ocean engineering; (KK3.1)
5. Competent to solve ocean engineering problems related to coastal structures, ports and offshore structures based on ocean engineering principles, by considering economic, security, public safety and environmental sustainability factors, including the ability to:
6. identify, formulate, analyze, and finding the problem sources in ocean engineering;
7. proposing the best solution for solving ocean engineering problems; and
8. select resources and utilize the most appropriate, effective, and efficient designing and engineering design tools in solving ocean engineering problems; (KK3.3)
9. Being able to demonstrate independent performance, quality, and measurable; (KU4.2)
10. Being able to implement sustainability principles and develop knowledge; (KU4.15)

COURSE LEARNING OUTCOME

1. Students are able to explain the basic concepts of technical economics (S1.9, P2.1, KU4.2)
2. Students are able to compare alternative solutions and choose the best investment; (KK3.3, KU4.2)
3. Students are able to apply the best methods appropriate to evaluate a project; (S1.9, P2.1, KK3.3, KU4.2)
4. Students are able to simulate project activities in Ms. software. Project and Ms. Excel; (S1.9, P2.1, KK3.3, KU4.15)

MAIN SUBJECT

1. The basic concept of technical economics
2. Interest, the formula of rates and types of rates
3. Type of Investment
4. Procedure Analysis of Net Present Value
5. Calculation and analysis of rate of return
6. Break even analysis, sensitivity analysis, and risk analysis
7. Depreciation
8. Capital Recovery Analysis
9. Project Management Principles and Procedures
10. Project Scheduling Method
11. Network Planning Analysis

PREREQUISITES

REFERENCES

1. Leland T. Bank, Anthoy J. Tarquin. *"Engineering Economy"* Fourth Edition, McGraw-Hill International Edition, 1998.
2. Pujawan, N. I.,"*Ekonomi Teknik*", 2nd ed.,Guna Widya. 2009.
3. Husen, A. "*Manajemen Proyek: Perencanaan, Penjadwalan & Pengendalian Proyek*". Andi Publisher. 2011.
4. William G. Sulivan, Elin M.Wicks, S. Patrick Koelling.," *Engineering Economy*". 14th Edition Pearson Prentice Hall, 2009.

Design of Fixed Offshore Structures - MO18-4603

COURSE	Course Name**:** Design of Fixed Offshore Structures
	Corse Code : MO18-4603
	Credit : 3 SKS
	Semester : 6 (Six)
DESCRIPTION OF COURSE	
The course of the Design of Jacket Fixed Offshore Structure consists of four parts: first is the understanding of design standards & codes, second understanding of design layout, the size and concept of structure, third design and analysis of Jacket offshore fixed structure using computer programs which includes the modeling of topside and jacket structures, foundation analysis, pile-soil interaction modeling, in-place analysis, seismic and fatigue analysis, four report preparation, technical drawing using CAD and presentations and other additional materials which will be support students to be able in designing and analyze of jacket fixed offshore structures	
LEARNING OUTCOMES	
ATTITUDE	1. Internalizing values, norms and academic ethics; (S8) 2. Demonstrating attitude of responsibility on work in his/her field of expertsei independently (S9); 3. Trying his/her best to achieve perfect results (S11); 4. Working together to be able to make the most of his/her potential. (S12);
KNOWLEDGE	1. Mastering the theoretical concepts of engineering sciences, engineering principles, and engineering design required in the field of ocean engineering in depth (P2); 2. Mastering the principles and methods of application required for ocean engineering covering coastal structures, ports and offshore structures for the management of marine resources and activities (P3); 3. Mastering the concept and principles of environmental conservation; (P4) 4. Mastering the concepts and principles of occupational safety and health in the laboratory and in the field; (P5) 5. Mastering general concepts, principles, and communication techniques for specific purposes; (P6) 6. Having the insight into the latest technology development in the field of ocean engineering (P7); 7. Mastering the concept of academic integrity in general, among others, able to understand the meaning and concept of plagiarism specifically, in terms of the type of plagiarism, the consequences of violations and prevention efforts (P8)
SPECIAL SKILL	1. Competent to apply mathematics, science and engineering principles to create or modify models in the field of ocean engineering; (KK1) 2. Competent to design ocean structures that include coastal structures, ports and offshore structures for manageming of marine resources and activities by considering the applied standards, codes and regulations and taking account of economic, security, public safety and environmental

	sustainability factors (KK2) ; 3. Competent to solve ocean engineering problems related to coastal structures, ports and offshore structures based on ocean engineering principles, by considering economic, security, public safety and environmental sustainability factors, including the ability to: 4. identify, formulate, analyze, and finding the problem sources in ocean engineering; 5. proposing the best solution for solving ocean engineering problems; and 6. select resources and utilize the most appropriate, effective, and efficient designing and engineering design tools in solving ocean engineering problems (KK3); 7. Competent to follow and understand the latest technological developments in the field of ocean technology in the framework of lifelong learning (KK5);
GENERAL SKILL	1. Being able to apply logical, critical, systematic and innovative thinking in the context of development or implementation of science and technology that concerns and implements the value of humanities in accordance with their area of expertise (KU1); 2. Being able to demonstrate independent performance, quality, and measurable (KU2); 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 uploaded it in the college page (KU3) 4. 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 (KU5) 5. Being able to maintain an expanded network with mentors, colleagues, colleagues both inside and outside the institution (KU6) 6. 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 (KU7) 7. Being able to conduct self-evaluation process to work group under his/her responsibility, and able to manage learning independently; (KU8) 8. Being able to document, store, secure and recover data to ensure validity and prevent plagiarism; (KU9) 9. Competent to understand and realize academic integrity in general and prevent plagiarism; (KU11) 10. Being able to implement information and communication technology (ICT) in the context of implementation of his/her work; (KU12) 11. Being able to develop themselves and compete in national and international level (KU14) 12. Being able to implement sustainability principles and develop knowledge

	(KU15) 13. Competent to implement information and communication technology in the field (KU16)

COURSE LEARNING OUTCOME

- **GOAL :**
  - Making students able to understand, explain and do the planning and analysis of jacket fixed offshore structures.

- **Competencies:**
  - Students are able to understand and implement the codes & standard in designing of jacket fixed offshore structures
  - Students are able to understand, explain and design the concept and layout of jacket fixed offshore structures.
  - Students are able to understand, explain, and perform the design and analysis of jacket fixed offshore structures.
  - Students are able to make scientific reports and technical drawings using CAD
  - Students are able to work together in a team work and communicate effectively.

MAIN SUBJECT

- Understanding of standard & codes in designing of jacket fixed offshore structures
- Concept and layout Design consists of:
  - General consideration
  - Design criteria & procedure
  - Lay-out planning
  - Preliminary scantling determination based on manual calculation
- Structural design of fixed jacket platform
  - Structural steel design & modeling using computer
  - Pile and foundation design & Pile soil interaction modeling
  - In-place analysis
  - Seismic analysis
  - Fatigue analysis
- Reporting and presentation
  - Structure Drawing of Basic Design using CAD
  - Reporting
  - Presentation

PREREQUISITES

1. Mechanics of Material 1 (MO18-4202)
2. Mechanics of Material 2 (MO18-4305)
3. Finite Element Method (MO18-4405)
4. Mechanics of Sea Wave (MO18-4406)
5. Soil Mechanics and Foundation Design (MO18-4402)
6. Fatigue and Fracture Mechanics (MO18-4504)
7. Design & Construction of Offshore Structure I (MO18-4505)

MAIN REFERENCES

- Graff, W.J., "Introduction to Offshore Structures," Gulf Publisher, London, 1981.
- McClelland, B. and Reifel, M.D., "Planning and Design of Fixed Offshore Platforms," Van Nostrand Reinhold Co., New York, 1986.
- Hsu, T. H., "Applied Offshore Structural Engineering," Gulf Publishing Co., 1984.
- Wardenier, J. et.al. “Offshore and Hydraulic Steel Strucures Vol 1 & 2”, X3CT2, Faculteit Civiele Techniek en Gewetenschappen, Delft Univeristy of Technology, Delft, The Netherlands, 1985.
- Dawson, T.H., "Offshore Structural Engineering," Prentice-Hall, Inc., New Jersey, 1983.
- Baltrop, N.D.P, et all: “ Dynamics of Fixed Marine Structures”, 3th edition, Butterworth-Heinemann Ltd, 1991
- Clauss, G. T. et al: "Offshore Structures, Vol 1 - Conceptual Design and Hydromechanics", Springer, London 1992.
- Subrata K. Chakrabarti: Handbook of Ocean Engineering, Elsevier, London, 2005.
- Subrata K. Chakrabarti: Hydrodynamics of Offshore Structures, Springer-Verlag, berlin, 1987

ADDITIONAL REFERENCES

- API RP 2A WSD 21st Edition, Recommended Practice for Planning, Designing and Constructing Fixed Offshore Platforms—Working Stress Design, 2010
- DOE-OG, "Offshore Installation: Guidance on Design and Construction", U.K., Dept. of Energy, London 1985.
- DET NORSKE VERITAS, Offshore standard: structural design of offshore units (WSD method), APRIL 2002, DNV-OS-C201
- BS6235, "Code of Practice for Fixed Offshore Structures", British Standards Institution, London, 1982.
- API RP 2 SIM “Structural Integrity Management of Fixed Offshore Structures”, 2014
- ISO 19902, “Petroleum and natural gas industries - Fixed steel offshore structures”, Switzerland, 2007

Design & Construction of Offshore Structure II - MO18-4605

COURSE	Course name : Design & Construction of Offshore Structure II
	Course Code : MO18-4605
	Credit : 3 sks
	Semester : 6 (six)
DESCRIPTION OF COURSE	
The course of Design and Construction of Offshore Structure II teaches students to understand the principles of floating offshore design such as FPSO, FLNG, Buoy, etc. Students will be introduced to the types of floating offshore structures, functions and its construction parts. Students are also invited to understand the role of classification, statutory and regulation in the design and operation of floating offshore structures. Students are also invited to understand the design concepts and methods, as well as the principles of floating offshore structure design. In addition, the understanding for the strength of the hull design, the ultimate strength of the structure and some other materials will be a support for students to understand design the complete floating offshore structure.	
LEARNING OUTCOME	
ATTITUDE	1. Internalizing values, norms and academic ethics; (S8) 2. Demonstrating attitude of responsibility on work in his/her field of expertsei independently (S9); 3. Trying his/her best to achieve perfect results (S11); 4. Working together to be able to make the most of his/her potential (S12);
KNOWLEDGE	1. Mastering the theoretical concepts of engineering sciences, engineering principles, and engineering design required in the field of ocean engineering in depth (P2); 2. Mastering the principles and methods of application required for ocean engineering covering coastal structures, ports and offshore structures for the management of marine resources and activities (P3); 3. Mastering the concept and principles of environmental conservation; (P4) 4. Having the insight into the latest technology development in the field of ocean engineering (P7); 5. Mastering the concept of academic integrity in general, among others, able to understand the meaning and concept of plagiarism specifically, in terms of the type of plagiarism, the consequences of violations and prevention efforts (P8)
SPECIAL SKILL	1. Competent to design ocean structures that include coastal structures, ports and offshore structures for manageming of marine resources and activities by considering the applied standards, codes and regulations and taking account of economic, security, public safety and environmental sustainability factors (KK2) ; 2. Competent to solve ocean engineering problems related to coastal structures, ports and offshore structures based on ocean engineering principles, by considering economic, security, public safety and

	environmental sustainability factors, including the ability to: 3. identify, formulate, analyze, and finding the problem sources in ocean engineering; 4. proposing the best solution for solving ocean engineering problems; and 5. select resources and utilize the most appropriate, effective, and efficient designing and engineering design tools in solving ocean engineering problems (KK3); 6. Competent to follow and understand the latest technological developments in the field of ocean technology in the framework of lifelong learning (KK5);
GENERAL SKILL	1. Being able to apply logical, critical, systematic and innovative thinking in the context of development or implementation of science and technology that concerns and implements the value of humanities in accordance with their area of expertise (KU1); 2. Being able to demonstrate independent performance, quality, and measurable (KU2); 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 uploaded it in the college page (KU3) 4. 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; (KU7) 5. Being able to conduct self-evaluation process to work group under his/her responsibility, and able to manage learning independently (KU8) 6. Competent to understand and realize academic integrity in general and prevent plagiarism; (KU11) 7. Being able to implement information and communication technology (ICT) in the context of implementation of his/her work (KU12) 8. Being able to develop themselves and compete in national and international level; (KU14) 9. Being able to implement sustainability principles and develop knowledge:; (KU15) 10. Competent to implement information and communication technology in the field (KU16)
COURSE LEARNING OUTCOME	
• **GOAL:** o Making students understand the principles of design and able to conduct analysis of offshore floating structure • **Competency:** o Students are able to understand, and able to explain types of types and construction of offshore floating buildings	

- Students are able to understand and to explain the role of classification, statutory and regulations in the design of offshore floating structures
- Students are able to understand and to define the method and process of design of floating offshore structures.
- Students are able to understand and to explain the analysis of offshore floating structure.
- Students are able to perform computer-based calculations and analysis of offshore floating structure.

MAIN SUBJECTS

1. Introduction of offshore floating structures: background; types, function and characteristics of Floating Platforms such as FPSO/FPU/FLNG/drilling Ship, Semisubmersible, compliant platforms (TLP, SPAR, SPM), MODU (Mobile Offshore Drilling Unit).
2. Floating Structure Design Methods; Parent design approach, Trend curves approach (Statistics), Iterative design approach, Parametric studies approach, Optimisation approach;
3. Classification, Statutory and regulation
4. Structural Design Principles of Floating Offshore Platforms:
    a. Environmental loads on floating structures,
    b. Loads and dynamic responses,
    c. Scantling design and analysis,
    d. Structural analysis,
    e. Limit state design.
5. Hull Design:
    a. Function and system of framing: transverse system, longitudinal system, combination, primary and secondary member, cross section in the middle area of the ship; moment of inertia of cross section,
    b. Construction connection of side with bottom, side with deck; Primary with primary structures, primary with secondary structures, secondary with secondary structures; bottom structures, double hull structures
    c. Transversal bulkhead and longitudinal bulkhead; load on structure; local strengthening; construction decks, supports of process equipment and modules.
    d. Longitudinal strength; Structures with thin-walled cross-section, normal and shear stresses, LWT distribution in longitudinal section, DWT distribution in longitudinal section, still water shear force and bending moment, horizontal shear force and bending moment, torsion, moment of inertia of ship, stresses due to shear forces, bending moments and torsion, class survey and approval, effective stress, permissible stresses.
6. Ultimate strength: Buckling/ collapse of beam – and beam-column, Ultimate strength of plate and stiffened plates, Ultimate strength of cylindrical shell, Offshore structure under impacts loads, Collapse analysis of ship hull)

PREREQUISITES

1. Mechanic of Material 1 (MO18-4202)
2. Mechanic of Material 2 (MO18-4305)
3. Finite Element Method (MO18-4405)

4. Mechanics of wave (MO18-4406)
5. Hydrodynamics of floating structures (MO18-4506)

MAIN REFERENCES

- Evans, H.J., "Ship Strucrtural Design Concepts," Cornell Maritime Press, 1975.
- Lewis, E.V. (Ed), "Principles of Naval Architecture," 2nd. Revision; Vol. 1, SNAME, 1988.
- Rawson, K.J. and Tupper, E.C., *Basic Ship Theory* Vol. I, Butterworth-Heinemann, Woburn, 2002
- Gerwick, Ben C., "Construction of Marine and Offshore Structures", 2nd Edition, CRC Press, 2000
- Clauss, G. T. et al: "Offshore Structures, Vol 2 ", Springer, London 1992.
- Subrata K. Chakrabarti:Handbook of Ocean Engineering, Elsevier, London, 2005.
- Subrata K. Chakrabarti: Hydrodynamics of Offshore Structures, Springer-Verlag, berlin, 1987
- El-Reedy, Muhammed A., "Offshore Structures: Design, Construction and Maintenance", Elsevier, Amsterdam,2012
- Bai, Yong, Marine Structural Design, Elsevier, NY, 2003
- Moan, T, Safety of Offshore Structures, Centre for Offshore Research & Engineering, NUS, 2004
- Moan, T, Development of Accidental Collapse Limit State Criteria for Offshore Structures, Risk Acceptance and Risk Communication Stanford, March 26-27, 2007
- Lamb, T. (ed), Ship Design and Construction Vol. II, SNAME, Jersey City, 2004
- Lloyd, A.R.J.M., Ship Behaviour in Rough Weather, Ellis Horwood Ltd., Chichester, UK, 1989
- Faltinsen, O.M., Sea Loads on Ships and Offshore Structures, Cambridge University Press, 1993
- Hughes, O.F. and Paik, J.K., Ship Structural Analysis and Design, SNAME, Jersey City, 2010
- Bhattacharyya, R. Dynamics of Marine Vehicles, John Wiley & Sons Inc., New York, 1978
- Pinkster, J. A., Low Frequency Second Order Wave Exciting Forces on Floating Structures, MARIN Publication No. 600, Wageningen, 1980
- Wichers, J.E.W., A Simulation Model for a Single Point Moored Tanker, MARIN Publication No. 797, Wageningen, 1988

ADDITIONAL REFERENCES

- DnV: Structural design of offshore ships, DNV-OS-C102, April 2004
- ABS: Guide for Building And Classing, Floating Production Installations, April 2004
- BKI, *Rules for the Classification and Construction of Seagoing Steel Ships*, Vol. II Rules for Hull, Jakarta 2012
- DNV-GL, *Rules for Classification Ships, Part 3 Hull Chap 5 Hull Girder Strength*, 2015
- LR, "Rules and Regulations for the Classification of a Floating Offshore Installation at a Fixed Location", Part 1 to 11, June 2013.

Marine System Operation and HSE - MO18-4604

COURSE	Course Name : Marine System Operation and HSE
	Course Code : MO18-4604
	Credit : 3 sks
	Semester : 6 (Six)
DESCRIPTION OF COURSE	
The course of Operating System and Marine HSE teaches the students to the basic principles, types of activities and characteristics of marine operations by considering the management system of Safety, Occupational Health and Environment (HSE). The material is divided into subjects covering: basics of HSE, management system of HSE, offshore structural integrated management systems, types and characteristics of marine operations and services and prevention of marine pollution.	
LEARNING OUTCOME	
ATTITUDE	1. Internalizing values, norms and academic ethics; (S8) 2. Demonstrating attitude of responsibility on work in his/her field of expertsei independently (S9); 3. Trying his/her best to achieve perfect results (S11); 4. Working together to be able to make the most of his/her potential (S12);
KNOWLEDGE	1. Mastering the theoretical concepts of engineering sciences, engineering principles, and engineering design required in the field of ocean engineering in depth (P2); 2. Mastering the principles and methods of application required for ocean engineering covering coastal structures, ports and offshore structures for the management of marine resources and activities (P3); 3. Mastering the concept and principles of environmental conservation; (P4) 4. Mastering the concepts and principles of occupational safety and health in the laboratory and in the field; (P5) 5. Mastering general concepts, principles, and communication techniques for specific purposes; (P6) 6. Having the insight into the latest technology development in the field of ocean engineering; (P7); 7. Mastering the concept of academic integrity in general, among others, able to understand the meaning and concept of plagiarism specifically, in terms of the type of plagiarism, the consequences of violations and prevention efforts (P8)
SPECIAL SKILL	1. Competent to apply mathematics, science and engineering principles to create or modify models in the field of ocean engineering; (KK1) 2. Competent to design ocean structures that include coastal structures, ports and offshore structures for manageming of marine resources and activities by considering the applied standards, codes and regulations and taking account of economic, security, public safety and environmental sustainability factors (KK2) ;

	3. Competent to solve ocean engineering problems related to coastal structures, ports and offshore structures based on ocean engineering principles, by considering economic, security, public safety and environmental sustainability factors, including the ability to: 4. identify, formulate, analyze, and finding the problem sources in ocean engineering; 5. proposing the best solution for solving ocean engineering problems; and 6. select resources and utilize the most appropriate, effective, and efficient designing and engineering design tools in solving ocean engineering problems (KK3); 7. Competent to follow and understand the latest technological developments in the field of ocean technology in the framework of lifelong learning (KK5);
GENERAL SKILL	8. Being able to apply logical, critical, systematic and innovative thinking in the context of development or implementation of science and technology that concerns and implements the value of humanities in accordance with their area of expertise (KU1); 9. Being able to demonstrate independent performance, quality, and measurable (KU2); 10. 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 uploaded it in the college page, (KU3) 11. 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; (KU7) 12. Being able to conduct self-evaluation process to work group under his/her responsibility, and able to manage learning independently; (KU8) 13. Competent to understand and realize academic integrity in general and prevent plagiarism; (KU11) 14. Being able to implement information and communication technology (ICT) in the context of implementation of his/her work; (KU12) 15. Being able to develop themselves and compete in national and international level; (KU14) 16. Being able to implement sustainability principles and develop knowledge:; (KU15) 17. Competent to implement information and communication technology in the field (KU16)
COURSE LEARNING OUTCOME	
GOAL: • The students are able to understand, explain and conduct assessment on marine operation system by considering the basics of health and safety management system	

(HSE).

Competencies:

- Students are able to understand the concept of marine operations and services which include: process of lifting, towing, load out, and installation of jacket platform, also berthing analysis;
- Students are able to implement the concept and modeling also analysis of a marine operation either manually or using software;
- Students are able to understand the concept of health and safety management system (HSE);
- Students are able to understand and explain the integrated management system in offshore structure and operations;
- Students are able to understand and explain the impact and protection of pollution at sea.

MAIN SUBJECTS

1. Marine Safety Management System
2. Risk, Reliability and Safety: An Introduction
3. Safety Management System of HSE
4. ISM and ISPS Codes
5. Audit, Investigation and Inspection of HSE
6. Process safety management system: Concept, principal & methodology
7. Offshore structural integrity management system
8. Fixed Offshore Structure
9. Floating Offshore Structure
10. Mooring system of offshore floating platform
11. Risk Based Inspection
12. Design criteria & Procedures Operation Requirement
13. Marine Operation System and Services
14. Load-out process and analysis
15. Ballasting system of floating platform
16. Towing operation: stability and maneuvering, wet and dry transport system);
17. Offshore installation: lifting analysis, process launching, pipe-laying, jacking mechanism, mooring analysis.
18. Offshore removal system and operation
19. Ship and port safety management system: transport system, Oil and gas handling safety system.
20. Prevention of marine pollution management system

PREREQUISITES

1. The theory of Floating Platform Design I (MO18-4201)
2. The theory of Floating Platform Design II (MO18-4304)
3. Mechanics of Sea Wave (MO18-4406)
4. Design and Construction of Offshore Structure I (MO18-4505)

MAIN REFERENCES

1. Gerwick, Ben C. " Construction of Marine and Offshore Structures, 3rd edition", CRC Press, Taylor and Francis Group, 2007
2. Subrata K. Chakrabarti:Handbook of Ocean Engineering, Elsevier, London, 2005.

3. Nielsen, F.G.: "Marine Operations. Lecture Notes" (Jan. 2006)
4. Berg, T. E.: ."Marine Operations - Subsea Vehicles. Lecture Notes“
5. HSE. “Marine risk assessment”, Offshore Technology Report 2001/063, Prepared by Det Norske Veritas (DNV), HSE Books, 2002
6. HSE, “Structural integrity management framework for fixed jacket structures”, RR484, 2009
7. HSE, “Offshore Installations (Safety Case) Regulations 1992, HSE Books, London, 2005
8. Institute of Energy, Guidelines for the Management of Safety Critical Elements, 2007.
9. Dong Guo, “Analysis of Global Marine Environmental Pollution and Prevention and Control of Marine Pollution”, Barcelona, 2017
10. Errizal, “ Safety and Occupational Health (Keselamatan dan Kesehatan Kerja/ K3)”, IPB, Bogor
11. Ramli, Soehatman,” Safety management system of HSE (Sistem Manajemen K3): OHS Management system”, Jakarta 2016

ADDITIONAL REFERENCES

1. API RP 2A WSD 21st Edition, Recommended Practice for Planning, Designing and Constructing Fixed Offshore Platforms—Working Stress Design, 2010
2. API RP 2 SIM “Structural Integrity Management of Fixed Offshore Structures”, 2014
3. ABS, “Guidance Notes on Risk Assessment Applications For The Marine And Offshore Oil And Gas Industries”, June 2000
4. DNV-OS-H101, “Marine Operation: General”, Offshore Standard, 2011
5. Oil &Gas UK, “Mooring Integrity Guidance”, Report 080406 Rev F
6. International Safety Management Code Resolution A.741(18) as amended by MSC.104(73), MSC.179(79), MSC.195(80) and MSC.273(85)
7. OHSAS 18001: Occupational Health and Safety Management, 2007
8. BPMIGAS, “Sistem Manajemen Keselamatan dan Kesehatan Kerja Kontraktor K3S”, PTK, No: 016/PTK/III/2007

Research Methodology - MO18-4701

COURSE	Course Name : Research Methodology
	Course Code : MO18-4701
	Credit : 3 sks
	Semester : VII

DESCRIPTION of COURSE

The course of Scientific Writing and Proposal of Final Project contains materials how students understand the terms of a research activity, able to find out a research idea, and then able to develop a fine and right Final Project Proposal, and able to make a presentation in a sceintifc forum.

LEARNING OUTCOME

1. Internalizing values, norms and academic ethics.; (S1.8)
2. Trying his/her best to achieve perfect results; (S1.11)
3. Mastering general concepts, principles, and communication techniques for specific purposes;; (P2.6)
4. Having the insight into the latest technology development in the field of ocean engineering; (P2.7)
5. Mastering the concept of academic integrity in general, among others, able to understand the meaning and concept of plagiarism specifically, in terms of the type of plagiarism, the consequences of violations and prevention efforts (P2.8)
6. Competent to criticize the policy in solving environmental problems from the point of view of ocean engineering that has been and / or is being implemented, as outlined in the form of scientific papers; (KK3.4)
7. 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; (KU4.4)
8. Being able to document, store, secure and recover data to ensure validity and prevent plagiarism; (KU4.9)
9. Competent to understand and realize academic integrity in general and prevent plagiarism; (KU4.11)
10. Competent to publish academic work in the form of thesis which is uploaded in university's website (KU.13)

COURSE LEARNING OUTCOME

1. Students are able to understand the nature of research
2. Students are able to find the research idea for Final Project and put it into proposal.
3. Students are able to write research proposals and reports well in accordance with scientific principles.
4. Students are able to write journals for seminars / journals.
5. 5. Students are able to present the research results in the seminar

MAIN SUBJECT

1. Definition of research and it's requirements.
2. Language of scientific writing
3. The shape and structure of scientific writing.
4. The framework (composition) of the final project proposal.
5. Abstract of research.
6. Background of problems

7. Formulate the problem and purpose of the research
8. Literature review and basic of theory
9. Citation technique using Harvard Method
10. Formulate methods and steps to solve the problem.
11. Technique of conclusion
12. Plan the schedule of research activities
13. Prepare paper for seminars / journals.
14. Presentation technics and seminars.
15. Understanding of Final Project Rules in the Department of Ocean Engineering ITS

PREREQUISITES

Indonesian Languange

REFERENCES

1. Michaelson, H.B. “How to Write and Publish Engineering Papers and Reports”, Third Edition, Oryx Press, 1990
2. Ikhwani, H. Diktat Kumpulan Materi Kuliah Metode Penelitian dan Seminar. Jurusan Teknik Kelautan FTK-ITS, 2008.
3. Peraturan Pelaksanaan Tugas Akhir DTK-FTK ITS 2017
4. Some examples of seminar proceedings and journals

Floating Structure Design - MO18-4703

COURSE	Course Name : Floating Structure Design
	Course Code : MO18-4703
	Credit : 3 sks
	Semester : VII

DESCRIPTION of COURSE

In this course material is divided into four parts. The first part involves the design of a floating oil terminal (FSO), which includes the determination of the main dimensions, the division of cargo tank compartment, the design of structural components, and the drawings of FSO main cross-section structures. The second part concerns with the assessment of global and local structural strength, which includes the FSO's longitudinal strength and the strength of critical support structures in the cargo space. The third part concerns with the analysis of motion characteristics and operability of free floating structures due to the wave load in the operating area. The fourth part deals with the design of mooring systems and the analysis of the strength of the mooring system to withstand the combined environmental loads, consisting of currents, winds and waves.

LEARNING OUTCOME

1. Demonstrating attitude of responsibility on work in his/her field of expertsei independently (S9);
2. Trying his/her best to achieve perfect results (S11);
3. Working together to be able to make the most of his/her potential (S12);
4. Mastering the theoretical concepts of natural science and the principle of application of engineering mathematics in general (P1);
5. Mastering the theoretical concepts of engineering sciences, engineering principles, and engineering design required in the field of ocean engineering in depth (P2);
6. Mastering the principles and methods of application required for ocean engineering covering coastal structures, ports and offshore structures for the management of marine resources and activities (P3);
7. Mastering the concepts and principles of occupational safety and health in the laboratory and in the field (P5);
8. Having the insight into the latest technology development in the field of ocean engineering (P7);
9. Competent to apply mathematics, science and engineering principles to create or modify models in the field of ocean engineering (KK1);
10. Competent to design ocean structures that include coastal structures, ports and offshore structures for manageming of marine resources and activities by considering the applied standards, codes and regulations and taking account of economic, security, public safety and environmental sustainability factors (KK2) ;
11. Competent to solve ocean engineering problems related to coastal structures, ports and offshore structures based on ocean engineering principles, by considering economic, security, public safety and environmental sustainability factors, including the ability to:
12. identify, formulate, analyze, and finding the problem sources in ocean engineering;
13. proposing the best solution for solving ocean engineering problems; and

14. select resources and utilize the most appropriate, effective, and efficient designing and engineering design tools in solving ocean engineering problems (KK3);
15. Competent to follow and understand the latest technological developments in the field of ocean technology in the framework of lifelong learning (KK5);
16. Being able to apply logical, critical, systematic and innovative thinking in the context of development or implementation of science and technology that concerns and implements the value of humanities in accordance with their area of expertise (KU1);
17. Being able to demonstrate independent performance, quality, and measurable (KU2);
18. 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 (KU4);
19. 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 (KU5);

COURSE LEARNING OUTCOME

1. Students are able to understand, explain and perform general design and floating floating terminal structure (FSO) (S9, S11, S12, P1, P2, P3, P5, P7, KK1, KK2, KK3, KK5, KU1, KU2, KU4, KU5);
2. Students are able to understand, explain and carry out computation and review of global and local power structures, which include floating oil terminal longitudinal strength and strength of critical support structures in cargo space (S9, S11, S12, P1, P2, P3, P5 , P7, KK1, KK2, KK3, KK5, KU1, KU2, KU4, KU5);
3. Students are able to understand, explain and compute as well as analyze the moption characteristics and operability of free floating structures with reference to the wave load in the operating area (S9, S11, S12, P1, P2, P3, P5, P7, KK1, KK2, KK3, KK5, KU1, KU2, KU4, KU5);
4. Students are able to understand, explain and carry out design and computation mooring system and mooring system strength analysis to withstand the combined environmental loads, consisting of currents, winds and waves (S9, S11, S12, P1, P2, P3, P5, P7, KK1, KK2, KK3, KK5, KU1, KU2, KU4, KU5).

MAIN SUBJECT

1. Determination of the main dimensions and distribution tank compartments of the floating oil terminal (FSO);
2. Design and determination of the main scantling sizes, as well as development of the cross-section technical drawings of the FSO;
3. Determination of tanker load distribution against the extended wave load action, computation of load effects (shear force and bending moment) and FSO longitudinal strength;
4. Computational strength of local strength of the main support structures in the cargo space;
5. Calculation and description of the FSO hull model, checking of hydrostatic data, as well as determination of gravity and moment of mass inertia;
6. Computation of motion response (RAO) for FSO in free floating condition in a number of loading conditions and wave directions;
7. Spectral analysis to determine the operability of FSO in free floating condition

according to the appropriate criteria;
8. Design of mooring system, including configuration as well as size and material of mooring lines;
9. Computation and simulations of floating terminal under the excitation of combined environmental loads due to currents, winds and waves;
10. Analysis of mooring system strength.

PREREQUISITES

1. Theory of Floating Structure I (MO18-4201)
2. Theory of Floating Structure II (MO18-4304)
3. Ocean Wave Mechanics (MO18-4406)
4. Finite Element Method (MO18-4405)
5. Hydrodynamics of Marine Structures (MO18-4506)
6. Design & Construction of marine Structures II (MO18-4605)

REFERENCES

Main:

1. Lamb, T. (ed), Ship Design and Construction Vol. II, SNAME, Jersey City, 2004
2. IACS, Common Structural Rules for Bulk Carriers and Oil Tankers, London, 2017
3. IACS, Double Hull Oil Tankers - Guidelines for Surveys, Assessment and Repair of Hull Structures, No. 96, London, 2007
4. BKI, Rules for the Classification and Construction of Seagoing Steel Ships, Vol. II Rules for Hull, Jakarta 2012
5. Lewis, E.V. (ed), Principles of Naval Architecture, Vol. I – Stability and Strength, SNAME, Jersey City, 1988
6. Rawson, K.J. and Tupper, E.C., Basic Ship Theory Vol. I, Butterworth-Heinemann, Woburn, 2002
7. DNV-GL, Rules for Classification Ships, Part 3 Hull Chap 5 Hull Girder Strength, 2015
8. Hughes, O.F. and Paik, J.K., Ship Structural Analysis and Design, SNAME, Jersey City, 2010
9. Djatmiko, E.B., Perilaku dan Operabilitas Bangunan Laut di Atas Gelombang Acak, ITS Press, Surabaya, 2012
10. Lloyd, A.R.J.M., Ship Behaviour in Rough Weather, Ellis Horwood Ltd., Chichester, UK, 1989

Faltinsen, O.M., Sea Loads on Ships and Offshore Structures, Cambridge University Press, 1993

11. Bhattacharyya, R. Dynamics of Marine Vehicles, John Wiley & Sons Inc., New York, 1978
12. Pinkster, J. A., Low Frequency Second Order Wave Exciting Forces on Floating Structures, MARIN Publication No. 600, Wageningen, 1980
13. Wichers, J.E.W., A Simulation Model for a Single Point Moored Tanker, MARIN Publication No. 797, Wageningen, 1988
14. OCIMF, Mooring Equipment Guidelines 3rd Edition, Livingston, 2008
15. DNVGL, Position Mooring, Offshore Standard, DNVGL-OS-E301, 2015
16. DNVGL, Offshore Mooring Chain, Offshore Standard, DNVGL-OS-E302, 2015
17. DNVGL, Offshore Fibre Ropes, Offshore Standard, DNVGL-OS-E303, 2015
18. DNVGL, Offshore Mooring Steel Wire Ropes, Offshore Standard, DNVGL-OS-E304,

2015

19. Additional:
20. Manual Maxsurf, Moses, Orcaflex, Ansys, STAAD
21. All books, scientific papers, printed or electronic technical information which are related to the subject of floating structure design.

Offshore Pipeline Engineering - MO18-4702

COURSE	Course Name : Offshore Pipeline Engineering
	Course Code : MO18-4702
	Credit : 3 sks
	Semester : VII

DESCRIPTION of COURSE

The course contains the basic materials of submarine pipeline design for the purposes of oil and gas transportation and other fluids.

LEARNING OUTCOME

1. Demonstrating attitude of responsibility on work in his/her field of expertsei independently (S.9)
2. Working together to be able to make the most of his/her potential (S.12)
3. Mastering the theoretical concepts of engineering sciences, engineering principles, and engineering design required in the field of ocean engineering in depth (P.2)
4. Mastering the principles and methods of application required for ocean engineering covering coastal structures, ports and offshore structures for the management of marine resources and activities (P.3)
5. Competent to apply mathematics, science and engineering principles to create or modify models in the field of ocean engineering (KK.1)
6. Competent to design ocean structures that include coastal structures, ports and offshore structures for manageming of marine resources and activities by considering the applied standards, codes and regulations and taking account of economic, security, public safety and environmental sustainability factors (KK.2)
7. 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 (KU.4)

COURSE LEARNING OUTCOME

1. Students are able to calculate the main parameters of offshore pipeline include inside / outside diameter, pipe thickness, and concrete thickness
2. Students are able to perform static stability analysis of pipe to calculate hydrodynamic forces due to current and wave.
3. Students are able to analyze buckling of pipe.
4. Students know the pipe installation and construction of offshore pipeline.
5. Students know the technology of pipeline protection
6. Students know the maintenance of pipeline under the sea

MAIN SUBJECT

1. Fluid dynamics and sizing analysis:
2. On bottom stability analysis:
3. Buckle analysis:
4. Instalation and construction method:
5. Pipeline scouring:
6. Protection method:
7. Pipeline Maintenance

PREREQUISITES

1. Mechanics,
2. Fluid Mechanics,
3. Hydrodynamamic

REFERENCES

1. Mouselli, A.H. 1981. Offshore Pipeline Design, Analysis and Methods. Penwell Books Publs Company, Oklahoma.
2. Yong Bai, 2003. Pipelines and Risers. Elsevier Science Ltd, UK.
3. Guo, B., Song, S., Chacko, J, dan Ghalambor, A. 2005. Offshore Pipeline. Elsevier, USA.
4. Ziu, C. 1995. Handbook of Double Containment Piping Systems.McGraw-Hill, Inc.
5. Mc Allister (ed). 1998. Pipe Line Rules of Thumbs Hand Books. 4 th edition. Gulf Publishing Company.
6. DnV. 1996. Rules for Submarine Pipeline Systems.
7. Papers on Submarine Pipeline Technology Seminar, Singapore 14 & 15 August 1997. Notchez International Pte Ltd, Singapore.
8. Ikhwani, H., 2009, Diktat Perancangan Pipa Bawah Laut, JTK-FTK ITS

Operation Research and Optimization - MO18-4801

COURSE	Course Name : Operation Research and Optimization
	Course Code : MO18-4801
	Credit : 2 sks
	Semester : 8

DESCRIPTION of COURSE

Research Operation and Optimization is a part of design and production course group in Ocean Engineering Department, FTK – ITS. This course discuss about the basic of decision making and constructing as well as solving optimization problem. This course is fundamental for ocean engineer to manage ocean resources as effective and efficient as possible.

LEARNING OUTCOME

1. Believing in the oneness of God and able to demonstrate religious attitude. Deep Understanding the engineering science concepts, engineering principles and engineering construction which are needed in ocean engineering (S1)
2. Working together, having social sensitivity and caring for community and environment (S6)
3. Trying his/her best to achieve perfect results (S11)
4. Working together to be able to make the most of his/her potential (S12)
5. Mastering the theoretical concepts of natural science and the principle of application of engineering mathematics in general (P1)
6. Mastering the theoretical concepts of engineering sciences, engineering principles, and engineering design required in the field of ocean engineering in depth (P2)
7. Mastering the concept of academic integrity in general, among others, able to understand the meaning and concept of plagiarism specifically, in terms of the type of plagiarism, the consequences of violations and prevention efforts. (P8)
8. Competent to apply mathematics, science and engineering principles to create or modify models in the field of ocean engineering (KK1)
9. Competent to solve ocean engineering problems related to coastal structures, ports and offshore structures based on ocean engineering principles, by considering economic, security, public safety and environmental sustainability factors, including the ability to:
    1) identify, formulate, analyze, and finding the problem sources in ocean engineering;
    2) proposing the best solution for solving ocean engineering problems; and
    3) select resources and utilize the most appropriate, effective, and efficient designing and engineering design tools in solving ocean engineering problems (KK3)
10. Competent to follow and understand the latest technological developments in the field of ocean technology in the framework of lifelong learning (KK5)
11. Being able to apply logical, critical, systematic and innovative thinking in the context of development or implementation of science and technology that concerns and implements the value of humanities in accordance with their area of expertise (KU1)
12. Being able to demonstrate independent performance, quality, and measurable

terukur (KU2)

13. 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 (KU5)

COURSE LEARNING OUTCOME

Student could construct optimization model in general engineering and management problem, understand some optimization methods, and solve optimization formulations by using a software developed by themselves.

MAIN SUBJECT

1. Basic concept of decision making
2. Linear programming
3. Integer programming
4. Goal programming
5. Non linier programming
6. Decision table analysis
7. Decision Tree Analysis
8. Analytical Hierarchy Process

PREREQUISITES

-

REFERENCES

Main Book :

1. Rosyid, DM : Optimasi, ITS Press, 2009

Supporting books :

1. Vanderplaatz, G.N, " Numerical Optimization Techniques for Engineering Design With Applications." McGraw-Hill Inc, New York, 1984
2. Arora, J.S., "Introduction to Optimum Design". McGraw-Hill Inc, New York, 1989
3. Taha, H.A. "Operation Research", Macmillan Publishing Co, 1987

Risk Analysis and Reliability - MO18-4802

COURSE	Course Name : Risk Analysis and Reliability
	Course Code : MO18-4802
	Credit : 2 sks
	Semester : 8
DESCRIPTION of COURSE	
Reliability and risk is a member of advanced of engineering courses of Ocean Engineeering Departement, FTK, ITS. This course discuss about the basic of concept of probability based design.	
LEARNING OUTCOME	
Believing in the oneness of God and able to demonstrate religious attitude. Deep Understanding the engineering science concepts, engineering principles and engineering construction which are needed in ocean engineering (S1) Working together, having social sensitivity and caring for community and environment (S6) Trying his/her best to achieve perfect results (S11) Working together to be able to make the most of his/her potential (S12) Mastering the theoretical concepts of natural science and the principle of application of engineering mathematics in general (P1) Mastering the theoretical concepts of engineering sciences, engineering principles, and engineering design required in the field of ocean engineering in depth (P2) Mastering the concept of academic integrity in general, among others, able to understand the meaning and concept of plagiarism specifically, in terms of the type of plagiarism, the consequences of violations and prevention efforts. (P8) Competent to apply mathematics, science and engineering principles to create or modify models in the field of ocean engineering (KK1) Competent to solve ocean engineering problems related to coastal structures, ports and offshore structures based on ocean engineering principles, by considering economic, security, public safety and environmental sustainability factors, including the ability to: identify, formulate, analyze, and finding the problem sources in ocean engineering; proposing the best solution for solving ocean engineering problems; and select resources and utilize the most appropriate, effective, and efficient designing and engineering design tools in solving ocean engineering problems (KK3) Competent to follow and understand the latest technological developments in the field of ocean technology in the framework of lifelong learning (KK5) Being able to apply logical, critical, systematic and innovative thinking in the context of development or implementation of science and technology that concerns and implements the value of humanities in accordance with their area of expertise (KU1) Being able to demonstrate independent performance, quality, and measurable terukur (KU2) 13. 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 (KU5)	

COURSE LEARNING OUTCOME
Student understand the uncertainty concept in structure Student understand Mean Time To Failure Data Student understand LRFD based design concept Student be able to calculate structural reliability Student be able to calculate the reliability of system
MAIN SUBJECT
Uncertainty in design LRFD concept FTA FMECA AFOSM and MVFOSM Monte Carlo Simulation Quality assurance
PREREQUISITES
Engineering Statistic
REFERENCES
Main Book : Rosyid, Daniel M. Pengantar Rekayasa Keandalan. Airlangga University Press. 2007 **Supporting books :** Davidson J. (editor). *The Reliability of Mechanical Systems*. London. *Mechanical Engineering Publication Ltd.* 1988 Devore JL. *Probability and Statistics for Engineering and the Sciences, Fourth Edition*. *Duxbury Press. 1995* Rosyid DM. and Caldwell JB. *Design Approach and Dimensional Similarity in Layout Optimization of Structural Systems. Jurnal International Structural Computers and Structures, 1991;40(50):1125 – 37*

Syllabus for Optional Course

Physical Models and Experimental Design - MO18-4711

COURSE	Course Name : Physical Model and Experimental Design
	Course Code : MO18-4711
	Credit : 3 sks
	Semester : VII

DESCRIPTION of COURSE

This course guide take the students along the correct road to perform physical model to get experimentally constants and coefficient used to obtain a fairly complete definition of physical process under investigation. Furthermore, the design of experimen and the analysis process of the experimental results will b discussed

LEARNING OUTCOME

1. Demonstrating attitude of responsibility on work in his/her field of expertsei independently (S9);
2. Mastering the theoretical concepts of natural science and the principle of application of engineering mathematics in general (P1);
3. Mastering the theoretical concepts of engineering sciences, engineering principles, and engineering design required in the field of ocean engineering in depth (P2);
4. Mastering the principles and methods of application required for ocean engineering covering coastal structures, ports and offshore structures for the management of marine resources and activities (P3);
5. Mastering the concepts and principles of occupational safety and health in the laboratory and in the field (P5);
6. Has an insight into the development of cutting-edge technology in marine engineering (P7);
7. Competent to apply mathematics, science and engineering principles to create or modify models in the field of ocean engineering (KK1);
8. Competent to design ocean structures that include coastal structures, ports and offshore structures for manageming of marine resources and activities by considering the applied standards, codes and regulations and taking account of economic, security, public safety and environmental sustainability factors (KK2) ;
9. Competent to solve ocean engineering problems related to coastal structures, ports and offshore structures based on ocean engineering principles, by considering economic, security, public safety and environmental sustainability factors, including the ability to:
    1) identify, formulate, analyze, and finding the problem sources in ocean engineering;
    2) proposing the best solution for solving ocean engineering problems; and
    3) select resources and utilize the most appropriate, effective, and efficient designing and engineering design tools in solving ocean engineering problems (KK3);
10. Competent to follow and understand the latest technological developments in the field of ocean technology in the framework of lifelong learning (KK5);
11. Being able to apply logical, critical, systematic and innovative thinking in the context of development or implementation of science and technology that concerns and

implements the value of humanities in accordance with their area of expertise (KU1);
12. Being able to demonstrate independent performance, quality, and measurable (KU2);

COURSE LEARNING OUTCOME

1. Students are able to understand concepts and can perform the Dimensional Analysis (S9, P1, P2, P3, KK1, KK2);
2. Students are able to understand physical phenomena and can perform modeling technique, based on the concept of dimensional analysis (S9, P1, P2, P3, KK1, KK2, KK5, KU2);
3. Students are able to understand the design procedure in designing physical model experiments (S9, P1, P2, P3 , KK1, KK2, KK5, KU2);
4. Students are able to understand satistical concepts used in the analysis of eexperimental results and perform multiparameter regression (S9, P1, P2, P3, KK1, KK2, KK5, KU2);

MAIN SUBJECT

1. Theory
   a. Dimensional Analysis
   b. Similarity Theory and Similitude Analysis
   c. Method of Synthesis
   d. Scaling and Scale Errors
2. Practice
   a. Model Technique
   b. Model of Coastal Structure
   c. Model of Coastal Processes
   d. Model of Thermal and Effluent Outfalls
3. Analysis
   a. Design of Experiment
   b. Multi Parameter Regression

PREREQUISITES

-

REFERENCES

1. 1985, Physical modelling in coastal engineering / edited by Robert A. Dalrymple
2. Physical Models and Laboratory Techniques in Coastal Engineering Steven A. Hughes, World Scientific, 1993
3. Hydraulic modeling : J.J. Sharp. The Butterworth Group, London-Boston-Sydney-Wellington-Durban-Toronto, 1981. 242 pp
4. Fundamental of Fluid Mechanics, Munson Young, Okishii

Behavior of Floating Structure - MO18-4712

COURSE	Course Name : Behavior of Floating Structure
	Course Code : MO18-4712
	Credit : 3 sks
	Semester : VII

DESCRIPTION of COURSE

The material in this course is divided into four sections. The first part is the dynamic effect of relatively vertical motion which is reflected in the form of slamming and green water. At this stage the students were also introduced about the correlation between excitation due to the 1st-order wave frequencies and the 2nd-order low-frequency wave drifting. The second part involves a preliminary understanding of the various types of floating marine structure systems and their components, followed by modeling concepts including mooring design and computation procedures with respect to internal load cases and external or environmental load cases, either correlated in the modes of collinear or non-collinear. Eventually the modeling results will be checked in compliance with the applicable assessment criteria. The third part is the modeling to predict riser safety in accordance with the applicable assessment criteria. The fourth is the introduction of the concept of oil and gas transfer between the floating terminal to the shuttle tanker, taking into account the internal and external load cases to predict its safety in accordance with applicable criteria.

LEARNING OUTCOME

13. Demonstrating attitude of responsibility on work in his/her field of expertsei independently (S9);
14. Mastering the theoretical concepts of natural science and the principle of application of engineering mathematics in general (P1);
15. Mastering the theoretical concepts of engineering sciences, engineering principles, and engineering design required in the field of ocean engineering in depth (P2);
16. Mastering the principles and methods of application required for ocean engineering covering coastal structures, ports and offshore structures for the management of marine resources and activities (P3);
17. Mastering the concepts and principles of occupational safety and health in the laboratory and in the field (P5);
18. Has an insight into the development of cutting-edge technology in marine engineering (P7);
19. Competent to apply mathematics, science and engineering principles to create or modify models in the field of ocean engineering (KK1);
20. Competent to design ocean structures that include coastal structures, ports and offshore structures for manageming of marine resources and activities by considering the applied standards, codes and regulations and taking account of economic, security, public safety and environmental sustainability factors (KK2) ;
21. Competent to solve ocean engineering problems related to coastal structures, ports and offshore structures based on ocean engineering principles, by considering economic, security, public safety and environmental sustainability factors, including the ability to:
    4) identify, formulate, analyze, and finding the problem sources in ocean

engineering;
5) proposing the best solution for solving ocean engineering problems; and
6) select resources and utilize the most appropriate, effective, and efficient designing and engineering design tools in solving ocean engineering problems (KK3);

22. Competent to follow and understand the latest technological developments in the field of ocean technology in the framework of lifelong learning (KK5);
23. Being able to apply logical, critical, systematic and innovative thinking in the context of development or implementation of science and technology that concerns and implements the value of humanities in accordance with their area of expertise (KU1);
24. Being able to demonstrate independent performance, quality, and measurable (KU2);

COURSE LEARNING OUTCOME

5. Students are able to understand concepts and can perform the calculation of relative vertical motion in the 1st-order wave scheme (S9, P1, P2, P3, KK1, KK2);
6. Students are able to understand phenomena and can perform computation of slamming and green water on floating structure by applying the deterministic and stochastic approaches, including load effects, based on the concept of vertical motion (S9, P1, P2, P3, KK1, KK2, KK5, KU2);
7. Students are able to understand the concept of the wave drift force and the floating structure motion of the 2nd-order, as well as the superposition aspects with the 1st-order motion (S9, P1, P2, P3);
8. Students are able to understand the design procedure as well as perform the computation of floating structure mooring system and strength based on the combination of 1st- and 2nd-order in the regular or random wave field, wind loads and currents (S9, P1, P2, P3 , KK1, KK2, KK5, KU2);
9. Students are able to understand concepts and perform dynamic and riser load calculations on floating structures due to the combination of 1st- and 2nd-order excitation of wave loads, current and wind loads (S9, P1, P2, P3, KK1, KK2, KK5, KU2);
10. Students are able to understand the concept and perform the calculation of the safety in cargo transfer system between the floating storage terminal of oil and gas to shuttle tankers with tandem and side by side modes (S9, P1, P2, P3, KK1, KK2, KK5, KU2);

MAIN SUBJECT

4. Dynamic effects of floating structure in the field of wave propagation, superposition of 1st- and 2nd-order wave forces;
5. Formulation and calculation of the bow relative motion;
6. Formulation and computation of slamming and greenwater;
7. Design of mooring system;
8. Computation and simulation of dynamics and strength of the mooring system;
9. Computation and simulation of dynamics and riser strength;
10. Computation and simulating the dynamics and integrity of the sea charge transfer system in tandem mode and side by side mode.

PREREQUISITES

1. Mechanics of Ocean Waves (MO18-4406)
2. Finite Element Methods (MO18-4405)
3. Hidrodynamics of Marine Structures (MO18-4506)

REFERENCES

5. *Bhattacharyya*, R., *Dynamics of Marine Vehicles*, John Wiley & Sons Inc., New York, 1978
6. Lloyd, A.R.J.M., *Ship Behaviour in Rough Weather*, Ellis Horwood Ltd., Chichester, UK, 1989
7. Lewis, E.V., *Principles of Naval Architecture, Vol III: Motion in Waves and Controlability*, SNAME Publication, New Jersey, 1990
8. Djatmiko, E.B., Perilaku dan Operabilitas Bangunan Laut di Atas Gelombang Acak, ITS Press, Surabaya, 2012
9. McCormick, M.E., *Ocean Engineering Wave Mechanics*, John Wiley & Sons Inc., New York, 1973
10. Chakrabari, S.K., *Hydrodynamics of Offshore Structures*, Springer-Verlag, Berlin, 1990
11. Patel, M.H., *Compliant Offshore Structures*, Butterworth-Heinemann, London, 1991
12. Pinkster, J. A., *Low Frequency Second Order Wave Exciting Forces on Floating Structures*, MARIN Publication No. 600, Wageningen, 1980
13. Wichers, J.E.W., *A Simulation Model for a Single Point Moored Tanker*, MARIN Publication No. 797, Wageningen, 1988
14. de Kat, J.O. and Wichers, J.E.W., "Behaviour of a Moored Ship in Unsteady Current Wind and Waves", *Marine Technology*, Vol. 28, 1991
15. Faltinsen, O.M., *Sea Loads on Ships and Offshore Structures*, Cambridge University Press, 1993
16. Yilmaz, O. and Incecik, A., "Hydrodynamic Design of Moored Floating Platforms", *Marine Structures*, Vol. 9, 1996
17. OCIMF, *Mooring Equipment Guidelines* 3rd Edition, Livingston, 2008
18. DNVGL, *Position Mooring*, Offshore Standard, DNVGL-OS-E301, 2015
19. DNVGL, *Offshore Mooring Chain*, Offshore Standard, DNVGL-OS-E302, 2015
20. DNVGL, *Offshore Fibre Ropes*, Offshore Standard, DNVGL-OS-E303, 2015
21. DNVGL, *Offshore Mooring Steel Wire Ropes*, Offshore Standard, DNVGL-OS-E304, 2015

Resistance and Propulsion System - MO18-4713

COURSE	Course Name : Resistance nd Propulsion System
	Course Code : MO18-4713
	Credit : 3 sks
	Semester : VII/VIII

DESCRIPTION of COURSE

This course elaborates resistance and propulsion systems in marine floating vessels, with two main topics of discussion. First, the theory of resistance components, the determination of resistance through experimental models, the determination of resistance through the theoretical series diagram for marine floating vessels. Second, the geometry and the definition of marine screw propellers, the various propeller theories, the interaction of propellers and the floating vessel body, the theory of cavitation, the propeller model experiments, propeller design by using series diagrams. Third, calculation of main engine power as prime mover of floating vessels.

LEARNING OUTCOME

1. Demonstrating attitude of responsibility on work in his/her field of expertsei independently (S9);
2. Mastering the theoretical concepts of natural science and the principle of application of engineering mathematics in general (P1);
3. Mastering the theoretical concepts of engineering sciences, engineering principles, and engineering design required in the field of ocean engineering in depth (P2);
4. Mastering the principles and methods of application required for ocean engineering covering coastal structures, ports and offshore structures for the management of marine resources and activities (P3);
5. Mastering the concepts and principles of occupational safety and health in the laboratory and in the field (P5);
6. Having the insight into the latest technology development in the field of ocean engineering (P7);
7. Competent to apply mathematics, science and engineering principles to create or modify models in the field of ocean engineering (KK1);
8. Competent to design ocean structures that include coastal structures, ports and offshore structures for manageming of marine resources and activities by considering the applied standards, codes and regulations and taking account of economic, security, public safety and environmental sustainability factors (KK2) ;
9. Competent to solve ocean engineering problems related to coastal structures, ports and offshore structures based on ocean engineering principles, by considering economic, security, public safety and environmental sustainability factors, including the ability to:
10. identify, formulate, analyze, and finding the problem sources in ocean engineering;
    1) proposing the best solution for solving ocean engineering problems; and
    2) select resources and utilize the most appropriate, effective, and efficient designing and engineering design tools in solving ocean engineering problems (KK3);
11. Competent to follow and understand the latest technological developments in the

field of ocean technology in the framework of lifelong learning (KK5);
12. Being able to apply logical, critical, systematic and innovative thinking in the context of development or implementation of science and technology that concerns and implements the value of humanities in accordance with their area of expertise (KU1);
13. Being able to demonstrate independent performance, quality, and measurable (KU2);

COURSE LEARNING OUTCOME

- Student understand the types of resistance component occur on floating marine vessels;
- Student able to perform computation to determine the resistance occur on floating marine vessels by applying theoretical and experimental approaches;
- Student understand the theory and geometry of marine screw propellers, including theory of cavitation;
- Student able to design and perform the computation of marine screw propellers as the propulsor component of floating vessel;
- Student able to perform computation of main engine power as the propulsor of floating vessel.

MAIN SUBJECT

1. Common aspects of resistance and propulsion on ship and marine floating structures (MFS);
2. The basic theory of resistance on ship and MFS;
3. Components of ship and MFS' resistance;
4. Determination and calculation of resistance using ship series diagram;
5. Calculation of resistance by Holtrop method;
6. Calculation of resistance on semi-submersible;
7. Determination of resistance by experimental method;
8. General description of geometry and theories of ship propeller;
9. The cavitation phenomenon of the propeller;
10. The design of marine screw propeller;
11. Open water propeller test;
12. Calculation of main engine power.

PREREQUISITES

Theory of Floating Structure I (MO18-4201)
Fluid Mechanics (MO18-4306)

REFERENCES

Main:

- Harvald, Sv.Aa., Resistance and Propulsion of Ship, John Wiley & Sons, New York, 1983
- Van Lammeren, W.P.A., Resistance, Propulsion and Steering of Shpis, The Technical Publishing Company H Stam-Haarlem, Holland, 1984
- Lewis, E.V. (ed), Principles of Naval Architecture, Vol II: Resistance, Propulsion and Vibration, SNAME Publication, New Jersey, 1990
- Carlton J.S., Marine Propellers and Propulsion, Butterworth – Heinemann Ltd, 1994

- Murtedjo, M., Tahanan dan Propulsi, Modul Kuliah, Jurusan Teknik Kelautan ITS, 2002
- Rawson, K.J. and Tupper, E.C., Basic Ship Theory Vol. I, Butterworth-Heinemann, Woburn, 2002
- Bhattacharyya, R., Dynamics of Marine Vehicles, John Wiley & Sons Inc., New York, 1978

Additional:

- Manual Maxsurf
- Any text book, scientific papers, printed and electronic technical information related to the topics of resistance and powering of marine vessels.

Marine and Offshore Corrosion - MO18-4721

COURSE	Course Name : Marine and Offshore Corrosion
	Course Code : MO18-4721
	Credit : 3 sks
	Semester : VII

DESCRIPTION of COURSE

The course contains material on the basis of corrosion of the metal electrochemically, its method of prevention and application to the design of coastal and marine structures.

LEARNING OUTCOME

1. Demonstrating attitude of responsibility on work in his/her field of expertise independently
2. Working together to be able to make the most of his/her potential.
3. Mastering the theoretical concepts of natural science and the principle of application of engineering mathematics in general;
4. Mastering the theoretical concepts of engineering sciences, engineering principles, and engineering design required in the field of ocean engineering in depth;
5. Competent to apply mathematics, science and engineering principles to create or modify models in the field of ocean engineering;
6. 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

COURSE LEARNING OUTCOME

1. Students can understand the corrosion behavior of the structure.
2. Students can understand the factors that cause corrosion.
3. Students can understand the basic theory of corrosion.
4. Students can recognize the types of corrosion and control
5. Students can calculate anode requirements for corrosion protection on coastal / offshore structures

MAIN SUBJECT

1. Corrosion Definition
2. Factors Causing Corrosion
3. The Basic Theory of Corrosion: Inner Energy; Chemical Theory; Electrical Theory; Polarization; Passivity
4. Types of Corrosion and Protection: Homogeneous Corrosion; Galvanized Corrosion; Corrosion Cracks; Well/Pitting Corrosion; Intergranular Corrosion; Selective Leaching; Erosion Corrosion; Stress Corrosion; Fatigue Corrosion; Biological Corrosion
5. Corrosion Response Application on structure: Offshore Pipeline; Onshore Pipelines; Offshore & Floating Structures

PREREQUISITES

Marine Chemistry, Marine Physics

REFERENCES

1. Kenneth, R.T, Corrosion for Students of Design and Engineering, Mc Graw Hill, New York, 1988.
2. Fontana, M.G., Corrosion Engineering, Mc Graw Hill International Editions, Singapore, 1987.

3. Widharto, S., Karat dan Pencegahannya, PT Pradnya Paramita, Jakarta, 1999.
4. Supomo, H., Diktat Korosi, jurusan Teknik Perkapalan FTK-ITS, 1998.
5. Parker, M.E, and E. G. Peattie, Pipeline Corrosion and Cathodic, third edition, Elsevier Science, USA, 1999

Risk Based Design - MO18-4722

COURSE	Course Name : Risk Based Design
	Course Code : MO18-4722
	Credit : 3 sks
	Semester : VII

DESCRIPTION of COURSE

Risk-Based Design Lecture includes a cluster of courses of choice Marine Building Materials in the Department of Marine Engineering FTK-ITS. Risk-Based Design of offshore installations has the following key issues for threatening hazards, analyzing cause and probability, analyzing unintentional scenarios, analytical calculations for escalation, escaping, evacuation and safety system rescue and emergency analysis, and risk control.This compulsory subject is indispensable because the offshore industry is a high-risk job exposed to major accidents such as fires, explosions, collisions and falling objects. The danger and its analysis are read in separate chapters. Mitigation and risk control as well, followed by an outline from alternative handling to risk modeling, in particular being addressed on structures associated with offshore structures and tankers production and storage.

LEARNING OUTCOME

1. Demonstrating attitude of responsibility on work in his/her field of expertsei independently; (S1.9)
2. Mastering the theoretical concepts of natural science and the principle of application of engineering mathematics in general; (P2.1)
3. Mastering the principles and methods of application required for ocean engineering covering coastal structures, ports and offshore structures for the management of marine resources and activities (P2.3)
4. Competent to apply mathematics, science and engineering principles to create or modify models in the field of ocean engineering; (KK3.1)
5. Competent to solve ocean engineering problems related to coastal structures, ports and offshore structures based on ocean engineering principles, by considering economic, security, public safety and environmental sustainability factors, including the ability to:
6. identify, formulate, analyze, and finding the problem sources in ocean engineering;
7. proposing the best solution for solving ocean engineering problems; and
8. select resources and utilize the most appropriate, effective, and efficient designing and engineering design tools in solving ocean engineering problems; (KK3.3)
9. Being able to demonstrate independent performance, quality, and measurable; (KU4.2)
10. Being able to implement sustainability principles and develop knowledge; (KU4.15)

COURSE LEARNING OUTCOME

1. Students are able to explain basic concepts of risk-based design (S1.9, P2.1, KU4.2)
2. Students are able to perform risk assessment procedures and techniques; (KK3.3, KU4.2)1
3. Students are able to apply appropriate risk assessment methods to evaluate an offshore building; (S1.9, P2.1, KK3.3, KU4.2)
4. Students are able to simulate the risk of offshore building; (S1.9, P2.1, KK3.3, KU4.15)

MAIN SUBJECT

1. Definition and Understanding of Risk
2. Concept of Probability Theory and Consequences
3. Simple System Network Model
4. Complex Network System Model
5. Method of Risk Assessment Qualitative, Semi Quantitative and Quantitative
6. Case Procedures and HAZOP (Hazard and Operability)
7. Fault Tree Analysis and Procedure (FTA)
8. Procedure and Case Study of ETA (Event Tree Analysis)
9. Procedure and Case Study of Bow Tie Analysis
10. Risk Management and Assessment
11. Design-Based Design for Offshore Building in accordance with Standard and Code
12. Safety Integrity

PREREQUISITES

-

REFERENCES

1. Vinnem, J. E. “Offshore Risk Assessment Vol 2. Principles, Modelling and Applications of QRA Studies”. 2014. Springer.
2. Pearce, R. (2011). Risk Control For Asset Managers. Northfield Information Services, INC.
3. Rausand, M. *System Reliability Theory*, 2nd ed, Wiley, 2005b.
4. Stamatelatos, M. W. V. *Fault Tree Handbook with Aerospace Applications*. NASA Headquarters Office of Safety and Mission Assurane, USA, 2002.
5. (ABS), A. B. S. (2001). *Principles of Risk Based Decision Making*. United States of America.
6. (API), A. P. I. (1993). Recommended Practice for Design and Hazards Analysis for Offshore Production Facilities, *API RP 14J*. Washington.
7. (API), A. P. I. (2005). Design and Analysis of Station Keeping Systems for Floating Structures, *Recommended Practive 2SK Third Edition*. Washington, D.C: API Publishing Services.
8. (DNV), D. N. V. (2002). *Marine Risk Assessment* (Offshore Technology Report No. 63).
9. (DNV), D. N. V. (2003). *Risk Management in Marine and Subsea Operations*. DNV-RP-H101: Det Norske Veritas.

Shipyard Technology and Management - MO18-4723

COURSE	Course Name : Shipyard Technology and Management
	Course Code : MO18-4723
	Credit : 3 sks
	Semester : 8

DESCRIPTION of COURSE

The course of this Dockyard Management includes a cluster of Marine Building Production courses at the Marine Engineering Department of FTK-ITS. This course material begins with an introduction to the management of the shipyard as a place and. Followed by a description of a shipyard facility containing cranes, dry docks, slipway, dust-free warehouses, and other facilities. As well as discussions on control and production planning, material control, cost control, design control, process control, people's clock control and quality control, standards.

LEARNING OUTCOME

1. Demonstrating attitude of responsibility on work in his/her field of expertsei independently; (S1.9)
2. Mastering the theoretical concepts of natural science and the principle of application of engineering mathematics in general; (P2.1)
3. Mastering the principles and methods of application required for ocean engineering covering coastal structures, ports and offshore structures for the management of marine resources and activities; (P2.3)
4. Competent to apply mathematics, science and engineering principles to create or modify models in the field of ocean engineering; (KK3.1)
5. Competent to design ocean structures that include coastal structures, ports and offshore structures for manageming of marine resources and activities by considering the applied standards, codes and regulations and taking account of economic, security, public safety and environmental sustainability factors; (KK3.2):
6. Competent to solve ocean engineering problems related to coastal structures, ports and offshore structures based on ocean engineering principles, by considering economic, security, public safety and environmental sustainability factors, including the ability to:
    1) identify, formulate, analyze, and finding the problem sources in ocean engineering;
    2) proposing the best solution for solving ocean engineering problems; and
    3) select resources and utilize the most appropriate, effective, and efficient designing and engineering design tools in solving ocean engineering problems; (KK3.3)
7. Being able to demonstrate independent performance, quality, and measurable; (KU4.2)
8. 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; (KU4.15)

COURSE LEARNING OUTCOME

1. Students are able to explain basic concepts of Dockyard Management (S1.9, P2.1, KU4.2)

2. Students are able to understand and explain shipyard facilities; (KK3.3, KU4.2)
3. Students are able to understand the procedures and can implement control and production planning, material control, cost control in the shipyard (S1.9, P2.1, KK3.3, KU4.2)
4. Students are able to understand and control the person's hours and quality control, standard setting of work and also (S1.9, P2.1, KK2.3, KU4.15)
5. Students are able to understand the procedure and can perform the description of survey type based on standard and code; (S1.9, P2.1, KK3.3, KU4.15).

MAIN SUBJECT

1. The basic concept of dockyard management
2. Production Planning Control
3. Material Control
4. Cost Control
5. Design ControL
6. Process Control
7. Man hour Control
8. Quality Control
9. Working Standard
10. Survey Type Based on Standard and Code

PREREQUISITES

-

REFERENCES

- Corder, A., Teknik Manajemen Pemeliharaan Industri, Erlangga, Jakarta, 1996.
- (DNV), D. N. V. 2003. Risk Management in Marine and Subsea Operations. DNV-RP-H101. Det Norske Veritas.
- Handoyo, J.J., Manajemen Perawatan Kapal, Djangkar, 2016
- Paik, J. K., Thayamballi, A. K. Ship Shaped Offshore Installations: Design, Building and Operation. Cambridge University Press, 2007.
- STANDARDS, A. 2004. Risk Management Guidelines Companion to AS/NZS 4360:2004, Standards Australia/Standards New Zealand.
- Sasono, H. B.,MANAJEMEN KAPAL NIAGA TEORI, APLIKASI DAN PELUANG-PELUANG BISNIS. Andi Publisher. 2014.
- Taylor, M. (2006). Safety Services. Guidance on Accident, Incident and Near Miss Investigation.. Safety Guidance Version 1.5. The University of Manchester.

Under Water System and Work - MO18-4724

COURSE	Course Name : Under Water System and Work
	Course Code : MO18-4724
	Credit : 3 sks
	Semester : 8

DESCRIPTION of COURSE

The course of UNDER WATER SYSTEM AND WORK is one of the applied subjects in the Department of Ocean Engineering FTK-ITS. This course discusses about the principles of design technologies related to underwater systems and work. The aims of this course is to be a basic knowledge and skills that must be owned for ocean engineering graduated in order to answer the challenges of underwater work and utilization of marine resources.

LEARNING OUTCOME

1. Mastering the theoretical concepts of engineering sciences, engineering principles, and engineering design required in the field of ocean engineering in depth; (P 2.2)
2. Having the insight into the latest technology development in the field of ocean engineering; and; (P 2.7)
3. Competent to apply mathematics, science and engineering principles to create or modify models in the field of ocean engineering; (KK 3.1)
4. Competent to follow and understand the latest technological developments in the field of ocean technology in the framework of lifelong learning; (KK 3.5)
5. Being able to apply logical, critical, systematic and innovative thinking in the context of development or implementation of science and technology that concerns and implements the value of humanities in accordance with their area of expertise; (KU 4.1)
6. 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 uploaded it in the college page; (KU 4.3)
7. Working together, having social sensitivity and caring for community and environment (S 1.6)

COURSE LEARNING OUTCOME

1. Students are able to understand the theoretical concepts of science-engineering and engineering principles of marine and energy resources; (P 2.2)
2. Students are able to design and innovate in the development or implementation of science and technology related to system and underwater work (KU 4.1)
3. Students are able to examine the implications of developing or implementing science related to systems and underwater work in order to obtain solutions, ideas, designs or art criticisms, and to prepare scientific descriptions of the results of their studies in the form of thesis or final project report, and upload them on the university page ; (KU 4.3)

MAIN SUBJECT

- Students are able to understand the basics of diving, diving physicology, underwater work and making diving operations.

- Students understand the problems and relative advantages of underwater vehicles
- Students designing underwater works
- Students understand how to do under water Non Destructive Test
- Students understand future development

PREREQUISITES

Passed Welding Course

REFERENCES

Book :

1. Occupational diving work, Code of Practice 2005, This preserved code commences on 1 January 2012. (https://www.worksafe.qld.gov.au/__data/assets/pdf_file/0010/58177/occupational-diving-work-cop-2005.pdf
2. UNDERWATER WELDING AND CUTTING, Module of doctoral study: Advanced production technologies Academic year: 2014/2015 rev 2016. (https://www.fsb.unizg.hr/usb_frontend/files/1465217921-0-underwaterweldingandcuttinggaraikouh_rev2.pdf)
3. Diving and Underwater Technology, Civil Engineering. (http://www.unizd.hr/Portals/30/doc_meetings/Tony%20Tapp.pdf)
4. Underwater Wireless Sensor Communications.

Ocean Industrial Management - MO18-4725

COURSE	Course Name : Ocean Industrial Management
	Course Code : MO18-4725
	Credit : 3 sks
	Semester : 8

DESCRIPTION of COURSE

This Industrial Management course includes a cluster of Marine Building Production courses in the Department of Marine Engineering FTK-ITS. This course begins with an introduction to industrial management that contains the functions and levels of management within the organization. Analyze techniques and production processes based on inventory, demand and time measurement methods, direct and indirect time methods. Then followed by a discussion of project management which consists of planning, supply and implementation. The next section was introduced about construction management along with computer applications to calculate project costs. Followed by analyzing network planning on a project with CPM and PDM methods and simulating with Ms Project and Primavera.

LEARNING OUTCOME

1. Demonstrating attitude of responsibility on work in his/her field of expertise independently
2. Mastering the theoretical concepts of natural science and the principle of application of engineering mathematics in general;
3. Mastering the principles and methods of application required for ocean engineering covering coastal structures, ports and offshore structures for the management of marine resources and activities;
4. Competent to apply mathematics, science and engineering principles to create or modify models in the field of ocean engineering;
5. Competent to design ocean structures that include coastal structures, ports and offshore structures for manageming of marine resources and activities by considering the applied standards, codes and regulations and taking account of economic, security, public safety and environmental sustainability factors;
6. Competent to solve ocean engineering problems related to coastal structures, ports and offshore structures based on ocean engineering principles, by considering economic, security, public safety and environmental sustainability factors, including the ability to:
7. identify, formulate, analyze, and finding the problem sources in ocean engineering;
8. proposing the best solution for solving ocean engineering problems; and
9. select resources and utilize the most appropriate, effective, and efficient designing and engineering design tools in solving ocean engineering problems;
10. Being able to demonstrate independent performance, quality, and measurable
11. Being able to implement sustainability principles and develop knowledge:

COURSE LEARNING OUTCOME

1. Students are able to explain the basic concepts of technical economics (S1.9, P2.1, KU4.2)
2. Students are able to compare alternative solutions and choose the best investment; (KK3.3, KU4.2)
3. Students are able to apply the best methods appropriate to evaluate a project; (S1.9, P2.1, KK3.3, KU4.2)
4. Students are able to simulate project activities in Ms. software. Project and Ms. Excel; (S1.9, P2.1, KK3.3, KU4.15)

MAIN SUBJECT

1. The basic concept of technical economics
2. Interest, the formula of rates and types of rates
3. Type of Investment
4. Procedure Analysis of Net Present Value
5. Calculation and analysis of rate of return
6. Break even analysis, sensitivity analysis, and risk analysis
7. Depreciation
8. Capital Recovery Analysis
9. Project Management Principles and Procedures
10. Project Scheduling Method
11. Network Planning Analysis

PREREQUISITES

-

REFERENCES

1. Leland T. Bank, Anthoy J. Tarquin. *"Engineering Economy"* Fourth Edition, McGraw-Hill International Edition, 1998.
2. Pujawan, N. I.,"*Manajemen Industri*", 2nd ed.,Guna Widya. 2009.
3. Husen, A. "*Manajemen Proyek: Perencanaan, Penjadwalan & Pengendalian Proyek*". Andi Publisher. 2011.
4. William G. Sulivan, Elin M.Wicks, S. Patrick Koelling.," *Engineering Economy*". 14th Edition Pearson Prentice Hall, 2009.

Deepwater Engineering - MO18-4734

COURSE	Corse Name : Deepwater Engineering
	Course Code : MO18-4734
	Credit : 3 sks
	Semester : 8 – Elective Course
DESCRIPTION OF COURSE	
This course Deepwater Engineering is an elective course and teaches students to understand the basic principles, types of activities and the characteristics of offshore structural engineering structures for the deep sea, both to support oil and gas operations and for other activities. The material is divided as follows: an introduction to deep water engineering, deep water drilling and production systems, deep water structures, subsea engineering, and offshore aquaculture.	
LEARNING OUTCOME	
ATTITUDE	1. Internalizing values, norms and academic ethics; (S8) 2. Demonstrating attitude of responsibility on work in his/her field of expertsei independently (S9); 3. Trying his/her best to achieve perfect results (S11); 4. Working together to be able to make the most of his/her potential (S12);
KNOWLEDGE	1. Mastering the theoretical concepts of engineering sciences, engineering principles, and engineering design required in the field of ocean engineering in depth (P2); 2. Mastering the principles and methods of application required for ocean engineering covering coastal structures, ports and offshore structures for the management of marine resources and activities (P3); 3. Mastering the concept and principles of environmental conservation (P4) 4. Mastering the concepts and principles of occupational safety and health in the laboratory and in the field;; (P5) 5. Mastering general concepts, principles, and communication techniques for specific purposes; (P6) 6. Having the insight into the latest technology development in the field of ocean engineering (P7); 7. Mastering the concept of academic integrity in general, among others, able to understand the meaning and concept of plagiarism specifically, in terms of the type of plagiarism, the consequences of violations and prevention efforts (P8)
SPECIAL SKILL	1. Competent to apply mathematics, science and engineering principles to create or modify models in the field of ocean engineering 2. Competent to design ocean structures that include coastal structures, ports and offshore structures for manageming of

	marine resources and activities by considering the applied standards, codes and regulations and taking account of economic, security, public safety and environmental sustainability factors (KK2) ; 3. Competent to solve ocean engineering problems related to coastal structures, ports and offshore structures based on ocean engineering principles, by considering economic, security, public safety and environmental sustainability factors, including the ability to: 7) identify, formulate, analyze, and finding the problem sources in ocean engineering; 8) proposing the best solution for solving ocean engineering problems; and 9) select resources and utilize the most appropriate, effective, and efficient designing and engineering design tools in solving ocean engineering problems; (KK3); 4. Competent to follow and understand the latest technological developments in the field of ocean technology in the framework of lifelong learning (KK5);
GENERAL SKILL	1. Being able to apply logical, critical, systematic and innovative thinking in the context of development or implementation of science and technology that concerns and implements the value of humanities in accordance with their area of expertise (KU1); 2. Being able to demonstrate independent performance, quality, and measurable performance (KU2); 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 uploaded it in the college page, (KU3) 4. 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; (KU7) 5. Being able to conduct self-evaluation process to work group under his/her responsibility, and able to manage learning independently (KU8) 6. Competent to understand and realize academic integrity in general and prevent plagiarism; (KU11) 7. Being able to implement information and communication technology (ICT) in the context of implementation of his/her work; (KU12) 8. Being able to develop themselves and compete in national and

	international level; (KU14) 9. Being able to implement sustainability principles and develop knowledge; (KU15) 10. Competent to implement information and communication technology in the field (KU16)technology in the context of implementation of its work (KU16)

COURSE LEARNING OUTCOME

- GOAL:
  - Students are able to understand, explain, analyze and develop engineering on deep sea structures.
- Competencies:
  - Students are able to understand the basic concept of developing new technology especially deep sea technology;
  - Students are able to understand the concept of technology fordeep sea drilling and productionsystem
  - Students are able to understand the engineering of deep sea structures;
  - Students are able to understand technology and subsea engineering
  - Students are able to understand and explain aquaculture technology.

MAIN SUBJECTS

- Introduction to Deepwater Engineering (2x3x50 minute2)
  a. Deepwater Environment: hydrodynamics, geology, survey, marginal field.
  b. Structural dynamics
  c. Structural Reliability
- Deepwater **Drilling & Production System (3x3x50 minutes)**
  a. Drilling and Production Risers.
  b. Dynamic Positioning
  c. Open Water Operations: Remotely operated vehicles.
  d. Subsea Wellheads & Templates
  e. BOP System.
  f. Deepwater Subsea Pipeline
- Deepwater Ocean Structure (4x3x50 minutes)
  a. Compliant Structure: SPAR, Guyed Tower, TLP, etc
  b. Floating Structure: Semisubmersible, FPSO/ FLNG, Buoy, etc
  c. Novel and small field offshore structure
- Subsea Engineering (2x3x50 minutes)
  a. Introduction to Subsea Engineering
  b. Subsea Production System
  c. Subsea Production Control System
  d. Subsea Distribution System
  e. Subsea Positioning & Installation
- Offshore Aquaculture (3x3x50 minutes)
  a. Introduction of offshore aquaculture: food-securities, fishery development, roles and development
  b. Design Consideration and Conceptual: Innovation and novel design
  c. International regulations, codes and standards
  d. Building, Positioning, installation and Operation
  e. Marine aquaculture: economic and spatial analysis

f. Marine Aquaculture: environment and sustainable development

PREREQUISITES

1. Mechanics of Sea Wave (MO18-4406)
2. Dynamics Structure (MO18-4502)

MAIN REFERENCES

1. Subrata K. Chakrabarti:Handbook of Ocean Engineering, Elsevier, London, 2005.
2. Bai, Yong, Marine Structural Design, Elsevier, NY, 2003
3. Bai, Yong, Pipeline and Risers, Elsevier, NY, 2001
4. Bai, Yong, Subsea Engineering Handbook, NY, 2012
5. Moan, T, Safety of Offshore Structures, Centre for Offshore Research & Engineering, NUS, 2004
6. Bhattacharyya, R. Dynamics of Marine Vehicles, John Wiley & Sons Inc., New York, 1978
7. Pinkster, J. A., Low Frequency Second Order Wave Exciting Forces on Floating Structures, MARIN Publication No. 600, Wageningen, 1980
8. Patel, Minoo H, Dynamics of Offshore Structures, London, 1989
9. Patel, Minoo H, Compliant Offshore Structures, London, 1991
10. Lloyd, A.R.J.M., Ship Behaviour in Rough Weather, Ellis Horwood Ltd., Chichester, UK, 1989
11. Faltinsen, O.M., Sea Loads on Ships and Offshore Structures, Cambridge University Press, 1993
12. Paik, JK and Thayamballi, Anil Kumar, Ship-Shaped Offshore Installation: Design, Building and Operation, Cambridge, 2007
13. Moan, T, Design of Marine Structures; Conceptual Design, Vol2
14. Bjerke, H.J. :Subsea Challenges in Ice-Infested Waters, USA-Norway Arctic Petroleum Tchnology Workshop, 2009.
15. ISO, Petroleum and Natural Gas Industries-Design and Operation of the Subsea Production Systems, Part 1: General Requirements and Recommendations, ISO, 2005, 13628-1.
16. Pierobon, Leonardo: Novel design methods and control strategies for oil and gas offshore power systems, Denmark, 2015
17. FAO, Aquaculture operations infloating HDPE cages, A field handbook, Rome, 2015
18. Helga Gunnlaugsdóttir, et all, Offshore Aquaculture: Development, building and testing of a deep water mooring system, Norway, 2013
19. YeyesMulyadi, NurSyahroni, KriyoSambodho, m Zikra, Haryo D.A, "KerambaJaringApung(KJA) tradisionaluntukBudidayaIkandan Lobster",Edisi-1, 2017.
20. Djatmiko, E. B.PerilakudanOperabilitasBangunanLautdiatasGelombangAcak. Surabaya: ITS Press, 2012
21. Benetti, D. D. Site Selection Criteria for Open Ocean Aquaculture. The Marine Technology Society Journal. Sustainable U.S. Marine Aquaculture Expansion in the 21st Century, 2010
22. De Cew, Judson et al.. Assessment of a Mooring System for Offshore

Aquaculture. World Aqua Culture Society. Baton Rouge, LA, USA, 2012.

ADDITIONAL REFERENCES

1. ABS: Guidance Notes On Review And Approval Of Novel Concepts, NY, 2017
2. ABS: Guidance Notes On Qualifying New Technologies, NY, 2017
3. ABS: Design Guideline for Stationkeeping Systems of Floating Offshore Wind Turbines, 2013
4. ABS: Rules for Building and Classing FPI, 2014
5. Alexandsratos, N. and J. Bruinsma, 2012.World Agriculture Towards 2030/2050: The 2012 Revision. Rome, FAO.
6. Food and Agricultural Organization of the United Nations. 2011. FAO Food Outlook: Global Market Analysis. FAO Trade and Markets Division Report. Rome, FAO. 1856 pp.
7. Kapetsky, J.M., Aguilar-Manjarrez, J. &Jenness, J. 2013. A global assessment of potential for offshore mariculture development from a spatial perspective. FAO Fisheries and Aquaculture Technical Paper No. 549. Rome, FAO. 181 pp.
8. Journals, papers and Proceedings.

Port Planning and Management - MO18-4741

COURSE	Corse Name **: Port Planning and Management**
	Course Code : MO18-4741
	Credit : 3 sks
	Semester : 7 (seven) – Elective Course
DESCRIPTION OF COURSE	
The course of Port Planning and Management is a course on the concept of port planning, port development and port management. In this course, students will be taught about the role and function of ports to calculate port capacity and productivity, terminal planning and facilities choices, and also port operation management. The learning targets of this course are students expected to be able to prepare feasibility studies, Port Master Plan, port development layout, design of port scantling and facilities, and to understand port operation management. The learning strategy applied is by lecture and discussion methods in the classroom, presentation, field trip to port. There is also both individual and group assignments as well as exams at the middle and end of the semester to evaluate how deep the level of understanding and analytical skills of students about port planning and port management.	
LEARNING OUTCOME	
ATTITUDE	1. Internalizing values, norms and academic ethics; (S8) 2. Demonstrating attitude of responsibility on work in his/her field of expertsei independently (S9); 3. Trying his/her best to achieve perfect results (S11); 4. Working together to be able to make the most of his/her potential (S12);
KNOWLEDGE	1. Mastering the theoretical concepts of engineering sciences, engineering principles, and engineering design required in the field of ocean engineering in depth (P2); 2. Mastering the principles and methods of application required for ocean engineering covering coastal structures, ports and offshore structures for the management of marine resources and activities (P3); 3. Mastering the concept and principles of environmental conservation (P4) 4. Having the insight into the latest technology development in the field of ocean engineering (P7); 5. Mastering the concept of academic integrity in general, among others, able to understand the meaning and concept of plagiarism specifically, in terms of the type of plagiarism, the consequences of violations and prevention efforts (P8)
SPECIAL SKILL	1. Competent to apply mathematics, science and engineering principles to create or modify models in the field of ocean engineering 2. Competent to design ocean structures that include coastal structures, ports and offshore structures for manageming of marine resources and activities by considering the applied standards, codes and regulations and taking account of economic, security, public safety and environmental sustainability factors (KK2) ;

	3. Competent to solve ocean engineering problems related to coastal structures, ports and offshore structures based on ocean engineering principles, by considering economic, security, public safety and environmental sustainability factors, including the ability to: a. identify, formulate, analyze, and finding the problem sources in ocean engineering; b. proposing the best solution for solving ocean engineering problems; and c. select resources and utilize the most appropriate, effective, and efficient designing and engineering design tools in solving ocean engineering problems; (KK3); 4. Competent to follow and understand the latest technological developments in the field of ocean technology in the framework of lifelong learning (KK5);
GENERAL SKILL	1. Being able to apply logical, critical, systematic and innovative thinking in the context of development or implementation of science and technology that concerns and implements the value of humanities in accordance with their area of expertise (KU1); 2. Being able to demonstrate independent performance, quality, and measurable performance (KU2); 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 uploaded it in the college page, (KU3) 4. 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; (KU7) 5. Being able to conduct self-evaluation process to work group under his/her responsibility, and able to manage learning independently (KU8) 6. Competent to understand and realize academic integrity in general and prevent plagiarism; (KU11) 7. Being able to implement information and communication technology (ICT) in the context of implementation of his/her work; (KU12) 8. Being able to develop themselves and compete in national and international level; (KU14) 9. Being able to implement sustainability principles and develop knowledge; (KU15) 10. Competent to implement information and communication technology in the field (KU16)
COURSE LEARNING OUTCOME	
• GOAL: – To make the students are able to understand, and explain the concept of port planning and management, and able to analyze the layout and repons of the	

port structure.

- Competencies:
  - Students are able to understand the functions, roles, and types of ports;
  - Students are able to understand the operational and concept of port planning
  - Students are able to prepare a feasibility study and master plan of a port
  - Students are able to design and analyze the layout and structure of the port;
  - Students are able to understand operation management, competition and harbor environment.

MAIN SUBJECTS

1. An introduction to Port planning: Functions, roles and types of ports; Ship and Shipping; the flow of goods and ships traffics. [**1x3x50 minutes**]
2. Port operation: Cargo handling, loading and unloading system, loading and unloading equipment, **[1x3x50 minutes]**
3. Port Design Criteria: survey, environmental data analysis, tidal, wind, current and wave, soil mechanics; [**1x3x50 minutes**]
4. Port Planning: Integrated port planning principles, Planning Procedures, Port strategic planning; **[1x3x50 minutes]**
5. Feasibility Study and Port Master Plan: Preparation of feasibility study, layout planning, layout evaluation, development stage, port development concept, port development strategy; port development analysis; **[2x3x50 minutes]**
6. Port capacity and productivity: Concept and application of port capacity calculation; Port productivity, port productivity measurement theory, port capacity evaluation; [**2x3x50 minutes]**
7. Structure Terminal Planning: Port requirements and equipment, Selection of port location; Technical requirements of port planning; port structures design; berthing facility planning; shore facility planning; the shipping channel criteria; ship maneuvering at port; navigation buoys; **[3x3x50 minutes]**
8. Construction, operation and reparation of port; **[1x3x50 minutes]**
9. Port Management: Port operational management; model of port operational systems, ports competition; Port privatization and ownership; port environmental management **[2x3x50 minutes]**

PREREQUISITES

1. Oceanography (MO18-4303)
2. Soil mechanics and foundation design (MO18-4402)
3. Mechanics of Sea Wave (MO18-4406)
4. Structures of Coastal Protection (MO18-4501)
5. Design of Coastal Structures (MO18-4503)

MAIN REFERENCES

1. Thorensen, Carl A, Port Designers Handbook: Recommendations and Guidelines, Thomas Telford, 2003
2. Velsink, H, Ports and Terminals – Planning and Functional Design, TU Delft, 1993
3. Frankel, Ernst G, Port Planning Development, John Willey & Sons, 1987
4. Brita-Albez, Modeling and Simulation, Springer Verlag London, 2007
5. Hagerschou, Hans dkk, Planning and design of Port and Marine Terminals, 2nd

Edition, Thomas Telford, London, 2004
6. Jurgen W. Bose, Handbook of Terminal Planning, Springer-Science, Hamburg, 2001
7. World Bank, Alternative Port Management Structures and Ownership models, Port Reform Toolkits, 2nd Edition, Module 3, 2007
8. Frankel, Ernst G, Port Planning Development, John Willey & Sons, 1987
9. OECD, Port Competition and Hinterland Connection, Joint Transport Research Centre, Paris, 2008
10. Prajudo, Setjo. Manajemen Pelabuhan, Diktat Kuliah, Fakultas Teknologi Kelautan, ITS Surabaya, 2007.

ADDITIONAL REFERENCES

1. UNCTAD, Port Development A Handbook For Planners in Developing Countries, 2nd Edition, New York, 1985
2. Department of Transportation, Standard Design Criteria For Ports In Indonesia, Jakarta 1987.
3. The Technical Standards and Commentaries of Port and Harbor Facilities in Japan,2012
4. SNI-03-2847-2002 Tata-Cara-Perencanaan-Struktur-Beton-Untuk-Bangunan-Gedung
5. SNI-03-1729-2002-Tata-Cara-Perencanaan-Struktur-Baja-Untuk-Bangunan-Gedung
6. Peta Gempa Indonesia 2010 Surat Edaran Menteri Pekerjaan Umum 12/SE/M/2010
7. Journals, papers and Proceedings.

Geographical Information System and Remote Sensing - MO18-4742

COURSE	Course Name : Geographical Information System and Remote Sensing
	Course Code : MO18-4742
	Credit : 3 sks
	Semester : 8

COURSE DESCRIPTION

Mata kuliah ini mengenalkan pengetahuan cartographic dari proyeksi peta dan prinsip-prinsip INDERAJA kepada mahasiswa pemula di bidang ini. Dimana kuliah ini memberikan pemahaman tentang physics dari INDERAJA, Teknik Aerial Photographic , photogrametry, multispectral, hyperspectral dan thermal imaging. Serta mengenalkan tentang teknologi pengolahan image RADAR dan LIDAR ditambah dengan memberikan pengenalan tentang skala peta, system koordinat dan keakuratan pemetaan, pengenalan dan identifikasi data geografis: posisi, atribut, hubungan spatial, retrieving data, manipulasi data, analisa dan menampilkan spatially-referenced data. Dalam kuliah ini mahasiswa juga diberikan pemahaman mengenai aplikasi SIG dan INDERAJA khususnya untuk pengelolaan wilayah pesisir dan manajemen bencana

LEARNING OUTCOMES

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. Mastering the theoretical concepts of natural science and the principle of application of engineering mathematics in general;
6. Mastering the theoretical concepts of engineering sciences, engineering principles, and engineering design required in the field of ocean engineering in depth;
7. Having the insight into the latest technology development in the field of ocean engineering;
8. Competent to apply mathematics, science and engineering principles to create or modify models in the field of ocean engineering;
9. Competent to follow and understand the latest technological developments in the field of ocean technology in the framework of lifelong learning.
10. Competent to do an adaptation, co-operation, creation, contribution and innovation to apply science in the life and become global educated person
11. Being able to implement information and communication technology (ICT) in the context of implementation of his/her work

COURSE LEARNING OUTCOMES

- Students can explain the physics and system of Remote Sensing
- Students can explain the priciples of Map Projection
- Students can explain technique to obtain data and analysis of RADAR and LIDAR data
- Students can analyze simple data using opensource software (MultiSpec dan GRASS)
- Students can combine GIS technique and Remote Sensing to solve simple problems in

coastal management and coastal hazard management

MAIN SUBJECT

1. Remote Sensing as Technology and Its Histories
2. Physical Properties, interaction, measumenets and Reflector target anaysis
3. Equipments in Remote Sensing, , aerial photography and processes
4. Elements of visual interpretation, multispectral and hyperspectral systems
5. Principles of thermal radiation and thermal imaging
6. RADAR transmission characteristics, passive image microwave sensing/ LIDAR interpretation
7. Remote Sensing for vegetation, water, soil and geomorphology, introduction to MultiSpec
8. Introduction to GIS, GIS component, GRASS Introduction
9. GRASS Project and Discussion
10. GIS Model data: Vector model and Raster Model
11. GIS Model data: Vector vs Raster Model
12. Spatial Data Analysis
13. Spatial Data Analysis and Analytical Model in GIS
14. Future of GIS, GIS for coastal management and coastal hazard management

PREREQUISITES

- Calculus I dan II
- Physics
- Computer Programming

REFERENCE

Main

- Jensen, John, R., 2000, Remote Sensing of the Environment: An Earth Resources Perspective, New jersey: Prentice Hall, ISBN: 0-13-489733-1
- Neteler, M and Mitasova, H., 2005, Neteler, M and Mitasova, H., 2005, OPEN SOURCE GIS: A GRASS GIS APPROACH Second Edition, Kluwer Academic Publishers
- Shamsi, U.M., 2005, GIS applications for water, wastewater, and stormwater systems, Taylor and Francis, London
- MULTISPEC, https://engineering.purdue.edu/~biehl/MultiSpec/
- GRASS (Geographic Resources Analysis Support System), http://grass.fbk.eu/

Additional

- John A. Richards and Xiuping Jia, Remote Sensing Digital Image Analysis
- GIS for sustainable development, edited by Michele Campagna
- GIS for coastal zone management, edited by Darius J. Bartlett and Jennifer L. Smith
- Environmental Modelling with GIs and Remote Sensing, edited by Andrew Skidmore

Dredging and Reclamation- MO18-4746

COURSE	Course Name : Dredging and Reclamation
	Course Code : MO18-4746
	Credit : 3 sks
	Semester : VIII

DESCRIPTION of COURSE

This course discussthe varios Dredging Equipments used for Capital Dredging as well as Maintenance Dredging. The Reclamation project will also be discussed, including goverment rules, guidelines and processes.

LEARNING OUTCOME

1. Demonstrating attitude of responsibility on work in his/her field of expertise independently
2. Working together to be able to make the most of his/her potential.
3. Mastering the theoretical concepts of natural science and the principle of application of engineering mathematics in general;
4. Mastering the theoretical concepts of engineering sciences, engineering principles, and engineering design required in the field of ocean engineering in depth;
5. Competent to apply mathematics, science and engineering principles to create or modify models in the field of ocean engineering;
6. 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

COURSE LEARNING OUTCOME

1. Students know the type of various dredging equipments and how to dispose the dredging materials wirhout harming the environment
2. Students understand the processes that occur in the dredging and reclamation projects
3. Students are able to design reclamation project with existing environmental data and technical considerations
4. Students understand the operation of dredging equipments and how to monitor the dredging progress

MAIN SUBJECTS

In this course students will study the following topics:

1) Dredging
   - Dredging Equipments.
   - Design of Dredging Projects
   - Dredging.Volume Analysis
   - Quality and environmental regulations related to dredging projects.
2) Hydrodynamics and water quality.
   - Flow processes in the dredging equipments.
   - Initial dilution
   - Secondary dispersion and decay.
3) Reclamation
   - Review of govermental rules and bylaw, Env. Impact Analysis
   - Review of environmental data collection.
   - Embankment material selection.

- Settlement Analysis
- Coastal protection design and construction
- Operational and maintenance

PREREQUISITES

Fluid Mechanics,
Design of Coastal Structures
Soil Mechanics and Foundation
Hidrodynamics

REFERENCES

Main

1. Bray, RN and Cohen, M. 2010. Dredging for Development, IADC and IAPH Joint Publication
2. Vlasbloom (2003). Dredging Equipments
3. Bray, RN (Editor) 2008. *Environmental Aspects of dredging*. IADC/CEDA-Taylor & Francis. International Association of Dredging Companies (IADC). 2014 .*Facts About Backhoe Dredgers*, Number 3
4. Kurniawan Ali R., Wulandari Surono. 2013. *Model Reklamasi Tambang Rakyat Berwawasan Lingkungan : Tinjauan Atas Reklamasi Lahan Bekas Tambang Batu Apung Ijobalit, Kabupaten Lombok Timur, Propinsi Nusa Tenggara Barat*. Jurnal Teknologi Mineral dan Batubara. Vol. 9 No. 3/IX. Hal 165-174.

Additional

1. Peraturan menteri perhubungan no.52 tahun 2011 tentang pengerukan dan reklamasi
2. Peraturan menteri pekerjaan umum no.40 tahun 2007 tentang pedoman perencanaan tata ruang dan reklamasi
3. Peraturan presiden no.122 tahun 2012 tentang reklamasi di wilayah pesisir dan pulau pulau kecil.
4. Undang undang no.27 tahun 2007 dan no.1 tahun 2014 tentang pengelolaan wilayah pesisir dan pulau pulau kecil
5. Departemen Kelautan dan Perikanan, 2001, Pedoman Umum Pengelolaan Pulau-pulau Kecil yang Berkelanjutan dan Berbasis Masyarakat, Jakarta: Ditjen Pesisir dan Pulau-pulau Kecil.
6. Departemen Pekerjaan Umum Direktorat Jenderal Penataan Ruang, Peraturan Menteri Pekerjaan Umum No. 40/PRT/M/2007 tentang Kawasan Reklamasi Pantai, Jakarta, 2007.
7. Yuwono, Nur, “Materi Bahasan Reklamasi”, Makalah Lokakarya Nasional Pengelolaan Jasa Kemaritiman dan Kelautan, DKP, Jakarta, 20 Juni 2007.

Ocean Outfall - MO18-4751

COURSE	Course Name : Ocean Outfall
	Course Code : MO18-4751
	Credit : 3 sks
	Semester : VIII

DESCRIPTION of COURSE

Ocean Outfall course contains material about the design of pipeline for waste disposal to the sea.

LEARNING OUTCOME

7. Demonstrating attitude of responsibility on work in his/her field of expertise independently
8. Working together to be able to make the most of his/her potential.
9. Mastering the theoretical concepts of natural science and the principle of application of engineering mathematics in general;
10. Mastering the theoretical concepts of engineering sciences, engineering principles, and engineering design required in the field of ocean engineering in depth;
11. Competent to apply mathematics, science and engineering principles to create or modify models in the field of ocean engineering;
12. 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

COURSE LEARNING OUTCOME

5. Students know the conditions of waste disposal to the environment
6. Students understand the processes that occur in the ocean outfall pipeline
7. Students are able to design ocean outfall with existing environmental data and technical considerations
8. Students understand the operation of ocean outfall and how the maintenance process is

MAIN SUBJECTS

In this course students will study the following topics:

Introduction

- Definition of ocean outfall and marine treatment.
- Primary, secondary, and tertiary treatments.
- Comparison of several alternative treatments (treatment options).
- Quality and environmental regulations related to ocean outfall.

b) Hydrodynamics and water quality design.

- Flow processes in the outfall pipe.
- Initial dilution
- Secondary dispersion and decay.

c) Technical Design

- Review of environmental data collection.
- Pipeline material selection.
- Outfall construction
- Structural design.
- • Operational and maintenance

PREREQUISITES
Fluid Mechanics, Hidrodynamics
REFERENCES
1. Grace, R.A. “Marine Outfall Systems : Planning, design, and construction”. Prentice-Hall, New Jersey, 1978. 2. Water Research Centre (WRC). “Design Guide for Marine Treatment Schemes”. Volume I – IV, 1990. 3. Wood, I.R., Bell, R.G., and Wilkinson, D.L. “Ocean Disposal of Wastewater”. World Scientific, Singapore, 1993. 4. Gunnerson, C.G. (editor).”Wastewater Management for Coastal Cities : The ocean disposal option”. World Bank Technical Paper Number 77, Washington DC, 1988. 5. McGhee, T.J. “Water Supply and Sewerage”. McGraw-Hill, Inc. Sixth Edition, Singapore, 1991.

Marine Polution - MO18-4752

COURSE	Course Name : Marine Polution
	Course Code : MO18-4752
	Credit : 3 sks
	Semester : VII

DESCRIPTION of COURSE

The Marine Pollution course contains material on sources of pollution in the coastal and marine areas, their impact on the environment and methods of pollution prevention.

LEARNING OUTCOME

1. Demonstrating attitude of responsibility on work in his/her field of expertIse independently; (S1.9)
2. Working together, having social sensitivity and caring for community and environment; (S1.6)
3. Working together to be able to make the most of his/her potential; (S1.12)
4. Mastering the theoretical concepts of natural science and the principle of application of engineering mathematics in general; (P2.1)
5. Mastering the theoretical concepts of engineering sciences, engineering principles, and engineering design required in the field of ocean engineering in depth; (P2.2)
6. Mastering the concept and principles of environmental conservation; (P2.4)
7. Competent to apply mathematics, science and engineering principles to create or modify models in the field of ocean engineering; (KK3.1)
8. Competent to criticize the policy in solving environmental problems from the point of view of ocean engineering that has been and / or is being implemented, as outlined in the form of scientific papers; (KK3.4)
9. 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; (KU4.4)

COURSE LEARNING OUTCOME

1. Students understand the meaning of pollution
2. Students know the sources of pollution
3. Students understand the impact of pollution on the coastal and marine environment
4. Students are able to model the spread of marine pollution
5. Students understand the handling of pollution waste in the sea and beach.

MAIN SUBJECT

In this course students will study the following topics:

1. Introduction
   - Definition of pollution and pollution of beaches and sea
   - Pollution control in the context of integrated coastal management
   - Types of pollutants (pollutants)
   - Sources of pollution (land-based and marine-based pollution)
2. Principles in the analysis of coastal and marine pollution
   - Coastal and marine ecosystems interaction of pollutants with ecological entities Oceanography and its relationship to the behavior of pollutants in the sea
   - Impact of coastal and marine pollution
   - Fate and transport of pollutants on the beach and seaDefinition of molecular /

turbulent diffusion, advection, shear, dispersion

3. Case studies of coastal and marine pollution
    - Industrial drilling and oil production
    - Oil transportation (oil spills)
    - Transportation of passengers (boat waste)
    - Dredging of ports
    - Development of coastal cities (industrial and domestic waste)

PREREQUISITES

1. Fluid Mechanics,
2. Hidrodynamics

REFERENCES

1. Bishop, P. “Marine Pollution and Its Control”, Mc. Graw-Hill., Inc., USA, 1983.
2. Clark, R.B. “Marine Pollution” (4th ed), Oxford University Press Inc., Engleand, 1997.
3. Gunnerson, C.G. (editor).”Wastewater Management for Coastal Cities : The ocean disposal option”. World Bank Technical Paper Number 77, Washington DC, 1988.
4. McGhee, T.J. “Water Supply and Sewerage”. McGraw-Hill, Inc. Sixth Edition, Singapore, 1991.