DOCUMENTS CURRICULUM 2018

Graduate Program

Civil Engineering

Civil Engineering Department

Faculty of Civil Engineering, Environmental and Geo Engineering

Institut Teknologi Sepuluh Nopember

OUTLINE :

- **COURSE LIST**
- **SYLLABUS**

GRADUATE'S LEARNING OUTCOMES
ENGINEERING STUDY PROGRAM - CIVIL ENGINEERING
UNDERGRADUATE PROGRAM

EVERY GRADUATE OF
THE CIVIL ENGINEERING
UNDERGRADUATE PROGRAM
SHOULD HAVE THE FOLLOWING LEARNING OUTCOMES

1. ATTITUDES:

a. believe in the oneness of God and manifest religious attitude;
b. uphold the value of humanity in performing his/her duties based on religion, morality and ethics;
c. contribute in improvement of the quality of lives in his/her community, nation, state, and in advancement of civilization based on "Pancasila" (the Nation Five Basic Principles);
d. function as citizen who prides and loves his/her homeland, possess nationalism and responsibility to the country and nation;
e. appreciate the diversity of cultures, point of views, religions and beliefs, as well as of opinions or original findings of others;
f. work together with others and have social sensitivity and care for his/her community and environment;
g. law abiding and discipline on his/her functions in community and state;
h. internalize values, norms, and academic ethics;
i. manifest attitude of responsibility on work in his/her area of expertise, independently;
j. internalize spirit of independence, struggle, and entrepreneurship;
k. try his/her best to achieve perfect results; and
l. work together to make the most of his/her potential.

2. KNOWLEDGE

a. mastering the concepts of natural science and principles of engineering mathematics application on planning and design in the areas of : structural engineering, water resources engineering, geotechnical engineering, transportion engineering, and construction management;
b. mastering the theoretical concepts of engineering sciences, engineering principles, and engineering design required in the areas of: structural engineering, water resource engineering, geotechnical

engineering, transport engineering, and construction management;

c. mastering the principles and methods for applying regulations, standards, guidelines and manuals in the areas of structural engineering, water resources engineering, geotechnical engineering, transport engineering, and construction management;
d. mastering the concepts and principles of environmental conservation;
e. mastering the concepts and principles of occupational safety and health in laboratory and in field;
f. mastering the principles and current issues in economic and socio-cultural in general;
g. mastering the general concepts, principles, and communication techniques for specific purposes;
h. possessing insights of the development of cutting-edge technology and advanced materials in the areas of structural engineering, water resources engineering, geotechnical engineering, transport engineering, and construction management; and
i. mastering the concept of academic integrity in general and concept of plagiarism in particular, in terms of plagiarism type, violation consequences and its prevention efforts.

3. SPECIFIC SKILLS:

a. able to apply mathematics, science, and engineering principles to create or modify civil engineering models in the areas of structure, water resources, geotechnics, and transportation;
b. able to solve civil engineering problems related to structure, water resources, geotechnic, and transportation, including the ability to:
    1) identify, formulate, analyze, and locate the source of civil engineering problems;
    2) propose the best solution to solve civil engineering problems based on engineering principles, taking into account the factors of: economic, safety, public safety and environmental sustainability;
    3) plan and design infrastructure in the areas of: structural engineering (building with minimum eight-story high, and bridges with main span of minimum 60 meters), engineering of water resources (small dam of maximum 10 meter high, irrigation system for maximum of 3000 ha, drainage of area, and river and coastal structures), geotechnical engineering

(foundations, retaining walls, and soil improvement methods), and transportation engineering (roads, railways, ports and airports) based on engineering principles and taking into account technical standards, performance aspects, reliability, ease of implementation, sustainability, while also considering the factors of: economy, public safety, culture, social and environment;

4) select resources and utilize the results of engineering analysis based on information and computing technologies suitable for planning/design in the areas of: structural engineering, water resources engineering, geotechnical engineering, and transportation engineering;

c. able to supervise and control the construction implementation as the results of engineering planning and design, for namely: structural engineering, water resources engineering, geotechnical engineering, and transportation engineering, with reference to the prevailing codes, norms, standards, guidelines and manuals;
d. able to use the latest technology available in carrying out the work; and
e. able to criticize the policy on solving infrastructure problems, during or after their implementation, in the form of scientific papers.

4. GENERAL SKILLS:

a. able to apply logical, critical, systematic, and innovative thinking in the context of development or implementation of science and technology that also concerns and applies the value of humanities in accordance with his/her area of expertise;
b. able to demonstrate independent, qualified and measurable performances;
c. able to examine the implications of the development or implementation of science and technology that also concerns and applies the value of humanities in accordance with his/her expertise based on codes, procedures and scientific ethics in order to produce solutions, ideas, design, or art critic;
d. able to compose scientific descriptions of the results of his/her study in the form of undergraduate thesis or final project report, and upload them in the college homepage;

e. able to make decisions appropriately in the context of problem solving in his/her area of expertise based on the result of analysing information and data;
f. able to maintain and expand network with supervisors, colleagues, and peers from both inside and outside his/her institution;
g. able to take responsibility for the achievement of group work, and perform supervision evaluation on completion of work assigned to the workers under his/her responsibility;
h. able to conduct self-evaluation process to the work group under his/her responsibility, and able to manage independent learning;
i. able to document, store, secure and recover data to ensure validity and prevent plagiarism;
j. able to adapt, cooperate, be creative, contribute, and innovate in applying science to the social life and able to act as global citizen with global awareness;
k. able to uphold the academic integrity in general and prevent the practice of plagiarism;
l. able to implement information technology in the context of scientific development and expertise area implementation;
m. able to use at least one international language in oral and written communications;
n. able to develop his/herself and compete in national and international level;
o. able to implement the principles of sustainability to improve knowledge; and
p. able to apply entrepreneurship and understand technology-based entrepreneurship.

COURSE LIST

ENGINEERING STUDY PROGRAM - CIVIL ENGINEERING
UNDERGRADUATE PROGRAM
COURSE LIST

No.	Course Code	Course Title	Credits
		SEMESTER I	
1		Basic Mathematics 1	3
2		Basic Physics 1	4
3		Religion	2
4		Indonesian	2
5		Citizenship	2
6	RC18-4101	Basic Statistic	2
7	RC18-4102	Statically Determinate Structure	3
		Total of Credit	18
		SEMESTER II	
1		Basic Mathematics 2	3
2		Basic Physics 2	3
3		Chemistry	3
4		Pancasila	2
5		English	2
6	RC18-4201	Computer Programming	2
7	RC18-4202	Mechanic of Materials	3
		Total of Credit	18
		SEMESTER III	
1		Introduction Geopasial to Information	2
2	RC18-4301	Applied Mechanics and Structural Modelling	3
3	RC18-4302	Building Material Technology	4
4	RC18-4303	Fluid Mechanics and and Hydraulics	4
5	RC18-4304	Transportation and Traffic Design	3
6	RC18-4305	Civil Engineering Drawing	3
		Total of Credit	19
		SEMESTER IV	
1	RC18-4401	Steel Structure Element	3
2	RC18-4402	Concrete Structure Element	3
3	RC18-4403	Hydrology	3
4	RC18-4404	Railway Engineering	2

5	RC18-4405	Construction Management	2
6	RC18-4406	Soil Mechanic and Foundation	4
		Total of Credit	17
		SEMESTER V	
1	RC18-4501	Structure Steel Building	4
2	RC18-4502	Structure Concrete Building	3
3	RC18-4503	Drainage	3
4	RC18-4504	River Engineering	2
5	RC18-4505	Construction Equipment and Methods	3
6	RC18-4506	Embankment And Earth Retaining Structure	5
		Total of Credit	20
		SEMESTER VI	
1	RC18-4601	Bridge Engineering	2
2	RC18-4602	Design of Reinforced Concrete Building	2
3	RC18-4603	Irrigation and Water Structures	4
4	RC18-4604	Hydraulic Coastal Engineering and Port Planning	4
5	RC18-4605	Project Cost and Schedule Control	2
6	RC18-4606	Highway Design	5
		Total of Credit	19
		SEMESTER VII	
1		Insights and Technology Apllications	3
2	RC18-4701	Steel Bridges Design	2
3	RC18-4702	Decision Making Techniques	3
4	RC18-4703	Airport Planning and Design	2
5	RC18-4704	Academic Report Writing	2
6		Elective Course	6
		Total of Credit	18
		SEMESTER VIII	
1		Technopreneurship	2
2	RC18-4801	Procurement and Contract for Construction Project	2
3		Enrichment	3
4	RC18-4802	Internship	2
5	RC18-4803	Final Project	6
		Total of Credit	15

ELECTIVE COURSE LIST

No.	Course Code	Course Title	Credits
1	RC18-4705	Finite Element Method	3
2	RC18-4706	Ductile Design of Steel Structures	3
3	RC18-4707	Structural Dynamics	3
4	RC18-4708	Long Span Bridge Engineering	2
5	RC18-4709	Prestressed Concrete	2
6	RC18-4710	Advanced Foundation Engineering	2
7	RC18-4711	Dynamically Loaded Foundation	2
8	RC18-4712	Soil Improvement Method	2
9	RC18-4713	Geology Engineering	2
10	RC18-4714	Rock Foundation Engineering	2
11	RC18-4715	Design of Pipeline	2
12	RC18-4716	Design of Coastal Protection	2
13	RC18-4717	Water Resources Management	2
14	RC18-4718	Operation and Maintenance of Water Infrastructures	2
15	RC18-4719	Design of Dam	2
16	RC18-4720	Hydropower	2
17	RC18-4721	Highway Economy	2
18	RC18-4722	Passengers and Freight Transportation Facilities	2
19	RC18-4723	Demand Transportation Planning	2
20	RC18-4724	Railway Geometric	2
21	RC18-4725	Port Facilities	2
22	RC18-4726	Introduction to Infrastructure Asset Management	2
23	RC18-4727	Health, Safety, and Environment	2
24	RC18-4728	Resource Optimization	2
25	RC18-4729	Property Valuation	2
26	RC18-4730	Feasibility Study for Construction Project	2
27	RC18-4731	Utility	2

Enrichment Course List :			
1	RC18-4804	Principle of Civil Infrastructures	3

SYLLABUS

CURRICULUM SYLLABUS 2018

COURSE	**Course Name**	**: BASIC STATISTIC**
	Course Code	**: RC18 - 4101**
	Credit	**: 2 credits**
	Semester	**: 1 (Odd)**

COURSE DESCRIPTION
This course contains of : Statistic Introduction for Civil Engineering, Probability Concept, Normal Distribution, Sampling Dsitribution, Parameter Estimate, Hypothesis Calibration, and SPSS.
LEARNING OUTCOMES
1. Being able to apply mathematic, sains, engineering principles to create or modify Civil Engineering models in the areas of structure, water resources, geotechnic, and transportation. 2. Being able to use the latest technology available in carrying out the work.
COURSE LEARNING OUTCOMES
The student being able to calculate the probability, solves Normal Probability Events, calculate sampling distribution, parameter estimates, hypothesis calibration, and apply SPSS software.
MAIN SUBJECTS
The introduction of Statistic forCivil Engineering, Probability Concept, Normal Distribution, Sampling Distribution, Parameter Estimates, Hypotesis Calibration, and SPSS.
PREREQUISITES
None
REFFERENCES
Book : 1. Ang, A.H.S, and Tang, W.H. (2007), “Probability Concepts in Engineering: Emphasis on Application in Civil & Environmental Engineering”. 2nd Edition, John Wiley & Sons. 2. P. Mann (2010) , “ Introductory Statistic”, John Wiley & Sons 3. Ukestiyatno. (2014). "Statistika Dasar".1st Edition, Andi Offset.

COURSE	**Course Name**	**: STATICALLY DETERMINATE STRUCTURE**
	Course Code	**: RC18 - 4102**
	Credit	**: 3 credits**
	Semester	**: 1 (Odd)**

COURSE DESCRIPTION

This Course is about: Support, Reaction, Equilibrium Condition, Internal Forces (Moment, Shear, Axial), Inclined Beam, Function Load, Influence Line, Maximum Maximorum Moment, Indirect Girder, Gerber Beam, 3 Joint Portal, Simple Truss Construction.

LEARNING OUTCOMES

1. mastering theoretical concept of engineering sciences, engineering principles, and engineering design required in the areas of structural engineering
2. mastering principle and application method of regulations, standards, guidelines and manuals in the areas of structural engineering
3. Being able to apply mathematics, science and engineering principles to create or modify civil engineering models in the areas of structure

COURSE LEARNING OUTCOMES

Student being able to solve statically determinate structure problem: determine reaction, calculate and draw internal forces diagram (moment, shear, and axial). Student being able to solve and draw influence line of reaction and influence line of internal forces. Student being able to understand of internal forces meaning.

MAIN SUBJECTS

Support, reaction, Equilibrium condition, Angled Beam, Function Load, Influence Line, Internal Forces. Maximum Maximorum Moment, Indirect Girder, Gerber Beam , 3 Joint Portal, Simple Truss Construction.

PREREQUISITES

None

REFERENCES

Book :

1. Armenakas, Anthony E (1988). "Classical Structural Analysis " , McGraw Hill, Singapore.
2. Hibbeler, R.C. (2006). " Structural Analysis " 6th Edition , Prentice Hall, Singapore
3. Kassimali, Aslam. (2011)." Structural Analysis ". 4th Edition. Cengage Learning, USA .
4. Samuel E. French (1996). "Determinate Structure Statics, Strength, Analysis,

Design". Copyright by Delmar Publisher a division of International Thomson Publishing Inc.
5. Triwulan, Mekaika Statis Tertentu

CURRICULUM SYLLABUS 2018

COURSE	**Course Name**	**: COMPUTER PROGRAMMING**
	Course Code	**: RC18 - 4201**
	Credit	**: 2 credits**
	Semester	**: II (Even)**

COURSE DESCRIPTION
This course contains of : application and computer programming
LEARNING OUTCOMES
1. Being able to solve civil engineering problems related to structure, water resources, geotechnic, and transportation, including the ability to select resources and utilize the results of engineering analysis based on information and computing technologies suitable for planning / design in the areas of: structural engineering, water resources engineering, geotechnical engineering, and transportation engineering; 2. Being able to use the latest technology available in carrying out the work;
COURSE LEARNING OUTCOMES
1. Being able to use the updated softwares and applications to optimize student function and engineer function 2. Being able to use logica skillfully by using computer programming media
MAIN SUBJECTS
Application and computer programming
PREREQUISITES
None
REFERENCES
Book :

COURSE	**Course Name**	**: MECHANIC OF MATERIALS**
	Course Code	**: RC18 - 4202**
	Credit	**: 3 credits**
	Semester	**: II (Even)**

COURSE DESCRIPTION

This course is about : 1) Stress-Strain, 2) Bending Stress on beam. 3) Shear Stress in Beam, 4) Torsion Stress, 5) Combined stress, 6) Plane Stress Analysis, 7) Member Design based on Stress, 8) Statically Determinate beam deformation, 9) axial member stability.

LEARNING OUTCOMES

1. mastering theoretical concept of engineering sciences, engineering principles, and engineering design required in the areas of structural engineering
2. mastering principle and application method of regulations, standards, guidelines and manuals in the areas of structural engineering
3. Being able to apply mathematics, science and engineering principles to create or modify civil engineering models in the areas of structure

COURSE LEARNING OUTCOMES

Being able to mastering and apply calculation process of 1) Stress-Strain, 2) Bending Stress on beam. 3) Shear Stress in Beam, 4) Torsion Stress, 5) Combined stress, 6) Plane Stress Analysis, 7) Member Design based on Stress, 8) Statically Determinate beam deformation, 9) Axial member stability.

MAIN SUBJECTS

1) Stress-Strain, 2) Bending Stress on beam. 3) Shear Stress in Beam, 4) Torsion Stress, 5) Combined stress, 6) Plane Stress Analysis, 7) Member Design based on Stress, 8) Statically Determinate beam deformation, 9) Axial member stability.

PREREQUISITES

- Statically determinate Structure
- Basic Mathematic 1

REFERENCES

Buku :

1. E.P Popov, "Mechanics of Materials", Prentice Hall Inc., 2nd edition, 1976
2. Timothy A. Philpot "Mechanics of materials", 2008
3. JM Gere, "Mechanics of Materials", 8th Edition.

CURRICULUM SYLLABUS 2018

COURSE	**Course Name**	**: INTRODUCTION TO GEOPASIAL INFORMATION**
	Course Code	**:**
	Credit	**: 2 credits**
	Semester	**: III (Odd)**

COURSE DESCRIPTION

This course contains geospatial information and its application. Students will study introduction of geospatial information – science and technology in the field of spatial information (spatial)– so it can support the work of Civil Engineering, Environmental Engineering, Geomatics Engineering and Geophysical Engineering. Through this lecture students will understand the scope of science and technology in the Faculty of Civil Engineering, Environment and Earth.

LEARNING OUTCOMES

1. Mastering the concepts and principles of geospatial information science and technology
2. Able to identify and resolve problems related to geospatial information
3. Mastering methods and processes in data retrieval based on geospatial information science and technology
4. Able to analyze, interpret spatial data using geospatial information science and technology
5. Able to present spatial data using geospatial information science and technology

COURSE LEARNING OUTCOMES

1. Students have knowledge of Geospatial Information
2. Students have knowledge of basic theories and methods of Geospatial Information
3. Students have experience to make observations in related fields to Geospatial Information
4. Students are able to explain how the Geospatial Information process
5. Students are able to express their ideas or ideas orally and in writing.
6. Students are able to apply the concepts and procedures of Geospatial Information science and techniques as one of the methods in geospatial information either work independently or teamwork.

MAIN SUBJECTS

1. The basic purpose of Geospatial Information

2. The development and problems of Geospatial Information
3. The Use of hardware and software
4. Data, human and method components in Geospatial Information
5. Geospatial Information Processes and Spatial Data Sources
6. The basic concepts and procedures for creating the GIS Web and Database Structure
7. Geospatial Information Services (Ina-Geoportal) and International Standards (ISO)
8. The Use of Geospatial Information for Land Use Management, Natural Resource Inventory, Regional Natural Disaster Control, Geospatial Information for Urban and Regional Planning, Geospatial Information for Archeology and Application of GIS Web

PREREQUISITES

None

REFERENCES

Book :

1. Aronoff, S. 1989. Geographic Information Systems: A Management Perspective. Ottawa, Canada:WDL Publications.
2. Brovelli, M. A. dan D. Magni . An Archaeological Web Gis Application Based On Mapserver And
3. Burrough, P. A. Dan McDonnell, R. A. 1998. Principles of Geographical Information Systems. New York: Oxford University Press
4. Fleming, C., (ed.)., 2005. The GIS Guide for Local Government Officials.ESRI Press. Redlands.
5. MuljoSukojo, *B., 2017. PengantarInformasiGeospasial, DepartemenTeknikGeomatika FTSLK ITS Surabaya*

COURSE	**Course Name**	**: APPLIED MECHANICS AND STRUCTURAL MODELLING**
	Course Code	**: RC18 - 4301**
	Credit	**: 3 credits**
	Semester	**: III (Odd)**

COURSE DESCRIPTION

This Course is about: definition of statically inderteminate structure, slope deflection method, matrix method structural analysis, modeling using auxillary software, structure loading, using auxillary software, interpret results and verify the output of auxillary software.

LEARNING OUTCOMES

1. mastering theoretical concept of engineering sciences, engineering principles, and engineering design required in the areas of structural engineering
2. mastering principle and application method of regulations, standards, guidelines and manuals in the areas of structural engineering
3. being able to apply mathematics, science and engineering principles to create or modify civil engineering models in the areas of structure
4. being able to use the latest technology available in carrying out the work

COURSE LEARNING OUTCOMES

Students being able to do structural analysis using slope deflection method, matrix method, and using auxillary program.

MAIN SUBJECTS

Definition of statically indeterminate structure, slope deflection method, matrix method structural analysis, structural modeling using auxillary software, structure loading, interpret and verifying output result of auxillay software.

PREREQUISITES

Mechanics of Materials

REFERENCES

Book :

1. Norris, Charles H., Wilbur, John B, and Utku, S., "Elementary Structural Analysis", 1976
2. McGuire, et al, "Advanced Structural Analysis", 2002
3. Daryl L Logan"A First Course in the Finite Element Method", 6th Edition.

COURSE	**Course Name**	**: BUILDING MATERIAL TECHNOLOGY**
	Course Code	**: RC18 - 4302**
	Credit	**: 4 credits**
	Semester	**: III (Odd)**

COURSE DESCRIPTION
This course is about: Concrete as building material, concrete quality control, concrete durability, concrete's mix design, concrete testing, assessment and proposal of concrete repair, special concrete's technologproposal of concrete repair, special concrete's technology, steel technology.
LEARNING OUTCOMES
1. Being able to apply mathematics, science and engineering principles to create or modify civil engineering models in the areas of structure, water resources, geotechnic, and transportation. 2. propose the best solution to solve civil engineering problems based on engineering principles, taking into account economic, safety, public safety and environmental sustainability factors;
COURSE LEARNING OUTCOMES
Student being able to plan and design infrastructures in area of concrete and building material technology.
MAIN SUBJECTS
Concrete as building material, concrete quality control, concrete durability, concrete's mix design, concrete testing, assessment and proposal of concrete repair, special concrete's technologproposal of concrete repair, special concrete's technology, steel technology.
PREREQUISITES
None
REFERENCES
Book : 1. Beton dalam praktek 2. Concrete Technology by A. M. Neville 2nd Edition 3. SNI 2847 4. ACI 214r - 11 Guide To Evaluation of Strength Test Result of Concrete 5. ACI 211.4r - 93 Guide For Selecting Proportion For High Strength Concrete 6. ACI 3641r-94 Guide For Evaluation of Concrete Struktur 7. ACI SP-002(07): Manual of Concrete Inspection

COURSE	**Course Name**	**: FLUID MECHANICS AND HYDRAULICS**
	Course Code	**: RC18 - 4303**
	Credit	**: 4 credits**
	Semester	**: III (Odd)**

COURSE DESCRIPTION

This course contains : fluid definition and fluid determinants, hydrostatic fluid, hydrostatic approaches to infrastructure, hydraulic basic equations, energy line, open channel characteristics, critical flow, uniform open / uniform channel, the profile of water flow with changing gradually, springing up and plunging.

LEARNING OUTCOMES

1. Students are able to design the infrastructure in the field of engineering: water engineering based on engineering principles with technical standards, performance aspects, reliability, ease of implementation, sustainability, as well as taking into account economic, public safety, cultural, social and environmental factors (environmental consideration).
2. Able to use the latest technology available in carrying out the work.
3. Able to work independently and work in teams.

COURSE LEARNING OUTCOMES

1. Students are able to calculate the amount of pressure and hydrostatic force in water building infrastructure
2. Students are able to plan open and closed channels, calculate loss energy on a hydraulic system, describe the profile of the water level and calculate the pump requirements

MAIN SUBJECTS

Fluid Definition and Fluid Determinants, Hydrostatic Fluid, Hydrostatic Approaches to Infrastructure, Hydraulic Basic Equations, Energy Line, Open Channel Characteristics, Critical Flow, Uniform Open / Uniform Channel, the profile of water flow with changing gradually, springing up and plunging.

PREREQUISITES

Basic Phisic 1

REFERENCES

Book :

1. Streeter Victor L. and E.B Wylie, Fluid Mechanics, Mc Graw Hill Kugakusha, Ltd, 1954
2. Streeter Victor L. and E.B Wylie, Arko Prijono (alih bahasa), Mekanika Fluida, Penerbit Erlangga Jakarta, 1999
3. Chow, V.T.,Open Channel Hydraulics, Mc Graw Hill, Ltd.
6. Hidrolika saluran Terbuka

COURSE	**Course Name**	**: TRAFFIC AND TRANSPORTATION ENGINEERING**
	Course Code	**: RC18 - 4304**
	Credit	**: 3 credits**
	Semester	**: III (Odd)**

COURSE DESCRIPTION

This course contains: Transportation problems, traffic components, network systems and transport services, management and policy systems, transportation demand systems, traffic data collection techniques, capacity and traffic performance calculations, four steps model, road safety, traffic

LEARNING OUTCOMES

1. Able to apply math, science and engineering principles to create or modify civil engineering models transportation
2. Able to resolve civil engineering issues related to transportation, including the ability to:
   - Identify, formulate, analyze, and locate the source of civil engineering problems;
   - Propose the best solution to solve civil engineering problems based on engineering principles, taking into economic, safety, public safety and environmental sustainability factors
   - select resources and utilize the results of engineering analysis based on information and computing technologies appropriate for planning / design;
3. Able to use the latest technology available in carrying out the work; and
4. Able to criticize the resolution of infrastructure problems that have been and / or are being implemented, and poured in the form of scientific papers.

COURSE LEARNING OUTCOMES

Students are able to know the transportation problem and how to solve it, able to do data collection, know the capacity of road network by using four steps models

MAIN SUBJECTS

Transportation problems, traffic components, network systems and transport services, control and policy systems, transportation demand systems, traffic data collection techniques, capacity calculation and traffic performance, four modeling steps, road safety, traffic management

PREREQUISITES

None

REFERENCES

Buku :

1. _____, Undang-undang No. 22 Tahun 2009 Tentang Lalu Lintas dan Angkutan Jalan, 2009
2. _____, Undang-undang No. 38 Tahun 2004 Tentang Jalan, 2004
3. F.D. Hobbs, “Perencanaan dan Teknik Lalu Lintas”
4. Louis J. Pignataro, “Traffic Engineering”
5. C. Jotin Khisty, “Transportasi Engineering”
6. Morlock, “Pengantar Teknik Transportasi”, 1995
7. L.R. Kadiyali, “Traffic Engineering and Transport Planning”
8. Tamin, O.F., “Perencanaan dan Pemodelan Transportasi”, 2000
9. Taaffe E.J. and Gauthier Jr, H.L., “Geography of Transportation”, 1973
10. Dickey, “Metropolitan Transportation Planning”, 1975
11. Black, J., “Urban Transport Planning Theory and Practice”, 1981
12. Simon, J. and Furth, P.G., “Generating a bus route O-D matrix from on-off data. Journal of Transportation”, 1985
13. Ortuzar, J.deD. And Willumsen, L.G., “Moselling Transport”, 1990
14. Stopher and Meyburg, “Urban Transportation Modeling and Planning”, 1975

COURSE	**Course Name**	**: CIVIL ENGINEERING DRAWING**
	Course Code	**: RC18 - 4305**
	Credit	**: 3 credits**
	Semester	**: III (Odd)**

COURSE DESCRIPTION

This course contains about: Introduction of Civil Building, Autocad Basics, Drawing an1 Floor House, Volume Calculation.

LEARNING OUTCOMES

1. Being able to apply mathematics, science and engineering principles to create or modify civil engineering models
2. Being able to solve civil engineering problems including the ability to select resources and utilize the results of engineering analysis based on information and computing technologies suitable for planning / design in the areas of: structural engineering, water resources engineering, geotechnical engineering, and transportation engineering;
3. Being able to use the latest technology available in carrying out the work; and
4. Being able to criticize the policy of solving infrastructure problems that have been and / or are being implemented, and written in the form of scientific papers.

COURSE LEARNING OUTCOMES

1. Being able to know about civil buildings
2. Being able to draw civil engineering buildings by autocad programme;
3. Being able to draw an 1 floor house, and
4. Being able to calculate the volume of the civil building.

MAIN SUBJECTS

Introduction of Civil Building, Autocad Basics, Drawing an 1 Floor House, Volume Calculation.

PREREQUISITES

None

REFERENCES

Book :

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COURSE	**Course Name**	**: STEEL STRUCTURE ELEMENT**
	Course Code	**: RC18 - 4401**
	Credit	**: 3 credits**
	Semester	**: IV (Even)**

COURSE DESCRIPTION
This subject is about : design and analysis of steel structure element due to tension force, compression force, flexural force, compression – flexure combination, also bolt and weld connection.
LEARNING OUTCOMES
Able to apply engineering principles to make or modificate engineering of civil in structural field
COURSE LEARNING OUTCOMES
Students able to do design and analysis of steel structure element due to tension force, compression force, flexural force, compression – flexure combination, also bolt and weld connection.
MAIN SUBJECTS
Design and analysis of steel structure element due to tension force, compression force, flexural force, compression – flexure combination, also bolt and weld connection.
PREREQUISITES
Static Defined Mechanic of Engineering Mechanic of Materials
REFERENCES
Book : 1. BSN (2002).Tata cara Perencanaan Struktur Baja Untuk Bangunan Gedung SNI 03-1729-2002, BSN 2. BSN (2015).Spesifikasi untuk bangunan gedung baja struktural SNI 03-1729-2015, BSN 3. Mc Cormack, J.C. (1995), Structural Steel Design – LRFD Method - 5th Edition, Prentice Hall 4. Salmon C.G. and Johnson J.E., “Steel Structures: Design and Behavior, LRFD”, Pearson International Edition 5. Marwan - Isdarmanu., “Elemen Struktur Baja”, -

COURSE	**Course Name**	**: CONCRETE STRUCTURE ELEMENT**
	Course Code	**: RC18 - 4402**
	Credit	**: 3 credits**
	Semester	**: IV (Even)**

COURSE DESCRIPTION
This subject is about: Basics of reinforced concrete design that include design concept, flexural element design (plate and beam), service ability analysis, shear and torsional design, length of distribution, column element design, tie and strut method and prestressed concrete introduction.
LEARNING OUTCOMES
Able to plan and design infrastructure in the field of: engineering structure especially in reinforced concrete structure based on engineering pronciples with considering technical standards, performance aspects, reliability, ease of implementation, sustainability
COURSE LEARNING OUTCOMES
Students able to design reinforced comcrete element based on theoretical formula and design codes / standard
MAIN SUBJECTS
Basics of reinforced concrete design that include design concept, flexural element design (plate and beam), service ability analysis, shear and torsional design, length of distribution, column element design, tie and strut method and prestressed concrete introduction
PREREQUISITES
Static Defined Mechanic of Engineering Mechanic of Materials
REFERENCES
Book : 1. Wight, J. K., and MacGregor, J. G. (2008). Reinforced concrete: mechanics and design. 5th edition, Prentice Hall. 2. Jack C McCormac, Ruseel H Brown (2008). Design of Reinforced Concrete. Ninth Edition, 3. Badan Standar Nasional (2013). SNI 2847 2013 Tata Cara Perencanaan Struktur Beton Bertulang 4. American Concrete Institute (2014). Building Code Requirements for Reinforced Concrete. Farmington Hills, MI 48331 USA 5. American Concrete Institute (2015). The Reinforced Concrete Design Handbook (Part 1 and Part 2). Farmington Hills, MI 48331 USA

COURSE	**Course Name**	**: HYDROLOGY**
	Course Code	**: RC18 - 4403**
	Credit	**: 3 credits**
	Semester	**: IV (Even)**

DESCRIPTION OF COURSE

This course contains about: rain, evaporation and infiltration, surface run off, flood discharge plan, and flood routing.

LEARNING OUTCOMES

1. Students are able to design the infrastructure in the field of engineering: water engineering based on engineering principles with technical standards, performance aspects, reliability, ease of implementation, sustainability, as well as taking into account economic, public safety, cultural, social and environmental factors (environmental consideration).
2. Able to use the latest technology available in carrying out the work.
3. Able to work independently and work in teams.

COURSE LEARNING OUTCOME

Students are able to calculate the mean rainfall area and rain intensity, Evaporation and infiltration, Surface Run Off, flood discharge plan, and flood Routing.

MAIN SUBJECTS

Rain, evaporation and infiltration, surface run off, flood discharge plan, and flood routing.

PREREQUISITES

Basic Statistics, Introduction to Geopathial Information, Hydraulic

REFERENCES

Book :

1. Subramanya, K. (1988). Engineering Hydrology. Tata McGraw-Hill Publishing Company Limited, New Delhi
2. Hidrologi, Bambang Triatmojo
3. Hidrologi , Suripin
4. Modul Hidrologi, Umboro Lasminto
5. Hidrologi, Soewarno
6. Disertasi, Hidrograf Satuan Sintetik ITS 2, I Gede Tunas

COURSE	Course Name	: RAILWAY ENGINEERING
	Course Code	: RC18 - 4404
	Credit	: 2 credits
	Semester	: IV (Even)

COURSE DESCRIPTION

Railway Construction is the course that discussing: Rolling stock, railway element, railway construction calculation, railway crossroad, signaling and comunication, and railway station

LEARNING OUTCOMES

1. Being able to solve civil engineering problems related to structure, water resources, geotechnic, and transportation, including the ability to:
   - identify, formulate, analyze, and locate the source of civil engineering problems;
   - propose the best solution to solve civil engineering problems based on engineering principles, taking into account economic, safety, public safety and environmental sustainability factors;
   - select resources and utilize the results of engineering analysis based on information and computing technologies suitable for planning/design in the areas of: structural engineering, water resources engineering, geotechnical engineering, and transportation engineering;

COURSE LEARNING OUTCOMES

1. Students able to describe type of rolling stocks, rolling stock axle load, railway element, railway crossroad, signaling and comunication, and railway station
2. Students able to calculate railway construction

MAIN SUBJECTS

Rolling stock, railway element, railway construction calculation, railway crossroad, signaling and comunication, and railway station

PREREQUISITES

None

REFERENCES

BOOK:

1. _____, Undang-undang No. 23 Tahun 2007 tentang Perkeretaapiaan
2. _____, PM No. 60 Tahun 2012 tentang Persyaratan Teknis Jalur Kereta Api
3. Wahyudi, H (1993) Teknik Jalan Rel. Diktat Teknik Sipil ITS
4. Hapsoro, S (2000) Jalan Kereta Api
5. Profilidis, V.A., (2009), "Railway Management and Engineering", 3rd Edition

COURSE	Course Name	: CONSTRUCTION MANAGEMENT
	Course Code	: RC18 - 4405
	Credit	: 2 credits
	Semester	: IV (Even)

COURSE DESCRIPTION
The subject is aboutmodern construction management; project life cycle; project stakeholders;organizational structure; feasibility study; integration of design & construction processes; project selection &procurement; planning, monitoring, & controlling processes.
LEARNING OUTCOMES
Being able to supervise and control the implementation of construction of engineering planning and design results, namely: structural engineering, water resources engineering, geotechnical engineering, and transportation engineering, with reference to applicable rules, norms, standards, guidelines and manuals;
COURSE LEARNING OUTCOMES
1. Students able to understand modern construction management; project life cycle; project stakeholders; organizational structure. 2. Students able to understandfeasibility study; integration of design, project selection & procurement, and construction processes. 3. Students able to understand planning, monitoring, & controlling processes at construction project.
MAIN SUBJECTS
1. Modern construction management; project life cycle; project stakeholders; organizational structure. 2. Feasibility study; integration of design, project selection & procurement, and construction processes. 3. Planning, monitoring, & controlling processes at construction project.
PREREQUISITES
None
REFERENCES
Books : 1. Erik W Larson & Clifford F Gray , Project Management : The Managerial Process - 7th Edition, Mc-Graw Hill Education, 2017 2. Jack R Meredith, Samuel J Mantel Jr., Scott M Shafer, Project Management: A Managerial Approach - 9th Edition, Wiley, 2016 3. Harold Kerzner, Project Management: A Systems Approach to Planning, Scheduling, and Controlling - 12th Edition, Wiley, 2017 4. Project Management Body of Knowledge (The PMBOK® Guide) - Sixth Edition, Project Management Institute, 2017

COURSE	**Course Name**	**: SOIL MECHANIC AND FOUNDATION**
	Course Code	**: RC18 - 4406**
	Credit	**: 4 credits**
	Semester	**: IV (Even)**

COURSE DESCRIPTION

This course contain about : soil composition, soil classification system, effective stress, stress distribution, soil compression, shear strength of soil, shallow foundation and deep foundations (driven and bored piles)

LEARNING OUTCOMES

Ability to:

1. apply mathematics, science and engineering principles to create or modify civil engineering models in geotechnics;
2. plan and design infrastructure in the areas of geotechnical engineering based on engineering principles and taking into account technical standards, performance aspects, reliability, ease of implementation, sustainability, while also considering the factors of economy, public safety, culture, social and environment; and
3. use the latest technology available in carrying out the work.

COURSE LEARNING OUTCOMES

Ability to:

1. determine the physical soil parameters;
2. classify the soil using the Unified Soil Classification system and AASHTO;
3. determine the soil strength;
4. calculate the bearing capacity of shallow foundation and its settlement; and
5. calculate the bearing capacity of deep foundation (driven and bored piles).

MAIN SUBJECTS

1. Soil composition.
2. Soil classification system.
3. Effective stress.
4. Stress distribution.
5. Soil compression.
6. Shear strength of soil.
7. Shallow foundation.
8. Deep foundations (driven and bored piles).

PREREQUISITES

None

REFERENCES

Book :

1. Das, Braja M. (2006). Priciples of Geotechnical Engineering. 5th Edition. Thomson Publishers.
2. Das, Braja M. (2011). Priciples of Foundation Engineering. 7th Edition, Global Engineering, USA
3. Poulos, H. G. and E. H. Davis (1980). Pile Foundation Analysis and Design. John Wiley and Sons, New York.

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COURSE	**Course Name**	**: STRUCTURE STEEL BUILDING**
	Course Code	**: RC18 - 4501**
	Credit	**: 4 credits**
	Semester	**: V (Odd)**

COURSE DESCRIPTION
This course is about : Design and analysis of steel building construction, steel building connection, building stability, baseplate, composite structure element and plate girder
LEARNING OUTCOMES
Able to apply engineering principles to make od modificate engineering of civil in structure field
COURSE LEARNING OUTCOMES
Students able to do design and analysis of design and analysis of steel building construction, steel building connection, building stability, baseplate, composite structure element and plate girder
MAIN SUBJECTS
Design and analysis of steel building construction, steel building connection, building stability, baseplate, composite structure element and plate girder
PREREQUISITES
Steel Structure Element
REFERENCES
Book : 1. BSN (2002).Tata cara Perencanaan Struktur Baja Untuk Bangunan Gedung SNI 03-1729-2002, BSN 2. BSN (2015).Spesifikasi untuk bangunan gedung baja struktural SNI 03-1729-2015, BSN 3. Salmon C.G. and Johnson J.E., “Steel Structures: Design and Behavior, LRFD”, Pearson International Edition 4. Marwan - Isdarmanu., "Struktur Bangunan Baja”, -

COURSE	**Course Name**	**: STRUCTURE CONCRETE BUILDING**
	Course Code	**: RC18 - 4502**
	Credit	**: 3 credits**
	Semester	**: V (Odd)**

COURSE DESCRIPTION

This course is about : earthquake resistant concrete structure concept design used static equivalent and dynamic spectrum load by ductile detailing in accordance with SNI (Indonesia National Standar)

LEARNING OUTCOMES

Graduates able to solve civil engineering problem that related to planning and designing infrastructure in the areas of: engineering structures based on engineering principles taking into account technical standards, performance aspects, reliability, ease of implementation, sustainability, as well as taking into account economic, public safety, cultural, social and environmental factors (environmental consideration)

COURSE LEARNING OUTCOMES

Students able to understand about earthquake resistance design concept, calculate structural analysis due to static equivalent and dynamic spectrum load and also apply ductile detailing in accordance with SNI for some building types.

MAIN SUBJECTS

Design concept of earthquake concrete structure, structural configuration, static and dynamic load, structural analysis, element capacity design, gravitation frame and non structural element.

PREREQUISITES

1. Concrete Structure Element
2. Applied Engineering Mechanic
3. Mechanic of Materials

REFERENCES

Book :

1. SNI 03-2847-2013 Persyaratan beton struktural untuk bangunan gedung.
2. SNI 03-1726-2012 Tata cara perencanaan ketahanan gempa untuk struktur bangunan gedung dan non gedung
3. SNI 1727-2013 Beban minimum untuk perancangan bangunan gedung dan struktur lain
4. Concrete Buildings in Seismic Regions, George G. Penelis and Gregory G. Penelis, CRC Press, 2014

COURSE		
	Course Name	**: DRAINAGE**
	Course Code	**: RC18 - 4503**
	Credit	**: 3 credits**
	Semester	**: V (Odd)**

COURSE DESCRIPTION

This course contains about: drainage concept, component in planning of drainage system, urban drainage, surface drainage and subsurface, complementary building in drainage system.

LEARNING OUTCOMES

1. Students are able to design the infrastructure in the field of engineering: water engineering based on engineering principles with technical standards, performance aspects, reliability, ease of implementation, sustainability, as well as taking into account economic, public safety, cultural, social and environmental factors (environmental consideration).
2. Able to use the latest technology available in carrying out the work.
3. Able to work independently and work in teams.

COURSE LEARNING OUTCOMES

Students are able to plan drainage system along with complementary building in drainage system by considering engineering principles based on technical standard, performance aspect, reliability, ease of implementation, sustainability, and attention to economic, social and environmental factors

MAIN SUBJECTS

Drainage concept, component in planning of drainage system, urban drainage, surface drainage and subsurface, complementary building in drainage system.

MAIN SUBJECTS

None

REFERENCE

Book :

1. Masduki, H. Moh,. 1997. Drainase Pemukiman. Institut Teknologi Bandung Press : Bandung.
2. Suripin, M.Eng. Dr. Ir. 2004. Drainase Perkotaan yang Berkelanjutan. Andi Offset : Yogyakarta.
3. Ven Te Chow. 1989. Hidrolika Saluran Terbuka.

COURSE	**Course Name**	**: RIVER ENGINEERING**
	Course Code	**: RC18 - 4504**
	Credit	**: 2 credits**
	Semester	**: V (Odd)**

COURSE DESCRIPTION

This course contains:
River characteristics and its problems, watershed characteristics, river hydraulics, flow and sediment properties, mechanisms of initial sediment movement, impact river bedinto sediment transport, sediment transport (suspended load, bed load, total load), river characteristics effect due to river flow and sediment transport, river morphology , river engineering building planning.

LEARNING OUTCOMES

plan and design river engineering infrastructure based on engineering principles taking into account technical standards, performance aspects, reliability, ease of implementation,sustainability, and attention to economic, public safety, cultural, social and environmental factors.

COURSE LEARNING OUTCOMES

Students are able to analyze river hydraulics, estimating of sediment transport, and design of river engineering building planning

MAIN SUBJECTS

River characteristics and its problems, watershed characteristics, river hydraulics, flow and sediment properties, mechanisms of initial sediment movement, impact river bed into sediment transport, sediment transport (suspended load, bed load, total load), river characteristics effect due to river flow and sediment transport, river morphology , river engineering building planning.

PREREQUISITES

- Fluid Mechanics and Hydraulics
- Hydrology
- Introduction of Geospatial Information

REFERENCES

Book :

1. Julien, P.Y., River Mechanics, Cambridge University Press, 2002
2. Dingman, S.L., Fluvial Hydraulics, Oxford University Press., 2009

COURSE	**Course Name**	**: CONSTRUCTION EQUIPMENT AND METHODS**
	Course Code	**: RC18 - 4505**
	Credit	**: 3 credits**
	Semester	**: V (Odd)**

COURSE DESCRIPTION

The subject is aboutsite layout planning concepts; construction equipment; construction methods: earthwork and foundation, highrise buildings structure, bridges structure, and railways structure.

LEARNING OUTCOMES

1. Plan and design infrastructure in the areas of: structural engineering (minimum building of eight floors and bridges with spans of at least 60 meters), engineering of water resources (small dam of 10 meter high, irrigation area maximum of 3000 ha, drainage area as well as river and beach buildings), geotechnical engineering (foundations, retaining soil structures and soil improvement methods), and transport engineering (roads, railways, ports and airports) based on engineering principles taking into account technical standards, performance aspects, reliability, ease of implementation, sustainability, and attention to economic, public safety, cultural, social and environmental factors;
2. Being able to use the latest technology available in carrying out the work;

COURSE LEARNING OUTCOMES

1. Students able to understand site layout planning concepts.
2. Students able to understand construction equipment in carrying out the work.
3. Students able to understand criteria to select construction equipment and methods.
4. Students able to understand construction methodsfor earthwork and foundation, highrise buildings structure, bridges structure, and railways structure.

MAIN SUBJECTS

1. Site layout planning concepts
2. Construction methodsfor earthwork and foundation
3. Construction methodsfor highrise buildings structure
4. Construction methodsfor bridges structure
5. Construction methodsfor railways structure

PREREQUISITES

1. Construction Management
2. Soil Mechanics

3. Embankment and Retaining Wall
4. Elementsof Concrete Structures
5. Elements of Steel Structures

REFERENCES

Book :

1. Robert L Peurifoy, Clifford J. Schexnayder, Robert Schmitt, Aviad Shapira,Construction Planning, Equipment, and Methods - 9th Edition, McGraw Hill, 2018
2. Douglas D. Gransberg, Calin M. Popescu, Richard Ryan, Construction Equipment Management for Engineers, Estimators, and Owners (Civil and Environmental Engineering) - 1st Edition, Taylor & Francis, 2006
3. Edward Allen, Joseph Iano, Fundamentals of Building Construction: Materials and Methods 6th Edition, Wiley, 2013
4. Coenraad Esveld, Modern Railway Track, MRT Production,1989.
5. Herman Wahyudi, Jalan Kereta Api Lanjut, Sistem dan Fasilitas Jalan Rel, Diktat Kuliah Jurusan Teknik Sipil FTSP-ITS.

COURSE	**Course Name**	**: EMBANKMENT AND EARTH RETAINING STRUCTURE**
	Course Code	**: RC18 - 4506**
	Credit	**: (4+1) credits**
	Semester	**: V (Odd)**

COURSE DESCRIPTION

This course contains about: water seepage in soil, soil compaction, slope stability, horizontal soil pressure, retaining wall, sheet-pile, geotextile for soil reinforcement, geotextile wall, and auxiliary program for Geotechnical.

LEARNING OUTCOMES

Ability to:

1. apply mathematics, science and engineering principles to create or modify civil engineering models in geotechnics;
2. plan and design infrastructure in the areas of geotechnical engineering based on engineering principles and taking into account technical standards, performance aspects, reliability, ease of implementation, sustainability, while also considering the factors of economy, public safety, culture, social and environment; and
3. use the latest technology available in carrying out the work.

COURSE LEARNING OUTCOMES

Ability to:

1. determine the uplift force and heave caused by seepage force;
2. determine the water content optimum and maximum density of the compacted soil in the laboratory;
3. check slope stability;
4. design earth retaining structure using retaining wall, sheet-pile, geotextile wall; geotextile reinforcement; and
5. implement the auxiliary program to solve the Geotechnical problems.

MAIN SUBJECTS

1. Permeability or water seepage through soil, uplift force, and heave.
2. Soil compaction.
3. Slope stability.
4. Horizontal soil pressure.
5. Earth retaining structures: retaining wall, sheet-pile, geotextile for soil reinforcement.
6. Auxiliary program for Geotechnical Engineering.

PREREQUISITES

Soil and Foundation Engineering

REFERENSES

Book :

1. Das, Braja M. (2006). Priciples of Geotechnical Engineering. 5th Edition. Thomson Publishers.
2. Das, Braja M. (2011). Priciples of Foundation Engineering. 7th Edition, Global Engineering, USA
3. Koerner, Robert M. (1990). Designing with Geosynthetics. 2nd Edition, Prentice-Hall Inc. New Jersey
4. Bowles, Joseph E. (1996). Foundation Analysis and Design. 5th Edition, The McGraw-Hill Companies, Inc. New York.

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COURSE	**Course Name**	**: BRIDGE ENGINEERING**
	Course Code	**: RC18 - 4601**
	Credit	**: 2 credits**
	Semester	**: VI (Even)**

COURSE DESCRIPTION
The Bridge Engineering is one of courses of Civil Engineering that discussing about the development of bridge, the types and elements of short span bridge, the determining of bridge location, the materials of bridge, the data and procedure in designing of dimension of bridge, the strength calculation of elements of bridge structure, the drawing of calculation results.
LEARNING OUTCOMES
The graduate able to planand design infrastructure in the areas ofstructural engineering, bridges with spans of at least 60 meters, based on engineering principles taking into account technical standards, performance aspects, reliability, ease of implementation,sustainability, and attention to economic, public safety, cultural, social and environmental factors.
COURSE LEARNING OUTCOMES
The graduate able to design a bridge structure including deck or floor, longitudinal beam, transversal beam, trusses, main load resisting structure, bearing and foundation, and making drawing of calculation result.
MAIN SUBJECTS
The subjects of Bridge Engineering are the definition of bridge, the elements of bridge, load for superstructure of bridge, the calculation of elements of bridge structure including deck or floor, longitudinal beam, transversal beam, main load resisting element, load for substructure of bridge, materials for bridge, knowledge about another types of short span bridge (girder bridge, composite bridge, plate girder bridge, hybrid bridge, orthotropic bridge, concrete girder bridge, and prestressed concrete girder bridge), the determination of bridge's location, the determination of bridge's type, the determination of economics span of bridge.
PREREQUISITES
1. Steel Structure 2. Reinforced Concrete Structure 3. Soil Mechanics and Foundation
REFERENCES
Book : 1. Johnson Victor, " Essenstials of Bridge Engineering "

2. M.S.Troitsky, " Planning and Design of Bridges "
3. Hool and Kinne, Movable and Longspan Steel Bridge "
4. Wai - Fah Chen, " Bridge Engineering Handbook "
5. Xanthakos, P.P. (1995), Bridges Sub Structure and Foundation Design, Prentice-Hall, New Jersey.
6. SNI 1725:2016 (Pembebanan untuk Jembatan)
7. SNI 2833:2016 (Perancangan Jembatan terhadap Beban Gempa)

COURSE	**Course Name**	**: DESIGN OF REINFORCED CONCRETE BUILDING**
	Course Code	**: RC18 - 4602**
	Credit	**: 2 credits**
	Semester	**: VI (Even)**

COURSE DESCRIPTION

The Design of Reinforced Concrete Structure is a course that discussing about seismic provisions, preliminary design, design of secondary element of strucrure, loading (live, dead, and seismic), modeling and analysis of structure using software, reinforcing (beam, column, and beam column joint), drawing. In otherwise, this course also discuss about management construction aspects, i.e. the scope of project, volume of work, productivity analysis, estimation of the duration of activity, the sequencing of activity, scheduling, the analysis of unit price, budget plan, S-curve.

LEARNING OUTCOMES

The graduate able to planand design infrastructure in the areas ofstructural engineering, minimum building of eight floors, based on engineering principles taking into account technical standards, performance aspects, reliability, ease of implementation, sustainability, and attention to economic, public safety, cultural, social and environmental factors.

COURSE LEARNING OUTCOMES

1. Students able to design the eight floors of reinforced concrete building using Special Moment Resisting Framessystem according to SNI 03 1726 2012 dan SNI 03 2847 2013.
2. Students able to plan the scope of project, construction method, scheduling and budget plan of the project.

MAIN SUBJECTS

1. Seismic provisions, preliminary design, design of secondary element of strucrure, loading (live, dead, and seismic), modeling and analysis of structure using software, reinforcing (beam, column, and beam column joint), drawing.
2. The scope of project, volume of work, productivity analysis, estimation of the duration of activity, the sequencing of activity, scheduling, the analysis of unit price, budget plan, S-curve.

PREREQUISITES

1. Element of Concrete Structure
2. Reinforced Concere Structure
3. Construction Managements
4. Equipments and Methods of Constructions

REFERENCES

1. SNI 03-2847-2013 Persyaratan beton struktural untuk bangunan gedung.
2. SNI 03-1726-2012 Tata cara perencanaan ketahanan gempa untuk struktur bangunan gedung dan non gedung
3. SNI 1727-2013 Beban minimum untuk perancangan bangunan gedung dan struktur lain
4. Project Management Institute, Project Management Body of Knowledge (PMBOK) Guide - Fifth Edition, 2013
5. Erik W Larson & Clifford F Gray , Project Management - The Managerial Process, Mc-Graw Hill, 2011

COURSE	**Course Name**	**: IRRIGATION AND WATER STRUCTURES**
	Course Code	**: RC18 - 4603**
	Credit	**: 4 credits**
	Semester	**: VI (Even)**

COURSE DESCRIPTION

This course contains:

The principles of irrigation system in Indonesia, irrigation network/scheme, design of irrigation channels (open channel hydraulics), design of weirs, tertiary units, irrigation structures (drop and diversion structures/culvert-gutter-syphon), head works (structures and stability control).

LEARNING OUTCOMES

Being able to solve civil engineering problems related to water resources, including the ability to:

1. Identify, formulate, analyze, and locate the source of civil engineering problems;
2. Propose the best solution to solve civil engineering problems based on engineering principles, taking into account economic, safety, public safety and environmental sustainability factors;
3. Plan and design infrastructure in the areas of water resources engineering (small dams of 10 meter high, irrigation area maximum of 3000 ha, drainage area as well as river and beach buildings based on engineering principles taking into account technical standards, performance aspects, reliability, ease of implementation,sustainability, and attention to economic, public safety, cultural, social and environmental factors;

COURSE LEARNING OUTCOMES

Students are able to explain the irrigation system in Indonesia (maximum area of 3000 ha), able to plan and design of sustainable irrigation channel (open channel hydraulics), able to plan and design of weirs, tertiary units, irrigation structures (drop and diversion structures/culvert-gutter-syphon), head works (structures and stability control)

MAIN SUBJECTS

The principles of irrigation system in Indonesia, irrigation network, design of irrigation channels (open channel hydraulics), design of weirs, tertiary units, irrigation structures (drop and diversion structures/culvert-gutter-syphon), head

works (structures and stability control).

PREREQUISITES

1. Fluid Mechanics and Hydraulics
2. Hydrology

REFERENCE

Book :

1. Chow, Ven Te, Open Channel Hydraulics (Indonesian version), Erlangga, Jakarta 1985.
2. Soesanto, Soekibat Rendy, ITS Irrigation Module 2008 (in Indonesia)
3. Anggrahini, 1991, open channel hydraulics (in Indonesia),Penerbit Erlangga, Surabaya.
4. Chow, V.T, 1959, Open Channel Hydraulic, Mc Graw Hill, New York.
5. Department of Public Works General Directorate of Irrigation, Criteria for Irrigation Design (KP) 01- Irrigation System, Jakarta. 1986. (in Indonesia).
6. Department of Public Works General Directorate of Irrigation, Criteria for Irrigation Design (KP) 02- Headworks, Jakarta. 1986. (in Indonesia).
7. Department of Public Works General Directorate of Irrigation, Criteria for Irrigation Design (KP) 03- Irrigation Channels, Jakarta. 1986. (in Indonesia).
8. Department of Public Works General Directorate of Irrigation, Criteria for Irrigation Design (KP) 04- Irrigation Structures, Jakarta. 1986. (in Indonesia).
9. Department of Public Works General Directorate of Irrigation, Criteria for Irrigation Design (KP) 05- Tertiary Units, Jakarta. 1986. (in Indonesia).
10. Department of Public Works General Directorate of Irrigation, Criteria for Irrigation Design (KP) 06- Structures Parameter, Jakarta. 1986. (in Indonesia).
11. Department of Public Works General Directorate of Irrigation, Criteria for Irrigation Design (KP) 07- Drawing Standart, Jakarta. 1986. (in Indonesia).
12. Eman Mawardi & Moch. Memed “Hydraulics design of weirs”(in Indonesia, ALFA BETA, Bandung
13. USBR Design of Small Dam, US Government Printing Office.

COURSE	**Course Name**	**: HYDRAULIC COASTAL ENGINEERING AND PORT PLANNING**
	Course Code	**: RC18 - 4604**
	Credit	**: 2 credits**
	Semester	**: VI (Even)**

COURSE DESCRIPTION

This course contains about:

1. Understanding definition of coastall zone, Coastall Engineering,problem beaches in Indonesia; Waveform deformation includes Refraction, Defraction, Reflection and Broken Waves; Fluctuations in water level include Tsunami, Wave and wind setup, Global Warming, Tidal and Sea Plate Response Plans; Statistics and Wave Forecasting include Wave Statistics, Approximate wave with return period and generated of wave; The coastal process includes the shape of the coastal line, the nature of coastal sediments, the mechanism of coastal sediment transport by wave, coastal sediment transport and coastal morphology; Beach Building type / kinds and function
2. Definitions, functions and facilities of ports, as well as procedures for ship handling and cargo as well as ship characteristics; explain the data needed in port planning and how to obtain it; planning the waters area, port land, port dock facilities, breakwater and ship docking.

LEARNING OUTCOMES

Capable of resolving civil engineering issues related to transportation, including the ability to:

1. identify, formulate, analyze and locate the source of civil engineering problems;
2. planning and designing infrastructure in the field of port engineering
3. select resources and utilize engineering analysis results based on information and computing technologies appropriate for planning / design.

COURSE LEARNING OUTCOMES

1. Students are able to explain and calculate parameter parameters affecting the system / morphology and its effect on coastal buildings such as wind / wave, fluctuation of tidal water, ocean currents; able to analyze waveform deformation process and determine sea level height based on ups and downs; able to determine the size of the plan and the water level of the plan in the waters / sea; able to explain and determine the quantity of sediment transport capacity on shore; able to explain and determine the conditions of shoreline change; able to explain and determine the type and function of coastal building / coastal protection; able to explain and influence sediment transport

to the shipping path.
2. Can explain the definition, function and facilities of the port, as well as procedures for ship handling and cargo as well as ship characteristics; explain the data needed in port planning and how to obtain it; planning the waters area, port land, port dock facilities, breakwater and boat docking.

MAIN SUBJECTS

1. Definition of definition of coastal zone, Coastal Engineering, problem beaches in Indonesia; Waveform deformation includes Refraction, Defraction, Reflection and Broken Waves; Fluctuations in water level include Tsunami, Wave and wind water rises, Global Warming, Tidal and Sea Plate Response Plans; Statistics and Wave Forecasting include Wave Statistics, Approximate wave with return period and Wave Generation; The coastal process includes the shape of the coastal line, the nature of coastal sediments, the mechanism of coastal sediment transport by wave, coastal sediment transport and coastal morphology; Beach Building type / kinds and function.
2. Definitions, functions and facilities of ports, as well as procedures for ship handling and cargo as well as ship characteristics; explain the data needed in port planning and how to obtain it; planning the waters area, port land, port dock facilities, breakwater and boat docking.

PREREQUISITES

Fluid Mechanics and Hydraulics

REFERENCES

Buku :

1. Center for Civil Engineering Research and Codes. Manual on the use of Rock in Coastal and shoreline Engineering, CIRIA - CUR, London,2003
2. Goda, Yoshimi, Random Seas and Design of Maritime Structures' University of Tokyo Press, 1985
3. Kampguis, J.William, Introduction to Coastal Engineering and Management, World Scientific Singapore, 2000
4. Silvester, Richard, RC Hsu, John, Coastal Stabilization, World Scientific, Singapore 1997
5. Triatmodjo, Bambang, Teknik Pantai, Beta Offset, Yogyakarta , 1999
6. Triatmodjo, Bambang, Perencanaan Pantai, Beta Offset, Yogyakarta , 1999
7. US ARMY Corp of Engineers, Coastal Engineering Manual, Coastal Engineering Research Center, Misissipi, 2003.
8. van Rijn, Leo C, Principles of Sediment Transport in Rivers, Estuaries and Coastal Area, Aqua Publication, Amsterdam, 1993
9. Peraturan Pemerintah No. 61 Tahun 2009 Tentang Kepelabuhanan
10. Technical Standards and Commentaries For Port and Harbour Faciilties in Japan, OCDI
11. Port Desingners Handbook, Carl A. Thoresen

COURSE	**Course Name**	**: PROJECT COST AND SCHEDULE CONTROL**
	Course Code	**: RC18 - 4605**
	Credit	**: 2 credits**
	Semester	**: VI (Even)**

COURSE DESCRIPTION

The subject is about planning process & concepts, defining project scope, quantity take-off, productivity analysis, project scheduling, cost estimation, cost performance baseline curve (S-Curve),cost & schedule control

LEARNING OUTCOMES

1. Being able to supervise and control the implementation of construction of engineering planning and design results, namely: structural engineering, water resources engineering, geotechnical engineering, and transportation engineering, with reference to applicable rules, norms, standards, guidelines and manuals.
2. Being able to use the latest technology available in carrying out the work.

COURSE LEARNING OUTCOMES

1. Students able to defining project scope
2. Students able to develop project schedule
3. Students able to estimate project cost
4. Students able to develop cost performance baseline curve (S-Curve)
5. Students able to control cost & schedule

MAIN SUBJECTS

1. Planning process & concepts
2. Defining project scope
3. Quantity take-off
4. Productivity analysis
5. Project scheduling
6. Cost estimation
7. Cost performance baseline curve (S-Curve)
8. Cost & schedule control

PREREQUISITES

Construction Equipment & Methods

REFERENCES

Book :

1. Erik W Larson & Clifford F Gray , Project Management : The Managerial Process - 7th Edition, Mc-Graw Hill Education, 2017
2. Jack R Meredith, Samuel J Mantel Jr., Scott M Shafer, Project Management :

A Managerial Approach - 9th Edition, Wiley, 2016
3. Harold Kerzner, Project Management: A Systems Approach to Planning, Scheduling, and Controlling - 12th Edition, Wiley, 2017

COURSE	**Course Name**	**: HIGHWAY DESIGN**
	Course Code	**: RC18 - 4606**
	Credit	**: 5 credits**
	Semester	**: VI (Even)**

COURSE DESCRIPTION

This course contains about: The concept of road geomeric planning, horizontal alignment, vertical alignment, horizontal and vertical alignment coordination, pavement planning concepts, CBR for subgrade, asphalt, aggregate, mix design, flexible pavement design, rigid pavement design.

LEARNING OUTCOMES

a. capable of resolving civil engineering issues related to transportation, including the ability to:
   - identify, formulate, analyze, and locate the source of civil engineering problems;
   - propose the best solution for solving civil engineering problems based on engineering principles, taking into account economic, safety, public safety and environmental sustainability factors;
   - plan and design infrastructure in the field of road engineering
   - select resources and utilize the results of engineering analysis based on information and computing technologies appropriate for planning / design;

b. capable of using the latest technology available in carrying out the work; and

c. able to criticize the settlement of infrastructure problems that have been and / or are being implemented, and poured in the form of scientific papers.

COURSE LEARNING OUTCOMES

Able to understand the concept of road geomeric planning; calculate horizontal alignment, vertical alignment, horizontal and vertical alignment coordination; understand the concept of pavement planning; calculate CBR for subgrade; check for asphalt and aggregate quality; asphalt concrete mix design ; design of flexible and rigid pavement; understand the implementation of flexible and rigid pavement work

MAIN SUBJECTS

Concept of road geometric planning, horizontal alignment, vertical alignment, horizontal and vertical alignment coordination, pavement planning concepts, CBR of subgrade, asphalt, aggregate, mix design of asphalt concrete, design pavement thickness of flexible and rigid.

PREREQUISITES

None

REFERECES

Book :

1. Undang-undang No. 38 Tahun 2004 tentang Jalan
2. Peraturan Pemerintah No. 34 Tahun 2006 tentang Jalan
3. Peraturan Menteri No. 60 Tahun 2012 tentang Persyaratan Teknis Jalur Kereta Api
4. Departemen Pekerjaan Umum, Dirjen Bina Marga, "Tata Cara Perencanaan Geometrik Jalan Antar Kota"
5. Departemen Pekerjaan Umum, Dirjen Bina Marga, "Standar Perencanaan Geometrik Untuk Jalan Perkotaan"
6. Silvia Sukirman, "Dasar-dasar Perencanaan Geometrik Jalan Raya"
7. AASHTO, "A Policy on Geometric Design of Highways and Streets, Fifth Edition", 2004
8. Bina Marga, "Perencanaan Tebal Perkerasan Lentur Jalan Raya dengan Metode Analisa Komponen", 1987
9. AASHTO, "Guide for Design of Pavement Structures", 1993
10. Asphalt Institute, "Asphalt technology and Construction Practices", 1983
11. Yoder and Witzchak, "Pavement Design"
12. Bina Marga, "Metode Pemeliharaan Jalan"

CURRICULUM SYLLABUS 2018

COURSE	**Course Name**	**: STEEL BRIDGES DESIGN**
	Course Code	**: RC18 - 4701**
	Credit	**: 2 credits**
	Semester	**: VII (Odd)**

COURSE DESCRIPTION

This course consists of preliminary design, design of deck or floor, longitudinal beam, transversal beam, wind truss, joint, foundation, abutment, and pier.

LEARNING OUTCOMES

The graduate able to planand design infrastructure in the areas of structural engineering, bridges with spans of at least 60 meters, based on engineering principles taking into account technical standards, performance aspects, reliability, ease of implementation, sustainability, and attention to economic, public safety, cultural, social and environmental factors.

COURSE LEARNING OUTCOMES

The students able to design bridge structure and foundation (substructure) with taking seismic load as consideration.

MAIN SUBJECTS

Preliminary design, design of deck or floor, longitudinal beam, transversal beam, wind truss, joint, foundation, abutment, and pier.

PREREQUISITES

1. Steel Structure
2. Reinforced Concrete Structure
3. Embankment and Soil Resisting Structure

REFERENCES

Book :

1. SNI 1725-2016 Pembebanan Untuk Jembatan
2. SNI 2833 2013 Perancangan jembatan terhadap beban gempa
3. AASHTO LRFD 2012 BridgeDesignSpecifications 6th Ed (US)
4. Das, Braja M. (1985). Priciples of Geotechnical Engineering. PWS Publishers, New York.
5. Das, Braja M. (1990). Priciples of Foundation Engineering. 2nd Edition, PWS - Kent Publishing Company, Boston
6. Bowles, Joseph E. (1996). Foundation Analysis and Design. 5th Edition. The McGraw-Hill Companies, Inc. New York.
7. Poulos, H. G. and E. H. Davis (1980). Pile Foundation Analysis and Design. John Wiley and Sons, New York.

COURSE	**Course Name**	**: DECISION MAKING TECHNIQUES**
	Course Code	**: RC18 - 4702**
	Credit	**: 3 credits**
	Semester	**: VII (Odd)**

COURSE DESCRIPTION

The subject is about engineering economics includes cost concept, time value of money concept, investment feasibility; optimization techniques includes linier programming, transportation model, assignment model; and multi-criteria decision making.

LEARNING OUTCOMES

1. Being able to solve civil engineering problems related to structure, water resources, geotechnic, and transportation, including the ability to identify, formulate, analyze, and locate the source of civil engineering problems.
2. Being able to apply mathematics, science and engineering principles to create or modify civil engineering models in the areas of structure, water resources, geotechnic, and transportation.

COURSE LEARNING OUTCOMES

Students able to implementengineering economics theory andoptimization techniques in decision making process.

MAIN SUBJECTS

1. Engineering economics includes cost concept, time value of money concept, investment feasibility.
2. Optimization techniques includes linier programming, transportation model, assignment model.
3. Multi-criteria decision making techniques.

PREREQUISITES

Construction Management

REFERENCES

Book :

1. Barry Render, Ralph M. Stair, Jr., Michael E. Hanna, Trevor S. Hale, Quantitative Analysis for Management - 12th Edition, Pearson, 2015
2. William G. Sullivan, Elin M. Wicks, C. Patrick Koelling, Engineering Economy - 16th Edition, Pearson Education, 2014
3. Thomas L. Saaty, The Analytic Hierarchy Process: Planning, Priority Setting, Resource Allocation (Decision Making Series), McGraw-Hill, 1980

COURSE	**Course Name**	**: AIRPORT PLANNING**
	Course Code	**: RC18 - 4603**
	Credit	**: 2 credits**
	Semester	**: VII (Odd)**

COURSE DESCRIPTION

This course contains: History of airfield, airport parts, determination and accessibility of airport location, airport regulation and standardization, aircraft characteristics, runnway geometry, taxiway geometry, exit taxiway location, gate position, apron area, air side capacity , and airport navigation aids

LEARNING OUTCOMES

a. Able to resolve civil engineering issues related to transportation, including the ability to:
   - Identify, formulate, analyze, and locate the source of civil engineering problems;
   - Propose the best solution for solving civil engineering problems based on engineering principles, taking into account economic, safety, public safety and environmental sustainability factors;
   - Select resources and utilize the results of engineering analysis based on information and computing technologies appropriate for planning / design;

b. Able to use the latest technology available in carrying out the work; and

c. Able to criticize the resolution of infrastructure problems that have been and / or are being implemented, and poured in the form of scientific papers.

COURSE LEARNING OUTCOMES

Students are able to know the history of airports, airport parts, determination and accessibility of airport location, airport regulation and standardization, aircraft characteristics, runnway geometry, taxiway geometry, exit taxiway location, gate position, apron area, air side capacity and tools help airport navigation.

MAIN SUBJECTS

History of airports, airport parts, site selection and accessibility, airport rules and regulations, aircraft characteristics, runnway geometry, taxiway geometry, exit taxiway location, gate position, apron area, air side capacity and urban navigation aids air

PREREQUISITES

None

REFERENCES

Book :

1. Keputusan Menteri No. 11 Tahun 2010 tentang Tatanan Kebandarudaraan Nasional, Kementerian Perhubungan RI, 2010

2. Surat Keputusan Dirjen Perhubungan Udara (SKEP 77/VI/2005) tentang Persyaratan Teknik Pengoperasian Fasilitas Teknik Bandar Udara, Dirjen Perhubungan Udara, 2005
3. SNI 03-7095-2005 tentang Marka & Rambu, Badan Sertifikasi Nasional (BSN), 2005
4. Annex ICAO Annex 14 Sixth Edition, ICAO, 2013
5. Airport Pavement Design and Evaluation, FAA, 1995
6. Norman Ashford dan Paul H. Wright., "Airport Engineering", John Wiley &Sons, Cetakan ke 2, 1984
7. Robert Horonjeff dan Francis X. McKelvey., "Planning &Design of Ariports", McGraw-Hill, Inc, Cetakan ke 4, 1994
8. "Airport Terminal Reference Manual", IATA, 1989

COURSE	**Course Name**	**: ACADEMIC REPORT WRITING**
	Course Code	**: RC18 - 4604**
	Credit	**: 2 credits**
	Semester	**: VII (Odd)**

COURSE DESCRIPTION
This course consists of: Gap Analysis, writing composition, format and writing of POMITS, presentation technique, writing of Chapter 1, 2 and 3.
LEARNING OUTCOMES
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 his/her area of expertise; 2. being able to demonstrate independent, qualified and measurable performances; and 3. being able to create scientific descriptions of the results of his/her study in the form of undergraduate thesis or final project report, and upload them in the college page or institute's website;
COURSE LEARNING OUTCOMES
Students able to compile of GAP analisys, writing composition, format and writing of POMITS, do technique presentation, and present of writing of Chapter 1, 2 and 3.
MAIN SUBJECTS
GAP Analysis, writing composition, format and writing of POMITS, presentation technique, writing of Chapter 1, 2 and 3.
PREREQUISITES
None
REFERENCES
Book : "Buku Pedoman Tugas Akhir", Komisi Akademik Sub Komisi TA.

CURRICULUM SYLLABUS 2018

COURSE	**Course Name**	**: PROCUREMENT AND CONTRACT FOR CONSTRUCTION PROJECT**
	Course Code	**: RC18 - 4801**
	Credit	**: 2 credits**
	Semester	**: VIII (Even)**

COURSE DESCRIPTION
The subject is about project selection & procurement concepts, procurement methods, conduct procurements, procurement document, bidding document, basic concepts of contract, contract documents, and administer contract.
LEARNING OUTCOMES
Plan and design infrastructure in the areas of: structural engineering (minimum building of eight floors and bridges with spans of at least 60 meters), engineering of water resources (small dam of 10 meter high, irrigation area maximum of 3000 ha, drainage area as well as river and beach buildings), geotechnical engineering (foundations, retaining soil structures and soil improvement methods), and transport engineering (roads, railways, ports and airports) based on engineering principles taking into account technical standards, performance aspects, reliability, ease of implementation, sustainability, and attention to economic, public safety, cultural, social and environmental factors;
COURSE LEARNING OUTCOMES
Students able to understand project selection & procurement concepts, procurement methods, conduct procurements, procurement document, bidding document, basic concepts of contract, contract documents, and administer contract.
MAIN SUBJECTS
1. Project selection & procurement concepts 2. Procurement methods 3. Conduct procurements 4. Procurement document & bidding document 5. Basic concept of contract 6. Contract documents 7. Administer contract
PREREQUISITES
Construction Management
REFERENCES
Book :

1. Peraturan Presiden Nomor 54 Tahun 2010 tentang Pengadaan Barang/Jasa Pemerintah
2. Peraturan Presiden Nomor 4 Tahun 2015, Perubahan Keempat atas Peraturan Presiden Nomor 54/2010 tentang Pengadaan Barang/Jasa Pemerintah
3. Jimmie Hinze, Construction Contracts - 3rd Edition, 2001
4. Will Hughes, Ronan Champion, John Murdoch, Construction Contracts : Law and Management - 5th Edition, Taylor & Francis Ltd, 2015

CURRICULUM SYLLABUS 2018

COURSE	**Course Name**	**: FINITE ELEMENT METHOD**
	Course Code	**: RC18 - 4705**
	Credit	**: 3 credits**
	Semester	**: VII (Elective)**

COURSE DESCRIPTION
This course discuss about Overview of finite element method, Bar element, Beam element, Structural system, 2D plane (CST, Q4, Q8, Q9), Solid elements (8 nodes, 20 nodes)
LEARNING OUTCOMES
Being able to solve civil engineering problems related to structure, water resources, geotechnic, and transportation, including the ability to propose the best solution to solve civil engineering problems based on engineering principles, taking into account economic, safety, public safety and environmental sustainability factors
COURSE LEARNING OUTCOMES
1. Student able to understand the basic calculation concept using finite element method. 2. Student able to perform finite element modeling and analysis for structures using bar element, beam element, structural system, 2D plane (CST, Q4, Q8, Q9), solid elements (8 nodes, 20 nodes)
MAIN SUBJECTS
Overview, Bar element, Beam element, Structural system, 2D plane (CST, Q4, Q8, Q9), Solid elements (8 nodes, 20 nodes)
PREREQUISITES
None
REFERENCES
Book : 1. Cook, R. D., et al. "Concepts and Application of Finite Element Analysis," 4th edition, John Wiley & Sons, Inc, New York, USA. 2. Cook, R. D. "Finite Element Modeling for Stress Analysis," John Wiley & Sons,Inc, New York, USA 3. Logan, D. L. "A First Course in the Finite Element Method," PWS Engineering. 4. Bathe, K. J. "Finite Element Procedures in Engineering Analysis," Prentice-Hall. 5. Zienkiewicz, O. C. "Finite Element Method - The Basis," Betterworth

Heinemann.
6. Wilson, E. L. “Numerical Method for Finite Element Analysis,” Prentice Hall.
7. Macleod, I. A. “Analytical Modeling of Structural System,” Ellis Horwood.
8. Holzer, S. M. “Computer Analysis of Structures – Matrix Structural Analysis
9. Structured Programming,” Elsevier, Oxford, U.K.Ellis Horwood.

COURSE	**Course Name**	**: DUCTILE DESIGN OF STEEL STRUCTURES**
	Course Code	**: RC18 - 4706**
	Credit	**: 3 credits**
	Semester	**: VII (Elective)**

COURSE DESCRIPTION

This course discuss about mechanical properties of steel, plastic behavior of steel section, Collapse mechanism of steel structures, Push-over analysis, Ductile moment frame, centric and eccentrically braced frame, anti-buckling braced frame, Steel plate shear wall.

LEARNING OUTCOMES

Being able to solve civil engineering problems related to structureincluding the ability toplan and design infrastructure in the areas of: structural engineering based on engineering principles taking into account technical standards, performance aspects, reliability, ease of implementation,sustainability, and attention to economic, public safety, cultural, social and environmental factors;

COURSE LEARNING OUTCOMES

1. Student understand mechanic behavior of steel, effect of temperature and ductility
2. Student understand plastic behavior of steel cross section due to axial and moment.
3. Student able to analyze and design moment resisting frame

MAIN SUBJECTS

Mechanical properties of steel, plastic behavior of steel section, Collapse mechanism of steel structures, Push-over analysis, Ductile moment frame, centric and eccentrically braced frame, anti-buckling braced frame, Steel plate shear wall.

PREREQUISITES

Structure Steel Building

REFERENCES

Book:

1. AISC. (2010) “Seismic Provisions for Structural Steel Building,” American Institute of Steel Construction, Chicago.
2. Brockenbrough, R.L., Merritt, F.S. (2006), “Structural Steel Designer’s Handbook, 4th edition,” McGraw-Hill, New York
3. Bruneau, M., Uang, C.M., dan Whittaker, A. (1998), “Ductile Design of Steel

Structures," McGraw-Hill, New York
4. Englekirk, R. (1994), "Steel Structures, Controlling Behavior Through Design," John Wiley and Sons, New York.
5. Tata Cara Perencanaan Struktur Baja untuk Bangunan Gedung (2002), Standar Nasional Indonesia, 03-1729-2002
6. Tata Cara Perencanaan Ketahanan Gempa untuk Bangunan Gedung (2002), Standar Nasional Indonesia, 03-1726-2002

COURSE	Course Name	: STRUCTURAL DYNAMICS
	Course Code	: RC18 - 4707
	Credit	: 3 credits
	Semester	: VII (Elective)

COURSE DESCRIPTION
This course discuss about : SDOF including Free Vibration, Force Vibration (harmonic and impulse load), Numerical methos, Generalized SDOF; MDOF including Free Vibration, Dynamic response Linear System, Earthquake Engineering
LEARNING OUTCOMES
Being able to solve civil engineering problems related to structure, water resources, geotechnic, and transportation, including the ability to propose the best solution to solve civil engineering problems based on engineering principles, taking into account economic, safety, public safety and environmental sustainability factors
COURSE LEARNING OUTCOMES
Student able to solve the equation of SDOF including Free Vibration, Force Vibration (harmonic and impulse load), Numerical methos, Generalized SDOF; MDOF including Free Vibration, Dynamic response Linear System, Earthquake Engineering
MAIN SUBJECTS
SDOF including Free Vibration, Force Vibration (harmonic and impulse load), Numerical methos, Generalized SDOF; MDOF including Free Vibration, Dynamic response Linear System, Earthquake Engineering
PREREQUISITES
None
REFERENCES
Book : 1. Clough, R. W. and Penzien, J., "Dynamics of Structures" (3rd edition), McGraw-Hill Companies, Inc., 2003 2. Chopra, A. K., "Dynamics of Structures (4th edition)", Pearson, 2011 3. Paz, M., "Structural Dyanamics (4th edition)", Springer Science & Business Media, 2012 4. Thomson, W.T.,"Theory of vibration with Applications" 2nd ed.,Prentice Hall, Inc, 1981

COURSE	**Course Name**	**: LONG SPAN BRIDGE ENGINEERING**
	Course Code	**: RC18 - 4708**
	Credit	**: 2 credits**
	Semester	**: VII (Elective)**

COURSE DESCRIPTION

This course discuss about : 1) Review of bridge engineering, 2) Arch Bridge, 3) Suspension bridge, 4) Cable stayed bridge, 5) Long span prestress bridge, 6) Methods of long span bridge in practice.

LEARNING OUTCOMES

Being able to solve civil engineering problems related to structureincluding the ability toplan and design infrastructure in the areas of: structural engineering based on engineering principles taking into account technical standards, performance aspects, reliability, ease of implementation,sustainability, and attention to economic, public safety, cultural, social and environmental factors;

COURSE LEARNING OUTCOMES

Student able to :

- do preliminary design of arch bridge
- choose type of arch bridge depends on position of bridge deck, materials, span and applied load
- choose appropriate support to overcome the longitudinal and transversal deformation
- choose phylon type based on bridge deck elevation
- describe catenary shape of cable
- sketch the diagram of influence line of cable in suspension bridge
- describe type of cable and its connection

MAIN SUBJECTS

1) Review of bridge engineering, 2) Arch Bridge, 3) Suspension bridge, 4) Cable stayed bridge, 5) Long span prestress bridge, 6) Methods of long span bridge in practice.

PREREQUISITES

None

REFERENCES

Book :

1. Hool, G.A and Kinne, W.S. (1943), “Movable and Long-Span Steel Bridges”, McGraw-Hill, New York.

2. Pugsley, S.A. (1968), “The Theory of Suspension Bridges, 2nd Ed” Edward Arnold, London
3. Giemsing, N.J. (1983). “Cable Supported Bridges, Concepts and Design”, John Wiley and Sons, New York
4. Troitsky, M.S. (1990), “Prestressed Steel Bridges : Theory and Design”, Van Nostrand Reinhold, New York
5. Podolny, W. and Scalzi, J.B. (1976). “Construction and Design of Cable Stayed Bridges”, John Wiley and Sons, New York.
6. Walther, R., Houriet, B., Isler, W., dan Moïa, P. (1985). “Cable Stayed Bridges”, Thomas Telford Ltd., London

COURSE		
	Course Name	**: PRESTRESSED CONCRETE**
	Course Code	**: RC18 - 4709**
	Credit	**: 2 credits**
	Semester	**: VII (Elective)**

COURSE DESCRIPTION
This course disscuss about : 1) Basic concept of prestressed concrete, 2) Material and system of prestress, 3) Loss of prestress, 4) Analysis and design for flexure of prestressed concrete, 5) Analysis and design for Shear and torsion of prestressed concrete, 6) Indeterminate prestressed beam, 7) Camber, defection and crack control, 8)Tension and compression component of prestressed, 9)Introduction eathquake design of prestressed structures
LEARNING OUTCOMES
Being able to solve civil engineering problems related to structureincluding the ability toplan and design infrastructure in the areas of: structural engineering based on engineering principles taking into account technical standards, performance aspects, reliability, ease of implementation,sustainability, and attention to economic, public safety, cultural, social and environmental factors.
COURSE LEARNING OUTCOMES
Student able to understand 1) Basic concept of prestressed concrete, 2) Material and system of prestress, 3) Loss of prestress, 4) Analysis and design for flexure of prestressed concrete, 5) Analysis and design for Shear and torsion of prestressed concrete, 6) Indeterminate prestressed beam, 7) Camber, defection and crack control, 8)Tension and compression component of prestressed, 9)Introduction eathquake design of prestressed structures
MAIN SUBJECTS
1) Basic concept of prestressed concrete, 2) Material and system of prestress, 3) Loss of prestress, 4) Analysis and design for flexure of prestressed concrete, 5) Analysis and design for Shear and torsion of prestressed concrete, 6) Indeterminate prestressed beam, 7) Camber, defection and crack control, 8)Tension and compression component of prestressed, 9)Introduction eathquake design of prestressed structures
PREREQUISITES
1. Engineering mechanices 2. Reinforced Concrete elements
REFERENCES
Book : 1. Lin, T. Y.; and Burns, N. H. "Design of Prestressed Concrete Structures," Mcgraw-Hill, 1982

2. Naaman,E.A "Prestressed concrete Analysis and desain"
3. Nawy, E. G. "Prestressed Concrete," Pearson Education, Inc., 2008

COURSE	**Course Name**	**: ADVANCE FOUNDATION ENGINEERING**
	Course Code	**: RC18 - 4710**
	Credit	**: 2 credits**
	Semester	**: VII (Elective)**

COURSE DESCRIPTION

This course disscuss about : mat foundation, cellular cofferdam, caisson foundation, secant pile, soldier pile, diaphragm wall, soil nailing, ground anchor, consideration of the influence of groundwater seepage into excavation.

LEARNING OUTCOMES

Ability to:

1. apply mathematics, science and engineering principles to create or modify civil engineering models in geotechnics;
2. plan and design infrastructure in the areas of geotechnical engineering based on engineering principles and taking into account technical standards, performance aspects, reliability, ease of implementation, sustainability, while also considering the factors of economy, public safety, culture, social and environment; and
3. use the latest technology available in carrying out the work.

COURSE LEARNING OUTCOMES

Ability to:

1. design bearing capacity of mat foundation;
2. design cellular cofferdam;
3. design bearing capacity of caisson foundation;
4. design secant pile, soldier pile, and diaphragm wall;
5. design soil nailing and ground anchor; and
6. the influence of groundwater seepage into excavation

MAIN SUBJECTS

Mat Foundation, Cellular Cofferdam, Caisson Foundation, Secant Pile, Soldier Pile, Diapraghma Wall, Soil Nailing and Ground Anchor and are able to calculate the influence of ground water on the excavation

PREREQUISITES

1. Soil Mechanics and Foundation Engineering
2. Embankment and Earth Retaining Structure

REFERENCES

Book :

1. Das, Braja M. (2011). Priciples of Foundation Engineering. 7th Edition, Global Engineering, USA .

2. Bowless, J.E. (1997). Foundation Analysis and Design, 5th Edition, The Mc.Graw-Hill Companies, Inc., Singapore
3. Peck, Ralph. B (1973). Foundation Engineering, 2nd Edition, John Wiley & Sons Inc, New York
4. Zeevaert, Leonardo (1983), Foundation Engineering For Difficult Subsoil Conditions, 2nd Edition, Van Nostrand Reinhold Company, New York

COURSE	**Course Name**	**: DYNAMICALLY LOADED FOUNDATION**
	Course Code	**: RC18 - 4711**
	Credit	**: 2 credits**
	Semester	**: VII (Elective)**

COURSE DESCRIPTION

This course disscuss about : Machine foundation, isolating vibration, laterally loaded pile by elastic and dynamic analysis, introduction of liquefaction, and vibration due to pile driving

LEARNING OUTCOMES

Ability to:

1. apply mathematics, science and engineering principles to create or modify civil engineering models in geotechnics;
2. plan and design infrastructure in the areas of geotechnical engineering based on engineering principles and taking into account technical standards, performance aspects, reliability, ease of implementation, sustainability, while also considering the factors of economy, public safety, culture, social and environment; and
3. use the latest technology available in carrying out the work.

COURSE LEARNING OUTCOMES

Ability to:

1. calculate the amplitude and resonance frequency of foundation due to machine activity with considering environmental concept;
2. measure the isolation;
3. obtain lateral deflection of pile, maximum moment and soil pressure due to lateral load by elastic or dynamic analysis
4. vibration influence due to pile driving; and
5. introduction of liquefaction.

MAIN SUBJECTS

1. Machine foundation.
2. Isolating vibration.
3. Laterally loaded pile by elastic and dynamic analysis.
4. Introduction of liquefaction.
5. Vibration due to pile driving.

PREREQUISITES

Soil Mechanics and Foundation

REFERENCES

Book :

1. Arya, S, O'Neil, M, dan Pincus, G (1979).Design of Structures and Foundation for Vibrating Machines. Gulf Publishing Company, Houston, Texas, ch 1,2,3,4 dan 6.
2. Prakash, S. . (1980). Soil Dynamic. McGrawHill Book Company, ch 1 dan 9
3. Richart, F.E. Jr, Hall, J.R. Jr dan Wood, R.D.(1970) Vibration of Soil and Foundation, Prentice Hall Inc, Englewood Cliff, N.J. Ch 7,8 dan 9
4. Sidharta, Ananta S. (2016). Pondasi dengan Beban Dinamis, buku pegangan kuliah edisi VII, FTSP-Sipil, ITS

COURSE		
	Course Name	**: SOIL IMPROVEMENT METHOD**
	Course Code	**: RC18 - 4712**
	Credit	**: 2 credits**
	Semester	**: VII (Elective)**

COURSE DESCRIPTION

This course consists of: bearing capacity improvement method for soft soil: preloading, geotextile reinforcement, and micropile; soil improvement method by Menard; method to handle swelling soil.

LEARNING OUTCOMES

Ability to:

1. apply mathematics, science and engineering principles to create or modify civil engineering models in geotechnics;
2. plan and design infrastructure in the areas of geotechnical engineering based on engineering principles and taking into account technical standards, performance aspects, reliability, ease of implementation, sustainability, while also considering the factors of economy, public safety, culture, social and environment; and
3. use the latest technology available in carrying out the work.

COURSE LEARNING OUTCOMES

Ability to:

1. design soil improvement to increase the soil bearing capacity by using preloading system, geotextile, micropile, or stone column;
2. design the preloading system combined with vertical drain to eliminate the soil compression and to accelerate its compression period.
3. explain the soil improvement method by Menard;
4. design how to handle the swelling soil; and
5. design soil reclamation and its construction work

MAIN SUBJECTS

1. The importance of soil improvement method for Civil Engineers.
2. Review of Geosynthetics as an embankment reinforcement.
3. Bearing capacity improvement method for soft soil using Micropile.
4. Soil improvement method by MENARD.
5. How to handle swelling soil.
6. Preloading method and the use of vertical drain to accelerate the compression process for reclamation.

PREREQUISITES

1. Soil Mechanics and Foundation Engineering
2. Embankment and Earth Retaining Structures

REFERENCES

Book :

1. Mochtar, Noor Endah, (2012). Modul Ajar Metode Perbaikan Tanah. Surabaya: Jurusan Teknik Sipil FTSP-ITS.
2. Koerner, Robert M. (1997). Designing with Geosynthetics. New Jersey: Prentice-Hall, Inc.
3. Ingles, O. G. and Metchalf, J. B., (1972), Soil Stabilization- Principles and Practice, Butterworths, Australia
1. Menard (2007). Soil Improvement Specialist, Soltraitement Around the World, publikasi oleh Menard

COURSE		
	Course Name	**: GEOLOGY ENGINEERING**
	Course Code	**: RC18 - 4713**
	Credit	**: 2 credits**
	Semester	**: VII (Elective)**

COURSE DESCRIPTION

This course consists of: site investigation, rock mass characterization, deformation and settlement, bearing capacity of foundation on rock, sliding stability on rock, anchorage system, and construction consideration,

LEARNING OUTCOMES

Ability to:

1. apply mathematics, science and engineering principles to create or modify civil engineering models in geotechnics;
2. plan and design infrastructure in the areas of geotechnical engineering based on engineering principles and taking into account technical standards, performance aspects, reliability, ease of implementation, sustainability, while also considering the factors of economy, public safety, culture, social and environment; and
3. use the latest technology available in carrying out the work.

COURSE LEARNING OUTCOMES

Ability to:

1. read geology map.
2. understand rock characteristic.
3. design bearing capacity of foundation on rock including its compression;
4. determine the stability and sliding of rock slope;
5. design the anchor, bolt and dowel on rock

MAIN SUBJECTS

1. Site investigation,
2. Rock mass characterization,
3. Deformation and settlement,
4. Bearing capacity of foundation on rock,
5. Sliding stability on rock, anchorage system, and
6. Construction consideration,

PREREQUISITES

1. Soil Mechanics and Foundation Engineering

REFERENCES

Book :

1. Billing MP, "Structural Geology", 1980.
2. Hamblin and Howard, "Earth Dynamics System", 1978.

3. John Pits, HS., "A Manual of Geologi for Civil Engineering", 1984 .
4. Todd D.K., "Ground Water Hydrology", 1980..

COURSE	**Course Name**	**: ROCK FOUNDATION ENGINEERING**
	Course Code	**: RC18 - 4714**
	Credit	**: 2 credits**
	Semester	**: VII (Elective)**

COURSE DESCRIPTION

This course consists of: Introduction, Understanding Rocks & Utilization of geological map; Laboratory test on rocks, Stress & strain theory and failure criteria of an intact rock; classification theory & shear strength for a rock mass; Rock mass failure and rock mass deformation due to foundation load; The bearing capacity of a rock mass for the shallow foundation, pile foundation; Stability (safety factor) and reinforcement of a trench excavation in a rock mass; Anchor, dowel and bolt.

LEARNING OUTCOMES

Ability to:

1. apply mathematics, science and engineering principles to create or modify civil engineering models in geotechnics;
2. plan and design infrastructure in the areas of geotechnical engineering based on engineering principles and taking into account technical standards, performance aspects, reliability, ease of implementation, sustainability, while also considering the factors of economy, public safety, culture, social and environment; and
3. use the latest technology available in carrying out the work.

COURSE LEARNING OUTCOMES

Ability to:

1. read the geological map;
2. understand the characteristics of the rock;
3. plan the carrying capacity of various foundations on the rock including its deformation;
4. determine the stability and slope failure of rock; and
5. plan the system of anchor, bolt and dowel on rocks.

MAIN SUBJECTS

1. Introduction.
2. Understanding Rocks & Utilization of geological map.
3. Laboratory test on rocks.
4. Stress & strain theory and failure criteria of an intact rock.
5. Classification theory & shear strength for a rock mass.
6. Rock mass failure and rock mass deformation due to foundation load.

7. The bearing capacity of a rock mass for the shallow foundation, pile foundation.
8. Stability and reinforcement of a trench excavation in a rock mass.
9. Anchor, dowel and bolt.

PREREQUISITES

3. Soil Mechanics and Foundation Engineering
4. Embankment and Earth Retaining Structures

REFERENCES

Book :

1. Goodman,R.E. (1989). Introduction to Rock Mechanics
2. Hoek,E and Bray,J.W (1981), Rock Slope Engineering
3. Moesdarjono,S (2009), Teknik Pondasi Pada Lapisan Batuan, ITS Press, Surabaya,Indonesia.

COURSE		
	Course Name	**: DESIGN OF PIPELINE**
	Course Code	**: RC18 - 4715**
	Credit	**: 2 credits**
	Semester	**: VII (Elective)**

COURSE DESCRIPTION

This course contains:
Application of hydraulics closed channel flow through pipeline (flow in pipes), pipeline networks, pipeline connection points, pumps, valves and water tanks or reservoirs, computer program for piping water network planning (Epanet).

LEARNING OUTCOMES

Being able to solve civil engineering problems related to water resources, including the ability to:

1. Identify, formulate, analyze, and locate the source of civil engineering problems;
2. Propose the best solution to solve civil engineering problems based on engineering principles, taking into account economic, safety, public safety and environmental sustainability factors;
3. Being able to use the latest technology available in carrying out the work;

COURSE LEARNING OUTCOMES

- Students are able to plan of hydraulics closed channel flow through pipeline (flow in pipes), pipeline networks, pipeline connection points, pumps, valves and water tanks or reservoirs, computer program for piping water network planning (Epanet).

MAIN SUBJECTS

Principal of newton's equation, Boundary Layer, Pipes Energy Loss, Energy Loss Energy due to Pipe Age, principal of Energy Equation, Piping Network, Epanet (Basic Theory), Simulation of Input and Output data, Pipeline Network Modeling Exercise.

PREREQUISITES

None

REFERENCES

Book :

1. Streater V.L dan Benyamin Willie. Fluid Mechanics. McGraw-Hill inc.
2. Bambang Triatmojo, Hidraulika II, Beta Offset, 2008(in Indonesia)
3. Lewis A. Rossman, EPANET 2 User Manual, Water Supply and Water Resources Division National Risk Management Research Laboratory Cincinnati, 2000

COURSE	**Course Name**	**: DESIGN OF COASTAL PROTECTION**
	Course Code	**: RC18 - 4716**
	Credit	**: 2 credits**
	Semester	**: VII (Elective)**

COURSE DESCRIPTION

This course contains:

Basic theory review of Coastal Engineering, Types of Coastal Protection Building, Lay-Out / Plan of Coastal Building, Coastal Building Selection,Upright and Lean SideCoastal Building, BreakingWaves, Waveline on Upright Side Building, Sloping Side Coastal Building Planning, BreakingWave Building Materials

LEARNING OUTCOMES

Being able to solve civil engineering problems related to water resources, including the ability to:

1. Identify, formulate, analyze, and locate the source of civil engineering problems;
2. Propose the best solution to solve civil engineering problems based on engineering principles, taking into account economic, safety, public safety and environmental sustainability factors;
3. Being able to use the latest technology available in carrying out the work;

COURSE LEARNING OUTCOMES

Students are able to explain and calculate parameters for coastal protection planning such as wave, tide, sediment transport; able to determine the type of coastal protection building related with topography, bathymetry, hydro-oceanographic conditions and coastal environment; able to determine the dimensions of structural elements and top elevations of buildings; able to draw coastal protection buildings;

MAIN SUBJECTS

Review of Basic Coastal Engineering, Types of Coastal Protection Building, Lay-Out / Plan of Coastal Building, Coastal Building Selection, Upright and Lean Side Coastal Building, Breaking Waves, Waveline on Upright Side Building, Sloping Side Coastal Building Planning, Breaking Wave Building Materials

PREREQUISITES

- Fluid Mechanics and Hydraulics
- Hydraulic Coastal Engineering and Port Planning

REFERENCES

Book :

1. Center for Civil Engineering Research and Codes. Manual on the use of Rock in Coastal and shoreline Engineering, CIRIA - CUR, London,2003
2. Goda, Yoshimi, Random Seas and Design of Maritime Structures' University of Tokyo Press, 1985
3. Kampguis, J.William, Introduction to Coastal Engineering and Management, World Scientific Singapore, 2000
4. Triatmodjo, Bambang, Perencanaan Bangunan Pantai, Beta Offset, Yogyakarta , 1999
5. US ARMY Corp of Engineers, Coastal Engineering Manual, Coastal Engineering Research Center, Misissipi, 2003.

COURSE	**Course Name**	**: WATER RESOURCES MANAGEMENT**
	Course Code	**: RC18 - 4717**
	Credit	**: 2 credits**
	Semester	**: VII (Elective)**

COURSE DESCRIPTION

This course contains about: The concept of water system (hydrosystem), applied of hydrology, applied of hydraulics, availability of water resources, water resources projects, and water resources management system.

LEARNING OUTCOMES

Students are able to explain the technical irrigation system and network in Indonesia (maximum area 3000 ha), able to plan the dimension of sustainable irrigation channel, able to plan the discharge measurement, able to plan the tertiary units, able to plan the diversion structure, able to plan the crosses structure, able to plan the main building (dam remains high maximum 10 m) and calculate the stability of the weir.

COURSE LEARNING OUTCOMES

Students are able to explain the water system (hydrosystem); linkage of the hydrological cycle to water resources; utilization and calculation of rain and discharge data; knowledge practical to apply of hydraulics to water resources; availability of water resources such as the groundwater, river water and reservoirs; water resources projects, irrigation, water supply, hydroelectricity, river transport, river flood control, drainage and river sediment control; water resources management system related to legislation and technical economic analysis for water resources.

MAIN SUBJECTS

The concept of water system (hydrosystem), applied of hydrology, applied of hydraulics, availability of water resources, water resources projects, and water resources management system.

PREREQUISITES

1. Irrigation and Water Building
2. Drainage
3. River Engineering

REFERENCES

Book :

1. Anwar, Nadjadji (2017): Rekayasa Sumber Daya Air, ITS Press, Surabaya
2. Chin, David (2006): Water-Resources Engineering, Pearson Prentice Hall,

New Jersey.
3. Linsley, R.K., M.A. Kohler, D.I. Freyberg, and G. Tsobanoglous (1992): Water Resources Engineering, Mc.Graw-Hill, New York.
4. Mays, W.L. (2001): Water Resources Engineering, John Wiley & Sons, Inc., New York
5. Mays, W.L. and Y.K. Tung (1992): Hydrosystems Engineering and Management, McGraw-Hill Inc., New York.

COURSE	**Course Name**	**: OPERATION AND MAINTENANCE OF WATER INFRASTRUCTURES**
	Course Code	**: RC18 - 4718**
	Credit	**: 2 credits**
	Semester	**: VII (Elective)**

COURSE DESCRIPTION

This course contains about: 1) Concepts and procedures for operation and maintenance of water structures which include irrigation building, drainage, reservoir, river and coastal; 2) Legislation and standards related to water resources; 3. Implementation of operation and maintenance related to institutional and human resources and financing.

LEARNING OUTCOMES

Students are able to explain the technical irrigation system and network in Indonesia (maximum area 3000 ha), able to plan the dimension of sustainable irrigation channel, able to plan the discharge measurement, able to plan the tertiary units, able to plan the diversion structure, able to plan the crosses structure, able to plan the main building (dam remains high maximum 10 m) and calculate the stability of the weir.

COURSE LEARNING OUTCOMES

1) Students are able to explain the operating system of water structures consisting of irrigation, drainage, reservoir, river and coastal. 2) Students are able to perform maintenance analysis on parts of water buildings, such as concrete buildings in diversion structure, stone pairs, revetment, channel slop, water depth, drainage basin, basin reservoir, river embankment, crib building and jetty. 3) Students can make plans of institutional, human resources and financing requirements for the operation and maintenance of water buildings.

MAIN SUBJECTS

1) Concepts and procedures for operation and maintenance of water structures which include irrigation building, drainage, reservoir, river and coastal; 2) Legislation and standards related to water resources; 3. Implementation of operation and maintenance related to institutional and human resources and financing

PREREQUISITES

1. Irrigation and Water Structures
2. Drainage
3. River Engineering

REFERENCES

Book :

1. Buku-buku pedoman dan standar SNI PUSAIR Kementerian PUPR

COURSE	**Course Name**	**: DESIGN OF DAM**
	Course Code	**: RC18 - 4719**
	Credit	**: 2 credits**
	Semester	**: VII (Elective)**

COURSE DESCRIPTION

This course contains: dams and weirs (functions, types and data needed in planning), calculation of reservoir volume, stability design of main dam (earthfill/rockfill dam), design of spill way and energy dissipator

LEARNING OUTCOMES

1. Plan and design infrastructure in water resources engineering based on engineering principles taking into account technical standards, performance aspects, reliability, ease of implementation, sustainability, and attention to economic, public safety, cultural, social and environmental factors;
2. Being able to use the latest technology available in carrying out the work;

COURSE LEARNING OUTCOME

Students are able to classify the functions, types and data planning for stable dams design along with its spillway and energy dissipator.

MAIN SUBJECTS

This course contains about: dams and weirs (functions, types and data needed in planning), calculation of reservoir volume, stability design of main dam (earth/rock dam), spill way and energy dissipater design

PREREQUISITES

1. Fluid Mechanics and Hydraulics
2. Hydrology

REFERENCES

Book :

1. Design of Small Dam, Bureau of Reclamation, United Stated Departemen of The Interior, 3rd Edition 1987
2. Sosrodarsono S. dan K. Takeda, Bendung tipe urugan, Pradnya Paramita, 1977
3. Sosrodarsono S. dan K. Takeda, Bendung tipe urugan, Pradnya Paramita, 1977
4. Linsley Ray K., Kohler Max A., J.L.H. Paulhus , Hydrology for Engineer (Hidrologi untuk Insinyur), Erlangga, Jakarta,1997
5. Chow, V.T., Open Channel Hydraulics, Mc Graw Hill Kugakusha, 1954

COURSE	**Course Name**	**: HYDROPOWER**
	Course Code	**: RC18 - 4720**
	Credit	**: 2 credits**
	Semester	**: VII (Elective)**

COURSE DESCRIPTION

This course contains about the concept of utilization of water sources as a hydropower and civil building design on hydropower

LEARNING OUTCOMES

1. Being able to plan and design infrastructure in the areas of engineering of water resources based on engineering principles taking into account technical standards, performance aspects, reliability, ease of implementation, sustainability, and attention to economic, public safety, cultural, social and environmental factors;
2. Being able to use the latest technology available in carrying out the work; and

COURSE LEARNING OUTCOMES

Being able to calculate the potential of water sources as a hydropower, plan the civil building design on hydropower and analyze the feasibility of a hydropower

MAIN SUBJECTS

1. Introduction of hydropower
2. Potential of water resources as a hydropower
3. Micro hydropower case study
4. Design of civil buildings on hydropower
5. Feasibility study of hydropower

PREREQUISITES

1.Hydrology
2. Fluid Mechanics and and Hydraulics

REFERENCES

Book :

1. SNI 8397:2017 Panduan studi kelayakan pembangunan Pembangkit Listrik Tenaga Mikro Hidro (PLTMH)
2. Patty, "Tenaga Air"
3. IMIDAP-2008 Pedoman Teknik: Standardisasi Peralatan dan Komponen Pembangkit Listrik Tenaga Mikro Hidro (PLTMH)
4. IMIDAP-P-021-2009 Buku 1: Pedoman Studi Potensi (Pra Studi Kelayakan)
5. IMIDAP-P-022-2010 Buku 2A: Pedoman Studi Kelayakan Hidrologi
6. IMIDAP-P-0223-2009 Buku 2B: Pedoman Studi Kelayakan Sipil
7. IMIDAP-P-021-2009 Buku 1: Pedoman Studi Potensi (Pra Studi Kelayakan)

COURSE		
	Course Name	**: HIGHWAY ECONOMY**
	Course Code	**: RC18 - 4721**
	Credit	**: 2 credits**
	Semester	**: VII (Elective)**

COURSE DESCRIPTION

This course contains about:conception of highway economy, the concept generalized cost, AASHTO user cost method, BOK, saving concept, cashflow, feasibility of road project.

LEARNING OUTCOMES

a. capable of resolving civil engineering issues related to transportation, including the ability to:
   - identify, formulate, analyze, and locate the source of civil engineering problems;
   - propose the best solution for solving civil engineering problems based on engineering principles, taking into account economic, safety, public safety and environmental sustainability factors;
   - select resources and utilize the results of engineering analysis based on information and computing technologies appropriate for planning / design;

b. capable of using the latest technology available in carrying out the work; andable to criticize the settlement of infrastructure problems that have been and / or are being implemented, and poured in the form of scientific papers.

COURSE LEARNING OUTCOMES

Students are able to understand the concept of generalized cost calculation, user cost AASHTO method, BOK, saving concept, cash flow, road project feasibility.

MAIN SUBJECTS

The scope and concepts of highway economy, generalized cost calculation concept, user cost AASHTO method, BOK, saving concept, cash flow, road project feasibility

PREREQUISITES

None

REFERENCES

Book :

1. Oglesby C.H.dan R.G. Hicks , "Teknik Jalan Raya", Erlangga, Cetakan ke 3, 1993
2. Tamin, O.Z., "Perencanaan dan Pemodelan Transportasi", Edisi ke dua, Penerbit ITB Press, 2000
3. N.D. Lea Consultant & Associates Ltd. Traffic Economic Studies and Analyses, Road Improvement Project, Draft Final Report, 1975
4. Pacific Consultant Internatonal Consultant, Surabaya-Mojokerto Toll Road.

COURSE	**Course Name**	**: PASSENGERS AND FREIGHT TRANSPORTATION FACILITIES**
	Course Code	**: RC18 - 4722**
	Credit	**: 2 credits**
	Semester	**: VII (Elective)**

COURSE DESCRIPTION

This course contains: Importance of passenger transport, transit system, transit mode, demand calculation, route planning and service type and ticket system, scheduling planning and capacity calculation, performance calculation and fleet amount, public transport management basis, (halte-terminal-station), pedestrian facilities, bicycle transportation facilities, parking and park & ride facilities, freight transport modes, loading-unloading, distribution center

LEARNING OUTCOMES

a. capable of resolving civil engineering issues related to transportation, including the ability to:
   - identify, formulate, analyze, and locate the source of civil engineering problems;
   - propose the best solution for solving civil engineering problems based on engineering principles, taking into account economic, safety, public safety and environmental sustainability factors;
   - select resources and utilize the results of engineering analysis based on information and computing technologies appropriate for planning / design;

b. capable of using the latest technology available in carrying out the work; and able to criticize the settlement of infrastructure problems that have been and / or are being implemented, and poured in the form of scientific papers.

COURSE LEARNING OUTCOMES

1. Students are able to design passenger and goods transport infrastructure based on engineering principles taking into account technical standards, performance aspects, reliability, ease of implementation, sustainability, and attention to economic, safety, public, cultural, social and environmental factors.
2. Able to use the latest technology available in carrying out the work

MAIN SUBJECTS

Importance of passenger transport, transit system, transit mode, demand calculation, route planning and service type and ticketing system, scheduling planning and capacity calculation, performance calculation and number of fleets, public transport management basis, determination of stop facilities (stop-terminal-station) pedestrian facilities, bicycle transportation facilities, parking and park & ride facilities, freight modes, freight facilities (loading-unloading, distribution

center)

PREREQUISITES

None

REFERENCE

Book :

1. Vuchic, V.R.," Urban Transportation Planning System and Technology", 1981
2. Abubakar, I. et al, " Menuju Lalu Lintas dan Angkutan Jalan yang Tertib", Departemen Perhubungan 1995
3. NAASRA, "Guide to Traffic Engineering Practice", 1988
4. Giannopoulos, G.A., "Bus Planning and Operation in Urban Areas: A Practical Guide. Avebury", 1989

COURSE	**Course Name**	**: DEMAND TRANSPORTATION PLANNING**
	Course Code	**: RC18 - 4723**
	Credit	**: 2 credits**
	Semester	**: VII (Elective)**

DESCRIPTION OF COURSE

This course contains about: survey demand according to human and vehicle movement pattern in a study area, can create and calibrate parameters of modest transportation models, and can calculate demand forecasting and demand restrictions using transportation models

LEARNING OUTCOMES

a. capable of resolving civil engineering issues related to transportation, including the ability to:
   - identify, formulate, analyze, and locate the source of civil engineering problems;
   - propose the best solution for solving civil engineering problems based on engineering principles, taking into account economic, safety, public safety and environmental sustainability factors;
   - select resources and utilize the results of engineering analysis based on information and computing technologies appropriate for planning / design;

b. capable of using the latest technology available in carrying out the work; and able to criticize the settlement of infrastructure problems that have been and / or are being implemented, and poured in the form of scientific papers.

COURSE LEARNING OUTCOME

Students are able to understand the concept of demand survey according to human and vehicle movement patterns in a study area, can create and calibrate the parameters of simple transportation models, and can calculate demand forecasting and demand restrictions using transportation models

MAIN SUBJECTS

Survey demand according to human and vehicle movement patterns within a study area, can create and calibrate the parameters of simple transport models, and can calculate demand forecasting and demand restrictions using transport models

PREREQUISITES

None

REFERENCES

Book :

1. Tamin, O.F., “Perencanaan dan Pemodelan Transportasi”, 2000

2. Taaffe E.J. and Gauthier Jr, H.L., “Geography of Transportation”, 1973
3. Dickey, “Metropolitan Transportation Planning”, 1975
4. Black, J., “Urban Transport Planning Theory and Practice”, 1981
5. Simon, J. and Furth, P.G., “Generating a bus route O-D matrix from on-off data. Journal of Transportation”, 1985
6. Ortuzar, J.deD. And Willumsen, L.G., “Moselling Transport”, 1990
7. Stopher and Meyburg, “Urban Transportation Modeling and Planning”, 1975

COURSE	**Course Name**	**: RAILWAY GEOMETRIC**
	Course Code	**: RC18 - 4724**
	Credit	**: 2 credits**
	Semester	**: VII (Elective)**

COURSE DESCRIPTION

This course contains about: Development of Railway, Railway Classification, Concept of Road Railway Construction Plan, Review Topografi, Design Criteria, Horizontal Alignment and Vertical Alignment, cut and fill, RAB Calculations and Plan and Profile Drawings

LEARNING OUTCOMES

a. capable of resolving civil engineering issues related to transportation, including the ability to:
   - identify, formulate, analyze, and locate the source of civil engineering problems;
   - propose the best solution for solving civil engineering problems based on engineering principles, taking into account economic, safety, public safety and environmental sustainability factors;
   - select resources and utilize the results of engineering analysis based on information and computing technologies appropriate for planning / design;

b. capable of using the latest technology available in carrying out the work; and able to criticize the settlement of infrastructure problems that have been and / or are being implemented, and poured in the form of scientific papers.

COURSE LEARNING OUTCOMES

Students are able to know and understand thedevelopment of Railway, Railway Classification, Concept of Road Railway Construction Plan, Review Topografi, Design Criteria, Horizontal Alignment and Vertical Alignment, cut and fill, RAB Calculations and Plan and Profile Drawings

MAIN SUBJECTS

Development of Railway, Railway Classification, Concept of Road Railway Construction Plan, Review Topografi, Design Criteria, Horizontal Alignment and Vertical Alignment, cut and fill, RAB Calculations and Plan and Profile Drawings

PREREQUISITES

None

REFERENCES

Book :

1. _____, Undang-undang No. 23 Tahun 2007 tentang Perkeretaapiaan

2. _____, PM No. 60 Tahun 2012 tentang Persyaratan Teknis Jalur Kereta Api
3. Wahyudi, H (1993) Teknik Jalan Rel. Diktat Teknik Sipil ITS
4. Hapsoro, S (2000) Jalan Kereta Api
5. Profilidis, V.A., (2009), “Railway Management and Engineering”, 3rd Edition

COURSE	**Course Name**	**: PORT FACILITIES**
	Course Code	**: RC18 - 4725**
	Credit	**: 2 credits**
	Semester	**: VII (Elective)**

COURSE DESCRIPTION

This course contains about:conception of open pile dock structure, concrete structure system and steel pile sheet for port dock, simple ruble mound breakwater structure, simple monolith breakwater structure, dredging equipment, dredging, port performance, Introduction to port economy, Navigation Support Facility

LEARNING OUTCOMES

capable of resolving civil engineering issues related to transportation, including the ability to:

1. identify, formulate, analyze, and locate the source of civil engineering problems;
2. propose the best solution for solving civil engineering problems based on engineering principles, taking into account economic, safety, public safety and environmental sustainability factors;
3. select resources and utilize the results of engineering analysis based on information and computing technologies appropriate for planning / design;

COURSE LEARNING OUTCOMES

Students are able to design open pile dock structure, concrete structure system and steel sheet pile for port dock, ruble mound breakwater structure, simple monolith structure breakwater, dredging, port performance, Introduction to port economy, Navigation Aid facility.

MAIN SUBJECTS

Open pile dock structure, concrete structure system and steel pile sheet for port dock, simple ruble mound breakwater structure, simple monolith breakwater structure, dredging equipment, dredging, port performance, Introduction to port economy, Navigation Support Facility

PREREQUISITES

Hydraulic Coastall Engineering and Port Planning

REFERENCES

Book :

1. Peraturan Pemerintah No. 61 Tahun 2009 Tentang Kepelabuhanan
2. Technical Standards and Commentaries For Port and Harbour Faciilties in Japan, OCDI
3. Port Desingners Handbook, Carl A. Thoresen

COURSE	**Course Name**	**: INTRODUCTION TO INFRASTRUCTURE ASSET MANAGEMENT**
	Course Code	**: RC18 - 4726**
	Credit	**: 2 credits**
	Semester	**: VII (Elective)**

COURSE DESCRIPTION

The subject is about basic concepts of asset management, strategic planning concepts of infrastructure asset, asset life cycle, asset integration of roads and bridges, water infrastructure facilities, and buildings.

LEARNING OUTCOMES

Being able to solve civil engineering problems related to structure, water resources, geotechnic, and transportation, including the ability to:

1) identify, formulate, analyze, and locate the source of civil engineering problems;

2) propose the best solution to solve civil engineering problems based on engineering principles, taking into account economic, safety, public safety and environmental sustainability factors;

COURSE LEARNING OUTCOMES

Students able to understand basic concepts of asset management, strategic planning concepts of infrastructure asset, asset integration of roads and bridges, water infrastructure facilities, and buildings.

MAIN SUBJECTS

- Basic concepts of asset management
- Strategic planning concepts of infrastructure asset
- Asset life cycle
- Asset integration of roads and bridges, water infrastructure facilities, and buildings.

PREREQUISITES

Construction Management

PREFERENCES

Book :

1. Siregar, D.D., (2004), Manajemen aset, Satyatama Graha Tama
2. Queenland Government (2002), Guideline to Asset Management
3. Grigg, Neil S. (1988), Infrastructure Engineering and Management, John Wiley & Sons, New York.
4. Leong, KC. (2004), The Essence of Asset Management-A Guide UNDP, Kuala Lumpur.

5. Waheed Uddin, W. Ronald Hudson, Ralph C. G. Haas (2013), Public Infrastructure Asset Management - 2nd Edition, McGraw Hill

COURSE	**Course Name**	**: HEALTH, SAFETY, AND ENVIRONMENT**
	Course Code	**: RC18 - 4727**
	Credit	**: 2 credits**
	Semester	**: VII (Elective)**

COURSE DESCRIPTION

The subject is about Health, Safety, and Environment (HSE) introduction, HSE program in construction project, hazards in construction project, risk assessment, risk analysis methods.

LEARNING OUTCOMES

1. Plan and design infrastructure in the areas of: structural engineering (minimum building of eight floors and bridges with spans of at least 60 meters), engineering of water resources (small dam of 10 meter high, irrigation area maximum of 3000 ha, drainage area as well as river and beach buildings), geotechnical engineering (foundations, retaining soil structures and soil improvement methods), and transport engineering (roads, railways, ports and airports) based on engineering principles taking into account technical standards, performance aspects, reliability, ease of implementation, sustainability, and attention to economic, public safety, cultural, social and environmental factors.
2. Being able to supervise and control the implementation of construction of engineering planning and design results, namely: structural engineering, water resources engineering, geotechnical engineering, and transportation engineering, with reference to applicable rules, norms, standards, guidelines and manuals.

COURSE LEARNING OUTCOMES

1. Students able to identify hazards in construction project
2. Students able to conduct risk analysis
3. Students able to determine risk response

MAIN SUBJECTS

1. Introduction to Health, Safety, and Environment (HSE)
2. HSE program in construction project
3. Hazards in construction project
4. Risk assessment
5. Risk analysis methods

PREREQUISITES

Construction Management

REFERENCES

Book :

1. Phil Hughes Mbe & Ed Ferret, Introduction Health and Safety in Construction - Second Edition, Elsevier,2007
2. Helen Lingard and Steve Rowlinson,Occupational Health and Safety in Construction Project Management, Spun Press, 2005

COURSE	**Course Name**	**: RESOURCE OPTIMIZATION**
	Course Code	**: RC18 - 4728**
	Credit	**: 2 credits**
	Semester	**: VII (Elective)**

COURSE DESCRIPTION

The subject is about resource optimization using resource levelling techniques; time optimization using probabilistic scheduling, cost optimization using value engineering, cost & time optimization using Time Cost Trade Off (TCTO) method.

LEARNING OUTCOMES

1. Being able to apply mathematics, science and engineering principles to create or modify civil engineering models in the areas of structure, water resources, geotechnic, transportation, and construction management.
2. Being able to supervise and control the implementation of construction of engineering planning and design results, namely: structural engineering, water resources engineering, geotechnical engineering, and transportation engineering, with reference to applicable rules, norms, standards, guidelines and manuals.
3. Select resources and utilize the results of engineering analysis based on information and computing technologies suitable for planning / design in the areas of: structural engineering, water resources engineering, geotechnical engineering, and transportation engineering.

COURSE LEARNING OUTCOMES

Students able to implement project optimization techniques of time, cost, and resources.

MAIN SUBJECTS

Project optimization techniques includesresource optimization using resource levelling techniques; time optimization using probabilistic scheduling, cost optimization using value engineering, and cost & time optimization using Time Cost Trade Off (TCTO) method.

PREREQUISITES

1. Project Cost and Schedule Control
2. Decision Making Techniques

REFERENCES

Book :

1. Erik W Larson & Clifford F Gray , Project Management : The Managerial Process - 7th Edition, Mc-Graw Hill Education, 2017
2. Jack R Meredith, Samuel J Mantel Jr., Scott M Shafer, Project Management :

A Managerial Approach - 9th Edition, Wiley, 2016
3. Harold Kerzner, Project Management: A Systems Approach to Planning, Scheduling, and Controlling - 12th Edition, Wiley, 2017
4. Project Management Body of Knowledge (The PMBOK® Guide) - Sixth Edition, Project Management Institute, 2017

COURSE	**Course Name**	**: PROPERTY VALUATION**
	Course Code	**: RC18 - 4729**
	Credit	**: 2 credits**
	Semester	**: VII (Elective)**

COURSE DESCRIPTION
The subject is about concepts and basic theories of property valuation, and property valuation methods.
LEARNING OUTCOMES
Being able to solve civil engineering problems related to structure, water resources, geotechnic, and transportation, including the ability to : propose the best solution to solve civil engineering problems based on engineering principles, taking into account economic, safety, public safety and environmental sustainability factors;
COURSE LEARNING OUTCOMES
Students able to estimate economic value of property
MAIN SUBJECTS
1. Concepts and basic theories of property valuation 2. Property valuation methods
PREREQUISITES
Decision Making Techniques
REFERENCES
Books : 1. Peter Wyatt, Property Valuation, John Wiley and Sons, 2013 2. David Isaac dan John O'Leary, Property Valuation Principles - 2nd Edition, Palgrave, 2012

COURSE	**Course Name**	**: FEASIBILITY STUDY FOR CONSTRUCTION PROJECT**
	Course Code	**: RC18 - 4730**
	Credit	**: 2 credits**
	Semester	**: VII (Elective)**

COURSE DESCRIPTION

The subject is about aspects of project feasibility study; components of cash flow statement, depreciation & taxes; analysis of financial feasibility (before and after taxes); sensitivity analysis; analysis of economics feasibility.

LEARNING OUTCOMES

1. Being able to solve civil engineering problems related to structure, water resources, geotechnic, and transportation, including the ability to:plan and design infrastructure in the areas of: structural engineering (minimum building of eight floors and bridges with spans of at least 60 meters), engineering of water resources (small dam of 10 meter high, irrigation area maximum of 3000 ha, drainage area as well as river and beach buildings), geotechnical engineering (foundations, retaining soil structures and soil improvement methods), and transport engineering (roads, railways, ports and airports) based on engineering principles taking into account technical standards, performance aspects, reliability, ease of implementation,sustainability, and attention to economic, public safety, cultural, social and environmental factors;
2. Being able to supervise and control the implementation of construction of engineering planning and design results, namely: structural engineering, water resources engineering, geotechnical engineering, and transportation engineering, with reference to applicable rules, norms, standards, guidelines and manuals

COURSE LEARNING OUTCOMES

1. Students able to analyze financial feasibility
2. Students able to analyze economics feasibility

MAIN SUBJECTS

1. Aspects of project feasibility study.
2. Components of cash flow statement.
3. Depreciation & taxes.
4. Analysis of financial feasibility (before and after taxes).
5. Sensitivity analysis.
6. Analysis of economics feasibility.

PREREQUISITES
Decision Making Techniques
REFERENCES
Books : 1. Mike E Miles dkk, Real Estate Development, Urban Land Institute, 2016 2. Abol Ardalan, Economic and Financial Analysis for Engineering and Project Management, CRC Press, 1999

COURSE	**Course Name**	**: UTILITY**
	Course Code	**: RC18 - 4731**
	Credit	**: 2 credits**
	Semester	**: VII (Elective)**

COURSE DESCRIPTION

The subject is about basic concepts, function, and working system of building utilities (plumbing, sanitation, electricity, lighting, protective system, telecommunication, air conditioning, vertical transportation, fire fighting, lightning rod protection system)

LEARNING OUTCOMES

Being able to solve civil engineering problems related to structure, water resources, geotechnic, and transportation, including the ability to propose the best solution to solve civil engineering problems based on engineering principles, taking into account economic, safety, public safety and environmental sustainability factors;

COURSE LEARNING OUTCOMES

Students able to understand basic concepts, function, and working system of building utilities (plumbing, sanitation, electricity, lighting, protective system, telecommunication, air conditioning, vertical transportation, fire fighting, lightning rod protection system) and connection of building system.

MAIN SUBJECTS

Basic concepts, function, and working system of building utilities (plumbing, sanitation, electricity, lighting, protective system, telecommunication, air conditioning, vertical transportation, fire fighting, lightning rod protection system)

PREREQUISITES

Construction Management

REFERENCES

Book :

1. Cyril M Harris, Handbook of Utilitites and Services for Buildings : Planning, Design, and Installation, McGraw-Hill, 1990
2. Walter T Grondzik dkk, Mechanical and Electrical Equipment for Building - 12th Edition, Wiley, 2014
3. Frank R Dagostino & Joseph B Wujek, Mechanical and Electrical System in Construction and Architecture - 5th Edition, Pearson

COURSE	**Course Name**	**: PRINCIPLES OF CIVIL INFRASTRUCTURES**
	Course Code	**: RC18 - 4804**
	Credit	**: 2 credits**
	Semester	**: VII (Elective)**

COURSE DESCRIPTION

- This course contains civil infrastructure comprising buildings, bridges, highways, railways, airports, ports, weirs, dams, and drainage.
- This course contains issues on geotechnical engineering especially embankment and foundation.
- This course contains project implementation methods, project scheduling, and project cost estimation.

LEARNING OUTCOMES

1. Students are able to utilize the latest technology in the work.
2. Students are able to plan and design infrastructure in the areas of: structural engineering, geotechnical engineering, transportation engineering and construction management (planning schedule, quality, procurement, construction methods, and costs) based on engineering principles, taking into account technical standards, performance aspects, ease of implementation, sustainability, and attention to economic factors, public safety, cultural, social and environmental

COURSE LEARNING OUTCOMES

1. Students are able to understand civil infrastructure consisting of buildings, bridges, highways, railways, airports, ports, weirs, dams, and drainage.
2. Students are able to understand the problems in geotechnical especially embankment and foundation.
3. Students are able to understand the project implementation method, project scheduling, and project cost estimation.

MAIN SUBJECTS

1. Introduction to civil infrastructure and existing fields in civil engineering.
2. Infrastructure of one or two-story building (non-engineering building)
3. Infrastructure of high-rise concrete and steel building (engineering building)
4. Short-run bridge infrastructure (less than 20 m) and medium (20-60 m), span of the forges (more than 60 m)
5. Road Infrastructure, Railway, Airport, Sea-Port
6. Infrastructure of Bendung, Dam and Drainage
7. Geotechnical

8. Method of Implementation
9. Work Order
10. Equipment required
11. Scheduling and estimating project costs. Case study

PREREQUISITES

None

REFERENCES

Book :

1. Peurifoy,RL, Constuction Planning,Equipment and Methode
2. Susy Fatena R, Alat Berat untuk Proyek Konstruksi
3. Rchundly, Constuction Technology
4. M.Khard, Form work for concrete
5. Edward R.Strun, Design and Typical Details of Connections for Precast and Prestress, PCI
6. John Breen,Antoine Norman, External Prestressing in Bridge
7. Patrick J.Dawling, Costruction Steel Design
8. Manual of Concrete Practice, ACI
9. M.S. Troistky, Prestressed Steel Bridges
10. Rene Walter, Cable Stayed Bridge
11. Pedoman Perencanaan Jembatan, SNI & SKBI tentang Jembatan.
12. Ground Water Handbook
13. Rock Mechanics
14. William W. Hang, Railroad Engineering
15. Coenraad Esveld, Modern Railway Track, MRT Production,1989.
16. Herman Wahyudi, Jalan Kereta Api Lanjut, Sistem dan Fasilitas Jalan Rel, Diktat Kuliah Jurusan Teknik Sipil FTSP-ITS.
17. Technical Standard for Port and Harbour Facilities in Japan, The overseas coastal area development Institut of Japan, 1991.
18. Perencanaan, Perancangan dan Pembangunan Pelabuhan, PT. Pelabuhan Indonesia Persero, 2000.
19. Tomlinson M.J., Pile Design and Construction Practice, A Viewpoint Publication,1977
20. USBR, Design of Small Dam
21. Project Management : The Managerial Process 7th Edition, Erik Walrson and Clifford F.Gray, Mc Graw-Hill Education.2017
22. A Guide to The Project Management Body of Knowledge (PMBOK Guide), 2017. Project Management Institute
23. Project Management : A Systems Approach to Planning, Schedulling, and Controlling Twelfth Edition. Harold Kerzner. John Willey & Sons, 2017.