# DOCUMENTS CURRICULUM 2018

## *Postgraduate Program*

### Master and Doctor
### Civil Engineering


**Civil Engineering Department**

**Faculty of Civil Engineering, Environmental and Geo Engineering**

**Institut Teknologi Sepuluh Nopember**

# MASTER PROGRAM

## *OUTLINE :*

- **LEARNING ACHIEVEMENT**
- **COURSE LIST**
- **SYLLABUS**

**GRADUATE'S LEARNING ACHIEVEMENT**
**STUDY PROGRAM - CIVIL ENGINEERING**
**MAGISTER PROGRAM**

**EACH GRADUATE OF**
**STUDY PROGRAM - CIVIL ENGINEERING**
**MAGISTER PROGRAM**
**HAS THE FOLLOWING LEARNING OUTCOMES**

**1. ATTITUDES:**

a. Believing in the oneness of God and manifest religious attitude;
b. upholding the value of humanity in performing his/her duties based on religion, morality and ethics;
c. contributing 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. functioning as citizen who prides and loves his/her homeland, possessing nationalism and responsibility to the country and nation;
e. appreciating the diversity of cultures, point of views, religions and beliefs, as well as of opinions or original findings of others;
f. working together with others and having social sensitivity and caring for his/her community and environment;
g. being law abiding and discipline on his/her functions in community and state;
h. internalizing values, norms, and academic ethics;
i. manifesting attitude of responsibility on work in his/her area of expertise, independently;
j. internalizing spirit of independence, struggle, and entrepreneurship;
k. trying best to achieve perfect results; and
l. working together to make the most of his/her potential.

**2. KNOWLEDGE:**

a. mastering the theory of engineering science in civil engineering field;
b. mastering the theoretical concept and system design method of civil engineering (systems analysis, systems architecture, or system engineering) in depth;
c. mastering the theory and design method of civil engineering technology in depth, at least in one specialized field of: structural, water resources, geotechnical, and transportation engineering;

d. mastering the theory of engineering management at least in one specialized field of: water resources, transportation, and construction management; and
e. 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:**

In field of civil engineering including structural engineering, water resources management and engineering, geotechnical engineering, transportation management and engineering, or construction management, each graduate should be able to demonstrate his/her ability in:

a. solving civil engineering problems by utilizing other interdisciplinary or multidisciplinary fields of knowledge, while paying attention to economic, health and safety factors of the public, and to cultural, social and environmental sustainability.
b. performing deepening and broadening of knowledge in field of civil engineering to provide original and proven contributions through researches with interdisciplinary or multidisciplinary approaches;
c. formulating new research questions from conducted research for the development of science and technology in the field of civil engineering; and
d. criticizing and providing feedbacks for improvements from civil engineering perspective to policy in solving existing infrastructure problems, in the form of a scientific paper.

**4. GENERAL SKILLS:**

a. Being able to develop logical, critical, systematic, and creative thinking through scientific research, to develop creation of designs or works of art in the field of science and technology which concerns and applies humanities value in accordance with their field of expertise, to have ability to prepare scientific concept and result of study based on rules, procedures, and scientific ethics in the form of a thesis or other equivalent form, and to upload it on college homepages, as well as on papers to be published in accredited scientific journals, or to be accepted international journals;
b. being able to perform academic validation or studies in accordance with their areas of expertise in solving problems in relevant communities or industries through the development of knowledge and expertise;

c. being able to formulate ideas, result of thought, and scientific arguments in a responsible manner based on academic ethics, and to communicate them through the media to their academic peers and to wider communities;
d. being able to identify the scientific field of the object of his/her research and to position his/her research into a research map that has been developed through interdisciplinary or multidisciplinary approach;
e. being able to make decisions in the context of solving problems in the development of science and technology that also concerns and implements the values of humanities based on analytical or experimental studies of information and data;
f. being able manage, develop and maintain working network with colleagues and peers within the institute and with broader research communities;
g. being able to improve the learning capacity, independently;
h. being able document, store, secure, and retrieve data of research results in order to ensure validity and prevent plagiarism;
i. being able to adapt, cooperate, be creative, contribute, and innovate in applying science to the social life and being able to act as global citizen with global awareness;
j. being able to uphold the academic integrity in general and to prevent the practice of plagiarism;
k. being able to utilize information technology in the context of scientific development and expertise area implementation;
l. being able to use at least one international language in oral and written communications;
m. being able to develop themselves and compete in national and international level; and
n. being able to implement the sustainable principal in developing knowledge.

# COURSE LIST

**STUDY PROGRAM - CIVIL ENGINEERING**
**MAGISTER PROGRAM**
**COURSE LIST**

**EXPERTISE AREA STRUCTURAL ENGINEERING**

| No. | Code | Course Tittle | Credits |
|---|---|---|---|
| **SEMESTER I** | | | |
| 1 | RC18-5101 | Statistic for Research | 3 |
| 2 | RC18-5102 | Engineering Mathematics | 3 |
| 3 | RC18-5103 | Ductile Behavior of Steel Structures | 3 |
| 4 | RC18-5104 | Ductile Behavior of Concrete Elements | 3 |
| | | | |
| | | Total of Credits | 12 |
| **SEMESTER II** | | | |
| 1 | RC18-5201 | Research Methodology and Scientific Report Writing | 3 |
| 2 | RC18-5202 | Theory of Elasticity | 3 |
| 3 | | Elective Course (Structural Dynamics) | 3 |
| 4 | | Elective Course (Finite Element Methods ) | 3 |
| | | | |
| | | Total of Credits | 12 |
| **SEMESTER III** | | | |
| 1 | | Elective Courses | 4 |
| | | | |
| | | Total of Credits | 4 |
| **SEMESTER IV** | | | |
| 1 | RC18-5401 | Thesis | 8 |
| | | | |
| | | Total of Credits | 8 |

**ELECTIVE COURSE LIST**

| No. | Code | Course Tittle | Credits |
|---|---|---|---|
| 1 | RC18-5301 | Structural Dynamics | 3 |
| 2 | RC18-5302 | Finite Element Methods | 3 |
| 3 | RC18-5303 | Theory of Plates And Shell | 3 |
| 4 | RC18-5304 | Optimation for Civil Engineering | 3 |
| 5 | RC18-5305 | Advanced Mechanics of Materials | 3 |
| 6 | RC18-5306 | Theory of Plasticity | 3 |
| 7 | RC18-5307 | Experimental Stress Analysis | 3 |
| 8 | RC18-5308 | Structures Maintenance | 3 |
| 9 | RC18-5309 | Composites Material | 3 |
| 10 | RC18-5310 | Structures Stability | 3 |
| 11 | RC18-5311 | Materials Technology | 3 |
| 12 | RC18-5312 | Ductile Behavior of Concrete Strucrtures | 3 |
| 13 | RC18-5313 | Design of Special Structures | 3 |
| 14 | RC18-5314 | Precast and Prestressed Structures | 3 |
| 15 | RC18-5315 | Structural Concept and System | 3 |

**EXPERTISE AREA GEOTECHNICS**

| No. | Code | Course Title | Credits |
|---|---|---|---|
| **SEMESTER I** | | | |
| 1 | RC18-5101 | Statistic for Research | 3 |
| 2 | RC18-5102 | Engineering Mathematics | 2 |
| 3 | RC18-5121 | Rheology and Soil Microscopics Behavior | 3 |
| 4 | RC18-5122 | Foundation Engineering and Geotechnical Modeling | 3 |
| | | Total of Credits | 11 |
| **SEMESTER II** | | | |
| 1 | RC18-5201 | Research Methodology and Scientific Report Writing | 3 |
| 2 | RC18-5221 | Soil Dynamics | 3 |
| 3 | RC18-5222 | Soil Improvement Method and Reclamation | 3 |
| 4 | | Elective course | 2 |
| | | Total of Credits | 11 |
| **SEMESTER III** | | | |
| 1 | RC18-5321 | Advanced Soil Investigation and Interpretation | 3 |
| | | Elective Course | 3 |
| | | Total of Credits | 6 |
| **SEMESTER IV** | | | |
| 1 | RC18-5401 | Thesis | 8 |
| | | Total of Credits | 8 |

**ELECTIVE COURSE LIST**

| No. | Code | Course Title | Credits |
|---|---|---|---|
| 1 | RC18-5322 | Dewatering and Excavation | 3 |
| 2 | RC18-5323 | Soil & Rock Dams | 3 |
| 3 | RC18-5324 | Peat Soil | 2 |
| 4 | RC18-5325 | Unsaturated Soil | 2 |
| 5 | RC18-5326 | Development, Problems, And Resolution In Geotechnics | 3 |

**EXPERTISE AREA CONSTRUCTIONT PROJECT MANAGEMENT**

| No. | Code | Course Tittle | Credits |
|---|---|---|---|
| **SEMESTER I** | | | |
| 1 | RC18-5101 | Statistic for Research | 3 |
| 2 | RC18-5131 | System Analysis and Decision Making | 3 |
| 3 | RC18-5132 | Property Project Development | 3 |
| 4 | RC18-5133 | Project Management | 3 |
| | | | |
| | | Total of Credits | 12 |
| **SEMESTER II** | | | |
| 1 | RC18-5201 | Research Methodology and Scientific Report Writing | 3 |
| 2 | RC18-5231 | Time and Cost Management | 3 |
| 3 | RC18-5232 | Risk and Quality Management | 3 |
| 4 | RC18-5233 | Construction Technology and Management | 3 |
| | | | |
| | | Total of Credits | 12 |
| **SEMESTER III** | | | |
| 1 | RC18-5331 | Procurement and Contract Management | 2 |
| 2 | | Elective Course | 2 |
| | | | |
| | | Total of Credits | 4 |
| **SEMESTER IV** | | | |
| 1 | RC18-5401 | Thesis | 8 |
| | | | |
| | | Total of Credits | 8 |

**ELECTIVE COURSE LIST**

| No. | Code | Course Title | Credits |
|---|---|---|---|
| 1 | RC18-5332 | Construction Automation | 2 |
| 2 | RC18-5333 | Design Management | 2 |
| 3 | RC18-5334 | Strategic Management | 2 |
| 4 | RC18-5335 | Sustainable Construction | 2 |

**EXPERTISE AREA WATER RESOURCE MANAGEMENT AND ENGINEERING**

| No. | Code | Course Title | Credits |
|---|---|---|---|
| **SEMESTER I** | | | |
| 1 | RC18-5101 | Statistic for Research | 3 |
| 2 | RC18-5141 | Applied Hydrology | 3 |
| 3 | RC18-5142 | Applied Hydrolics | 3 |
| 4 | RC18-5143 | Analysis Of Water Resources System | 3 |
| | | | |
| | | Total of Credits | 12 |
| **SEMESTER II** | | | |
| 1 | RC18-5201 | Research Methodology and Scientific Report Writing | 3 |
| 2 | RC18-5241 | Integrated Water Resources Management | 3 |
| 3 | RC18-5242 | River Morphology | 3 |
| 4 | RC18-5243 | Coastal Hydrodynamics | 3 |
| | | | |
| | | Total of Credits | 12 |
| **SEMESTER III** | | | |
| 1 | | Elective Courses | 4 |
| | | | |
| | | Total of Credits | 4 |
| **SEMESTER IV** | | | |
| 1 | RC18-5401 | Thesis | 8 |
| | | | |
| | | Total of Credits | 8 |

**ELECTIVE COURSE LIST**

| No. | Code | Course Title | Credits |
|---|---|---|---|
| 1 | RC18-5182 | GIS and Remote Sensing | 3 |
| 2 | RC18-5341 | Hydraulic Physic Modelling | 2 |
| 3 | RC18-5342 | Ground Water Exploration | 2 |

**EXPERTISE AREA TRANSPORTATION MANAGEMENT AND ENGINEERING**

| No. | Code | Course Title | Credits |
|---|---|---|---|
| **No.** | | | |
| 1 | RC18-5101 | Statistic for Research | 3 |
| 2 | RC18-5151 | Urban and Regional Transportation System | 3 |
| 3 | RC18-5152 | Traffic Management | 3 |
| 4 | RC18-5153 | Transportation Economic | 3 |
| | | | |
| | | Total of Credits | 12 |
| **SEMESTER II** | | | |
| 1 | RC18-5201 | Research Methodology and Scientific Report Writing | 3 |
| 2 | RC18-5251 | Highway Management | 3 |
| 3 | RC18-5252 | Transportation Modelling | 3 |
| 4 | RC18-5253 | Intermoda and Transportation Facilities | 2 |
| | | | |
| | | Total of Credits | 11 |
| **SEMESTER III** | | | |
| 1 | RC18-5351 | Enviroment Effect and Safety Transportation | 2 |
| 2 | | Elective Courses | 3 |
| | | | |
| | | Total of Credits | 5 |
| **SEMESTER IV** | | | |
| 1 | RC18-5401 | Thesis | 8 |
| | | | |
| | | Total of Credits | 8 |

**ELECTIVE COURSE LIST**

| No. | Code | Course Title | Credits |
|---|---|---|---|
| 1 | RC18-5171 | Heavy Rail Geometric System | 3 |
| 2 | RC18-5172 | Urban and Regional Railway Network | 3 |
| 3 | RC18-5273 | Mass Transportation System | 3 |
| 4 | RC18-5352 | Pavement Distress Management | 3 |
| 5 | RC18-5353 | Port Management | 3 |
| 6 | RC18-5354 | Airport Management | 3 |

**EXPERTISE AREA INFRASTRUCTURE ASSET MANAGEMENT**

| No. | Code | Course Title | Credits |
|---|---|---|---|
| **SEMESTER I** | | | |
| 1 | RC18-5101 | Statistic for Research | 3 |
| 2 | RC18-5161 | Infrastructure Asset Management | 3 |
| 3 | RC18-5162 | Infrastructure System | 6 |
| | | | |
| | | Total of Credits | 12 |
| **SEMESTER II** | | | |
| 1 | RC18-5201 | Research Methodology and Scientific Report Writing | 3 |
| 2 | RC18-5261 | Infrastructure Operation and Maintenance Management | 3 |
| 3 | RC18-5262 | Infrastructure Asset Management Economic | 3 |
| 4 | RC18-5263 | Infrastructure Asset System Information Management | 2 |
| | | | |
| | | Total of Credits | 11 |
| **SEMESTER III** | | | |
| 1 | RC18-5361 | Regional and Environmental System | 3 |
| 2 | | Elective Course | 2 |
| | | | |
| | | Total of Credits | 5 |
| **SEMESTER IV** | | | |
| 1 | RC18-5401 | Thesis | 8 |
| | | | |
| | | Total of Credits | 8 |

**ELECTIVE COURSE LIST**

| No. | Code | Course Name | Credits |
|---|---|---|---|
| 1 | RC18-5362 | Infrastructure Policy | 2 |
| 2 | RC18-5363 | Special Topics for Infrastructure Asset Management | 2 |
| 3 | RC18-5364 | Risk Management | 2 |
| 4 | RC18-5365 | Strategic Management | 2 |
| 5 | RC18-5366 | Project Management | 2 |

**EXPERTISE AREA RAILWAY ENGINEERING AND MANAGEMENT**

| No. | Code | Course Title | Credits |
|---|---|---|---|
| **SEMESTER I** | | | |
| 1 | RC18-5101 | Statistic for Research | 3 |
| 2 | RC18-5171 | Heavy Rail Geometric System | 3 |
| 3 | RC18-5172 | Urban and Regional Railway Network | 3 |
| 4 | RC18-5173 | Railway Construction | 3 |
| | | | |
| | | Total of Credits | 12 |
| **SEMESTER II** | | | |
| 1 | RC18-5201 | Research Methodology and Scientific Report Writing | 3 |
| 2 | RC18-5271 | Management of Railway Operational | 3 |
| 3 | RC18-5272 | Railway Bridge Engineering | 3 |
| 4 | RC18-5273 | Mass Transportation System | 3 |
| | | | |
| | | Total of Credits | 12 |
| **SEMESTER III** | | | |
| 1 | | Elective Courses | 4 |
| | | | |
| | | | |
| | | Total of Credits | 4 |
| **SEMESTER IV** | | | |
| 1 | RC18-5401 | Thesis | 8 |
| | | | |
| | | Total of Credits | 8 |

**ELECTIVE COURSE LIST**

| No. | Code | Course Title | Credits |
|---|---|---|---|
| 1 | RC18-5152 | Traffic Management | 3 |
| 2 | RC18-5153 | Transportation Economic | 3 |
| 3 | RC18-5252 | Transportation Modelling | 3 |
| 4 | RC18-5253 | Intermoda and Transportation Facilities | 3 |
| 5 | RC18-5351 | Enviroment Effect and Safety Transportation | 3 |
| 6 | RC18-5371 | Geotechnical Aspect of Railway | 3 |
| 7 | RC18-5372 | Light Rail Geometric System | 3 |
| 8 | RC18-5373 | Railway Tunnel Engineering | 3 |

**EXPERTISE AREA HIDROINFORMATICS**

| No. | Code | Course Title | Credits |
|---|---|---|---|
| **SEMESTER I** | | | |
| 1 | RC18-5101 | Statistic for Research | 3 |
| 2 | RC18-5181 | Computational Fluid Dynamic | 3 |
| 3 | RC18-5182 | GIS and Remote Sensing | 3 |
| 4 | RC18-5183 | Information Technology and Computer Science | 3 |
| | | Total of Credits | 12 |
| **SEMESTER II** | | | |
| 1 | RC18-5201 | Research Methodology and Scientific Report Writing | 3 |
| 2 | RC18-5281 | Numerical Modelling of River | 2 |
| 3 | RC18-5282 | Numerical Modelling of Hydrology And Ground Water | 3 |
| 4 | RC18-5283 | Data Driven and Computational Intelligence | 2 |
| | | Total of Credits | 10 |
| **SEMESTER III** | | | |
| 1 | RC18-5381 | Coastal Hydrodynamic Modelling | 2 |
| 2 | RC18-5382 | Numerical Modelling of Decision Support and Control System | 2 |
| 3 | | Elective Course | 2 |
| | | Total of Credits | 6 |
| **SEMESTER IV** | | | |
| 1 | RC18-5401 | Thesis | 8 |
| | | Total of Credits | 8 |

**ELECTIVE COURSE LIST**

| No. | Code | Course Title | Credits |
|---|---|---|---|
| 1 | RC18-5341 | Hydraulic Physic Modelling | 2 |
| 2 | RC18-5383 | Numerical Modelling of Urban Drainage | 2 |

# SYLLABUS

**CURRICULUM SYLLABUS 2018**
**EXPERTISE AREA STRUCTURAL ENGINEERING**

| | | |
|---|---|---|
| **COURSE** | **RC18 - 5101** | **: STATISTICS FOR RESEARCH** |
| | **Credits** | **: 3 CREDITS** |
| | **Semester** | **: I (COMPULSORY)** |

| **DESCRIPTION OF COURSE** |
|---|
| This course discuss statistic for research including: 1) The role of statistic engineering, 2) Probability, 3) Discrete Random Variables and Probability Distributions, 4) Continuous Random Variables and Probability Distributions, 5) Random Sampling and Data Description, 6) Statistical Intervals for a Single Sample, 7) Tests of Hypotheses for a Single Sample, 8) Statistical Inference for Two Samples, 9) Simple Linear Regression and Correlation, 10) Multiple Linear Regression, 11) Design and Analysis of Single-Factor Experiments: The Analysis of Variance, 12) Design of Experiments with Several Factors, 13) Statistical Quality Control, 14) Non-linear Regression |
| **LEARNING OUTCOMES** |
| Solve the civil engineering problems by utilizing other interdisciplinary or multidisciplinary field of knowledge, and pay attention to the economic, health and safety factors of the public, cultural, social and environmental sustainability. |
| **COURSE LEARNING OUTCOMES** |
| Students able to perform statistics analysis for research including: 1) The role of statistic engineering, 2) Probability, 3) Discrete Random Variables and Probability Distributions, 4) Continuous Random Variables and Probability Distributions, 5) Random Sampling and Data Description, 6) Statistical Intervals for a Single Sample, 7) Tests of Hypotheses for a Single Sample, 8) Statistical Inference for Two Samples, 9) Simple Linear Regression and Correlation, 10) Multiple Linear Regression, 11) Design and Analysis of Single-Factor Experiments: The Analysis of Variance, 12) Design of Experiments with Several Factors, 13) Statistical Quality Control, 14) Non-linear Regression |
| **MAIN SUBJECTS** |
| 1) The role of statistic engineering,<br>2) Probability,<br>3) Discrete Random Variables and Probability Distributions,<br>4) Continuous Random Variables and Probability Distributions,<br>5) Random Sampling and Data Description,<br>6) Statistical Intervals for a Single Sample,<br>7) Tests of Hypotheses for a Single Sample,<br>8) Statistical Inference for Two Samples, |

9) Simple Linear Regression and Correlation,
10) Multiple Linear Regression,
11) Design and Analysis of Single-Factor Experiments: The Analysis of Variance,
12) Design of Experiments with Several Factors,
13) Statistical Quality Control,
14) Non-linear Regression.

**PREREQUISITES**

None

**REFERENCES**

**BOOKS :**


1. Applied Statistics for Civil and Environmental Engineers-Wiley-Blackwell (2008)

2. Applied Statistics and Probability for Engineers, Douglas C. Montgomery and George C. Runger (2002)

**CURRICULUM SYLLABUS 2018**

| | | |
|---|---|---|
| **COURSE** | **RC18 - 5102** | **: ENGINEERING MATHEMATICS** |
| | **Credits** | **: 3 CREDITS** |
| | **Semester** | **: I (COMPUSORY)** |

**DESCRIPTION OF COURSE**

This course discuss about :
1) Gauss elimination, 2) Eigen vaue, 3) Numerical method for structural equilibrium, 4) Finite difference method, 5) framework and dynamic application, 6) Optimation on structures dynamics application

**LEARNING OUTCOMES**

Solve the civil engineering problems by utilizing other interdisciplinary or multidisciplinary field of knowledge, and pay attention to the economic, health and safety factors of the public, cultural, social and environmental sustainability.

**COURSE LEARNING OUTCOMES**

1. Able to understand and applied Gauss elimination method
2. Able to determine the eigen value
3. Able to use numerical method for structural equilibrium
4. Able to understand and applied the finite difference method
5. Able to compose the framework and dynamic application
6. Able to do Optimation on structures dynamics application

**MAIN SUBJECTS**

1. Pendahuluan,
2. Eliminasi Gauss,
3. Nilai Eigen,
4. Metode Numerik untuk Kesetimbangan Struktur,
5. Metode beda hingga,
6. Kerangka Kerja dan Aplikasi Dinamis,
7. Optimasi dalam Kesetimbangan dan Dinamika Struktur.

**PREREQUISITES**

NONE

**REFERENCES**

**Books:**

1. Gilbert, S, “Introduction to Applied Mathematics,” Wesley-Cambridge Press, 1990

2. Bellomo, N. and Preziasi, L, “Modeling Mathematical Methods and Scientifics Computation,” CRC Press, 1994
3. Penny, J. and Lindfield, G, “Numerical Methods using Matlab,” PrenticeHall, 2000

**CURRICULUM SYLLABUS 2018**

| | | |
|---|---|---|
| **COURSE** | **RC18 - 5103** | **: DUCTILE BEHAVIOR OF STEEL STRUCTURES** |
| | **Credit** | **: 3 CREDITS** |
| | **Semester** | **: I (COMPULSORY)** |

**DESCRPTION OF COURSE**

This course discuss:
1) Stress Strain Diagram of Steel; 2) Effect of Temperature to Stress Strain, Ductility and Bending; 3) Effect of Velocity Strain to Yield Stress and Tension; 4) Yield strength probability, plasticity, hysteretic and Bauschinger effect; 5) ElastoPlasic Model of the Material; 6) Plastic Behavior of Steel Section due to Bending Moment and Combination of Bending moment and Axial force; 7) Theorem of lower boundary and upper boundary; 8) Yield mechanism of structure and combination of many variation; 9) Pushover method; 10) Brace Frame; 11) Ductile Moment Resisting Frame; 12) Special Detailing of Ductile Frame; 13) Design of Ductile Frame Based on Earthquake Design and Steel Design Code in Indonesia; 13) Special Energy Dissipation System; 14) Practical Use of Ductile Steel Design.

**LEARNING OUTCOMES**

Solve the civil engineering problems by utilizing other interdisciplinary or multidisciplinary field of knowledge, and pay attention to the economic, health and safety factors of the public, cultural, social and environmental sustainability.

**COURSE LEARNING OUTCOMES**

Students able to analyze ductile behavior of stee structures including: 1) Stress Strain Diagram of Steel; 2) Effect of Temperature to Stress Strain, Ductility and Bending; 3) Effect of Velocity Strain to Yield Stress and Tension; 4) Yield strength probability, plasticity, hysteretic and Bauschinger effect; 5) Elasto-Plastic Model of the Material; 6) Plastic Behavior of Steel Section due to Bending Moment and Combination of Bending moment and Axial force; 7) Theorem of lower boundary and upper boundary; 8) Yield mechanism of structure and combination of many variation; 9) Pushover method; 10) Brace Frame; 11) Ductile Moment Resisting Frame; 12) Special Detailing of Ductile Frame; 13) Design of Ductile Frame Based on Earthquake Design and Steel Design Code in Indonesia; 13) Special Energy Dissipation System; 14) Practical Use of Ductile Steel Design

**MAIN SUBJECTS**

1. Stress Strain Diagram of Steel,
2. Effect of Temperature to Stress Strain,
3. Ductility and Bending,
4. Effect of Velocity Strain to Yield Stress and Tension,

5. Yield strength probability,
6. plasticity,
7. histerethic and Bauschinger effect,
8. Elasto Plasic Model of the Material,
9. Plastic Behavior of Steel Section due to Bending Moment and Combintaion of Bending moment and Axial force,
10. Theorema of lower boundary and upper boundary,
11. Yield meccanism of structure and combination of many variation,
12. Pushover Method,
13. Ductile Moment Resisting Frame,
14. Special Detailing of Ductile Frame,
15. Earthquake Design ang Steel Design Code in Indonesia,
16. Special Energy Dissipationn System,
17. Practical Use of Ductile Steel Design.

**PREREQUISITES**

None

**REFERENCES**

**Books :**


1. AISC,"Seismic Provisions for Structural Steel Building", American Institute of Steel Construction, Chicago, 1997.
2. AISC,. "Seismic Provisions for Structural Steel Building", American Institute of Steel Construction, Chicago, 2005.
3. Applied Technology Council (ATC) 40, "Seismic Evaluation and Retrofit of Concrete Buildings", ATC-40, ATC, Vol.1, 2, Redwood City, CA, 1996.
4. Beedle, L. S, "Plastic Design of Steel Frames", John Wiley and Sons, New York, 1958.
5. Bruneau, M., Uang, C.M., and Whittaker, A. "Ductile Design of Steel Structures", McGraw-Hill, New York, 1998.
6. Englekirk, R, "Steel Structures, Controlling Behavior through Design", John Wiley and Sons, New York, 1994.
7. LaboratoriumMekanikaStruktur, "PerencanaanStruktur Baja untukBangunanGedungMenggunakanMetoda LRFD", PusatPenelitianAntarUniversitas, BidangIlmuRekayasa, ITB, Bandung, 2000.
8. Standar Nasional Indonesia 03-1729-2015
9. Standar Nasional Indonesia 03-1729-2002
10. Standar Nasional Indonesia 03-1726-2012

**CURRICULUM SYLLABUS 2018**

| | | |
|---|---|---|
| **COURSE** | **RC18 - 5104** | **: DUCTILE BEHAVIOR OF CONCRETE ELEMENTS** |
| | **Credits** | **: 3 CREDITS** |
| | **Semester** | **: I (COMPULSORY)** |

**DESCRIPTION OF COURSE**

This course discuss :
(1) Design Approach, (2) Stress-Strain Relationship For Concrete And Steel , (3) Flexural Strength, (4) Strength of Members with Flexure and Axial Load, (5) Ultimate Deformation and Ductilty of Flexural Members, (6) Strength and Deformation of Shear Members, (7) Bond And Anchorage, (8) Strength and Ductility of Frame.

**LEARNING OUTCOMES**

Solve the civil engineering problems by utilizing other interdisciplinary or multidisciplinary field of knowledge, and pay attention to the economic, health and safety factors of the public, cultural, social and environmental sustainability.

**COURSE LEARNING OUTCOMES**

1. Able to understand concept design of reinforced concrete
2. Able to analyze stress-strain relationship for concrete and steel, flexural strength, strength of members with flexure and axial load, ultimate deformation and ductilty of flexural members, strength and deformation of shear members, bond and anchorage, strength and ductility of frame.

**MAIN SUBJECTS**

1. The Desing Approach,
2. Stress - strain Relationship for Concrete and Steel,
3. Flexural Strength, Strength of Members with Flexure and Axial Load,
4. Ultimate Deformation and Ductility of Flexural Members,
5. Strength And Deformation of Shear Members,
6. Strength of Ductility of Frame.

**PREREQUISITES**

None

**REFERENCES**

**BOOKS :**

1. Park, R. and Paulay, T., “Reinforced Concrete Structures”,John Wiley and Sons, 1992
2. Wight, J.K, and MacGregor, J.G. Reinforced Concrete Mechanics and Designs”(Sixth Edition), 2012

3. Paulay, T. and Priestley, M.J.N., “Seismic Desing of Reinforced Concrete and Mansonry Buildings”,John Wiley & Sons, INC., 1992
4. Tavio, “Desain Sistem Rangka Pemikul Momen dan Dinding Struktur Beton BertulangTahan Gempa : Sesuai SNI 03-2847-2002 dan SNI 03-1725-2002 Dilengkapi Permodelandan Analisis dengan Program Bantu ETABS v9.07, “ITS Press, Surabaya, 2009.
5. Purwono, R; Tavio; Iswandi Imran, dan Raka, I. G. P., “Tata Cara Perhitungan StrukturBeton untuk Bangunan Gedung (SNI 03-2847-2002) DIlengkapi Penjelasan (S-2002),“ITS Press, Surabaya, 2007

**CURRICULUM SYLLABUS 2018**

| | | |
|---|---|---|
| **COURSE** | **RC18 - 5201** | **: RESEARCH METHODOLOGY AND SCIENTIFIC REPORT WRITING** |
| | **Credits** | **: 3 CREDIT** |
| | **Semester** | **: II (COMPULSORY)** |

| **DESCRIPTION OF COURSE** |
|---|
| This course discuss about : 1) Introduction to research, 2) GAP Analysis to find thesis problems, 3) preparation of thesis proposal, 4) writing composistion, 5) writing method of data analysis, 6) presentation technique, 7) publication writing, 8) writing of chapter 1,2,3 |
| **LEARNING OUTCOMES** |
| Solve the civil engineering problems by utilizing other interdisciplinary or multidisciplinary field of knowledge, and pay attention to the economic, health and safety factors of the public, cultural, social and environmental sustainability. |
| **COURSE LEARNING OUTCOMES** |
| Student able to :<br>1. develop and update knowledge of their respective fields of expertise through research in accordance with the rules of the standard procedure to produce works that are tested and can be published.<br>2. synthesize the latest research results (last 10 years) and able to make a hypothesis of problems based on scientific studies.<br>3. perform independent research planning with supervisory supervision in an integrated, and able to present research plan. |
| **MAIN SUBJECTS** |
| 1) Introduction to research,<br>2) GAP Analysis to find thesis problems,<br>3) preparation of thesis proposal,<br>4) writing composistion,<br>5) writing method of data analysis,<br>6) presentation technique,<br>7) publication writing, 8) writing of chapter 1,2,3 |
| **PREREQUISITES** |
| None |

**REFERENCES**

**BOOKS :**

1. Petunjuk Penulisan Tesis – ITS
2. Daniel Chandler, 1995, Writing strategies and writer tool.

**CURRICULUM SYLLABUS 2018**

| | | |
|---|---|---|
| **COURSE** | **RC18 - 5202** | **: THEORY OF ELASTICITY** |
| | **Credits** | **: 3 CREDITS** |
| | **Semester** | **: II (COMPULSORY)** |

**DESCRIPTION OF COURSE**

This course discuss:
(1) Introductory concepts and Mathematics (2)Theory of Stress, (3) Theory of Deformation, (4) Three-Dimensional Equations of Elasticity, (5) Plane Theory of Elasticity in Rectangular Cartesian Coordinates, (6) Plane Elasticity in Polar Coordinates (7) Prismatic Bars Subjected to End Load (8)General Solution of Elasticity.

**LEARNING OUTCOMES**

a. Solve the civil engineering problems by utilizing other interdisciplinary or multidisciplinary field of knowledge, and pay attention to the economic, health and safety factors of the public, cultural, social and environmental sustainability.
b. do the deepening or extension of knowledge in field of civil engineering to provide original and tested innovative contributions through research with interdisciplinary or multidisciplinary approaches

**COURSE LEARNING OUTCOMES**

Student able to:
1. applied the tensorial concept on stress and strain
2. complete the stress and strain orientation using transform tensor.
3. develop plane theory elasticity on Cartesian Rectangular and Polar coordinate
4. develop further elasticity theory

**MAIN SUBJECTS**

1. Introductory Concepts and Mathematics,
2. Theory of Deformation, Theory of Stress,
3. Three-Dimensional Equations of Elasticity,
4. Plane Theory of Elasticity in Cartesian,
5. Plate Elasticity in Polar Coordinates.

**PREREQUISITES**

None

**REFERENCES**

**BOOKS :**

1. Thimosenko, “Theory of Elasticity”( 3rd Edition), McGraw-Hill.

2. Boresi, A.P. and Lynn, P.P.,."Elasticity in Engineering Mechanics,"(Sixth Edition), Prentice Hall 1974
3. Ugural, A.C. and Fenster, S.K., "Advanced Strength and Applied Elasticity,", Elsevier.

**CURRICULUM SYLLABUS 2018**

| | | |
|---|---|---|
| **COURSE** | **RC18 - 5301** | **: STRUCTURAL DYNAMICS** |
| | **Credits** | **: 3 CREDITS** |
| | **Semester** | **: III (ELECTIVE)** |

| **DESCRIPTION OF COURSE** |
|---|
| 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** |
| a. Solve the civil engineering problems by utilizing other interdisciplinary or multidisciplinary field of knowledge, and pay attention to the economic, health and safety factors of the public, cultural, social and environmental sustainability. |
| **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** |
| Introduction, 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** |
| **BOOKS :**<br>1. Clough, R. W. and Penzien, J., "Dynamics of Structures" (3rd edition),McGraw-Hill Companies, Inc., 2003<br>2. Chopra, A. K., "Dynamics of Structures (4th edition)",Pearson, 2011 |

**CURRICULUM SYLLABUS 2018**

| | | |
|---|---|---|
| **COURSE** | **RC18 - 5302** | **: FINITE ELEMENT METHODS** |
| | **Credits** | **: 3 CREDITS** |
| | **Semester** | **: III (ELECTIVE)** |

**DESCRIPTION OF COURSE**

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**

Solve the civil engineering problems by utilizing other interdisciplinary or multidisciplinary field of knowledge, and pay attention to the economic, health and safety factors of the public, cultural, social and environmental sustainability.

**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**

1. Pendahuluan,
2. SDOF – Free Vibration,
3. SDOF – Forced Vibration,
4. SDOF – Metode Numerik,
5. Generalized SDOF,
6. Multi Degree Of Freedom (MDOF),
7. MDOF –Free Vibrations,
8. Dynamic response of linear system,
9. Earthquake response of linear and inelastic systems.

**PREREQUISITES**

None

**REFERENCES**

**BOOKS :**


1. Cook, R. D., et al., "Concept and Application of Finite Element Analysis", John Wiley and Sons, Inc., 2002
2. Logan, D. L., "A First Course of Finite Element Analysis", The McGraw-Hill Companies, Inc., 1992
3. Reddy, J. N., "Finite Element Method", John Wiley and Sons, Inc., 1992
4. Wahyuni, E, Soetrisno, W, "MetodeElemenHingga", ITSPress, 2015

**CURRICULUM SYLLABUS 2018**

| | | |
|---|---|---|
| **COURSE** | **RC18 - 5303** | **: THEORY OF PLATES AND SHELL** |
| | **Credits** | **: 3 CREDITS** |
| | **Semester** | **: III (ELECTIVE)** |

| **DESCRIPTION OF COURSE** |
|---|
| This course discuss :<br>1) Flexure on plates 2) rectaguar pates with difference boundary condition, 3) continuous plate, 4) large deformation on plate, 5) deformation on shells, 6) Approach with Finite element method |
| **LEARNING OUTCOMES** |
| Solve the civil engineering problems by utilizing other interdisciplinary or multidisciplinary field of knowledge, and pay attention to the economic, health and safety factors of the public, cultural, social and environmental sustainability. |
| **COURSE LEARNING OUTCOMES** |
| Students able to analyze and calculate 1) Flexure on plates 2) rectaguar pates with difference boundary condition, 3) continuous plate, 4) large deformation on plate, 5) deformation on shells, 6) Approach with Finite element method |
| **MAIN SUBJECTS** |
| 1) Flexure on plates<br>2) rectaguar pates with difference boundary condition,<br>3) continuous plate,<br>4) large deformation on plate,<br>5) deformation on shells,<br>6) Approach with Finite element method |
| **PREREQUISITES** |
| None |
| **REFERENCES** |
| **BOOKS :**<br>1. Timishenko, S.and Woiniwsky-Krieger, S., "Theory of Plates and Shells", 1959<br>2. Szilard, R., "Theories and Application of Plate Analysis", 2004<br>3. Suprobo, P., "Theori of Plates 2nd Edition," 2011 |

**CURRICULUM SYLLABUS 2018**

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|---|---|---|
| **COURSE** | **RC18 - 5304** | **: OPTIMATION FOR CIVIL ENGINEERING** |
| | **Credits** | **: 3 CREDITS** |
| | **Semester** | **: III (ELECTIVE)** |

**DESCRIPTION OF COURSE**

This course discuss about :

1) Introduction to optimation for civil engineering, 2) Problems on optimation design, 3) Optimation design with mathematics programming, 4) Optimation of steel truss with optimality criteria, 5)Contimous optimation design for steel truss with metaheuristik method, 6) Discrete optimation design for steel truss with metaheuristik method

**LEARNING OUTCOMES**

Solve the civil engineering problems by utilizing other interdisciplinary or multidisciplinary field of knowledge, and pay attention to the economic, health and safety factors of the public, cultural, social and environmental sustainability.

**COURSE LEARNING OUTCOMES**

Student able to

1. understand and solve problem related to optimation
2. perform optimation design using mathematical programming
3. perform optimation of steel truss with optimality criteria
4. perform optimation design of steel truss with metaheuristik method
5. perform discrete optimation design of steel truss with metaheuristik method

**MAIN SUBJECTS**

1) Introduction to optimation for civil engineering
2) Problems on optimation design
3) Optimation design with mathematics programming
4) Optimation of steel truss with optimality criteria,
5)Contimous optimation design for steel truss with metaheuristik method,
6) Discrete optimation design for steel truss with metaheuristik method

**PREREQUISITES**

None

**REFERENCES**

**BOOKS :**

Timishenko, S.andWoiniwsky-Krieger, S., “Theory of Plates and Shells”, 1959

**CURRICULUM SYLLABUS 2018**

| | | |
|---|---|---|
| **COURSE** | **RC18 - 5305** | **: ADVANCED MECHANICS OF MATERIALS** |
| | **Credits** | **: 3 CREDITS** |
| | **Semester** | **: III (ELECTIVE)** |

**DESCRIPTION OF COURSE**

This course discuss about :
1) stress, strain, energy and collapse mechanism, 2) Theory of elasticity, 3) thick walled cylinder, 4) Torsion, 5) Unsymetric flexure, 6) Center of shear and thick beam, 7) Plastic failure and limit analysis, 8) Beam-Column, 9) Buckling and nonlinearity

**LEARNING OUTCOMES**

Solve the civil engineering problems by utilizing other interdisciplinary or multidisciplinary field of knowledge, and pay attention to the economic, health and safety factors of the public, cultural, social and environmental sustainability.

**COURSE LEARNING OUTCOMES**

1. Mampu menghitung Tegangan, Regangan, Energi dan Keruntuhan, dan Memahami Teori Elastisitas
2. Mampu menghitung Silinder Berdinding Tebal, gaya Torsi, Lentur Tidak Simetris, Pusat Geser dan Balok Berdinding Tebal, Kegagalan Plastis dan Analisa Limit, Balok Kolom, Tekuk dan Nonlinearitas

**MAIN SUBJECTS**

1) stress, strain, energy and collapse mechanism,
2) Theory of elasticity,
3) thick walled cylinder,
4) Torsion,
5) Unsymetric flexure
6) Center of shear and thick beam,
7) Plastic failure and limit analysis,
8) Beam-Column,
9) Buckling and nonlinearity

**PREREQUISITES**

None

**REFERENCES**

**BOOKS :**

1. Cook, R.D and Young, W.C., "Advanced Mechanics of Materials (2nd edition)," Pearson Education Inc., 1998

2. Boresi, A.P and Schmidt, R.J., “Advanced Mechanics of Materials (6th edition),” Wiley, 2002
3. Ugural, A.C and Fenster, S.K., “Advanced Mechanics of Materials and Applied Elasticity (5th edition),” Prentice Hall, 2012

**CURRICULUM SYLLABUS 2018**

| | | |
|---|---|---|
| **COURSE** | **RC18 - 5308** | **: STRUCTURES MAINTENANCE** |
| | **Credits** | **: 3 CREDITS** |
| | **Semester** | **: III (ELECTIVE)** |

**DESCRIPTION OF COURSE**

This course discuss :
(1) Digital Signal Processing, (2) Review Structural Dynamic, (3) Review Finite Elements, (4) Sensing and Non Destructive Evaluation (5) Review Stuctural Reliability and Modelling.

**LEARNING OUTCOMES**

Solve the civil engineering problems by utilizing other interdisciplinary or multidisciplinary field of knowledge, and pay attention to the economic, health and safety factors of the public, cultural, social and environmental sustainability.

**COURSE LEARNING OUTCOMES**

Students understand and able to applied Digital Signal Processing, Structural Dynamic, Finite Elements, Sensing and Non Destructive Evaluation, Review Stuctural Reliability and Modelling on Structural maintenance

**MAIN SUBJECTS**

1. Digital Signal Processing,
2. Review Structural Dynamic,
3. Review Finite Elements,
4. Sensing and Non Destructive Evaluation,
5. Review Stuctural Reliability and Modelling.

**PREREQUISITES**

None

**REFERENCES**

**BOOKS :**


1. Chen, Structural Health Monitoring conf proceedings, Editor F-K Chang,. California, 2005 & 2009.
2. Ambient Vibration Monitoring, Helmut Wenzel, Dieter Pichler, Wiley, 2005.
3. Health Monitoring of Aerospace Structures, W. Staszewski, C. Boller, G. Tomlinsaon, Wiley, 2003.
4. Federal Emergency Management Agency (FEMA), 1997, NEHRP Guidelines for the Seismic Rehabilitation of Buildings, FEMA 27
5. Structural Condition Assessment, R.T. Ratay, 2005.

**CURRICULUM SYLLABUS 2018**

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|---|---|---|
| **COURSE** | **RC18 - 5309** | **: COMPOSITES MATERIAL** |
| | **Credits** | **: 3 CREDITS** |
| | **Semester** | **: III (ELECTIVE)** |

**DESCRIPTION OF COURSE**

COURSE ini berisikan tentang :
1) Stress, Strain and Torsion 2) Axial, Bending, Shear; 3) Compound Stress, Plane Stress – Strain, Combined Stresses; 4) Complex Stress and Strain; 5) Matrix of Composite (Polymer, Carbon Fibel, Ceramic, Metal); 6) Strength and Failure Models; 7) Damage, Measurement, Analysis and Modelling; 8) Fatigue and Creep of Composites.

**LEARNING OUTCOMES**

Solve the civil engineering problems by utilizing other interdisciplinary or multidisciplinary field of knowledge, and pay attention to the economic, health and safety factors of the public, cultural, social and environmental sustainability.

**COURSE LEARNING OUTCOMES**

Having capability of designing and analyzing 1) Stress, Strain and Torsion 2) Axial, Bending, Shear; 3) Compound Stress, Plane Stress – Strain, Combined Stresses; 4) Complex Stress and Strain; 5) Matrix of Composite (Polymer, Carbon Fibel, Ceramic, Metal); 6) Strength and Failure Models; 7) Damage, Measurement, Analysis and Modelling; 8) Fatigue and Creep of Composites

**MAIN SUBJECTS**

1. Stress,
2. Strain and Torsion,
3. Axial,
4. Bending,
5. Shear;
6. Compound Stress,
7. Plane Stress – Strain,
8. Combined Stresses;
9. Complex Stress and Strain;
10. Matrix of Composite (Polymer, Carbon Fibel, Ceramic, Metal);
11. Strength and Failure Models;
12. Damage,
13. Measurement,
14. Analysis and Modelling;
15. Fatigue and Creep of Composites.

| **PREREQUISITES** |
| --- |
| None |
| **REFERENCES** |
| **BOOKS :**<br>1. Chawla, Krishan K, “Composite Material”, Springer Science and Bussines Media, 2012.<br>2. Cook, Nathan H., “Mechanics and Material for Design”, Mc-Graw Hill, 1984.<br>3. Megson T.H.G., “Strength of Materials for Civil Engineer”, Edwar Arnold, 1983.<br>4. Popov E.P, “Mechanics of Material” Prentice Hall, 1976.<br>5. Stinchcombm., “Composite Materals Fatigue and Fracture”, ASTM, 1993.<br>5. Structural Condition Assessment, R.T. Ratay, 2005. |

**CURRICULUM SYLLABUS 2018**

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|---|---|---|
| **COURSE** | **RC18 - 5310** | **: STRUCTURES STABILITY** |
| | **Credits** | **: 3 CREDITS** |
| | **Semester** | **: III (ELECTIVE)** |

| **DESCRIPTION OF COURSE** |
|---|
| This course discuss about :<br>1) Column stability, 2) Beam-Colum Stability, 3) Stability of rigid frame, 4) Beam stability, 5) Numerical methods for structural stability |
| **LEARNING OUTCOMES** |
| Solve the civil engineering problems by utilizing other interdisciplinary or multidisciplinary field of knowledge, and pay attention to the economic, health and safety factors of the public, cultural, social and environmental sustainability. |
| **COURSE LEARNING OUTCOMES** |
| Able to calculate 1) Column stability, 2) Beam-Colum Stability, 3) Stability of rigid frame, 4) Beam stability, 5) Numerical methods for structural stability |
| **MAIN SUBJECTS** |
| 1) Column stability,<br>2) Beam-Colum Stability,<br>3) Stability of rigid frame,<br>4) Beam stability,<br>5) Numerical methods for structural stability |
| **PREREQUISITES** |
| None |
| **REFERENCES** |
| **BOOKS :**<br>1. Chen, W.F.andLui, E.M., "Structural Stability: Theory and Implementation",Prentice Hall, 1987<br>2. Simitses, G.J. and Hodges, D.H., "Fundamentals of Structural Stability," Butterworth-Heinemann, 2006 |

**CURRICULUM SYLLABUS 2018**

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|---|---|---|
| **COURSE** | **RC18 - 5311** | **: MATERIALS TECHNOLOGY** |
| | **Credits** | **: 3 CREDITS** |
| | **Semester** | **: III (ELECTIVE)** |

| **DESCRIPTION OF COURSE** |
|---|
| This course discuss: Introduction to Concrete, Materials for Making Concrete, Fresh Concrete, Hardened Concrete, Advanced Cementitious Composites, Nondestructive Testing in Concrete Engineering , Material technology of Steel structures, Material Properties for wood structures |
| **LEARNING OUTCOMES** |
| Solve the civil engineering problems by utilizing other interdisciplinary or multidisciplinary field of knowledge, and pay attention to the economic, health and safety factors of the public, cultural, social and environmental sustainability. |
| **COURSE LEARNING OUTCOMES** |
| Students able to understand, analyze and use the materials for construction in accordance to its behavior |
| **MAIN SUBJECTS** |
| Introduction to Concrete, Materials for Making Concrete, Fresh Concrete, Hardened Concrete, Advanced Cementitious Composites, Nondestructive Testing in Concrete Engineering , Material technology of Steel structures, Material Properties for wood structures |
| **PREREQUISITES** |
| None |
| **REFERENCES** |
| **BOOKS :**<br>1. Newman, J. and Choo, B.S., "Advanced Concrete Technology (1st edition)," Butterworth-Heinemann, 2003<br>2. Li, Z.J., "Advanced Concrete Technology (1st edition)," Wiley, 2011<br>3. Figovsky, O. and Beilin, D., "Advanced Polymer Concrete and Compounds," CRC Press, 2013 |

**CURRICULUM SYLLABUS 2018**

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|---|---|---|
| **COURSE** | **RC18 - 5312** | **: DUCTILE BEHAVIOR OF CONCRETE STRUCRTURES** |
| | **Credits** | **: 3 CREDITS** |
| | **Semester** | **: III (ELECTIVE)** |

**DESCRIPTION OF COURSE**

This course discuss about:
1) Introduction Concepts of Seismic Design. (2) Causes And Effects of Earthquakes, (3) Principal Member Design, (4) Reinforced Concrete Ductile Frames, (5) Structural Walls, (6) Dual Systems,

**LEARNING OUTCOMES**

Solve the civil engineering problems by utilizing other interdisciplinary or multidisciplinary field of knowledge, and pay attention to the economic, health and safety factors of the public, cultural, social and environmental sustainability.

**COURSE LEARNING OUTCOMES**

1. Able to understand Concepts of Seismic Design,
2. Able to identify Causes And Effects of Earthquakes,
3. Able to design and analyze principal member, Reinforced Concrete Ductile Frames, Structural Walls, and Dual Systems,

**MAIN SUBJECTS**

1. Introduction to Concrete,
2. Materials for Making Concrete,
3. Fresh Concrete, Hardened Concrete,
4. Advanced Cementitious Composites,
5. Nondestructive Testing in Concrete Engineering ,
6. Material technology of Steel structures,
7. Material Properties for wood structures

**PREREQUISITES**

None

**REFERENCES**

**BOOKS :**


1. Paulay, T. and Priestley, M.J.N., “Seismic Desing of Reinforced Concrete and Mansonry Buildings”,John Wiley & Sons, INC., 1992
2. Park, R. and Paulay, T., “Reinforced Concrete Structures”,John Wiley and Sons, 1992
3. Wight, J.K, and MacGregor, J.G. Reinforced Concrete Mechanics and Designs”(Sixth Edition), 2012

4. Tavio, “Desain Sistem Rangka Pemikul Momen dan Dinding Struktur Beton BertulangTahan Gempa : Sesuai SNI 03-2847-2002 dan SNI 03-1725-2002 Dilengkapi Permodelandan Analisis dengan Program Bantu ETABS v9.07, “ITS Press, Surabaya, 2009
5. Purwono, R; Tavio; Iswandi Imran, dan Raka, I. G. P., “Tata Cara Perhitungan StrukturBeton untuk Bangunan Gedung (SNI 03-2847-2002) DIlengkapi Penjelasan (S-2002), “ITS Press, Surabaya, 2007.

**CURRICULUM SYLLABUS 2018**

| | | |
|---|---|---|
| **COURSE** | **RC18 - 5313** | **: DESIGN OF SPECIAL STRUCTURES** |
| | **Credits** | **: 3 CREDITS** |
| | **Semester** | **: III (ELECTIVE)** |

| **DESCRIPTION OF COURSE** |
|---|
| This course discuss<br>1) Innovative design methods, 2) Innovative construction method, 3) Innovative maintenance methods, 4) Innovative destruction methods. |
| **LEARNING OUTCOMES** |
| Solve the civil engineering problems by utilizing other interdisciplinary or multidisciplinary field of knowledge, and pay attention to the economic, health and safety factors of the public, cultural, social and environmental sustainability. |
| **COURSE LEARNING OUTCOMES** |
| Students able to do 1) Innovative design methods, 2) Innovative construction method, 3) Innovative maintenance methods, 4) Innovative destruction methods |
| **MAIN SUBJECTS** |
| Student able to<br>1) Innovative design methods,<br>2) Innovative construction method,<br>3) Innovative maintenance methods,<br>4) Innovative destruction methods |
| **PREREQUISITES** |
| None |
| **REFERENCES** |
| **BOOKS :** |

**CURRICULUM SYLLABUS 2018**

| | | |
|---|---|---|
| **COURSE** | **RC18 - 5314** | **: PRECAST AND PRESTRESSED STRUCTURES** |
| | **Credits** | **: 3 CREDITS** |
| | **Semester** | **: III (ELECTIVE)** |

**DESCRIPTION OF COURSE**

This course discuss about: 1) Application of precast and prestressed, 2) preliminary design of precast and prestressed concrete, 3) Design element of precast and prestressed, 4) Design of connection, 5) Handling and construction of precast and prestressed concrete, Architectural precast concrete.

**LEARNING OUTCOMES**

Solve the civil engineering problems by utilizing other interdisciplinary or multidisciplinary field of knowledge, and pay attention to the economic, health and safety factors of the public, cultural, social and environmental sustainability.

**COURSE LEARNING OUTCOMES**

Students able to performed element design of precast-prestressed component including connection and construction methods

**MAIN SUBJECTS**

1. Aplikasi dan Material Beton Pracetak - Pratekan,
2. Preliminary Desain Beton Pracetak – Pratekan,
3. Analisis Struktur Beton Pracetak – Pratekan,
4. Desain Komponen Beton Pracetak – Pratekan,
5. Desain Sambungan,
6. Penanganan dan Pendirian Komponen Beton Praetak – Pratekan,
7. Beton Pracetak Arsitektural.

**PREREQUISITES**

None

**REFERENCES**

**BOOKS :**


1. PCI Design Handbook 6th Ed, PCI Industry Handbook Committee, LeslieD.Martin, Christopher J.Perry, Editor
2. Persyaratan Beton Struktural untuk Bangunan Gedung, SNI 2847:2013, BSNI-2013
3. Tata Cara Perencanaan Ketahanan Gempa untuk Struktur Bangunan Gedung dan Non Gedung, SNI 1726:2012,BSNI-2012
4. Tata Cara Perancangan Beton Pracetak dan Prategang untuk Bangunan Gedung, SNI 7834:2012, BSNI-2012

| | | |
|---|---|---|
| **COURSE** | **RC18 - 5315** | **: STRUCTURAL CONCEPT AND SYSTEM** |
| | **Credit** | **: 3 CREDITS** |
| | **Semester** | **: III (ELECTIVE)** |

**DESCRIPTION OF COURSE**

The course contents the system and concept of structures and devided of : Statics: equilibrium, centre of mass, effect of different cross sections, bending, shear and torsion, stress distribution, span and deflection, direct force paths, smaller internal forces, buckling, prestress, horisontal movement; Dynamics: Energy exchange, pendulum system, free vibration, resonance, damping in structures, vibration reduction, human body models in structural vibration.

**LEARNING OUTCOMES**

To solve the civil engineering problems by utilizing other interdisciplinary or multidisciplinary field of knowledge, and pay attention to the economic, health and safety factors of the public, cultural, social and environmental sustainability.

**COURSE LEARNING OUTCOME**

Students are able to analyse the concept and system of structures, which consisted of: Statics: equilibrium, centre of mass, effect of different cross sections, bending, shear and torsion, stress distribution, span and deflection, direct force paths, smaller internal forces, buckling, prestress, horisontal movement; Dynamics: Energy exchange, pendulum system, free vibration, resonance, damping in structures, vibration reduction, human body models in structural vibration.

**MAIN SUBJECT**

1. Introduction;
2. Statics: equilibrium, centre of mass, effect of different cross sections, bending, shear and torsion, stress distribution, span and deflection, direct force paths, smaller internal forces, buckling, prestress,horisontal movement;
3. Dynamics: Energy exchange, pendulum system, free vibration, resonance, damping in structures, vibration reduction, human body models in structural vibration.

**PREREQUISITES**

None

**REFERENCE**

**Book :**

1. Ji, Tianjian and Bell, Adrian, “Seeing and Touching Structural Concepts”, Taylor and Francis, 2008.

2. Clough, R. W. and Penzien, J., “Dynamics of Structures” (3rd edition), McGraw-Hill Companies, Inc., 2003
3. Chopra, A. K., “Dynamics of Structures (4th edition)”, Pearson, 2011

**CURRICULUM SYLLABUS 2018**
**EXPERTISE AREA GEOTECHNICS**

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| **COURSE** | **RC18 - 5121** | **: RHEOLOGY AND SOIL MICROSCOPICS BEHAVIOR** |
| | **Credits** | **: 3 CREDITS** |
| | **Semester** | **: I (COMPULSORY)** |

**DESCRIPTION OF COURSE**

Course Contents:
Introduction, Basic of Rheology Modeling, Structural Bonding and Crystal Characteristics, Soil Mineralogy, Determination of Soil Composition, Electrolyte System of Groundwater, Soil Elements and Measurement, Soil Composition and Mechanical Characteristics, Effective Stress, Inter-granular Stress. and Total Stress, Soil Structure and Stability, Relation of Macroscopics-Microscopic in Clay, Critical State Line, Rheology Model and Soil Behavior.

**LEARNING OUTCOMES**

1. solve the civil engineering problems by utilizing other interdisciplinary or multidisciplinary field of knowledge, and pay attention to the economic, health and safety factors of the public, cultural, social and environmental sustainability.
2. do the deepening or extension of knowledge in field of civil engineering to provide original and tested innovative contributions through research with interdisciplinary or multidisciplinary approaches;
3. formulate new research questions from conducted research for the development of science and technology in the field of civil engineering to produce innovative and tested works; and
4. criticize and provide feedback on improvements from a civil engineering perspective to settlement policy in infrastructure problems has and/or is being applied in the form of a scientific paper.

**COURSE LEARNING OUTCOMES**

1. Being able to perform rheology models from various soil types and experiments; and
2. Being able to interpret the microscopic-macroscopics behavior obtained from laboratory test result upon various experiments and loads.

**MAIN SUBJECTS**

Structural Bonding and Crystal Characteristics, Soil Mineralogy, Determination of Soil Composition, Electrolyte System of Groundwater, Soil Elements and Measurement, Soil Composition and Mechanical Characteristics, Effective Stress, Inter-granular Stress. and Total Stress, Soil Structure and Stability, Relation of

Macroscopics-Microscopic in Clay, Critical State Line, Rheology Model and Soil Behavior.

**PREREQUISITES**

None

**REFERENCES**

**Book:**


1. Atkinson J.H and Bransby P.L (1978). "The mechanics of soils, An introduction to critical state of Soil mechanics", McGraw-Hill Book Company Limited
2. Grim, R.E. (1968), Clay Mineralogy 2nd Edition McGraw-Hill Book Co
3. Mitchell J.K. (1993), "Fundamentals of Soil Behaviour". John Wiley&Sons, Inc
4. Suklje L. (1969). "Rheological aspects of soil mechanics". Wiley-Interscience.

**CURRICULUM SYLLABUS 2018**

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| **COURSE** | **RC18 - 5122** | **: FOUNDATION ENGINEERING AND GEOTECHNICAL MODELING** |
| | **Credits** | **: 3 CREDITS** |
| | **Semester** | **: I (COMPULSORY)** |

**DESCRIPTION OF COURSE**

Course Contents:
Allowable building settlement, Force and Load Distribution, Shallow foundation modeling by Plaxis, Force Deployment and Settlement of Shallow Foundation, Introduction, Characteristics and Models in Geotechnical Experiments, Footing and Embankment, Excavation, Consolidation and Submerged, Ground Anchor and Dynamic Foundation, Load vs Settlement, Load Distribution by Numerical Method vs Analytical Method, Foundation Settlement, Aspect of Design and Philosophy of Mat Foundation.

**LEARNING OUTCOMES**

1. solve the civil engineering problems by utilizing other interdisciplinary or multidisciplinary field of knowledge, and pay attention to the economic, health and safety factors of the public, cultural, social and environmental sustainability.
2. do the deepening or extension of knowledge in field of civil engineering to provide original and tested innovative contributions through research with interdisciplinary or multidisciplinary approaches;
3. formulate new research questions from conducted research for the development of science and technology in the field of civil engineering to produce innovative and tested works; and
4. criticize and provide feedback on improvements from a civil engineering perspective to settlement policy in infrastructure problems has and/or is being applied in the form of a scientific paper.

**COURSE LEARNING OUTCOMES**

1. Being able to determine and analyze the characteristics and also being able to perform the laboratory model.;
2. Being able to model the footing and embankment, retaining structure of excavation works upon dry and submerged condition (with using ground anchor), and finite element analysis for dynamic foundation.
3. Understanding the allowable building settlement, principal of force and load distributions, principal and influence of force deployment, aspect of design and philosophy of mat foundation.

| MAIN SUBJECTS |
| --- |
| Introduction, Model of various soil types and soil parameters in Plaxis, Plaxis manual procedure, Application of Plaxis Modeling for embankment on soft soil, Application of Plaxis Modeling for foundation under dynamic loading, Application of Plaxis Modeling for retaining structure of excavation works upon dry and submerged condition (ground anchor reinforcement), Allowable building settlement, Force and Load Distribution, Shallow foundation modeling, Force Deployment and Settlement of Shallow Foundation and Load vs Settlement, Foundation Settlement, Aspect of Design and Philosophy of Mat Foundation, Foundation on the difficult soil (expansive soil and collapsible soil), sanitary landfills. |
| **PREREQUISITES** |
| None |
| **REFERENCES** |
| 1. Atkinson J.H and Bransby P.L. The mechanics of soils, An introduction to critical state of Soil mechanics, McGraw-Hill Book Company Limited,1978<br>2. Brinkgreve R.B.J and PA Vermeer, Finite Element For Soil and RocK Analyses, A.A. Balkema/Rotterdam/Brookfield/1998<br>3. Manual Plaxis 2012<br>4. Magnan J.P. Remblais et Foundations sur Sols Compressibles, Presses de l'Ecole Nationale des Pontts et Chaussees<br>5. Coduto D.p. Foundation Design, Prentice Hall, EnglewoodClifts,N.J, 1994 |

**CURRICULUM SYLLABUS 2018**

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|---|---|---|
| **COURSE** | **RC18 - 5221** | **: SOIL DYNAMIC** |
| | **Credits** | **: 3 CREDITS** |
| | **Semester** | **: II (COMPULSORY)** |

**DESCRIPTION OF COURSE**

Course contents:

Characterization of seismic movement, vibration theory, soil behavior due to cyclic loading, sand liquefaction, measurement of soil dynamic characteristics, seismic response of soil layer, review of vibration theory and its application for vibration foundation; influence of embedment and damping for coupling calculation of shallow foundation and pile foundation (single and group of pile).

**LEARNING OUTCOMES**

1. solve the civil engineering problems by utilizing other interdisciplinary or multidisciplinary field of knowledge, and pay attention to the economic, health and safety factors of the public, cultural, social and environmental sustainability.
2. do the deepening or extension of knowledge in field of civil engineering to provide original and tested innovative contributions through research with interdisciplinary or multidisciplinary approaches;
3. formulate new research questions from conducted research for the development of science and technology in the field of civil engineering to produce innovative and tested works; and
4. criticize and provide feedback on improvements from a civil engineering perspective to settlement policy in infrastructure problems has and/or is being applied in the form of a scientific paper.

**COURSE LEARNING OUTCOMES**

1. Being able to understand and govern the soil behavior due to dynamic load;
2. Being able to design the machine foundation
3. Being able to design the soil retaining structures due to lateral load based on the allowable deflection.

**MAIN SUBJECTS**

Characterization of seismic movement, vibration theory, soil behavior due to cyclic loading, sand liquefaction, measurement of soil dynamic characteristics, seismic response of soil layer, review of vibration theory and its application for vibration foundation, resonance frequency, amplitude upon resonance, vibration foundation, geotechnical consideration, coupling load with damping influence, calculating "k" value and "D" of pile group, foundation under transient load, isolating vibration, lateral pressure on retaining wall.

| PREREQUISITES |
| --- |
| None |
| **REFERENCES** |
| 1. Arya, S., O'Neill, M. dan Pincus, G., (1979), "Design of Structures and Foundation for Vibrating Machines", Gulf Publishing Company, Houston, Texas,<br>2. DasB.M. (1993), "Principle of Soil Dynamics", Brooks/Cole, A Division of Thomson Learning,<br>3. Prakash, S. And Puri, VK. (1980), "Foundation for Machines Analysis and Design",John Wiley & Son Inc.,<br>4. Richart, F.E., Jr., Hall, J.R., Jr., dan Wood, R.D. (1970),"Vibration of Soils and Foundations", Prentice Hall Inc., Englewood Cliffs, N.J., |

**CURRICULUM SYLLABUS 2018**

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|---|---|---|
| **COURSE** | **RC18 - 5222** | **: SOIL IMPROVEMENT METHOD AND RECLAMATION** |
| | **Credits** | **: 3 CREDITS** |
| | **Semester** | **: II (COMPULSORY)** |

**DESCRIPTION OF COURSE**

Course contents:

Bearing capacity improvement of soft soil by preloading system, geotextile installation, micropile, and stone columns; soil improvement by using method of Menard; shrink-swell soil improvement; design and construction method of reclamation.

**LEARNING OUTCOMES**

1. solve the civil engineering problems by utilizing other interdisciplinary or multidisciplinary field of knowledge, and pay attention to the economic, health and safety factors of the public, cultural, social and environmental sustainability.
2. do the deepening or extension of knowledge in field of civil engineering to provide original and tested innovative contributions through research with interdisciplinary or multidisciplinary approaches;
3. formulate new research questions from conducted research for the development of science and technology in the field of civil engineering to produce innovative and tested works; and
4. criticize and provide feedback on improvements from a civil engineering perspective to settlement policy in infrastructure problems has and/or is being applied in the form of a scientific paper.

**COURSE LEARNING OUTCOMES**

1. Being able to design the soil reinforcement for bearing capacity improvement by preloading system, geotextile installation, wooden rod/micropile, and stone columns
2. Being able to design a preloading system combined with vertical drain to accelerate the consolidation time of soft soil layers;
3. Being able to define the soil improvement by Menard method;
4. Being able to design shrink-swell soil improvement; and
5. Being able to design a reclamation work and its construction method.

**MAIN SUBJECTS**

The Importance of Soil Improvement Methods for Civil Engineer, Geosynthetics as an Embankment Reinforcement, Geosynthetics: Vertical Wall Reinforcement, Bearing capacity improvement of soft soil by using wooden rod/micropile, Stone

Column, Soil Improvement Methods by method of Menard, Shrink-Swell Soil Improvement, Construction Method of Reclamation, Settlement Problems and calculations, Failure problems and calculations, Acceleration of settlement, Design of Vertical Drain, Geotextile, Soil Monitoring & Site problems .

**PREREQUISITES**

None

**REFERENCES**

**Book :**


1. Das, Braja M. (1985). Priciples of Geotechnical Engineering. PWS Publishers, New York.
2. Das, Braja M. (1990). Priciples of Foundation Engineering. 2nd Edition, PWS - Kent Publishing Company, Boston
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.

**CURRICULUM SYLLABUS 2018**

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| **COURSE** | **RC18 - 5321** | **: ADVANCED SOIL INVESTIGATION AND INTERPRETATION** |
| | **Credits** | **: 3 CREDITS** |
| | **Semester** | **: III (COMPULSORY)** |

**DESCRIPTION OF COURSE**

Course contents:
Origin of Soil, Review of Clay Mineralogy, Soil Classification Test, Soil Compaction Test, CBR Test, Consolidation Test, Shear Strength Test and Clay Mineralogy Test.

**LEARNING OUTCOMES**

1. solve the civil engineering problems by utilizing other interdisciplinary or multidisciplinary field of knowledge, and pay attention to the economic, health and safety factors of the public, cultural, social and environmental sustainability.
2. do the deepening or extension of knowledge in field of civil engineering to provide original and tested innovative contributions through research with interdisciplinary or multidisciplinary approaches;
3. formulate new research questions from conducted research for the development of science and technology in the field of civil engineering to produce innovative and tested works; and
4. criticize and provide feedback on improvements from a civil engineering perspective to settlement policy in infrastructure problems has and/or is being applied in the form of a scientific paper.

**COURSE LEARNING OUTCOMES**

1. Students are able to determine the apropriate soil investigations according to the soil condition in Indonesia
2. Students properly understand the laboratory testing procedure that represents the in-situ soil condition (undisturbed condition)
3. Students could determine an error in geotechnical reporting.

**MAIN SUBJECTS**

Origin of Soil, Review of Clay Mineralogy, Soil Classification Test, Soil Compaction Test, CBR Test, Consolidation Test, Shear Strength Test and Clay Mineralogy Test.

| **PREREQUISITES** |
| --- |
| None |
| **REFERENCES** |
| **BOOKS :**<br>1. Modul Pengujian Tanah Lanjut, Laboratorium Mekanika Tanah dan Batuan ITS, 2017. |

**CURRICULUM SYLLABUS 2018**

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| **COURSE** | **RC18 - 5322** | **: DEWATERING AND EXCAVATION** |
| | **Credits** | **: 3 CREDITS** |
| | **Semester** | **: III (ELECTIVE)** |

**DESCRIPTION OF COURSE**

Course contents :

Pumping method; dry excavation design; planning dewatering; deep excavation process; deep trench design; lateral stresses occurring during the deep excavation process; analysis of the occurrence of heave and sand boiling during deep excavation; and case studies in the field.

**LEARNING OUTCOMES**

1. solve the civil engineering problems by utilizing other interdisciplinary or multidisciplinary field of knowledge, and pay attention to the economic, health and safety factors of the public, cultural, social and environmental sustainability.
2. do the deepening or extension of knowledge in field of civil engineering to provide original and tested innovative contributions through research with interdisciplinary or multidisciplinary approaches;
3. formulate new research questions from conducted research for the development of science and technology in the field of civil engineering to produce innovative and tested works; and
4. criticize and provide feedback on improvements from a civil engineering perspective to settlement policy in infrastructure problems has and/or is being applied in the form of a scientific paper.

**COURSE LEARNING OUTCOMES**

1. Able to plan dry excavation, dewatering, and deep excavation;
2. Able to calculate the lateral stresses that occur during the deep excavation process; and
3. Able to analyze the occurrence of heave and sand boiling when deep excavation

**MAIN SUBJECTS**

Introduction, Pumping Methods, Dry Excavation Design, Dewatering Planning, Deep Excavation Process, Deep Excavation Design, Lateral Stress Occurred During Deep Excavation Process, Analysis Of Heave And Sand Boiling During In-Deep Excavation, Case Study In The Field

**PREREQUISITES**

None

| REFERENCES |
| --- |
| **Book :**<br>1. Hausmann R, Manfred, Engineering Principles of Ground Modification, McGraw-Hill Publishing Company,1990<br>2. Asiyanto, Metode Konstruksi Proyek Jalan, Penerbit Universitas Indonesia, 2008 |

**CURRICULUM SYLLABUS 2018**

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| **COURSE** | **RC18 - 5323** | **: SOIL & ROCK DAMS** |
| | **Credits** | **: 3 CREDITS** |
| | **Semester** | **: III (ELECTIVE)** |

**DESCRIPTION OF COURSE**

Course contents:

Preliminary; Type of earth and rock dams, (uniform material, dams with different material grouped (zoned), rock-fill dam, RCC dam (RCC = roller compacted concrete); Typical cross section forms of various types of dams; Material specifications and basic principles of dam planning ( general design consideration); Problems related to the use of materials and methods of dams construction, Tasks 1. Cases of damage dams by participants: Site Investigation: Hydrological Investigation, Hydro-geological Investigation, Geophysical Investigation, Geotechnical Investigation Site preparation: Preparation for foundation, Preparation for cutting, Preparation for abutment dam; Seepage analysis and control; Embankment Design and stability analyzes: Analysis for sudden draw-down conditions, Analysis for seismic stability; Dam instrumentation and monitoring; Case study and field review, Task 2.

**LEARNING OUTCOMES**

1. solve the civil engineering problems by utilizing other interdisciplinary or multidisciplinary field of knowledge, and pay attention to the economic, health and safety factors of the public, cultural, social and environmental sustainability.
2. do the deepening or extension of knowledge in field of civil engineering to provide original and tested innovative contributions through research with interdisciplinary or multidisciplinary approaches;
3. formulate new research questions from conducted research for the development of science and technology in the field of civil engineering to produce innovative and tested works; and
4. criticize and provide feedback on improvements from a civil engineering perspective to settlement policy in infrastructure problems has and/or is being applied in the form of a scientific paper.

**COURSE LEARNING OUTCOMES**

1. Able to design the construction of soil and rock dams that comply the requirements of geotechnical stability. .
2. Can mention the basic principles for designing soil and rock dams in terms of hydrotechnical and other requirements beyond geotechnical terms
3. Able to plan the instrumentation system for monitoring the dam of soil and rock during its operation later.

4. Able to develop and update Geotechnical knowledge of soil dams through research

**MAIN SUBJECTS**

Introduction, Selections of materials and checks, Site investigation and site preparation, Seepage analysis and control, Embankment design and anlyses, Dam instrumentation and monitoring, Case study and field review

**PREREQUISITES**

None

**REFERENCES**

**Book :**


1. Sherard and Woodward, "Earth and Earth Rock Dams", John Wiley & Sons, 1963.
2. US Army Corps of Engineers - ENGINEERING AND DESIGN - EM 1110-2-2300 30 July 2004 - General Design and Construction Considerations for Earth and Rock-Fill Dams.
3. Jansen, Robert B," Advanced Dam Engineering, for Design, Construction and Rehabilitation", Van Nostrand Reinhold, 1988.

**CURRICULUM SYLLABUS 2018**

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| **COURSE** | **RC18 - 5324** | **: PEAT SOILS** |
| | **Credits** | **: 3 CREDITS** |
| | **Semester** | **: III (ELECTIVE)** |

**DESCRIPTION OF COURSE**

Course contents:
Peat soil and the problem for civil engineering construction; physical behavior of peat soil; peat soil classification; peat soil degradation; peat soil strength; how to peat soil testing in the laboratory and in the field, the method of peat soil discharges; determine the nature of peat soil in laboratory.

**LEARNING OUTCOMES**

1. solve the civil engineering problems by utilizing other interdisciplinary or multidisciplinary field of knowledge, and pay attention to the economic, health and safety factors of the public, cultural, social and environmental sustainability.
2. do the deepening or extension of knowledge in field of civil engineering to provide original and tested innovative contributions through research with interdisciplinary or multidisciplinary approaches;
3. formulate new research questions from conducted research for the development of science and technology in the field of civil engineering to produce innovative and tested works; and
4. criticize and provide feedback on improvements from a civil engineering perspective to settlement policy in infrastructure problems has and/or is being applied in the form of a scientific paper.

**COURSE LEARNING OUTCOMES**

1. Being able to classify peat soil,
2. Being able to determine the physical and technical properties of peat soil,
3. Being able to determine the parameters of peatland rheology to predict field compression, and
4. Being able to predict peat soil strength, and improve peat soil to increase its carrying capacity.

**MAIN SUBJECTS**

Peat soil and the problem for the construction of Civil Engineering, Physical Behavior of Peat soil, Peat soil Classification, Peat Soil Strength, Peat soil Testing Methods in the laboratory and in the field, Peat Land Parcel Method, Laboratory Experiment.

**PREREQUISITES**

None

**REFERENCES**

**Book :**


1. ASTM Annual Book (1985). ” Standard Classification of Peat Samples by Laboratory Testing (D4427-84)”. ASTM, Section 4, Volume 04.08 Soil and Rock, pp 883-884.
2. Fuchsman, C. H. Editor. (1986). "Peat and Water Aspect of Water Retention and Dewatering in Peat". Elsevier Applied Science Publishers, London and New York.
3. Haan, E. D, R. Termaat, and T. B. Edil, Editors, (1993). "Advances in Understanding and Modelling The Machanical Behaviour o fPeat". Proc. of The International Workshop on Advances in Understanding and Modelling The Machanical, Delft, Netherlands. June, 1993
4. MacFarlane, I.C. (1959). ”Muskeg Engineering Handbook”. National Research Council of Canada, University of Toronto Press, Toronto, Canada.

**CURRICULUM SYLLABUS 2018**

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| **COURSE** | **RC18 - 5325** | **: UNSATURATED SOIL** |
| | **Credits** | **: 3 CREDITS** |
| | **Semester** | **: III (ELECTIVE)** |

**DESCRIPTION OF COURSE**

Course contents:
Introduction, Three-Phase System for Unsaturated Soils, Stress State Variables for Unsaturated Soil, Changes in Negative Pore Pressure (Drying and Wetting Soil), Basic of Soil Water Characteristic Curve , Soil Water Characteristic Curve for Different Types of Soil, Application of Unsaturated Soil Concept to Compacted Soils and Slope Stability.

**LEARNING OUTCOMES**

1. solve the civil engineering problems by utilizing other interdisciplinary or multidisciplinary field of knowledge, and pay attention to the economic, health and safety factors of the public, cultural, social and environmental sustainability.
2. do the deepening or extension of knowledge in field of civil engineering to provide original and tested innovative contributions through research with interdisciplinary or multidisciplinary approaches;
3. formulate new research questions from conducted research for the development of science and technology in the field of civil engineering to produce innovative and tested works; and
4. criticize and provide feedback on improvements from a civil engineering perspective to settlement policy in infrastructure problems has and/or is being applied in the form of a scientific paper.

**COURSE LEARNING OUTCOMES**

1. Ability to understand unsaturated soil concept
2. Ability to introduce unsaturated soil concept to compacted soil and slope stability problems.
3. Ability to develop sustainable knowledge of civil engineering.
4. Ability to analyze compaction soil problems related to unsaturated soil concept.
5. Ability to analyze slope stability problems related to unsaturated soil concept.

**MAIN SUBJECTS**

Introduction of unsaturated soil concept, Unsaturated soil element phase theory, Unsaturated soil characteristics, Unsaturated soil shear stress, Negative pore change in drying-wetting process, Laboratory test for drying-wetting using Whatman type filter paper no. 42, Air volume relationship with matric suction in unsaturated soil, Parameters in Soil Water Characteristic Curve curve, Soil Water Characteristic Curve curve approach, Soil Water Characteristic Curve Curve in

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| various soil types (clay, silt and sand), Soil compaction unsaturated, Proctor test procedure for unsaturated soil, Unstable soil slope stability. |
| **PREREQUISITES** |
| Soil Mechanics and Foundation |
| **REFERENCES** |
| **Book :**<br>1. Fredlund, D.G. and Rahardjo, H. (1993). Soil Mechanics for Unsaturated Soils, Wiley – Interscience, New York.<br>2. Charles W.W. Ng and Bruce Menzies (2007). Advanced Unsaturated Soil Mechanics and Engineering<br>3. Eddy F. Ramirez (2013). Introducing Unsaturated Soil Mechanics to Undergraduate Students through the Net Stress Concepts. A Master of Science Thesis. Arizona State University. |

**CURRICULUM SYLLABUS 2018**

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| **COURSE** | **RC18 - 5326** | **: DEVELOPMENT, PROBLEMS, AND RESOLUTION IN GEOTECHNICS** |
| | **Credits** | **: 3 CREDITS** |
| | **Semester** | **: III (ELECTIVE)** |

**DESCRIPTION OF COURSE**

Course contents:
Several case studies and soil & foundation problems are common in the field
Some theories, methods of soil improvement and current soil work

**LEARNING OUTCOMES**

1. solve the civil engineering problems by utilizing other interdisciplinary or multidisciplinary field of knowledge, and pay attention to the economic, health and safety factors of the public, cultural, social and environmental sustainability.
2. do the deepening or extension of knowledge in field of civil engineering to provide original and tested innovative contributions through research with interdisciplinary or multidisciplinary approaches;
3. formulate new research questions from conducted research for the development of science and technology in the field of civil engineering to produce innovative and tested works; and
4. criticize and provide feedback on improvements from a civil engineering perspective to settlement policy in infrastructure problems has and/or is being applied in the form of a scientific paper.

**COURSE LEARNING OUTCOMES**

Students are able to analyze some soil and foundation problems and being able to determine the right solution by considering the latest theories and methods.

**MAIN SUBJECTS**

The case of collapse under building structure along with the alternative solution, the case of landslide a slope, embankment on soft soil and alternative solution, Case of collapse of under building structure (foundation, abutment, poer, sheet-pile, retaining wall) in the period of physical implementation and alternative solution, pile of foundation in terms of bearing capacity and material resistance of foundation piles, and alternative solution, Cases of differential settlement of buildings and alternative solutions, Cases of negative skin friction and alternative solutions, Several classic and current methods to predict final settlement and land collapse, current in the world, some soil tests in the laboratory as well as in the field, Some new theories and methods of implementing modern soil work in the world Some relevant topics related to soil and foundation cases, based on the results of

dissertation research in Indonesia as well as in the world Some topics / foundations, as well as some current methods or theories other than those listed above, which appear abrupt, casuistic, moderate and virtually desirable to be discussed

**PREREQUISITES**

None

**REFERENCES**

**Book :**


1. Hausmann R, Manfred, Engineering Principles of Ground Modification, McGraw-Hill Publishing Company,1990
2. Asiyanto, Metode Konstruksi Proyek Jalan, Penerbit Universitas Indonesia, 2008

**CURRICULUM SYLLABUS 2018**
**EXPERTISE AREA CONSTRUCTIONT MANAGEMENT**

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| **COURSE** | **RC18 - 5131** | **: SYSTEM ANALYSIS AND DECISION MAKING** |
| | **CREDITS** | **: 3 CREDITS** |
| | **SEMESTER** | **: I (COMPULSORY)** |

| **DESCRIPTION OF COURSE** |
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| The course contents concept and definition of system; system design process, system analysis and design evaluation, design for feasibility of operation, System Engineering Management |
| **LEARNING OUTCOMES** |
| 1. Solve the civil engineering problems by utilizing other interdisciplinary or multidisciplinary field of knowledge, and pay attention to the economic, health and safety factors of the public, cultural, social and environmental sustainability.<br>2. Do the deepening or extension of knowledge in field of civil engineering to provide original and tested innovative contributions through research with interdisciplinary or multidisciplinary approaches;<br>3. Formulate new research questions from conducted research for the development of science and technology in the field of civil engineering to produce innovative and tested works. |
| **COURSE LEARNING OUTCOMES** |
| 1. Student are able to model and to analyze system in civil engineering problem.<br>2. Student are able to apply decision making tools in the case of construction project management. |
| **MAIN SUBJECTS** |
| Introduction to System Modeling, Linear programming & Integer programming, Assignment, Transportation and Transhipment, Inventory model, Multi Criteria Decision Analysis (MCDA), Decision under Uncertainty, Game Theory, System Dynamic. |
| **PREREQUISITES** |
| None |
| **REFERENCES** |
| **Book :**<br>1. Barry Render, Ralph M. Stair Jr., Michael E. Hanna, (2014), Quantitaive analysis for management (12th edition), Prentice Hall |

2. Bilash Kanti Bala and Fatimah Mohamed Arshad (2016), System Dynamics: Modeling and simulation , Springer
3. Matt Devos and Deborah A. Kent,(2017),Game Theory: A Palyfull Interoduction, Amer Mathematical Society

**CURRICULUM SYLLABUS 2018**

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| **COURSE** | **RC18 - 5132** | **: PROPERTY PROJECT DEVELOPMENT** |
| | **CREDITS** | **: 3 CREDITS** |
| | **SEMESTER** | **: I (COMPULSORY)** |

**DESCRIPTION OF COURSE**

The course content: project finance, property and corporate properties, generating ideas through experience and awareness, market research and concept improvements, project development stages, market analysis and market opportunities, project development feasibility, highest and best use (HBU), financial analysis of project development, project financing.

**LEARNING OUTCOMES**

1. Solve the civil engineering problems by utilizing other interdisciplinary or multidisciplinary field of knowledge, and pay attention to the economic, health and safety factors of the public, cultural, social and environmental sustainability.
2. Do the deepening or extension of knowledge in field of civil engineering to provide original and tested innovative contributions through research with interdisciplinary or multidisciplinary approaches

**COURSE LEARNING OUTCOMES**

1. Understanding the concept of property development as a business as well as a corporate property asset,
2. Able to explain basic knowledge of commercial and public project development.
3. Understanding project development process.
4. Able to develop ideas and sharpening ideas through an understanding of market research and public needs,
5. Able to plan a development of commercial and public project.
6. Able to explain basic knowledge of financial analysis of project investment,
7. Able to develop investment plan and finance of a commercial project development.

**MAIN SUBJECTS**

Perspectives of property knowledge and basic concept of property development, Classification of property projects and commercial infrastructure, Property development as a means of production, Eight phases of property development and commercial infrastructure, Basic financial concepts: Time value of money, discounted cash flow, Market research for ideas refinement , market analysis and market positioning, Marketability and Feasibility, Highest and Best use of land, Project Development Strategy and Decision

| PREREQUISITES |
| --- |
| None |
| **REFERENCES** |
| **Book :**<br>1. Miles, M.E., Netherton, L.M dan Schmitz, A. (2015). Real Estate Development : Principles and Process. Edisi ke-5. Urban Land Institut.<br>2. Edwards, V. dan Ellison, L. (2004) Corporate Property Management. Blackwell Publishing, Oxford, UK.<br>3. Brueggeman, W.B, et al. (2001) Real Estate: Finance and Investment, Edisi ke-11. Mc.Graw Hill<br>4. Kyle, R.C., Floyd M.B. and Spodek, M. (2004) Property Management, edisi ke-7. Real Estate Education Company |

**CURRICULUM SYLLABUS 2018**

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|---|---|---|
| **COURSE** | **RC18 - 5133** | **: PROJECT MANAGEMENT** |
| | **CREDITS** | **: 3 CREDITS** |
| | **SEMESTER** | **: I (COMPULSORY)** |

| **DESCRIPTION OF COURSE** |
|---|
| The course content : Project Management Body of Knowledge (PMBOK), Project Organization, Scheduling, Cost Estimation, Quality managemen, Project teams, Project Communication, Project Risk, Project Procurement, Project Stakeholder, Project Safety and Environment, Project Finance and Claim, Project Closure. |
| **LEARNING OUTCOMES** |
| 1. Solve the civil engineering problems by utilizing other interdisciplinary or multidisciplinary field of knowledge, and pay attention to the economic, health and safety factors of the public, cultural, social and environmental sustainability.<br>2. Do the deepening or extension of knowledge in field of civil engineering to provide original and tested innovative contributions through research with interdisciplinary or multidisciplinary approaches;<br>3. Formulate new research questions from conducted research for the development of science and technology in the field of civil engineering to produce innovative and tested works. |
| **COURSE LEARNING OUTCOMES** |
| 1. Students are able to analyze and optimize the implementation of construction project management<br>2. Students are able to update the knowledge of construction project management<br>3. Students are able to develop knowledge of sustainable construction project management<br>4. Mastering one of the area/field of construction project management<br>5. Professional, honest, ethical, proactive, tenacious, confident, communicative, and appreciative. |
| **MAIN SUBJECTS** |
| Concept of Construction Project Management, Project Organization, Project Management Planning, Project Scheduling, Project Cost, Human Resource management, Communication And Project Reporting, Project Risk, Project Procurement, Project Stakeholder, Project Safety and Environment, Finance And Project Claims, Project closing |

| PREREQUISITES |
| --- |
| None |
| **REFERENCES** |
| **Book :**<br>1. Erik W Larson & Clifford F Gray , Project Management : The Managerial Process - 7th Edition, Mc-Graw Hill Education, 2017<br>2. Jack R Meredith, Samuel J Mantel Jr., Scott M Shafer, Project Management : A Managerial Approach - 9th Edition, Wiley, 2016<br>3. Harold Kerzner, Project Management: A Systems Approach to Planning, Scheduling, and Controlling - 12th Edition, Wiley, 2017<br>4. Project Management Body of Knowledge (The PMBOK® Guide) - Sixth Edition, Project Management Institute, 2017 |

**CURRICULUM SYLLABUS 2018**

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|---|---|---|
| **COURSE** | **RC18 - 5231** | **: TIME AND COST MANAGEMENT** |
| | **CREDIT** | **: 3 SKS** |
| | **SEMESTER** | **: II (COMPULSORY)** |

**DESCRIPTION OF COURSE**

The course content:
The concept of time and cost management in the field of construction management

**LEARNING OUTCOMES**

1. Solve the civil engineering problems by utilizing other interdisciplinary or multidisciplinary field of knowledge, and pay attention to the economic, health and safety factors of the public, cultural, social and environmental sustainability.
2. Do the deepening or extension of knowledge in field of civil engineering to provide original and tested innovative contributions through research with interdisciplinary or multidisciplinary approaches;
3.

**COURSE LEARNING OUTCOMES**

1. Able to update the knowledge of construction project management
2. Able to develop knowledge of sustainable construction project
3. Mastering one of the area of construction project management
4. Professional, honest, ethical, proactive, tenacious, confident, communicative, and appreciative.

**MAIN SUBJECT**

Introduction to project Scheduling (Based on PMBOK), Productivity Analysis and Learning Curve, Deterministic Scheduling, Probabilistic Scheduling, Schedule Optimization, Schedule Control (Case Study), Cost Concepts and Project Cost Management, Activity Based Management, Budgeting and Cost Allocation, Measurement and Cost Performance.

**PREREQUISITES**

None

**REFERENCES**

**Book :**


1. Erik W Larson & Clifford F Gray , Project Management : The Managerial Process - 7th Edition, Mc-Graw Hill Education, 2017
2. Harold Kerzner, Project Management: A Systems Approach to Planning, Scheduling, and Controlling - 12th Edition, Wiley, 2017
3. Saleh Mubarak, (2010), Construction Project Scheduling and Control 2nd edition, John Wiley & Son
4. Yong Woo Kim, (2017), Activity Based Costing for Construction Companies, Jhon Wiley & Son
5. Kenneth K. Humpreys, (2005), Project and cost engineers hand book, Marcel Dekker

**CURRICULUM SYLLABUS 2018**

| | | |
|---|---|---|
| **COURSE** | **RC18 - 5232** | **: RISK AND QUALITY MANAGEMENT** |
| | **CREDIT** | **: 3 CREDITS** |
| | **SEMESTER** | **: II (COMPULSORY)** |

**DESCRIPTION OF COURSE**

The concept of risk management and quality management in the field of construction management

**LEARNING OUTCOMES**

1. Solve the civil engineering problems by utilizing other interdisciplinary or multidisciplinary field of knowledge, and pay attention to the economic, health and safety factors of the public, cultural, social and environmental sustainability.
2. Do the deepening or extension of knowledge in field of civil engineering to provide original and tested innovative contributions through research with interdisciplinary or multidisciplinary approaches;

**COURSE LEARNING OUTCOMES**

Students are able to understand and apply the concept of risk management and quality management as the basis for decision making in the field of construction project management

**MAIN SUBJECTS**

The concept of risk management, Risk identification, Risk assessment / risk analysis / risk evaluation, Risk response, Risk management standards and application of risk management concepts in the case of construction projects,
Quality management concepts, Total quality management (TQM), Cost of quality, Quality improvement, Quality planning, Quality assurance, Quality control, Presentation of quality management application tasks.

**PREREQUISITES**

None

**REFERENCES**

**Book :**


1. Loosemore, M., Rafter, J., Reilly, C., and Higgon, D. (2005). Risk Management in Projects. Second ed., London and New York, Taylor and Francis
2. Australian/New Zealand Standard (2004). Risk Management. Standards Association of Australia.
3. AS/NZS (Australian and New Zealand Standard) (2004) Guidelines for Managing Risk: in the Australian and New Zealand Public Sector. HB 143.
4. PMI (2013). A Guide to Project Mangement Body of knowledge (PMBoK Guide). Fifth Edition, Project Management Institute, Inc.
5. Rust, R., Zahorik, A.J., Keiningham, T.L. (1994). Return on Quality. Heinemann Singapore.
6. Kubal, M.T. (1994). Engineered Quality in Construction. McGraw-Hill, Inc.
7. Mears, P. (1995), Quality Improvement Tools and Techniqes. McGraw-Hill, Inc.

**CURRICULUM SYLLABUS 2018**

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|---|---|---|
| **COURSE** | **RC18 - 5233** | **: CONSTRUCTION TECHNOLOGY AND MANAGEMENT** |
| | **CREDIT** | **: 3 CREDITS** |
| | **SEMESTER** | **: II (COMPULSORY)** |

**DESCRIPTION OF COURSE**

The Course content:
Construction site layout, Type of Construction equipment, Construction method of Civil infrastructure, Optimization of construction operation

**LEARNING OUTCOMES**

1. Solve the civil engineering problems by utilizing other interdisciplinary or multidisciplinary field of knowledge, and pay attention to the economic, health and safety factors of the public, cultural, social and environmental sustainability.
2. Do the deepening or extension of knowledge in field of civil engineering to provide original and tested innovative contributions through research with interdisciplinary or multidisciplinary approaches;
3. Formulate new research questions from conducted research for the development of science and technology in the field of civil engineering to produce innovative and tested works.

COURSE LEARNING OUTCOME

1. Students are able to plan the needs and types of construction equipment
2. Students are able to develop construction planning and management for civil infrastructure
3. Students are able to do optimization in construction process
4. Students are able to incorporate aspects of green building, public health and safety in construction planning
5. Students are able to apply information technology in construction such as Virtual Reality, Augmented Reality, 3D animation, and tools in optimization

**MAIN SUBJECTS**

Construction project preparation, type of construction equipments, application of construction technology and management in civil infrastructure, aspects of construction technology, optimization of construction technology and management, Construction Information Technology

**PREREQUISITES**

None

| REFERENCES |
| --- |
| **Book :**<br>1. John Schaufelberger, 1999, "Construction Equipment Management", Prentice Hall<br>2. Nunally,2000, "Managing Construction Equipment", Prentice Hall<br>3. Roger Grenoo et all, 2012, Advanced Construction Technology<br>4. Maxwell, 1991, Information Technology in Construction Technology |

**CURRICULUM SYLLABUS 2018**

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| **COURSE** | **RC18 - 5331** | **: PROCUREMENT AND CONTRACT MANAGEMENT** |
| | **CREDITS** | **: 2 CREDITS** |
| | **SEMESTER** | **: III (COMPULSORY)** |

**DESCRIPTION OF COURSE**

The Course content:
Procurement of Goods and Services in the Government and Private sectors, types of procurement, procurement documents and procurement processes, Procurement/bidding document evaluation, Contract Preparation, Contract Quality Plan and Contract Implementation.

**LEARNING OUTCOMES**

1. Solve the civil engineering problems by utilizing other interdisciplinary or multidisciplinary field of knowledge, and pay attention to the economic, health and safety factors of the public, cultural, social and environmental sustainability.
2. Do the deepening or extension of knowledge in field of civil engineering to provide original and tested innovative contributions through research with interdisciplinary or multidisciplinary approaches;

**COURSE LEARNING OUTCOMES**

1. Students are able to make a bidding document, and conduct evaluation of the proposed bidding documents from Engineering consultant and contractors
2. Students are able to compose contract documents and Work Agreement Letters
3. Students are able to understand several International contract standards,
4. Students are able to create a Project Document, addendum of the contract, and closing of the contract.

**MAIN SUBJECTS**

Concept of Procurement (Goods / Services), Types of Procurement, Procurement Process, Contract Document, Implementation of Contract.

**PREREQUISITES**

None

**REFERENCES**

**Books :**

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**

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|---|---|---|
| **COURSE** | **RC18 - 5308** | **: CONSTRUCTION AUTOMATION** |
| | **CREDITS** | **: 2 CREDITS** |
| | **SEMESTER** | **: III (ELECTIVES)** |

**DESCRIPTION OF COURSE**

The course content:
Introduction to Construction Automation, Robot Applications in Construction, Building Information Model (BIM), Implementation of BIM in Construction, Meta Heuristic and Artificial Intelligence.

**LEARNING OUTCOMES**

1. Solve the civil engineering problems by utilizing other interdisciplinary or multidisciplinary field of knowledge, and pay attention to the economic, health and safety factors of the public, cultural, social and environmental sustainability.
2. Do the deepening or extension of knowledge in field of civil engineering to provide original and tested innovative contributions through research with interdisciplinary or multidisciplinary approaches;

**COURSE LEARNING OUTCOMES**

1. Student are able to update the knowledge of construction project management
2. Student are able to develop knowledge of sustainable construction project
3. Mastering one of the area of construction project management
4. Professional, honest, ethical, proactive, tenacious, confident, communicative, and appreciative.

**MAIN SUBJECTS**

Introduction to Construction Automation, Robot Applications in Construction, Building Information Model (BIM), Implementation of BIM in Construction, Meta Heuristic and Artificial Intelligence.

**PREREQUISITES**

None

**REFERENCES**

**Book :**

1. Carlos Balaguer and Mohamed Abderrahim, (2014), Robotic and Automation in Construction, Jhon Wiley & Son, USA

2. Brad Hardin, Dave mac cool, (2015) BIM and Construction Management: Proven tools, method and workflows, Jhon Wiley & Son, USA
3. Nikola K Kasbov, Foundation of Neural Network, Fuzzy system and Knowledge Engineering, The MIT Press Cambridge, Massachusetts, London, England

**CURRICULUM SYLLABUS 2018**

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|---|---|---|
| **COURSE** | **RC18 - 5334** | **: DESIGN MANAGEMENT** |
| | **CREDIT** | **: 2 CREDIT** |
| | **SEMESTER** | **: III (ELECTIVES)** |

**DESCRIPTION OF COURSE**

The course content:
The development and changes occurring in the construction industry have resulted in how the design product is produced and how the production process is, what and who is involved in it for the purpose of obtaining the right design information at the right time.

**LEARNING OUTCOMES**

1. Solve the civil engineering problems by utilizing other interdisciplinary or multidisciplinary field of knowledge, and pay attention to the economic, health and safety factors of the public, cultural, social and environmental sustainability.
2. Do the deepening or extension of knowledge in field of civil engineering to provide original and tested innovative contributions through research with interdisciplinary or multidisciplinary approaches;

**COURSE LEARNING OUTCOMES**

1. Students understand the basic concepts of engineering design management, production management design as well as understand the design management in the practice of construction projects.
2. Students understand special topics on management and value engineering

**MAIN SUBJECTS**

Introduction, definition and terminology of design and construction projects, Principles of design production management and monitoring process, Knowledge of design management analysis in practice, Building Information Modeling (BIM) knowledge as a method of design management, collaboration design and how this method is used in the management of design decisions.

**PREREQUISITES**

None

**REFERENCES**

**Book :**

1. Stephen Emmitt & Kirti Ruikar (2013) Collaborative Design Management. Abingdon, Oxon: Routledge.
2. Frederick S. Merritt & Jonathan T. Ricketts (2001) Building Design and Construction Handbook, Sixth Edition. New York: McGraw-Hill
3. John Kelly, Stephen Male & D. Graham (2004) Value Management of

Construction Projects. London: Blackwell Science
4. Rick Best & Gerard De Valence (1999) Building in Value: Pre-Design Issues. United Kingdom: Taylor & Francis Ltd: London.
5. Randy Deutsch (2011). BIM and Integrated Design: Strategies for Architectural Practices. New York: Wiley

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|---|---|---|
| **COURSE** | **RC18 - 5334** | **: STRATEGIC MANAGEMENT** |
| | **CREDITS** | **: 2 CREDITS** |
| | **Semester** | **: III (ELECTIVES)** |

**DESCRIPTION OF COURSE**

The course content:
Concept of strategic management; Strategy formulation, Strategy analysis and choice, Strategy implementation, Strategy evaluation, Case study

**LEARNING OUTCOMES**

1. Solve the civil engineering problems by utilizing other interdisciplinary or multidisciplinary field of knowledge, and pay attention to the economic, health and safety factors of the public, cultural, social and environmental sustainability.
2. Do the deepening or extension of knowledge in field of civil engineering to provide original and tested innovative contributions through research with interdisciplinary or multidisciplinary approaches;

**COURSE LEARING OUTCOMES**

1. Able to update the knowledge of construction project management
2. Able to develop knowledge of sustainable construction project
3. Mastering one of the area of construction project management
4. Professional, honest, ethical, proactive, tenacious, confident, communicative, and appreciative.

**MAIN SUBJECTS**

The concept of Strategic Management, Vision, Mission and Project Objectives; External Factors; Internal Factors; Tools And Matching Techniques Strategies; QSPM analysis; Implementation of Operational and Management Strategy; Implementation of Finance and RD Strategy; Tools And Techniques for evaluating And Monitoring. Strategy Review; Strategy Formulation.

**PREREQUISITES**

None

**REFERENCES**

**Book :**

1. David, F.R., and David, F.R., “Strategic Management: Concepts and Cases”, Prentice Education Limited, 2015

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|---|---|---|
| **COURSE** | **RC18 - 5335** | **: SUSTAINABLE CONSTRUCTION** |
| | **CREDIT** | **: 2 CREDITS** |
| | **SEMESTER** | **: III (ELECTIVES)** |

**DESCRIPTION OF COURSE**

The course content:
The concept of sustainable construction and the aspects that must be understood in its application in the field of construction management

**LEARNING OUTCOMES**

1. Solve the civil engineering problems by utilizing other interdisciplinary or multidisciplinary field of knowledge, and pay attention to the economic, health and safety factors of the public, cultural, social and environmental sustainability.
2. Do the deepening or extension of knowledge in field of civil engineering to provide original and tested innovative contributions through research with interdisciplinary or multidisciplinary approaches;

**COURSE LEARNING OUTCOMES**

Students are able to understand the concept of sustainable construction projects

**POKOK BAHASAN**

Introduction, Sustainable development concept and background, Sustainability in the built environment (construction industry), Built Environment Hydrologic Cycle, The green building design process, Ecological design, Sustainable site and landscape, Energy reduction, Closing Materials Loops, The Built Environment Carbon Footprint, Indoor Environmental Quality, Construction Operations and Commissioning, International Building Assessment Systems and Green Building Council Indonesia (GBCI), Field Visit

**PREREQUISITES**

None

**REFERENCES**

**Book :**

1. Kibert, C.J. (2016). Sustainable construction: green building design and delivery. Wile publisher. Fourth Edition.
2. Du plessis, C.(2002). Agenda 21 for sustainable cosntruction in developing countries: A discussion document. The International Council for Research and Innovation in Buildiong and Construction (CIB)

**CURRICULUM SYLLABUS 2018**
**EXPERTISE AREA WATER RESOURCE MANAGEMENT AND ENGINEERING**

| | | |
|---|---|---|
| **COURSE** | **RC18 - 5141** | **: APPLIED HYDROLOGY** |
| | **CREDITS** | **: 3 CREDITS** |
| | **SEMESTER** | **: I (COMPULSORY)** |

**DESCRIPTION OF COURSE**

This course contains about quantity hydrology such as rainfall- discharge relation and discharge – discharge relation, and also water quality included standart of water quality and water pollutin

**LEARNING OUTCOMES**

a. solve the civil engineering problems by utilizing other interdisciplinary or multidisciplinary field of knowledge, and pay attention to the economic, health and safety factors of the public, cultural, social and environmental sustainability.
b. do the deepening or extension of knowledge in field of civil engineering to provide original and tested innovative contributions through research with interdisciplinary or multidisciplinary approaches;
c. formulate new research questions from conducted research for the development of science and technology in the field of civil engineering to produce innovative and tested works; and
d. criticize and provide feedback on improvements from a civil engineering perspective to settlement policy in infrastructure problems has and/or is being applied in the form of a scientific paper.

**COURSE LEARNING OUTCOMES**

1. Being able to understanding and analysis rainfall-discharge relation modeling
2. Being able to understanding and analysis discharge-discharge relation modeling
3. Being able to understanding and analysis characteristics of raw water and waste water
4. Being able to understanding raw water and waste water management system

Being able to understanding raw water and waste water quality modeling

**MAIN SUBJECTS**

1. Cyclus of Hydrology
2. Hydrograph

3. Unit Hydrograph
4. Flood routing
5. Rainfall-Runoff modeling
6. Discharge – Discharge modeling
7. Standard of water quality
8. Water pollution
9. Water quality management
10. Waste water management in water body
11. Waste water management with land aplication
12. Leachate management
13. Water front city
14. Water quality modeling – water quality management
15. Waste water management

**PREREQUISITES**

None

**REFERENCES**

**Book :**


1. David R. Maidment, 1992, Handbook of Hydrology, McGRAW-HILL, INC
2. Keith J. Beven, 2000, Rainfall-runoff modelling, John Wiley & Sons, LTD
3. Donald M. Kent (editor), 2000, Applied wetlands sciences and technology, 2nd.es., Lewis Publisher
4. L.W. Canter, R.C. Knox, 1985, Ground water pollution control
5. R.B. Clark, 2001, Marine pollution
6. Steven C. Chapra, 1997, Surface water quality modelling
1. 7. William Wesley Eckenfelder, 1991, Principles of water quality management

**CURRICULUM SYLLABUS 2018**

| | | |
|---|---|---|
| **COURSE** | **RC18 - 5142** | **: APPLIED HYDROLICS** |
| | **CREDITS** | **: 3 CREDITS** |
| | **SEMESTER** | **: I (COMPULSORY)** |

**DESCRIPTION OF COURSE**

This course contains:
Hydrodinamics of Uniform flow : hydrodinamics equation, velocity distribution, discharge calculation on fixed bed and mobile bed, flow in curves, instability at surface, non uniform flow : rappidly varied flow, transitions, lateral inflow, hydrodinamic of unsteady flow : kinematic wave, diffusive wave, flood wave and translatory wave, sediment transport and local score.

**LEARNING OUTCOMES**

In field of water resources management and engineering, each graduate is being able to:

1. Solve the civil engineering problems by utilizing other interdisciplinary or multidisciplinary field of knowledge, and pay attention to the economic, health and safety factors of the public, cultural, social and environmental sustainability.
2. Do the deepening or extension of knowledge in field of civil engineering to provide original and tested innovative contributions through research with interdisciplinary or multidisciplinary approaches;
3. Formulate new research questions from conducted research for the development of science and technology in the field of civil engineering to produce innovative and tested works; and
4. Criticize and provide feedback on improvements from a civil engineering perspective to settlement policy in infrastructure problems has and/or is being applied in the form of a scientific paper.

**COURSE LEARNING OUTCOMES**

At the completion of the topic, students are expected to be able to apply hydraulic formula and use to solve hydraulic cases that occur in field

**MAIN SUBJECTS**

Hydrodinamics of Uniform flow : hydrodinamics equation, velocity distribution, discharge calculation on fixed bed and mobile bed, flow in curves, instability at surface, non uniform flow : rappidly varied flow, transitions, lateral inflow, hydrodinamic of unsteady flow : kinematic wave, diffusive wave, flood wave and translatory wave, sediment transport and local score.

| **PREREQUISITES** |
| --- |
| None |
| **REFERENCES** |
| **Books :**<br>1. Anggrahini , 1997, Hidrolika Salan Terbuka, CV. Citra Media.<br>2. Chow, V.T., 1954, Open Channel Hydraulics,Mc Graw Hill Kogakusha Ltd.<br>3. Graf, Walter H., 1997, Fluvial Hydraulics, John Wiley & Sons, New York.<br>4. Jansen, P. Ph., Principle of River Engineering, 1979, Delftse Uitgevers Maatschappaij b.v.Anwar, Nadjadji : "Modul Kuliah Analisa Sistem dan Penelitian Operasional", Jurusan Teknik Sipil FTSP ITS, Surabaya, 2000. |

**CURRICULUM SYLLABUS 2018**

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|---|---|---|
| **COURSE** | **RC18 - 5143** | **: ANALYSIS OF WATER RESOURCES SYSTEM** |
| | **CREDITS** | **: 3 CREDITS** |
| | **SEMESTER** | **: I (COMPULSORY)** |

**DESCRIPTION OF COURSE**

This course contains:
Concept of System Analysis, Liner Programming, Transportation modeling, Multi purposes modeling, Multi criteria modelling, Dynamic Programming, Network Analysis and others

**LEARNING OUTCOMES**

In field of water resources management and engineering, each graduate is being able to:

1. Solve the civil engineering problems by utilizing other interdisciplinary or multidisciplinary field of knowledge, and pay attention to the economic, health and safety factors of the public, cultural, social and environmental sustainability.
2. Do the deepening or extension of knowledge in field of civil engineering to provide original and tested innovative contributions through research with interdisciplinary or multidisciplinary approaches;
3. Formulate new research questions from conducted research for the development of science and technology in the field of civil engineering to produce innovative and tested works; and
4. Criticize and provide feedback on improvements from a civil engineering perspective to settlement policy in infrastructure problems has and/or is being applied in the form of a scientific paper.

**COURSE LEARNING OUTCOMES**

At the completion of the topic, students are expected to be able to:

1. Explain the concept of water resources analysis system
2. Formulate civil engineering cases/problems with linear programming, transportation modeling, multi purposes modeling, multi criteria modelling , dynamic programming
3. - Able to complete linear programming, transportation modeling, multi purposes modeling, multi criteria modelling , dynamic programming using computer software

**MAIN SUBJECTS**

1.Concept of System Analysis, 2.Linier Programming, 3.Transportation modeling, 4.Multi purposes modeling, 5. Multi criteria modelling 6.Dynamic Programming, 7.Network Analysis and others

| PREREQUISITES |
| --- |
| None |
| **REFERENCES** |
| **Books :**<br>1. Taylor III, Bernard W. : "Introduction to Management Science", eigth edition, International Edition, Prentice Hall, Pearson Education, Inc., Upper<br>2. Saddle River, New Jersey, 2004. / Terjemahan oleh Djakman, C.D., Silvira, V., dan Bachtiar, Y.S. :"Sains Management", Penerbit Salemba Empat, Jakarta, 2005.<br>3. Ossenbrugen, Paul J. : SYSTEMS ANALYSIS FOR CIVIL ENGINEERS, John Wiley & Sons, New York, 1984.<br>4. Mays, Larry W. & Yeou-Koung Tung : HYDROSYSTEMS ENGINEERING AND MANAGEMENT, Mc.Graw-Hill, Inc, New York, 1992.<br>5. Anwar, Nadjadji : "Modul Kuliah Analisa Sistem dan Penelitian Operasional", Jurusan Teknik Sipil FTSP ITS, Surabaya, 2000. |

**CURRICULUM SYLLABUS 2018**

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|---|---|---|
| **COURSE** | **RC18 - 5241** | **: INTEGRATED WATER RESOURCES MANAGEMENT** |
| | **CREDITS** | **: 3 CREDITS** |
| | **SEMESTER** | **: II (COMPULSORY)** |

**DESCRIPTION OF COURSE**

This course contains:
Introduction of Integrated water resources management, Technical Aspect, Social and Economical Aspect, Institutional Aspect, Environmental Aspect

**LEARNING OUTCOMES**

In field of water resources management and engineering, each graduate is being able to:

1. Solve the civil engineering problems by utilizing other interdisciplinary or multidisciplinary field of knowledge, and pay attention to the economic, health and safety factors of the public, cultural, social and environmental sustainability.
2. Do the deepening or extension of knowledge in field of civil engineering to provide original and tested innovative contributions through research with interdisciplinary or multidisciplinary approaches;
3. Formulate new research questions from conducted research for the development of science and technology in the field of civil engineering to produce innovative and tested works; and
4. Criticize and provide feedback on improvements from a civil engineering perspective to settlement policy in infrastructure problems has and/or is being applied in the form of a scientific paper.

**COURSE LEARNING OUTCOMES**

At the completion of the topic, students are expected to be able to:

1. Explain the concept of integrated water resources system.
2. Provide solutions of water resources problems in the watershed.
3. Develop integrated water resources development plan (master plan development).

**MAIN SUBJECTS**

1. Introduction of Integrated water resources management
2. Technical Aspect
3. Social and Economical Aspect
4. Institutional Aspect
5. Environmental Aspect

| **PREREQUISITES** |
| --- |
| None |
| **REFERENCES** |
| 6. |

**CURRICULUM SYLLABUS 2018**

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| **COURSE** | **RC18 - 5242** | **: RIVER MORPHOLOGY** |
| | **CREDITS** | **: 3 CREDITS** |
| | **SEMESTER** | **: II (COMPULSORY)** |

**DESCRIPTION OF COURSE**

This course contains about: river characteristic and morphology; tnitiation of sediment movement and sediment transport; river dynamic ; and river engineeering

**LEARNING OUTCOMES**

1. solve the civil engineering problems by utilizing other interdisciplinary or multidisciplinary field of knowledge, and pay attention to the economic, health and safety factors of the public, cultural, social and environmental sustainability.
2. do the deepening or extension of knowledge in field of civil engineering to provide original and tested innovative contributions through research with interdisciplinary or multidisciplinary approaches;
3. formulate new research questions from conducted research for the development of science and technology in the field of civil engineering to produce innovative and tested works; and

criticize and provide feedback on improvements from a civil engineering perspective to settlement policy in infrastructure problems has and/or is being applied in the form of a scientific paper.

**COURSE LEARNING OUTCOMES**

1. Being able to understand about river characteristic and river morphology
2. Being able to understand the initiation process of sediment movement
3. Being able to understand about sediment transport
4. Being able to understand about river equilibrium
5. Being able to understand about river dynamic
6. Being able to apply river flow stabilitation concept
7. Being able to understand about river engineering concept
8. Being able to understand about numerical modelling concept on the river

**MAIN SUBJECTS**

1. River Characteristic and river morphology
2. Initiation of sediment movement
3. Sediment Transport
4. River equilibrium
5. River dynamic (aggradation and degradation)
6. River flow stabilitation
7. River Engineering

| Numerical Modelling |
| --- |
| **PREREQUISITES** |
| 1. Applied Hydrology<br>2. Applied Hydraulics |
| **REFERENCES** |
| **Book :**<br>1. Anggrahini, “Hidrolika Saluran Terbuka”, 1997<br>2. Chow, V.T., “Open Channel Hydroulics”, 1959<br>3. Bambang Triatmojo, Hidraulika II, Beta Offset, 2008<br>4. Dingman, S.L.,”Fluvial Hydraulics”, Oxford University Press, 2009<br>5. Sofia, F.,”Teknik Sungai-Diktat”, 2000<br>7. Julien, P.Y., “River Mechanics”, Cambridge University Press, 2002 |

**CURRICULUM SYLLABUS 2018**

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|---|---|---|
| **COURSE** | **RC18 - 5243** | **: COASTAL HYDRODYNAMICS** |
| | **CREDITS** | **: 3 CREDITS** |
| | **SEMESTER** | **: II (COMPULSORY)** |

**DESCRIPTION OF COURSE**

This cours contain:
Wave theory ordo 1,2,3 and 4, Wave transformation, Wave statictic and wave prediction, Water surface fluctuation and Tide/tidal, Sediment transport at coastal area such as longshore sediment transport, off-shore sediment transport and coastal-line profile, Morphology or shore-line changes analyticaly and numericaly, Type, Function and the effect of coastal protection infrastructure to the change of shore-line/ environment, Coastal geomorphology, Coastal Configuration and Coastal orientation , Calculation of coastal arch, Coastal management using Headland control, Wave forces acting on coastal infrastructures

**LEARNING OUTCOMES**

In field of water resources management and engineering, each graduate is being able to:

1. solve the civil engineering problems by utilizing other interdisciplinary or multidisciplinary field of knowledge, and pay attention to the economic, health and safety factors of the public, cultural, social and environmental sustainability.
2. do the deepening or extension of knowledge in field of civil engineering to provide original and tested innovative contributions through research with interdisciplinary or multidisciplinary approaches;
3. formulate new research questions from conducted research for the development of science and technology in the field of civil engineering to produce innovative and tested works; and
4. criticize and provide feedback on improvements from a civil engineering perspective to settlement policy in infrastructure problems has and/or is being applied in the form of a scientific paper.

**COURSE LEARNING OUTCOMES**

Students are able to explain and determine the parameters related to morphology and coastal buildings such as wave, Water surface fluctuation and Tide/tidal,longshore sediment transport; capable to analyze coastal morphology and coastal building utilization and its effect on coastal morphology analytically

and numerically; able to determine and analyze the effect of Wave forces acting on coastal infrastructures, able to analyze coastal protection with various coastal protection buildings based on physical condition and sustainable environment

**MAIN SUBJECTS**

1. Wave theory ordo 1,2,3 and 4
2. Wave transformation
3. Wave statictic and wave prediction
4. Water surface fluctuation and Tide/tidal
5. Sediment transport at coastal area such as longshore sediment transport, off-shore sediment transport and coastal-line profile
6. Morphology or shore-line changes analyticaly and numericaly
7. Type, Function and the effect of coastal protection infrastructure to the change of shore-line/ environment
8. Coastal geomorphology
9. Coastal Configuration and Coastal orientation
10. Calculation of coastal arch
11. Coastal management using Headland control
12. Wave forces acting on coastal infrastructures

**PREREQUISITES**

- Applied Statistics for reseach
- Applied Hydraulics

**REFERENCES**


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.

**CURRICULUM SYLLABUS 2018**

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|---|---|---|
| **COURSE** | **RC18 - 5341** | **: HYDRAULICS PHYSICAL MODELLING** |
| | **CREDITS** | **: 3 CREDITS** |
| | **SEMESTER** | **: III (ELECTIVE)** |

**DESCRIPTION OF COURSE**

This course contains:
Physical and experiment model, dimensional analysis : system of unit, principall of dimensional analysis, theory of similarity : basic consepts and difinition in the theory of similarity, general law of mechanical similaririty in hidrodinamics, the referred law : Froude law, Reynolds law, Weber law, procedure of investigation, laboratory instalation and instrumentation, type of models : model of pressure system, model of rivers and open channels, model of wire and dam, model estuary, coastal and maritime engineering works.

**LEARNING OUTCOMES**

In field of water resources management and engineering, each graduate is being able to:

1. Solve the civil engineering problems by utilizing other interdisciplinary or multidisciplinary field of knowledge, and pay attention to the economic, health and safety factors of the public, cultural, social and environmental sustainability.
2. Do the deepening or extension of knowledge in field of civil engineering to provide original and tested innovative contributions through research with interdisciplinary or multidisciplinary approaches;
3. Formulate new research questions from conducted research for the development of science and technology in the field of civil engineering to produce innovative and tested works; and
4. Criticize and provide feedback on improvements from a civil engineering perspective to settlement policy in infrastructure problems has and/or is being applied in the form of a scientific paper.

**COURSE LEARNING OUTCOMES**

At the completion of the topic, students are expected to be able to apply the principles of hydraulics physical modelling of various cases.

**MAIN SUBJECTS**

Physical and experiment model, dimensional analysis : system of unit, principall of dimensional analysis, theory of similarity : basic consepts and difinition in the theory of similarity, general law of mechanical similaririty in hidrodinamics, the referred law : Froude law, Reynolds law, Weber law, procedure of investigation,

laboratory instalation and instrumentation, type of models : model of pressure system, model of rivers and open channels, model of wire and dam, model estuary, coastal and maritime engineering works

**PREREQUISITES**

None

**REFERENCES**

**Books :**


1. Anggrahini , 1997, Hidrolika Salan Terbuka, CV. Citra Media.
2. Chow, V.T., 1954, Open Channel Hydraulics,Mc Graw Hill Kogakusha Ltd.
3. Novak, P. dan J. Cabelka, Models in Hidraulic Engineering, Pitman Advanced Publishing Programs, Boston-London-Melbourne

**CURRICULUM SYLLABUS 2018**

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| **COURSE** | **RC18 - 5342** | **: GROUND WATER EXPLORATION** |
| | **CREDITS** | **: 3 CREDITS** |
| | **SEMESTER** | **: III (ELECTIVE)** |

**DESCRIPTION OF COURSE**

This course contains:
Basic hydrogeological problems (Groundwater and the hydrologic cycle); Introduce the fundamentals of subsurface fluid flow (groundwater flow in aquifers); Provide an overview of current issues in the field of groundwater engineering;Provide a basis for further applied groundwater coursework, Groundwater investigation techniques - which covers laboratory techniques and the fundamentals of groundwater investigation;.

**LEARNING OUTCOMES**

In field of water resources management and engineering, each graduate is being able to:

1. solve the civil engineering problems by utilizing other interdisciplinary or multidisciplinary field of knowledge, and pay attention to the economic, health and safety factors of the public, cultural, social and environmental sustainability.
2. do the deepening or extension of knowledge in field of civil engineering to provide original and tested innovative contributions through research with interdisciplinary or multidisciplinary approaches;
3. formulate new research questions from conducted research for the development of science and technology in the field of civil engineering to produce innovative and tested works; and
4. criticize and provide feedback on improvements from a civil engineering perspective to settlement policy in infrastructure problems has and/or is being applied in the form of a scientific paper.

**COURSE LEARNING OUTCOMES**

At the completion of the topic, students are expected to be able to:

1. Develop an understanding for solving basic hydrogeological problems;
2. Introduce the fundamentals of subsurface fluid flow and chemical transport;
3. Provide an overview of current issues in the field of groundwater engineering;
4. Provide a basis for further applied groundwater coursework.
5. Demonstrate enhanced problem-solving, critical-thinking and reasoning abilities

**MAIN SUBJECTS**

Physical Properties of Porous Media , Aquifers and Aquifers Types , Hydraulic

Conductivity, Darcy's Law , Aquifer Storativity , Homogeneity and Isotropy, Hydraulic Gradients, Permeameters , Variable Density, Saline aquifers Exploration Methods , Geology and Groundwater Flow , Hydrologic Cycle & Water Balance, Elements of Hydrologic Cycle , Groundwater Flow Equations , Steady-State Analytical Solutions , Flow Nets , Introduction to Numerical Methods

**PREREQUISITES**

- Applied Statistics for reseach
- Applied Hydraulics
- Applied Hydrology

**REFERENCES**

Books :


1. Kasenow, Michael, Applied Ground-Water Hydrology and Well Hydraulics, Water Resources Publucations, Colorado,2001
2. Kasenow, Michael, User's Manual for Aquifer Test, Water Resources Publucations, Colorado,2001
3. Raghunanth, H. M, Ground Water (2nd Edition), New Age International (P) Limited Publisers, 2003

**CURRICULUM SYLLABUS 2018**
**EXPERTISE AREA TRANSPORTATION MANAGEMENT AND ENGINEERING**

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| **COURSE** | **RC18 - 5151** | **: URBAN AND REGIONAL TRANSPORTATION SYSTEM** |
| | **CREDIT** | **: 3 CREDITES** |
| | **SEMESTER** | **: I (COMPULSORY)** |

**DESCRIPTION OF COURSE**

Urban dan Regional Transportation System is the course that discussing:
Demand and supply concept on regional and urban transport, hierarchy of urban and regional transportation network, strategic transportation node priority concept, multimoda competition, route and study area, zoning concept on transportation planning, demand forecasting concept, demand restriction concept

**LEARNING OUTCOMES**

1. do the deepening or extension of knowledge in field of civil engineering to provide original and tested innovative contributions through research with interdisciplinary or multidisciplinary approaches;
2. criticize and provide feedback on improvements from a civil engineering perspective to settlement policy in infrastructure problems has and/or is being applied in the form of a scientific paper.

**COURSE LEARNING OUTCOMES**

Student able to understand and analyzed demand and supply concept on regional and urban transport hierarchy of urban and regional transportation network, strategic transportation node priority concept, multimoda competition, route and study area, zoning concept on transportation planning, demand forecasting concept, demand restriction concept

**MAIN SUBJECTS**

Demand and supply concept on regional and urban transport, hierarchy of urban and regional transportation network, strategic transportation node priority concept, multimoda competition, route and study area, zoning concept on transportation planning, demand forecasting concept, demand restriction concept

**PREREQUISITES**

Tidak Ada

| REFERENCES |
| --- |
| **Book :**<br>1. Black, J. (1981), Urban Transportation Planning<br>2. Dickey (1975), Metropolitan Transportation Planning<br>3. Tamin, OZ (2000), Perencanaan dan Pemodelan Transportasi<br>4. Taaffe, et al (1985), Geography of Transportation |

**CURRICULUM SYLLABUS 2018**

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| **COURSE** | **RC18 - 5152** | **: TRAFFIC MANAGEMENT** |
| | **CREDIT** | **: 3 CREDITS** |
| | **SEMESTER** | **: I (COMPULSORY)** |

**DESCRIPTION OF COURSE**

Traffic Management is the course that discussing:
Traffic flow fundamental, signalized intersection coordination, traffic management concept based on supply approach and demand approach, quantitative indicators on traffic management (speed, delay, safety), various schemes of traffic management and its impact, Vissim software application

**LEARNING OUTCOMES**

1. solve the civil engineering problems by utilizing other interdisciplinary or multidisciplinary field of knowledge, and pay attention to the economic, health and safety factors of the public, cultural, social and environmental sustainability
2. do the deepening or extension of knowledge in field of civil engineering to provide original and tested innovative contributions through research with interdisciplinary or multidisciplinary approaches;
3. criticize and provide feedback on improvements from a civil engineering perspective to settlement policy in infrastructure problems has and/or is being applied in the form of a scientific paper

**COURSE LEARNING OUTCOMES**

1. Student able to analyze and evaluate traffic performance, include traffic management implementation based on traffic flow fundamental theory.
2. Student able to compare traffic performance indicator before and after traffic management implementation, include for probability of better travel time, traffic performance, and traffic safety
3. Student is able to operate Vissim software application

**MAIN SUBJECTS**

Traffic flow fundamental, Koordinasi simpang, konsep manajemen lalu lintas yang berupa supply approach dan demand approach. Indikator terukur dalam manajemen lalu lintas (kecepatan, delay, keselamatan). Macam-macam skema manajemen lalu lintas dan pengaruhnya, aplikasi software Vissim

**PREREQUISITES**

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**REFERENCES**

**Book :**


1. Oglesby CH, RG Hicks (1982) Highway Engineering, Fourth edition, John Wiley and Sons Inc.
2. Panduan Kapasitas Jalan Indonesia (2014)/Manual Kapasitas jalan Indonesia (1997), Direktorat Bina Marga Departemen Pekerjaan Umum Republik Indonesia.
3. Institute of Transport Studies, Monash University, Traffic Enginnering and Management (2003), Volume 1 dan Volume 2.
4. Khisty CJ. (1990) Traffic Enginnering an Introduction, Prentice Hall.
5. Transportation Reasearch Board (1985) TRP Special Report 209.2 Highway Capacity Manual

**CURRICULUM SYLLABUS 2018**

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| **COURSE** | **RC18 - 5153** | **: TRANSPORTATION ECONOMIC** |
| | **CREDIT** | **: 3 CREDITS** |
| | **SEMESTER** | **: I (COMPULCORY)** |

**DESCRIPTION OF COURSE**

Transportation Economic is the course that discussing:
Economic transportation concept, economic and financial feasibility concept, feasibility of toll road and non-toll road development, feasibility of transportation facilities development, feasibility of port development, feasibility of airport development

**LEARNING OUTCOMES**

1. solve the civil engineering problems by utilizing other interdisciplinary or multidisciplinary field of knowledge, and pay attention to the economic, health and safety factors of the public, cultural, social and environmental sustainability
2. criticize and provide feedback on improvements from a civil engineering perspective to settlement policy in infrastructure problems has and/or is being applied in the form of a scientific paper

**COURSE LEARNING OUTCOMES**

Student able to evaluate the economic and financial feasibility of transportation infrastructure and facilities

**MAIN SUBJECTS**

Economic transportation transportation, economic and financial feasibility concept, feasibility of toll road and non-toll road development, feasibility of transportation facilities development, feasibility of port development, feasibility of airport development

**PREREQUISITES**

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**REFERENCES**

**Book :**


1. Oglesby CH, RG Hicks (1982) Highway Engineering, Fourth edition, John Wiley and Sons Inc.
2. OZ Tamin, "Perencanaan dan Pemodelan Transportasi", 2002.
3. Grant EL, WG Ireson, RS Leaventworth (2002), Dasar-Dasar Ekonomi Teknik, Rineka Cipta.
4. DeGarno EP, WG. Sullvan, JR Canada (1984), Engineering Economy, Seventh edition, Macmillan Publishing Company, New York,

5. Bruun P. (1990), Port Enginnering, Fourth edition, Gulf Publishing Company.
6. Horonjeff, R and FX MacKelvey (1983), Planning and Design of Airports, Third edition, McGrawHill Inc.

**CURRICULUM SYLLABUS 2018**

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| **COURSE** | **RC18 - 5251** | **: HIGHWAY MANAGEMENT** |
| | **CREDIT** | **: 3 CREDITS** |
| | **SEMESTER** | **: II (COMPULSORY)** |

**DESCRIPTION OF COURSE**

Highway Management is the course that discussing:
Technical specification for pavement design and pavement material, new road construction and overlay construction based on deflection data, asphalt concrete mix design compostion, technical specification road goemetric design and its problem, type of road geometric and its application, road infrastructure management

**LEARNING OUTCOMES**

1. do the deepening or extension of knowledge in field of civil engineering to provide original and tested innovative contributions through research with interdisciplinary or multidisciplinary approaches;
2. criticize and provide feedback on improvements from a civil engineering perspective to settlement policy in infrastructure problems has and/or is being applied in the form of a scientific paper

**COURSE LEARNING OUTCOMES**

- Student able to understand technical standard for pavement design and pavement material
- Student able to evaluate road pavement structure for new road design and overlay design based on pavement deflection data
- Student able to evaluate comparison of asphlat concrete mix design for the highest Marshall Stability
- Student able to understand regulation and technical standard road geometric design and its problem
- Student able to understand various road geometric type and implementation
- Student able to analyze and solve on transportation problem, especially road infrastructure management

**MAIN SUBJECTS**

Technical specification for pavement design and pavement material, new road construction and overlay construction based on deflection data, asphalt concrete mix design, technical specification road goemetric design and its problem, type of road geometric and its application, road infrastructure management

**PREREQUISITES**

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## REFERENCES


1. Departemen Pekerjaan Umum. (1997). Tata Cara Perencanaan Geometrik Jalan Antar Kota, Direktorat Jenderal Bina Marga
2. Departemen Pekerjaan Umum. (1992). Standar Perencanaan Geometrik Untuk Jalan Perkotaan, Direktorat Jenderal Bina Marga
3. Departemen Pekerjaan Umum. (2009). Geometrik Jalan Bebas Jambatan Untuk Jalan Tol, Direktorat Jenderal Bina Marga
4. AASHTO. (2011). Geometric Design of Highways and Streets
5. AASHTO. (1993). Guide for Design of Pavement Structures
6. Department of Transport (1997), The Dmaging Effects of Overloaded Heavy Vehicles on Roads, Directorate : Traffic Control, Republic of South Africa
7. Departemen Pekerjaan Umum (2005), Cara Uji Lendutan Perkerasan Lentur Dengan Alat Benkelman Beam (SNI 2416:2011), Direktorat Jenderal Bina Marga
8. Departemen Pekerjaan Umum (2005), Pedoman Perencanaan Tebal Lapis Tambah Perkerasan Lentur Dengan Metode Lendutan Lendutan (Pd T-05-2005-B) Direktorat Jenderal BM
9. Departemen Pekerjaan Umum (2013), Manual Desain Perkerasan Jalan (Nomor 02/M/BM/2013), Direktorat Jenderal Bina Marga
10. Departemen Pekerjaan Umum (1989), Tata Cara Perencanaan Tebal Perkerasan dengan Analisa Komponen (SNI 03-1732-1989), Direktorat Jenderal Bina Marga
11. Huang, H Yang, (2004), Pavement Analysis and Design, 2nd edition, Prentice Hall, New Jersey

**CURRICULUM SYLLABUS 2018**

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| **COURSE** | **RC18 - 5252** | **: TRANSPORTATION MODELLING** |
| | **CREDIT** | **: 3 CREDITS** |
| | **SEMESTER** | **: II (COMPULSORY)** |

**DESCRIPTION OF COURSE**

Transportation Modelling is the course discussing:
Types of transportation modelling and sequential staging transportation modelling, network attributes in transportation modelling, preparation of data collection, trip generation modelling, trip distribution modelling, modal split modelling, trip assignment modelling, two stages combination model, model forecasting

**LEARNING OUTCOMES**

1. do the deepening or extension of knowledge in field of civil engineering to provide original and tested innovative contributions through research with interdisciplinary or multidisciplinary approaches;
2. criticize and provide feedback on improvements from a civil engineering perspective to settlement policy in infrastructure problems has and/or is being applied in the form of a scientific paper.

**COURSE LEARNING OUTCOMES**

Student able to transportation modelling that include: model overview, network attributes in transportation modelling, preparation of data collection, trip generation modelling, trip distribution modelling, modal split modelling, trip assignment modelling, two stages combination model, model forecasting

**MAIN SUBJECTS**

Types of transportation modelling and sequential staging transportation modelling, network attributes in transportation modelling, preparation of data collection, trip generation modelling, trip distribution modelling, modal split modelling, trip assignment modelling, two stages combination model, model forecasting

**PREREQUISITES**

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**REFERENCES**

**Buku :**


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., “Modelling Transport”, 1990
7. Stopher and Meyburg, “Urban Transportation Modeling and Planning”, 1975

**CURRICULUM SYLLABUS 2018**

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| **COURSE** | **RC18 - 5253** | **: INTERMODA AND TRANSPORTATION FACILITIES** |
| | **CREDIT** | **: 3 CREDITS** |
| | **SEMESTER** | **: II (COMPULSORY)** |

**DESCRIPTION OF COURSE**

Intermoda and Transportation Facilities is the course that discussing:
Transportatian facilities concept for pedestrians and unmotorised, transportatian facilities concept for toll road and non-toll road, transportatian facilities concept for road transport, transportatian facilities concept for an airport, transportatian facilities concept for a port, transportatian facilities concept for multimoda and intermoda transfer

**LEARNING OUTCOMES**

1. do the deepening or extension of knowledge in field of civil engineering to provide original and tested innovative contributions through research with interdisciplinary or multidisciplinary approaches;
2. criticize and provide feedback on improvements from a civil engineering perspective to settlement policy in infrastructure problems has and/or is being applied in the form of a scientific paper.

**COURSE LEARNING OUTCOMES**

Student able to understand transportatian facilities concept for pedestrians and unmotorised, transportatian facilities concept for toll road and non-toll road, transportatian facilities concept for road transport, transportatian facilities concept for an airport, transportatian facilities concept for a port, transportatian facilities concept for multimoda and intermoda transfer

**MAIN SUBJECTS**

Transportatian facilities concept for pedestrians and unmotorised, transportatian facilities concept for toll road and non-toll road, transportatian facilities concept for road transport, transportatian facilities concept for an airport, transportatian facilities concept for a port, transportatian facilities concept for multimoda and intermoda transfer

**PREREQUISITES**

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**REFERENCES**

**Buku :**

1. Abubakar, I. , et al," Menuju Lalu Lintas dan Angkutan Jalan yang Tertib". Direktorat Jenderal Perhubungan Darat, 1995.

2. Bruun P.” Port Enginnering, fourth edition”, Gulf Publishing Company, 1990.
3. Grava S,”Urban Transport Systems, Choices for Communities”, MacGraw Hill Inc New York, 2002.
4. Horonjeff, R and FX MacKelvey, “Planning and Design of Airports”, Third edition, McGrawHill Inc, 1983.
5. Mahoney (……..) Intermodal Transportation
6. Vuchic V,” Public Transport System and Technology”, 1981.

**CURRICULUM SYLLABUS 2018**

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| **COURSE** | **RC18 - 5351** | **: ENVIROMENT EFFECT AND SAFETY TRANSPORTATION** |
| | **CREDIT** | **: 3 CREDITS** |
| | **SEMESTER** | **: III (COMPULSORY)** |

**DESCRIPTION OF COURSE**

Enviroment Effect and Safety Transportation is the course that discussing: Transportation and environment problem, policy and regulation related on environment issue at transportation sector, environment impact indicator at transportation sector, impact reduction based on technology and demand management, sustainable trasportation

**LEARNING OUTCOMES**

1. solve the civil engineering problems by utilizing other interdisciplinary or multidisciplinary field of knowledge, and pay attention to the economic, health and safety factors of the public, cultural, social and environmental sustainability.
2. do the deepening or extension of knowledge in field of civil engineering to provide original and tested innovative contributions through research with interdisciplinary or multidisciplinary approaches;
3. formulate new research questions from conducted research for the development of science and technology in the field of civil engineering to produce innovative and tested works; and
4. criticize and provide feedback on improvements from a civil engineering perspective to settlement policy in infrastructure problems has and/or is being applied in the form of a scientific paper.

**COURSE LEARNING OUTCOMES**

1. Student able to understand the environment impact that caused by transporattion activity
2. Student able to know that the environment impact that caused by transporattion activity, have been wriiten on national and international policy
3. Student able to identify environment impact caused by transportation sector
4. Student able to understand the technology and transport demand management that can be used to reduce environment impact
5. Student able to understand the importance of sustainability in transportation sector

| MAIN SUBJECTS |
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| Transportation and enviroment problem, policy and regulation related on enviroment issue at transportation sector, enviroment impact indicator at transportation sector, impact reduction based on technology and demand management, sustainable trasportation. |
| **PREREQUISITES** |
| - |
| **REFERENCES** |
| **Buku :**<br>1. Oglesby,C.H(1993), Highway Engineering<br>2. Khisty,C.J(2003), Traffic Engineering<br>3. TowardSafeRoadinDevelopingCountries<br>4. Indonesia Highway Capacity Manual (IHCM) |

**CURRICULUM SYLLABUS 2018**

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| **COURSE** | **RC18 - 5352** | **: PAVEMENT DISTRESS MANAGEMENT** |
| | **CREDIT** | **: 3 CREDITS** |
| | **SEMESTER** | **: III (ELECTIVE)** |

**DESCRIPTION OF COURSE**

Pavement distress management is the course that discussing:
The evaluation method of road pavement condition, road pavement problem, road pavement maintenance program, institutional aspect in maintenance of road pavement distress, workshop the evaluation of road pavement condition

**LEARNING OUTCOMES**

1. solve the civil engineering problems by utilizing other interdisciplinary or multidisciplinary field of knowledge, and pay attention to the economic, health and safety factors of the public, cultural, social and environmental sustainability.
2. do the deepening or extension of knowledge in field of civil engineering to provide original and tested innovative contributions through research with interdisciplinary or multidisciplinary approaches;
3. criticize and provide feedback on improvements from a civil engineering perspective to settlement policy in infrastructure problems has and/or is being applied in the form of a scientific paper.

**COURSE LEARNING OUTCOMES**

- Student able to understand the evaluation method of road pavement condition, road pavement problem, road pavement maintenance program, institutional aspect in maintenance of road pavement distress
- Student able to evaluate road pavement condition

**MAIN SUBJECTS**

The evaluation method of road pavement condition, road pavement problem, road pavement maintenance program, institutional aspect in maintenance of road pavement distress, workshop the evaluation of road pavement condition

**PREREQUISITES**

Highway Management

**REFERENCES**

**Book:**

1. Bina Marga, "Manual Pemeliharaan Jalan", Jilid IA: Perawatan Jalan, Departemen Pekerjaan Umum, Jakarta, 1983.

2. Bina Marga, “Panduan Penentuan Klasifikasi Fungsi Jalan di Wilayah Perkotaan”, No.018/T/BNKT/1990, Departemen Pekerjaan Umum, Jakarta, 1990.
3. Bina Marga, “Tata Cara Penyusunan Program Pemeliharaan Jalan Kota, No.018/T/BNKT/1990”, Departemen Pekerjaan Umum, Jakarta, 1990.
4. Bina Marga, “Biaya OperasiKendaraan (BOK) untuk Jalan Perkotaan di Indonesia”, Departemen Pekerjaan Umum, Jakarta, 1995.
5. Dirgolaksono, P. dan I.B. Mochtar, “Studi Penyempurnaan Metode Penilaian Kerusakan Jalan Berdasarkan Evaluasi Visual untuk Kondisi Kerusakan Jalan di Indonesia”, Tugas Akhir, FTSP-ITS, Surabaya, 1990.
6. AASHTO, ”Interim Guide for Design of Pavement Structures”, 1972

**CURRICULUM SYLLABUS 2018**

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| **COURSE** | **RC18 - 5353** | **: PORT MANAGEMENT** |
| | **CREDIT** | **: 3 CREDITS** |
| | **SEMESTER** | **: III (ELECTIVE)** |

**DESCRIPTION OF COURSE**

Port management is the course that discussing:
The regulation of port, port operational system, port management system, income and expenditure in port operational to economic and financial analysis

**LEARNING OUTCOMES**

1. solve the civil engineering problems by utilizing other interdisciplinary or multidisciplinary field of knowledge, and pay attention to the economic, health and safety factors of the public, cultural, social and environmental sustainability.
2. criticize and provide feedback on improvements from a civil engineering perspective to settlement policy in infrastructure problems has and/or is being applied in the form of a scientific paper.

**COURSE LEARNING OUTCOMES**

- Student able to undertand the regulation of port, general cargo port operational concept, container port operational concept, principle of general cargo port management, principle of container port management,
- Student able to calculate and analyse the income and expenditure in port operational

**MAIN SUBJECTS**

The regulation of port, port operational system, port management system, income and expenditure in port operational to economic and financial analysis

**PREREQUISITES**

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**REFERENCES**

**Book:**

1. PP 61 Tahun 2009
2. Kasumigaseki, Chiyoda-ku, “Technical Standards And Comentaries For Port and Harbour Facilities in Japan,” OCDI, 2002

**CURRICULUM SYLLABUS 2018**

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| **COURSE** | **RC18 - 5354** | **: AIRPORT MANAGEMENT** |
| | **CREDIT** | **: 3 CREDITS** |
| | **SEMESTER** | **: III (ODD/ELECTIVE)** |

**DESCRIPTION OF COURSE**

Airport management is the course that discussing:
Airport operational system, airport peak hour and schedulling, airport operation, runway capacity, ground handling, terminal operation, airport accesibility

Mata kuliah ini berisi tentang :
Sistem operasional airport; puncak kesibukan bandara dan penjadwalan; kesiapan operasional bandara; kapasitas runway; Ground handling; operasional terminal; Akses bandara

**LEARNING OUTCOMES**

1. solve the civil engineering problems by utilizing other interdisciplinary or multidisciplinary field of knowledge, and pay attention to the economic, health and safety factors of the public, cultural, social and environmental sustainability.
2. do the deepening or extension of knowledge in field of civil engineering to provide original and tested innovative contributions through research with interdisciplinary or multidisciplinary approaches;
3. formulate new research questions from conducted research for the development of science and technology in the field of civil engineering to produce innovative and tested works; and
4. criticize and provide feedback on improvements from a civil engineering perspective to settlement policy in infrastructure problems has and/or is being applied in the form of a scientific paper

**COURSE LEARNING OUTCOMES**

- Student able to understand and describe airport operational system
- Student able to determine airport peak hour that effect to airport flight schedulling
- Student able to determine airport maintenance management that effect to airport operational
- Student able to analyze airport capacity that depend on runway capacity
- Student able to set airport gate to aiport efficiency and optimization
- Student able to estimate passenger facilities at airport terminal by passenger and baggage movement simulation
- Student able to determine the acces to airport that considering accesibility and

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| avalaibility intermoda connection |
| **MAIN SUBJECTS** |
| Airport operational system, airport peak hour and schedulling, airport operation, runway capacity, ground handling, terminal operation, airport accesibility |
| **PREREQUISITES** |
| Tidak Ada |
| **REFERENCES** |
| **Buku :**<br>1. Norman Ashford dan Paul H. Wright., "Airport Engineering", John Wiley &Sons, Fourth Edition, 2011<br>2. Robert Horonjeffdan Francis X. McKelvey., "Planning &Design of Ariports", McGraw-Hill, Inc, Fifth Edition, 2010<br>3. "Airport Terminal Reference Manual", IATA, 2004.<br>4. Janic, Milan, "Air Transport System Analysis and Modelling," Gordon and Breach Science Publishers, 2000<br>5. Ashford, Norman, et al, "Airport Operation", Third Edition, McGraw-Hill, 2013<br>6. Kazda, Antonin & Caves, Robert E. " Airport Design and Operation", second Edition, Elsevier, 2007<br>7. ACRP Report 40 – Curbside and Terminal<br>8. ACRP Report 85 – Capacity<br>9. ACRP Sync 005 – Ground Access Model |

**CURRICULUM SYLLABUS 2018**
**EXPERTISE AREA INFRASTRUCTURE ASSET MANAGEMENT**

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|---|---|---|
| **COURSE** | **RC18 - 5161** | **: INFRASTRUCTURE ASSET MANAGEMENT** |
| | **CREDIT** | **: 3 CREDITS** |
| | **SEMESTER** | **: I (COMPULSORY)** |

**DESCRIPTION OF COURCE**

The course content:

a. Asset management definition
b. Types of asset (public, private, semi private)
c. Infrastructure asset; life cycle asset ; asset inventory ; Information system of asset management
d. Master plan, Feasibility study, Detail Engineering Design
e. Operation aspect, Maintenance aspect
f. Asset evaluation : Disposal, development dan usage
g. Asset sustainability
h. Integrated asset management

**LEARNING OUTCOME**

a. Do the deepening or extension of knowledge in field of civil engineering to provide original and tested innovative contributions through research with interdisciplinary or multidisciplinary approaches;
b. Being able to implement the sustainable principal in developing knowledge

**COURSE LEARNING OUTPUTS**

a. Being able to explain the principal concept of public policy
b. Being able to explain the principal concept of analysis tools
c. Being able to better understand the procurement asset
d. Being able to better understand the asset operation and maintenance
e. Being able to better understand the asset disposal
f. Being able to better understand the asset evaluation

**MAIN SUBJECTS**

Asset management definition, asset life cycle, Strategic asset planning, procurement asset, asset operation and maintenance, asset disposal dan asset evaluation.

**PREREQUISITES**

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**REFERENCE**

**Books:**


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

**CURRICULUM SYLLABUS 2018**

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|---|---|---|
| **COURSE** | **RC18 - 5162** | **: INFRASTRUCTURE SYSTEM** |
| | **CREDIT** | **: 6 CREDITS** |
| | **SEMESTER** | **: I (COMPULSORY)** |

**DESCRIBPTION OF COURCE**

The course contents explanation of 4 infrastructure asset : human settlement, road and bridges, public housing and water resources

**LEARNING OUTCOME**

a. Being able to identify the scientific field that becomes the object of his research and positions into a research map developed through interdisciplinary or multidisciplinary approach;
b. Being able to take decisions in the context of solving problems of science and technology development that concerns and implements the humanities value based on analytical or experimental studies of information and data;
c. Being able to implement the sustainable principal in developing knowledge.
d. Being able to implement information technology in the context of scientific development and expertise area implementation;

**COURSE LEARNING OUTCOME**

Being able to better understand asset infrastructures: human settlement, road and bridges, public housing and water resources

**MAIN SUBJECTS**

a. Infrastructure asset planning
b. Infrastructure asset procurement
c. Infrastructure asset operation

**PREREQUISITE**

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**REFERENCES**


- Grigg, 1988,"Infrastructure Engineering and Management".

**CURRICULUM SYLLABUS 2018**

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|---|---|---|
| **COURSE** | **RC18 - 5262** | **: INFRASTRUCTURE OPERATION AND MAINTENANCE MANAGEMENT** |
| | **CREDIT** | **: 3 CREDITS** |
| | **SEMESTER** | **: II (COMPULSORY)** |

| **DESCRIBPTION OF COURCE** |
|---|
| The course contents operation and maintenance management of infrastructure asset. The course discusses operation procedure and principal concept of each infrastructures (human settlement, road and bridges, water resources and public housing) |
| **LEARNING OUTCOME** |
| a. do the deepening or extension of knowledge in field of civil engineering to provide original and tested innovative contributions through research with interdisciplinary or multidisciplinary approaches;<br>b. Being able to perform academic validation or studies in accordance with their areas of expertise in solving problems in relevant communities or industries through the development of knowledge and expertise;<br>c. Being able to take decisions in the context of solving problems of science and technology development that concerns and implements the humanities value based on analytical or experimental studies of information and data;<br>d. Being able to implement the sustainable principal in developing knowledge. |
| **COURSE LEARNING OUTCOME** |
| Being able to better understand and to explain the basic principle of operation and maintenance of each infrastructures. |
| **MAIN SUBJECTS** |
| Operation management : basic principal of infrastructure operation, infrastructure function, types of operation, conditions of failures.<br>Maintenance management : infrastructure function, basic principle of maintenance management, types of failures, types of reparing program. Each infrastructures has specific operation and failure characteristics. |
| **PREREQUISITE** |
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| **REFERENCES** |
| **Books :**<br>1. NSPM Infrastruktur terkait Manajemen Operasi dan Manajemen Pemeliharaan. |

**CURRICULUM SYLLABUS 2018**

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|---|---|---|
| **COURSE** | **RC18 - 5262** | **: INFRASTRUCTURE ASSET MANAGEMENT ECONOMIC** |
| | **CREDIT** | **: 3 CREDITS** |
| | **SEMESTER** | **: II (COMPULSORY)** |

**DESCRIBPTION OF COURCE**

The course contents discussion about infrastructure economics, which includes micro, meso and macro approach.

**LEARNING OUTCOME**

a. Do the deepening or extension of knowledge in field of civil engineering to provide original and tested innovative contributions through research with interdisciplinary or multidisciplinary approaches;
b. Being able to identify the scientific field that becomes the object of his research and positions into a research map developed through interdisciplinary or multidisciplinary approach;
c. Being able to take decisions in the context of solving problems of science and technology development that concerns and implements the humanities value based on analytical or experimental studies of information and data;
d. Being able to implement the sustainable principal in developing knowledge.

**COURSE LEARNING OUTCOME**

Being able to better understand, to explain and to review the basic principle of infrastructure asset economic

**MAIN SUBJECTS**

Infrastructure economics characteristic
Micro economics review : investment analysis, economy analysis, operation and maintenance financial, infrastructure disposal economic and financial analysis
Meso economics review : Type of infrastructure management (UPT, BUMN/D, Public Private Partnership)
Macro economics review : The relationship between infrastructure and regional economic

**PREREQUISITE**

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**REFERENCES**

**Books :**

1. William G. Sullivan, Elin M. Wicks, C. Patrick Koelling, Engineering Economy – 16 th Edition, Pearson Education, 2014
2. Crundwell, F.K, Finance for Engineers: Evaluation and Funding of Capital Project, Springer – Verlag, London Limited

**CURRICULUM SYLLABUS 2018**

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|---|---|---|
| **COURSE** | **RC18 - 5263** | **: INFRASTRUCTURE ASSET SYSTEM INFORMATION MANAGEMENT** |
| | **CREDIT** | **: 2 CREDITS** |
| | **SEMESTER** | **: II (COMPULSORY)** |

**DESCRIBPTION OF COURCE**

The course contents the planning of asset management information, both in spatial and non spatial, based on the relevant regulation

**LEARNING OUTCOME**

a. Do the deepening or extension of knowledge in field of civil engineering to provide original and tested innovative contributions through research with interdisciplinary or multidisciplinary approaches;

b. Being able to implement information technology in the context of scientific development and expertise area implementation;

**COURSE LEARNING OUTCOME**

Being able to plan and to use Management Information System and Geographic Information System to manage infrastructure asset.

Being able to apply Geographic Information System in the form of assignment of spatial and non spatial asset data using information technology

**MAIN SUBJECT**

1. Infrastructure inventory
2. Geographic Information System

**PREREQUISITE**

-

**REFERENCES**

**Books :**


1. Burrough P.A, Principle of GIS for Land Resources Assessment, Oxford, 1998
2. Christopher Jones, GIS and Computer Cartography, Longman england, 1999
3. Teguh Hariyanto,Modul Mata Kuliah SIG, Prodi Teknik Geomatika FTSP-ITS,2003

**CURRICULUM SYLLABUS 2018**

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| **COURSE** | **RC18 - 5361** | **: REGIONAL AND ENVIRONMENTAL SYSTEM** |
| | **CREDIT** | **: 2 CREDITS** |
| | **SEMESTER** | **: III (COMPULSORY)** |

**DESCRIBPTION OF COURCE**

The course contents the understanding of regional and environmental system, the relationship between those two aspects with infrastructure.

**LEARNING OUTCOME**

a. Do the deepening or extension of knowledge in field of civil engineering to provide original and tested innovative contributions through research with interdisciplinary or multidisciplinary approaches;
b. Being able to identify the scientific field that becomes the object of his research and positions into a research map developed through interdisciplinary or multidisciplinary approach;
c. capable of managing, developing and maintaining networking with colleagues, peers within the broader institutes and research community;
d. Being able to implement the sustainable principal in developing knowledge.

**COURSE LEARNING OUTCOME**

Being able to understand and to correlate reional and environmental system with infrastructure.

**MAIN SUBJECTS**

Regional system definition: region administration, type of region, spatial planning, region development, strategic development region.
Environmental system : the component of environmental system, environmental impact, environmental capacity, environment management.
Infrastructure : the relationship between regional and environmental system .

**PREREQUISTE**

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**REFERENCES**


- Arsyad, Lincoln [1999] "Pengantar Perencanaan dan Pembangunan Ekonomi Daerah", BPFE Yogyakarta
- Nugroho, Iwan dan Dahuri, Rokhmin [2004] "Pembangunan Wilayah, Perspektif Ekonomi, Sosial, dan Lingkungan", LP3ES, Jakarta

**CURRICULUM SYLLABUS 2018**

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|---|---|---|
| **COURSE** | **RC18 - 5362** | **: INFRASTRUCTURE POLICY** |
| | **CREDIT** | **: 2 CREDITS** |
| | **SEMESTER** | **: III (ELECTIVE)** |

| **DESCRIBPTION OF COURCE** |
|---|
| The course contents public policy principal for infrastructure, which include public policy arrangement and evaluation |
| **LEARNING OUTCOME** |
| a. do the deepening or extension of knowledge in field of civil engineering to provide original and tested innovative contributions through research with interdisciplinary or multidisciplinary approaches;<br>b. Being able to identify the scientific field that becomes the object of his research and positions into a research map developed through interdisciplinary or multidisciplinary approach;<br>c. Being able to take decisions in the context of solving problems of science and technology development that concerns and implements the humanities value based on analytical or experimental studies of information and data; |
| **COURSE LEARNING OUTCOME** |
| Being able to identify the critical issue of infrastructure asset<br>Being able to evaluate and to propose public policy |
| **MAIN SUBJECTS** |
| Critical issue in infrastructure asset, public policy arrangement, public policy evaluation, decision analysis and policy proposal. |
| **PREREQUISITE** |
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| **REFERENCES** |
| 1.<br>2. |

**CURRICULUM SYLLABUS 2018**

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|---|---|---|
| **COURSE** | **RC18 - 5363** | **: SPECIAL TOPICS FOR INFRASTRUCTURE ASSET MANAGEMENT** |
| | **CREDIT** | **: 2 CREDITS** |
| | **SEMESTER** | **: III (ELECTIVE)** |

| **DESCRIBPTION OF COURCE** |
|---|
| The course content: The development of infrastructure asset management knowledge, the infrastructure asset management practice in Indonesian Ministry of Public Works and Public Housing and in the developed countries |
| **LEARNING OUTCOME** |
| a. Do the deepening or extension of knowledge in field of civil engineering to provide original and tested innovative contributions through research with interdisciplinary or multidisciplinary approaches;<br>b. Being able to identify the scientific field that becomes the object of his research and positions into a research map developed through interdisciplinary or multidisciplinary approach;<br>c. Being able to take decisions in the context of solving problems of science and technology development that concerns and implements the humanities value based on analytical or experimental studies of information and data; |
| **COURSE LEARNING OUTCOME** |
| Being able to better understand and to apply the infrastructure asset management practice. |
| **MAIN SUBJECTS** |
| The development of infrastructure asset management practice: analysis tools for infrastructure life cycle, Infrastructure Asset Management professional practice |
| **PREREQUISITE** |
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| **REFERENCES** |
| 3.<br>4. |

**CURRICULUM SYLLABUS 2018**

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| **COURSE** | **RC18 - 5364** | **: RISK MANAGEMENT** |
| | **CREDIT** | **: 2 CREDITS** |
| | **SEMESTER** | **: III (ELECTIVE)** |

**DESCRIBPTION OF COURCE**

The Course content:
Procurement of Goods and Services in the Government and Private sectors, types of procurement, procurement documents and procurement processes, Procurement/bidding document evaluation, Contract Preparation, Contract Quality Plan and Contract Implementation.

**LEARNING OUTCOMES**

1. Solve the civil engineering problems by utilizing other interdisciplinary or multidisciplinary field of knowledge, and pay attention to the economic, health and safety factors of the public, cultural, social and environmental sustainability.
2. Do the deepening or extension of knowledge in field of civil engineering to provide original and tested innovative contributions through research with interdisciplinary or multidisciplinary approaches;
3.

**COURSE LEARNING OUTCOMES**

1. Students are able to make a bidding document, and conduct evaluation of the proposed bidding documents from Engineering consultant and contractors
2. Students are able to compose contract documents and Work Agreement Letters
3. Students are able to understand several International contract standards,
4. Students are able to create a Project Document, addendum of the contract, and closing of the contract.
5.

**MAIN SUBJECTS**

Concept of Procurement (Goods / Services), Types of Procurement, Procurement Process, Contract Document, Implementation of Contract.

**PREREQUISITE**

-

**REFERENCES**

1. Loosemore, M., Rafter, J., Reilly, C., and Higgon, D. (2005). Risk Management in Projects. Second ed., London and New York, Taylor and Francis

2. Australian/New Zealand Standard (2004). Risk Management. Standards Association of Australia.
3. AS/NZS (Australian and New Zealand Standard) (2004) Guidelines for Managing Risk: in the Australian and New Zealand Public Sector. HB 143.
4. PMI (2013). A Guide to Project Mangement Body of knowledge (PMBoK Guide). Fifth Edition, Project Management Institute, Inc.

**CURRICULUM SYLLABUS 2018**

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| **COURSE** | **RC18 - 5365** | **: STRATEGIC MANAGEMENT** |
| | **CREDIT** | **: 2 CREDITS** |
| | **SEMESTER** | **: III (ELECTIVE)** |

| **DESCRIBPTION OF COURCE** |
|---|
| The course content:<br>Concept of strategic management; Strategy formulation, Strategy analysis and choice, Strategy implementation, Strategy evaluation, Case study |
| **LEARNING OUTCOMES** |
| 1. Solve the civil engineering problems by utilizing other interdisciplinary or multidisciplinary field of knowledge, and pay attention to the economic, health and safety factors of the public, cultural, social and environmental sustainability.<br>2. Do the deepening or extension of knowledge in field of civil engineering to provide original and tested innovative contributions through research with interdisciplinary or multidisciplinary approaches; |
| **COURSE LEARING OUTCOMES** |
| 1. Able to update the knowledge of construction project management<br>2. Able to develop knowledge of sustainable construction project<br>3. Mastering one of the area of construction project management<br>4. Professional, honest, ethical, proactive, tenacious, confident, communicative, and appreciative. |
| **MAIN SUBJECTS** |
| The concept of Strategic Management, Vision, Mission and Project Objectives; External Factors; Internal Factors; Tools And Matching Techniques Strategies; QSPM analysis; Implementation of Operational and Management Strategy; Implementation of Finance and RD Strategy; Tools And Techniques for evaluating And Monitoring. Strategy Review; Strategy Formulation. |
| **PREREQUISITES** |
| None |
| **REFERENCES** |
| **Book :**<br>1. David, F.R., and David, F.R., "Strategic Management: Concepts and Cases", Prentice Education Limited, 2015 |

**CURRICULUM SYLLABUS 2018**

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|---|---|---|
| **COURSE** | **RC18 - 5366** | **: PROJECT MANAGEMENT** |
| | **CREDIT** | **: 2 CREDITS** |
| | **SEMESTER** | **: III (ELECTIVE)** |

**DESCRIBPTION OF COURCE**

The course contents the project management for infrastructure .

**LEARNING OUTCOME**

a. Do the deepening or extension of knowledge in field of civil engineering to provide original and tested innovative contributions through research with interdisciplinary or multidisciplinary approaches;
b. Being able to identify the scientific field that becomes the object of his research and positions into a research map developed through interdisciplinary or multidisciplinary approach
c. Being able to implement the sustainable principal in developing knowledge

**COURSE LEARNING OUTCOME**

Being able to apply the management project knowledge in the case of infrastructure development

**MAIN SUBJECTS**

Project management concept, stakeholders, project organization, project planning, project controlling and project procurement.

**PREREQUISITE**

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**REFERENCES**


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

**CURRICULUM SYLLABUS 2018**
**EXPERTISE AREA RAILWAY ENGINEERING AND MANAGEMENT**

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| **COURSE** | **RC18 - 5171** | **: HEAVY RAIL GEOMETRIC SYSTEM** |
| | **CREDIT** | **: 3 CREDITS** |
| | **SEMESTER** | **: I (COMPULSORY)** |

**DESCRIPTION OF COURSE**

Heavy Ral Geometric System is the course that discussing:
Speed and dimension heavy rail, standard gauge for normal speed, standard gauge for high speed railway, narrow gauge Indonesia, curvature, gradient and length of vertical curve, plan and profile, cross section, earthwork

**LEARNING OUTCOMES**

1. do the deepening or extension of knowledge in field of civil engineering to provide original and tested innovative contributions through research with interdisciplinary or multidisciplinary approaches;
2. criticize and provide feedback on improvements from a civil engineering perspective to settlement policy in infrastructure problems has and/or is being applied in the form of a scientific paper

**COURSE LEARNING OUTCOMES**

- Student able to understand speed and dimension heavy rail, standard gauge for normal speed, standard gauge for high speed railway, narrow gauge Indonesia, curvature, gradient and length of vertical curve, plan and profile, cross section, earthwork
- Student able to analyse curvature, gradient and length of vertical curve, plan and profile, cross section, earthwork

**MAIN SUBJECTS**

Speed and dimension heavy rail, standard gauge for normal speed, standard gauge for high speed railway, narrow gauge Indonesia, curvature, gradient and length of vertical curve, plan and profile, cross section, earthwork

**PREREQUISITES**

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**REFERENCES**

**Book:**

1. PM 60 th 2012
2. PM 36 th 2014
3. Profillidis, V.A. (2006) Railway Management & Engineering

**CURRICULUM SYLLABUS 2018**

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|---|---|---|
| **COURSE** | **RC18 - 5172** | **: URBAN AND REGIONAL RAILWAY NETWORK** |
| | **CREDIT** | **: 3 CREDITS** |
| | **SEMESTER** | **: I (COMPULSORY)** |

| **DESCRIPTION OF COURSE** |
|---|
| Urban dan regional railway network is the course discussing:<br>Type of rollingstock, mass rapid transit, metropolitan train, tram/Light Rail Transit (LRT), LRRT and Tram train, Heavy rail, High Speed Train, other type of trin, emplassemen network, depo network |
| **LEARNING OUTCOMES** |
| 1. do the deepening or extension of knowledge in field of civil engineering to provide original and tested innovative contributions through research with interdisciplinary or multidisciplinary approaches;<br>2. criticize and provide feedback on improvements from a civil engineering perspective to settlement policy in infrastructure problems has and/or is being applied in the form of a scientific paper. |
| **COURSE LEARNING OUTCOMES** |
| Student able to understand and analyse Transit (LRT), LRRT and Tram train, Heavy rail, High Speed Train, other type of trin, emplassemen network, depo network |
| **MAIN SUBJECTS** |
| Type of rollingstock, mass rapid transit, metropolitan train, tram/Light Rail Transit (LRT), LRRT and Tram train, Heavy rail, High Speed Train, other type of trin, emplassemen network, depo network |
| **PREREQUISITES** |
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| **REFERENCES** |
| **Book:**<br>1. Vuchic, V.R. (1981) Urban Public Transportation: System and Technologu<br>2. Profillidis, V.A. (2006) Railway Management & Engineering<br>3. TCRP Report 57: Track Design Handbook for Light Rail Transit<br>4. Vuchic, V.R. (2005) Urban Transit: Operation, Planning, and Economics |

**CURRICULUM SYLLABUS 2018**

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|---|---|---|
| **MATA KULIAH** | **RC18 - 5173** | **: RAILWAY CONSTRUCTION** |
| | **CREDIT** | **: 3 CREDITS** |
| | **SEMESTER** | **: I (COMPULSORY)** |

**DESCRIPTION OF COURSE**

Railway Track Construction is the course that discussing:
Railway engineering and type of rolling stock, train axle load, type of railway construction, principle of railway design, railway elements, upper structure of railway, emplassemen of station

**LEARNING OUTCOMES**

a. solve the civil engineering problems by utilizing other interdisciplinary or multidisciplinary field of knowledge, and pay attention to the economic, health and safety factors of the public, cultural, social and environmental sustainability.
b. do the deepening or extension of knowledge in field of civil engineering to provide original and tested innovative contributions through research with interdisciplinary or multidisciplinary approaches;
c. focriticize and provide feedback on improvements from a civil engineering perspective to settlement policy in infrastructure problems has and/or is being applied in the form of a scientific paper

**COURSE LEARNING OUTCOMES**

Student able to understand railway engineering and type of rolling stock, train axle load, type of railway construction, principle of railway design, railway elements, upper structure of railway, emplassemen of station

**MAIN SUBJECTS**

Railway engineering and type of rolling stock, train axle load, type of railway construction, principle of railway design, railway elements, upper structure of railway, emplassemen of station

**PREREQUISITES**

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**REFERENCES**

**Book:**

1. _____, Undang-undang RI No. 23 Tahun 2007 tentang Perkeretaapiaan
2. _____, Peraturan Menteri Perhubungan 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,

**CURRICULUM SYLLABUS 2018**

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| **COURSE** | **RC18 - 5271** | **: MANAGEMENT OF RAILWAY OPERATIONAL** |
| | **CREDIT** | **: 3 CREDITS** |
| | **SEMESTER** | **: II (COMPULSORY)** |

**DESCRIPTION OF COURSE**

Management of Railway Operational is the course that discussing:
Supporting of railway operational and management, propulsion components, signalling and comunication system, propulsion and signalling comunication, speed profile, railway time table, operation pattern of rolling stock, cooperation, ticketing and subsidy, information system

**LEARNING OUTCOMES**

1. do the deepening or extension of knowledge in field of civil engineering to provide original and tested innovative contributions through research with interdisciplinary or multidisciplinary approaches;
2. focriticize and provide feedback on improvements from a civil engineering perspective to settlement policy in infrastructure problems has and/or is being applied in the form of a scientific paper

**COURSE LEARNING OUTCOMES**

Student able to analyse the management of railway operational, that include:
Supporting of railway operational and management, propulsion components, signalling and comunication system, propulsion and signalling comunication, speed profile, railway time table, operation pattern of rolling stock, cooperation, ticketing and subsidy, information system

**MAIN SUBJECTS**

Supporting of railway operational and management, propulsion components, signalling and comunication system, propulsion and signalling comunication, speed profile, railway time table, operation pattern of rolling stock, cooperation, ticketing and subsidy, information system

**PREREQUISITES**

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**REFERENCES**

**Book:**

1. Vuchic, V.R. (1981) Urban Public Transportation: System and Technologu

2. Profillidis, V.A. (2006) Railway Management & Engineering
3. TCRP Report 57: Track Design Handbook for Light Rail Transit
4. Vuchic, V.R. (2005) Urban Transit: Operation, Planning, and Economics

**CURRICULUM SYLLABUS 2018**

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| **COURSE** | **RC18 - 5272** | **: RAILWAY BRIDGE ENGINEERING** |
| | **CREDIT** | **: 3 CREDITS** |
| | **SEMESTER** | **: II (COMPULSORY)** |

**DESCRIPTION OF COURSE**

Railway Bridge Engineering is the course that discussing:
The need of bridge to avoid nature constraint and artificial environment and train axle load, upper structure and lower structure of bridge that across river and elevated track, force on bridge analysis, bridge construction analysis, forced on elevated track analysis, elevated track construction analysis, clereance, scouring, drainage, soil and stone bearing review, stability controll of shallow foundation, sondir and boring bearing review, pile strength controll

**LEARNING OUTCOMES**

1. do the deepening or extension of knowledge in field of civil engineering to provide original and tested innovative contributions through research with interdisciplinary or multidisciplinary approaches;
2. focriticize and provide feedback on improvements from a civil engineering perspective to settlement policy in infrastructure problems has and/or is being applied in the form of a scientific paper

**COURSE LEARNING OUTCOMES**

Student able to understand railway bridge engineering that include:
The need of bridge to avoid nature constraint and artificial environment and train axle load, upper structure and lower structure of bridge that across river and elevated track, force on bridge analysis, bridge construction analysis, forced on elevated track analysis, elevated track construction analysis, clereance, scouring, drainage, soil and stone bearing review, stability controll of shallow foundation, sondir and boring bearing review, pile strength controll

**MAIN SUBJECTS**

The need of bridge to avoid nature constraint and artificial environment and train axle load, upper structure and lower structure of bridge that across river and elevated track, force on bridge analysis, bridge construction analysis, forced on elevated track analysis, elevated track construction analysis, clereance, scouring, drainage, soil and stone bearing review, stability controll of shallow foundation, sondir and boring bearing review, pile strength controll

**PREREQUISITES**

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**REFERENCES**

**Book :**


1. _____, Undang-undang RI No. 23 Tahun 2007 tentang Perkeretaapiaan
2. _____, Peraturan Menteri Perhubungan 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,

**CURRICULUM SYLLABUS 2018**

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|---|---|---|
| **COURSE** | **RC18 - 5273** | **: MASS TRANSPORTATION SYSTEM** |
| | **CREDIT** | **: 3 CREDITS** |
| | **SEMESTER** | **: II (COMPULSORY)** |

**DESCRIPTION OF COURSE**

Mass transportation system is the course that discussing:
Urban development, mass transportation development, classification, right of way mass transportation, headway, mass transportation system capacity, mass transportation performance based on demand and capacity, comparison between MRT, LRT and BRT, route lay-out and mass transportation facilities based on land use structure and urban road network, demand management concept that including oriented development and transportation demand management, mass transportation operational system, mass transportation development and financing.

**LEARNING OUTCOMES**

1. do the deepening or extension of knowledge in field of civil engineering to provide original and tested innovative contributions through research with interdisciplinary or multidisciplinary approaches;
2. criticize and provide feedback on improvements from a civil engineering perspective to settlement policy in infrastructure problems has and/or is being applied in the form of a scientific paper.

**COURSE LEARNING OUTCOMES**

- Student able to understand urban development, mass transportation development, classification, right of way mass transportation, comparison between MRT, LRT and BRT, route lay-out and mass transportation facilities based on land use structure and urban road network, demand management concept that including oriented development and transportation demand management, mass transportation operational system, mass transportation development and financing.
- Student able to analyze headway, mass transportation system capacity, mass transportation performance based on demand and capacity

**MAIN SUBJECTS**

Urban development, mass transportation development, classification, right of way mass transportation, headway, mass transportation system capacity, mass transportation performance based on demand and capacity, comparison between MRT, LRT and BRT, route lay-out and mass transportation facilities based on land use structure and urban road network, demand management concept that including oriented development and transportation demand management, mass

transportation operational system, mass transportation development and financing.

**PREREQUISITES**

-

**REFERENCES**

**Book :**


1. Institute for Transportation and Development Policy (2016) The BRT Standard.
2. Institute for Transportation and Development Policy (2016) The TOD Standard.
3. Vuchic, V.R. (2005) Urban Transit: Operation, Planning, and Economics
4. Vuchic, V.R. (1985). Urban Public Transportation System and Technology, Prentice Hall
5. Gianopoulos, G.A. (1989). Bus Planning and Operation in Urban Areas: A Practical Guide, Avebury.
6. Transport and Road Research Laboratory (1976) NATO CCMS Report no 45: Bus Priority System

**CURRICULUM SYLLABUS 2018**

| | | |
|---|---|---|
| **COURSE** | **RC18 - 5371** | **: GEOTECHNICAL ASPECT OF RAILWAY** |
| | **CREDIT** | **: 3 CREDITS** |
| | **SEMESTER** | **: III (ELECTIVE)** |

**DESCRIPTION OF COURSE**

Geotechnical aspect of railway is the course that discussing:
Geotechnical problems on railway, erathwork problems, amplitude & time of settlement, slope stability: sliding & puncture, soil improvement method, expansive soil case, peat soil case, geothecnical aspect study case and its solution

**LEARNING OUTCOMES**

a. solve the civil engineering problems by utilizing other interdisciplinary or multidisciplinary field of knowledge, and pay attention to the economic, health and safety factors of the public, cultural, social and environmental sustainability.
b. do the deepening or extension of knowledge in field of civil engineering to provide original and tested innovative contributions through research with interdisciplinary or multidisciplinary approaches;
c. criticize and provide feedback on improvements from a civil engineering perspective to settlement policy in infrastructure problems has and/or is being applied in the form of a scientific paper

**COURSE LEARNING OUTCOMES**

Student able to understand geotechnical problems on railway, erathwork problems, amplitude & time of settlement, slope stability: sliding & puncture, soil improvement method, expansive soil case, peat soil case, geothecnical aspect study case and its solution

**MAIN SUBJECTS**

Geotechnical problems on railway, erathwork problems, amplitude & time of settlement, slope stability: sliding & puncture, soil improvement method, expansive soil case, peat soil case, geothecnical aspect study case and its solution

**PREREQUISITES**

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**REFERENCES**

**Book:**

1. _____, Undang-undang RI No. 23 Tahun 2007 tentang Perkeretaapiaan
2. _____, Peraturan Menteri Perhubungan 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,

**CURRICULUM SYLLABUS 2018**

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|---|---|---|
| **COURSE** | **RC18 - 5372** | **: LIGHT RAIL GEOMETRIC SYSTEM** |
| | **CREDIT** | **: 3 CREDITS** |
| | **SEMESTER** | **: III (ELECTIVE)** |

**DESCRIPTION OF COURSE**

Light rail geometric system is the course that discussing:
Light rail transit (LRT), right of way (ROW), geometric specification: Light rail transit (LRT), Light rail rapid transit (LRRT), tram train, curvature, gradient and length of vertical curvature, plan and profile, cross section, earthwork

**LEARNING OUTCOMES**

1. do the deepening or extension of knowledge in field of civil engineering to provide original and tested innovative contributions through research with interdisciplinary or multidisciplinary approaches;
2. criticize and provide feedback on improvements from a civil engineering perspective to settlement policy in infrastructure problems has and/or is being applied in the form of a scientific paper.

**COURSE LEARNING OUTCOMES**

Student able to understand and analyse light rail transit (LRT) that including: right of way (ROW), geometric specification: Light rail transit (LRT), Light rail rapid transit (LRRT), tram train, curvature, gradient and length of vertical curvature, plan and profile, cross section, earthwork

**MAIN SUBJECTS**

Light rail transit (LRT), right of way (ROW), geometric specification: Light rail transit (LRT), Light rail rapid transit (LRRT), tram train, curvature, gradient and length of vertical curvature, plan and profile, cross section, earthwork

**PREREQUISITES**

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**REFERENCES**

**Book:**

1. PM 60 th 2012
2. PM 36 th 2014
3. TCRP Report 57: Track Design Handbook for Light Rail Transit

**CURRICULUM SYLLABUS 2018**

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|---|---|---|
| **COURSE** | **RC18 - 5373** | **: RAILWAY TUNNEL ENGINEERING** |
| | **CREDIT** | **: 3 CREDITS** |
| | **SEMESTER** | **: III (ELECTIVE)** |

**DESCRIPTION OF COURSE**

Railway tunnel engineering is the course that discussing:
The need of railway tunnel to avoid nature constraint and artificial environment and train axle load, type of railway tunnel construction, ground water pressure, sea water pressure, Caissons pneumatic pressure, drainage, soil and stone type, soil pressure, earth pressure balance, soil improvemt for immersed tunnel, force analysis, casing, slurry, concrete, tunnel construction process, inspection and controlling

**LEARNING OUTCOMES**

1. do the deepening or extension of knowledge in field of civil engineering to provide original and tested innovative contributions through research with interdisciplinary or multidisciplinary approaches;
2. criticize and provide feedback on improvements from a civil engineering perspective to settlement policy in infrastructure problems has and/or is being applied in the form of a scientific paper.

**COURSE LEARNING OUTCOMES**

Student able to understand Railway Tunnel Engineering that including: the need of railway tunnel to avoid nature constraint and artificial environment and train axle load, type of railway tunnel construction, ground water pressure, sea water pressure, Caissons pneumatic pressure, drainage, soil and stone type, soil pressure, earth pressure balance, soil improvemt for immersed tunnel, force analysis, casing, slurry, concrete, tunnel construction process, inspection and controlling

**MAIN SUBJECTS**

The need of railway tunnel to avoid nature constraint and artificial environment and train axle load, type of railway tunnel construction, ground water pressure, sea water pressure, Caissons pneumatic pressure, drainage, soil and stone type, soil pressure, earth pressure balance, soil improvemt for immersed tunnel, force analysis, casing, slurry, concrete, tunnel construction process, inspection and controlling

**PREREQUISITES**

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**REFERENCES**

**Book:**


1. _____, Undang-undang RI No. 23 Tahun 2007 tentang Perkeretaapiaan
2. _____, Peraturan Menteri Perhubungan 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

**CURRICULUM SYLLABUS 2018**
**EXPERTISE AREA HIDROINFORMATICS**

| | | |
|---|---|---|
| **COURSE** | **RC18 - 5181** | **: COMPUTATIONAL FLUID DYNAMIC** |
| | **CREDIT** | **: 3 CREDITS** |
| | **SEMESTER** | **: I (COMPULSORY)** |

| **DESCRIPTION OF COURCE** |
|---|
| This course contains flow equations, numerical analysis for 1D, 2D and 3D flows, dispersion equations and 2D dispersion calculations, 1D, 2D and 3D flow modeling. |
| **LEARNING OUTCOME** |
| 1. solve the civil engineering problems by utilizing other interdisciplinary or multidisciplinary field of knowledge, and pay attention to the economic, health and safety factors of the public, cultural, social and environmental sustainability.<br>2. do the deepening or extension of knowledge in field of civil engineering to provide original and tested innovative contributions through research with interdisciplinary or multidisciplinary approaches; |
| **COURSE LEARNING OUTPUTS** |
| 1. Being able to do numerical analysis of differential equation of flow.<br>2. Being able to use numerical modelling to simulate flow in 1D, 2D and 3D<br>3. Being able to use numerical modelling to simulate pollutant dispersion |
| **MAIN SUBJECTS** |
| Uniform flow, non-uniform flow, steady flow, unsteady flow, critical flow, losses, Saint Venant, Muskingum Routing, Dispersion, the first order upstream Schme, jets and Plumes, discretization, Hec -RAS, Grid, Navier Stoke, SIMPLE method, turbulent model, stability & convergence, boundary condition, free surface Algorithm, SSIIM Model. |
| **PREREQUISITES** |
| - |
| **REFERENCE** |
| 1. Olsen, Numerical Modelling and Hydraulic, 20112, ISBN 82-7598-074-7<br>2. Olsen, Three Dimension numerical model for Simulation of Sedimen Movement In Water Intake with Multi Block Option, SSIIM User Manual, 2013<br>3. US Army Corps Engineer, Hydraulic Reference Manual HEC-RAS, 2010 |

**CURRICULUM SYLLABUS 2018**

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|---|---|---|
| **COURSE** | **RC18 - 5182** | **: GIS AND REMOTE SENSING** |
| | **CREDIT** | **: 3 CREDITS** |
| | **SEMESTER** | **: I (COMPULSORY)** |

| **DESCRIBPTION OF COURCE** |
|---|
| This course contains spatial data management with geographic information systems and remote sensing (GIS) and its application in the field of water resources. |
| **LEARNING OUTCOME** |
| 1. solve the civil engineering problems by utilizing other interdisciplinary or multidisciplinary field of knowledge, and pay attention to the economic, health and safety factors of the public, cultural, social and environmental sustainability.<br>2. do the deepening or extension of knowledge in field of civil engineering to provide original and tested innovative contributions through research with interdisciplinary or multidisciplinary approaches; |
| **COURSE LEARNING OUTPUTS** |
| 1. Being able to to explain the principles of spatial data processing<br>2. Being able to to demonstrate the use of GIS and remote sensing for development and help solve water resource problems<br>3. Being able to use GIS program applications and their extensions to solve simple problems in the field of water resources |
| **MAIN SUBJECTS** |
| Introduction of GIS, Information acquisition and treatment, Remote sensing, Introduction to the software, DEM, Watershed Modeling, Rainfall Runoff modeling. |
| **PREREQUISITES** |
| - |
| **REFERENCES** |
| 1. Principle of Remote Sensing<br>2. Principle of Geographical Information System<br>3. ArcView 10 user manual |

**CURRICULUM SYLLABUS 2018**

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|---|---|---|
| **COURSE** | **RC18 - 5183** | **: INFORMATION TECHNOLOGY AND COMPUTER SCIENCE** |
| | **KREDIT** | **: 3 CREDITS** |
| | **SEMESTER** | **: I (COMPULSORY)** |

**DESCRIPTION OF COURSE**

This course contains knowledge of information technology and computer science and its utilization in the field of water resources engineering.

**LEARNING OUTCOME**

1. solve the civil engineering problems by utilizing other interdisciplinary or multidisciplinary field of knowledge, and pay attention to the economic, health and safety factors of the public, cultural, social and environmental sustainability.
2. do the deepening or extension of knowledge in field of civil engineering to provide original and tested innovative contributions through research with interdisciplinary or multidisciplinary approaches;

**COURSE LEARNING OUTPUTS**

1. Being able to explain the principles and terminology of information technology
2. Being able to demonstrate the use of information technology for development and help solve the problems of water resources
3. Being able to arrange the algorithm of solving simple water resource problems
4. Being able to create a program and implement it to solve simple problems in the field of water resources with programming languages Pascal, Basic, C ++, Fortran or other computer languages

**MAIN SUBJECTS**

Internet and World Wide Web, Internet Impact for the People, Software, Application software, Hardware: CPU, Computer Networking, Programming, Information Technology Security, Databases, E-Business, Organizational Information Systems, Development of Information System, Writing algorithm and flowchart. Introduction and Structure of Delphi. Pascal Programming Language, syntactic elements, data types, Helps systems, Delphi files, units, components, data types; string. Declare its own data type. Variable, types, constants. Data type: enumerated, sub range, array set, record. Operators and expressions. Structure and modular programming. If-then-else statement. Iteration statement. Display results, modeling with TMemo component. Text Files in Pascal. Procedures and functions. Various types of parameters. String handling function. Software validation. Testing strategies and techniques. White and black box testing. Marketing of Software.

| PREREQUISITES |
| --- |
| - |
| **REFERENCES** |
| 1. Williams, B.K, Stacy C. Sawyer (2007). Using Information Technology: A Practical Introduction to Computers & Communications. Seventh Edition, McGraw-Hill, New York. ISBN-13: 978-0-07-110768-6<br>2. Abdul Kadir, Dasar Teknologi Informasi, Andi Offset, Yogjakarta.<br>3. H. M. Deitel, P. J. Deitel. 2004. Java™ How to Program, Sixth Edition. Prentice Hall<br>4. Mary Campione, Kathy Walrath, Alison Huml. 2000. Java™ Tutorial, Third Edition: A Short Course on the Basics. Addison Wesley.<br>5. Walter Doberenz, Borland Delphi 7, ISBN-978-3446223257 |

**CURRICULUM SYLLABUS 2018**

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|---|---|---|
| **COURSE** | **RC18 – 5281** | **: NUMERICAL MODELLING OF RIVER** |
| | **CREDIT** | **: 3 CREDITS** |
| | **SEMESTER** | **: II (COMPULSORY)** |

**DESCRIPTION OF COURSE**

This course contains the basic theory of flow, transport of pollutants, transport sediments in the river and application of numerical modeling for flow, water quality and river sediment transport.

**LEARNING OUTCOME**

1. solve the civil engineering problems by utilizing other interdisciplinary or multidisciplinary field of knowledge, and pay attention to the economic, health and safety factors of the public, cultural, social and environmental sustainability.
2. do the deepening or extension of knowledge in field of civil engineering to provide original and tested innovative contributions through research with interdisciplinary or multidisciplinary approaches;

**COURSE LEARNING OUTPUTS**

1. Being able to develop numerical model to simulate river flow.
2. Being able to develop numerical model to simulate river sediment transport.
3. Being able to develop numerical model to simulate water quality in river

**MAIN SUBJECTS**

River characteristics, river hydraulics, flow equations, flood waves, river transport sediments, water quality mathematical equations, numerical methods and application of numerical models of flow of 1D and 2D, sediment transport and river water quality.

**PREREQUISITES**

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**REFERENCES**


1. Howard H. Chang, Fluvial Processes in River Engineering, Krieger Publishing Company, 2008
2. Olsen, Numerical Modelling and Hydraulic, 20112, ISBN 82-7598-074-7
3. Olsen, Three Dimension numerical model for Simulation of Sedimen Movement In Water Intake with Multi Block Option, SSIIM User Manual, 2013
4. US Army Corps Engineer, Hydraulic Reference Manual HEC-RAS, 2010

**CURRICULUM SYLLABUS 2018**

| | | |
|---|---|---|
| **COURSE** | **RC18 - 5282** | **: NUMERICAL MODELLING OF HYDROLOGY AND GROUND WATER** |
| | **CREDIT** | **: 3 CREDITS** |
| | **SEMESTER** | **: II (COMPULSORY)** |

| **DESCRIPTION OF COURSE** |
|---|
| This course contains basic theory and application of hydrological numerical modeling and groundwater of a watershed.. |
| **LEARNING OUTCOME** |
| 1. solve the civil engineering problems by utilizing other interdisciplinary or multidisciplinary field of knowledge, and pay attention to the economic, health and safety factors of the public, cultural, social and environmental sustainability.<br>2. do the deepening or extension of knowledge in field of civil engineering to provide original and tested innovative contributions through research with interdisciplinary or multidisciplinary approaches; |
| **COURSE LEARNING OUTPUTS** |
| 1. Being able to explain the principles and terminology of hydrology and hydrogeology processes.<br>2. Being able to develop numerical model to use deterministic and stocastic technique to simulate hydrology process in the watersshed.<br>3. Being able to use numerical model to simulate ground water flow. |
| **MAIN SUBJECTS** |
| Hydrology and hydrogeology process deterministic model, stokastic model, tank model, ARIMA model, HEC-HMS model, Model IFAS model, ground water flow, contaminant transport, MODFLOW and PM5 model. |
| **PREREQUISITES** |
| - |
| **REFERENCES** |
| 1. David R. Maidment, 1992, Handbook of Hydrology, McGRAW-HILL, INC<br>2. Keith J. Beven, 2000, Rainfall-runoff modelling, John Wiley & Sons, LTD<br>3. User Manual HEC-HMS<br>4. User Manual IFAS<br>5. User Manual ARIMA<br>6. User Manual Modflow PM5 |

**CURRICULUM SYLLABUS 2018**

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|---|---|---|
| **COURSE** | **RC18 - 5285** | **: DATA DRIVEN AND COMPUTATIONAL INTELLIGENCE** |
| | **CREDIT** | **: 3 CREDITS** |
| | **SEMESTER** | **: II (COMPULSORY)** |

**DESCRIPTION OF COURSE**

This course contains the basic theories of data driven techniques from machine learning and data mining such as Machine learning, Lazy and Eager Learning, Fuzzy System, Artificial Neural Network and Genetic Algorithm and using data driven model to solve problems and development in the water resources field .

**LEARNING OUTCOME**

1. solve the civil engineering problems by utilizing other interdisciplinary or multidisciplinary field of knowledge, and pay attention to the economic, health and safety factors of the public, cultural, social and environmental sustainability.
2. do the deepening or extension of knowledge in field of civil engineering to provide original and tested innovative contributions through research with interdisciplinary or multidisciplinary approaches;

**COURSE LEARNING OUTPUTS**

1. Being able to keep up with the latest data driven and computational intellegence methods
2. Being able to adopt the data driven and computational intellegence methods in the field of water resources
3. Being able to use data driven and computational intelligent techniques to develop and solve water resources problems

**MAIN SUBJECTS**

Machine Learning, Eager dan lazy Learning, Fuzzy System, Artificial Neural Network and Genetic Algorithm and its aplication in water resources engineering.

**PREREQUISITES**

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**REFERENCES**

1. Amit Konar, "Computational Intelligence: Principles, Techniques and Applications", Springer-Verlag Berlin Heidelberg, 2005

2. Ajoy K. Palit and Dobrivoje Popovic, "Computational Intelligence in Time Series Forecasting": Theory and Engineering Applications, Springer-Verlag London Limited, 2005
3. Gregory Levitin, "Computational Intelligence in Reliability Engineering", Springer-Verlag Berlin Heidelberg, 2007

**CURRICULUM SYLLABUS 2018**

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|---|---|---|
| **COURSE** | **RC18 - 5381** | **: COASTAL HYDRODYNAMIC MODELLING** |
| | **CREDIT** | **: 2 CREDITS** |
| | **SEMESTER** | **: III (COMPULSORY)** |

| **DESCRIPTION OF COURSE** |
|---|
| This course contains the basic theory of coastal hydrodynamics, geometry model, initial condition and oundary condition, coastal hydrodynamic model, sediment transport model, wave model. |
| **LEARNING OUTCOME** |
| 1. Solve the civil engineering problems by utilizing other interdisciplinary or multidisciplinary field of knowledge, and pay attention to the economic, health and safety factors of the public, cultural, social and environmental sustainability.<br>2. do the deepening or extension of knowledge in field of civil engineering to provide original and tested innovative contributions through research with interdisciplinary or multidisciplinary approaches; |
| **COURSE LEARNING OUTPUTS** |
| 1. Being able to explain the principles of hydodynamic processes.<br>2. Being able to determine the parameter, input, initian condition, boundary condition for coastal modelling.<br>3. Being able to use numerical model to simulate current, wave and transport sedimen in the coastal area. |
| **MAIN SUBJECTS** |
| Tides, current, wave, transport sedimen, bahtymetri, discretization, mesh, boundary condition, model control, hydrodynamic model, wave model anda sediment transport. |
| **PREREQUISITES** |
| - |
| **REFERENCES** |
| **1.** Jinhae Zheng, Hydrodynamic Teory and Model, Intech, 2012<br>2. Deltares, User manual of Delft3D Flow, Simulation of Multi-Dimension Hydrodynamic Flows and Transport phenomena including Sedimen, 2014<br>3. Deltares, User manual of Delft3D Wave, Simulation of Short-Crested Wave with Swan, 2014 |

**CURRICULUM SYLLABUS 2018**

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|---|---|---|
| **COURSE** | **RC18 - 5382** | **: NUMERICAL MODELLING OF DECISION SUPPORT AND CONTROL SYSTEM** |
| | **CREDIT** | **: 2 CREDITS** |
| | **SEMESTER** | **: III (COMPULSORY)** |

**DESCRIPTION OF COURSE**

This model contains the basic theory and modelling of real control, optimization technique, system analysys for decision support in the field of water resources engineering.

**LEARNING OUTCOME**

1. solve the civil engineering problems by utilizing other interdisciplinary or multidisciplinary field of knowledge, and pay attention to the economic, health and safety factors of the public, cultural, social and environmental sustainability.
2. do the deepening or extension of knowledge in field of civil engineering to provide original and tested innovative contributions through research with interdisciplinary or multidisciplinary approaches;

**COURSE LEARNING OUTPUTS**

1. Being able to do optimization using linear and dynamic programming.
2. Being able to simulate control system modelling of water system.
3. Being able to use the result of the modelling for decission support system.

**MAIN SUBJECTS**

Classical optimization theory, single-and multi-variable non-linear optimization. Steepest descent, conjugate gradient, direct methods. Dynamic programming, Application of optimization techniques to practical problems, conceptual framework for control systems. Levels of control and decision support. Basic control tecniques feed-backward / feed-forward loops. meteorologicaland hydrological monitoring systems; local control devices, communication, central control systems, supervisory control and data acquisition systems, model and decision support systems. Traditional controllers: PID-control.

Advanced controller: model-based optimum control; fuzzy controllers and use of artificial neural networks for control, types of modeling approaches, simple applications of optimization and simulation models to problems of water allocation, irrigation planning, reservoir operation and capacity expansion. Definition of decision variables, objective functions, constraints, state variables, stages and optimum' solutions. Multi-objective models and the concept of trade-offs between conflicting objectives. Distinction between multi-purposes and multi-objectives.

Various qualitative and quantitative approaches to multi-objective analyzes. modeling of stochastic processes.

**PREREQUISITES**

-

**REFERENCES**

**Buku :**


1. John C. Schaake, D. Lai, Linear Programming and Dynamic Programming Application to Water Distribution Network Design, M.I.T. Hydrodynamics Laboratory, 1969
2. Vicenç Puig,Carlos Ocampo-Martínez,Ramon Pérez,Gabriela Cembrano,Joseba, Real-time Monitoring and Operational Control of Drinking-Water Systems, Springer, 2017
3. Magdalene Marinaki,Markos Papageorgiou, Optimal Real-time Control of Sewer Networks, Springer 2005
4. Aquarius, user manual Software
5. Lingo, User Manual Software

**CURRICULUM SYLLABUS 2018**

| | | |
|---|---|---|
| **COURSE** | **RC18 - 5383** | **: NUMERICAL MODELLING OF URBAN DRAINAGE** |
| | **CREDIT** | **: 2 CREDITS** |
| | **SEMESTER** | **: III (ELECTION)** |

| **DESCRIPTION OF COURSE** |
|---|
| This course contains the basic theory of numerical modelling of urban drainage system. |
| **LEARNING OUTCOME** |
| 1. solve the civil engineering problems by utilizing other interdisciplinary or multidisciplinary field of knowledge, and pay attention to the economic, health and safety factors of the public, cultural, social and environmental sustainability.<br>2. do the deepening or extension of knowledge in field of civil engineering to provide original and tested innovative contributions through research with interdisciplinary or multidisciplinary approaches; |
| **COURSE LEARNING OUTPUTS** |
| • Being able to explain the principles up urban drainage modelling.<br>• Being able to develop a numerical model for simulation uban drainage system.<br>• Being able to intrepret the result of the urban drainage modeling. |
| **MAIN SUBJECTS** |
| Basic concept of urban drainage, model geometry, hydraulic, dynamic wave, kinematic wave, pump and regulator, and advance feature such as seepage, minor losses, force main, culvet and roadway weirs |
| **PREREQUISITES** |
| - |
| **REFERENCES** |
| 1. Reference Manual Storm Water Management Model<br>2. Keith J. Beven, 2000, Rainfall-runoff modelling, John Wiley & Sons, LTD |

# DOCTORAL PROGRAM

## *OUTLINE :*

- **LEARNING ACHIEVEMENT**
- **COURSE LIST**
- **SYLLABUS**

**GRADUATE'S LEARNING ACHIEVEMENT**
**STUDY PROGRAM - CIVIL ENGINEERING**
**DOCTORAL PROGRAM**

**EACH GRADUATE OF**
**STUDY PROGRAM - CIVIL ENGINEERING**
**DOCTORAL PROGRAM**
**HAS THE FOLLOWING LEARNING OUTCOMES**

**1. ATTITUDES:**

a. Believing in the oneness of God and able to demonstrate religious attitude;
b. Upholding the value of humanity in undertaking the tasks based on religion, morality and ethics;
c. Contributing in improving the quality of community life, nation, state, and the advance of civilization based on Pancasila (Five Basic Principles);
d. Playing a role as a proud citizen who loves his/her homeland, having a nationalism and responsibility to the country and nation;
e. Appreciating the diversity of cultures, point of views, religions and beliefs as well as opinions or the original findings of others;
f. Working together, having social sensitivity and caring for community and environment;
g. Law abiding and disciplined in community and state life;
h. Internalizing values, norms, and academic ethics;
i. Demonstrating attitude of responsibility on work in his/her area of expertise independently;
j. Internalizing spirit of independence, struggle, and entrepreneurship;
k. Trying best to achieve perfect results; and
l. Working together to be able to make the most of his/her potential.

**2. KNOWLEDGE:**

a. mastering philosophy of engineering science in field of civil engineering.
b. mastering the substantial and advanced theory of civil engineering, at least in one specialized field: structure, water resources, geotechnical, and transportation;
c. mastering the substantial and advanced theory of engineering management, at least in one specialized field: water resources, transportation, and construction; and

d. mastering 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:**

In field of civil engineering, including structural engineering, water resources management and engineering, geotechnical engineering, transportation management and engineering, or construction management, each graduate is being able to:

a. do the deepening and extension of knowledge in system and/ or technology of civil engineering through interdisciplinary, multidisciplinary or transdiciplinary research;
b. proposed a new solution or recommend proposed solution to solve limitation and sustainability of the earth's resources in perspective of civil engineering;
c. perform a scientific study and provide a recommendation to the civil engineering problem solving policies that have been and / or are being implemented using engineering principles and rules; and
d. navigate the current issues and the science development in the field of civil engineering into the development process of science and technology or the formulation of policies in the field of civil engineering.

**4. GENERAL SKILLS:**

a. Being able to discover or develop new theories or concepts or scientific ideas, contribute to the development and practice of science and / or technology that concerns and implements the value of the humanities in its field of expertise, by producing scientific research based on scientific methodology, logical thinking, critical, systematic, and creative ;
b. capable of preparing interdisciplinary, multidisciplinary or transdisciplinary research, including theoretical and / or experimental studies in the fields of science, technology, art and innovation as outlined in the form of dissertations, and papers published in reputable international journals; b. capable of preparing interdisciplinary, multidisciplinary or transdisciplinary research, including theoretical and / or experimental studies in the fields of science, technology, art and innovation as outlined in the form of dissertations, and papers published in reputable international journals;
c. capable of selecting appropriate, current, advanced, and beneficial

research on humanity through interdisciplinary, multidisciplinary, or transdisciplinary approaches, in order to develop and / or produce problem solving in the fields of science, technology, art or society, based on the results of a study of the availability of internal and external resources; c. capable of selecting appropriate, current, advanced, and beneficial research on humanity through interdisciplinary, multidisciplinary, or transdisciplinary approaches, in order to develop and / or produce problem solving in the fields of science, technology, art or society, based on the results of a study of the availability of internal and external resources;

d. Being able to develop a roadmap of research with interdisciplinary, multidisciplinary, or transdisciplinary approaches, based on a study of the main objectives of the study and its constellations on broader objectives;
e. Being able to develop scientific and technological or art arguments and solutions based on a critical view of facts, concepts, principles or theories that can be accounted for scientifically and academically, and communicate them through mass media or directly to the community;
f. Being able to demonstrate academic leadership in the management, development and fostering of resources and organizations under their responsibility;
g. Being able to manage, including storing, auditing, securing, and rediscovering data and information of research results under his responsibility;
h. Being able to develop and maintain collegial and welfare relationships within their own environment or through networks of collaboration with non-institutional research communities;
i. Being able to adapt, cooperate, be creative, contribute, and innovate in applying science to the social life and being able to act as global citizen with global insight;
j. Being able to uphold the academic integrity in general and prevent the practice of plagiarism;
k. Being able to implement information technology in the context of scientific development and expertise area implementation;
l. Being able to use at least one international language in oral and written communications;
m. Being able to develop themselves and compete in national and international level; and
n. Being able to implement the sustainable principal in developing knowledge.

# COURSE LIST

**STUDY PROGRAM – CIVIL ENGINEERING**
**DOCTORAL PROGRAM**
**COURSE LIST**

| No. | Code | Course Tittle | Credits |
|---|---|---|---|
| | | **SEMESTER I** | |
| 1 | RC18-6101 | Research Methodology and Pre-Proposal | 3 |
| 2 | | Elective Courses | 6 |
| | | | |
| | | Total of Credits | 9 |
| | | **SEMESTER II** | |
| 1 | RC18-6201 | Dissertation Proposal | 8 |
| | | | |
| | | Total of Credits | 8 |
| | | **SEMESTER III** | |
| 1 | RC18-6301 | Dissertation 1 | 7 |
| | | | |
| | | Total of Credits | 7 |
| | | **SEMESTER IV** | |
| 1 | RC18-6401 | Dissertation 2 | 5 |
| | | | |
| | | Total of Credits | 5 |
| | | **SEMESTER V** | |
| 1 | RC18-6501 | Publication | 5 |
| | | | |
| | | Total of Credits | 5 |
| | | **SEMESTER VI** | |
| 1 | RC18-6601 | Dissertation 3 | 8 |
| | | | |
| | | Total of Credits | 8 |

**Notes :**

1. Dissertation 1 :Qualitative and Quantitative Analysis / Data Collection and Analysis
2. Dissertation 2: Reputable International Seminar
3. Publication : Reputable International Journal
4. Dissertation 3 : Dissertation, Clossed Session and Doctoral Promotion

**ELECTIVE COURSE LIST**

| No. | Code | Course Tittle | Credits |
|---|---|---|---|
| 1 | RC18-6102 | Modelling and Finite Element Analysis for Structure | 3 |
| 2 | RC18-6103 | Geotechnics Modelling and Engineering | 3 |
| 3 | | Taking Course in Mater Program According to Research Topic | |

# SYLLABUS

**SILABUS KURIKULUM 2018**

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|---|---|---|
| **COURSE** | **RC18 -6101** | **: RESEARCH METHODOLOGY AND PRA-PROPOSAL** |
| | **CREDITS** | **: 3 CREDITS** |
| | **SEMESTER** | **: 1 (ODD)** |

| **DESCRIPTION OF COURSE** |
|---|
| This course discuss about : 1) Introduction to research, 2) GAP Analysis to find dissertation problems, 3) preparation of thesis proposal, 4) writing composistion, 5) writing method of data analysis, 6) presentation technique, 7) publication writing, 8) writing of chapter 1,2,3 |
| **LEARNING OUTCOMES** |
| 1. do the deepening and extension of knowledge in system and/ or technology of civil engineering through interdisciplinary, multidisciplinary or transdiciplinary research;<br><br>2. perform a scientific study and provide a recommendation to the civil engineering problem solving policies that have been and / or are being implemented using engineering principles and rules; and<br>3. navigate the current issues and the science development in the field of civil engineering into the development process of science and technology or the formulation of policies in the field of civil engineering. |
| **COURSE LEARNING OUTCOMES** |
| Student able to :<br>1. develop and update knowledge of their respective fields of expertise through research in accordance with the rules of the standard procedure to produce works that are tested and can be published.<br>2. synthesize the latest research results (last 10 years) and able to make a hypothesis of problems based on scientific studies.<br>3. perform independent research planning with supervisory supervision in an integrated, and able to present research plan. |
| **MAIN SUBJECT** |
| 1) Introduction to research,<br>2) GAP Analysis to find thesis problems,<br>3) preparation of thesis proposal,<br>4) writing composistion,<br>5) writing method of data analysis, |

| |
|---|
| 6) presentation technique,<br>7) publication writing, 8) writing of chapter 1,2,3 |
| **PREREQUISITES** |
| None |
| **REFERENCES** |
| **Buku :**<br>1. Petunjuk penulisan Disertasi – ITS<br>2. Daniel Chandler, 1995, Writing strategies and writer tool. |

| | | |
|---|---|---|
| **COURSE** | **RC18 - 6102** | **: MODELING AND FINITE ELEMENT ANALYSIS FOR STRUCTURES** |
| | **CREDITS** | **: 3 CREDITS** |
| | **SEMESTER** | **: 1 (ODD)** |

**DESCRIPTION OF COURSE**

This course discuss about finite element metod incuding: 1) Bar Element, 2) Beam element, 3) Structural symmetry, 4) 2D Plane elements, 5) Element CST, 6) Element LST, 7) Element Q4, 8) Element Q6, 9) Element Q8 dan Q9, 10) Element 8 node brick, 11) Element 20 node brick

**LEARNING OUTCOMES**

1. do the deepening and extension of knowledge in system and/ or technology of civil engineering through interdisciplinary, multidisciplinary or transdiciplinary research;
2. proposed a new solution or recommend proposed solution to solve limitation and sustainability of the earth's resources in perspective of civil engineering;
3. perform a scientific study and provide a recommendation to the civil engineering problem solving policies that have been and / or are being implemented using engineering principles and rules; and
4. navigate the current issues and the science development in the field of civil engineering into the development process of science and technology or the formulation of policies in the field of civil engineering.

**COURSE LEARNING OUTCOMES**

Student able to analyze using finite element method including : 1) Bar Element, 2) Beam element, 3) Structural symmetry, 4) 2D Plane elements, 5) Element CST, 6) Element LST, 7) Element Q4, 8) Element Q6, 9) Element Q8 dan Q9, 10) Element 8 node brick, 11) Element 20 node brick

**MAIN SUBJECT**

1) Bar Element, 2) Beam element, 3) Structural symmetry, 4) 2D Plane elements, 5) Element CST, 6) Element LST, 7) Element Q4, 8) Element Q6, 9) Element Q8 dan Q9, 10) Element 8 node brick, 11) Element 20 node brick

**PREREQUISITES**

None

**REFERENCES**

**Books:**

1. Cook, R. D., et al., “Concept and Application of Finite Element Analysis”, John Wiley and Sons, Inc., 2002

2. Logan, D. L., “A First Course of Finite Element Analysis”, The McGraw-Hill Companies, Inc., 1992
3. Reddy, J. N., “Finite Element Method”, John Wiley and Sons, Inc., 1992
4. Wahyuni, E, Sutrisno, W, “MetodeElemenHingga”, ITSPress, 2015

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|---|---|---|
| **COURSE** | **RC18 -6103** | **: GEOTECHNICS MODELING AND ENGINEERING** |
| | **CREDITS** | **: 3 CREDITS** |
| | **SEMESTER** | **: 1 (GASAL)** |

**DESCRIPTION OF COURSE**

This course discuss about: Requirement of building settlement and its tolerance, Force and Load Distribution, Modeling of shallow foundation with plaxis, deployement of force and settlement of shallow foundations, introduction, parameters and models in geotechnical, footing and embankment, excavation, consolidation and submerged, ground anchor and dinamic foundation, load vs settlement and numerical vs analitic load distribution, foundation settlement, design aspects and philosophy of mat foundation

**LEARNING OUTCOMES**

a. do the deepening and extension of knowledge in system and/ or technology of civil engineering through interdisciplinary, multidisciplinary or transdiciplinary research;
b. proposed a new solution or recommend proposed solution to solve limitation and sustainability of the earth's resources in perspective of civil engineering;
c. perform a scientific study and provide a recommendation to the civil engineering problem solving policies that have been and / or are being implemented using engineering principles and rules; and
d. navigate the current issues and the science development in the field of civil engineering into the development process of science and technology or the formulation of policies in the field of civil engineering

**COURSE LEARNING OUTCOMES**

a. able to determine and analyze the parameters and modeled in the laboratory;
b. capable of modeling footing and embankment, retaining wall in dry and submerged with ground anchor, and dynamic foundation for finite element analysis;
c. understand the requirements of building settlement and tolerance, the principle of force distribution, the principle of force deployment and its influence, as well as aspects of Mat Foundation design and philosophy.

**MAIN SUBJECT**

1. Requirement of building settlement and its tolerance,
2. Force and Load Distribution,
3. Modeling of shallow foundation with plaxis,
4. Deployement of force and settlement of shallow foundations,
5. Introduction, parameters and models in geotechnics,
6. Footing and embankment,

7. Excavation,
8. Consolidation and submerged,
9. Ground anchor and dinamic foundation,
10. Load vs settlement and numerical vs analitic load distribution,
11. Foundation settlement,
12. Design aspects and philosophy of mat foundation

**PREREQUISITES**

None

**REFERENCES**

**Books :**


1. Atkinson J.H and Bransby P.L. The mechanics of soils, An introduction to critical state of Soil mechanics, McGraw-Hill Book Company Limited,1978
2. Brinkgreve R.B.J and PA Vermeer, Finite Element For Soil and RocK Analyses, A.A. Balkema/Rotterdam/Brookfield/1998
3. Manual Plaxis 2012
4. Magnan J.P. Remblais et Foundations sur Sols Compressibles, Presses de l'Ecole Nationale des Pontts et Chaussees
5. Coduto D.p. Foundation Design, Prentice Hall, Englewood Clifts,N.J, 1994

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|---|---|---|
| **COURSE** | **RC18 -6201** | **: DISSERTATION PROPOSAL** |
| | **CREDITS** | **: 8 CREDITS** |
| | **SEMESTER** | **: 1I (EVEN)** |

**DESCRIPTION OF COURSE**

This course discuss about the writing of dissertation proposal for doctoral research plan

**LEARNING OUTCOMES**

1. do the deepening and extension of knowledge in system and/ or technology of civil engineering through interdisciplinary, multidisciplinary or transdiciplinary research;
2. proposed a new solution or recommend proposed solution to solve limitation and sustainability of the earth's resources in perspective of civil engineering;
3. perform a scientific study and provide a recommendation to the civil engineering problem solving policies that have been and / or are being implemented using engineering principles and rules; and
4. navigate the current issues and the science development in the field of civil engineering into the development process of science and technology or the formulation of policies in the field of civil engineering.

**COURSE LEARNING OUTCOMES**

The student is able to understand the scientific way of thinking, review the topic for their dissertation and defend their dissertation proposal in front of the examiner

**MAIN SUBJECT**

- Understand the Scientific writing
- Understand the GAP Analysis writing
- Understand the background and research objectives
- Understand the latest research to support their research
- Understand the research methods

**PREREQUISITES**

None

**REFERENCES**

**Buku :**

1. Petunjuk penulisan Disertasi – ITS
2. Daniel Chandler, 1995, Writing strategies and writer tool.
3. Cargill, M. dan O'Connor, P., Writing Scientific Research Articel