

## 1.5 Courses Description

### 1.5.1 Undergraduate Program

#### SI 1101 Engineering Drawing (Mandatory, 2 credits)

##### Course Description

This course is an introduction to the students about the basic and standard for drawing technique, including sizing and folded drawing.

The drawing technique is emphasized in how to draw an object graphically, and projection point from surface and arch lines, and projection drawing from different point of view.

Besides that, the students is given the requirements technical drawing the civil engineering objects such as construction of building structure, watering, highway etc.

In the end, the students is capable of drawing the civil objects and to interpret civil drawing.

##### Related Courses:

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##### References

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#### SI 10T1 Concepts of Technology (Mandatory, 2 credits)

##### Course Description

This course will broaden student knowledge of technology, planning, and will give student alternative to understand other points of views of any sains to specific problems. Course covered include: infrastructure paradigm, management of water resources, settlement and any aspects related to civil and planning engineering.

##### Related Courses

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##### References

1. Anonym, "Dasar- dasar Teknologi dan Kerekayasaan", FTSP, 2001
2. Anonym, "Manusia Teknologi dan Lingkungan: Kemampuan dan Pengembangan", Penerbit ITB, 1996
3. David, et al., "The Man –Made World", Mc Graw Hill 1971
4. Derry, T.K. and Williams, T.I "A short history of technology from the earliest time to AD 1990"

## **SI 1201 Computer Programming in Civil Engineering (Mandatory, 2 credits)**

### **Course Description**

The course is concerned with the basic procedure of computer programming and its application, using one of the chosen programming language, concordant to the programming language that often used in Civil Engineering field.

### **Related Courses**

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### **References**

1. Kernighan and Ritchie, "The C Programming Language", The 2<sup>nd</sup> edition, Prentice Hall, 1988

## **SI 2111 Statics (Mandatory, 3 credits)**

### **Course Description**

This course offers materials related to deterministic structural analysis methods. Subjects covered include description of force/load and structural model and supports, understanding of internal forces, equilibrium equation, structural analysis (beams, frames, trusses) and influence line.

### **Related Courses**

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### **References**

1. Timoshenko, S.P., and Young, D.H., "Theory of Structures", McGrawHill
2. Meriam, J.L., "Engineering Mechanics Volume 1: Statics", John Wiley.
3. Beer, F.R. and Johnson, Jr., E.R., "Vector Mechanics for Engineers", Mc Graw Hill

## **SI 2101 Introduction to Civil Engineering and Construction Material (Mandatory, 3 credits)**

### **Course Description**

This course offers an introduction of structures, types of structures, force behavior in structures, and construction materials. Materials explained include concrete, steel, wood, and pavement materials. Comprehension of different concrete materials such as cement, aggregates, water, admixture/ additive, and methods of concrete mixing, pouring, and curing is also presented. For steel material, various topics including steel making, mechanical behavior, strength, ductility, toughness, fracture, fatigue, residual stress, corrosion, standardization, and mechanical test for steel are discussed. For pavement materials, knowledge on basic soil characteristics, aggregates, asphalt, and design methods, and mechanical behavior of asphalt and aggregates are presented. After this course, student should understand different types of structures, mechanical behavior of construction materials and their physical and chemical properties.

### **Related Courses**

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### **References**

1. Gaylord, E.H. and Gaylord, C.N., "Structural Engineering Handbook", MacGraw-Hill Book Company, 1978
2. Atkins, H.N, "Highway Materials, Soils, and Concretes", 4<sup>th</sup> edition, Prentice Hall, USA, 2003
3. Neville, "Properties of Concrete", Pitman Publishing, 1975

## **SI 2131 Fluid Mechanics and Hydraulics (Mandatory, 3 credits)**

### **Course Description**

To give understanding and comprehension on physical character of fluids, flow character and interaction of fluid dynamics with its media. To give concept, analysis, and methods to determine the flow regime (turbulent, critical, supercritical etc.) and channel dimension calculation, energy losses due to the change of channel geometry as well as momentum of flow in open channels and pipes. Understanding of uniform flow, gradually varied flow and rapidly varied flow.

### **Related Courses**

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### **References:**

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## **SI2102 Probability and Statistics (Mandatory, 3 credits)**

### **Course Description**

This course discusses basic theory of statistics and its applications in civil engineering. Materials given include basic understanding of statistics, mathematics, population and sample, data presentation, methods of calculating mean, standard deviation, mean estimation, outliers tests, simulation and probability theory, models of distributions, statistical tests of distributions, mean and standard deviation, linear and nonlinear regression, coefficient of correlation, stepwise analysis, and computer application for statistical analysis. This course is intended to develop the ability in design research, in data analysis, and in decision analysis using valid statistical approach.

### **Related Courses**

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### **References**

1. Ang, A. and Tang, W.H., "Probability Concepts in Engineering Planning and Design", John Wiley, 1975

## **SI 2211 Mechanics of Materials (Mandatory, 3 credits)**

### **Course Description**

This course offers basic subjects on mechanics materials which include characteristics of cross-section, elastic material stress-strain relationship, cross-sectional behavior due to flexure, shear, axial, and torsion. This course also covers methods to calculate deformation of structural elements, specifically beam elements. This course is intended to develop the ability to analyze sections and calculate deformation, stress and strain due to various internal forces applied at the cross-section.

### **Related Courses**

1. SI2111 Statics, Prerequisites

### **References**

1. Timoshenko, S.P., and Young, D.H., "Elements of Strength of Materials", Von Nostrand Reinhold Ltd., 5th edition, Canada.

## **SI 2241 Introduction to Transportation System (Mandatory, 3 credits)**

### **Course Description**

The lecture provides materials for comprehending the basic knowledge of transportation means and infrastructures. The discussion does not lead to any particular transportation mode.

The lecture introduces concepts of activity - transportation system, transportation network system, transportation planning, technology, operating system and control, economical aspect, safety aspect, environment aspect, law aspect, traffic study, capacity concept, link and intersections traffic performances.

### **Related Courses**

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### **References**

1. Morlok, "Introduction to Trans. Eng. & Plan", McGraw Hill, 1978
2. Hay, "An Introduction to Trans. Eng.", McGraw Hill, 1977
3. Yu, "Trans. Eng.: Introduction to Planning Design and Operation", North Holland, 1982

## **SI 2221 Soil Mechanics I (Mandatory, 3 credits)**

### **Course Description**

Origin of soils, clays, specific gravity, particle size and grain size distribution, soil composition and structure, weight-volume relationships, index properties, soil classification, permeability, in-situ permeability uniform and layered soils, seepage and flownets, effective stress, seepage force, stresses in solids, normal and shear stresses, stresses under loaded areas, shear strength of soils, Mohr-Coulomb soil failure criteria, triaxial tests, unconfined triaxial test, shear strength parameters based on laboratory tests, Insitu tests.

### **Related Courses**

1. SI 2101 Introduction to Material Civil Engineering

### **References**

1. Das, B. M. (2001) "Principle of Geotechnical Engineering", 5<sup>th</sup> Edition, PWS Publishing, Boston, USA
2. Holtz, R. D. and Kovacs, W. D. "An Introduction to Geotechnical Engineering, Prentice Hall, 1981

## **SI 2231 Hydrology and Drainage Engineering (Mandatory, 3 credits)**

### **Course Description**

To give understanding and comprehension of definition, physical characteristics, method of analysis of the important hydrological parameter in the design of hydraulic structure and water resource management, as well as parameter analysis and design of drainage system.

### **Scope of the subject:**

1. Hydrologic cycle, definition and important characteristics of hydrological parameter (catchment area, rainfall, climatology, and surface runoff)
2. Measurement method and hydrology parameter analysis
3. Analysis of hydrological parameters and its application in civil engineering: evaporation, evapo-transpiration, rating curve, rainfall intensity, maximum rainfall, infiltration, runoff coefficient, dependable discharge, flood discharge and hydrograph.
4. Analysis of drainage design parameter, such as: drainage load, flood routing and capacity of control structures.

### **Related Courses**

1. SI2131 Fluid Mechanics and Hydraulics, Prerequisites

### **References:**

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## **GD 22L1 Land Surveying (Mandatory, 2 credits)**

### **Course Description**

### **Related Courses**

### **References**

## **SI 3111 Structural Analysis (Mandatory, 3 credits)**

### **Course Description**

This course offers comprehension and ability in structural deformation analysis and calculation of support reactions and internal forces for indeterminate structures, limited to structures with bar elements (trusses, beams, frames). Methods for analysis focus on classical methods suitable for application without computer programs. This course is intended to develop the ability to calculate deformation and analyze support reactions and internal forces for indeterminate structures using classical methods.

### **Related Courses**

1. SI2111 Statics, Prerequisites
2. SI2211 Mechanics of Materials, Prerequisites

### **References**

1. West, H.H., "Fundamentals of Structural Analysis", John Wiley & Sons, Inc
2. Wang, C.K, "Intermediate Structural Analysis", MacGraw-Hill, 1983
3. Timoshenko, S.P., and Young, D.H., "Theory of Structures", McGrawHill

## **SI 3112 Concrete Structures (Mandatory, 3 credits)**

### **Course Description**

This course covers strength, serviceability, behavior and design of reinforced concrete structural members, emphasized on: effects of material characteristics in member's behavior; flexure, flexure and normal, shear and torsion (referred to SNI Beton 2002 and ACI 318-02 standards); serviceability limit states; anchorage. This course is intended to develop the ability to design reinforced concrete structural members due to flexure, normal, shear, torsion and their combinations.

### **Related Courses**

1. SI2101 Introduction to Civil Engineering and Construction Materials, Prerequisites
2. SI2111 Statics, Prerequisites
3. SI2211 Mechanics of Materials, Prerequisites

### **References**

1. McGregor, J.G. and Salmon, C.G., "Reinforced Concrete: Mechanics and Design", Prentice Hall, 1997
2. ACI 318-02, "Building Code Requirements for Structural Concrete", American Concrete Institute, 2002

## **SI 3141 Transportation Engineering I (Mandatory, 3 credits)**

### **Course Description**

This lecture consists of 2 parts: geometric design and pavement design. The geometric design consists of road and railway geometric design, whereas pavement design includes flexible and rigid pavement, ballast for railway, and pavement material for road and railway.

The material for geometric design consists of alignment on straight and curve part, application of Indonesian standard, whereas pavement design includes designing pavement layer thickness, sub-base for road and ballast construction for railway and pavement material for road and rail.

### **Related Courses**

1. GD22L1 Land Surveying, Prerequisited
2. SI2241 Introduction to Transportation, Prerequisited

### **References**

1. SKBI 23.2.6, “Petunjuk Perencanaan Tebal Perkerasan Lentur Jalan dengan Metoda Analisa Komponen”, Dit. Jen. Bina Marga, 1987
2. Yoder, E.j., and Witczak, M.W., “Principles of Pavement Design”, the 2<sup>nd</sup> edition, John Wiley & Sons, 1975
3. Krebs, R.D. and Walker, R.D., “Highway Materials”, McGraw-Hill, 1971

## **SI 3121 Soil Mechanics II (Mandatory, 3 credits)**

### **Course Description**

Soil compressibility, consolidation settlement, 1-D consolidation laboratory test, Void ratio - effective stress relationship, consolidation in normally and overconsolidated clays, overconsolidation ratio, primary consolidation, secondary consolidation, time rate of consolidation, 1-D Terzaghi consolidation theory, at rest lateral earth pressure, Rankine active earth pressure, Rankine passive earth pressure, slope stability, safety factor of earth stability, stability of continuous slopes, slice method, slope stability with water flow, compaction theory, behaviors and structures of compacted soils, standard and modified proctor compaction tests, CBR, specifications of compacted soils, compaction techniques, soil exploration, exploratory borings, soil sampling, insitu tests: SPT, CPT, and pressuremeter.

### **Related Courses**

1. SI 2221 Soil Mechanics I, Prerequisited

### **References**

1. Holtz, R. D. and Kovacs, W. D. “An Introduction to Geotechnical Engineering, Prentice Hall, 1981
2. Das, B. M. “Principle of Geotechnical Engineering”, 5<sup>th</sup> Edition, PWS Publishing, Boston, USA, 2001
3. Bowles, J. E. () “Physical and Geotechnical Properties of Soil” Mc Graw-Hill

## **SI 3131 Irrigation and Hydraulic Structure (Mandatory, 3 credits)**

### **Course Description**

To give understanding and comprehension on irrigation system and its components. Definition of irrigation, climate effects and its character, land use, infiltration and percolation, water requirement, water deliverance techniques, crop pattern, design of cropping area, rotation group planning, irrigation and drainage network planning, hydraulic structure design: division structure, withdrawal structure, head works (fixed dam, rubber dam)

### **Related Courses**

TL2130 Hydrology, Prerequisited

### **References:**

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## **SI 3101 Numerical Methods (Mandatory, 2 credits)**

### **Course Description**

This course explains numerical methods and introduces applications of numerical methods for civil engineering problems. Subjects include introduction of numerical methods, nonlinear equation, interpolation, differentiation and numerical integration, solving of linear equation system, solving of ordinary differential equation, curve analysis, introduction to computer programming for civil engineering problems.

This course is intended to give an understanding of numerical methods and their applications in civil engineering problems, and to improve the ability to understand, use, and develop computer programs.

### **Related Courses**

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### **References**

1. Nasution, A. dan Zakaria, H., "Metode Numerik dalam Ilmu Rekayasa Sipil", Penerbit ITB, Bandung
2. Kahaner, D., Moler, C., and Nash, S., "Numerical Method and Software", Prentice Hall
3. Rice, J.R., "Numerical Methods, Software, and Analysis", McGraw-Hill\

## **SI 3211 Structural Analysis with Matrix Methods (Mandatory, 3 credits)**

### **Course Description**

This course offers Structural Analysis with Matrix Methods as an introduction to finite element methods for bar elements. The course is intended to give students knowledge and comprehension of theory of matrix methods and basic theory of finite element methods, understanding the practical aspects of application of matrix and finite element methods such as structural modeling and interpretation of computer program output, and familiar with programming in finite element methods.

### **Related Courses**

1. SI2111 Statics, Prerequisites
2. SI2211 Mechanics of Materials, Prerequisites

### **References**

1. Hariandja, B.H., "Analisis Lanjut Sistem Struktur Berbentuk Rangka dalam Formulasi Matrix", Penerbit Aksara Hutasada
2. Weaver, W. and Gere, J.M., "Matrix Analysis of Framed Structures", Van Nostrand Reinhold
3. Yang, T.Y., "Finite Element Structural Analysis", Prentice Hall, Inc., New Jersey

## **SI 3212 Steel Structures (Mandatory, 3 credits)**

### **Course Description**

This course offers basic subjects in steel structures. Materials covered include mechanical behavior of steel; LRFD design concept; failure, strength, and design steel structure elements/components: tension bar, compression bar, and flexural beam; strength of bolted and welded connections under axial load, shear force (eccentric), moment and their combinations. This course is intended to develop a comprehension and ability to design steel structure elements and their connections.

### **Related Courses**

1. SI2111 Statics, Prerequisites
2. SI2211 Mechanics of Materials, Prerequisites

### **References**

1. Englekirk, R., "Steel Structure, Controlling Behavior Through Design", John Wiley & Sons, N.Y., 1994
2. McCormack, J.C., and Nelson, J.K., "Steel Structures: LRFD Method", 3<sup>rd</sup> Ed., Pearson International, Prentice Hall, 2003
3. Salmon & Johnson, "Steel Structures: Design and Behavior", 4<sup>th</sup> Ed., HarperCollins, 1996

## **SI 3221 Foundation Engineering (Mandatory, 3 credits)**

### **Course Description**

Soil Mechanics review, insitu soil characterization, soil laboratory tests, soil shear strength, reliability and risk analysis, shallow foundations, bearing capacity theories: Terzaghi, Meyerhoff, Brinch Hansen, bearing capacity by cone penetration test (CPT) data, reduced bearing capacity, safety factor, stress distribution, elastic (immediate) settlement, Terzaghi's consolidation theory, creep, deep foundations, deep foundation capacity, deep foundation capacity by SPT, deep foundation capacity by CPT, pile capacity by dynamic method (PDA), axial and uplift tests, lateral capacity of deep foundations, lateral test, axial and lateral deformation of deep foundation, design aspects and construction of deep foundation.

### **Related Courses**

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### **References**

1. Tomlinson "Pile Design and Construction Practice" Viewpoint Publications, 1977
2. Coduto, D. P. "Foundation Design Principles and Practices", Prentice Hall, New Jersey, NY., 1994
3. Brown, R. W. () "Practical Foundation Engineering Handbook" McGraw Hill

## **SI 3231 Water Resources Development (Mandatory, 3 credits)**

### **Course Description**

River basin concept and introduction to water infrastructure, potency of water resource in conjunction with supply and demand; survey and investigation for water resources planning; reservoir planning; decision supporting system and application of engineering economic basics, probability and statistic, simulation techniques, optimization techniques in planning and water resources management related to water resources project investment, reservoir operation system, hydropower, irrigation and drinking water, water resources conservation and control against flood, drought and land erosion.

### **Related Courses**

### **References:**

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## **SI 3241 Transportation Engineering II (Mandatory, 3 credits)**

### **Course Description**

This lecture presents the design processes of airport and seaport. The airport design including the introduction to airport master plan and air control, properties of airplanes, airport classification, design of aerodrome, making and lighting and general planning of terminal area. The sea port design is regarding the sea port system design, master plan, port type, number of berth determination and terminal planning.

### **Related Courses**

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### **References**

1. Horonjeff, Robert and Francis X. McKelvey, "Planning and Design of Airport", McGraw-Hill Book Company, New York, N. Y., 1983
2. International Civil Aviation Organization, "Aerodrome Design Manuals", Montreal, Quebec, 1983
3. Federal Aviation Administration, "Aircraft Data", Advisory Circular No. 150/53255C. Washington, D.C., 1987
4. Federal Aviation Administration, "Airport Design", Advisory Circular No. 150/5300-13, Washington, D.C., 1987
5. Federal Aviation Administration, "Airport Master Plans", Advisory Circular No. 150/5070-6A, Washington, D.C., 1987

## **SI 3251 Construction Management (Mandatory, 3 credits)**

### **Course Description**

This course covers various aspects of construction management, from the planning stage which is carried out by the owner, the design stage, the procurement stage, up to the construction stage and the last stage (maintenance, delivery). An overview of the whole processes in a construction project cycle are given. Construction management techniques are not delivered in detail. The objective of this course is that students can understand the whole processes in a construction project cycle in general and the managerial aspect of a construction project.

### **Related Courses**

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### **References**

1. Halpin and Woodhead, "Construction Management", 2<sup>nd</sup> edition, John Wiley & Sons, 1998
2. Fisk, "Construction Project Administration", 6<sup>th</sup> edition, Prentice Hall, 2000
3. Barrie and Paulson, "Professional Construction Management", 3<sup>rd</sup> edition, McGraw-Hill, 1992

## **GL 3121 Introduction to Engineering Geology (Mandatory, 2 credits)**

### **Course Description**

### **Related Courses**

### **References**

## **SI 4151 Construction Method and Equipment (Mandatory,3 credits)**

### **Course Description**

This course covers introduction to various construction methods, technology and equipment generally used in a civil construction work. Concept of equipment management, equipment selection, equipment optimization, principles of equipment cost estimation. Introduction to equipment characteristics and operation mainly in preparation works, earth works, foundation works, and concrete construction works. The objective of this course is that students can understand the concept and basic knowledge on construction methods and able to identify general construction equipment so that they can later apply it in various construction works.

### **Related Courses:**

1. SI2101 Introduction to Material Civil Construction

### **References**

1. Peurifoy, Ledbetter, Schexnayder, "Construction Planning, Equipment & Methods", 6<sup>th</sup> edition, McGraw Hill, 2001
2. Nunnally, S.W., "Construction Methods and Management", 6<sup>th</sup> edition, Prentice Hall, 2003
3. Allen, E., "The Professional Handbook of Building Construction", John Wiley and Sons, 1985

## **SI 4111 Structural Engineering (Mandatory, 2 credits)**

### **Course Description**

This course explains design process of structures, starting from defining design criteria to finishing reports. In the final six weeks, the students should design a complete structural system (building or bridge) in detail. This course is intended to develop the ability to design a structural system, write design reports, and present the report.

### **Related Courses**

1. SI3111 Structural Analysis, Prerequisites
2. SI3112 Concrete Structures, Prerequisites
3. SI3211 Structural Analysis with Matrix Methods, Prerequisites
4. SI3212 Steel Structures, Prerequisites

### **References**

1. Gaylord, E.H. and Gaylord, C.N., "Structural Engineering Handbook", MacGraw-Hill Book Company, 1978
2. McGregor, J.G., "Reinforced Concrete: Mechanics and Design", Prentice Hall, 1997

## **SI 40K1 Job Training (Mandatory, 2 credits)**

### **Course Description**

The subject gives visual experience and recognizance for the students to real construction activities and all of its aspect which covered: engineering aspect, contractual and administrative as well as the practice in the field.

This subject will also improve the student's writing skills, especially in writing a technical report regarding to all of the aspects which had been done during the industrial attachment, in a systematic and comprehensive manner.

### **Related Courses**

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### **References**

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## **SI 4251 Engineering Economics (Mandatory, 2 credits)**

### **Course Description**

This course covers decision making technique in engineering through economic analysis. Basics of economics; concept of interest and time value of money, investment alternatives evaluation technique; tax and depreciation method; engineering work cost estimation; influence of inflation; public works and industrial projects economic study; break even point analysis and return period; risk and uncertainty in economic study.

The objective of this course is that students can understand the basic principles and decision making techniques in investment based on economic evaluation so that they are able to carry out a simple economic analysis on an engineering product or investment alternative.

### **Related Courses**

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### **References**

1. Blank, L.T. and Tarquin, A.J., "Engineering Economy", Edisi ke-3<sup>rd</sup>, McGraw Hill, 2002
2. Marsudi Joyowiyono, "Ekonomi Teknik", 2<sup>nd</sup> edition, Badan Penerbit Pekerjaan Umum, 1990
3. De Neufville, R., "Applied Systems Analysis", McGraw-Hill Publishing Company, 1990

## **TL 4201 Environmental Engineering (Mandatory, 3 credits)**

### **Course Description**

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### **Related Courses**

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### **References**

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## **SI 40Z1 Final Project (Mandatory, 4 credits)**

### **Course Description**

Final Year Project is an activity at the end stage of undergraduate program in Civil Engineering Department. This project is an exercise to formulate opinions and presenting in a technical report as well as in a standard presentation method, and defend them in an oral examination. The final year project could be in the form of planning, design, operation and maintenance of civil engineering infrastructure which involve several division in the field of civil engineering, or in the form of report of the theoretical or experimental research in the desired division.

### **Related Courses**

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### **References:**

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## **SI 40T1 Infrastructure in Engineered Region (Mandatory, 2 credits)**

### **Course Description**

Presentation in stadium general with different topics are presented by the speaker which is really understand with the topic related in infrastructure problem. It is intended with infrastructure capacity in the scope of engineering, such as planning stages, infrastructure management aspect and department in urban infrastructure.

### **Related Courses:**

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### **References**

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## **SI 4252 Civil Engineering System (Mandatory, 3 credits)**

### **Course Description**

This course covers basic modeling and mathematic model for decision making in boundary. This technique is covered by linear programming, dynamic programming, Introduction inventory model, and introduction queuing problem. After this course is taken, the students are expected to have knowledge and ability in finding solution or decision making and still concerning the problem in civil engineering problem.

### **Related Courses:**

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### **References**

1. Taha, H.A, "Operation Research and Introduction", Edisi ke-5th, Prentice Hall Int., (Latest Edition), 1992
2. Ossenbruggen, "System Analysis for Civil Engineers", John Wiley & Sons Inc., 1984
3. De Neufville. R., "Applied Systems Analysis", McGraw-Hill Publishing Company, 1990

## **SI 4112 Advanced Steel Structures (Elective, 3 credits)**

### **Course Description**

This course offers advanced subjects in steel structures. Materials covered include lateral torsional buckling of beam, behavior of thin-plate element, combined flexure and axial load, composite structural components, and design of various steel structures including industrial buildings, multistory frames, simple plastic design, transmission tower, and railroad bridges. This course is intended to develop a comprehension and ability to design more complex elements/components of steel structure elements and commonly found steel structures.

### **Related Courses**

1. SI3111 Structural Analysis, Prerequisites
2. SI3212 Steel Structure, Prerequisites

### **References**

1. Englekirk, R., "Steel Structure, Controlling Behavior Through Design", John Wiley & Sons, N.Y., 1994
2. McCormack, J.C., and Nelson, J.K., "Steel Structures: LRFD Method", 3<sup>rd</sup> Ed., Pearson International, Prentice Hall, 2003
3. Salmon & Johnson, "Steel Structures: Design and Behavior", 4<sup>th</sup> Ed., HarperCollins, 1996

## **SI 4113 Advanced Concrete Structures (Elective, 3 credits)**

### **Course Description**

This course offers advanced subjects on reinforced concrete structures. Materials covered include strength, serviceability, behavior and design of reinforced concrete structures, emphasized on: plate system and two-way slab with or without beams; slender columns and deep beams, design and analysis of frame system according to the available standards, beam-column connection. This course is intended to develop the ability to design reinforced concrete structures due to various loadings based on standards/codes.

### **Related Courses**

1. SI3112 Concrete Structures, Prerequisites

### **References**

1. McGregor, J.G., "Reinforced Concrete: Mechanics and Design ", Prentice Hall, 1997
2. Winter, G. dan Nilson, A.H., "Perencanaan Beton Bertulang", Pradnya Paramita, Jakarta, 1993
3. Wang, C.K. and Salmon, C.G., "Reinforced Concrete Design", Edisi 'ke-4, Harper& Row, N-Y, 1985

## **SI 4114 Timber Structures and Materials (Elective, 3 credits)**

### **Course Description**

This course offers a comprehension of characteristics of wood and wood structures: simple beams, connection. The subjects include mechanical properties of wood, stress grades and working stresses; behavior and design of connections, beams, and beam-columns; design of buildings and bridges; other structural applications: trusses, rigid frames, arches, and pole-type buildings; pinned and bolted connections, and their combinations. This course is intended to develop the comprehension of wood material and the ability to design wood structures.

### **Related Courses**

1. SI2101 Introduction to Civil Engineering and Construction Materials, Prerequisites
2. SI2111 Statics, Prerequisites
3. SI2211 Mechanics of Materials, Prerequisites

### **References**

1. Karlsen, G.G., "Wooden Structures", MIR Publisher, 1967

## **SI 4121 Introduction to Soil Dynamics and Earthquake Engineering (Elective, 3 credits)**

### **Course Description**

Soil Dynamics: Basic theory of vibration, single degree of freedom system, multi degree of freedom system, stress wave in elastic medium, compression and shear waves, Rayleigh waves, wave propagation in elastic medium, seismic wave due to earthquake. Introduction to Earthquake Engineering: mechanism and amplitude of earthquake, plate tectonics, seismic design parameters, earthquake attenuation, maximum ground acceleration, local site effects, response spectra, liquefaction, seismic slope stability, seismic design of retaining walls, seismic design of basement and foundations.

### **Related Courses**

1. SI 2221 Soil Mechanics I, Prerequisites
2. SI 3121 Soil Mechanics II, Prerequisites
3. SI 3221 Foundation Engineering, Prerequisites

### **References**

1. Richart, F. E., Hall, J.R., Woods, R. D. "Vibrations of Soils and Foundations" Prentice-Hall, Inc., Englewood Cliffs, New Jersey, NY., 1970
2. Das, B. M. "Fundamentals of Soil Dynamics", Elsevier, N.Y., 1983
3. Prakash, S., Puri, V. K. "Foundations for Machines: Analysis and Design" John Wiley & Sons, N.Y., 1988
4. Kramer, S. L. "Geotechnical Earthquake Engineering", Prentice Hall, Inc., Upper Saddle River, NJ, USA., 1996

## **SI 4141 Evaluation & Maintenance of Transportation Infrastructure (Elective, 3 credits)**

### **Course Description**

This lecture discusses the connectivity between design and maintenance of pavement structure of the road or runway, that includes evaluation processes of pavement and traffic condition, maintenance design, Pavement Management System (PMS), maintenance work techniques, introduction to software for pavement structural condition evaluation and PMS and also field work to get to know equipment of pavement condition inspection.

This course is given to improve the ability in evaluating the pavement structure condition and damaged factors, determining the appropriate recommendation of pavement maintenance and estimating the connectivity between the pavement structure performance and 5-years budgeting operation plan.

### **Related Courses**

1. SI3141 Transportation Engineering I, Prerequisites

### **References**

1. AASHTO, "AASHTO Guide for Design of Pavement Structures", Washington, D.C., 1993
2. Dit. Jend. Bina Marga, "Manual Pemeliharaan Jalan Jilid 1A No. 03/MN/B/1983". Jakarta, 1983
3. PIARC, "HDM-4 Documentations", France, 2000

## **SI 4241 Traffic Control and Management (Elective, 3 credits)**

### **Course Description**

Discusses transportation problems, alternative solutions, traffic restrains, road management, intersection management, public transportation management, local area management, freight transport management, movement management, parking management and strategy evaluation.

Students are able to comprehend the transportation problems that concerns with demand (Traffic) and supply (Infrastructure) and also its software. Students are able to analyze the determination of traffic management techniques based on traffic characteristics parameters and the comprehension of traffic management techniques. Students are able to do the analysis and evaluation from the application of traffic management techniques.

### **Related Courses**

1. SI2241 Introduction to Transportation System, Prerequisites
2. SI3141 Transportation Engineering I, Prerequisites

### **References**

1. Underwood, R.T., "Traffic Management: an Introduction", Hargreen P.C., Melbourne, 1990
2. McShane, W.R. and Roses, R.P., "Traffic Engineering", Prentice Hall, 1990
3. IHT, "Road and Traffic in Urban Area", 2001

## **SI 5121 Retaining Structures (Elective, 3 credits)**

### **Course Description**

Approach to design and analysis, stress conditions in soils – “at rest”, active, and passive, Rankine theory of earth pressure, Coulomb theory of earth pressure; lateral earth pressure during earthquake; dewatering; local and global stability; rigid and flexible reinforced earth walls; analyses and designs of sheet pile, anchored sheet pile, anchored bulkheads, braced-cuts, tie back cuts, slurry trench walls, diaphragm, reinforced earth, and cofferdam.

### **Related Courses**

1. SI 2221 Soil Mechanics I, Prerequisites
2. SI 3121 Soil Mechanics II, Prerequisites
3. SI 3221 Foundation Engineering, Prerequisites

### **References**

1. Bowles, J. E., “Foundation Analysis and Design” 5<sup>th</sup> edition, McGraw Hill Book Company, New York, N.Y., 1996
2. Das, B. M., “Principles of Foundation Engineering”, 5<sup>th</sup> edition, PWS Publishing, Boston, USA, 2001

## **SI 5131 Dams and Water Power (Elective, 3 credits)**

### **Course Description**

Civil engineering aspect in the design of dam: type, function and capacity of dam; measurement method and data analysis; site determination, planning and hydraulic design of primary structure and supporting structure, operational and safety aspects.

### **Related Courses**

1. SI2131 Fluid Mechanics and Hydraulics, Prerequisites

### **References**

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## **SI 5132 Coastal and Swamp Engineering (Elective, 3 credits)**

### **Course Description**

Definition of coast and lowland, coastal hydraulics, wave mechanics, tide, wave transformation, coast protection system, low land formation process, lowland hydrology and hydrometry, water and soil quality, design of infrastructure construction, lowland development

### **Related Courses**

1. SI2131 Fluid Mechanics and Hydraulics, Prerequisites

### **References:**

1. Hang Tuah, "Rekayasa Rawa dan Pantai", Diktat Kuliah
2. Herbich, J.B., "Handbook of Coastal Engineering", McGraw-Hill Pub. Co
3. Lobbrecht, et al, "Swampland Development in Indonesia", Dept. Civil of Eng. Univ. TU Delft

## **SI 5141 Transpotation Planning and Modelling (Elective, 3 credits)**

### **Course Description**

Concerns with transportation planning concept, land use and transportation interaction concept, accessibility and mobility concept, system modeling concept, trip generation/attraction, trip distribution, modal split, trip assignment, transportation demand model based on traffic flow and introduction to transportation modeling software.

Students know about transportation planning concept and system modeling in general and the 4 stages transportation planning model in details. Students have the ability to model the trip demand in the future by using the 4 stages transportation planning model. Students are able to carry out the simulation (using a transportation model software) for predicting the traffic flow movement if some changes occur in the transportation system

### **Related Courses**

1. SI2241 Introduction to Transportation System, Prerequisites

### **References**

1. Tamin, O.Z., "Perencanaan dan Pemodelan Transportasi", 1<sup>st</sup> edition, Penerbit ITB, 1997
2. Ortuzar & Willumsen, "Modelling Transport", John Willey, 1990
3. Tamin, O.Z., "Perencanaan dan Pemodelan Transportasi", 2<sup>nd</sup> edition, Penerbit ITB, 2000

## **SI 5151 Construction Cost Estimation (Elective, 3 credits)**

### **Course Description**

This course covers cost estimation methods in various stages of construction work planning/design. These estimation methods include: conceptual, parametric, detailed, bid, and range estimating. Computer applications for cost estimation utilizing commercial software are also introduced. Through this course the students are expected to acquire the basic knowledge in cost estimation for design and construction purposes, and the skill to estimate the cost of construction work for bidding and cost control purposes.

### **Related Courses:**

1. SI4151 Method and Construction Equipment, Prerequisites
1. S14251 Engineering Economic, Co-requisites

### **References**

1. Peurifoy and Oberlender, "Estimating Construction Cost", Edisi ke 2-th, McGraw Hill, 2002
2. Cobb and Elliot, ed., "Cost Estimating: Concepts and Approaches", AACE, 1989
3. Ostwald, P.F., "Engineering Cost Estimating", Edisi ke-3<sup>rd</sup>, Prentice Hall, 1992

## **SI 5152 Project Planning and Control System (Elective, 3 credits)**

### **Course Description**

This course covers construction project planning and control aspects which include work budgeting, scheduling and progress measurement. The materials consist of project planning in various stages by applying several planning methods (strategic planning, SWOT analysis) and scheduling methods (bar chart, AOA, AON, linear scheduling, PERT), resources scheduling, and schedule – cost integration (CSCS/C), and computer applications in construction project management.

The objective of this course is that students will have the basic capability to analyze and plan construction project control system which include cost and schedule aspects in an integrated manner.

### **Related Courses:**

1. SI3251 Construction Management, Prerequisites

### **References**

1. Ahuja, Dozzi, and Abourizk, "Project Management: Techniques in Planning and Controlling Construction Projects, 2<sup>nd</sup> Ed", Edisi ke 2-nd, John Wiley, 1994
2. G. Oberlender, "Project Management for Engineering and Construction", Edisi ke-2<sup>nd</sup>, McGraw Hill, 2000
3. Callahan, Quackenbush & Rowing, "Construction Project Scheduling", McGraw Hill, 1992

## **SI 5211 Structural Dynamics and Introduction to Earthquake Engineering (Elective, 3 credits)**

### **Course Description**

This course presents subjects of structural dynamics and introduction to earthquake engineering as a unity. The first part covers knowledge of structural system subjected to dynamic loading with various loading conditions. The second part explains earthquake engineering, structural response under seismic loading and calculation of static equivalent seismic load. Concept and design application of Indonesian seismic codes is also presented.

After this course, students should be familiar with structural dynamics, understand physical phenomenon of dynamics, develop mathematical models of engineering problems and solve the problems.

### **Related Courses**

1. SI7113 Dinamika Struktur Lanjut, Prerequisites
2. SI7211 Rekayasa Kegempaan, Prerequisites

### **References**

1. Clough and Penzien, "Dynamics of Structures", McGraw Hill
2. Mario Paz, "Structural Dynamics", Van Nostrand Reinhold.
3. Naeim, F., "The Seismic Design Handbook", Edisi ke-2nd, Van Nostrand, N.Y., 2001

## **SI 5212 Behavior of Prestressed Concrete (Elective, 3 credits)**

### **Course Description**

This course offers analysis and design of prestressed concrete cross sections and structures. Materials covered include design of prestressed concrete elements for bending, shear, torsion; cross section analysis; design of anchorage area; analysis of indeterminate prestressed concrete structure; and design of prestressed concrete bridge structure. This course is intended to expand knowledge on behavior of prestressed concrete structural elements and to analyze and design prestressed concrete structures.

### **Related Courses**

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### **References**

1. Collins and Mitchell, "Prestressed Concrete", Prentice Hall, 1985
2. Nawy, E.G., "Prestressed Concrete: A Fundamental Approach ", Prentice Hall, 2000

## **SI 5221 Advance Foundation Engineering (Elective, 3 credits)**

### **Course Description**

Soil Mechanics review, insitu soil characterization, soil laboratory tests, soil shear strength, reliability and risk analysis, shallow foundations, bearing capacity theories: Terzaghi, Meyerhoff, Brinch Hansen, Vesic, API, bearing capacity by cone penetration test (CPT) data, reduced bearing capacity, safety factor, stress distribution, elastic (immediate) settlement, Terzaghi's consolidation theory, creep, deep foundations, deep foundation capacity, deep foundation capacity by SPT, deep foundation capacity by CPT, pile capacity by dynamic method (PDA), axial and uplift tests, lateral capacity of deep foundations, lateral test, axial and lateral deformation of deep foundation, t-z method, q-z method, and p-y method, analysis of pile groups, behaviors piles during earthquake, design aspects and construction of deep foundation.

### **Related Courses**

1. SI 2102 Statistics and Probablistics, Prerequisited
2. SI 2221 Soil Mechanics I, Prerequisited
3. SI 3101 Numerical Method, Prerequisited
4. SI 3121 Soil Mechanics II, Prerequisited
5. SI 3221 Foundation Engineering, Prerequisited
6. SI 6221 Soil Improvement, Prerequisited

### **References**

1. Canadian Geotechnical Society, "Canadian Foundation Engineering Manual", 2<sup>nd</sup> edition, The Canadian Geotechnical Society, 1985
2. Terzaghi, K., Peck, R. B., and Mesri, G., "Soil Mechanics in Engineering Practice" 3<sup>rd</sup> edition, John Wiley & Sons, 1996
3. Flemming, W. G. K., Weltman, A. J., Randolph, M.F., "Piling Engineering", Blackie Academic & Professional, 1992

## **SI 5222 Stability in Geotechnical Engineering (Elective, 3 credits)**

### **Course Description**

Stress conditions in soil – "at rest", active, and passive, Rankine theory of earth pressure, coulomb theory, critical height of vertical unsupported cuts, retaining wall stability, influence of distributed and line loads on backfill, influence of water on lateral loads, passive earth pressure estimate, braced excavation, breast walls, planted walls, reinforced earth – types and mechanics of reinforcement, retaining wall design requirements, reinforced earth wall – metal strips, reinforced earth wall – geogrids, corrosion considerations, causes and classifications of slope, failures of slope stability, infinite slope, stability of finite slope, methods of slices, sliding wedge analysis, circular arc analysis, prevention and control of slope failures

### **Related Courses**

1. SI 2221 Soil Mechanics I, Prerequisited
2. SI 3121 Soil Mechanics II, Prerequisited
3. SI 3221 Foundation Engineering, Prerequisited

### **References**

1. Edil, T. B. () "Seepage slopes and embankments" lecture notes, University of Wisconsin, Madison, USA.
2. Leroueil, S, et al., "Embankments on soft clays" Ellis Horwood, NY, 1990
3. Perloff, W. H. and Baron W., "Soil Mechanics Principles and Applications" John Wiley & Sons, New York, NY, 1986

### **SI 5231 River Engineering (Elective, 3 credits)**

#### **Course Description**

Hydraulic characters of rivers, morphology and stability, stability and river protection. Character of rivers network, basic river classification, river hydraulic, dynamic in the change of morphology, meandering process, protection on river environment, river normalization, river functions (transportation, flood control, etc.), control structure and benefits of river

#### **Related Courses**

1. SI2131 Fluid Mechanics and Hydraulics, Prerequisites
2. SI7232 Erosion and Sediment Trnsport, Co-requisites

#### **References:**

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### **SI 5232 Advanced Hydraulics (Elective, 3 credits)**

#### **Course Description**

To give understanding and basic concept of nearly horizontal flow and the laws of conservation and the numerical techniques used to solve flow equation. Mathematical models of 1-D, 2-D and 3-D flows. Turbulent model, characteristic method; Applied numerical methods to solve the flow equation: finite difference (explicit and implicit scheme). Numerical schemes to solve flow equation 1-D, 2-D and 3-D flows, e.g.: Lax-Wendroff scheme, MacCormack, Abbott-Ionescu, Preissmann, UNO and TVD. Splitting techniques: ADI, optimal splitting, strang, etc.

#### **Related Courses**

1. SI2131 Fluid Mechanics and Hydraulics, Prerequisites
2. SI6001 Advanced Numerical Method, Prerequisites
3. SI6131 Advanced Fluid Mechanics, Prerequisites

#### **References:**

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## **SI 5241 Structure & Pavement Material Engineering (Elective, 3 credits)**

### **Course Description**

Reviews the analysis of strain in pavement structure, analytical method in pavement structure design, analysis of traffic load and its influence to pavement structure, advanced pavement material and its analysis method, introduction to software for evaluating pavement structure.

Students have the knowledge and comprehension concerning various alternative methods of pavement design, element and material which are used for the construction of road transportation infrastructure together with its supporting equipment.

### **Related Courses**

1. SI3141 Transportation Engineering I, Prerequisites
2. SI3241 Transportation Engineering II, Prerequisites

### **References**

1. Collis, L., Fox, R.A., "Aggregate: Sand, Gravel, and Crushed Rock Aggregate for Construction Purposes", The Geological Society, London, 1985
2. Hwang, Y.H., "Pavement Analysis and Design", The 2<sup>nd</sup> edition, Prentice Hall, USA, 2004
3. Shell Bitumen, "The Shell Bitumen Handbook", National Research Council, Washington D.C., USA, 1990

## **SI 5251 Legal Aspects and Contract Management (Elective, 3 credits)**

### **Course Description**

This course covers legal and contractual concept and aspects for construction projects. The materials consist of various direct and indirect legal and contractual aspects on the practices of procurement and contract management as well as contract development and management strategy (contract planning, contract formation, contract administration and contract auditing) for construction projects. Through this course students are expected to know and be able to develop legal and contractual aspects concept in contract development and management strategy for construction and infrastructure projects on all stages.

### **Related Courses:**

1. SI3251 Construction Management, Prerequisites
2. SI6251 Management Financial Construction, Co-requisite

### **References**

1. Hinze, "Construction Contracts.", Mc Graw, 1993
2. Meyer, M., Baber, R. and Pfaffenberger, B., "Computers in Your Future", Prentice Hall, 1999
3. Jackson, M.J., "Computers in Construction Planning and Control", Allen & Anwin, 1986

## **SI 5252 Computer Applications in Construction (Elective, 3 credits)**

### **Course Description**

This course covers the knowledge on computer technology application in construction management and engineering, such as: significance of computer technology in construction activities, computer hardware and software technology, internet technology, CAD, cost estimation, project management, database integration, spreadsheet, simulation, programming language, and information system for owners, contractors, and construction managers.

The materials include knowledge on computer technology capability, hardware and software, and other related technologies which could be applied to support construction management and engineering activities. Through this course the students are expected to be able to design a computer application prototype that is relevant with construction activities.

### **Related Courses**

1. SI3251 Construction Management, Prerequisites

### **References**

1. Paulson, Jr., B.C., "Computer Application in Construction", McGraw Hill, 1995
2. Meyer, M., Baber, R. and Pfaffenberger, B., "Computers in Your Future", Prentice Hall, 1999
3. Jackson, M.J., "Computers in Construction Planning and Control", Allen & Anwin, 1986

## **KL 5201 Ocean Zone Management (Elective, 3 credits)**

### **Course Description**

Concepts of coastal zone management and development.

### **Prerequisite**

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### **References**

1. B. Cicin-Sain and R. W. Knecht, Integrated Coastal and Ocean Management Concepts and Practices, Island Press, 1998