

## Objectives - Module Matrix Program Studi BCE

LO1	To have ability to be responsible, ethical, adaptable, cooperative and communicative in carrying out tasks.
LO2	Able to apply mathematics, natural science (physics) and engineering principles to design, implement and supervise multi-storey buildings.
LO3	To be able to identify and solve clearly-defined building construction problems, by analyzing data, using technical standards and guidelines, and able to choose the right solution method
LO4	Able to make engineering designs of multi-storey Buildings, which meet the construction standards and adopt the construction digitalization technology developments
LO5	To be able to draw buildings to support the processes of designing, Building construction implementation and supervision using digital technology.
LO6	To be able to do site survey for Buildings.
LO7	To be able to make cost estimates with reference to technical drawings, technical specifications, able to arrange work implementation schedules.
LO8	To be able to make Building test reports and quality control.
LO9	To be able to carry out, supervise and control the building construction process by taking into account health, public safety, environment (CSMS) aspects, legal and economic aspects
LO10	To be able to prepare contract documents and administrative requirements for the design, implementation and supervision of Building construction.

Semester 1

Table 1: Objectives module matrix, example 1

Course	Code	LO	Intended learning outcomes for the programme as a whole (competence profile/learning outcomes)	Corresponding module objectives/modules (operationalisation)
Pancasila	PNJ101	LO1	To have ability to be responsible, ethical, adaptable, cooperative and communicative in carrying out tasks.	<ol style="list-style-type: none"> <li>1. Students are able to explain the Introduction to Pancasila Education.</li> <li>2. Students are able to explain Pancasila in the study of the Indonesian history,</li> <li>3. Students are able to explain Pancasila as the basis of the state, as the national ideology, as a philosophical system and as an ethical system,</li> <li>4. Students are able to explain Pancasila as the basis for science development,</li> </ol>
Indonesian Language	PNJ102	LO1	To have ability to be responsible, ethical, adaptable, cooperative and communicative in carrying out tasks.	<ol style="list-style-type: none"> <li>1. Able to explain the Indonesian Language history, function, and styles.</li> <li>2. Able to apply Indonesian spelling and word choices.</li> <li>3. Able to make effective sentences and paragraphs.</li> <li>4. Able to write quotations, sources of quotations, and bibliography.</li> <li>5. Able to write scientific papers.</li> </ol>
English	TRG 101	LO1	To have ability to be responsible, ethical, adaptable, cooperative and communicative in carrying out tasks.	<ol style="list-style-type: none"> <li>1. Students are able to identify parts of speech and look for their meanings of new words, and to derive words based on each part of speech,</li> <li>2. Student are able to scan the reading materials to look for specific information,</li> <li>3. Student are able to listen to main idea and specific information,</li> <li>4. Student are able to write paragraphs in unity and coherence,</li> <li>5. Student are able to give an oral report of written text (workshop practice)</li> </ol>

Applied Physics	TRG 102	LO2	Able to apply mathematics, natural science (physics) and engineering principles to design, implement and supervise multi-storey buildings.	<ol style="list-style-type: none"> <li>1. Students are able to solve problems in case study concerning unit and dimensional systems, various unit conversions, vector &amp; scalar quantities, and their application in Civil Engineering</li> <li>2. Students are able to analyze problems in case study concerning kinematics, namely magnitude in motion, straight motion, bullet motion, circular motion</li> <li>3. Students are able to solve problems in case study concerning force dynamics, rigid body equilibrium and lifts in Civil Engineering</li> <li>4. Students are able to analyze problems in case study concerning oscillations and waves</li> <li>5. Students are able to discuss problems in case study concerning static fluids, dynamic fluids, and heat transfer, as well as the applications of Physics in Civil Engineering in graphical form on Microsoft excel</li> </ol>
Engineering Mechanics 1	TRG 103	LO2	Able to apply mathematics, natural science (physics) and engineering principles to design, implement and supervise multi-storey buildings.	<ol style="list-style-type: none"> <li>1. Students are able to explain the concepts of forces and moments, certain static structures and procedures for analyzing certain static structures</li> <li>2. Students are able to identify various types of loads, displacement, and concept of law of balance that serves on Building structures</li> </ol>
		LO4	Able to make engineering designs of multi-storey Buildings, which meet the construction standards and adopt the construction digitalization technology developments	<ol style="list-style-type: none"> <li>1. Students are able to calculate the displacement reaction and internal forces in the form of moments, shearing forces and normal forces on simple beams, cantilever beams, overhanging beams, plane static moments and gravity center of sections, as well as moment of inertia of sections</li> <li>2. Students are able to describe moment diagrams, shearing forces and normal forces for simple</li> </ol>

				beams, cantilever beams, overhanging beams
Material Technology	TRG 104	LO4	Able to make engineering designs of multi-storey Buildings, which meet the construction standards and adopt the construction digitalization technology developments	<ol style="list-style-type: none"> <li>1. Students are able to identify the cycles and criteria of natural stone that meet the requirements, classification and aggregate requirements for building materials.</li> <li>2. Students are able to explain the criteria and functions of several types of hydraulic adhesive materials used in Building construction work.</li> <li>3. Students are able to explain the types of admixture used in concrete, as well as the types and requirements of water for concrete.</li> <li>4. Students are able to explain the types of ceramics for building and their requirements, the types of metal that meet the requirements and suitable for building construction work, types of cement materials for building construction work.</li> <li>5. Students are able to identify the type of wood used in building construction work.</li> </ol>
Land Measurement Science 1 (Theory)	TRG 105	LO2	Able to apply mathematics, natural science (physics) and engineering principles to design, implement and supervise multi-storey buildings.	<ol style="list-style-type: none"> <li>1. Students are able to analyze data resulted from measurements using simple tools and measurement of level properties (chained, longitudinal and transverse profiles, situation/contour waterpass).</li> </ol>
		LO6	To be able to do site survey for Buildings.	<ol style="list-style-type: none"> <li>1. Students are able to explain the measurement tools and equipment, measurement dimensions, distance measurement, to make straight and perpendicular lines in the field, errors that occur in field measurements and coordinate measurement.</li> <li>2. Students are able to plan a simple horizontal curve</li> <li>3. Students are able to explain the sections and requirements of level properties in field measurements</li> </ol>

Engineering Drawing 1	TRG 106	LO4	Able to make engineering designs of multi-storey Buildings, which meet the construction standards and adopt the construction digitalization technology developments	1. To be able to explain the concept of engineering drawings and 3D BIM in construction process
		LO5	To be able to draw buildings to support the processes of designing, Building construction implementation and supervision using digital technology.	<ol style="list-style-type: none"> <li>1. Able to make Sketch Drawings based on the results of measurement</li> <li>2. Able to make drawings using several 2D &amp; 3D drawing techniques, both manually or BIM-based</li> <li>3. Able to prepare DED drawing documents</li> <li>4. Able to present 2D and 3D shop drawings</li> </ol>
Land Measurement 1	TRG 107	LO6	To be able to do site survey for Buildings.	<ol style="list-style-type: none"> <li>1. Students are able to use measuring tools and equipment suitable to their works</li> <li>2. Students are able to measure sites and horizontal curves as well as carry out stake out work with simple tools in the field.</li> <li>3. Students are able to measure level, longitudinal and cross-sectional profiles, as well as measure sites/contour using waterpass tools</li> </ol>
		LO8	To be able to make Building test reports and quality control.	Students are able to make site maps and reports based on data resulted from measurements using simple tools and measurement of level properties (chained, longitudinal and cross-sectional profiles, situation/contour waterpass)

Wood Construction Work	TRG 108	LO9	To be able to carry out, supervise and control the building construction process by taking into account health, public safety, environment (CSMS) aspects, legal and economic aspects	<ol style="list-style-type: none"> <li>1. Students have good understanding about woods and the types of wood joints in building / civil construction, the implementation of OHSE (Occupational Health, Safety &amp; Environment) according to the manual.</li> <li>2. Students are able to use woodworking tools (manual and electric hand tools) according to the manual.</li> <li>3. Students are able to know how to use planes and saws; how to do beam connection works; pole connection works; wide direction plank joint works; corner joint works; wood joint applications; as well as finishing work on wood.</li> </ol>
Masonry Construction Work	TRG 109	LO9	To be able to carry out, supervise and control the building construction process by taking into account health, public safety, environment (CSMS) aspects, legal and economic aspects	<ol style="list-style-type: none"> <li>1. Students are able to explain the definition and scope of masonry practice, the introduction to masonry materials and tools, types of masonry joints</li> <li>2. Students are able to make river stone and rollag foundations, ½ stone and bricks, plastering and rendering, installation of ceramics (walls and floors)</li> </ol>

Semester 2

Course	Code	LO	Intended learning outcomes for the programme as a whole (competence profile/learning outcomes)	Corresponding module objectives/modules (operationalisation)
Citizenship	PNJ 201	LO1	To have ability to be responsible, ethical, adaptable, cooperative and communicative in carrying out tasks.	<ol style="list-style-type: none"> <li>1. Students are able to explain about the introduction to citizenship education, national identity and national integration</li> <li>2. Students are able to explain about the Indonesian constitution</li> <li>3. Students are able to explain about the rights and obligations of the state and citizens</li> <li>4. Students are able to explain about the Indonesian democracy dynamics and law enforcement in Indonesia</li> <li>5. Students are able to explain about geopolitics, geostrategic, archipelago insight and national resilience</li> </ol>
Engineering Drawing 2	TRG 201	LO4	Able to make engineering designs of multi-storey Buildings, which meet the construction standards and adopt the construction digitalization technology developments	<ol style="list-style-type: none"> <li>1. Students are able to identify draft/sketch drawings resulted from measurements to be prepared into computer-based shop drawings</li> <li>2. Students are able to make shop drawings which are part of detailed building construction using Autocad program independently</li> <li>3. Students are able to make initial settings/ setup for Autocad work screens for 3D modeling according to drafts/sketches</li> </ol>
		LO5	To be able to draw buildings to support the processes of designing, Building construction implementation and supervision using digital technology.	<ol style="list-style-type: none"> <li>4. Students are able to make complete shop drawings of medium-scale and multi-storey building construction using Autocad and 3D BIM programs</li> <li>5. Students are able to save drawing data in a format appropriate to the shop drawing document.</li> </ol>

Land Measurement Science 2	TRG 202	LO6	To be able to do site survey for Buildings.	<ol style="list-style-type: none"> <li>1. Students are able to explain about the classification, parts, and reading angles of Theodolite tools, the types of polygons, tachometric measurement methods, vertical and horizontal curves, the basics for using Total Stations and EDM in field measurements.</li> <li>2. Students are able to analyze data resulted from polygon measurements</li> <li>3. Students are able to analyze data resulted from situation measurement using tachometric method.</li> <li>4. Students are able to design horizontal and vertical curves.</li> <li>5. Students are able to explain how to calculate area using graphical, numerical and mechanical graphical methods.</li> </ol>
Applied Mathematics	TRG 203	LO2	Able to apply mathematics, natural science (physics) and engineering principles to design, implement and supervise multi-storey buildings.	<ol style="list-style-type: none"> <li>1. Students are able to explain about the concept of real number system and determine the solution set on real number equation and inequality to solve problems related to the basics of building construction work</li> <li>2. Students are able to determine and describe a function to solve problems related to the fundamentals of building construction work.</li> <li>3. Students are able to determine the derivatives of a function to solve problems related to the fundamentals of building construction work</li> <li>4. Students are able to calculate the integral of a function to solve problems related to the fundamentals of building construction work</li> <li>5. Students are able to calculate matrix values to solve problems related to the basics of building construction work</li> </ol>



Soil Mechanics 1	TRG 204	LO2	Able to apply mathematics, natural science (physics) and engineering principles to design, implement and supervise multi-storey buildings.	1. Students are able to explain the definition of soil physical properties and mechanical properties.
		LO3	To be able to identify and solve clearly-defined building construction problems, by analyzing data, using technical standards and guidelines, and able to choose the right solution method	1. Students are able to determine soil parameter values based on laboratory soil testing data 2. Students are able to determine soil parameter values based on field soil testing data 3. Students are able to calculate soil bearing capacity based on CBR value, soil density, and shear strength.
Engineering Mechanics 2	TRG 205	LO2	Able to apply mathematics, natural science (physics) and engineering principles to design, implement and supervise multi-storey buildings.	1. Students are able to calculate the internal forces on inclined beams; on gerber beams; on certain static portals; on the three-joint portals; on three-hinged arches; normal stress and shear stress on a structure's cross-section; influence lines for statically determinate structures (simple beams, cantilever beams, overhanging beams, and gerber beams).
		LO4	Able to make engineering designs of multi-storey Buildings, which meet the construction standards and adopt the construction digitalization technology developments	1. Students are able to implement Hooke's law on a pole
Material Technology 2	TRG 206	LO3	To be able to identify and solve clearly-defined building construction problems, by analyzing data, using technical standards and guidelines, and able to choose the right solution method	1. Students are able to identify various types of mortars that meet building requirements and mortar quality according to the applicable standards; the criteria, physical and mechanical properties of normal concrete according to the quality classification based on applicable standards;

		LO8	To be able to make Building test reports and quality control.	<ol style="list-style-type: none"> <li>1. Students are able to design a normal concrete mixture for Building construction according to the applicable standards</li> <li>2. Students are able to identify the criteria and the manufacture and the use of lightweight concrete, heavy concrete, spray concrete, fiber concrete, high quality concrete, asphalt concrete in Building construction;</li> <li>3. Students are able to design a high quality concrete mixture for Building Construction according to the applicable standards</li> <li>4. Students are able to design an asphalt concrete mixture according to the applicable standards</li> </ol>
Material Testing 1	TRG 207	LO8	To be able to make Building test reports and quality control.	<ol style="list-style-type: none"> <li>1. Students are able to test cement for buildings according to SOP</li> <li>2. Students are able to test fine agregates for buildings according to SOP</li> <li>3. Students are able to test coarse agregates for buildings according to SOP</li> <li>4. Students are able to test mortar for buildings according to SOP</li> <li>5. Students are able to test timber/woods for buildings according to SOP</li> </ol>
Land Measurement 2	TRG 208	LO6	To be able to do site survey for Buildings.	<ol style="list-style-type: none"> <li>1. Students are able to operate Theodolite and Total Station correctly according to the specified terms and conditions.</li> <li>2. Students are able to do polygon and site measurement in field, to stake out horizontal / vertical curves in field using Teodolite or Total Station tools.</li> <li>3. Students are able to calculate the coordinates of points measured in the field based on the directional angles and distance, area in the field directly and indirectly.</li> <li>4. Students are able to calculate an area using graphical, and numerical methods and using a planimeter</li> </ol>

		LO8	To be able to make Building test reports and quality control.	Students are able to make polygon images, site maps, vertical and horizontal curves and field measurement analysis reports using Teodolite or Total Station tools
Scaffolding and Mould Construction Work 1	TRG 209	LO9	To be able to carry out, supervise and control the building construction process by taking into account health, public safety, environment (CSMS) aspects, legal and economic aspects	<ol style="list-style-type: none"> <li>1. Students are able to explain the meaning, scope and requirements of mould and scaffolding work, materials, tools and Occupational Safety and Health requirements in mould and scaffolding construction</li> <li>2. Students are able to calculate the strength and cost for mould and Scaffolding construction works</li> <li>3. Students are able to apply the occupational safety and health system to mould and scaffolding works</li> <li>4. Students are able to make stake out board construction, column mould and scaffolding construction for conventional and semi-auto systems, beam mould and scaffolding construction for conventional systems, floor mould and scaffolding construction for conventional and semi-auto systems, stair mould and scaffolding construction with bordes out in Building Construction.</li> <li>5. Students are able to carry out the stages of mould and scaffolding recasting and tidying up in conventional and semi-auto systems</li> </ol>
Drainage Construction Work	TRG 210	LO9	To be able to carry out, supervise and control the building construction process by taking into account health, public safety, environment (CSMS) aspects, legal and economic aspects	<ol style="list-style-type: none"> <li>1. Students are able to explain the meaning of Drainage, rainwater drainage, waste water drainage, Main Buildings and Drainage Supplementary Buildings</li> <li>2. Students are able to plan the drainage construction work</li> <li>3. Students are able to carry out Stake Out/Bowplank/Stake Out board, (Open) Channels, (Closed) Channel, Simple plastering, water-channel works and Drainage Building maintenance works.</li> <li>4. Students are able to recast the</li> </ol>

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### Semester 3

Course	Code	LO	Intended learning outcomes for the programme as a whole (competence profile/learning outcomes)	Corresponding module objectives/modules (operationalisation)
Religion	PNJ 301	LO1	To have ability to be responsible, ethical, adaptable, cooperative and communicative in carrying out tasks.	<ol style="list-style-type: none"> <li>1. Able to Explain about Islam and Its Scope, The Concept of God, Ethics, Morals, Morals in Islam.</li> <li>2. Able to Explain about Human Essence, Islamic Law, Human Rights in Islam, democracy in Islam, and inter-religious harmony.</li> <li>3. Able to Explain the Definition of Science, Knowledge, Technology, and art in Islam.</li> <li>4. Able to Explain the Definition of Civil Society, Cultural Concepts, and Political Systems in Islam.</li> <li>5. Able to Explain the Definition of Economics in Islam, zakat, infaq, and alms.</li> </ol>
Construction Management 1	TRG 301	LO3	To be able to identify and solve clearly-defined building construction problems, by analyzing data, using technical standards and guidelines, and able to choose the right solution method	<ol style="list-style-type: none"> <li>1. Students are able to explain the definition, reasons, and process of construction dispute resolution, arbitration, claims</li> <li>2. Students are able to calculate the price escalations</li> <li>3. Students are able to explain about construction management</li> </ol>
		LO10	To be able to prepare contract documents and administrative requirements for the design, implementation and supervision of Building construction.	<ol style="list-style-type: none"> <li>1. Students are able to explain about tenders and bid processes</li> <li>2. Students are able to explain about contract process</li> </ol>

Fluid Mechanics	TRG 302	LO2	Able to apply mathematics, natural science (physics) and engineering principles to design, implement and supervise multi-storey buildings.	<ol style="list-style-type: none"> <li>1. Students are able to explain about the basic properties of fluids, the basic concepts of Fluid Mechanics, tools used in Fluid Mechanics lab practices,</li> <li>2. Students are able to calculate the force working due to water pressure, buoyancy, pressure level and water installation in a Building</li> </ol>
		LO8	To be able to make Building test reports and quality control.	<ol style="list-style-type: none"> <li>1. Students are able to measure flow rate and pressure level,</li> <li>2. Students are able to calculate the reduced flow rate and pressure loss in the fluid flow through a sharpened orifice</li> <li>3. Students are able to calculate the Venturimeter coefficient, the pressure loss in a straight pipe due to friction that occurs in the pipe, the pipe roughness value based on Darcy (ks), Strickler roughness value (Kst) of various types of pipes, pressure loss due to bends, the flow rate, the of venturimeter and orificemeter measuring instruments that installed to the pipe, the specific gravity values of various fluids.</li> </ol>
Soil Mechanics 2	TRG 303	LO2	Able to apply mathematics, natural science (physics) and engineering principles to design, implement and supervise multi-storey buildings.	<ol style="list-style-type: none"> <li>1. Students are able to calculate the coefficient of permeability and seepage velocity, stress distribution in soil, consolidation and settlement, lateral earth pressure, and to overcome slope slides</li> </ol>
		LO3	To be able to identify and solve clearly-defined building construction problems, by analyzing data, using technical standards and guidelines, and able to choose the right solution method	<ol style="list-style-type: none"> <li>1. Students are able to explain the definition of permeability, stress distribution in soil, consolidation settlement, lateral earth pressure, slope stability, and soil problems</li> <li>2. Students are able to analyze soil problems in Building construction techniques and how to overcome them</li> </ol>

Engineering Mechanics 3	TRG 304	LO4	Able to make engineering designs of multi-storey Buildings, which meet the construction standards and adopt the construction digitalization technology developments	<ol style="list-style-type: none"> <li>1. Students are able to calculate the magnitude of truss forces on truss frames for building structures; angular rotation and deflection on certain beams and static portals of buildings; torque, shear modulus, angle of twist; stress due to twisting and torsional moments; and bending on columns and beams.</li> <li>2. Students are able to draw the influence lines for trusses for building structures.</li> </ol>
Material Testing 2	TRG 305	LO8	To be able to make Building test reports and quality control.	<ol style="list-style-type: none"> <li>1. Students are able to design normal concrete mixtures and high quality concrete according to the applicable standards</li> <li>2. Students are able to mix and test the normal-fresh and high-performance concrete for building construction according to SOP</li> <li>3. Students are able to carry out test on hardened concrete according to SOP</li> <li>4. Students are able to test the crack depth of cracked concrete for building construction according to SOP</li> <li>5. Students are able to test the core drill for building construction according to SOP</li> </ol>

Soil Testing	TRG 306	LO8	To be able to make Building test reports and quality control.	<p>1. Students are able to carry out manual drilling, sampling and sample storage, sondir testing, DCP testing, sandcone testing, moisture content testing, density testing, specific gravity testing, liquid limit testing, plastic limit testing, sieve analysis testing, hydrometer analysis testing, standard compaction testing, CBR laboratory testing, free compressive strength testing, direct shear testing, and triaxial testing.</p> <p>2. Students are able to analysis the results of manual drilling testing, sondir testing, DCP testing, sandcone testing, moisture content testing, density testing, specific gravity testing, liquid limit testing, plastic limit testing, sieve analysis testing, hydrometer analysis testing, standard compaction testing, CBR laboratory testing, free compressive strength testing, direct shear testing, and triaxial testing.</p> <p>3. Students are able to make reports on manual drilling testing, sondir testing, DCP testing, sandcone testing, moisture content testing, density testing, specific gravity testing, liquid limit testing, plastic limit testing, sieve analysis testing, hydrometer analysis testing, standard compaction testing, CBR laboratory testing, free compressive strength testing, direct shear testing, and triaxial testing.</p>
Quantity Survey	TRG 307	LO7	To be able to make cost estimates with reference to technical drawings, technical specifications, able to arrange work implementation schedules.	<p>1. Students are able to make WBS (Work Breakdown Structure) from DED drawings</p> <p>2. Students are able to calculate the quantity of preparation work, Construction OSH, earthwork, structural work, architectural work and MEP work.</p>

		LO10	To be able to prepare contract documents and administrative requirements for the design, implementation and supervision of Building construction.	1. Students are able to make BoQ (Bill of Quantity)
Plumbing and Piping Construction Work	TRG 308	LO9	To be able to carry out, supervise and control the building construction process by taking into account health, public safety, environment (CSMS) aspects, legal and economic aspects	<ol style="list-style-type: none"> <li>1. Students explain about the introduction to plumbing / piping, plumbing and piping tools</li> <li>2. Students are able to draw plumbing and piping systems</li> <li>3. Students are able to make galvanized steel pipe threads, clean water piping networks, and dirty water piping networks</li> </ol>
Mould and Scaffolding Construction Work 2	TRG 309	LO9	To be able to carry out, supervise and control the building construction process by taking into account health, public safety, environment (CSMS) aspects, legal and economic aspects	<ol style="list-style-type: none"> <li>1. Students are able to explain about full formwork system methods and the tools, as well as Occupational Health and Safety requirements in building construction</li> <li>2. Students are able to calculate the strength and cost/rent for mould and scaffolding construction works</li> <li>3. Students are able to apply the occupational safety and health system to mould and scaffolding works</li> <li>4. Students are able to make full system mould and scaffolding construction, full system beam mould and scaffolding construction, full system floor mould and scaffolding construction, stairs standard and ¼ circle scaffolding construction,</li> <li>5. Students are able to carry out the stages of mould and scaffolding recasting and tidying up</li> </ol>



## Semester 4

Course	Code	LO	Intended learning outcomes for the programme as a whole (competence profile/learning outcomes)	Corresponding module objectives/modules (operationalisation)
Cost Estimation	TRG 401	LO7	To be able to make cost estimates with reference to technical drawings, technical specifications, able to arrange work implementation schedules.	1. Students are able to analyze the unit price of preparation work, Construction OSH, earthwork, structural work, architectural work and MEP work.
		LO10	To be able to prepare contract documents and administrative requirements for the design, implementation and supervision of Building construction.	1. Students are able to make Budget Plan
KBG 1	TRG 402	LO3	To be able to identify and solve clearly-defined building construction problems, by analyzing data, using technical standards and guidelines, and able to choose the right solution method	1. Able to determine the type of building foundation according to the building loads and soil conditions, wall structural materials to be used in buildings, materials for window and door frames, floors and floor covering materials according to building functions, roof construction according to the shape of building layout
		LO4	Able to make engineering designs of multi-storey Buildings, which meet the construction standards and adopt the construction digitalization technology developments	1. Able to map room layout in buildings and building utilities consisting of: clean water installations, used water installations and waste water installations, rainwater installations in buildings 2. Able to distinguish construction defects and failures in buildings, preventatively and curatively overcome the construction defects and failures in buildings
Construction Management 2	TRG 403	LO3	To be able to identify and solve clearly-defined building construction problems, by analyzing data, using technical standards and guidelines, and able to choose the right solution method	1. Students are able to explain about Construction project planning and scheduling. 2. Students are able to develop Project Scheduling Methods

		LO9	To be able to carry out, supervise and control the building construction process by taking into account health, public safety, environment (CSMS) aspects, legal and economic aspects	1. Students are able to control projects using Project Scheduling methods.
Engineering Mechanics 4	TRG 404	LO2	Able to apply mathematics, natural science (physics) and engineering principles to design, implement and supervise multi-storey buildings.	1. Student are able to identify statically indeterminate structures and indeterminate static degrees 2. Student are able to calculate statically indeterminate beams using the consistent deformation method; statically indeterminate beam using 3- Moment Equation method; statically indeterminate beam using Cross method; indeterminate static portal using cross method
		LO4	Able to make engineering designs of multi-storey Buildings, which meet the construction standards and adopt the construction digitalization technology developments	1. Student are able to analyze simple building structure using classical methods are software
PTM and Heavy Equipment	TRG 405	LO9	To be able to carry out, supervise and control the building construction process by taking into account health, public safety, environment (CSMS) aspects, legal and economic aspects	1. Students are able to explain the definition of heavy equipment, equipment management, the importance of maintenance and operating costs, the functions and uses of tractors, bulldozers, Motor Graders, compactors and the types of excavators 2. Students are able to calculate Ownership Costs, Operating costs, Depreciation Costs, Investment Costs, Wear Costs, Fuel Costs, Lubricant Material Costs, Filter Costs, Tire Costs, Maintenance and Repair Costs and Operator Costs 3. Students are able to explain the Technical Principles of Rolling Resistance, Grade Resistance, Total Resistance, Rimpull, Drawbarpull, Tensile Strength on Equipment, Traction Coefficient, and Height Effects and material characteristics

				<p>4. Students are able to explain about the manufacture of heavy equipment and soil mechanization tools, able to determine the implementation time, the implementation and management costs of heavy equipment and soil mechanization tools</p> <p>5. Students are Able to Explain the Cycles, Analyze time and motion, Determine samples, Make conclusions, Use the results of operation analysis.</p>
Steel Construction 1	TRG 406	LO2	Able to apply mathematics, natural science (physics) and engineering principles to design, implement and supervise multi-storey buildings.	1. Students are able to explain the steel properties and qualities and identify the types of steel profile, the steel structure design concepts using LRFD method,
		LO4	Able to make engineering designs of multi-storey Buildings, which meet the construction standards and adopt the construction digitalization technology developments	<p>1. Sdtuents are able to calculate pure bending of rods and its application to surrounding structures, the axial tensile strength, the compressive axial forces, the bolted connection strength</p> <p>2. Students are able to design steel roof frame and to design shop drawings manually or using BIM (Building Information Modeling)</p>
Concrete Structure 1	TRG 407	LO2	Able to apply mathematics, natural science (physics) and engineering principles to design, implement and supervise multi-storey buildings.	<p>1. Able to check the strength of single and double reinforced beams according to the applicable standards</p> <p>2. Able to make shear designs on beams and make detailed reinforcement drawings according to the applicable standards</p>
		LO4	Able to make engineering designs of multi-storey Buildings, which meet the construction standards and adopt the construction digitalization technology developments	<p>1. Able to design single and double reinforced beams and make detailed reinforcement drawings according to the applicable standards</p> <p>2. Able to design one-way and two-way slabs and make detailed drawings according to the applicable</p>

				<p>reinforcement standard</p> <p>3. Able to make engineering design reports for reinforced concrete slab and beam elements in building structures.</p>
Foundation Engineering 1	TRG 408	LO2	Able to apply mathematics, natural science (physics) and engineering principles to design, implement and supervise multi-storey buildings.	<p>1. Students are able to calculate the bearing capacity of shallow foundations using empirical methods (using Terzaghi, Meyerhoff, Brinch Hansen, and Vesic equations) and based on the results of SPT and sondir tests</p>
		LO4	Able to make engineering designs of multi-storey Buildings, which meet the construction standards and adopt the construction digitalization technology developments	<p>1. Students are able to explain the definitions, functions, types of shallow foundations (especially those related to building construction) and retaining walls</p> <p>2. Students are able to plan shallow foundations and retaining walls and to control their stability</p>
Report Writing in English	TRG 409	LO1	To have ability to be responsible, ethical, adaptable, cooperative and communicative in carrying out tasks.	<p>1. Students are able to describe and apply various types of sentences in English.</p> <p>2. Students are able to describe and apply various types of paragraphs in English.</p> <p>3. Students are able to explain and apply the Report systematics in English.</p> <p>4. Students are able to explain and apply report writing process in English.</p> <p>5. Students are able to explain and apply presentation-based oral communication.</p>
Steel Construction Work	TRG 410	LO9	To be able to carry out, supervise and control the building construction process by taking into account health, public safety, environment (CSMS) aspects, legal and economic aspects	<p>1. Students are able to explain the definition and scope of steel practices, steel materials and steel tools and profiles</p> <p>2. Students are able to use manual tools in steel construction work</p> <p>3. Students are able to carry out the works of electric welding, gas (oxy-acetylene) welding, steel construction form / Shop Drawing, components of</p>

				steel construction, steel construction works.
Concrete Construction Work	TRG 411	LO9	To be able to carry out, supervise and control the building construction process by taking into account health, public safety, environment (CSMS) aspects, legal and economic aspects	<ol style="list-style-type: none"> <li>1. Students are able to explain the definition and scope of concrete, concrete materials and tools and reinforcement work practices</li> <li>2. Students are able to make beam strirrups, beam reinforcement, column strirrups, column reinforcement, footing reinforcement, floor plate reinforcement, deck slab reinforcement and casting</li> </ol>

#### Semester 5

Course	Code	LO	Intended learning outcomes for the programme as a whole (competence profile/learning outcomes)	Corresponding module objectives/modules (operationalisation)
Computer Applications	TRG 501	LO2	Able to apply mathematics, natural science (physics) and engineering principles to design, implement and supervise multi-storey buildings.	1. Students are able to explain about the history of industrial revolution and the keys of industrial revolution 4.0, especially in building construction engineering, explain about the types of programming languages
		LO4	Able to make engineering designs of multi-storey Buildings, which meet the construction standards and adopt the construction digitalization technology developments	1. Students are able to use programming logic, write simple programs in Python in term of building construction engineering, use HTML programming language, use CSS programming language, write simple web-based programs in HTML and CSS in term of building construction engineering

KBG 2	TRG 502	LO3	To be able to identify and solve clearly-defined building construction problems, by analyzing data, using technical standards and guidelines, and able to choose the right solution method	<p>1. Able to determine the type of foundation for high-rise buildings according to building loads and soil conditions, the type of foundation suitable for high-rise buildings, types of fire extinguishers in high-rise buildings, types of clean water distribution systems in high-rise buildings, types of building maintenance and repairs in high-rise buildings, types of equipment and regulations for building maintenance and repairs applied in high-rise buildings</p> <p>2. Able to identify the making of columns, beams as planned, the installation of pre-cast walls for high-rise buildings, the making of concrete floor plates for high-rise buildings, the making of roofs for high-rise buildings, vertical transportation equipment to be used in high-rise buildings, electricity requirements in high-rise buildings, fire extinguisher requirements in high-rise buildings, clean water distribution systems requirements in high-rise buildings, sewage and used water systems for high-rise buildings, equipment and regulations for building maintenance and repairs used in high-rise buildings, implementation of building maintenance and repairs in high-rise buildings</p>
		LO4	Able to make engineering designs of multi-storey Buildings, which meet the construction standards and adopt the construction digitalization technology developments	1. Able to analyze sewage and used water system in high-rise buildings, building maintenance and repairs in high-rise buildings
Engineering Mechanics 5	TRG 503	LO2	Able to apply mathematics, natural science (physics) and engineering principles to design, implement and supervise multi-storey buildings.	1. Students are able to explain about deformation of structural elements & the basic theories of forces and stiffness methods

		LO4	Able to make engineering designs of multi-storey Buildings, which meet the construction standards and adopt the construction digitalization technology developments	1. Students are able to calculate a matrix operation; truss; determinate and indeterminate static beams; portals; as well as inclined footing portals
Statistics	TRG 504	LO2	Able to apply mathematics, natural science (physics) and engineering principles to design, implement and supervise multi-storey buildings.	1. To implement the concept of descriptive statistics and sampling techniques in the design and implementation of building construction 2. To implement data collection techniques in the design and implementation of building construction
		LO8	To be able to make Building test reports and quality control.	1. To implement the concept of classical assumption testing (prerequisites) in the design and implementation of building construction using software 2. To implement the concept of correlational and comparational analysis in the design and implementation of building construction using software 3. To implement the concept of descriptive, comparative, and associative hypothesis testing in the design and implementation of building construction using software
Steel Construction 2	TRG 505	LO2	Able to apply mathematics, natural science (physics) and engineering principles to design, implement and supervise multi-storey buildings.	1. Students are able to explain the concept of building structure design 2. Students are able to operate one of software for building structure analysis

		LO4	Able to make engineering designs of multi-storey Buildings, which meet the construction standards and adopt the construction digitalization technology developments	<ol style="list-style-type: none"> <li>1. Students are able to calculate the nominal bearing strength of floor deck; nominal bearing strength of composite beams; nominal bearing strength of axial bending and their application to the surrounding structure; nominal bearing strength of base plate; nominal bearing strength of welded joint</li> <li>2. Students are able to design the steel structure components in multi storey building and to design shop drawings both manually or using BIM (Building Information Modeling) for modeling and structure analysis</li> </ol>
Concrete Structure 2	TRG 506	LO2	Able to apply mathematics, natural science (physics) and engineering principles to design, implement and supervise multi-storey buildings.	<ol style="list-style-type: none"> <li>1. Be able to explain the types of columns and structural behaviors combined with axial loads in the design of building structural elements, the basic principles in designing reinforced concrete structures in column design, the basic principles in designing pile caps and footing foundation</li> </ol>
		LO4	Able to make engineering designs of multi-storey Buildings, which meet the construction standards and adopt the construction digitalization technology developments	<ol style="list-style-type: none"> <li>1. Able to design and make detailed reinforcement drawings for short and slender columns in accordance with SNI</li> <li>2. Able to design and make detailed reinforcement drawings for footing foundation and pile cap in accordance with SNI</li> <li>3. Able to make engineering design reports for column elements, pile cab, and footing foundation in building structures</li> </ol>
Foundation Engineering 2	TRG 507	LO3	To be able to identify and solve clearly-defined building construction problems, by analyzing data, using technical standards and guidelines, and able to choose the right solution method	<ol style="list-style-type: none"> <li>1. Students are able to explain the definitions, functions, types of shallow foundations (especially those related to building construction) and retaining walls</li> </ol>



		LO4	Able to make engineering designs of multi-storey Buildings, which meet the construction standards and adopt the construction digitalization technology developments	<ol style="list-style-type: none"> <li>1. Students are able to calculate the bearing capacity of shallow foundations using empirical methods (using Terzaghi, Meyerhoff, Brinch Hansen, and Vesic equations) and based on the results of SPT and sondir tests</li> <li>2. Students are able to plan shallow foundations and retaining walls and to control their stability</li> </ol>
Professional Ethics & Labor Laws	TRG 508	LO1	To have ability to be responsible, ethical, adaptable, cooperative and communicative in carrying out tasks.	<ol style="list-style-type: none"> <li>1. Able to explain about the definition of professional ethics, the use of ethics, profession and professionalism, ethics related to the use of engineering technology</li> <li>2. Able to explain copyright laws to avoid modes of cyber crimes</li> </ol>
		LO9	To be able to carry out, supervise and control the building construction process by taking into account health, public safety, environment (CSMS) aspects, legal and economic aspects	<ol style="list-style-type: none"> <li>1. Students are knowledgeable about construction industry employment applicable in Indonesia</li> <li>2. Students are expected to know and understand the concept of occupational safety and health and the application of occupational safety and health in the construction service industry</li> </ol>
Scaffolding Construction Work	TRG 509	LO9	To be able to carry out, supervise and control the building construction process by taking into account health, public safety, environment (CSMS) aspects, legal and economic aspects	<ol style="list-style-type: none"> <li>1. Students are able to explain the meaning of scaffolding work, the requirements of scaffolding work, the scope of scaffolding work, as well as the materials and tools for scaffolding work</li> <li>2. Students are able to calculate the material strength for scaffolding construction works in Building Construction Project</li> <li>3. Students are able to plan scaffolding works in Building Construction Project</li> <li>4. Students are able to perform scaffolding work in building construction projects, do assessment to ready-to use scaffolding, demolition and tidying-up Scaffolding</li> </ol>

				5. Students are able to present and report the results of scaffolding work practices
Pre-Cast Steel Construction Work	TRG 510	LO9	To be able to carry out, supervise and control the building construction process by taking into account health, public safety, environment (CSMS) aspects, legal and economic aspects	<ol style="list-style-type: none"> <li>1. Students are able to explain the concept of implementation and building structure design</li> <li>2. Students are able to operate one of software supporting building construction</li> <li>3. Students are able to calculate the lifting capacity of Foundation precast elements, Column precast elements, Beam precast elements, Floor precast elements</li> <li>4. Students are able to apply various types of building precast joints and connections, building structural components, and shop drawing design manually or using BIM (Building Information Modeling) for structural analysis modeling</li> </ol>

Semester 6

Course	Code	LO	Intended learning outcomes for the programme as a whole (competence profile/learning outcomes)	Corresponding module objectives/modules (operationalisation)
Structural Dynamics	TRG 601	LO2	Able to apply mathematics, natural science (physics) and engineering principles to design, implement and supervise multi-storey buildings.	<p>1. Students are able to explain the basic concepts of Structural Dynamics, structural response to dynamic loads, dynamic analysis to structures and degrees of freedom, single degree of freedom (SDOF) systems which include parameter modeling, mathematic modeling, free body diagrams and equations of motion of structure</p> <p>2. Students are able to explain free vibration of a SDOF system for harmonic motion for damped and undamped systems and viscous damped systems, SDOF for spatial form of excitation which includes viscous damped system response to ideal step input, undamped system response to rectangular pulses and loading ram, short duration impulse, impulse response unit, SDOF response to dynamic excitation using duhamel integral method, Spectrum Response</p>
		LO4	Able to make engineering designs of multi-storey Buildings, which meet the construction standards and adopt the construction digitalization technology developments	<p>1. Students are able to calculate systems with a single degree of freedom (SDOF) which include parameter modeling, mathematic modeling, free body diagrams and equations of motion of structure.</p> <p>2. Students are able to calculate DOF system for harmonic motion, SDOF for spatial form of excitation which includes of viscous damped systems for ideal step inputs for damped and undamped systems and viscous damped systems, SDOF response to dynamic excitation using duhamel integral method, Spectrum Response, MDOF system</p>

Engineering Economy	TRG 602	LO2	Able to apply mathematics, natural science (physics) and engineering principles to design, implement and supervise multi-storey buildings.	1. Students are able to explain about engineering economic theory, market mechanisms, production costs, time value of money
		LO7	To be able to make cost estimates with reference to technical drawings, technical specifications, able to arrange work implementation schedules.	1. Students are able to calculate a project investment value of and depreciation
Earthquake Proof Building Structures	TRG 603	LO2	Able to apply mathematics, natural science (physics) and engineering principles to design, implement and supervise multi-storey buildings.	1. Able to explain the concept & philosophy of earthquake proof buildings 2. Able to determine a structural system to be used in earthquake proof buildings 3. Be able to determine structural irregularities
		LO4	Able to make engineering designs of multi-storey Buildings, which meet the construction standards and adopt the construction digitalization technology developments	1. Able to calculate the design seismic load 2. Able to do detailing in buildings with a moment-bearing structural system
Entrepreneurship	TRG 604	LO1	To have ability to be responsible, ethical, adaptable, cooperative and communicative in carrying out tasks.	1. Students are able to explain the concept of entrepreneurship according to the scientific discipline development in a business plan 2. Students are able to identify business opportunities according to the characteristics and ethics of entrepreneurship in a business plan 3. Students are able to develop their creativity, innovation and business strategy according to their business plan 4. Students are able to conduct a business feasibility study in a business plan 5. Students are able to design marketing, business promotion and product selling skills according to their business plan

Prestressed and Precast Concrete Structures	TRG 605	LO2	Able to apply mathematics, natural science (physics) and engineering principles to design, implement and supervise multi-storey buildings.	1. Be able to explain about the stages in prestressed concrete beam construction, precast concrete systems in general, their advantages and disadvantages, the aspects related to precast concrete structure design and application, precast concrete construction methods.
		LO4	Able to make engineering designs of multi-storey Buildings, which meet the construction standards and adopt the construction digitalization technology developments	1. Able to design prestressed concrete beam structures and precast concrete structures.
Manajemen Konstruksi 3	TRG 606	LO1	To have ability to be responsible, ethical, adaptable, cooperative and communicative in carrying out tasks.	1. Students are able to identify Motivation & Leadership, Construction Project Organization, and Project Quality Design
		LO3	To be able to identify and solve clearly-defined building construction problems, by analyzing data, using technical standards and guidelines, and able to choose the right solution method	1. Students are able to describe Resource Management (Tools, Machines, Methods, Money, Materials)
		LO8	To be able to make Building test reports and quality control.	1. Students are able to compile Construction Project Report
		LO9	To be able to carry out, supervise and control the building construction process by taking into account health, public safety, environment (CSMS) aspects, legal and economic aspects	1. Students are able to explain about Project Preparation, Field Layout Design, Meetings & Negotiations 2. Students are able to explain about Construction Project Administration, Contract Change Order and Project Closing

Research Methodology	TRG 607	LO1	To have ability to be responsible, ethical, adaptable, cooperative and communicative in carrying out tasks.	<ol style="list-style-type: none"> <li>1. Students are able to choose a multi-storey Building research topic</li> <li>2. Students are able to formulate a research background, problems, objectives and benefits</li> </ol>
		LO2	Able to apply mathematics, natural science (physics) and engineering principles to design, implement and supervise multi-storey buildings.	<ol style="list-style-type: none"> <li>1. Students are able to use literature review as a literature study</li> </ol>
		LO3	To be able to identify and solve clearly-defined building construction problems, by analyzing data, using technical standards and guidelines, and able to choose the right solution method	<ol style="list-style-type: none"> <li>1. Students are able to make the schemes of research method</li> <li>2. Students are able to compile research proposals</li> </ol>
Special Topics	TRG 608	LO2	Able to apply mathematics, natural science (physics) and engineering principles to design, implement and supervise multi-storey buildings.	<ol style="list-style-type: none"> <li>1. Able to conduct building investigations</li> </ol>
		LO3	To be able to identify and solve clearly-defined building construction problems, by analyzing data, using technical standards and guidelines, and able to choose the right solution method	<ol style="list-style-type: none"> <li>1. Able to identify the steps in obtaining Certificate of Occupancy, in evaluating the existing buildings, types of destructive and non-destructive testing, structural strengthening methods</li> <li>2. Able to compile Certificate of Occupancy</li> <li>3. Able to operate nondestructive test tools</li> </ol>
		LO8	To be able to make Building test reports and quality control.	<ol style="list-style-type: none"> <li>1. Able to make recommendations on the buildings being evaluated</li> </ol>

Building Construction Project Design Work	TRG 609	LO2	Able to apply mathematics, natural science (physics) and engineering principles to design, implement and supervise multi-storey buildings.	1. Able to design building layout, longitudinal and transverse sections and the appearance of an 8-storey building designated for public
		LO3	To be able to identify and solve clearly-defined building construction problems, by analyzing data, using technical standards and guidelines, and able to choose the right solution method	1. Able to design superstructures on 8-storey buildings according to regulations 2. Able to design substructures on 8-storey buildings according to regulations
		LO4	Able to make engineering designs of multi-storey Buildings, which meet the construction standards and adopt the construction digitalization technology developments	1. Able to make detailed engineering design (DED) drawings of an 8-storey building structure according to the guidelines 2. Able to make an engineering design report for 8 floors building structure.