

Course: Earthquake Engineering (TS43002) / 4 credits

LEARNING OUTCOMES OF Earthquake Engineering :

1. Students understand the sources of earthquake, be able to define the magnitudes of earthquake, and familiar with the damages and deteriorations caused by seismic force (KU1, KU5).
2. Students are able to calculate the seismic design force and familiar with other requirements according to seismic design code (S2, P2, KK1, KK2).
3. Students understand the dynamic behavior of building and able to produce the dynamic analysis for design force calculation (P2, KK1).
4. Students can identify earthquake resisting force systems by analyzing their benefits as well as their drawbacks (P2, KK1, KK2).
5. Students are able to design an earthquake resistant building structure (S2, P2, KU1, KU5)

FINAL TERM EXAMINATION (WEEK 16)

[C1, C2, C3, C4, C5, C6, P2, A1, A2, A3, A4, A5] Students are able to design an earthquake resistant building structure (Week 12-15).

[C2, A1] Students can identify earthquake resisting force systems by analyzing their benefits as well as their drawbacks (Week ke 9-11).

MID TERM EXAMINATION (WEEK 8)

[C1, C2, C3, C4, C5, C6, P2, A1, A2, A3, A4, A5] Students understand the dynamic behavior of building and able to produce the dynamic analysis for design force calculation (Week 6-7).

[C1, C2, C3, C4, C5, C6, P2, A1, A2, A3, A4, A5] Students are able to calculate the seismic design force and familiar with other requirements according to seismic design code (Week 4-5).

[C1, C2, C5, A1, A2, A3] Students can identify the damages and deteriorations caused by seismic force (Week 2-3).

[C1, C2, C5, P2, A1, A2, A3] Students are able to define the magnitudes of earthquake (Week 1).



TARUMANAGARA UNIVERSITY
FACULTY OF ENGINEERING
DEPARTMENT OF CIVIL ENGINEERING (Undergraduate Program)

SEMESTERLY LECTURE PLAN

Course Name	Course Code	Credits	Semester	Date of Plan Preparation
Earthquake Engineering	TS43002	4	7	27 September 2019
Authorization	Course Leader	Structural Research Group Head	Head of Studi Progam	
	Ir. Hadi Pranata	Ir. Hadi Pranata	Dr. Widodo Kushartomo	
Learning Outcomes	Learning Outcomes of Studi Program Assigned to the Course			
	S2	Uphold the value of humanity in carrying out duties based on religion, morals, and ethics		
	P2	Understand the process of planning, design, analysis, implementation, supervision, operation, maintenance, repair / strengthening, and demolition of civil engineering buildings by considering aspects of safety, efficiency, and environment		
	KU1	Able to apply logical, critical, systematic and innovative thinking in the context of the development or implementation of science and technology that considers and applies humanities in accordance with their fields of expertise		
	KU5	Able to make appropriate decisions in the context of problem solving in their area of expertise, based on the results of information and data analysis		
	KK1	Able to identify all aspects of civil engineering building problems based on data and construction drawings, by mastering design principles, being able to provide guidance, and choosing various alternative solutions in the field of civil engineering.		
	KK2	Able to plan, design, analyze, implement, supervise, operate, maintain, repair / strengthen, and demolish civil engineering buildings by considering aspects of safety, efficiency, and the environment.		
	Course Learning Outcomes			
	CPMK1	Understand the causes and sources of earthquake, be able to define the magnitudes of earthquake, and familiar with the damages and deteriorations caused by seismic force (KU1, KU5).		
	CPMK2	Able to calculate the seismic design force and familiar with other requirements according to seismic design code (S2, P2, KK1, KK2).		
CPMK3	Understand the dynamic behavior of building and able to produce the dynamic analysis for design force calculation (P2, KK1).			
CPMK4	Able to identify earthquake resisting force systems by analyzing their benefits as well as their drawbacks (P2, KK1, KK2).			
CPMK5	Able to design an earthquake resistant building structure (S2, P2, KU1, KU5).			
Brief Description of the Course	In this course, students learn to produce an earthquake resistant building structure from reinforced concrete and steel structure.			

Course Material	<ol style="list-style-type: none"> 1. Background of seismicity, seismic sources, seismic waves, and seismic magnitudes 2. Influence of earthquake to the structure and its failure which may happen in elastic and ultimate manner. 3. Seismic Code 4. Static Equivalent seismic design force 5. Theory of vibration: understand the dynamic characteristics of structure. 6. Dynamic analysis: response spectrum analysis, response history analysis. 7. Earthquake resistant building design and capacity design concept 8. Introducing to seismic design concept for building structure including the seismic force resisting systems (Case study: steel structure building) 9. Explanation of seismic design of structural elements based on current standard code. 	
Reference	<ol style="list-style-type: none"> 1. Reinforced Concrete Mechanics and Design, third Edition 1997 James G. Mac Gregor 2. Reinforced Concrete Structures, Park, R. & T. Paulay 3. Seismic design of reinforced concrete and masonry buildings by T. Paulay & Mjn. Priestly 4. Seismic design of building structures by Micheal R Lindeburg.P.E & Majid Baradar P.E. 5. Perencanaan struktur beton bertulang tahan gempa by Prof Ir. Rachmat Purwono M.Sc. 6. Tata cara perencanaan ketahanan gempa untuk struktur bangunan gedung dan non gedung sni 1726-2012 7. Spesifikasi Untuk Bangunan Gedung Baja Struktural (SNI 1729:2015) 8. Seismic Design Manual 2nd Edition 9. Ductile Design of Steel Structures-Michel Bruneau Chia, Ming Uang, Rafael Sabelly 10. Ketentuan seismik untuk struktur baja bangunan gedung (ANSI/AISC 341-10) SNI 7860:2015 11. Sambungan Terprakualifikasi untuk Rangka Momen Khusus dan Menengah Baja pada Aplikasi Seismik (SNI 7972:2013)/AISC 358-10 	
Learning Media	Software:	Hardware :
	-	Laptop and LCD Projector
Course Lecturer	Ir. Hadi Pranata	
Pre-requisite courses:	TS 34631 Struktur Beton Bertulang (Reinforced Concrete Structure Design) TS 34651 Struktur Baja (Steel Structure Design) TS 43111 Dinamika Struktur (Structural Dynamics)	

Weeks	Final Learning Outcomes	Learning Material	Learning Format and Method	Time Estimation	Student Learning Experience	Assessment		
						Criteria and Format	Indicator	Portion (%)
(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)
1	Understand the sources of earthquake. Able to define the magnitudes of earthquake. [C1, C2, C5, P2, A1, A2, A3]	Background of earthquake, sources of earthquake, seismic waves, and seismic magnitude	<ul style="list-style-type: none"> Format: Lecture Method: Group discussion 	L: 4x50" SA: 60" IL: 60"	<ul style="list-style-type: none"> Make a summary about earthquake 	Criteria: Accuracy Non-test format: presentation	<ul style="list-style-type: none"> Accuracy in explaining general understanding about earthquake. 	5
2-3	Familiar with the damages and deteriorations caused by seismic force. [C1, C2, C5, A1, A2, A3]	Influence of earthquake to the structure and its failure which may happen in elastic and ultimate manner	<ul style="list-style-type: none"> Format: Lecture Method: Group discussion 	L: 2x(4x50") SA: 60" IL: 60"	<ul style="list-style-type: none"> Write a summary of impact from earthquake. 	Criteria: Accuracy Non-test format: presentation	<ul style="list-style-type: none"> Accuracy on the summary of impact from earthquake. 	5
4-5	Able to calculate the seismic design force and familiar with other requirements according to seismic design code. [C1, C2, C3, C4, C5, C6, P2, A1, A2, A3, A4, A5]	Seismic design code Seismic design magnitude using static equivalent method.	<ul style="list-style-type: none"> Format: Lecture Method: Group discussion and assignment 	L: 2x(4x50") SA: 60" IL: 60"	<ul style="list-style-type: none"> Determination on parameter criteria from the code Calculation of earthquake static force. Project 	Criteria: Accuracy and systematics Non-test format: presentation and assignment	<ul style="list-style-type: none"> Accuracy on implementing the code. Systematics in presenting a design report. 	10
6-7	Understand the dynamic behavior of building and able to produce the dynamic analysis	Theory of vibration Understand dynamic behavior of structure Dynamic analysis: response spectrum	<ul style="list-style-type: none"> Format: Lecture Method: 	L: 2x(4x50") SA: 60"	<ul style="list-style-type: none"> Write a summary of dynamic behavior of the building. Calculate a dynamic 	Criteria: Accuracy Non-test	<ul style="list-style-type: none"> Accuracy on implementing the code. Systematics in presenting a 	5

Weeks	Final Learning Outcomes	Learning Material	Learning Format and Method	Time Estimation	Student Learning Experience	Assessment		
						Criteria and Format	Indicator	Portion (%)
(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)
	for design force calculation. [C1, C2, C3, C4, C5, C6, P2, A1, A2, A3, A4, A5]	analysis and response history analysis	Group discussion and assignment	IL: 60"	force	format: presentation and assignment	design report	
8	Mid Term Examination							25
9-11	Able to identify earthquake resisting force systems by analyzing their benefits as well as their drawbacks [C2, A1]	Design Code/Standard <ul style="list-style-type: none"> • Discussion on seismic resistant design • Application on Special Moment Resisting Frame (SMRF) design for seismic resistant design 	<ul style="list-style-type: none"> • Format: Lecture • Method: Group discussion 	L: 3x(4x50") SA: 60" IL: 60"	<ul style="list-style-type: none"> • Write a summary of seismic force resisting system on steel structure including their benefits and drawbacks analysis 	Criteria: accuracy of analysis Non-test format: presentation and assignment	<ul style="list-style-type: none"> • Accuracy on implementing the code. 	10
12-15	Able to design an earthquake resistant building structure. [C1, C2, C3, C4, C5, C6, P2, A1, A2, A3, A4, A5]	<ul style="list-style-type: none"> • Seismic resistant design and capacity design concept • Introducing to SMRF connection (Prequalified type) 	<ul style="list-style-type: none"> • Format: Lecture • Method: Group discussion and assignment 	L: 4x(4x50") SA: 60" IL: 60"	<ul style="list-style-type: none"> • Detail design of earthquake resistant building structure 	Criteria: accuracy of analysis Non-test format: presentation and assignment	<ul style="list-style-type: none"> • Systematics in writing a design report 	15
16	Final Examination							25