



**Universitas Negeri Surabaya
Faculty of Engineering
Civil Engineering Undergraduate Study Program**

Document Code

SEMESTER LEARNING PLAN

Courses	CODE	Course Family	Credit Weight			SEMESTER	Compilation Date																																																																																			
Earthquake Engineering	2220102096	Compulsory Study Program Subjects	T=2	P=0	ECTS=3.18	4	August 22, 2022																																																																																			
AUTHORIZATION	SP Developer		Course Cluster Coordinator			Study Program Coordinator																																																																																				
	Drs. Andang Widjaja, S.T., M.T. ; Alwan Gangsar Brilian Putra, S.Tr.T., M.T. ; Yogie Risdianto, S.T., M.T. ; Mochamad Firmansyah Sofianto, S.T., M.Sc., M.T.		-			Yogie Risdianto, S.T., M.T.																																																																																				
Learning model	Case Studies																																																																																									
Program Learning Outcomes (PLO)	PLO study program that is charged to the course																																																																																									
	Program Objectives (PO)																																																																																									
	PO - 1	Students are able to design earthquake engineering in building structure planning.																																																																																								
	PO - 2	Students are able to apply earthquake engineering calculations in building structure planning.																																																																																								
	PO - 3	Students are able to calculate earthquake engineering in building structural planning.																																																																																								
	PLO-PO Matrix																																																																																									
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PO Matrix at the end of each learning stage (Sub-PO)																																																																																										
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Short Course Description	Introduction to earthquakes and their causes, the composition of the earth's layers and the theory of tectonic plates, the influence of earthquake forces on civil engineering buildings, calculating the center of mass and center of stiffness of buildings, earthquake forces acting on building structures, application of response spectrum in structural calculations with the help of software (software).) based on 1C Procedures for earthquake resistance planning for 1D building and non-building structures (SNI 1726:2012 and/or SNI 1726:2019)																																																																																									
References	Main :																																																																																									
	<ol style="list-style-type: none"> 1. Anonimous. 2012. Tatacara perencanaan ketahanan gempa untuk struktur bangunan gedung dan non gedung (SNI 1726:2012). Jakarta: Badan Standar Nasional 2. Andang Widjaja. 2010. Gempa. Surabaya: Jurusan Teknik Sipil FT UNESA 3. Himawan Indarto, Hanggoro Tri Cahyo A, Kukul C Adi Putra. 2013. Aplikasi SNI Gempa 1726 for Dummies. Semarang. 																																																																																									
	Supporters:																																																																																									

Supporting lecturer		Drs. Andang Widjaja, S.T., M.T. Yogie Risdianto, S.T., M.T. Irfan Prasetyo Loekito, S.T., M.Sc. Alwan Gangsar Brilian Putra, S.Tr.T., M.T.					
Week-	Final abilities of each learning stage (Sub-PO)	Evaluation		Help Learning, Learning methods, Student Assignments, [Estimated time]		Learning materials [References]	Assessment Weight (%)
		Indicator	Criteria & Form	Offline (offline)	Online (online)		
(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
1	Understanding earthquakes and their causes. The composition of the earth's crust and its formation	Able to explain the term earthquake, causes of earthquakes, tsunamis, and can mention the composition of the layers of the earth's crust, and the theory of earth plates	Form of Assessment : Participatory Activities	Lectures, discussions, questions and answers, and 2 X 50 assignments	Lectures, discussions, questions and answers, and assignments	<p>Material: earthquakes and their causes and the composition of the earth's crust and its formation. Reference: Anonymous. 2012. <i>Procedures for earthquake resistance planning for building and non-building structures (SNI 1726:2012)</i>. Jakarta: National Standards Agency</p> <p>Material: earthquakes and their causes and the composition of the earth's crust and its formation. Reader: Andang Widjaja. 2010. <i>Earthquake</i>. Surabaya: Civil Engineering Department, FT UNESA</p> <p>Material: earthquakes and their causes and the composition of the earth's crust and its formation. References: Himawan Indarto, Hanggoro Tri Cahyo A, Kuku C Adi Putra. 2013. <i>Application of SNI for the 1726 Earthquake for Dummies</i>. Semarang.</p>	2%

2	Understanding earthquakes and their causes. The composition of the earth's crust and its formation	Able to explain the term earthquake, causes of earthquakes, tsunamis, and can mention the composition of the layers of the earth's crust, and the theory of earth plates	Form of Assessment : Participatory Activities	Lectures, discussions, questions and answers, and 2 X 50 assignments	Lectures, discussions, questions and answers, and 2 X 50 assignments	<p>Material: Introduction and understanding of wood</p> <p>Reference: Anonymous. 2012. <i>Procedures for earthquake resistance planning for building and non-building structures (SNI 1726:2012)</i>. Jakarta: National Standards Agency</p> <hr/> <p>Material: The theory of the formation of the earth, the arrangement of the plates/crust of the earth, volcanoes, and Pangea Island.</p> <p>Reader: Andang Widjaja. 2010. <i>Earthquake</i>. Surabaya: Civil Engineering Department, FT UNESA</p> <hr/> <p>Material: The theory of the formation of the earth, the arrangement of the plates/crust of the earth, volcanoes, and Pangea Island.</p> <p>Reader: Andang Widjaja. 2010. <i>Earthquake</i>. Surabaya: Civil Engineering Department, FT UNESA</p>	7%
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3	Understanding earthquakes and their causes. The composition of the earth's crust and its formation	Able to explain the term earthquake, causes of earthquakes, tsunamis, and can mention the composition of the layers of the earth's crust, and the theory of earth plates	Criteria: Follow lectures carefully, take notes, ask questions and discuss during lectures	Lectures, discussions, questions and answers, and 2 X 50 assignments	Lectures, discussions, questions and answers, and 2 X 50 assignments	<p>Material: The theory of the formation of the earth, the arrangement of the earth's plates/crust, volcanoes, and the island of Pangea. Library: <i>Anonymous. 2012. Procedures for earthquake resistance planning for building and non-building structures (SNI 1726:2012). Jakarta: National Standards Agency</i></p> <hr/> <p>Material: The theory of the formation of the earth, the arrangement of the plates/crust of the earth, volcanoes, and Pangea Island. Reader: <i>Andang Widjaja. 2010. Earthquake. Surabaya: Civil Engineering Department, FT UNESA</i></p> <hr/> <p>Material: The theory of the earth's formation, the arrangement of the earth's plates/crust, volcanoes, and Pangea Island. Readers: <i>Himawan Indarto, Hanggoro Tri Cahyo A, Kukul C Adi Putra. 2013. Application of SNI for the 1726 Earthquake for Dummies. Semarang.</i></p>	2%
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4	Understand the effects of earthquakes on civil engineering buildings and the damage they cause. earthquake energy scale R and MMI conversion in buildings	Able to understand earthquake scale measurements and their effects on buildings	Form of Assessment : Participatory Activities	Lectures, discussions, questions and answers, and 2 X 50 assignments	Lectures, discussions, questions and answers, and assignments	<p>Material: the effect of earthquakes on civil engineering buildings and the damage they cause, the earthquake energy scale R and MMI conversion in buildings. Reference: Anonymous. 2012. <i>Procedures for earthquake resistance planning for building and non-building structures (SNI 1726:2012)</i>. Jakarta: National Standards Agency</p> <hr/> <p>Material: the effect of earthquakes on civil engineering buildings and the damage they cause, the earthquake energy scale R and MMI conversion on buildings. Library: Andang Widjaja. 2010. <i>Earthquake</i>. Surabaya: Civil Engineering Department, FT UNESA</p> <hr/> <p>Material: the effect of earthquakes on civil engineering buildings and the damage they cause, the earthquake energy scale R and MMI conversion in buildings. References: Himawan Indarto, Hanggoro Tri Cahyo A, Kukuh C Adi Putra. 2013. <i>Application of SNI for the 1726 Earthquake for Dummies</i>. Semarang.</p>	7%
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5	Understand the effects of earthquakes on civil engineering buildings and the damage they cause. earthquake energy scale R and MMI conversion in buildings	Able to understand earthquake scale measurements and their effects on buildings	<p>Criteria: Full marks, if the answer is accompanied by pictures and clear and correct narration.</p> <p>Form of Assessment : Participatory Activities</p>	Lectures, discussions, questions and answers, and 2 X 50 assignments	Lectures, discussions, questions and answers, and 2 X 50 assignments	<p>Material: the effect of earthquakes on civil engineering buildings and the damage they cause. R earthquake energy scale and MMI conversion in buildings</p> <p>Reference: <i>Anonymous. 2012. Procedures for earthquake resistance planning for building and non-building structures (SNI 1726:2012). Jakarta: National Standards Agency</i></p> <hr/> <p>Material: the effect of earthquakes on civil engineering buildings and the damage they cause. R earthquake energy scale and MMI conversion in buildings</p> <p>Library: <i>Andang Widjaja. 2010. Earthquake. Surabaya: Civil Engineering Department, FT UNESA</i></p> <hr/> <p>Material: the effect of earthquakes on civil engineering buildings and the damage they cause. R earthquake energy scale and MMI conversion in buildings</p> <p>Library: <i>Himawan Indarto, Hanggoro Tri Cahyo A, Kukuh C Adi Putra. 2013. Application of SNI for the 1726 Earthquake for Dummies. Semarang.</i></p>	3%
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6	Understand how earthquake recording and other data by BMKG works	Able to mention earthquake recording / how BMKG works	Form of Assessment : Participatory Activities	Lectures, discussions, questions and answers, and seeing the BMKG 2 X 50 equipment directly	Lectures, discussions, questions and answers, and seeing BMKG equipment directly	<p>Material: how to record earthquakes and other data by BMKG Library: <i>Andang Widjaja. 2010. Earthquake. Surabaya: Civil Engineering Department, FT UNESA</i></p> <p>Material: how to record earthquakes and other data by BMKG Library: <i>Himawan Indarto, Hanggoro Tri Cahyo A, Kukuh C Adi Putra. 2013. Application of SNI for the 1726 Earthquake for Dummies. Semarang.</i></p>	3%
7	Understand how earthquake recording and other data by BMKG works	Able to mention earthquake recording / how BMKG works	Form of Assessment : Participatory Activities	Lectures, discussions, questions and answers, and seeing the BMKG 2 X 50 equipment directly	Lectures, discussions, questions and answers, and seeing BMKG equipment directly	<p>Material: how to record earthquakes and other data by BMKG Library: <i>Andang Widjaja. 2010. Earthquake. Surabaya: Civil Engineering Department, FT UNESA</i></p> <p>Material: how to record earthquakes and other data by BMKG Library: <i>Himawan Indarto, Hanggoro Tri Cahyo A, Kukuh C Adi Putra. 2013. Application of SNI for the 1726 Earthquake for Dummies. Semarang.</i></p>	8%
8	Understand how earthquake recording and other data by BMKG works	Able to mention earthquake recording / how BMKG works	<p>Criteria: Full marks, if the answer is accompanied by pictures and clear and correct narration</p> <p>Form of Assessment : Test</p>	Midterm Exam 2 X 50	Midterm Exam 2 X 50		20%

9	Understand the calculation of the center of mass and stiffness of buildings	Determining the dimensions of column beam plates, calculating building loads, determining center of gravity, calculating static moments Calculating the center of mass of each floor of the entire building Calculating the center of stiffness of columns for each floor of the entire building	Form of Assessment : Participatory Activities	Lectures, discussions, questions and answers, assignments 2 X 50	Lectures, discussions, questions and answers, assignments	<p>Material: calculation of center of mass and stiffness of buildings. Reference: Anonymous. 2012. <i>Procedures for earthquake resistance planning for building and non-building structures (SNI 1726:2012)</i>. Jakarta: National Standards Agency</p> <hr/> <p>Material: calculation of center of mass and stiffness of buildings Reader: Andang Widjaja. 2010. <i>Earthquake</i>. Surabaya: Civil Engineering Department, FT UNESA</p> <hr/> <p>Material: calculation of center of mass and stiffness of buildings References: Himawan Indarto, Hanggoro Tri Cahyo A, Kukuh C Adi Putra. 2013. <i>Application of SNI for the 1726 Earthquake for Dummies</i>. Semarang.</p>	2%
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10	Understand the calculation of the center of mass and stiffness of buildings	Determining the dimensions of column beam plates, calculating building loads, determining center of gravity, calculating static moments Calculating the center of mass of each floor of the entire building Calculating the center of stiffness of columns for each floor of the entire building	Form of Assessment : Participatory Activities	Lectures, discussions, questions and answers, assignments 2 X 50	Lectures, discussions, questions and answers, assignments	<p>Material: calculation of center of mass and stiffness of buildings. Reference: Anonymous. 2012. <i>Procedures for earthquake resistance planning for building and non-building structures (SNI 1726:2012)</i>. Jakarta: National Standards Agency</p> <hr/> <p>Material: calculation of center of mass and stiffness of buildings Reader: Andang Widjaja. 2010. <i>Earthquake</i>. Surabaya: Civil Engineering Department, FT UNESA</p> <hr/> <p>Material: calculation of center of mass and stiffness of buildings References: Himawan Indarto, Hanggoro Tri Cahyo A, Kukuh C Adi Putra. 2013. <i>Application of SNI for the 1726 Earthquake for Dummies</i>. Semarang.</p>	7%
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11	Understand the calculation of the center of mass and stiffness of buildings	Determining the dimensions of column beam plates, calculating building loads, determining center of gravity, calculating static moments Calculating the center of mass of each floor of the entire building Calculating the center of stiffness of columns for each floor of the entire building	Form of Assessment : Participatory Activities	Lectures, discussions, questions and answers, assignments 2 X 50	Lectures, discussions, questions and answers, assignments	<p>Material: calculation of center of mass and stiffness of buildings. Reference: Anonymous. 2012. <i>Procedures for earthquake resistance planning for building and non-building structures (SNI 1726:2012)</i>. Jakarta: National Standards Agency</p> <hr/> <p>Material: calculation of center of mass and stiffness of buildings Reader: Andang Widjaja. 2010. <i>Earthquake</i>. Surabaya: Civil Engineering Department, FT UNESA</p> <hr/> <p>Material: calculation of center of mass and stiffness of buildings References: Himawan Indarto, Hanggoro Tri Cahyo A, Kukuh C Adi Putra. 2013. <i>Application of SNI for the 1726 Earthquake for Dummies</i>. Semarang.</p>	2%
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12	Understand and calculate or apply factors that influence earthquakes, calculate spectrum responses	Able to state the earthquake formula. Describe the earthquake formula and apply it by calculating according to the guidelines	Form of Assessment : Participatory Activities	Lectures, discussions, questions and answers, and 2 X 50 assignments	Lectures, discussions, questions and answers, and assignments	<p>Material: factors that influence earthquakes, calculating spectrum responses. Reference: Anonymous. 2012. <i>Procedures for earthquake resistance planning for building and non-building structures (SNI 1726:2012)</i>. Jakarta: National Standards Agency</p> <hr/> <p>Material: factors influencing earthquakes, calculating the spectrum response Reader: Andang Widjaja. 2010. <i>Earthquake</i>. Surabaya: Civil Engineering Department, FT UNESA</p> <hr/> <p>Material: factors influencing earthquakes, calculating the spectrum response References: Himawan Indarto, Hanggoro Tri Cahyo A, Kukuh C Adi Putra. 2013. <i>Application of SNI for the 1726 Earthquake for Dummies</i>. Semarang.</p>	7%
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13	Understand and calculate or apply factors that influence earthquakes, calculate spectrum responses	Be able to state the earthquake formula. Describe the earthquake formula and apply it by calculating according to the guidelines	Criteria: Full marks, if the answer is accompanied by pictures and clear and correct narration	Lectures, discussions, questions and answers, and 2 X 50 assignments	Lectures, discussions, questions and answers, and 2 X 50 assignments	<p>Material: factors that influence earthquakes, calculating spectrum responses. Reference: <i>Anonymous. 2012. Procedures for earthquake resistance planning for building and non-building structures (SNI 1726:2012). Jakarta: National Standards Agency</i></p> <hr/> <p>Material: factors influencing earthquakes, calculating the spectrum response Reader: <i>Andang Widjaja. 2010. Earthquake. Surabaya: Civil Engineering Department, FT UNESA</i></p> <hr/> <p>Material: factors influencing earthquakes, calculating the spectrum response References: <i>Himawan Indarto, Hanggoro Tri Cahyo A, Kukuh C Adi Putra. 2013. Application of SNI for the 1726 Earthquake for Dummies. Semarang.</i></p>	2%
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14	Applying earthquake calculations into building structure calculations with the help of software programs	Able to calculate building loads: dead and alive according to SNI 1726-2013 Calculating shear force, dividing shear force to each floor, dividing shear force to each portal, Applying spectrum response into earthquake calculations with software	Form of Assessment : Participatory Activities	Lectures, discussions, questions and answers, and 2 X 50 assignments	Lectures, discussions, questions and answers, and 2 X 50 assignments	<p>Material: earthquake calculations in building structure calculations with the help of software</p> <p>library: <i>Anonymous. 2012. Procedures for earthquake resistance planning for building and non-building structures (SNI 1726:2012). Jakarta: National Standards Agency</i></p> <hr/> <p>Material: earthquake calculations in building structure calculations with the help of the</p> <p>Pustaka software program: <i>Andang Widjaja. 2010. Earthquake. Surabaya: Civil Engineering Department, FT UNESA</i></p> <hr/> <p>Material: earthquake calculations in building structure calculations with the help of soft programs.</p> <p>Reader: <i>Himawan Indarto, Hanggoro Tri Cahyo A, Kukuh C Adi Putra. 2013. Application of SNI for the 1726 Earthquake for Dummies. Semarang.</i></p>	2%
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15	Applying earthquake calculations into building structure calculations with the help of software programs	Able to calculate building loads: dead and alive according to SNI 1726-2013 Calculating shear force, dividing shear force to each floor, dividing shear force to each portal, Applying spectrum response into earthquake calculations with software	Criteria: Full marks, if the answer is accompanied by pictures and clear and correct narration	Lectures, discussions, questions and answers, and 2 X 50 assignments	Lectures, discussions, questions and answers, and 2 X 50 assignments	<p>Material: earthquake calculations in building structure calculations with the help of software</p> <p>library: <i>Anonymous. 2012. Procedures for earthquake resistance planning for building and non-building structures (SNI 1726:2012). Jakarta: National Standards Agency</i></p> <hr/> <p>Material: earthquake calculations in building structure calculations with the help of the</p> <p>Pustaka software program: <i>Andang Widjaja. 2010. Earthquake. Surabaya: Civil Engineering Department, FT UNESA</i></p> <hr/> <p>Material: earthquake calculations in building structure calculations with the help of soft programs.</p> <p>Reader: <i>Himawan Indarto, Hanggoro Tri Cahyo A, Kukuh C Adi Putra. 2013. Application of SNI for the 1726 Earthquake for Dummies. Semarang.</i></p>	8%
16		Solve UAS questions correctly and precisely	<p>Criteria: Full marks are obtained if you do all the questions correctly and correctly</p> <p>Form of Assessment : Test</p>	Final Exam Semester 2 x 50	Final Exam Semester 2 x 50		30%

Evaluation Percentage Recap: Case Study

No	Evaluation	Percentage
1.	Participatory Activities	50%
2.	Test	50%
		100%

Notes

1. **Learning Outcomes of Study Program Graduates (PLO - Study Program)** are the abilities possessed by each Study Program graduate which are the internalization of attitudes, mastery of knowledge and skills according to the level of their study program obtained through the learning process.
2. **The PLO imposed on courses** are several learning outcomes of study program graduates (CPL-Study Program) which are used for the formation/development of a course consisting of aspects of attitude, general skills, special skills and knowledge.
3. **Program Objectives (PO)** are abilities that are specifically described from the PLO assigned to a course, and are specific to the study material or learning materials for that course.
4. **Subject Sub-PO (Sub-PO)** is a capability that is specifically described from the PO that can be measured or observed and is the final ability that is planned at each learning stage, and is specific to the learning material of the course.
5. **Indicators for assessing** abilities in the process and student learning outcomes are specific and measurable statements that identify the abilities or performance of student learning outcomes accompanied by evidence.
6. **Assessment Criteria** are benchmarks used as a measure or measure of learning achievement in assessments based on predetermined indicators. Assessment criteria are guidelines for assessors so that assessments are consistent and unbiased. Criteria can be quantitative or qualitative.
7. **Forms of assessment:** test and non-test.
8. **Forms of learning:** Lecture, Response, Tutorial, Seminar or equivalent, Practicum, Studio Practice, Workshop Practice, Field Practice, Research, Community Service and/or other equivalent forms of learning.
9. **Learning Methods:** Small Group Discussion, Role-Play & Simulation, Discovery Learning, Self-Directed Learning, Cooperative Learning, Collaborative Learning, Contextual Learning, Project Based Learning, and other equivalent methods.
10. **Learning materials** are details or descriptions of study materials which can be presented in the form of several main points and sub-topics.
11. **The assessment weight** is the percentage of assessment of each sub-PO achievement whose size is proportional to the level of difficulty of achieving that sub-PO, and the total is 100%.
12. TM=Face to face, PT=Structured assignments, BM=Independent study.