	Universitas Negeri Surabaya **Faculty of Engineering,** **Building Engineering Education Undergraduate Study Program**	**Document Code**

SEMESTER LEARNING PLAN

Courses	CODE	Course Family	Credit Weight	SEMESTER	Compilation Date
Earthquake Engineering	8320502194	Structure	T=2 P=0 ECTS=3.18	3	August 11, 2022

AUTHORIZATION	SP Developer	Course Cluster Coordinator	Study Program Coordinator
	Mochamad Firmansyah Sofianto, S.T., M.Sc., M.T. ; Drs. Andang Widjaja, S.T., M.T.	-	Dr. Gde Agus Yudha Prawira Adistana, S.T., M.T.

Learning model: Project Based Learning

Program Learning Outcomes (PLO)

PLO study program which is charged to the course

Program Objectives (PO)

PO - 1	Students are able to explain and design building structures based on wood materials and the connections in wooden structures
PO - 2	Students are able to describe and explain in the form of reports and drawings the structure of buildings and connections with wooden materials
PO - 3	Students are able to evaluate designs and drawings on building structures made from wood and their connections

PLO-PO Matrix

P.O
PO-1
PO-2
PO-3

PO Matrix at the end of each learning stage (Sub-PO)

P.O	Week															
	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16
PO-1																
PO-2																
PO-3																

Short Course Description: Students are able to understand the causes of earthquakes, introduction to earthquakes and their causes, the composition of the layers of the earth and the theory of tectonic plates, the influence of earthquake forces on civil engineering buildings, calculation of the center of mass and center of stiffness of buildings, earthquake forces acting on building structures, application of response spectrum in calculations structure with the help of software. Procedures for earthquake resistance planning for 1D building and non-building structures (SNI 1726:2012). as well as the impact on civil buildings. Apart from that, it can apply earthquakes in planning building structure calculations.

References

Main :

1. .Himawan Indarto, Hanggoro Tri Cahyo, A, Kukuh C. Adi Putra, 2013, Aplikasi SNI Gempa 1726-2012 for Dummies, Semarang, http://filebambangdewasa.wordpress.com
2. SNI 1726:2012 - Tata cara perencanaan ketahanan gempa untuk struktur bangunan gedung dan non gedung
3. Andang Widjaja, 2010, Gempa, Surabaya: Jurusan Teknik Sipil FT UNESA
4. Himawan Indarto, Hanggoro Tri Cahyo, A, Kukuh C. Adi Putra, 2013
5. SNI 1726-2019 Persyaratan Gempa Struktural dan Non struktural Untuk Bangunan Gedung

Supporters:

Supporting lecturer: Drs. Andang Widjaja, S.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 Understanding the structure 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 **Forms of Assessment** : Participatory Activities, Project Results Assessment / Product Assessment	Lectures, discussions, questions and answers, and assignments 2 X 50	Lectures, discussions, questions and answers, and 2 X 50 Project Based Learning assignments	**Material:** The theory of the earth's formation, the arrangement of the earth's plates/crust, volcanoes, and Pangea Island. **Reference:** *Himawan Indarto, Hanggoro Tri Cahyo, A, Kukuh C. Adi Putra, 2013, Application of SNI Earthquake 1726-2012 for Dummies, Semarang, http ://filebambangdewasa.wordpress.com/...* **Material:** The theory of the earth's formation, the arrangement of the earth's plates/crust, volcanoes, and Pangea Island. **Reference:** *Andang Widjaja, 2010, Earthquake, Surabaya: Department of Civil Engineering, FT UNESA*	20%
2	Understanding earthquakes and their causes Understanding the structure 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:** The maximum score of 100 or 4 is obtained if you do all the questions correctly **Form of Assessment** : Participatory Activities	Lectures, discussions, questions and answers, and assignments 2 X 50	Lectures, discussions, questions and answers, and assignments 2 X 50	**Material:** The theory of the earth's formation, the arrangement of the earth's plates/crust, volcanoes, and Pangea Island. **Reference:** *Andang Widjaja, 2010, Earthquake, Surabaya: Department of Civil Engineering, FT UNESA* **Material:** The theory of the earth's formation, the arrangement of the earth's plates/crust, volcanoes, and Pangea Island. **References:** *Himawan Indarto, Hanggoro Tri Cahyo, A, Kukuh C. Adi Putra, 2013*	7%
3	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	**Criteria:** Follow lectures carefully, take notes, ask questions and discuss during lectures	Lectures, discussions, questions and answers, and assignments 2 X 50	Lectures, discussions, questions and answers, and assignments 2 X 50	**Material:** The theory of the earth's formation, the arrangement of the earth's plates/crust, volcanoes, and Pangea Island. **Reference:** *Andang Widjaja, 2010, Earthquake, Surabaya: Department of Civil Engineering, FT UNESA* **Material:** The theory of the earth's formation, the arrangement of the earth's plates/crust, volcanoes, and Pangea Island. **References:** *Himawan Indarto, Hanggoro Tri Cahyo, A, Kukuh C. Adi Putra, 2013*	1%
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	**Criteria:** The maximum score of 100 or 4 is obtained if you do all the questions correctly **Form of Assessment** : Participatory Activities, Tests	Lectures, discussions, questions and answers, and assignments 2 X 50	Lectures, discussions, questions and answers, and assignments 2 X 50	**Material:** Types of earthquake damage in civil engineering buildings. Earthquake energy scale and conversion to the MMI scale in buildings. **Reference:** *Andang Widjaja, 2010, Earthquake, Surabaya: Department of Civil Engineering, FT UNESA* **Material:** Types of earthquake damage in civil engineering buildings Earthquake energy scale and conversion to the MMI scale in buildings **References:** *Himawan Indarto, Hanggoro Tri Cahyo, A, Kukuh C. Adi Putra, 2013* **Material:** Types of earthquake damage in civil engineering buildings Earthquake energy scale and conversion to the MMI scale in buildings **Reference:** *SNI 1726-2019 Structural and Non-structural Earthquake Requirements for Buildings*	7%
5	Understand how earthquake recording and other data at BMKG works	Able to mention earthquake recording / how BMKG works	**Criteria:** Follow lectures carefully, take notes, ask questions and discuss during lectures **Form of Assessment** : Participatory Activities	Lectures, discussions, questions and answers, and seeing the equipment directly at BMKG Tretes Pandaan 2 X 50	Lectures, discussions, questions and answers, and seeing the equipment directly at BMKG Tretes Pandaan 2 X 50	**Material:** Types of earthquake damage in civil engineering buildings. Earthquake energy scale and conversion to the MMI scale in buildings. **Reference:** *Himawan Indarto, Hanggoro Tri Cahyo, A, Kukuh C. Adi Putra, 2013, Application of SNI Earthquake 1726-2012 for Dummies, Semarang , http://filebambangdewasa.wordpress.com/...* **Material:** Types of damage caused by earthquakes in civil engineering buildings. Earthquake energy scale and conversion to the MMI scale in buildings. **Reference:** *Andang Widjaja, 2010, Earthquake, Surabaya: Department of Civil Engineering, FT UNESA* **Material:** Types of earthquake damage in civil engineering buildings Earthquake energy scale and conversion to the MMI scale in buildings **Reference:** *SNI 1726-2019 Structural and Non-structural Earthquake Requirements for Buildings*	2%
6	Understand how earthquake recording and other data at BMKG works	Able to mention earthquake recording / how BMKG works	**Criteria:** Follow lectures carefully, take notes, ask questions and discuss during lectures	Lectures, discussions, questions and answers, and seeing the equipment directly at BMKG Tretes Pandaan 2 X 50	Lectures, discussions, questions and answers, and seeing the equipment directly at BMKG Tretes Pandaan 2 X 50	**Material:** Earthquake recording methods **Reference:** *Andang Widjaja, 2010, Earthquake, Surabaya: Department of Civil Engineering, FT UNESA* **Material:** Earthquake Recording Methods **Literature:** *Himawan Indarto, Hanggoro Tri Cahyo, A, Kukuh C. Adi Putra, 2013, Application of SNI Earthquake 1726-2012 for Dummies, Semarang, http://filebambangdewasa.wordpress.com/...*	2%

7	Understand how earthquake recording and other data at BMKG works	Able to mention earthquake recording / how BMKG works	**Criteria:** The maximum score of 100 or 4 is obtained if you do all the questions correctly **Form of Assessment** : Participatory Activities, Tests	Lectures, discussions, questions and answers, and seeing the equipment directly at BMKG Tretes Pandaan 2 X 50	Lectures, discussions, questions and answers, and seeing the equipment directly at BMKG Tretes Pandaan 2 X 50	**Material:** Earthquake load calculations **References:** *Himawan Indarto, Hanggoro Tri Cahyo, A, Kukuh C. Adi Putra, 2013, Application of SNI Earthquake 1726-2012 for Dummies, Semarang, http://filebambangdewasa.wordpress.com/...* **Material:** Calculation of earthquake loads **Reference:** *SNI 1726-2019 Structural and Non-structural Earthquake Requirements for Buildings*	8%
8	Midterm exam	Do all the questions on UTS\	**Criteria:** The maximum score of 100 or 4 is obtained if you do all the questions correctly	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 for each 13th floor of the entire building Calculating the center of stiffness of columns for each 13th floor of the entire building	**Criteria:** The maximum score of 100 or 4 is obtained if you do all the questions correctly **Form of Assessment** : Participatory Activities	lecture, discussion, question and answer, assignment 2 X 50	lecture, discussion, question and answer, assignment 2 X 50	**Material:** Calculation of dead weight of buildings Calculation of column stiffness on each floor or level up to the entire building **Reference:** *Andang Widjaja, 2010, Gempa, Surabaya: Department of Civil Engineering, FT UNESA* **Material:** Calculation of dead weight of buildings Calculation of column stiffness on each floor or level up to the entire building **References:** *Himawan Indarto, Hanggoro Tri Cahyo, A, Kukuh C. Adi Putra, 2013* **Material:** Calculation of building dead weight Calculation of column stiffness on each floor or level up to the entire building **Reference:** *SNI 1726-2019 Structural and Non-structural Earthquake Requirements for Buildings*	1%
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 for each 13th floor of the entire building Calculating the center of stiffness of columns for each 13th floor of the entire building	**Criteria:** The maximum score of 100 or 4 is obtained if you do all the questions correctly **Form of Assessment** : Participatory Activities	lecture, discussion, question and answer, assignment 2 X 50	lecture, discussion, question and answer, assignment 2 X 50	**Material:** Calculation of dead weight of buildings Calculation of column stiffness on each floor or level up to the entire building **Reference:** *Andang Widjaja, 2010, Gempa, Surabaya: Department of Civil Engineering, FT UNESA* **Material:** Calculation of dead weight of buildings Calculation of column stiffness on each floor or level up to the entire building **References:** *Himawan Indarto, Hanggoro Tri Cahyo, A, Kukuh C. Adi Putra, 2013* **Material:** Calculation of building dead weight Calculation of column stiffness on each floor or level up to the entire building **Reference:** *SNI 1726-2019 Structural and Non-structural Earthquake Requirements for Buildings*	7%
11	Understand and calculate or apply factors that influence earthquakes, calculate response spectrum	Able to state the earthquake formula. Describe the earthquake formula and apply it by calculating according to the guidelines	**Criteria:** Follow lectures carefully, take notes, ask questions and discuss during lectures **Form of Assessment** : Participatory Activities	Lectures, discussions, questions and answers, and assignments 2 X 50	Lectures, discussions, questions and answers, and assignments 2 X 50	**Material:** Calculation of dead weight of buildings Calculation of column stiffness on each floor or level up to the entire building **Reference:** *Andang Widjaja, 2010, Gempa, Surabaya: Department of Civil Engineering, FT UNESA* **Material:** Calculation of dead weight of buildings Calculation of column stiffness on each floor or level up to the entire building **References:** *Himawan Indarto, Hanggoro Tri Cahyo, A, Kukuh C. Adi Putra, 2013* **Material:** Calculation of building dead weight Calculation of column stiffness on each floor or level up to the entire building **Reference:** *SNI 1726-2019 Structural and Non-structural Earthquake Requirements for Buildings*	7%
12	Understand and calculate or apply factors that influence earthquakes, calculate response spectrum	Able to state the earthquake formula. Describe the earthquake formula and apply it by calculating according to the guidelines	**Criteria:** A maximum score of 100 or 4 is obtained if you do the assignment correctly **Form of Assessment** : Participatory Activities	Lectures, discussions, questions and answers, and assignments 2 X 50	Lectures, discussions, questions and answers, and assignments 2 X 50	**Material:** SNI 1726-2012, Indonesia-SNI loading regulations and Earthquake book **Library:** *SNI 1726:2012 - Procedures for earthquake resistance planning for building and non-building structures* **Material:** SNI 1726-2012, Indonesia-SNI loading regulations and Earthquake book **Library:** *SNI 1726-2019 Structural and Non-structural Earthquake Requirements for Buildings*	7%

13	Understand and calculate or apply factors that influence earthquakes, calculate response spectrum	Able to state the earthquake formula. Describe the earthquake formula and apply it by calculating according to the guidelines	**Criteria:** Follow lectures carefully, take notes, ask questions and discuss during lectures **Form of Assessment** : Participatory Activities	Lectures, discussions, questions and answers, and assignments 2 X 50	Lectures, discussions, questions and answers, and assignments 2 X 50	**Material:** SNI 1726-2012, Indonesia-SNI loading regulations and Earthquake book **Library:** *SNI 1726:2012 - Procedures for earthquake resistance planning for building and non-building structures* **Material:** SNI 1726-2012, Indonesia-SNI loading regulations and Earthquake book **Library:** *SNI 1726-2019 Structural and Non-structural Earthquake Requirements for Buildings*	2%
14	Applying earthquake calculations into building structure calculations with the help of software programs	Able to state the earthquake formula. Describe the earthquake formula and apply it by calculating according to the guidelines. Able to calculate building loads: life and death according to SNI 1726-2013. Calculate shear force, divide shear force into each floor, divide shear force into each portal. Apply spectrum response into earthquake calculations. with software	**Criteria:** The maximum score of 100 or 4 is obtained if you do all the questions correctly **Form of Assessment** : Participatory Activities	Lectures, discussions, questions and answers, and assignments 2 X 50	Lectures, discussions, questions and answers, and assignments 2 X 50	**Material:** SNI 1726-2012, Indonesian-SNI loading regulations and Earthquake book: earthquake formula, division of earthquake zones or areas, earthquake intensity **Reference:** *SNI 1726:2012 - Procedures for earthquake resistance planning for building and non-building structures* **Material:** SNI 1726-2012, Indonesia-SNI loading regulations and Earthquake book: earthquake formula, division of earthquake zones or areas, earthquake intensity **Reference:** *SNI 1726-2019 Structural and Non-structural Earthquake Requirements for Buildings*	2%
15	Applying earthquake calculations into building structure calculations with the help of software programs	Able to state the earthquake formula, describe the earthquake formula and apply it by calculating according to the guidelines, able to calculate building loads: dead and alive according to SNI 1726-2013, calculate shear force, divide shear force to each floor, divide shear force to each portal, Apply spectrum response into earthquake calculations with software	**Criteria:** The maximum score of 100 or 4 is obtained if you do all the questions correctly **Form of Assessment** : Participatory Activities, Tests	Lectures, discussions, questions and answers, and assignments 2 X 50	Lectures, discussions, questions and answers, and assignments 2 X 50	**Material:** SNI 1726-2012, Indonesian-SNI loading regulations and Earthquake book: earthquake formula, division of earthquake zones or areas, earthquake intensity **Reference:** *Andang Widjaja, 2010, Earthquake, Surabaya: Department of Civil Engineering, FT UNESA* **Material:** SNI 1726-2012, Indonesia-SNI loading regulations and Earthquake book: earthquake formula, division of earthquake zones or areas, earthquake intensity **Reference:** *SNI 1726-2019 Structural and Non-structural Earthquake Requirements for Buildings*	8%
16	1. Able to explain the concept of dynamic load calculations based on soil data at a location 2. Be able to explain the system for resisting earthquake lateral forces 3. Able to calculate distributed lateral forces			Final Exam Semester 2 x 50	Final Exam Semester 2 x 50		30%

Evaluation Percentage Recap: Project Based Learning

No	Evaluation	Percentage
1.	Participatory Activities	56.5%
2.	Project Results Assessment / Product Assessment	10%
3.	Test	11.5%
		78%

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.