	Universitas Negeri Surabaya Faculty of Engineering, Electrical Engineering Undergraduate Study Program	Document Code

SEMESTER LEARNING PLAN

Courses	CODE	Course Family	Credit Weight			SEMESTER	Compilation Date
Stochastic Processes	2020103152	Compulsory Study Program Subjects	T=3	P=0	ECTS=4.77	7	July 17, 2024

AUTHORIZATION	SP Developer	Course Cluster Coordinator	Study Program Coordinator
	Dr. Lilik Anifah, S.T., M.T.	....	Dr. Lusia Rakhmawati, S.T., M.T.

Learning model	**Case Studies**
Program Learning Outcomes (PLO)	**PLO study program which is charged to the course**
	Program Objectives (PO)
	PLO-PO Matrix
	P.O
	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

Short Course Description	Complete calculations involving probability, conditional probability expected value, conditional expected value.
References	**Main :** 1. Leon Garcia, Alberto, Probability and Random Processes for Electical Engineering 2. Seldon, M. Ross, Introduction to Probability Models, 2nd edition, Academic Press, Inc., 1980 **Supporters:**
Supporting lecturer	Prof.Dr. Tri Wrahatnolo, M.Pd., M.T. Dr. Raden Roro Hapsari Peni Agustin Tjahyaningtijas, S.Si., M.T. Dr. Lilik Anifah, 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	Able to explain stochastic processes to model dynamic relationships between random events in various fields of science.	1. Review random variable material 2. Describe opportunities appropriately	**Criteria:** 1. The assessment criteria are carried out by looking at aspects: 2. 1. Participation: carried out by observing student activities (weight 2) 3. 2. UTS: carried out with an assessment during the middle of the semester (weight 2) 4. 3. UAS: carried out every semester to measure all indicators (weight 3) 5. 4. Task: carried out on each indicator (weight 3) **Form of Assessment** : Participatory Activities	lecture, discussion 3 X 50		**Material:** Stochastic processes for modeling dynamic relationships between random events. **Reference:** *Leon Garcia, Alberto, Probability and Random Processes for Electrical Engineering*	6%
2	Able to explain terminology and use conditional expectations and opportunities	- Able to explain stochastic material about expectations - Able to explain stochastic material about conditional opportunities	**Criteria:** 1. The assessment criteria are carried out by looking at aspects: 2. 1. Participation: carried out by observing student activities (weight 2) 3. 2. UTS: carried out with an assessment during the middle of the semester (weight 2) 4. 3. UAS: carried out every semester to measure all indicators (weight 3) 5. 4. Task: carried out on each indicator (weight 3) **Form of Assessment** : Participatory Activities	lectures and discussions 3 X 50		**Material:** Expectations **References:** *Leon Garcia, Alberto, Probability and Random Processes for Electical Engineering*	0%

3	Able to explain the terminology and definitions of classification and examples of stochastic processes	- Explain the definition of the classification section and its application to stochastic processes	**Criteria:** 1. 1. Participation: carried out by observing student activities (weight 2) 2. 2. UTS: carried out with an assessment during the middle of the semester (weight 2) 3. 3. UAS: carried out every semester to measure all indicators (weight 3) 4. 4. Task: carried out on each indicator (weight 3) 5. Student Final Grade: 6. Participation Score (2) x Lever Score (3) x UTS Score (2) x UAS Score (3) divided by 10. **Form of Assessment** : Participatory Activities	lectures and discussions 3 X 50		**Material:** Terminology and definitions of classification and examples of stochastic processes **References:** *Leon Garcia, Alberto, Probability and Random Processes for Electical Engineering*	7%
4	Able to explain terminology and use the Poisson process in inter-arrival times, waiting times and queuing theory	Understand and explain the terminology and use of the Poisson process in inter-arrival times, waiting times and queuing theory	**Criteria:** 1. The assessment criteria are carried out by looking at aspects: 2. 1. Participation: carried out by observing student activities (weight 2) 3. 2. UTS: carried out with an assessment during the middle of the semester (weight 2) 4. 3. UAS: carried out every semester to measure all indicators (weight 3) 5. 4. Task: carried out on each indicator (weight 3) 6. Student Final Grade: 7. Participation Score (2) x Lever Score (3) x UTS Score (2) x UAS Score (3) divided by 10. **Form of Assessment** : Participatory Activities	lectures and discussions 3 X 50		**Material:** Terminology and using the Poisson process **References:** *Leon Garcia, Alberto, Probability and Random Processes for Electical Engineering*	6%

5	Be able to explain discrete Markov chains about the definition and examples of discrete Markov chains, Types of state spaces and Irreducible Markov Chains	- Explain the definition and examples of discrete Markov chains - Explain Types of state spaces - Explain Irreducible Markov Chains	**Criteria:** 1.Accuracy in explaining the definition of discrete markov chains 2.The assessment criteria are carried out by looking at aspects: 3.1. Participation: carried out by observing student activities (weight 2) 4.2. UTS: carried out with an assessment during the middle of the semester (weight 2) 5.3. UAS: carried out every semester to measure all indicators (weight 3) 6.4. Task: carried out on each indicator (weight 3) 7.Student Final Grade: 8.Participation Score (2) x Lever Score (3) x UTS Score (2) x UAS Score (3) divided by 10. **Form of Assessment** : Participatory Activities	lectures and discussions 3 X 50		**Material:** Markov chains **References:** *Leon Garcia, Alberto, Probability and Random Processes for Electrical Engineering*	6%

6	1. Able to explain terminology and use discrete Markov chains in calculating n-step and long-term transition probabilities2. Be able to explain the Chapman-Kolmogorov equation3. Able to explain and determine accessible, communication, transient and recurring states of Markov chains	- Explaining Markov Chain Periodicity and Limit probability - Explaining transition probability matrices - Explaining transition diagrams - Explaining mathematical equations using the Chapman-Kolmogorov method - Explaining Markov chains with stationary distribution	**Criteria:** 1. Accuracy in explaining the definition of a discrete Markov chain, limit probability and periodicity of a Markov chain. Accuracy in constructing a transition matrix for a real problem and describing its transition diagram. Accuracy in explaining the Chapman-Kolmogorov equation. Accuracy in grouping Markov chain states. The assessment criteria are carried out by looking at the following aspects: 2. 1. Participation: carried out by observing student activities (weight 2) 3. 2. UTS: carried out with an assessment during the middle of the semester (weight 2) 4. 3. UAS: carried out every semester to measure all indicators (weight 3) 5. 4. Task: carried out on each indicator (weight 3) 6. Student Final Grade: 7. Participation Score (2) x Lever Score (3) x UTS Score (2) x UAS Score (3) divided by 10. **Form of Assessment** : Participatory Activities	discussions, lectures and exercises 3 X 50		**Material:** Markov Chain Periodicity and Limit probability. **Library:** *Leon Garcia, Alberto, Probability and Random Processes for Electical Engineering*	6%

7	1. Able to explain terminology and use discrete Markov chains in calculating n-step and long-term transition probabilities2. Be able to explain the Chapman-Kolmogorov equation3. Able to explain and determine accessible, communication, transient and recurring states of Markov chains	- Explaining Markov Chain Periodicity and Limit probability - Explaining transition probability matrices - Explaining transition diagrams - Explaining mathematical equations using the Chapman-Kolmogorov method - Explaining Markov chains with stationary distribution	**Criteria:** 1.Accuracy in explaining the definition of a discrete Markov chain, limit probability and periodicity of a Markov chain. Accuracy in constructing a transition matrix for a real problem and describing its transition diagram. Accuracy in explaining the Chapman-Kolmogorov equation. Accuracy in grouping Markov chain states. The assessment criteria are carried out by looking at the following aspects: 2.1. Participation: carried out by observing student activities (weight 2) 3.2. UTS: carried out with an assessment during the middle of the semester (weight 2) 4.3. UAS: carried out every semester to measure all indicators (weight 3) 5.4. Task: carried out on each indicator (weight 3) 6.Student Final Grade: 7.Participation Score (2) x Lever Score (3) x UTS Score (2) x UAS Score (3) divided by 10. **Form of Assessment** : Test	discussions, lectures and exercises 3 X 50		**Material:** Markov Chain Periodicity and Limit probability. **Library:** *Leon Garcia, Alberto, Probability and Random Processes for Electical Engineering*	7%

8	Able to explain continuous Markov chains in pure birth and death processes	Counting the number of pure births and deaths	**Criteria:** 1. Accuracy in explaining pure birth and death processes. Can implement Markov chains continuously in real cases. Assessment criteria are carried out by looking at aspects: 2. 1. Participation: carried out by observing student activities (weight 2) 3. 2. UTS: carried out with an assessment during the middle of the semester (weight 2) 4. 3. UAS: carried out every semester to measure all indicators (weight 3) 5. 4. Task: carried out on each indicator (weight 3) 6. Student Final Grade: 7. Participation Score (2) x Lever Score (3) x UTS Score (2) x UAS Score (3) divided by 10. **Form of Assessment** : Test	Lectures and exercises 3 X 50	-	**Material:** Continuous Markov chain in pure birth and death processes **References:** *Leon Garcia, Alberto, Probability and Random Processes for Electical Engineering*	10%
9	Able to explain continuous Markov chains in pure birth and death processes	Counting the number of pure births and deaths	**Criteria:** 1. Accuracy in explaining pure birth and death processes. Can implement Markov chains continuously in real cases. Assessment criteria are carried out by looking at aspects: 2. 1. Participation: carried out by observing student activities (weight 2) 3. 2. UTS: carried out with an assessment during the middle of the semester (weight 2) 4. 3. UAS: carried out every semester to measure all indicators (weight 3) 5. 4. Task: carried out on each indicator (weight 3) 6. Student Final Grade: 7. Participation Score (2) x Lever Score (3) x UTS Score (2) x UAS Score (3) divided by 10. **Form of Assessment** : Participatory Activities	Lectures and exercises 3 X 50		**Material:** continuous markov chain in pure birth and death processes **References:** *Leon Garcia, Alberto, Probability and Random Processes for Electical Engineering*	0%

10	Can understand and apply queuing theory Can apply queuing theory	Explaining, calculating and analyzing problems using queuing theory. Applying queuing theory	**Criteria:** 1.Accuracy in explaining queuing theory includes definitions and classifications. Know and be able to implement queuing theory in real cases. Assessment criteria are carried out by looking at the following aspects: 2.1. Participation: carried out by observing student activities (weight 2) 3.2. UTS: carried out with an assessment during the middle of the semester (weight 2) 4.3. UAS: carried out every semester to measure all indicators (weight 3) 5.4. Task: carried out on each indicator (weight 3) 6.Student Final Grade: 7.Participation Score (2) x Lever Score (3) x UTS Score (2) x UAS Score (3) divided by 10. **Form of Assessment** : Participatory Activities	Lecture, question and answer and written test 3 X 50		**Material:** Queuing theory **References:** *Leon Garcia, Alberto, Probability and Random Processes for Electrical Engineering*	0%

11	Can understand and apply queuing theory Can apply queuing theory	Explaining, calculating and analyzing problems using queuing theory. Applying queuing theory	**Criteria:** 1. Accuracy in explaining queuing theory includes definitions and classifications. Know and be able to implement queuing theory in real cases. Assessment criteria are carried out by looking at the following aspects: 2. 1. Participation: carried out by observing student activities (weight 2) 3. 2. UTS: carried out with an assessment during the middle of the semester (weight 2) 4. 3. UAS: carried out every semester to measure all indicators (weight 3) 5. 4. Task: carried out on each indicator (weight 3) 6. Student Final Grade: 7. Participation Score (2) x Lever Score (3) x UTS Score (2) x UAS Score (3) divided by 10. **Form of Assessment** : Participatory Activities	Lecture, question and answer and written test 3 X 50		**Material:** queuing theory **References:** *Leon Garcia, Alberto, Probability and Random Processes for Electrical Engineering*	6%

12	Able to discuss, communicate and work actively in a team Able to apply mathematical modeling theory (Markov Chain, Poisson Dynamic Programming and others)	Able to discuss and solve problems using mathematical modeling	**Criteria:** 1. Students' activeness in discussing and collaborating in the process of completing assignments and presentations. Quality of communication and presentation. Accuracy in explaining correctly and completely the results of the case study analysis carried out. Assessment criteria are carried out by looking at the following aspects: 2. 1. Participation: carried out by observing student activities (weight 2) 3. 2. UTS: carried out with an assessment during the middle of the semester (weight 2) 4. 3. UAS: carried out every semester to measure all indicators (weight 3) 5. 4. Task: carried out on each indicator (weight 3) 6. Student Final Grade: 7. Participation Score (2) x Lever Score (3) x UTS Score (2) x UAS Score (3) divided by 10. **Form of Assessment** : Participatory Activities	Discussions, lectures and exercises/assignments 3 X 50		**Material:** Markov Chain, Poisson Dynamic Programming **Library:** *Leon Garcia, Alberto, Probability and Random Processes for Electical Engineering*	6%

13	Able to discuss, communicate and work actively in a team Able to apply mathematical modeling theory (Markov Chain, Poisson Dynamic Programming and others)	Able to discuss and solve problems using mathematical modeling	**Criteria:** 1. Students' activeness in discussing and collaborating in the process of completing assignments and presentations. Quality of communication and presentation. Accuracy in explaining correctly and completely the results of the case study analysis carried out. Assessment criteria are carried out by looking at the following aspects: 2. 1. Participation: carried out by observing student activities (weight 2) 3. 2. UTS: carried out with an assessment during the middle of the semester (weight 2) 4. 3. UAS: carried out every semester to measure all indicators (weight 3) 5. 4. Task: carried out on each indicator (weight 3) 6. Student Final Grade: 7. Participation Score (2) x Lever Score (3) x UTS Score (2) x UAS Score (3) divided by 10. **Form of Assessment** : Test	Discussions, lectures and exercises/assignments 3 X 50		**Material:** Markov Chain, Poisson Dynamic Programming **Bibliography:** *Seldon, M. Ross, Introduction to Probability Models, 2nd edition, Academic Press, Inc., 1980*	7%

14	Able to discuss, communicate and work actively in a team Able to apply mathematical modeling theory (Markov Chain, Poisson Dynamic Programming and others)	Able to discuss and solve problems using mathematical modeling	**Criteria:** 1. Students' activeness in discussing and collaborating in the process of completing assignments and presentations. Quality of communication and presentation. Accuracy in explaining correctly and completely the results of the case study analysis carried out. Assessment criteria are carried out by looking at the following aspects: 2. 1. Participation: carried out by observing student activities (weight 2) 3. 2. UTS: carried out with an assessment during the middle of the semester (weight 2) 4. 3. UAS: carried out every semester to measure all indicators (weight 3) 5. 4. Task: carried out on each indicator (weight 3) 6. Student Final Grade: 7. Participation Score (2) x Lever Score (3) x UTS Score (2) x UAS Score (3) divided by 10. **Form of Assessment** : Test	Discussions, lectures and exercises/assignments 3 X 50		**Material:** Markov Chain, Poisson Dynamic Programming **Library:** *Leon Garcia, Alberto, Probability and Random Processes for Electical Engineering*	7%

15	Able to discuss, communicate and work actively in a team Able to apply mathematical modeling theory (Markov Chain, Poisson Dynamic Programming and others)	Able to discuss and solve problems using mathematical modeling	**Criteria:** 1. Students' activeness in discussing and collaborating in the process of completing assignments and presentations. Quality of communication and presentation. Accuracy in explaining correctly and completely the results of the case study analysis carried out. Assessment criteria are carried out by looking at the following aspects: 2. 1. Participation: carried out by observing student activities (weight 2) 3. 2. UTS: carried out with an assessment during the middle of the semester (weight 2) 4. 3. UAS: carried out every semester to measure all indicators (weight 3) 5. 4. Task: carried out on each indicator (weight 3) 6. Student Final Grade: 7. Participation Score (2) x Lever Score (3) x UTS Score (2) x UAS Score (3) divided by 10. **Form of Assessment** : Test	Discussions, lectures and exercises/assignments 3 X 50		**Material:** Markov Chain, Poisson Dynamic Programming **Library:** *Leon Garcia, Alberto, Probability and Random Processes for Electical Engineering*	6%

16	Able to discuss, communicate and work actively in a team Able to apply mathematical modeling theory (Markov Chain, Poisson Dynamic Programming and others)	Able to discuss and solve problems using mathematical modeling	**Criteria:** 1. Students' activeness in discussing and collaborating in the process of completing assignments and presentations. Quality of communication and presentation. Accuracy in explaining correctly and completely the results of the case study analysis carried out. Assessment criteria are carried out by looking at the following aspects: 2. 1. Participation: carried out by observing student activities (weight 2) 3. 2. UTS: carried out with an assessment during the middle of the semester (weight 2) 4. 3. UAS: carried out every semester to measure all indicators (weight 3) 5. 4. Task: carried out on each indicator (weight 3) 6. Student Final Grade: 7. Participation Score (2) x Lever Score (3) x UTS Score (2) x UAS Score (3) divided by 10. **Form of Assessment** : Test	Discussions, lectures and exercises/assignments 3 X 50		**Material:** Markov Chain, Poisson Dynamic Programming **Library:** *Leon Garcia, Alberto, Probability and Random Processes for Electical Engineering*	20%

Evaluation Percentage Recap: Case Study

No	Evaluation	Percentage
1.	Participatory Activities	43%
2.	Test	57%
		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.