

MODULE HANDBOOK

STOCHASTIC PROCESS



**STATISTICS UNDERGRADUATE PROGRAM
DEPARTMENT OF STATISTICS
FACULTY OF SCIENCE AND DATA ANALYTICS
INSTITUT TEKNOLOGI SEPULUH NOPEMBER
SURABAYA**

ENDORSEMENT PAGE



MODULE HANDBOOK STOCHASTIC PROCESS STATISTICS UNDERGRADUATE PROGRAM DEPARTMENT OF STATISTICS INSTITUT TEKNOLOGI SEPULUH NOPEMBER

Proses <i>Process</i>	Penanggung Jawab <i>Person in Charge</i>			Tanggal <i>Date</i>
	Nama <i>Name</i>	Jabatan <i>Position</i>	Tanda tangan <i>Signature</i>	
Perumus <i>Preparation</i>	Prof. Dr. Muhammad Mashuri, M. T	Dosen Lecturer		
Pemeriksa dan Pengendalian <i>Review and Control</i>	Dr. Drs Agus Suharsono, MS Dr. Wibawati, S.Si., M.Si. Dr. Muhammad Ahsan, S.Si. Dr. Hidayatul Khusna, S.Si.	Tim kurikulum Curriculum team		
Persetujuan <i>Approval</i>	Dr. Wibawati, S.Si., M.Si.	Koordinator RMK Course Cluster Coordinator		
Penetapan <i>Determination</i>	Dr. Kartika Fithriasari, M.Si	Kepala Departemen Head of Department		

MODULE HANDBOOK

STOCHASTIC PROCESS

Module name	STOCHASTIC PROCESS	
Module level	Undergraduate	
Code	SS234415	
Course (if applicable)	STOCHASTIC PROCESS	
Semester	4	
Person responsible for the module	Prof. Dr. Muhammad Mashuri, M. T	
Lecturer	Dr. Drs Agus Suharsono, MS Dr. Wibawati, S.Si., M.Si. Dr. Muhammad Ahsan, S.Si. Dr. Hidayatul Khusna, S.Si	
Language	Bahasa Indonesia and English	
Relation to curriculum	Undergraduate degree program, mandatory, 4th semester.	
Type of teaching, contact hours	Other SCL Method Non-SCL Method	
Workload	1. Lectures[L]: 3 x 50 = 150 minutes per week. 2. Exercises and Assignments[EA]: 3 x 60 = 180 minutes (3 hours) per week. 3. Independent Learning [IL]: 3 x 60 = 180 minutes (3 hours) per week.	
Credit points	3 credit points (SKS) Equivalent to 4.8 ECTS	
Requirements according to the examination regulations	A student must have attended at least 80% of the lectures to sit in the exams.	
Mandatory prerequisites	Introduction to Statistical Methods	
Learning outcomes and their corresponding PLOs	<p>CLO.1 Able to apply the knowledge of statistical quality control</p> <p>CLO.2 Able to design and collect the data using the appropriate statistical quality control method</p> <p>CLO.3 Able to analyze the data using appropriate statistical quality control methods and interpret the results</p> <p>CLO.4 Able to identify, formulate, and solve the problem in statistical quality control at various fields</p>	<p>PLO.6</p> <p>PLO.6</p> <p>PLO.8</p> <p>PLO.9</p> <p>PLO.10</p> <p>PLO.8</p> <p>PLO.9</p> <p>PLO.10</p>
Content	Statistical Quality Control is a part of the courses in business and industry fields. The objective of this course is to make the	

	students able to select the appropriate statistical methods in monitoring the product quality and process, particularly in the manufacturing industry. The materials are relating to the concept of quality improvement, seven statistics tools to improve the quality, control chart, the calculation of capability process, measurement system analysis, and acceptance sampling design. To complete the objective, the learning strategies used are discussion, presentation and practice, presentation and written test
Assessment and its weight	Assignment(25%) Midterm Exam(25%) Final Exam(25%) Quiz (25%)
Media employed	LCD, whiteboard, websites (myITS Classroom), zoom
Reading list	<ol style="list-style-type: none"> 1. Montgomery, D.C. (2012), Introduction to Statistical Quality Control 7^{ed}, John Wiley and Sons Inc., USA 2. Leavenworth, G.E. and Grant, R.S., 1988. Statistical Quality Control. USA: McGraw-Hill. 3. Besterfield, D.H., (2009), Quality Control 8th, Pearson International Edition, USA 4. Quesenberry, C.P., (1997), SPC Methods for Quality Improvement, John Wiley and Sons Inc., USA 5. Duncan, A.J., (1986), Quality Kontrol and Industrial Statistics 5^{ed}, Irwin, USA



INSTITUT TEKNOLOGI SEPULUH NOPEMBER
FAKULTAS SAINS DAN ANALITIKA DATA
PROGRAM STUDI SARJANA STATISTIKA
DEPARTEMEN STATISTIKA

Kode Dokumen

RENCANA PEMBELAJARAN SEMESTER/
SEMESTER LEARNING PLAN

MATA KULIAH (MK)/ <i>Course</i>	KODE/ <i>Code</i>	Rumpun MK/ <i>Course Group</i>	BOBOT (sks)/ <i>Weight (credit)</i>		SEMESTER/ <i>Semester</i>	Tgl Penyusunan/ <i>Drafting Date</i>
PROSES STOKASTIK/ <i>STOCHASTIC PROCESS</i>	SS234414	SKSD	T= 3	P= 0	IV	17 Desember 2022
OTORISASI/ <i>AUTHORIZATION</i>	Pengembang RPS/ <i>RPS Developer</i>		Koordinator RMK/ <i>Course Group Coordinator</i>		Ketua PRODI/ <i>Head of Department</i>	
	Prof. Drs. Nur Iriawan, M.Ikom, Ph.D		Prof. Drs. Nur Iriawan, M.Ikom, Ph.D		Dr. Kartika Fithriasari, M.Si	
Capaian Pembelajaran (CP)/ <i>Learning Achievement</i>	CPL-PRODI yang dibebankan pada MK/ <i>PLO</i>					
	CPL-4	Mampu menerapkan sains dan Matematika untuk mendukung pemahaman metode statistika				
	CPL-5	Mampu menerapkan teori statistika pada metode statistika				
	CPL-7	Mampu menggunakan perangkat komputasi modern untuk menyelesaikan permasalahan statistik				
	CPL-9	Mampu menerapkan metode statistika untuk menganalisis permasalahan teoritis dan rill				
	<i>PLO-4</i>	<i>Able to apply science and mathematics to support the understanding of statistical methods</i>				
	<i>PLO-5</i>	<i>Able to apply statistical theory to statistical methods</i>				
	<i>PLO-7</i>	<i>Able to use modern computing devices to solve statistical problems</i>				
	<i>PLO-9</i>	<i>Able to apply statistical methods to analyze theoretical and real problems</i>				
	Capaian Pembelajaran Mata Kuliah (CPMK)/ <i>CLO</i>					
	CPMK.1 Mampu menjelaskan pengertian proses stokastik dengan memadukan informasi variabel state dan parameternya					
	CPMK.2 Mampu menjelaskan Rantai Markov dan menyusun matriks transisi probailitas dari suatu masalah					
	CPMK.3 Mampu membuat matriks transisi probailitas n Langkah dan mampu menganalisis langkah pertama Markov (First Step Analysis)					
	CPMK.4 Mampu menjelaskan sifat-sifat, klasifikasi, stationeritas, ergotisitas, dan limit rantai Markov					

	<p>CPMK.5 Mampu menjelaskan sifat-sifat proses poisson dan proses poisson spasial CPMK.6 Mampu menjelaskan konsep proses input-output (birth-death process) dan implementasinya dalam sistem antrian yang banyak dijumpai sehari-hari.</p> <p><i>CLO.1 Be able to explain the meaning of a stochastic process by combining information on state variables and their parameters</i> <i>CLO.2 Be able to explain Markov Chain and construct a probability transition matrix of a problem</i> <i>CLO.3 Be able to make n-Step probability transition matrices and be able to analyze the first step of Markov (First Step Analysis)</i> <i>CLO.4 Be able to explain the properties, classification, stationarity, ergodicity, and limits of Markov chains</i> <i>CLO.5 Be able to explain the properties of the Poisson process and the spatial Poisson process</i> <i>CLO.6 Able to explain the concept of the input-output process (birth-death process) and its implementation in the queuing system which is often found in everyday life.</i></p>																																			
	<p>Matrik CPL – CPMK</p> <p><i>PLO-CLO Matrix</i></p> <table border="1"> <thead> <tr> <th>CPMK</th> <th>CPL-4</th> <th>CPL-5</th> <th>CPL-7</th> <th>CPL-9</th> </tr> </thead> <tbody> <tr> <td>CPMK-1</td> <td>V</td> <td>V</td> <td></td> <td></td> </tr> <tr> <td>CPMK-2</td> <td>V</td> <td>V</td> <td></td> <td>V</td> </tr> <tr> <td>CPMK-3</td> <td></td> <td>V</td> <td>V</td> <td>V</td> </tr> <tr> <td>CPMK-4</td> <td></td> <td></td> <td>V</td> <td>V</td> </tr> <tr> <td>CPMK-5</td> <td>V</td> <td>V</td> <td></td> <td>V</td> </tr> <tr> <td>CPMK-6</td> <td></td> <td>V</td> <td>V</td> <td>V</td> </tr> </tbody> </table>	CPMK	CPL-4	CPL-5	CPL-7	CPL-9	CPMK-1	V	V			CPMK-2	V	V		V	CPMK-3		V	V	V	CPMK-4			V	V	CPMK-5	V	V		V	CPMK-6		V	V	V
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CPMK-4			V	V																																
CPMK-5	V	V		V																																
CPMK-6		V	V	V																																
<p>Deskripsi Singkat MK/ <i>Course Description</i></p>	<p>Proses Stokastik merupakan salah satu mata kuliah bagian dari bidang kajian Pemodelan Statistika yang ditujukan untuk mengembangkan dan menganalisis model probabilitas yang menangkap fenomena efek keacakan event di jangka pendek maupun panjang atau di area sempit maupun luas. Model probabilitas yang dikaji akan melibatkan beragam model matematis dan komputasional yang dilengkapi dengan aplikasi, baik masalah kuantitatif maupun kualitatif di dunia riil di bidang bisnis, industri, lingkungan, pemerintahan, dan sosial.</p> <p><i>Stochastic Processes is one of the courses parts of the field of Statistical Modeling which is aimed at developing and analyzing probability models that capture the phenomenon of the effects of event randomness in the short and long term or in a narrow or wide area. The probability model studied will involve a variety of mathematical and computational models that are equipped with</i></p>																																			

	<i>applications, both quantitative and qualitative in the real world, in the fields of business, industry, environment, government, and society.</i>				
Bahan Kajian: Materi Pembelajaran/ Course Material	Teori Statistika, Teknik Komputasi dan Data Processing, Pemodelan, Industri dan Bisnis, Pemerintahan dan Kependudukan, Ekonomi dan Manajemen, Kesehatan dan Lingkungan <i>Statistical Theory, Computational Engineering and Data Processing, Modeling, Industry and Business, Government and Population, Economics and Management, Health and Environment</i>				
Pustaka/ References	Utama/Primary:				
	1. Karlin, S. and Taylor, H.M., 2011. An Introduction to Stochastic Modeling. 3rd edition. Academic Press				
	Pendukung/Secondary:				
	2. Beichelt, F. 2016. Applied Probability and Stochastic Processes. 2nd edition. LLC: Taylor dan Francis Group. 3. Sheldon, M. 2019. Ross-Introduction to Probability Models, 10th edition. Amsterdam: Elsevier.				
Dosen Pengampu/ Lecturers	Prof. Drs. Nur Iriawan, M.Ikom, Ph.D ; Prof. Dr. Bambang W. Otok, M.Si. ; Dr. Achmad Choiruddin, M.Sc. ; Dr. Hidayatul Khusna, S.Si.				
Matakuliah syarat/ Pre-requisite Course	Pengantar Teori Peluang <i>Introduction to Probability Theory</i>				
Mg Ke- Week	Kemampuan akhir tiap tahapan belajar (Sub-CPMK) Final capability for each learning step	Penilaian Evaluation	Bantuk Pembelajaran, Metode Pembelajaran, Penugasan Mahasiswa, [Estimasi Waktu] Learning Format	Materi Pembelajaran [Pustaka] Learning Material [References]	Bobot Penilaian (%) Evaluation Weight (%)

				<i>Learning Methods Assignment for Student [Estimated Time]</i>			
		<i>Indikator Indicator</i>	<i>Kriteria & Bentuk Criteria and Format</i>	<i>Luring Offline</i>	<i>Daring Online</i>		
(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
1	Mampu menjelaskan pengertian proses stokastik dengan memadukan informasi variabel state dan parameternya <i>Being able to explain the notion of stochastic processes by integrating information state variables and parameters</i>	1. Mampu menjelaskan perbedaan proses stokastik dengan parameter dan state spacenya 2. mampu mengidentifikasi ruang keadaan (state space) dan waktu keadaan (parameter space) dari suatu proses atau sistem stokastik <i>1. Able to explain differences in stochastic processes with their parameters and state space 2. Able to identify state space and state space (parameter space) of a process or stochastic system</i>	Observasi di Kelas, Latihan Soal Tugas 1 <i>Classroom Observation, Exercises Task 1</i>	Ceramah Interaktif, Diskusi, Latihan Soal <i>Interactive Lectures, Discussions, Exercise</i> TM: 1x3x50" PT: 1x3x60" BM: 1x3x60"		Pengertian Proses Stokastik dan Rantai Markov <i>Understanding Stochastic Processes and Markov Chains</i> [1] Bab 1 [2] Bab 6	5%
2	Mampu menjelaskan Rantai Markov dan menyusun matriks transisi probabilitas dari suatu masalah yang memenuhi sifat Markov	Mampu mengidentifikasi transisi-transisi yang mungkin antar ruang keadaan sesuai waktu proses, dan mampu menyusun matriks stokastiknya untuk 1	Observasi di Kelas, Latihan Soal	Ceramah Interaktif, Diskusi, Latihan Soal <i>Interactive Lectures, Discussions, Exercise</i>		1. Probabilitas transisi 1 langkah 2. Matriks transisi dari kasus tertentu <i>1. Probability of transition 1 step 2. Transition matrix of a</i>	10%

	<i>Able to explain the Markov chain and compile a probability transition matrix of a problem that satisfies the properties Markov</i>	langkah <i>Able to identify the possible transitions between the state space of time regarding to the process, and able to prepare for the first step of matrix stochastic</i>	Tugas 2 <i>Classroom Observation, Exercises Task 2</i>	TM: 1x3x50" PT: 1x3x60" BM: 1x3x60"		<i>particular case</i> [1] Bab 3 [2] Bab 8 (Sub-bab 8.1)	
3	Mampu menghitung dan memahami tujuan membuat matriks transisi probabilitas n Langkah, serta mampu menghitung probabilitas dan ekspektasi waktu pertama kali mencapai kondisi tertentu (<i>First Step Analysis</i>) <i>Able to calculate and understand the purpose of making an n-Step probability transition matrix, and be able to calculate the probability and expectations the first time it reaches the condition certain (First Step Analysis)</i>	Mampu mengidentifikasi transisi-transisi yang mungkin antar ruang keadaan sesuai waktu proses, dan mampu Menyusun matriks stokastiknya untuk n Langkah <i>Able to identify possible transitions between state spaces according to processing time, and able to arrange stochastic matrix for n steps</i>	Observasi di Kelas, Latihan Soal Tugas 3 <i>Classroom Observation, Exercises Task 3</i>	Presentasi Game Latihan soal & Diskusi <i>Presentation, Game, Exercise & Discussions</i> TM: 1x3x50" PT: 1x3x60" BM: 1x3x60"		Persamaan Chapman-Kolmogorov untuk menghitung probabilitas transisi n Langkah <i>The Chapman-Kolmogorov equation for calculating the n-Step transition probability</i> [1] Bab 3 [2] Bab 8 (Sub-bab 8.1)	5%
4-5	Mampu menghitung distribusi limit rantai Markov dan	Dapat menganalisis apakah matriks stokastik P mencapai	Observasi di Kelas,	Presentasi Game Latihan soal		Distribusi Limit, <i>First Step Analysis</i> dengan absorbing dan non	15%

	menghitung probabilitas dan ekspektasi waktu kepunahan generasi suatu proses <i>Able to calculate the limit distribution of the Markov chain and calculate the probability and expectation of the extinction time of a process generation</i>	kondisi <i>steady-state</i> dan mempunyai distribusi limit pada langkah ke- n bila $n \rightarrow \infty$, serta probabilitas & kapan kepunahan suatu generasi terjadi <i>Can analyze whether the stochastic matrix P reaches a condition steady-state and has a limit distribution in the nth step if $n \rightarrow \infty$, as well as the probability & when the extinction of a generation occurs</i>	Latihan Soal Quiz 1 <i>Classroom Observation, Exercises Quiz 1</i>	& Diskusi <i>Presentation, Game, Exercise & Discussions</i> TM: 1x3x50" PT: 1x3x60" BM: 1x3x60"		absorbing <i>state</i> <i>Limit distribution, First Step Analysis with absorbing and non-absorbing states</i> [1] Bab 3 [2] Bab 8 (Sub-bab 8.3 & 8.5)	
6-7	Mampu menjelaskan sifat- sifat dan klasifikasi rantai Markov (ergodicity, recurrent, aperiodic, dan irreducible) <i>Be able to explain the characteristics and classification of Markov chains (ergodicity, recurrent, aperiodic, and irreducible)</i>	Dapat mengklasifikasikan proses Markov dan menentukan kondisi ergodicity, recurrent, aperiodic, dan irreducible suatu proses Markov <i>Can classify Markov processes and determine the ergodicity, recurrent, aperiodic, and irreducible conditions of a Markov process</i>	Presentasi, Diskusi, Pengamatan Aktifitas kelas <i>Presentation, Discussion, Classroom Observation</i>	Presentasi Game Latihan soal & Diskusi <i>Presentation, Game, Exercise & Discussions</i> TM: 1x3x50" PT: 1x3x60" BM: 1x3x60"		Klasifikasikan proses Markov, kondisi ergodicity, recurrent, aperiodic, dan irreducible suatu proses Markov <i>Classify Markov processes, ergodicity, recurrent, aperiodic, and irreducible conditions of a Markov process</i> [1] Bab 4 [2] Bab 8 (Sub-bab 8.2)	10%
8	ETS/Midterm						
9	Mampu menjelaskan pengertian proses Poisson baik homogem maupun	Mampu mengidentifikasi sifat-sifat proses Poisson dan distribusi antar kedatangan kejadian	Observasi di Kelas,	Presentasi Latihan soal & Diskusi		Proses Poisson dari outing proses Bernoulli, Poisson homogem maupun non-hogem,	5%

	<p>non-homogen. <i>Be able to explain the meaning of the Poisson process, both homogeneous and non-homogeneous.</i></p>	<p>Poisson, serta kehomogenan proses & proses Cox. <i>Be able to identify the characteristics of the Poisson process and the distribution between arrivals of Poisson events, as well as the homogeneity of the process & Cox process.</i></p>	<p>Latihan Soal</p> <p>Tugas 4</p> <p><i>Classroom Observation, Exercises Task 4</i></p>	<p><i>Presentation, Exercise & Discussions</i></p> <p>TM: 1x3x50" PT: 1x3x60" BM: 1x3x60"</p>		<p>Cox process, dan distribusi antar kedatangan kejadian poisson. <i>Poisson process of outing Bernoulli process, homogeneous and non-homogeneous Poisson, Cox process, and distribution between arrivals of Poisson events.</i></p> <p>[1] Bab 5 (Sub-bab 5.1) [2] Bab 8 (Sub-bab 8.2)</p>	
10	<p>Mampu menjelaskan pengertian dan menerapkan proses Poisson spasial <i>Able to explain the meaning and apply the spatial Poisson process</i></p>	<p>Mampu mengidentifikasi proses distribusi hitungan (<i>counting process</i>) di dimensi ruang. <i>Able to identify the counting process in the spatial dimension.</i></p>	<p>Observasi di Kelas,</p> <p>Latihan Soal</p> <p>Tugas 5</p> <p><i>Classroom Observation, Exercises Task 5</i></p>	<p>Presentasi Latihan soal & Diskusi</p> <p><i>Presentation, Exercise & Discussions</i></p> <p>TM: 1x3x50" PT: 1x3x60" BM: 1x3x60"</p>		<p>Proses poisson berbasis dimensi ruang. <i>Spatial dimension-based Poisson process.</i></p> <p>[1] Bab 5 (Sub-bab 5.3 s/d 5.5)</p>	8%
11	<p>Mampu menjelaskan dan menerapkan proses poisson gabungan dan pemisahannya (<i>decompose dan compound Poisson process</i>) <i>Able to explain and apply the combined Poisson process and its</i></p>	<p>Mampu mengidentifikasi dan menghitung kejadian Poisson gabungan maupun pemisahannya. <i>Able to identify and calculate combined and split Poisson events.</i></p>	<p>Observasi di Kelas,</p> <p>Latihan Soal</p> <p>Tugas 6</p> <p><i>Classroom Observation, Exercises</i></p>	<p>Presentasi Latihan soal & Diskusi</p> <p><i>Presentation, Exercise & Discussions</i></p> <p>TM: 1x3x50" PT: 1x3x60" BM: 1x3x60"</p>		<p><i>Decompose dan compound Poisson process. Decompose and compound Poisson process.</i></p> <p>[1] Bab 5 (Sub-bab 5.6)</p>	7%

	<i>separation (decompose and compound Poisson process)</i>		<i>Task 6</i>				
12-13	Mampu menjelaskan Sifat <i>Continuous Time Markov Chains (pure birth, pure death, birth-death process)</i> . <i>Be able to explain the nature of Continuous Time Markov Chains (pure birth, pure death, birth-death process)</i>	<ol style="list-style-type: none"> Memahami dan menguasai konsep Model Markov Kontinyu serta mampu membedakannya dengan Model Markov Diskrit. Mampu menyusun distribusi urutan antar kejadian <i>birth</i> maupun <i>death</i>, dan <i>birth-death</i>, serta menghitung ekspektasi <i>k</i>-kejadian berikutnya Mampu menganalisis dan menentukan kondisi terserap (<i>absorbing</i>) dan kepunahan pada proses <i>birth-death</i> <ol style="list-style-type: none"> <i>Understand and master the concept of the Continuous Markov Model and be able to differentiate it from the Discrete Markov Model.</i> <i>Be able to compile the order distribution between birth and death events, and death-death, as well as calculate expectations of the next k-events</i> <i>Be able to analyze and determine the absorption and</i> 	Presentasi, Diskusi, Pengamatan Aktifitas kelas Quiz 2 <i>Presentation, Discussion, Classroom Observation Quiz 2</i>	Presentasi Latihan soal & Diskusi <i>Presentation, Exercise & Discussions</i> TM: 2x3x50" PT: 2x3x60" BM: 2x3x60"		<ol style="list-style-type: none"> Model Markov dengan waktu kontinyu Proses <i>birth, death, birth-death</i>, dan <i>absorbing</i>. <ol style="list-style-type: none"> <i>Markov model with continuous time</i> <i>The process of birth, death, birth-death, and absorbing</i> <p>[1] Bab 6</p>	15%

		<i>extinction conditions in the berth-death process</i>					
14	Mampu menjelaskan konsep dan mampu menerapkan model renewal pada fenomena <i>Continuous Time Markov Chains</i> <i>Be able to explain concepts and be able to apply renewal models to the Continuous Time Markov Chains phenomenon</i>	<ol style="list-style-type: none"> 1. Mampu menentukan distribusi waktu tunggu kejadian <i>renewal</i> ke-<i>n</i> dan karakteristiknya 2. Mampu menghitung residual, total, dan masa hidup peralatan sebelum <i>renewal</i> 3. Mampu menganalisis dan menentukan <i>block replacement</i> <ol style="list-style-type: none"> 1. <i>Be able to determine the waiting time distribution for the nth renewal event and its characteristics</i> 2. <i>Able to calculate residual, total, and equipment life before renewal</i> 3. <i>Able to analyze and determine block replacement</i> 	Presentasi, Diskusi, Pengamatan Aktifitas kelas Tugas 7 <i>Presentation, Discussion, Classroom Observation Task 7</i>	Presentasi Latihan soal & Diskusi <i>Presentation, Exercise & Discussions</i> TM: 1x3x50" PT: 1x3x60" BM: 1x3x60"		<ol style="list-style-type: none"> 1. Distribusi waktu tunggu kejadian <i>renewal</i>. 2. Residual, total, dan masa hidup peralatan serta pengantiannya secara individu atau blok. <ol style="list-style-type: none"> 1. <i>Distribution of waiting times for renewal events.</i> 2. <i>Residual, total, and equipment life and replacement individually or in blocks.</i> <p>[1] Bab 7</p>	10%
15	Mampu menjelaskan konsep dan mampu menerapkan model antrian serta faham bahwa proses antrian merupakan kejadian khusus dari model markov kontinyu, khususnya proses input- output (<i>birth-death process</i>). <i>Able to explain concepts and be able to apply the queuing model and</i>	<ol style="list-style-type: none"> 1. Mampu mengidentifikasi komponen sistem antrian sesuai prosesnya (FIFO, LIFO, SIRO, Priority) 2. Mampu menentukan <i>event graph</i> dan <i>state diagram</i> serta mampu menghitung kinerja sistem antrian jalur tunggal dan jalur ganda (khususnya <i>tandom network</i>) <ol style="list-style-type: none"> 1. <i>Able to identify queue system component according to the process (FIFO, LIFO, SIRO,</i> 	Presentasi, Diskusi, Pengamatan Aktifitas kelas Tugas 8 <i>Presentation, Discussion, Classroom Observation Task 8</i>	Presentasi Game Latihan soal & Diskusi <i>Presentation, Game, Exercise & Discussions</i> TM: 1x3x50" PT: 1x3x60" BM: 1x3x60"		<ol style="list-style-type: none"> 1. Model Antrian (proses input – output, sistem antrian kapasitas terbatas dan tak terbatas) 2. <i>Event graph</i> dan <i>state diagram</i> antrian jalur tunggal, jalur ganda, dan <i>tandom network</i> <ol style="list-style-type: none"> 1. <i>Queuing Model (input – output process, limited and unlimited capacity queuing system)</i> 2. <i>Event graphs and state diagrams of single-lane, dual-lane, and tandom network queues</i> 	10%

	<i>understand that the queuing process is a special event of the continuous Markov model, especially the input-output process (birth-death process).</i>	<i>Priority</i> 2. <i>Able to decide event graph dan state diagram also can calculate performance of single line and double line queuing systems (tandom network)</i>				[1] Bab 9	
16	Evaluasi Akhir Semester / Ujian Akhir Semester / <i>Final Exam</i>						

Catatan:

BM : Belajar mandiri

TM : Tatap muka

P : Praktikum di Laboratorium

PT : Penugasan terstruktur

