

# MODULE HANDBOOK

## INTRODUCTION OF SURVIVAL ANALYSIS



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

## ENDORSEMENT PAGE



### MODULE HANDBOOK INTRODUCTION OF SURVIVAL ANALYSIS 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>	Santi Wulan Purnami, S.Si, M.Si;	Dosen Lecturer		
Pemeriksa dan Pengendalian <i>Review and Control</i>	Santi Wulan Purnami, S.Si, M.Si; Jerry Dwi Trijoyo Purnomo, S.Si. M.Si.; Shofi Andari, S.Stat, M.Si	Tim kurikulum Curriculum team		
Persetujuan <i>Approval</i>	Prof. Dr. Bambang Widjanarko Otok, M.Si.	Koordinator RMK Course Cluster Coordinator		
Penetapan <i>Determination</i>	Dr. Kartika Fithriasari, M.Si	Kepala Departemen Head of Department		

# MODULE HANDBOOK

## INTRODUCTION OF SURVIVAL ANALYSIS

Module name	INTRODUCTION OF SURVIVAL ANALYSIS	
Module level	Undergraduate	
Code	SS234418	
Course (if applicable)	INTRODUCTION OF SURVIVAL ANALYSIS	
Semester	4	
Person responsible for the module	Dr. Santi Wulan Purnami, M.Si; Jerry Dwi Trijoyo Purnomo, S.Si. M.Si., Ph.D.	
Lecturer	Dr. Santi Wulan Purnami, S.Si, M.Si; Jerry Dwi Trijoyo Purnomo, S.Si. M.Si.; Dr. Shofi Andari, S.Stat, M.Si	
Language	Bahasa Indonesia and English	
Relation to curriculum	Undergraduate degree program, mandatory, 4th semester.	
Type of teaching, contact hours	Case Method (21.43%) Team Based Project (7.15%) Other SCL Methods (35.71%) Non-SCL Methods (35.71%)	
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	Regression Analysis	
Learning outcomes and their corresponding PLOs	CLO.1 Be able to explain concepts and apply the theory of survival analysis CLO.2 Able to use software (SPSS, SAS, R) for survival analysis CLO.3 Able to analyze data using the survival method and interpret it appropriately CLO.4 Able to identify, formulate and solve problems in the medical/health sector using survival analysis	PLO-5 PLO-7 PLO-10
Content	Survival analysis is a statistical method that can be applied in various fields, one of which is in the health sector. Survival analysis is a statistical method that emphasizes analyzing the time until an event occurs. In this lecture, the basics of survival analysis will be taught such as the Kaplan Meier survival function, Hazard function, Hazard ratio, survival regression	

	with parametric and semiparametric approaches. To better understand this method, applications in real cases will be taught manually or using software, especially SPSS, SAS and R.
Assessment and its weight	Assignment 1 (15%) Quiz (20%) Midterm Exam (25%) Final Project (35%)
Media employed	LCD, whiteboard, websites (myITS Classroom), zoom
Reading list	<ol style="list-style-type: none"> <li>1. Kleinbaum, David G. and Klein, Mitchel. 2012. <i>Survival Analysis: A self-Learning Text</i>. 3rd edition. Springer, Science+Business Media, LLC</li> <li>2. David, Collet. 2014. <i>Modelling Survival Data in Medical Research</i>. 3rd edition, Chapman and Hall/CRC.</li> <li>3. Hosmer, David W., Lemeshow, Stenley. and May, S. 2008. <i>Applied Survival Analysis</i>. Hoboken, New Jersey : John Wiley dan Sons, Inc.</li> <li>4. Le, C. T. 1997. <i>Applied Survival Analysis</i>. John Wiley dan Sons, Inc.</li> </ol>



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

**RENCANA PEMBELAJARAN SEMESTER/  
SEMESTER LEARNING PLAN**

<b>MATA KULIAH (MK)/ Course</b>	<b>KODE/ Code</b>	<b>Rumpun MK/ Course Group</b>	<b>BOBOT (sks)/ Weight (credit)</b>		<b>SEMESTER/ Semester</b>	<b>Tgl Penyusunan/ Drafting Date</b>
<b>PENGANTAR ANALISIS SURVIVAL / INTRODUCTION OF SURVIVAL ANALYSIS</b>	SS234418	Statistika Lingkungan dan Kesehatan	<b>T=3</b>	<b>P=0</b>		11 Januari 2023
<b>OTORISASI/ AUTHORIZATION</b>	<b>Pengembang RPS/ RPS Developer</b>		<b>Koordinator RMK/ Course Group Coordinator</b>		<b>Ketua PRODI/ Head of Department</b>	
	Dr. Santi Wulan Purnami, M.Si; Jerry Dwi Trijoyo Purnomo, S.Si. M.Si., Ph.D				Dr. Kartika Fithriasari, M.Si	
<b>Capaian Pembelajaran (CP)/ Learning Achievement</b>	<b>CPL-PRODI yang dibebankan pada MK/ PLO</b>					
	CPL-5	Mampu menerapkan teori statistika pada metode statistika				
	CPL-7	Mampu menggunakan perangkat komputasi modern untuk menyelesaikan permasalahan statistik				
	CPL-10	Mampu menerapkan metode statistika Bisnis, Industri, Ekonomi, Sosial, Kesehatan, atau Lingkungan pada permasalahan riil				
	<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-10</i>	<i>Able to apply business, industrial, economic, social, health or environmental statistical methods to real problems</i>					
	<b>Capaian Pembelajaran Mata Kuliah (CPMK)/ CLO</b>					
	CPMK 1. Mampu menjelaskan konsep dan menerapkan teori analisis survival					
	CPMK 2. Mampu menggunakan piranti lunak (SPSS, SAS, R) untuk analisis survival					
	CPMK 3. Mampu menganalisis data dengan metode survival dan menginterpretasikannya dengan tepat					
	CPMK 4. Mampu mengidentifikasi, memformulasi dan menyelesaikan problem di bidang kedokteran/kesehatan menggunakan analisis survival					

	<p><i>CLO.1 Be able to explain concepts and apply the theory of survival analysis</i></p> <p><i>CLO.2 Able to use software (SPSS, SAS, R) for survival analysis</i></p> <p><i>CLO.3 Able to analyze data using the survival method and interpret it appropriately</i></p> <p><i>CLO.4 Able to identify, formulate and solve problems in the medical/health sector using survival analysis</i></p>																				
	<p><b>Matrik CPL – CPMK</b></p> <p><i>PLO-CLO Matrix</i></p> <table border="1"> <thead> <tr> <th></th> <th>CPL-5</th> <th>CPL-7</th> <th>CPL-10</th> </tr> </thead> <tbody> <tr> <td>CPMK-1</td> <td>ü</td> <td></td> <td></td> </tr> <tr> <td>CPMK-2</td> <td></td> <td>ü</td> <td></td> </tr> <tr> <td>CPMK-3</td> <td></td> <td></td> <td>ü</td> </tr> <tr> <td>CPMK-4</td> <td></td> <td></td> <td>ü</td> </tr> </tbody> </table>		CPL-5	CPL-7	CPL-10	CPMK-1	ü			CPMK-2		ü		CPMK-3			ü	CPMK-4			ü
	CPL-5	CPL-7	CPL-10																		
CPMK-1	ü																				
CPMK-2		ü																			
CPMK-3			ü																		
CPMK-4			ü																		
<p><b>Deskripsi Singkat MK/</b></p> <p><i>Course Description</i></p>	<p>Analisis Survival adalah salah satu metode statistika yang dapat diterapkan di berbagai bidang, salah satunya di bidang kesehatan. Analisis survival merupakan metode statistika yang menekankan pada analisis waktu sampai terjadinya suatu kejadian. Pada kuliah ini diajarkan dasar-dasar analisis survival seperti fungsi survival Kaplan Meier, Fungsi Hazard, Hazard rasio, regresi survival dengan pendekatan parametrik dan semiparametrik. Untuk lebih memahami metode ini, aplikasi pada kasus nyata diajarkan secara manual maupun menggunakan piranti lunak terutama SPSS, SAS dan R.</p> <p><i>Survival analysis is a statistical method that can be applied in various fields, one of which is in the health sector. Survival analysis is a statistical method that emphasizes analyzing the time until an event occurs. In this lecture, the basics of survival analysis will be taught such as the Kaplan Meier survival function, Hazard function, Hazard ratio, survival regression with parametric and semiparametric approaches. To better understand this method, applications in real cases will be taught manually or using software, especially SPSS, SAS and R.</i></p>																				
<p><b>Bahan Kajian: Materi Pembelajaran/</b></p> <p><i>Course Material</i></p>	<p>Dasar Sains, Teori Statistika, Deskripsi dan Eksplorasi, Data Processing, Metode Statistika untuk Kesehatan</p> <p><i>Basic Science, Statistical Theory, Data Collection, Description and Exploration, Computing and Data Processing, Modeling, Health and Environment</i></p>																				
<p><b>Pustaka/</b></p> <p><i>References</i></p>	<p><b>Utama/Primary:</b></p> <p>1. Kleinbaum, David G. and Klein, Mitchel. 2012. <i>Survival Analysis: A self-Learning Text</i>. 3rd edition. Springer, Science+Business Media, LLC</p> <p><b>Pendukung/Secondary:</b></p> <p>1. Cox, D.R. and Oakes, D. 1984. <i>Analysis of Survival Data</i>. Cambridengane : University Printing House</p> <p>2. David, Collet. 2014. <i>Modelling Survival Data in Medical Research</i>. 3rd edition, Chapman and Hall/CRC.</p>																				

	<p>3. Hosmer, David W., Lemeshow, Stenley. and May, S. 2008. <i>Applied Survival Analysis</i>. Hoboken, New Jersey : John Wiley dan Sons, Inc.</p> <p>4. Le, C. T. 1997. <i>Applied Survival Analysis</i>. John Wiley dan Sons, Inc.</p>						
<b>Dosen Pengampu/ Lecturers</b>	Santi Wulan Purnami, S.Si, M.Si; Jerry Dwi Trijoyo Purnomo, S.Si. M.Si.; Shofi Andari, S.Stat, M.Si						
<b>Matakuliah syarat/ Pre-requisite Course</b>	Analisis Regresi <i>Regression Analysis</i>						
<b>Mg Ke- Week</b>	<b>Kemampuan akhir tiap tahapan belajar (Sub-CPMK) Final capability for each learning step</b>	<b>Penilaian Evaluation</b>		<b>Bantuk Pembelajaran, Metode Pembelajaran, Penugasan Mahasiswa, [Estimasi Waktu]</b>		<b>Materi Pembelajaran [Pustaka] Learning Material [References]</b>	<b>Bobot Penilaian (%) Evaluation Weight (%)</b>
		<b>Indikator Indicator</b>	<b>Kriteria &amp; Bentuk Criteria and Format</b>	<b>Luring Offline</b>	<b>Daring Online</b>		
<b>(1)</b>	<b>(2)</b>	<b>(3)</b>	<b>(4)</b>	<b>(5)</b>	<b>(6)</b>	<b>(7)</b>	<b>(8)</b>
1	Dapat menjelaskan konsep dan tujuan analisis survival  <i>Can explain the concept and purpose of survival analysis</i>	<ol style="list-style-type: none"> <li>Ketepatan menjelaskan konsep analisis survival</li> <li>Ketepatan menjelaskan tujuan analisis survival</li> <li>Ketepatan menjelaskan censored data</li> </ol>	<b>Non Tes:</b> - Observasi Aktifitas di kelas - Tugas <b>Non Test:</b> - Activity <i>Observation in Class</i>	Ceramah interaktif Diskusi (CID)  TM: 3x50" PT: 3x60" BM: 3x60"  <i>Interactive Lecturer, Discussion</i>		<b>Pengantar analisis survival:</b> konsep dasar analisis survival, censored data  <i>Introduction to survival analysis : basic concepts, survival analysis, censored data</i> [1] Bab 1	10%

		<ol style="list-style-type: none"> <li>1. <i>Can explain the concept of survival analysis</i></li> <li>2. <i>Can explain the purpose of the survival analysis</i></li> <li>3. <i>Can explain censored data</i></li> </ol>	- Task	<i>L: 3x50"</i> <i>EA: 3x60"</i> <i>IL: 3x60"</i>		[2] Bab 6	
2	<p>Dapat menghitung estimasi dan membuat grafik fungsi survival menggunakan metode parametrik dan Kaplan Meier</p> <p><i>Can calculate estimates and graph survival functions using the parametric method and Kaplan Meier</i></p>	<ol style="list-style-type: none"> <li>2.1 Dapat menghitung probabilitas survival</li> <li>2.2 Dapat membuat kurva Kaplan Meier</li> <li>2.3 Dapat mengidentifikasi bentuk model survival (parametrik)</li> </ol> <ol style="list-style-type: none"> <li>1. <i>Can calculate the probability of survival</i></li> <li>2. <i>Can create a Kaplan Meier (KM) curve</i></li> <li>3. <i>Can identify the shape of the survival model (parametric)</i></li> </ol>	<b>Non Tes:</b> - Observasi Aktifitas di kelas - Tugas <b>Non Test:</b> - Activity <i>Observation in Class</i> - Task	Ceramah interaktif Diskusi (CID) Latihan Soal  TM: 3x50" PT: 3x60" BM: 3x60"  <i>Interactive Lecturer, Discussion, Exercise</i>  <i>L: 3x50"</i> <i>EA: 3x60"</i> <i>IL: 3x60"</i>		<b>Fungsi survival:</b> fungsi survival (parametrik), kurva survival Kaplan Meier, hazard rate  <i>Survival function : Survival function(parametric), Kaplan Meier survival curve, hazard rate</i>  [1] Bab 2	10%
3-4	<p>Dapat melakukan pengujian perbedaan dua atau lebih kurva survival</p> <p><i>Can test the difference between two or more survival curves</i></p>	<ol style="list-style-type: none"> <li>1. Dapat melakukan uji Log Rank (LR) untuk 2 group</li> <li>2. Dapat melakukan uji LR untuk beberapa group (lebih dari 2 group)</li> </ol> <ol style="list-style-type: none"> <li>1. <i>Can do LR test for 2 groups</i></li> <li>2. <i>Can perform LR tests for several groups (more than 2 groups)</i></li> </ol>	<b>Non Tes:</b> - Observasi Aktifitas di kelas - Tugas <b>Non Test:</b> - Activity <i>Observation in Class</i> - Task	Small Group Discussion Praktikum  TM: 3x50" PT: 3x60" BM: 3x60"  <i>Small Group Discussion Practice</i>  <i>L: 3x50"</i> <i>EA: 3x60"</i> <i>IL: 3x60"</i>		<b>The log rank (LR) test:</b> LR test untuk 2 group dan lebih dari 2 group:  <i>The log rank (LR) test: LR test for 2 group and more than 2 group</i>  [1] Bab 2	10%
5-7	<p>Dapat mengidentifikasi dan melakukan estimasi parameter</p>	<ol style="list-style-type: none"> <li>1. Dapat mengidentifikasi</li> </ol>	<b>Tes:</b> Kuis 1	Ceramah interaktif Diskusi (CID)		<b>Regresi survival parametrik:</b> Regresi	20%



	<p>regresi survival untuk data lengkap maupun tersensor</p> <p><i>Can identify and estimate survival regression parameters for complete and censored data</i></p>	<p>regresi yang sesuai (regresi eksponensial, weibull, loglogistik)</p> <p>2. Dapat melakukan estimasi MLE dari parameter regres yang sesuai baik untuk data lengkap maupun tersensor</p> <p>3. Dapat menganalisis model regresi</p> <p>1. <i>Can identify suitable regressions (exponential regression, weibull, logistic)</i></p> <p>2. <i>Can estimate MLE from the appropriate regression parameters for both complete and censored data</i></p> <p>3. <i>Can analyze the regression model</i></p>	<p><b>Test:</b> <i>Quiz 1</i></p>	<p>Praktikum</p> <p>TM: 3x 3x50" PT: 3x 3x60" BM: 3x 3x60"</p> <p><i>Interactive Lecturer, Discussion, Practice</i></p> <p><b>L: 3x 3x50"</b> <b>EA: 3x 3x60"</b> <b>IL: 3x 3x60"</b></p>		<p>Eksponensial, Weibull, Loglogistik</p> <p><i>Parametric survival regression : Exponential, Weibull, Loglogistics</i></p> <p>[1] Bab 7</p>	
8	<b>ETS/Midterm</b>						
9-10	<p>Dapat mengidentifikasi dan merumuskan bentuk umum dari model Cox PH</p> <p><i>Can identify and formulate the general form of the Cox PH model</i></p>	<p>1. Dapat merumuskan bentuk spesifik dari model Cox PH yang sesuai</p> <p>2. Dapat merumuskan bentuk dan sifat-sifat fungsi hazard model Cox PH</p> <p>3. Dapat menginterpretasikan model Cox PH</p> <p>1. <i>Can formulate a specific form of the</i></p>	<p><b>Non Tes:</b></p> <ul style="list-style-type: none"> <li>- Observasi Aktifitas di kelas</li> <li>- Tugas</li> </ul> <p><b>Non Test:</b></p> <ul style="list-style-type: none"> <li>- Activity</li> <li>- Observation in Class</li> <li>- Task</li> </ul>	<p>Ceramah interaktif Diskusi (CID) Praktikum</p> <p>TM: 2x 3x50" PT: 2x 3x60" BM: 2x 3x60"</p> <p><i>Interactive Lecturer, Discussion, Practice</i></p> <p><b>L: 2x 3x50"</b> <b>EA: 2x 3x60"</b> <b>IL: 2x 3x60"</b></p>		<p><b>The Model Cox proportional Hazard (PH) model:</b></p> <p>Estimasi model cox PH, Hazard ratio model cox PH, interval estimation</p> <p><b>The Cox proportional Hazard (PH) model: Cox PH model estimation, Hazard ratio cox PH model, interval estimation</b></p> <p>[1] Bab 3</p>	20%

		<p><i>appropriate Cox PH model</i></p> <p>2. <i>Can formulate the form and characteristics of the hazard function Cox PH model</i></p> <p>3. <i>Can interpret the Cox PH model</i></p>					
11-12	<p>Dapat melakukan dan menganalisis uji asumsi dari model Cox PH dengan metode grafik dan uji goodness of fit (GOF)</p> <p><i>Can perform and analyze the assumption test of the Cox PH model with the graph method and the goodness of fit (GOF) test</i></p>	<p>1. Dapat melakukan uji asumsi model Cox PH dengan metode:</p> <ul style="list-style-type: none"> <li>- Grafik</li> <li>- Uji GOF</li> </ul> <p>2. Dapat menganalisis dan menginterpretasikan hasil evaluasi asumsi</p> <p><i>1. Can test the assumptions of the Cox PH model using the following methods: Graphics GOF test</i></p> <p><i>2. Can analyze and interpret the results of evaluation assumptions</i></p>	<p><b>Non Tes:</b></p> <ul style="list-style-type: none"> <li>- Observasi Aktifitas di kelas</li> <li>- Tugas Project</li> <li>- Presentasi</li> </ul> <p><b>Non Test:</b></p> <ul style="list-style-type: none"> <li>- Activity Observation in Class</li> <li>- Project Task</li> <li>- Presentation</li> </ul>	<p>Ceramah interaktif Diskusi (CID) Praktikum</p> <p>TM: 2x 3x50" PT: 2x 3x60" BM: 2x 3x60"</p> <p><i>Interactive Lecturer, Discussion, Practice</i></p> <p>L: 2x 3x50" EA: 2x 3x60" IL: 2x 3x60"</p>		<p><b>Evaluasi asumsi proportional hazards:</b> -- pendekatan grafik(log-log plots, nilai aktual dengan nilai prediksi) - pendekatan uji goodness of fit</p> <p><i>Evaluation of proportional hazards assumptions: -- graphical approach(log-log plots, actual values with predicted values)- goodness of fit test approach</i></p> <p>[1] Bab 4</p>	10%

13-14	<p>Dapat melakukan pemodelan menggunakan Stratified Cox Model</p> <p><i>Can perform modeling using the Stratified Cox Model</i></p>	<p>1. Dapat melakukan pemodelan Stratified <b>Cox regression</b></p> <p>2. Dapat menganalisis dan menginterpretasikan model Stratified <b>Cox regression</b></p> <p>1. <i>Can perform Stratified Cox regression modeling</i></p> <p>2. <i>Can analyze and interpret the Stratified Cox regression model</i></p>	<p><b>Non Tes:</b></p> <ul style="list-style-type: none"> <li>- Observasi Aktifitas di kelas</li> <li>- Tugas Project</li> <li>- Presentasi</li> </ul> <p><b>Non Test:</b></p> <ul style="list-style-type: none"> <li>- Activity Observation in Class</li> <li>- Project Task</li> <li>- Presentation</li> </ul>	<p>Ceramah interaktif Diskusi (CID) Praktikum</p> <p>TM: 3x 3x50" LT: 3x 3x60" BM: 3x 3x60"</p> <p><i>Interactive Lecturer, Discussion, Practice</i></p> <p>L: 3x 3x50" EA: 3x 3x60" IL: 3x 3x60"</p>		<p><b>Stratified Cox model:</b> Estimasi model, Hazard ratio, interval estimation</p> <p><i>Stratified Cox models: Model estimation, Hazard ratio, interval estimation</i></p> <p>[1] Bab 5</p>	10%
15	<p>Dapat melakukan pemodelan menggunakan Extended Cox Model</p> <p><i>Can perform modeling using the Extended Cox Model</i></p>	<p>1. Dapat melakukan pemodelan <i>Extended Cox regression</i></p> <p>2. Dapat menganalisis dan menginterpretasikan model <i>Extended Cox regression</i></p> <p>1. <i>Can perform Stratified Cox regression modeling</i></p> <p>2. <i>Can analyze and interpret the Stratified Cox regression model</i></p>	<p><b>Non Tes:</b></p> <ul style="list-style-type: none"> <li>- Observasi Aktifitas di kelas</li> <li>- Tugas Project</li> <li>- Makalah</li> <li>- Presentasi</li> </ul> <p><b>Non Test:</b></p> <ul style="list-style-type: none"> <li>- Activity Observation in Class</li> <li>- Project Task</li> <li>- Paper</li> <li>- Presentation</li> </ul>	<p>Ceramah interaktif Diskusi (CID) Praktikum</p> <p>TM: 3x 3x50" PT: 3x 3x60" BM: 3x 3x60"</p> <p><i>Interactive Lecturer, Discussion, Practice</i></p> <p>L: 3x 3x50" EA: 3x 3x60" IL: 3x 3x60"</p>		<p><b>Extended Cox model:</b> Estimasi model, Hazard ratio, interval estimation</p> <p><i>Extended Cox models: Model estimation, Hazard ratio, interval estimation</i></p> <p>[1] Bab 6</p>	10%
16	<b>Evaluasi Akhir Semester / Ujian Akhir Semester/<i>Final Exam</i></b>						

