

# MODULE HANDBOOK

## ANALYSIS OF RISK AND PORTFOLIO OPTIMIZATION



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

## ENDORSEMENT PAGE



### MODULE HANDBOOK ANALYSIS OF RISK AND PORTFOLIO OPTIMIZATION 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>	Dr.rer.pol Dedy Dwi Prastyo, M.Si	Dosen Lecturer		
Pemeriksa dan Pengendalian <i>Review and Control</i>	Dr.rer.pol Dedy Dwi Prastyo, M.Si; Dr. Drs. Agus Suharsono, MS	Tim kurikulum Curriculum team		
Persetujuan <i>Approval</i>	Dr. Ir. Setiawan, MS	Koordinator RMK Course Cluster Coordinator		
Penetapan <i>Determination</i>	Dr. Kartika Fithriasari, M.Si	Kepala Departemen Head of Department		

# MODULE HANDBOOK

## ANALYSIS OF RISK AND PORTFOLIO OPTIMIZATION

Module name	ANALYSIS OF RISK AND PORTFOLIO OPTIMIZATION	
Module level	Undergraduate	
Code	SS234746	
Course (if applicable)	ANALYSIS OF RISK AND PORTFOLIO OPTIMIZATION	
Semester	7	
Person responsible for the module	Dr.rer.pol Dedy Dwi Prastyo, M.Si	
Lecturer	Dr.rer.pol Dedy Dwi Prastyo, M.Si; Dr. Drs. Agus Suharsono, MS	
Language	Bahasa Indonesia and English	
Relation to curriculum	Undergraduate degree program, elective, 7th semester.	
Type of teaching, contact hours	Case Method (41,18%) Team Based Project (5,88%) Other SCL Methods (52,94%)	
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)perweek.	
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 Understand the concept of risk management in finance CLO-2 Able to Analyze the Financial Statement (Report) of Corporate CLO-3 Understand the Concept of Risk and Return CLO-4 Able to analyze and optimize portfolio	PLO-4 PLO-9 PLO-10
Content	Analysis of Risk and Portfolio Optimization is a course that contains statistical methods for measuring risk according to risk theory and financial theory. The results of the risk analysis can be used as a basis for decision making to determine risk diversification and investment portfolio optimization. Students learn the concepts of financial risk management, financial statement analysis, and statistical methods for risk analysis and modeling, as well as portfolio optimization. Students also learn methods for predicting	

	future risks based on historical data and fundamental analysis based on financial ratios. To achieve this goal, the learning strategies used are discussions, problem based learning (PBL), and exercises and assignments to analyze real data.
Assessment and its weight	Assignment I – 25% Midterm Exam – 25% Assignment II – 20% Final Project – 30%
Media employed	LCD, whiteboard, websites (myITS Classroom), zoom
Reading list	<ol style="list-style-type: none"> <li>1. Jonathan Berk and Peter DeMarzo. 2019. Corporate Finance, 5th Edition Global Edition. USA: Pearson.</li> <li>2. Tsay, R. S. (2013). <i>An Introduction to Analysis of Financial Data with R</i> (1st ed.). Hoboken, New Jersey: John Wiley &amp; Sons, Inc.</li> <li>3. Palczewski, A. (2018). LP Algorithms for Portfolio Optimization: The PortfolioOptim Package. <i>R Journal</i> 10 (1), 308-327.</li> <li>4. Richard Brealey, Stewart Myers, Franklin Allen and Alex Edmans (2022). <i>Principles of Corporate Finance</i>. 14th Edition. McGraw-Hill.</li> <li>5. Klugman, S.A., Panjer, H.H., Willmotm G.E., (2008), <i>Loss Model : From Data to Decision</i>, McGraw-Hill.</li> <li>6. Jorion, P., (2007), <i>Value at Risk: The New Benchmark for Managing Financial Risk</i>, 3<sup>rd</sup> edition, McGraw-Hill</li> <li>7. Kaas, R., Goovaerts, M., Dhaene, J. and Denuit, M., (2008), <i>Modern Actuarial Risk Theory</i>. Springer.</li> <li>8. Wei, W. W. (2006). <i>Time Series Analysis Univariate and Multivariate Methods</i> (2nd ed.). Canada: Addison Wesley Publishing Company.</li> <li>9. Hautsch, N. (2012). <i>Econometrics of Financial High-Frequency Data</i>. New York, Berlin, Heidelberg: Springer Verlag.</li> <li>10. Borak, S., Härdle, W., and Hafner, C. (2011), <i>Statistics of Financial Market: An Introduction</i>, 3<sup>rd</sup> ed., Springer.</li> <li>11. Härdle, W., Hautsch, N., and Overbeck L. (2008), <i>Applied Quantitative Finance</i>, 2<sup>nd</sup> ed., Springer.</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)/</b> <i>Course</i>	<b>KODE/</b> <i>Code</i>	<b>Rumpun MK/</b> <i>Course Group</i>	<b>BOBOT (sks)/</b> <i>Weight (credit)</i>		<b>SEMESTER/</b> <i>Semester</i>	<b>Tgl Penyusunan/</b> <i>Drafting Date</i>
<b>ANALISIS RISIKO DAN OPTIMASI PORTFOLIO/</b> <i>ANALYSIS OF RISK AND PORTFOLIO OPTIMIZATION</i>	SS234746	ANDEF	<b>T=3</b>	<b>P=</b>	VII	17 Desember 2022
<b>OTORISASI/</b> <i>AUTHORIZATION</i>	<b>Pengembang RPS/</b> <i>RPS Developer</i>		<b>Koordinator RMK/</b> <i>Course Group Coordinator</i>		<b>Ketua PRODI/</b> <i>Head of Department</i>	
	Dr.rer pol. Dedy Dwi Prastyo, S.Si, M.Si		Dr. Ir. Setiawan, MS		Dr. Kartika Fithriasari, M.Si	
<b>Capaian Pembelajaran (CP)/</b> <i>Learning Achievement</i>	<b>CPL-PRODI yang dibebankan pada MK/ PLO</b>					
	CPL-4	Mampu menerapkan Sains dan Matematika untuk mendukung pemahaman metode statistika				
	CPL-9	Mampu menerapkan metode statistika untuk menganalisis permasalahan teoritis dan riil.				
	CPL-10	Mampu menerapkan metode statistika Bisnis, Industri, Ekonomi, Sosial, Lingkungan atau Kesehatan pada permasalahan riil.				
	<i>PLO-4</i>	<i>Able to apply Science and Mathematics to support the understanding of statistical methods</i>				
<i>PLO-9</i>	<i>Able to apply statistical methods to analyze theoretical and real problems.</i>					
<i>PLO-10</i>	<i>Able to apply business, industrial, economic, social, environmental or health statistical methods to real problems.</i>					
	<b>Capaian Pembelajaran Mata Kuliah (CPMK)/ CLO</b>					

	<p>CPMK-1 Memahami konsep manajemen risiko dalam konteks finansial  CPMK -2 Mampu menganalisis laporan keuangan perusahaan  CPMK-3 Memahami konsep Risk dan Return  CPMK-4 Dapat menganalisis dan melakukan optimasi portfolio</p> <p><i>CLO-1 Understand the concept of risk management in finance</i>  <i>CLO-2 Able to Analyze the Financial Statement (Report) of Corporate</i>  <i>CLO-3 Understand the Concept of Risk and Return</i>  <i>CLO-4 Able to analyze and optimize portfolio</i></p>																				
	<p><b>Matrik CPL – CPMK</b>  <i>PLO-CLO Matrix</i></p> <table border="1" data-bbox="539 624 1666 794"> <thead> <tr> <th>CPMK</th> <th>CPL-4</th> <th>CPL-9</th> <th>CPL-10</th> </tr> </thead> <tbody> <tr> <td>CPMK-1</td> <td></td> <td></td> <td>V</td> </tr> <tr> <td>CPMK-2</td> <td>V</td> <td></td> <td>V</td> </tr> <tr> <td>CPMK-3</td> <td></td> <td>V</td> <td>V</td> </tr> <tr> <td>CPMK-4</td> <td>V</td> <td>V</td> <td>V</td> </tr> </tbody> </table>	CPMK	CPL-4	CPL-9	CPL-10	CPMK-1			V	CPMK-2	V		V	CPMK-3		V	V	CPMK-4	V	V	V
CPMK	CPL-4	CPL-9	CPL-10																		
CPMK-1			V																		
CPMK-2	V		V																		
CPMK-3		V	V																		
CPMK-4	V	V	V																		
<p><b>Deskripsi Singkat MK/ Course Description</b></p>	<p>Analisis Resiko dan Optimasi Portfolio merupakan salah satu mata kuliah yang berisi tentang metode-metode Statistika untuk mengukur resiko sesuai dengan teori risiko dan teori finansial. Hasil analisis risiko tersebut dapat digunakan sebagai salah satu dasar pengambilan keputusan untuk menentukan diversifikasi risiko dan optimasi portfolio investasi. Mahasiswa belajar konsep manajemen risiko finansial, analisis laporan keuangan, dan metode-metode Statistika untuk analisis dan pemodelan risiko, serta optimasi portfolio. Mahasiswa juga belajar metode untuk meramalkan risiko di masa mendatang berdasarkan data historis dan analisis fundamental berdasarkan rasio keuangan. Untuk mencapai tujuan tersebut maka strategi pembelajaran yang digunakan adalah diskusi, problem based learning (PBL), dan latihan serta tugas untuk melakukan analisis data riil.</p> <p><i>Analysis of Risk and Portfolio Optimization is a course that contains statistical methods for measuring risk according to risk theory and financial theory. The results of the risk analysis can be used as a basis for decision making to determine risk diversification and investment portfolio optimization. Students learn the concepts of financial risk management, financial statement analysis, and statistical methods for risk analysis and modeling, as well as portfolio optimization. Students also learn methods for predicting future risks based on historical data and fundamental analysis based on financial ratios. To achieve this goal, the learning strategies used are discussions, problem based learning (PBL), and exercises and assignments to analyze real data.</i></p>																				

<b>Bahan Kajian: Materi Pembelajaran/ Course Material</b>	Sains dan Matematika, Metode dan Pemodelan, Aplikasi di Berbagai Bidang (Lab) <i>Science and Mathematics, Methods and Modeling, Applications in Various Fields (Lab)</i>				
<b>Pustaka/ References</b>	<b>Utama/ Primary:</b>				
	<ol style="list-style-type: none"> <li>Jonathan Berk and Peter DeMarzo. 2019. Corporate Finance, 5th Edition Global Edition. USA: Pearson.</li> <li>Tsay, R. S. (2013). <i>An Introduction to Analysis of Financial Data with R</i> (1st ed.). Hoboken, New Jersey: John Wiley &amp; Sons, Inc.</li> <li>Palczewski, A. (2018). LP Algorithms for Portfolio Optimization: The PortfolioOptim Package. R Journal 10 (1), 308-327.</li> </ol>				
	<b>Pendukung/ Secondary:</b>				
	<ol style="list-style-type: none"> <li>Richard Brealey, Stewart Myers, Franklin Allen and Alex Edmans (2022). Principles of Corporate Finance. 14th Edition. McGraw-Hill.</li> <li>Klugman, S.A., Panjer, H.H., Willmotm G.E., (2008), <i>Loss Model : From Data to Decision</i>, McGraw-Hill.</li> <li>Jorion, P., (2007), Value at Risk: The New Benchmark for Managing Financial Risk, 3<sup>rd</sup> edition, McGraw-Hill</li> <li>Kaas, R., Goovaerts, M., Dhaene, J. and Denuit, M., (2008), <i>Modern Actuarial Risk Theory</i>. Springer.</li> <li>Wei, W. W. (2006). <i>Time Series Analysis Univariate and Multivariate Methods</i> (2nd ed.). Canada: Addison Wesley Publishing Company.</li> <li>Hautsch, N. (2012). <i>Econometrics of Financial High-Frequency Data</i>. New York, Berlin, Heidelberg: Springer Verlag.</li> <li>Borak, S., Härdle, W., and Hafner, C. (2011), <i>Statistics of Financial Market: An Introduction</i>, 3<sup>rd</sup> ed., Springer.</li> <li>Härdle, W., Hautsch, N., and Overbeck L. (2008), <i>Applied Quantitative Finance</i>, 2<sup>nd</sup> ed., Springer.</li> </ol>				
<b>Dosen Pengampu/ Lecturers</b>	Dr.rer.pol Dedy Dwi Prastyo, M.Si; Dr. Drs. Agus Suharsono, MS				
<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) <i>Final capability for each learning step</i></b>	<b>Penilaian/ Evaluation</b>	<b>Bantuk Pembelajaran, Metode Pembelajaran, Penugasan Mahasiswa, [Estimasi Waktu]  <i>Learning Format Learning Methods</i></b>	<b>Materi Pembelajaran [Pustaka] <i>Learning Material [References]</i></b>	<b>Bobot Penilaian (%) <i>Evaluation Weight (%)</i></b>

				Assignment for Student [Estimated Time]			
		Indikator <i>Indicator</i>	Kriteria & Bentuk <i>Criteria and Format</i>	Luring ( <i>offline</i> )	Daring ( <i>online</i> )		
(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
1-2	CPMK-1 Memahami konsep manajemen risiko dalam konteks finansial  <i>CLO-1 Understand the concept of risk management in finance</i>	1.Mampu menerapkan konsep Analisis Investasi, antara lain Nilai Tunai, Nilai Mendatang & Anuitas Akhir. 2.Mampu menerapkan konsep Analisis Investasi Anuitas Awal, Anuitas Tertunda serta Obligasi.  1. <i>Able to apply the concept of Investment Analysis, including Cash Value, Future Value &amp; Final Annuity.</i>  2. <i>Able to apply the concept of Initial Annuity Investment Analysis, Pending Annuity and Bonds.</i>	Ceramah Interaktif, Latihan Soal Diskusi (CILSD), Problem-based learning (PBL)  <i>Interactive Lecture and Discussion on Problem Exercises, Problem-based learning (PBL)</i>	Ceramah Interaktif, Diskusi,  <i>Interactive Lecture, Discussion</i>  <b>TM: 2 x 3 x 50"</b> <b>PT: 2 x 3 x 60"</b> <b>BM: 2 x 3 x 60"</b>		Review Matematika Keuangan meliputi Analisis Investasi (Nilai Tunai & Nilai Mendatang, Anuitas, dan obligasi)  <i>Review of Financial Mathematics (theory of interest) including Investment Analysis (Cash Value &amp; Future Value, Annuities, and bonds)</i>	10% / Kum 10%
3	CPMK-1 Memahami konsep manajemen risiko dalam konteks finansial  <i>CLO-1 Understand the concept of risk</i>	1. Memahami konsep manajemen Resiko, langkah-langkah dalam identifikasi & pengukuran risiko. 2. Memahami langkah-langkah dalam pengelolaan risiko.  1. <i>Understand the concept</i>	<i>Interactive Lecture and Discussion on Problem Exercises, PBL</i>	Ceramah Interaktif, Diskusi, <i>Interactive Lecture, Discussion</i>  <b>TM: 1 x 3 x 50"</b> <b>PT: 1 x 3 x 60"</b> <b>BM: 1 x 3 x 60"</b>		1. Identifikasi Resiko 2. Pengukuran Resiko 3. Pengelolaan Resiko  <i>1. Risk Identification 2. Risk Measurement 3. Risk Management</i>	10% / Kum 20%



	<i>management in finance</i>	<i>of risk management, the steps in risk identification &amp; measurement.</i>  2. <i>Understand the steps in risk management.</i>					
4-7	CPMK -2 Mampu menganalisis laporan keuangan perusahaan  <i>CLO-2 Able to Analyze the Financial Statement (Report) of Corporate</i>	Dapat memahami struktur laporan keuangan perusahaan  <i>Can understand the structure of the corporate's financial statements</i>	CILSD, PBL, Observasi di kelas, Tugas 2  <i>Interactive Lecture and Discussion on Problem Exercises, PBL, oral test, observation of classroom activities, Assignment</i>	Ceramah Interaktif, Diskusi  <i>Interactive Lecture, Discussion</i>  <b>TM: 4 x 3 x50"</b> <b>LT: 4 x 3 x 60"</b> <b>BM: 4 x 3 x60"</b>		Penjelasan mengenai laporan keuangan perusahaan secara Umum  <i>A description of the corporate's financial statements in general and in particular of activity, profitability, liquidity and solvency ratios</i>	30% / Kum 50%
8	<b>Evaluasi Tengah Semester / Ujian Tengah Semester / Midterm</b>						
9	CPMK-3 Memahami konsep Risk dan Return  <i>CLO-3 Understand the Concept of Risk and Return</i>	1. Memahami terjadinya resiko pasar serta metode-metode untuk mengukurnya. 2. Mampu menghitung resiko pasar dengan metode Value-at-Risk (VaR): pendekatan historis, analitis, simulasi Monte Carlo. 3. Mampu menerapkan pendekatan moving window dalam penghitungan VaR	CILSD, PBL, Observasi di kelas, Tugas 2  <i>Interactive Lecture and Discussion on Problem Exercises, PBL, oral test, observation of classroom activities, Assignment</i>	Ceramah Interaktif, Diskusi  <i>Interactive Lecture, Discussion</i>  <b>TM: 1 x 3 x 50"</b> <b>LT: 1 x 3 x 60"</b> <b>BM: 1 x 3 x 60"</b>		<b>Resiko Pasar:</b> 1. Metode Deviasi Standar 2. Metode Pengukuran Value at Risk (VaR) a. Metode Historis VaR b. Metode Analitis VaR c. Metode Simulasi Monte Carlo 3. Pendekatan moving window dalam penghitungan VaR 4. Backtesting  <b>Market Risk:</b> 1. <i>Standard Deviation Method</i>	10% / Kum 60%

		<ol style="list-style-type: none"> <li>1. Understand the market risk and methods to measure it.</li> <li>2. Able to calculate market risk using the Value-at-Risk (VaR) method with a historical, analytical, Monte Carlo simulation approaches.</li> <li>3. Able to apply a moving window approach in calculating the VaR</li> </ol>				<ol style="list-style-type: none"> <li>2. Value at Risk (VaR): <ol style="list-style-type: none"> <li>a. VaR using Historical Method</li> <li>b. VaR using Analytical Method</li> <li>c. VaR using Monte Carlo Simulation Methods</li> </ol> </li> <li>3. Moving window approach to calculate VaR</li> <li>4. Backtesting</li> </ol>	
10	CPMK-3 Memahami konsep Risk dan Return  <i>CLO-3 Understand the Concept of Risk and Return</i>	Mampu menghitung resiko dengan pendekatan Nonparametric  <i>Able to calculate risk with a nonparametric approach</i>	PBL, Observasi di kelas, Tugas 2  <i>PBL, oral test, observation of classroom activities, Assignment</i>	Ceramah Interaktif, Diskusi,  <i>Interactive Lecture, Discussion</i>  <b>TM: 1 x 3 x 50"</b> <b>LT: 1 x 3 x 60"</b> <b>BM: 1 x 3 x 60"</b>		Penghitungan VaR dengan pendekatan <i>Kernel Density Estimator</i> (KDE)  <i>VaR calculation using the Kernel Density Estimator (KDE) approach</i>	5%/Kum 65%
11	CPMK-3 Memahami konsep Risk dan Return  <i>CLO-3 Understand the Concept of Risk and Return</i>	Dapat menghitung resiko antar aset yang mempunyai dependensi menggunakan dengan pendekatan <i>Copulae</i>  <i>Can calculate the dependent risk using using Copulae approach</i>	PBL, Observasi di kelas, Tugas 2  <i>PBL, oral test, observation of classroom activities, Assignment</i>	Ceramah Interaktif, Diskusi  <i>Interactive Lecture, Discussion</i>  <b>TM: 1 x 3 x 50"</b> <b>LT: 1 x 3 x 60"</b> <b>BM: 1 x 3 x 60"</b>		Penghitungan VaR untuk asset yang tidak saling bebas dengan pendekatan <i>Copulae</i>  <i>calculations for dependent risk using Copulae approach</i>	5%/Kum 70%
12-13	CPMK-3 Memahami konsep Risk dan Return  <i>CLO-3 Understand the Concept of Risk and Return</i>	<ol style="list-style-type: none"> <li>1. Dapat menghitung VaR dengan pendekatan ARMA-X dan GARCH-X, serta regresi kuantil</li> <li>2. Memahami konsep Conditional VaR (CVaR)</li> </ol> <ol style="list-style-type: none"> <li>1. Can calculate VaR with ARMA-X and GARCH-X</li> </ol>	PBL, Observasi di kelas, Tugas 2  <i>PBL, oral test, observation of classroom activities, Assignment</i>	Ceramah Interaktif, Diskusi,  <i>Interactive Lecture, Discussion</i>  <b>TM: 2 x 3 x 50"</b> <b>LT: 2 x 3 x 60"</b> <b>BM: 2 x 3 x 60"</b>		Pemodelan risiko dengan melibatkan variabel eksogen menggunakan ARMA-X dan GARCH-X, serta Conditional VaR (CVaR)  <i>Modeling risk with exogenous variables using ARMA-X &amp;</i>	15%/Kum 85%

		<i>approaches, and quantile regression</i> 2. Understand the concept of Conditional VaR (CVaR)				<i>GARCH-X, and using Conditional VaR (CVaR)</i>	
14-15	CPMK-4 Dapat menganalisis dan melakukan optimasi portfolio  <i>CLO-4 Able to analyze and optimize portfolio</i>	1. Dapat melakukan optimasi portfolio berdasarkan kriteria <i>Sharp-ratio</i> 2. Dapat melakukan optimasi portfolio berdasarkan analisis fundamental ( <i>value investing</i> )  1. <i>Able to optimize portfolio based on Sharpe-ratio criterion</i> 2. <i>Able to optimize portfolio based on fundamental analysis (value investing)</i>	PBL, Observasi di kelas, Tugas 2  <i>PBL, oral test, observation of classroom activities, Assignment</i>	Ceramah Interaktif, Diskusi,  <i>Interactive Lecture, Discussion</i>  <b>TM: 2 x 3 x 50"</b> <b>LT: 2 x 3 x 60"</b> <b>BM: 2 x 3 x 60"</b>		1. Sharpe-ratio & efficient frontier 2. Algoritma Optimasi 3. Optimasi dengan algoritma pendekatan non-derivatif 4. Optimasi berdasarkan Value investing  1. <i>Sharpe-ratio &amp; efficient frontier</i> 2. <i>Algorithm for optimization</i> 3. Optimization using non-derivative approach algorithm 4. Value investing optimization	15%/100%
16	Evaluasi Akhir Semester / Ujian Akhir Semester / <i>final exam</i>						

