MODULE HANDBOOK

NONPARAMETRIC REGRESSION

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

ENDORSEMENT PAGE

	**MODULE HANDBOOK** **NONPARAMETRIC REGRESSION** **STATISTICS UNDERGRADUATE PROGRAM** **DEPARTMENT OF STATISTICS** **INSTITUT TEKNOLOGI SEPULUH NOPEMBER**

Proses *Process*	Penanggung Jawab *Person in Charge*			Tanggal *Date*
	Nama *Name*	Jabatan *Position*	Tanda tangan *Signature*	
Perumus *Preparation*	Prof. Dr. Drs. I Nyoman Budiantara, M.Si	Dosen *Lecturer*		
Pemeriksa dan Pengendalian *Review and Control*	Prof. Dr. Drs. I Nyoman Budiantara, M.Si	Tim kurikulum *Curriculum team*		
Persetujuan *Approval*	Dr. Santi Wulan Purnami, M.Si	Koordinator RMK *Course Cluster Coordinator*		
Penetapan *Determination*	Dr. Kartika Fithriasari, M.Si	Kepala Departemen *Head of Department*		

MODULE HANDBOOK
NONPARAMETRIC REGRESSION

Module name	NONPARAMETRIC REGRESSION	
Module level	Undergraduate	
Code	SS234636	
Course (if applicable)	NONPARAMETRIC REGRESSION	
Semester	7	
Person responsible for the module	Prof. Dr. I Nyoman Budiantara, M.Si	
Lecturer	Prof. Dr. I Nyoman Budiantara, M.Si	
Language	Bahasa Indonesia and English	
Relation to curriculum	Undergradute degree program, elective, 7th semester.	
Type of teaching, contact hours	Case Method (53,84%) Other SCL Methods (46,16%)	
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 Understand the basic concepts of parametric regression, regression and semiparametric regression and can distinguish between parametric regression, nonparametric regression and semiparametric regression. distinguish between parametric regression, nonparametric and semiparametric regression. CLO.2 Able to model data patterns using regression models nonparametric regression models using Spline, Kernel, Fourier Series and local polynimial CLO.3 Able to select the optimal bandwidth parameter in Kernel, selecting the optimal knot points in the Spline, and selecting the optimal Oscillation parameter in Fourier Series using various methods CLO.4 Able to model data patterns using semiparametric Spline, Fourier series, Kernel	PLO-7 PLO-9 PLO-10

	and local polynomial, as well as for multiresponse and longitudinal data	
Content	Nonparametric Regression is a method in Regression Analysis to model data patterns that do not follow a certain pattern. This course material begins with an introduction to parametric regression, distinguishing Parametric Regression, Nonparametric Regression Spline Truncated and Semiparametric Spline Truncated Regression. Furthermore, data modeling is discussed in depth using Spline Truncated Regression in univariable, multivariable nonparametric regression and choosing the best model, and its applications. In addition, a semiparametric Spline Truncated regression model is presented and the selection of the best model along with its application is presented. with its application is presented. Furthermore, the generalization of the Spline Truncated model to nonparametric and semiparametric regression for long data is discussed and semiparametric regression for longitudinal data, and its application in various fields.	
Assessment and its weight	Quiz (25%) Cognitive - Midterm Exam (25%) Case Method (25%) Cognitive - Final Exam (25%)	
Media employed	LCD, whiteboard, websites (myITS Classroom), zoom	
Reading list	1. Bilodeau, M., 1992, Fourier Smoother and Additive Models, The Canadian Journal of Statistics, 3, 257-269. 2. Eubank, R. L., 1988, Spline Smoothing and Regresi Non Parametrik, Mercel Dekker, New York. 3. Green, P. J., and Silverman, B. W.,1994, Regresi Non Parametrik and Generalized Linear Models, Chapman and Hall, London. 4. Hardle, W., 1990, Applied Regresi Non Parametrik, Cambridge University Press, New York 5. Hardle, W., 1991, Smoothing Tecniques With Implementation in S, Springger Verlag, New York. 6. Rupert, D., Wand, M.P, and Carrol, R.J., 2003, Semiparametric Regression, Cambridge University Presss, New York 7. Wahba, G., 1990, Spline Models for Observational Data, SIAM, Pensylvania. 8. Wu, H. and Zhang, J. T., 2006, Regresi Non Parametrik Method for Longitudinal Data Analisys Mixed Effects Modeling Approaches, John Wiley and Sons, New York.	

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

RENCANA PEMBELAJARAN SEMESTER/
SEMESTER LEARNING PLAN

MATA KULIAH (MK)/ *Course*	**KODE/** *Code*	**Rumpun MK/** *Course Group*	**BOBOT (sks)/** *Weight (credit)*		**SEMESTER/** *Semester*	**Tgl Penyusunan/** *Drafting Date*
REGRESI NONPARAMETRIK / *NONPARAMETRIC REGRESSION*	SS234636	Statistika Sosial dan Kependudukan	**T=3**	**P=0**		Agustus 2024

OTORISASI/ *AUTHORIZATION*	**Pengembang RPS/** *RPS Developer*	**Koordinator RMK/** *Course Group Coordinator*	**Ketua PRODI/** *Head of Department*
	Prof. Dr. Drs. I Nyoman Budiantara, M.Si	Prof. Dr. Drs. I Nyoman Budiantara, M.Si	Dr. Kartika Fithriasari, M.Si

Capaian Pembelajaran (CP)/ *Learning Achievement*	**CPL-PRODI yang dibebankan pada MK/** *PLO*	
	CPL-7	Mampu menggunakan perangkat komputasi modern untuk menyelesaikan permasalahan statistik
	CPL-9	Mampu menerapkan metode statistika dengan tepat serta mengevaluasinya untuk menganalisis permasalahan teoritis dan riil
	CPL-10	Mampu menerapkan metode Statistika Bisnis, Industri, Ekonomi Finansial, Sosial Kependudukan, Lingkungan atau Kesehatan yang berbasis Komputasi pada permasalahan riil
	PLO-7	*Able to use modern computing devices to solve statistical problems*
	PLO-9	*Able to apply statistical methods correctly and evaluate them to analyze theoretical and real problems*
	PLO-10	*Able to apply Computing-based Business, Industrial, Financial Economic, Social Population, Environmental or Health Statistics methods to real problems*
	Capaian Pembelajaran Mata Kuliah (CPMK)/ *CLO*	
	CPMK 1. Memahami konsep dasar regresi parametrik, regresi nonparametrik serta regresi semiparametrik dan bisa membedakan antara regresi parametrik, nonparametrik dan semiparametrik CPMK 2. Memodelkan pola data menggunakan model regresi nonparametrik Spline, Kernel, Deret Fourier dan Polinimial lokal	

<table>
<tr><td></td><td>CPMK 3. Memilih parameter bandwith optimal dalam Kernel, memilih titik knot optimal dalam Spline, dan memilih parameter Osilasi optimal dalam Deret Fourier menggunakan berbagai metode.
CPMK 4. Memodelkan pola data menggunakan semiparametrik Spline, deret Fourier, Kernel dan polinomial lokal, serta untuk data multirespons dan data longitudinal
CLO.1 Understand the basic concepts of parametric regression, regression and semiparametric regression and can distinguish between parametric regression, nonparametric regression and semiparametric regression. distinguish between parametric regression, nonparametric and semiparametric regression.
CLO.2 Able to model data patterns using regression models nonparametric regression models using Spline, Kernel, Fourier Series and local polynimial
CLO.3 Able to select the optimal bandwidth parameter in Kernel, selecting the optimal knot points in the Spline, and selecting the optimal Oscillation parameter in Fourier Series using various methods
CLO.4 Able to model data patterns using semiparametric Spline, Fourier series, Kernel and local polynomial, as well as for multiresponse and longitudinal data</td></tr>
<tr><td></td><td>Matrik CPL – CPMK
PLO-CLO Matrix

<table>
<tr><td></td><td>CPL-7</td><td>CPL-9</td><td>CPL-10</td></tr>
<tr><td>CPMK-1</td><td></td><td>✓</td><td></td></tr>
<tr><td>CPMK-2</td><td>✓</td><td>✓</td><td></td></tr>
<tr><td>CPMK-3</td><td>✓</td><td>✓</td><td></td></tr>
<tr><td>CPMK-4</td><td>✓</td><td>✓</td><td>✓</td></tr>
</table></td></tr>
<tr><td>Deskripsi Singkat MK/
Course Description</td><td>Regresi Nonparametrik adalah metode dalam Analisis Regresi untuk memodelkan pola data yang tidak mengikuti pola tertentu. Materi mata kuliah ini diawali dengan pengenalan regresi parametrik, membedakan Regresi Parametrik, Regresi Nonparametrik Spline Truncated dan Regresi Semiparametrik Spline Truncated. Selanjutnya dibahas secara mendalam pemodelan data menggunakan Spline Truncated Regression secara univariabel, regresi nonparametrik multivariabel dan memilih model terbaik, beserta aplikasinya. Selain itu, model regresi semiparametrik Spline Truncated disajikan dan pemilihan model terbaik disertai dengan penerapannya disajikan. Selanjutnya dibahas generalisasi model Spline Truncated pada regresi nonparametrik dan semiparametrik untuk data longitudinal, dan penerapannya di berbagai bidang.
Nonparametric Regression is a method in Regression Analysis to model data patterns that do not follow a certain pattern. This course material begins with an introduction to parametric regression, distinguishing Parametric Regression, Nonparametric Regression Spline Truncated and Semiparametric Spline Truncated Regression. Furthermore, data modeling is discussed in depth using Spline Truncated Regression in univariable, multivariable nonparametric regression and choosing the best model, and its applications. In addition, a semiparametric Spline Truncated regression model is presented and the selection of the best model along with its application is presented. with its application is presented. Furthermore, the generalization of the Spline Truncated model to nonparametric and semiparametric regression for long data is discussed and semiparametric regression for longitudinal data, and its application in various fields.</td></tr>
</table>

Bahan Kajian: Materi Pembelajaran/ ***Course Material***	Dasar Sains, Teori Statistika, Deskripsi dan Eksplorasi, Komputasi dan Data Processing, Pemodelan, Industri dan Bisnis, Pemerintahan dan Kependudukan, Ekonomi dan Manajemen, Kesehatan dan Lingkungan, Sosial Humaniora
Pustaka/ ***References***	**Utama/*Primary*:** 1. Bilodeau, M., 1992, Fourier Smoother and Additive Models, The Canadian Journal of Statistics, 3, 257-269 **Pendukung/*Secondary*:** 1. Eubank, R. L., 1988, Spline Smoothing and Regresi Non Parametrik, Mercel Dekker, New York. 2. Green, P. J., and Silverman, B. W.,1994, Regresi Non Parametrik and Generalized Linear Models, Chapman and Hall, London. 3. Hardle, W., 1990, Applied Regresi Non Parametrik, Cambridge University Press, New York 4. Hardle, W., 1991, Smoothing Tecniques With Implementation in S, Springger Verlag, New York. 5. Rupert, D., Wand, M.P, and Carrol, R.J., 2003, Semiparametric Regression, Cambridge University Presss, New York 6. Wahba, G., 1990, Spline Models for Observational Data, SIAM, Pensylvania. 7. Wu, H. and Zhang, J. T., 2006, Regresi Non Parametrik Method for Longitudinal Data Analisys Mixed Effects Modeling Approaches, John Wiley and Sons, New York.
Dosen Pengampu/ ***Lecturers***	Prof. Dr. Drs. I Nyoman Budiantara, M.Si
Matakuliah syarat/ ***Pre-requisite Course***	Analisis Regresi *Regression Analysis*

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 Learning Methods Assignment for Student [Estimated Time]*		**Materi Pembelajaran [Pustaka]** *Learning Material [References]*	**Bobot Penilaian (%)** *Evaluation Weight (%)*
		Indikator *Indicator*	**Kriteria & Bentuk** *Criteria and Format*	**Luring** *Offline*	**Daring** *Online*		
(1)	**(2)**	**(3)**	**(4)**	**(5)**	**(6)**	**(7)**	**(8)**
1	Mampu memahami konsep Konsep dasar regresi parametrik dan nonparametrik dan mampu membedakan regresi parametrik dan nonparametric *Able to understand the basic concepts of parametric and nonparametric regression concepts and to be able to distinguish between parametric and nonparametric*	1. Mampu menyelidiki pola data yang berpola tertentu dan tidak berpola. *1.* Mampu mengidentifikasi data yang mengikuti model regresi parametrik dan model regresi nonparametrik.	Tes Tulis, Tugas Soal	Ceramah Interaktif, Diskusi, Latihan Soal **TM: 3x50"** **LT: 3x60"** **BM: 3x60"**		Konsep dasar regresi parametrik dan nonparametrik, serta perbedaan dengan regresi parametrik.	10%
2-3	Mampu melakukan estimasi kurva regresi nonparametrik Spline *Able to estimate nonparametric regression curve using Spline*	1. Mampu mencari estimasi parameter model regresi spline dengan metode LS, PLS, MLE ataupun PL. *1.* Mampu mencari estimasi model regresi spline.	Tes Tulis, Tugas Soal	Ceramah Interaktif, Diskusi, Latihan Soal **TM: 2x3x50"** **LT: 2x3x60"** **BM: 2x3x60"**		Estimasi kurva regresi nonparametrik dengan pendekatan Spline.	15%

4	Mampu melakukan estimasi kurva regresi nonparametrik Kernel *Able to estimate nonparametric regression curve using Kernel*	*1.* Mampu mencari estimasi kurva regresi nonparametrik Kernel	Tes Tulis, Tugas Soal	Ceramah Interaktif, Diskusi, Latihan Soal **TM: 3x50"** **LT: 3x60"** **BM: 3x60"**		Estimasi kurva regresi nonparametrik dengan pendekatan Kernel.	10%
5-6	Mampu melakukan estimasi kurva regresi nonparametrik Deret Fourier *Able to estimate the nonparametric regression curve for Fourier Series*	*1.* Mampu mencari estimasi model regresi Deret Fourier	Tes Tulis, Tugas Soal	Ceramah Interaktif, Diskusi, Latihan Soal **TM: 2x3x50"** **LT: 2x3x60"** **BM: 2x3x60"**		Estimasi kurva regresi nonparametrik dengan pendekatan Deret Fourier.	15%
7	Mampu melakukan estimasi kurva regresi nonparametrik Polinomial Lokal *Able to estimate nonparametric regression curve Local Polynomial*	1. Mampu mencari estimasi model regresi Polinomial Lokal	Tes Tulis, Tugas Soal	Ceramah Interaktif, Diskusi, Latihan Soal **TM: 3x50"** **LT: 3x60"** **BM: 3x60"**		Estimasi kurva regresi nonparametrik dengan pendekatan Polinomial Lokal	10%
8	**ETS/*Midterm***						
9	Mampu memahami konsep dasar tentang titik knot dan parameter penghalus (bandwith) dalam regresi nonparametrik spline, kernel, deret fourier dan polinomial local *Able to understand the basic concept of knot points and smoothing parameters (bandwidth) in nonparametric regression of spline, kernel, fourier, and local polynomial*	Mampu memahami peran dan konsep dasar tentang : 1. Titik knot. *1.* Parameter penghalus (bandwith)	Tes Tulis, Tugas Soal	Ceramah Interaktif, Diskusi, Latihan Soal **TM: 3x50"** **LT: 3x60"** **BM: 3x60"**		Konsep dasar tentang titik knot dan parameter penghalus (bandwith) dalam regresi nonparametrik spline, kernel, deret fourier dan polinomial lokal.	10%

10-11	Mampu memilih titik knot dan parameter penghalus (bandwith) optimal dalam regresi nonparametrik dengan berbagai metode *Able to select optimal knot points and smoothing parameters (bandwidth) in nonparametric regression with various methods*	Mampu menggunakan metode: 1. GCV 2. CV 3. GML 4. UBR *1.* Dalam memilihan titik knot dan parameter penghalus (bandwith) optimal dalam regresi nonparametrik	Tes Tulis, Tugas Soal	Ceramah Interaktif, Diskusi, Latihan Soal **TM: 2x3x50"** **LT: 2x3x60"** **BM: 2x3x60"**		Pemilihan titik knot dan parameter penghalus (bandwith) optimal dalam regresi nonparametrik dengan berbagai metode	10%
12-13	Mampu memodelkan berbagai hubungan pola data dalam berbagai bidang ilmu menggunakan pendekatan regresi nonparametric *Able to model various data pattern relationships in various fields of science using the approach Nonparametric regression*	Mampu memodelkan berbagai hubungan pola data dalam dunia nyata menggunakan regresi nonparametrik : 1. Spline, 2. Kernel, 3. Deret Fourier *1.* 4. Polinomial Lokal.	Tes Tulis, Tugas Soal	Ceramah Interaktif, Diskusi, Latihan Soal **TM: 2x3x50"** **LT: 2x3x60"** **BM: 2x3x60"**		Aplikasi model regresi nonparametrik Spline, Kernel, Deret Fourier dan Polinomial Lokal.	10%

14-15	Mampu mengembangkan model regresi nonparametrik sederhana, menjadi model regresi nonparametrik yang lebih kompleks *Able to develop simple nonparametric regression model, to become a more complex*	Mampu mengembangkan model regresi nonparametrik sederhana menjadi model-model: 1. Model regresi nonparametrik multivariabel, 2. Model regresi nonparametrik multirespon 3. Model regresi nonparametrik untuk Data longitudinal *1.* Model regresi Semiparametrik.	Tes Tulis, Tugas Soal	Ceramah Interaktif, Diskusi, Latihan Soal **TM: 2x3x50"** **LT: 2x3x60"** **BM: 2x3x60"**		Model regresi nonparametrik multivariabel, multirespon dan Data longitudinal, serta regresi semiparametrik.	10%
16	**Evaluasi Akhir Semester / Ujian Akhir Semester/*Final Exam***						

	RENCANA ASESMEN & EVALUASI *Assessment and Evaluation Plan* Program Studi Sarjana Statistika / *Statistics Undergraduate Program* **REGRESI NONPARAMETRIK /** *NONPARAMETRIC REGRESSION*	**RA&E** SLK-36

Kode MK: SS234636 *Course Code:* *SS234636*	**Bobot sks (T/P):** 3 *CREDITS : 3*	**Rumpun MK:** Statistika Sosial dan Kependudukan *Course cluster:* *Social and Population Statistics*	Smt: VII *Semester VII*
OTORISASI *AUTHORIZATION*	**Penyusun** *Author* Prof. Dr. Drs. I Nyoman Budiantara, M.Si	**Koordinator RMK** *Coordinator of course cluster* Prof. Dr. Drs. I Nyoman Budiantara, M.Si	**Kaprodi** *Head of Department* Dr. Dra. Kartika Fithriasari, M.Si.

Mg ke (1)	Sub CP-MK (2)		Bentuk Asesmen (Penilaian) / Evaluation Type (3)	Bobot / Scoring (%) (4)
	No	Kemampuan akhir / Final Capability		
1	1.1	Mampu memahami konsep Konsep dasar regresi parametrik dan nonparametrik dan mampu membedakan regresi parametrik dan nonparametric *Able to understand the basic concepts of parametric and nonparametric regression concepts and to be able to distinguish between parametric and nonparametric*		10%
2-3	1.2	Mampu melakukan estimasi kurva regresi nonparametrik Spline *Able to estimate nonparametric regression curve using Spline*		15%
4	1.3	Mampu melakukan estimasi kurva regresi nonparametrik Kernel *Able to estimate nonparametric regression curve using Kernel*		10%
5-6	3.1	Mampu melakukan estimasi kurva regresi nonparametrik Deret Fourier		15%

		Able to estimate the nonparametric regression curve for Fourier Series		
7		Mampu melakukan estimasi kurva regresi nonparametrik Polinomial Lokal *Able to estimate nonparametric regression curve Local Polynomial*		10%
8	3.2	Evaluasi Tengah Semester *Mid Semester Evaluation*		
9	4.1	Mampu memahami konsep dasar tentang titik knot dan parameter penghalus (bandwith) dalam regresi nonparametrik spline, kernel, deret fourier dan polinomial local *Able to understand the basic concept of knot points and smoothing parameters (bandwidth) in nonparametric regression of spline, kernel, fourier, and local polynomial*		10%
10-11	4.2	Mampu memilih titik knot dan parameter penghalus (bandwith) optimal dalam regresi nonparametrik dengan berbagai metode *Able to select optimal knot points and smoothing parameters (bandwidth) in nonparametric regression with various methods*		10%
12-13		Mampu memodelkan berbagai hubungan pola data dalam berbagai bidang ilmu menggunakan pendekatan regresi nonparametric *Able to model various data pattern relationships in various fields of science using the approach Nonparametric regression*		10%
14-15		Mampu mengembangkan model regresi nonparametrik sederhana, menjadi model regresi nonparametrik yang lebih kompleks *Able to develop simple nonparametric regression model, to become a more complex*		10%
16		Evaluasi Akhir *Final Evaluation*		
				100%