MODULE HANDBOOK

INTRODUCTION TO BIOSTATISTICS AND EPIDEMOLOGY

	MODULE HANDBOOK INTRODUCTION TO BIOSTATISTICS AND EPIDEMOLOGY 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*	Shofi Andari, Ph.D	Dosen Lecturer		
Pemeriksa dan Pengendalian *Review and Control*	Shofi Andari, Ph.D.; Jerry Dwi T. Purnomo, Ph.D.	Tim kurikulum Curriculum team		
Persetujuan *Approval*	Dr. Bambang Widjanarko Otok, M.Si	Koordinator RMK Course Cluster Coordinator		
Penetapan *Determination*	Dr. Kartika Fithriasari, M.Si	Kepala Departemen Head of Department		

Module name	INTRODUCTION TO BIOSTATISTICS AND EPIDEMOLOGY	
Module level	Undergraduate	
Code	SS234753	
Course (if applicable)	INTRODUCTION TO BIOSTATISTICS AND EPIDEMOLOGY	
Semester	7	
Person responsible for the module	Shofi Andari, Ph.D	
Lecturer	Shofi Andari, Ph.D.; Jerry Dwi T. Purnomo, Ph.D.	
Language	Bahasa Indonesia and English	
Relation to curriculum	Undergradute degree program, elective, 7th semester.	
Type of teaching, contact hours		
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	Introduction to Statistical Methods, Introduction to Probability Theory, Nonparametric Statistics, Categorical Data Analysis	
Learning outcomes and their corresponding PLOs	CLO.1 Able to describe the concept of inferential statistics for the biological, environment, medical/health and agriculture data CLO.2 Able to use the biological, environment, medical/health and agriculture y data to solve the task CLO.3 Able to formulate problem-solving in analyzing biological, environment, medical/health and agriculture data with the appropriate interpretation CLO.4 Able to identify, formulate, and solve the biostatistics and epidemiology problems CLO. 5 Able to use computational technique and modern computer, including selecting the appropriate method that used in solving the case of biological, environment, medical/health and agriculture data	PLO-5 PLO-7 PLO-10

	CLO.6 Gain insight about the current issue and upcoming issue relating to the biostatistics CLO.7 Able to communicate effectively and collaborate with the teams in interdisciplinary and multidisciplinary CLO.8 Practice responsibilities and professional ethics CLO.9 Able to motivate themself to think creatively and lifelong learning
Content	Biostatistics is a part of statistics course that can be applied to Environmental And Health cases. The objectives of learning biostatistics are to prepare the students relating to the ability in analyzing the medical data, agriculture/fishery/marine using the appropriate statistical methods (quantitative and qualitative). In order to enhance the knowledge about the application of statistics, there are various research designs to be learned, namely Cross-Sectional Study; Case-Control Study; Cohort Study, and other measurements of Epidemiology (Incidence, Prevalence). The learning strategies used in this course are discussion, exercises, and study case (secondary data).
Assessment and its weight	
Media employed	LCD, whiteboard, websites (myITS Classroom), zoom
Reading list	1. Rosner, Bernard. 2016. Fundamentals of Biostatistics. 8th edition. Thomson Brooks/Cole. 2. Jewel, NP. 2004. Statistics for Epidemiology. Chapman & Hall/CRC. 3. MacFarland, Thomas W. & Yates, Jan M. 2021. Using R for Biostatistics. Springer. 4. Wassertheil-Smoller, S. 2015. Biostatistics and Epidemiology: A primer for healt and biomedical professionals. Springer. 5. Breslow NE, Day NE (1980). Statistical Methods in Cancer Research, Vol. I, The Analysis of Case- Control Studies. International Agency for Research on Cancer, Lyon. 6. Breslow NE, Day NE (1987). Statistical Methods in Cancer Research, Vol. II, The Design and Analysis of Cohort Studies. International Agency for Research on Cancer, Lyon. 7. Hosmer DW, Lemeshow S (1989). Applied Logistic Regression, John Wiley & Sons.

	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)/ *Course*	KODE/ *Code*	Rumpun MK/ *Course Group*	BOBOT (sks)/ *Weight (credit)*		SEMESTER/ *Semester*	Tgl Penyusunan/ *Drafting Date*
PENGANTAR BIOSTATISTIKA DAN EPIDEMOLOGI / *INTRODUCTION TO BIOSTATISTICS AND EPIDEMOLOGY*	SS234753	LINGKES	**T = 3**	**P = 3**	V	26 Agustus 2023

OTORISASI/ *AUTHORIZATION*		Pengembang RPS/ *RPS Developer*	Koordinator RMK/ *Course Group Coordinator*	Ketua PRODI/ *Head of Department*
		Shofi Andari, Ph.D.; Jerry Dwi T. Purnomo, Ph.D.	Prof. Dr. Bambang W. Otok	Dr. Kartika Fithriasari, M.Si

Capaian Pembelajaran (CP)/ *Learning Achievement*	CPL-PRODI yang dibebankan pada MK/ *PLO*	
	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
		Able to apply statistical theory to statistical methods
	PLO-5	*Able to use modern computing devices to solve statistical problems*
	PLO-7	*Able to apply business, industrial, economic, social, health or environmental statistical methods to real*
	PLO-10	*problems*
	Capaian Pembelajaran Mata Kuliah (CPMK)/ *CLO*	
	CPMK.1 Mampu menjelaskan konsep statistika inferens untuk data biologi, lingkungan, kedokteran/kesehatan, dan pertanian	
	CPMK.2 Mampu memanfaatkan data biologi, lingkungan, kedokteran/kesehatan, dan pertanian untuk mendukung penyelesaian pekerjaan	
	CPMK.3 Mampu memformulasikan penyelesaian masalah dengan menganalisis data biologi, lingkungan, kedokteran/kesehatan, dan pertanian serta	

	menginterpretasikan dengan tepat CPMK.4 Mampu mengindentifikasi,memformulasi, dan menyelesaikan masalah biostatistika dan epidemiologi CPMK.5 Mampu menggunakan teknik komputasi dan perangkat komputer modern yang diperlukan serta mampu memilih metode yang sesuai bagi data biologi, lingkungan, kedokteran/kesehatan, dan pertanian dalam menyelesaikan masalah riil CPMK.6 Memiliki pengetahuan tentang isu terkini dan mendatang yang berkaitan dengan bidang biostatistika dan epidemiologi CPMK.7 Mampu berkomunikasi secara efektif dan bekerjasama dalam tim yang interdisiplin dan multidisiplin CPMK.8 Memiliki tanggung jawab dan etika profesi CPMK.9 Mampu memotivasi diri untuk berpikir kreatif dan belajar sepanjang hayat *CLO.1 Able to describe the concept of inferential statistics for the biological, environment, medical/health and agriculture data* *CLO.2 Able to use the biological, environment, medical/health and agriculture y data to solve the task* *CLO.3 Able to formulate problem-solving in analyzing biological, environment, medical/health and agriculture data with the appropriate interpretation* *CLO.4 Able to identify, formulate, and solve the biostatistics and epidemiology problems* *CLO.5 Able to use computational technique and modern computer, including selecting the appropriate method that used in solving the case of biological, environment, medical/health and agriculture data* *CLO.6 Gain insight about the current issue and upcoming issue relating to the biostatistics* *CLO.7 Able to communicate effectively and collaborate with the teams in interdisciplinary and multidisciplinary* *CLO.8 Practice responsibilities and professional ethics* *CLO.9 Able to motivate themself to think creatively and lifelong learning*

Matrik CPL – CPMK

PLO-CLO Matrix

CPMK \ CPL	CPL-5	CPL-7	CPL-10
CPMK-1	v		
CPMK-2		v	v
CPMK-3	v	v	v
CPMK-4			v
CPMK-5		v	
CPMK-6			v
CPMK-7			v
CPMK-8			V
CPMK-9	v		v

Deskripsi Singkat	Biostatistika dan epidemiologi merupakan mata kuliah statistika yang diterapkan pada bidang lingkungan dan kesehatan. Tujuan mata kuliah

MK/ *Course Description*	yaitu untuk memberikan kemampuan mahasiswa untuk menganalisis data biologi, lingkungan, kedokteran/kesehatan, dan pertanian (termasuk di dalamnya perikanan, peternakan, kelautan, dan kehutanan) dengan metode statistika yang telah diperoleh dengan tepat.
	Biostatistics is a part of statistics course that can be applied to Environmental And Health cases. The objectives of learning biostatistics are to prepare the students relating to the ability in analyzing the medical data, agriculture/fishery/marine using the appropriate statistical methods (quantitative and qualitative). In order to enhance the knowledge about the application of statistics, there are various research designs to be learned, namely Cross-Sectional Study; Case-Control Study; Cohort Study, and other measurements of Epidemiology (Incidence, Prevalence). The learning strategies used in this course are discussion, exercises, and study case (secondary data).
Bahan Kajian: Materi Pembelajaran/ *Course Material*	Teori Statistika, Pengumpulan Data, Deskripsi dan Eksplorasi, Komputasi dan Data Processing, Pemodelan, Pemerintahan dan Kependudukan, Kesehatan dan Lingkungan, Sosial Humaniora *Statistical Theory, Data Collection, Description and Exploration, Computing and Data Processing, Modeling, Governance and Population, Health and Environment, Social Humanities*

Pustaka/ *References*	**Utama/*Primary*:**
	Rosner, Bernard. 2016. Fundamentals of Biostatistics. 8th edition. Thomson Brooks/Cole.
	Jewel, NP. 2004. Statistics for Epidemiology. Chapman & Hall/CRC.
	Pendukung/*Secondary*
	1. MacFarland, Thomas W. & Yates, Jan M. 2021. Using R for Biostatistics. Springer. 2. Wassertheil-Smoller, S. 2015. Biostatistics and Epidemiology: A primer for healt and biomedical professionals. Springer. 3. Breslow NE, Day NE (1980). Statistical Methods in Cancer Research, Vol. I, The Analysis of Case- Control Studies. International Agency for Research on Cancer, Lyon. 4. Breslow NE, Day NE (1987). Statistical Methods in Cancer Research, Vol. II, The Design and Analysis of Cohort Studies. International Agency for Research on Cancer, Lyon. 5. Hosmer DW, Lemeshow S (1989). Applied Logistic Regression, John Wiley & Sons.

Dosen Pengampu/ *Lecturers*	Jerry Dwi Trijoyo Purnomo, S.Si. M.Si.; Shofi Andari, S.Stat., M.Si., Ph.D.
Matakuliah syarat/ *Pre-requisite Course*	Pengantar Metode Statistika, Pengantar Teori Probabilitas, Statistika Nonparametrik, Analisis Data Kategorik *Introduction to Statistical Methods, Introduction to Probability Theory, Nonparametric Statistics, Categorical Data Analysis*

Mg Ke- *Week*	Kemampuan akhir tiap tahapan belajar (Sub-CPMK)	Penilaian *Evaluation*	Bantuk Pembelajaran, Metode Pembelajaran, Penugasan Mahasiswa,	Materi Pembelajaran [Pustaka]	Bobot Penilaian (%) *Evaluation*

(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
	Final capability for each learning step			**[Estimasi Waktu]** *Learning Format* *Learning Methods* *Assignment for Student* *[Estimated Time]*		*Learning Material [References]*	*Weight (%)*
		Indikator *Indicator*	**Kriteria & Bentuk** *Criteria and Format*	**Luring** *Offline*	**Daring** *Online*		
1	1. Dapat menjelaskan penerapan metode statistika sebagai bagian dari metode ilmiah pada bidang kesehatan dan lingkungan secara umum *Able to explain the application of statistical methods in medical/health data in general*	1.1. Memahami peran statistika sebagai bagian dari metode ilmiah pada bidang biologi, kesehatan, dan lingkungan 1.2. Dapat menjelaskan pengertian Biostatistika dan menjalankan R-markdown *1.1. Understand the role of statisticsas part of scientific method in the field of health, environment, and biology* *1.2. Able to explain the definition of biostatistics and run R-markdown*	Observasi di kelas + Tugas 1 *Observation during class activity + Assignment 1*	TM: 3 × 50" LT: 3 × 60" BM: 3 × 60" *L: 3 × 50"* *EA: 3 × 60"* *IL: 3 × 60"*		Rosner Ch 1 Was-Smol Ch 1 MacFarland Ch 9	5%/ 5%
2	2. Mampu menjelaskan dan mengaplikasikan	2.1. Dapat membedakan penentuan variabel	Observasi di kelas + Tugas 2	TM: 3 × 50" LT: 3 × 60"		Rosner Ch 13 Was-Smol Ch 1	7%/ 12%

	statistika deskriptif dengan studi kasus lead exposure (1) dan studi kasus tembakau (2) *Able to explain and apply descriptive statistics in biostatistics studies*	2.2. Dapat menyajikan data secara tepat baik dengan tabel maupun grafik sehingga memahami penerapan statistika descriptive melalui studi kasus (1) Efek lead exposure (2) Efek tobacco exposure *2.1. Able to distinguish the use of variables for different research design* *2.2. Able to understand the application of descriptive statistics on two case studies*	*Observation during class activity + Assignment 2*	BM: 3 × 60" *L: 3 × 50"* *EA: 3 × 60"* *IL: 3 × 60"*		Rosner Ch 2	
3	3. Mampu menerapkan penentuan variabel random diskret atau kontinu dari suatu kejadian dan menghitung peluangnya *Able to identify the discrete or continuous random variable out of a random event and calculate its probability*	3.1. Memahami suatu kejadian mengikuti distribusi diskret dan kontinu tertentu dan dapat menghitung peluang kejadiannya 3.2. Memahami konsep prevalensi dan insidensi *3.1 Able to understand events in the context of random variable, discrete or continuous, and compute their probabilities* *3.2 Able to understand prevalence and*	Observasi di kelas + Tugas 3 *Observation during class activity + Assignment 3*	TM: 3 × 50" LT: 3 × 60" BM: 3 × 60" *L: 3 × 50"* *EA: 3 × 60"* *IL: 3 × 60"*		Rosner Ch 3, 4, & 5 Was-Smol Ch 2 MacFarland Ch 2	7% / 19%

		incidence					
4	4 Mampu menerapkan estimasi parameter, titik maupun interval, dan merumuskan pengujian hipotesis yang sesuai pada kejadian nyata *Able to apply parameter estimation, point and interval, and formulate the hypothesis testing for real problems*	4.1 Dapat melakukan estimasi parameter titik dan interval dari beberapa distribusi variabel random 4.2 Dapat merumuskan dan menyusun hipotesis 4.1 *Able to estimate the parameter properly* 4.2 *Able to formulate and do the hypothesis testing for parameters*	Observasi di kelas *Observation during class activity*	TM: 3×50" LT: 3×60" BM: 3×60" *L: 3×50"* *EA: 3×60"* *IL: 3×60"*		Rosner Ch 6 & 7 MacFarland's Ch 3	6%/ 25%
5	<td colspan="7" align="center">*Midterm 1* **(ETS 1)**</td>
6	5 Mampu melakukan pengujian parameter dengan metode nonparametric *Able test for parameters using nonparametric methods*	5.1 Dapat melakukan pengujian median untuk data ordinal. 5.2 Dapat melakukan pengujian rangking dengan sign test dan Wilcoxon's sign test untuk kejadian biologi, kesehatan dan lingkungan 5.1 *Able to perform the median test for ordinal data* 5.2 *Able to perform the rank Wilcoxon test for cases in biology, health, and environment.*	Observasi di kelas + Tugas 3 *Observation during class activity + Assignment 3*	TM: 3×50" LT: 3×60" BM: 3×60" *L: 3×50"* *EA: 3×60"* *IL: 3×60"*		Rosner Ch 9	7%/ 33%

7	6 Mampu melakukan pengujian data kategoris *Able to test the categorical data properly*	6.1 Dapat melakukan pengujian kasus binomial dengan menggunakan uji proporsi 6.2 Dapat melakukan pengujian dari tabel kontingency (2 × 2 maupun secara umum) 6.3 Dapat menunjukkan hubungan antara Uji Wilcoxon dan uji χ² Untuk tabel kontingensi 2 × *k* *6.1 Able to perform the binomial test using the test of proportion* *6.2 Able to perform the test for contingency table with a size of 2 × 2 and r × c* *6.3 Able to explain the relation between Wilcoxon test and χ2 test for contingency table with a size of 2 × k*	Observasi di kelas + Tugas kelompok *Observation during class activity + Group activity*	TM: 3 × 50" LT: 3 × 60" BM: 3 × 60" *L: 3 × 50"* *EA: 3 × 60"* *IL: 3 × 60"*		Rosner Ch 10 Was-Smol Ch 8	7%/ 40%
8	7 Mampu memahami dan melakukan analisis regresi dan korelasi pada kasus nyata *Able test for parameters using nonparametric methods*	7.1 Dapat melakukan pengujian median untuk data ordinal. 7.2 Dapat melakukan pengujian rangking dengan sign test dan Wilcoxon's sign test untuk kejadian biologi, kesehatan dan	Observasi di kelas + Tugas 3 *Observation during class activity + Assignment 3*	TM: 3 × 50" LT: 3 × 60" BM: 3 × 60" *L: 3 × 50"* *EA: 3 × 60"* *IL: 3 × 60"*		Rosner Ch 11 Was-Smol Ch 8	7%/ 47%

		lingkungan *7.1 Able to perform the median test for ordinal data* *7.2 Able to perform the rank Wilcoxon test for cases in biology, health, and environment.*					
9	8 Inferensi untuk multisample *Able to perform inference statistics on multisample*	8.1 Dapat melakukan pengujian median untuk data ordinal. 8.2 Dapat melakukan pengujian rangking dengan sign test dan Wilcoxon's sign test untuk kejadian biologi, kesehatan dan lingkungan *8.1 Able to perform the median test for ordinal data* *8.2 Able to perform the rank Wilcoxon test for cases in biology, health, and environment.*	Observasi di kelas + Tugas 3 *Observation during class activity + Assignment 3*	TM: 3 × 50" LT: 3 × 60" BM: 3 × 60" *L: 3 × 50"* *EA: 3 × 60"* *IL: 3 × 60"*		Rosner Ch 12	7%/ 43%
10	*Midterm 2* (ETS 2)						

11	9. Pendahuluan dan gambaran umum mengenai tujuan riset epidemiologi dan studi desain
	Introduction and overview of goals of epidemiologic research
		9.1 Dapat menjelaskan tujuan riset epidemiologi.
		9.2 Dapat menjelaskan dan mengindentifikasi studi desain
		9.1 Able to explain the goals of epidemiologic
			Observasi di kelas
			Observation during class activity
				TM: 3 × 50"
				LT: 3 × 60"
				BM: 3 × 60"
				
				L: 3 × 50"
				EA: 3 × 60"
				IL: 3 × 60"
						Jewell
						  Chapter 1, 5
						Breslow & Day I
						  Chapter 1
						Breslow & Day II
						  Chapter 1
							7%/ 43%

	and epidemiologic study designs	*research* *9.2 Able to explain and identify different study designs*					
12-13	*10. Measures of disease occurrence and association:* *a. Different rates* *b. Inferences for rates* *c. Comparing two rates* *d. 2×2 table* *e. 2 χ test and Fisher's exact test* *f. R×C table* *g. Relative risk and odds ratio* *h. Inferences for relative risk and odds ratio*	10.1 Dapat menjelaskan tujuan riset epidemiologi. 10.2 Dapat menjelaskan dan mengindentifikasi studi desain *10.1 Able to explain the goals of epidemiologic research* *10.2 Able to explain the goals of epidemiologic research*	Observasi di kelas + Tugas 4 *Observation during class activity + Assignment 4*	TM: 3 × 50" LT: 3 × 60" BM: 3 × 60" *L: 3 × 50"* *EA: 3 × 60"* *IL: 3 × 60"*		Jewell Chapters 2, 4, 6, 7 Breslow & Day I Chapter 2, 4	
14	*11. Control of extraneous factors:* *a. Confounding and interaction* *b. Mantel-Haenszel method* *c. Analysis of matched data- McNemar's test* *d. Measure of agreement-Kappa statistic*	11.1 Dapat menjelaskan dan mengidentidikasi confounding factor dan interaksi 11.2 Dapat mengaplikasikan *11.1 Able to explain the goals of epidemiologic research* *11.2 Able to explain the goals of epidemiologic research*	Observasi di kelas *Observation during class activity*	TM: 3 × 50" LT: 3 × 60" BM: 3 × 60" *L: 3 × 50"* *EA: 3 × 60"* *IL: 3 × 60"*		Jewell Chapter 8, 9, 10, 11	
15	*12. Logistic regression:* *a. Concepts* *b. Model and assumption* *c. Interpretation of regression coefficients* *d. Inferences*	12.1 Dapat menjelaskan konsep dan melakukan pemodelan regresi logistic beserta mengintrepertasi-kannya.	Observasi di kelas + Tugas 5 *Observation during class activity + Assignment 5*	TM: 3 × 50" LT: 3 × 60" BM: 3 × 60" *L: 3 × 50"* *EA: 3 × 60"*		Jewell Chapter 12, 13 Hosmer & Lemeshow Chapter 1, 2	

	e. *Likelihood ratio test* f. *Goodness-of-fit test* g. *Residual plot*	12.2 Dapat menjelaskan dan melakukan evaluasi pada model regresi logistik 12.3 *Able to explain the concept and apply logistic regression* 12.4 *Able to explain and evaluate the logistics regression models*		*IL: 3 × 60"*			
16	**Final exam (EAS)**						