



OUTCOMES-BASED EDUCATION (OBE) COURSE SYLLABUS

Stat 122
Mathematical Statistics II

Quality Goals of the Faculty of Natural and Mathematical Sciences

1. Provide quality instruction, research, extension, and innovation for global competitiveness;
2. Develop knowledgeable, skilled, and innovative individuals who value and pursue the advancement of scientific knowledge for the betterment of society; and
3. Produce future-proof graduates and workforce in biology, biotechnology, chemistry, mathematics, meteorology, physics, and statistics.

Quality Objectives of the Department Statistics

1. Produce highly trained graduates in Statistics;
2. Undertake quality instruction, research, and extension activities in statistics and allied fields;
3. Actively promote the appropriate utilization of statistics among scientists, technologists, and development workers; and
4. Maintain productive linkages and cooperation with statistical units and agencies locally and internationally.

I. PROGRAM INFORMATION

1. Name of the Program	Bachelor of Science in Statistics
2. CHED CMO Reference	CMO No. 42 s2017
3. BOR Approval	BOR Resolution No. 61 s2018

4. Program Educational Objectives and Relationship to Institution Mission

Program Educational Objectives	Mission*		
	a	b	c
1. A number of graduates hold key statistical positions in government line agencies.	✓	✓	
2. Some of the graduates become regular instructors in High School.	✓	✓	
3. The top-ranking graduates are teaching in HEIs with at least an MS degree.	✓	✓	
4. A fraction of the graduates are employed as statisticians and/or researchers in research centers and private companies with research units.	✓	✓	✓
5. Some of the graduates are engaged in consultancy services in market research and project monitoring and evaluation work.	✓	✓	✓



*a - produce graduates equipped with advanced knowledge and lifelong learning skills, b - ethical standards through high quality instruction and innovative research, c - impactful community engagements

III. COURSE INFORMATION

1. Course Code	STAT 122
2. Course Title	Mathematical Statistics 2
3. Pre-requisite	Stat 121 (Mathematical Statistics 1)
4. Co-requisite	None
5. Credit	3 units
6. Semester Offered	2 nd Semester
7. Number of hours	3 hours lecture per week
8. Course Description	Functions of random variables, sampling distributions, point and interval estimation
9. Sustainable Development Goals	SDG 4 – Ensure Inclusive and Equitable Quality Education and Promote Lifelong Learning Opportunities for All
10. 4th Industrial Revolution (4IR)	Artificial Intelligence (AI) – Gemini
11. Education 5.0	Collaborative Learning, Technology at its Core, and Lifelong Learning.

12. Program Outcomes and Relationship to Program Educational Objectives

Program Outcomes (POs)	Program Educational Objectives				
	1	2	3	4	5
Common to All Baccalaureate Programs					
a	Articulate and discuss the latest developments in the practice of Statistics (PQF Level 6 descriptor)			✓	✓
b	Effectively communicate orally and in writing using both the English and Filipino languages.	✓		✓	✓
c	Work effectively and independently in multi-disciplinary and multi-cultural teams (PQF Level 6 descriptor)	✓		✓	✓
d	Demonstrate professional, social, and ethical responsibility, especially in practicing intellectual property rights and sustainable development.	✓		✓	✓
e	Preserve and promote "Filipino historical and cultural heritage" (based on RA 7722)				
Common to the Science and Mathematics Programs					
f	Demonstrate broad and coherent knowledge and understanding in the core areas of the physical and natural sciences and mathematics				
g	Apply critical and problem-solving skills using the scientific method	✓		✓	✓
h	Interpret scientific data and make judgments that include reflection on relevant scientific and ethical issues	✓		✓	✓
i	Carry out basic mathematical and statistical computations and use appropriate technologies in the analysis of data	✓		✓	✓

j	Communicate information, ideas, problems, and solutions, both orally and in writing, to other scientists, decision-makers, and the public	✓		✓	✓	✓
k	Relate science and mathematics to the other disciplines			✓	✓	✓
l	Design and perform safe and responsible techniques and procedures in laboratory or field practices	✓		✓	✓	✓
m	Critically evaluate inputs from others	✓		✓	✓	✓
n	Appreciate the limitations and implications of science in everyday life	✓		✓	✓	✓
o	Commit to the integrity of data	✓		✓	✓	✓

Specific to the BS Statistics Program

p	Demonstrate broad and coherent knowledge and understanding in the core areas of statistics, computing, and mathematics	✓	✓	✓	✓	✓
q	Generate information involving the conceptualization of a strategy for generating timely and accurate/reliable data, organizing a process for putting together or compiling the needed data, and transforming available data into relevant and useful forms	✓		✓	✓	✓
r	Translate real-life problems into statistical problems	✓		✓	✓	✓
s	Identify appropriate statistical tests and methods and use these properly for the given problems, select optimal solutions to problems, and make decisions in the face of uncertainty	✓		✓	✓	✓

13. Course Outcomes (COs) and Relationship to Program Outcomes (POs)

Program Outcomes Addressed by the Course Outcomes By the end of the course, the students must be able to:	Program Outcomes																		
	a	b	c	d	e	f	g	h	i	j	k	l	m	n	o	p	q	r	s
CO1: Derive distributions of functions of random variables	L	P				L	L	P	L	O	O			L		L	P	P	L
CO2: Derive sampling distributions related to the normal distribution	L	P				L	L	P	L	O	O			L		L	P	P	L
CO3: Derive point and interval estimates of population parameters	L	P				L	L	P	L	O	O			L		L	P	P	L
CO4: Evaluate properties of point estimators	L	P				L	L	P	L	O	O			L		L	P	P	L

Level: L: facilitates learning of competency

P: allows student to practice competency (no input, but competency is evaluated)

O: opportunity for development (no input or evaluation, but competency is practiced)

14. OBTL Course Content and Plan

Week	Topics	Learning Outcomes	Teaching and Learning Activities		Assessment Tasks
			Teaching Activities	Learning Activities	
1	<ul style="list-style-type: none"> • VSU Vision, Mission, and Quality Policy Statement • OBE Course Syllabus (content, policies, requirements, and grading system) • Values integration (Responsibility, honesty, diligence, and hard work) 	<ul style="list-style-type: none"> • State the vision, mission, and quality policy statement of VSU, • Describe the important components and features of the course, and • Integrate values in the class to achieve success in the course 	<ul style="list-style-type: none"> • Present and discuss the VSU Vision, Mission, and Quality Policy Statement • Explain the relevant components of the course • Solicit question and feedback from students 	<ul style="list-style-type: none"> • Articulate the VSU Vision, Mission, and Quality Policy Statement • Ask questions and provide feedback 	Recitation

CO1: Derive distributions of functions of random variables

1-4	Module 1: Distribution of Functions of Random Variables Lesson 1.1: The method distribution functions Lesson 1.2: The method of transformations Lesson 1.3: Some important results about independent random variables Lesson 1.4: The method of moment generating functions Lesson 1.5: Bivariate transformations	1. Apply method of distribution function, method of transformation, and method of generating function to derive the distribution of a function of a single random variable 2. Derive the distribution of linear combinations of several independent variables 3. Derive the distribution of	<ul style="list-style-type: none"> • Lectures • Demonstrations • Proving and deriving statistical results • Classroom exercises and assessment tasks 	<ul style="list-style-type: none"> • Solving Learning Tasks • Solving Assessment Tasks • Asking questions and clarifications on solutions to class exercises and problem sets 	<ul style="list-style-type: none"> • Quiz No. 1 • Quiz No. 2 • Problem Set No. 1 • First Long Exam
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	Lesson 1.6: Order statistics	<p>transformations involving two random variables</p> <p>4. Derive the distribution of order statistics</p>			
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CO2: Derive sampling distributions related to the normal distribution

5-7	Module 2: Sampling distributions and the Central Limit Theorem Lesson 2.1: Sampling distributions related to the normal distribution (chi-square, t, and F distributions) Lesson 2.2: The Central Limit Theorem Lesson 2.3: The normal approximation to the binomial distribution	1. Derive the t and F distributions 2. Describe the t and F distributions 3. Prove the Central Limit Theorem 4. Apply the Central Limit Theorem to find probabilities concerning the sample mean 5. Use the normal distribution to approximate binomial probabilities	<ul style="list-style-type: none"> • Lectures • Demonstrations • Proving and deriving statistical results • Classroom exercises and assessment tasks 	<ul style="list-style-type: none"> • Solving Learning Tasks • Solving Assessment Tasks • Asking questions and clarifications on solutions to class exercises and problem sets 	<ul style="list-style-type: none"> • Quiz No. 3 • Quiz No. 4 • Problem Set No. 2 • Second Long Exam
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8 Midterm Examination

CO3: Derive point and interval estimates of population parameters

9-13	Module 3: Point and interval estimation Lesson 3.1: Bias and mean square error Lesson 3.2: The standard error of an estimator Lesson 3.3: Estimating the population variance Lesson 3.4: Error bounds and the empirical rule	1. Evaluate if an estimator is unbiased for a particular parameter 2. Derive the standard error of common point estimators 3. Construct confidence intervals for population parameters 4. Derive	<ul style="list-style-type: none"> • Lectures • Demonstrations • Proving and deriving statistical results • Classroom exercises and assessment tasks 	<ul style="list-style-type: none"> • Solving Learning Tasks • Solving Assessment Tasks • Asking questions and clarifications on solutions to class exercises and problem sets 	<ul style="list-style-type: none"> • Quiz No. 5 • Quiz No. 6 • Quiz No. 7 • Problem Set No. 3 • Third Long Exam
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	<p>Lesson 3.5: Confidence intervals and pivotal quantities</p> <p>Lesson 3.6: Large-sample confidence intervals</p> <p>Lesson 3.7: Sample size determination</p> <p>Lesson 3.8: Small-sample confidence intervals for normal means</p> <p>Lesson 3.9: Confidence intervals for variances</p>	<p>formulas for the sample size for estimating a population mean and a population proportion</p>		<p>problem sets</p>						
CO4: Evaluate properties of point estimators										
14-17	<p>Module 4: Properties of point estimators and methods of estimation</p> <p>Lesson 4.1: Sufficiency</p> <p>Lesson 4.2: The Rao-Blackwell Theorem</p> <p>Lesson 4.3: Method of moments estimators</p> <p>Lesson 4.4: Maximum likelihood estimation</p> <p>Lesson 4.5: Consistency and the Weak Law of Large Numbers</p> <p>Lesson 4.6: Large-sample properties of maximum likelihood estimators</p>	<ol style="list-style-type: none"> 1. Use the Factorization Theorem to derive sufficient statistics 2. Apply the Rao-Blackwell Theorem to find the best unbiased estimator 3. Derive estimators using method of moments and maximum likelihood 4. Evaluate asymptotic properties of estimators 	<ul style="list-style-type: none"> • Lectures • Demonstrations • Proving and deriving statistical results • Classroom exercises and assessment tasks 	<ul style="list-style-type: none"> • Solving Learning Tasks • Solving Assessment Tasks • Asking questions and clarifications on solutions to class exercises and problem sets 	<ul style="list-style-type: none"> • Quiz No. 8 • Quiz No. 9 • Problem Set 4 • Fourth Long Exam 					
18	Final Examination									
15. Life-long Learning Opportunities										
Students will be encouraged to practice solving additional probability problems in other textbooks so that they will become more proficient and prepared when they enrol in Mathematical Statistics III.										
16. Contribution of Course to Meeting the Professional Component										
General Education: 0 %										
Mathematical Component: 40%										

Statistical Component: 60%				
17. References and Other Learning Resources				
A. Main References				
<ol style="list-style-type: none"> 1. Milla, N. E. (2025). Student Learning Guide in Stat 122 (Mathematical Statistics II). 2. Mendenhall, W., Scheaffer, R. L., and Wackerly, D. D. (2008). <i>Mathematical Statistics with Applications</i>, 7th ed. Brooks/Cole, Cengage Learning. 3. Hogg, R. V., Tanis, E. A., and Zimmerman, D. L. (2015). <i>Probability and Statistical Inference</i>, 9th ed. Pearson Education, Inc. 4. Hogg, R.V. and Craig, A. T. (2004). <i>Introduction to Mathematical Statistics</i>, Fifth Edition, Macmillan Publishing Co., Inc., N.Y. 5. Ramachandran, K. M. and Tsokos, C. P. (2009). <i>Mathematical Statistics with Applications</i>. Elsevier Inc. 6. Miller, I. and Miller, M. (1999). John E. Freund's <i>Mathematical Statistics</i>. 6th ed. Prentice-Hall Int'l., Inc. New Jersey. 7. Mood, Graybill, and Boes. 1974. <i>Introduction to the Theory of Statistics</i>. Third Edition. International Student Edition. McGraw-Hill Kogakusha, Ltd. 				
B. Other Learning Resources (Journals, Videos, Websites, Webinars, Open Educational Resources, etc.)				
<ol style="list-style-type: none"> 1. https://online.stat.psu.edu/stat415/ 				
18. Course Assessment and Evaluation				
The performance of students will be assessed and evaluated based on the following:				
Item No.	Assessment Tasks	Percentage Contribution (1)	No. of Times in the Semester (2)	Individual Task % Contribution (1/2)
1	Quizzes (Q)	15%	9	1.67/Q
2	Problem Sets (PS)	25%	4	6.25/PS
3	Long Examinations (LE)	60%	4	15/LE
COs	Assessment Tasks	Weight in Percent	Minimum Average for Satisfactory Rating	Target and Standards
CO 1	Quizzes (2)	3.33%	60%	At least 75% of the students get a rating of at least 60%
	Problem Sets (1)	6.25%		
	Long Examinations (1)	15.0%		
CO 2	Quizzes (2)	3.33%		
	Problem Sets (1)	6.25%		
	Long Examinations (1)	15.0%		
CO 3	Quizzes (3)	5.0%		
	Problem Sets (1)	6.25%		
	Long Examinations (1)	15.0%		
CO 4	Quizzes (2)	3.33%		
	Problem Sets (1)	6.25%		
	Long Examinations (1)	15.0%		
TOTAL		100%		

Grading System (50% Passing)			
Range	Grade	Range	Grade
98-100	1.00	53-59	3.25
95-97	1.25	46-52	3.50
90-94	1.50	39-45	3.75
85-89	1.75	32-38	4.00
80-84	2.00	25-21	4.25
75-79	2.25	18-24	4.50
70-74	2.50	11-17	4.75
65-69	2.75	0-10	5.0
60-64	3.00		

19. Course Policies

- A. Instructional materials such as lectures guides and assessment tasks are made available to all students via GitHub (<https://github.com/bertmilla76/Stat-122-Mathematical-Statistics-2->). Students are encouraged to read in advance the lecture guides before coming to class.
- B. Classes are conducted **face-to-face**, but under rare circumstances, class sessions may be delivered virtually using either ZOOM or Google Meet. FB Messenger Chat Group will be used for easy and faster communication and consultations.
- C. **Submission of Course Requirements.** Quizzes, problem sets, and long examinations are administered during face-to-face class sessions. Instructions on how to submit the answers to quizzes, problem sets, and long examinations are provided in each course requirement.
- D. **Queries and Clarifications.** For queries, clarifications, or urgent questions, a student may contact the course instructor during official class schedule; Monday to Friday only using the contact information given at the last part of this document or via the FB Messenger Group Chat.
- E. All students are reminded to observe all policies, regulations, and rules of the university (particularly on attendance and cheating) and other related laws of the land and are advised to read, understand, and practice the provisions of the VSU Student Manual.
- F. **NO REMOVAL EXAMINATION!** INC mark shall be given to students in accordance with BOR-Approved Policies.

These class policies shall serve as our written agreement for the whole semester. The students will be informed immediately of any changes on these policies that may arise for reasons of improving the delivery of the quality of instructions for betterment of the Teaching and Learning process.

20. Course Materials and Facilities Available

- Student Learning Guide (online via GitHub)
- Facebook Messenger Group Chat
- Statistics Computing Laboratory

21. Revision History				
Revision number	Date of Revision	Date of implementation	Highlights of Revision	Revised by
3	February 18, 2025	2 nd Sem., SY 2024-2025	Conformance to new OBE syllabus template; Revision of grade equivalents	Norberto E. Milla, Jr.
2	February 16, 2023	2 nd Sem., SY 2022-2023	Updated the course content, the teaching and learning activities, and the course assessment and evaluation.	Norberto E. Milla, Jr.
1	March 3, 2021	2 nd Sem., SY 2020-2021	Updated VSU's vision and mission, the course content, the references, and adjusting the class policies suited to flexible learning, and to conform with form TP-IMD-08 v3	Norberto E. Milla, Jr.
0	July 2019	2 nd Sem., SY 2019-2020	Original OBEdized syllabus in Mathematical Statistics 2 incorporating the topics indicated in the CMO for BS Statistics.	

22. Preparation			
Prepared by	Name	Signature	Date Signed
NORBERTO E. MILLA, JR.			2/21/25

IV. INSTRUCTOR/PROFESSOR INFORMATION

1. Name of Instructor/Professor	NORBERTO E. MILLA, JR.
2. Office and Department	Faculty Room No.1 (Annex), Department of Statistics
3. Telephone/Mobile Numbers	+63 9473941899
4. Email Address	bertmilla@vsu.edu.ph
5. Consultation Time	Monday 10-12, 3-5, Wednesday 11-12, 4-5

Vision: A global green university providing progressive leadership in agriculture, science & technology, education and allied fields for societal transformation.

Mission: To produce graduates equipped with advanced knowledge and lifelong learning skills with ethical standards through high quality instruction, innovative research, and impactful community engagements.

23. Department Instructional Materials Review Committee:

Committee	Name	Signature	Date Signed
Member:	VIRGELIO M. ALAO		FEB 21 2025
Member:	SWEET CHARISH G. GODINEZ		FEB 21 2025
Chairperson:	DONNA C. CUYNO		FEB 21 2025

	Name	Signature	Date Signed
Noted by:	SWEET CHARISH G. GODINEZ Head, DStat		FEB 21 2025
Verified by:	REV RHIZZA L. AURE Dean, FNMS		02/24/2025
Validated by:	MARK GIL A. VEGA Head, IMDO		2/25/25



EVALUATION OF OUTCOMES-BASED EDUCATION (OBE) COURSE SYLLABUS

Stat 122
Mathematical Statistics 2
Second Semester A.Y. 2024 - 2025

Name of faculty : Norberto E. Milla, Jr.
Department/Institute : Department of Statistics
Faculty: Natural and Mathematical Sciences

CRITERIA	Complied	Not Complied	Remarks
FORMAT			
1) The OBE course syllabus follows the university-prescribed format	✓		
2) The course syllabus covers the required number of weeks in one academic term	✓		
3) The syllabus is designed to align with the CMO-prescribed curriculum in relation to:			
a. Program Educational Objectives to VSU Vision, Mission, and Quality Policy Statement	✓		
b. Program Outcomes to Program Educational Objectives	✓		
c. Course Outcomes to Program Outcomes	✓		
4) Course policies and grading system are clearly defined	✓		
CONTENT			
1) Course content is aligned with the prescribed Sustainable Development Goals (SDG), Fourth Industrial Revolution (4IR), and Education 5.0.	✓		
2) Learning outcomes are clearly articulated (Specific, Measurable, Attainable, Realistic, Time-bounded (SMART), and anchored on Bloom's Taxonomy of Objectives)	✓		
3) Course coverage completely follows the course description	✓		
4) Topics/lessons are arranged in a logical – sequence	✓		
5) Gender-sensitivity and values education are integrated in the syllabus whenever applicable	✓		
6) Journal references are relevant, varied, and updated within the last 5 years as prescribed by CHED.	✓		
7) Textbook references are relevant and varied, and at least five book titles are copyrighted.	✓		



TEACHING-LEARNING			
1) Teaching-learning activities are:	✓		
a. varied and relevant	✓		
b. outcomes-based	✓		
c. encourage active learning	✓		
d. develop the students' critical-thinking skills and reflective judgment	✓		
LEARNING ASSESSMENT			
1) Learning outcomes and methods of assessment are aligned	✓		
2) Assessment methods used are varied and relevant	✓		
3) Schedule and frequency of assessment, and expected outputs are clearly defined	✓		

General Recommendation (Pls. check):

✓	APPROVED for use
	Needs to be REVISED (<i>please see comments</i>)

Department Instructional Materials Review Committee:

Committee	Name	Signature	Date Signed
Member:	VIRGELIO M. ALAO		FEB 21 2025
Member:	SWEET CHARISH G. GODINEZ		FEB 21 2025
Chairperson	DONNA C. CUYNO		FEB 21 2025

	Name	Signature	Date Signed
Noted by:	SWEET CHARISH G. GODINEZ Head, DStat		FEB 21 2025
Verified by ^{1/} :	REV RHIZZA L. AURE Dean, FNMS		02/24/25
Validated by ^{2/} :	MARK GIL A. VEGA Head, IMDO		2/25/25

1/ Means of Verification: Ratings on Individual evaluation sheets of the DIMRC members

2/ Means of Validation: Final action of the Faculty Dean