	SEMESTER LEARNING PLAN **DEPARTMENT OF GEOMATICS ENGINEERING** **FACULTY OF CIVIL, PLANNING, and GEO ENGINEERING**		
PROGRAM	**UNDERGRADUATE**		
COURSE NAME	**Physical Geodesy**	**CODE**	**RM184623**
SEMESTER	**VI (six)**	**CREDITS**	**3 (three)**
LECTURERS	**Ira Mutiara Anjasmara [coord]**		
	Muhammad Taufik, Akbar Kurniawan		

COURSE MATERIALS	1	Basic theory of geopotential
	2	Normal gravity / Reference gravity
	3	Gravity anomaly
	4	Height systems dan Coordinate systems
	5	Gravity observation and measurements, reduction of gravity value to a reference field
	6	Earth gravity model
	7	Geoid determination using Stokes Integral
	8	The influence of the dynamics of the Earth to Earth's gravity field
EXPECTED LEARNING OUTCOMES THAT IMPOSED IN THE COURSE	A	Able to apply mathematics, science, and engineering in the fields of geodesy, surveying, hydrography, remote sensing, photogrammetry, geographic information systems, and cadastral to gain a thorough. understanding of the principles of engineering.
	B	Able to design survey and mapping activities using the latest technology in the fields of geodesy, surveying, hydrographic, remote sensing, photogrammetry, and cadastral.
	C	Able to identify, formulate, analyze and solve problems in the fields of geodesy, surveying, hydrographic, remote sensing, photogrammetry, and cadastral.
	D	Able to perform spatial data acquisition using modern measurement methods, geospatial data processing, using industry standard software, and making standard designs and analyzes in the fields of geodesy, surveying, hydrography, remote sensing, photogrammetry, and cadastral.
	H	Able to work in inter-disciplinary and inter-cultural teams so they can compete at national and international levels.
COURSE LEARNING OUTCOME	1	Able to explain the main objectives of geodetic science in terms of determining the shape and size of the Earth.
	2	Able to explain basic theories and measurement methods to determine the shape and size of the Earth.
	3	Able to perform simple calculations to determine the shape and size of the Earth.
	4	Able to explain the physical dynamics of the earth and its influence in determining the shape and size of the Earth.
	5	Able to apply the use of Earth's shape and size models for practical purposes in the field of surveying and mapping based on their understanding of the theoretical basis and application of the shape and size of the Earth.

ABILITY CATEGORIES	*Cognitive Prosecess*	*Analyse*
	Knowledge Domain	*Procedural*
	Psychomotor	*Conscious control*
	Affective	*Change of attitude*

Class	Lesson learning outcome	Criteria dan Assessment Indicator	Weight (%)	Learning Materials	Learning Experience	Learning Methods	Estimated Time
(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
1	Able to explain the basic objectives of Geodesy science, especially the determination of the shape and size of the Earth.	Completeness of materials, the depth of explanations, correctness of the answers, communication effectiveness, proper attitude	5	Objectives of Geodesy	Lecturer	Teacher-centered learning	1 x 50'
				Definitions in physical Geodesy	Discussion	Student-centered learning	1 x 50'
				Reviews of physical and mathematical formulas in physical Geodesy	Exercise	Problem-based learning	1 x 50'
					Quiz		
2 - 3	Able to explain basic concepts and theories of geopotential.	Completeness of materials, the depth of explanation, correctness of the answer, communication effectiveness, proper attitude	10	Force, acceleration	Lecturer	Teacher-centered learning	2 x 50'
				Gravitational force, gravitation acceleration, and gravitational potential	Discussion	Student-centered learning	2 x 50'
				Centrifugal force, centrifugal acceleration, and centrifugal potential	Exercise	Problem-based learning	2 x 50'

				Gravity force, gravity acceleration, and gravity potential	Tugas mandiri		
				Theory and Solution of Laplace's Equation			
4	Able to explain the concept of reference gravity and be able to calculate the value of reference gravity.	Completeness of materials, the depth of explanations, correctness of the answers, communication effectiveness, proper attitude	10	Reference surfaces of the Earth	Lecturer	Teacher-centered learning	1 x 50'
				Concept of Geoid and Ellipsoid	Discussion	Student-centered learning	1 x 50'
				Normal gravity field	Exercise	Problem-based learning	1 x 50'
					Assignment 1		
5 - 6	Able to apply the concept of reference gravity in calculating the gravity anomaly value from the gravity measurement data that has been corrected and can explain the concept of isostasy in the gravity	Completeness of materials, the depth of explanations, correctness of the answers, communication effectiveness, proper attitude	15	Gravity anomaly	Lecturer	Teacher-centered learning	2 x 50'
				Gravity correction and reduction (free-air, bouguer, terrain, atmospheric)	Discussion	Student-centered learning	2 x 50'
				Free-air anomaly, Bouguer anomaly, Complete Bouguer anomaly, Helmert anomaly	Exercise	Problem-based learning	2 x 50'
				Isostasy	**Assignment 2**		
7	Able to explain the concept of height and coordinate systems and can show the relationship between high systems and gravity concepts.	Completeness of materials, the depth of explanations, correctness of the answers, communication effectiveness, proper attitude	10	Orthometric height system	Lecturer	Teacher-centered learning	1 x 50'
				Dinamic height system			
				Nomal height system	Discussion	Student-centered learning	1 x 50'
				Undulation			
				Geodetic and Astronomical Coordinate systems	Exercise	Problem-based learning	1 x 50'
				Vertical deflection			
8				**Mid Semester Exam**	**Assessment**		**2 x 50'**
9 - 10	Able to explain the basic concepts of gravity measurement and terrestrial gravity measurements.	Completeness of materials, the depth of explanations, correctness of the answers, communication effectiveness, proper attitude	10	Absolute and Relative Gravity measurements	Lecturer	Teacher-centered learning	2 x 50'
				Terrestrial gravity survey	Discussion	Student-centered learning	2 x 50'
				Marine gravity survey	Exercise	Problem-based learning	2 x 50'
				Airborne gravity survey	**Assignment 3**		
				Altimetry satellite sytem			
				Gravity satellite mission			
11-12	Able to explain the basic concepts and procedures of physical Earth modeling.	Completeness of materials, the depth of explanations, correctness of the answers, communication effectiveness, proper attitude	10	Burns formula	Lecturer	Teacher-centered learning	2 x 50'
				Geodetic boundary value problems	Discussion	Student-centered learning	2 x 50'
				Stokes Integral			
				Global Geopotential Model	Exercise	Problem-based learning	2 x 50'
13-14	Able to model geoid using the Integral Stokes method.	Completeness of materials, the depth of explanations, correctness of the answers, communication effectiveness, proper attitude	20	Direct numerical integration	Lecturer	Teacher-centered learning	2 x 50'
				Fast fourier transform (FFT)	Discussion	Student-centered learning	2 x 50'
				Least squares collocation	Exercise	Problem-based learning	2 x 50'
					Assignment 4		
15	Able to analyze the relationship between the processes of dynamics of the Earth with changes in the value of the distribution of Earth's gravity.	Completeness of materials, the depth of explanations, correctness of the answers, communication effectiveness, proper attitude	10	Earth's rotation and orientation : precesion, nutation, polar motion, length of day variation	Lecturer	Teacher-centered learning	1 x 50'
				Properties of arth's dynamics : solid Earth tides,plate tectonics, postglacial rebound	Discussion	Student-centered learning	1 x 50'
					Exercise	Problem-based learning	1 x 50'
16				**Final Semester Exam**	**Assessment**		2 x 50'
100							