## FI584 Positional Astronomy

Module name:	Positional Astronomy					
Module level, if applicable:	Undergraduate					
Code:	FI584					
Sub-heading, if applicable:	-					
Classes, if applicable:	_					
Semester:	7 <sup>th</sup>					
Module coordinator:	Judhistira Aria Utama					
Lecturer(s):	Judhistira Aria Utama					
Language:	Bahasa Indonesia					
Classification within the curriculum:	Elective course					
Type of Teaching	Contact hours per week during the semester	Class Size				
Lecture (conceptual, contextual and problem-solving approaches through expository, discussions and exercises).      Structured activities (assignments based on conceptual, contextual, and problem-solving approaches, Presentation)      Self-study (Reading Literature)	1 hours 40 minutes	20				
Workload:	The total workload is 91 hours/5440 minutes (3.2 ECTS) per semester, consisting of 25 hour 20 minutes/1400 minutes lectures (0.82 ECTS), 28 hours/1680 minutes structured activities (0.98 ECTS) and 28 hours/1680 minutes self-study (0.98 ECTS) per week for 14 weeks, 11hour 54 minutes/714 minutes for two exams (0.42 ECTS).					
Credit points:	3.2 ECTS					
Pre-requisites course(s):	FI121 Basic Physics I, FI340 Mechanics					
	After taking this course the students have abilities to:					
Course Learning Outcomes (CLO):	CLO1. Explain the Earth's shape through reasoning and authentic evidence and determine geographic coordinates using measuring instruments or astronomical observations.  CLO2. Explain the definition of a celestial sphere and its components.					

independent work or teamwork according to scien principles with full responsibility.  1. Earth Shape and Geographical Coordinate Syste Determination of geographic latitude & longitude fr astronomical observations  2. Celestial Globe: Definition, components of the celestial sphe astronomical triangle, properties of the astronomical triangle sines-cosines-tangent rule, Napier's rule  3. Sky Coordinate Systems (horizon, equator) and Transformations between Coordinate Systems I  4. Celestial Coordinate Systems (ecliptic, galaxy) and Intermediate Transformation Coordinate Systems II  5. Solar Time: True solar time & mean solar time (standard time local time)  6. Sidereal Time: Standard sidereal time & local sidereal time  7. Daily Phenomenon: Rise-Transit-Culmination-Set  8. Atmospheric Refraction  9. Geocentric Parallax  10. Aberration of Light  11. Precession and Nutation  12. Introduction to Sundial  13. Astronomy Project  14. Individual/Group Presentations  The final mark will be weight as follow:  Study/exam achievements:		CLO3.		nerical triangle ari		mining the			
CLO5. Describe/determine the position of celestial bodies in ecliptic and galactic coordinate systems and coordin system transformation.  CLO6. Apply the concept of solar time (in standard longitude) a local longitude) and Julian Date calculations precis according to the context.  CLO7. Determine the sidereal time and understand its relations with the solar time and apply it in determining rising-culmination time of celestial bodies.  CLO8. Calculate refraction correction calculations in astronom observations.  CLO9. Calculate geocentric parallax correction calculations astronomical observations.  CLO1. Calculate light aberration correction calculations astronomical observations.  CLO11. Calculate precession correction calculations and nutal in astronomical observations.  CLO12. Design and construct sundials from simple materials a medium for learning the daily pseudo motion of the sand the concept of solar time in independent work a teamwork.  CLO13. Disseminate innovation work in written reports/models independent work or teamwork according to scien principles with full responsibility.  1. Earth Shape and Geographical Coordinate System sunding transformation of geographical Coordinate Systems astronomical observations.  2. Celestial Globe: Definition, components of the celestial sphe astronomical observations.  2. Celestial Globe: Definition, components of the celestial sphe astronomical triangle, properties of the astronomical triangles of the astronomical triangles of the astronomical triangles properties of the astronomical triangles astronomical between Coordinate Systems II  5. Solar Time: True solar time & mean solar time (standard time)  6. Sidereal Time: Standard sidereal time & local sidereal time 7. Daily Phenomenon: Rise-Transit-Culmination-Set 8. Atmospheric Refraction 9. Geocentric Parallax 10. Aberration of Light 11. Precession and Nutation 12. Introduction to Sundial 13. Astronomy Project 14. Individual/Group Presentations		CLO4.	<ul> <li>Describe/determine the position of celestial boo horizon and equatorial coordinate systems and</li> </ul>						
CLO6. Apply the concept of solar time (in standard longitude) and Julian Date calculations precis according to the context.  CLO7. Determine the sidereal time and understand its relations with the solar time and apply it in determining rising-culmination time of celestial bodies.  CLO8. Calculate refraction correction calculations in astronom observations.  CLO9. Calculate geocentric parallax correction calculations astronomical observations.  CLO10. Calculate light aberration correction calculations astronomical observations.  CLO11. Calculate precession correction calculations astronomical observations.  CLO12. Design and construct sundials from simple materials a medium for learning the daily pseudo motion of the sand the concept of solar time in independent work a teamwork.  CLO13. Disseminate innovation work in written reports/models independent work or teamwork according to scien principles with full responsibility.  1. Earth Shape and Geographical Coordinate Syste Determination of geographic latitude & longitude frastronomical observations  2. Celestial Globe: Definition, components of the celestial sphe astronomical triangle, properties of the astronomical tr		CLO5.	Describe/d	etermine the positi					
according to the context.  CLO7. Determine the sidereal time and understand its relations with the solar time and apply it in determining rising-culmination time of celestial bodies.  CLO8. Calculate refraction correction calculations in astronom observations.  CLO9. Calculate geocentric parallax correction calculations astronomical observations.  CLO10. Calculate light aberration correction calculations astronomical observations.  CLO11. Calculate precession correction calculations astronomical observations.  CLO12. Design and construct sundials from simple materials a medium for learning the daily pseudo motion of the sand the concept of solar time in independent work a teamwork.  CLO13. Disseminate innovation work in written reports/models independent work or teamwork according to scien principles with full responsibility.  1. Earth Shape and Geographical Coordinate Syste Determination of geographic latitude & longitude frastronomical observations  2. Celestial Globe: Definition, components of the celestial sphe astronomical triangle, properties of the astronomical triangle, properti		CLO6.	Apply the	concept of solar tim	•	_			
rising-culmination time of celestial bodies.  CLO8 Calculate refraction correction calculations in astronom observations.  CLO9. Calculate geocentric parallax correction calculations astronomical observations.  CLO10. Calculate light aberration correction calculations astronomical observations.  CLO11. Calculate precession correction calculations and nutal in astronomical observations.  CLO12. Design and construct sundials from simple materials a medium for learning the daily pseudo motion of the \$\frac{8}{2}\$ and the concept of solar time in independent work a teamwork.  CLO13. Disseminate innovation work in written reports/models independent work or teamwork according to scien principles with full responsibility.  1. Earth Shape and Geographical Coordinate System Determination of geographic latitude & longitude frastronomical observations  2. Celestial Globe: Definition, components of the celestial sphe astronomical triangle, properties of the astronomical triangle, properties of the astronomical triangles insecosines-tangent rule, Napier's rule  3. Sky Coordinate Systems (horizon, equator) artransformations between Coordinate Systems I  4. Celestial Coordinate Systems (horizon, equator) artransformations between Coordinate Systems I  5. Solar Time: True solar time & mean solar time (standard time) local time)  6. Sidereal Time: Standard sidereal time & local sidereal time in local time)  7. Daily Phenomenon: Rise-Transit-Culmination-Set in Atmospheric Refraction  9. Geocentric Parallax  10. Aberration of Light  11. Precession and Nutation  12. Introduction to Sundial  13. Astronomy Project  14. Individual/Group Presentations  The final mark will be weight as follow:		CLO7.	according Determine	to the context. the sidereal time ar	nd understand its re	elationship			
CLO9. Calculate geocentric parallax correction calculations astronomical observations.  CLO10. Calculate light aberration correction calculations astronomical observations.  CLO11. Calculate precession correction calculations and nutal in astronomical observations.  CLO12. Design and construct sundials from simple materials a medium for learning the daily pseudo motion of the sand the concept of solar time in independent work at teamwork.  CLO13. Disseminate innovation work in written reports/models independent work or teamwork according to scien principles with full responsibility.  1. Earth Shape and Geographical Coordinate System Determination of geographic latitude & longitude frastronomical observations  2. Celestial Globe: Definition, components of the celestial spherastronomical triangle, properties of the astronomical triangle, properties of the astronomical triangle, sines-cosines-tangent rule, Napier's rule  3. Sky Coordinate Systems (horizon, equator) or Transformations between Coordinate Systems II  4. Celestial Coordinate Systems (ecliptic, galaxy) or Intermediate Transformation Coordinate Systems II  5. Solar Time: True solar time & mean solar time (standard time) local time)  6. Sidereal Time: Standard sidereal time & local sidereal time  7. Daily Phenomenon: Rise-Transit-Culmination-Set  8. Atmospheric Refraction  9. Geocentric Parallax  10. Aberration of Light  11. Precession and Nutation  12. Introduction to Sundial  13. Astronomy Project  14. Individual/Group Presentations		CLO8	rising-culm Calculate	ination time of celes refraction correction	stial bodies.	_			
CLO10. Calculate light aberration correction calculations astronomical observations.  CLO11. Calculate precession correction calculations and nutal in astronomical observations.  CLO12. Design and construct sundials from simple materials a medium for learning the daily pseudo motion of the sand the concept of solar time in independent work a teamwork.  CLO13. Disseminate innovation work in written reports/models independent work or teamwork according to scien principles with full responsibility.  1. Earth Shape and Geographical Coordinate Syste Determination of geographic latitude & longitude from astronomical observations  2. Celestial Globe: Definition, components of the celestial sphe astronomical triangle, properties of the astronomical triangle, properties of the astronomical triangles inses-cosines-tangent rule, Napier's rule  3. Sky Coordinate Systems (horizon, equator) of Transformations between Coordinate Systems I  4. Celestial Coordinate Systems (ecliptic, galaxy) of Intermediate Transformation Coordinate Systems II  5. Solar Time: True solar time & mean solar time (standard time) local time)  6. Sidereal Time: Standard sidereal time & local sidereal time  7. Daily Phenomenon: Rise-Transit-Culmination-Set  8. Atmospheric Refraction  9. Geocentric Parallax  10. Aberration of Light  11. Precession and Nutation  12. Introduction to Sundial  13. Astronomy Project  14. Individual/Group Presentations  The final mark will be weight as follow:		CLO9.	Calculate	geocentric paralla	x correction calc	ulations in			
CLO11. Calculate precession correction calculations and nutai in astronomical observations.  CLO12. Design and construct sundials from simple materials a medium for learning the daily pseudo motion of the sand the concept of solar time in independent work at teamwork.  CLO13. Disseminate innovation work in written reports/models independent work or teamwork according to scien principles with full responsibility.  1. Earth Shape and Geographical Coordinate Syste Determination of geographic latitude & longitude from astronomical observations.  2. Celestial Globe: Definition, components of the celestial sphe astronomical triangle, properties of the astronomical triangle, properties of th		CLO10.	Calculate	light aberration	correction calcu	lations in			
CLO12. Design and construct sundials from simple materials a medium for learning the daily pseudo motion of the sand the concept of solar time in independent work a teamwork.  CLO13. Disseminate innovation work in written reports/models independent work or teamwork according to scien principles with full responsibility.  1. Earth Shape and Geographical Coordinate System Determination of geographic latitude & longitude from astronomical observations.  2. Celestial Globe: Definition, components of the celestial spherastronomical triangle, properties of the astronomical triangle, properties of the astronomi		CLO11.	Calculate	precession correcti	on calculations an	d nutation			
teamwork. CLO13. Disseminate innovation work in written reports/models independent work or teamwork according to scien principles with full responsibility.  1. Earth Shape and Geographical Coordinate System Determination of geographic latitude & longitude fin astronomical observations  2. Celestial Globe: Definition, components of the celestial spherastronomical triangle, properties of the astronomical triangle, properties of the astronomical triangles, properties of the astronomical tri		CLO12.	Design an medium for	d construct sundial or learning the daily	y pseudo motion of	of the Sun			
Determination of geographical Coordinate System Determination of geographic latitude & longitude for astronomical observations  2. Celestial Globe: Definition, components of the celestial spherastronomical triangle, properties of the astronomical triangle, properties of the astronomical triangle, sines-cosines-tangent rule, Napier's rule  3. Sky Coordinate Systems (horizon, equator) of Transformations between Coordinate Systems I  4. Celestial Coordinate Systems (ecliptic, galaxy) of Intermediate Transformation Coordinate Systems II  5. Solar Time: True solar time & mean solar time (standard time) local time)  6. Sidereal Time: Standard sidereal time & local sidereal time  7. Daily Phenomenon: Rise-Transit-Culmination-Set  8. Atmospheric Refraction  9. Geocentric Parallax  10. Aberration of Light  11. Precession and Nutation  12. Introduction to Sundial  13. Astronomy Project  14. Individual/Group Presentations  The final mark will be weight as follow:  Study/exam achievements:		CLO13.	teamwork. CLO13. Disseminate innovation work in written reports/models in						
Determination of geographic latitude & longitude frastronomical observations  2. Celestial Globe: Definition, components of the celestial sphe astronomical triangle, properties of the astronomical triangle, sines-cosines-tangent rule, Napier's rule  3. Sky Coordinate Systems (horizon, equator) of Transformations between Coordinate Systems I  4. Celestial Coordinate Systems (ecliptic, galaxy) of Intermediate Transformation Coordinate Systems II  5. Solar Time: True solar time & mean solar time (standard time) local time)  6. Sidereal Time: Standard sidereal time & local sidereal time  7. Daily Phenomenon: Rise-Transit-Culmination-Set  8. Atmospheric Refraction  9. Geocentric Parallax  10. Aberration of Light  11. Precession and Nutation  12. Introduction to Sundial  13. Astronomy Project  14. Individual/Group Presentations  The final mark will be weight as follow:  Study/exam achievements:		4 -	principles	with full responsibilit	ïy.				
2. Celestial Globe: Definition, components of the celestial sphe astronomical triangle, properties of the astronomical triang sines-cosines-tangent rule, Napier's rule  3. Sky Coordinate Systems (horizon, equator) a Transformations between Coordinate Systems I  4. Celestial Coordinate Systems (ecliptic, galaxy) a Intermediate Transformation Coordinate Systems II  5. Solar Time: True solar time & mean solar time (standard time local time)  6. Sidereal Time: Standard sidereal time & local sidereal time  7. Daily Phenomenon: Rise-Transit-Culmination-Set  8. Atmospheric Refraction  9. Geocentric Parallax  10. Aberration of Light  11. Precession and Nutation  12. Introduction to Sundial  13. Astronomy Project  14. Individual/Group Presentations  The final mark will be weight as follow:  Study/exam achievements:		Det	ermination	of geographic I		System: ude from			
3. Sky Coordinate Systems (horizon, equator) a Transformations between Coordinate Systems I  4. Celestial Coordinate Systems (ecliptic, galaxy) a Intermediate Transformation Coordinate Systems II  5. Solar Time: True solar time & mean solar time (standard time local time)  6. Sidereal Time: Standard sidereal time & local sidereal time  7. Daily Phenomenon: Rise-Transit-Culmination-Set  8. Atmospheric Refraction  9. Geocentric Parallax  10. Aberration of Light  11. Precession and Nutation  12. Introduction to Sundial  13. Astronomy Project  14. Individual/Group Presentations  The final mark will be weight as follow:  Study/exam achievements:		2. Celestial Globe: Definition, components of the celestial sphere, astronomical triangle, properties of the astronomical triangle,							
4. Celestial Coordinate Systems (écliptic, galaxy) a Intermediate Transformation Coordinate Systems II  5. Solar Time: True solar time & mean solar time (standard tim local time)  6. Sidereal Time: Standard sidereal time & local sidereal time  7. Daily Phenomenon: Rise-Transit-Culmination-Set  8. Atmospheric Refraction  9. Geocentric Parallax  10. Aberration of Light  11. Precession and Nutation  12. Introduction to Sundial  13. Astronomy Project  14. Individual/Group Presentations  The final mark will be weight as follow:  Study/exam achievements:		3. Sky Coordinate Systems (horizon, equator) and							
Content:  Intermediate Transformation Coordinate Systems II  Solar Time: True solar time & mean solar time (standard tim local time)  Sidereal Time: Standard sidereal time & local sidereal time  Daily Phenomenon: Rise-Transit-Culmination-Set  Atmospheric Refraction  Geocentric Parallax  Aberration of Light  Precession and Nutation  Introduction to Sundial  Astronomy Project  Individual/Group Presentations  The final mark will be weight as follow:  Study/exam achievements:  Assessment  Assessment  Assessment									
local time) 6. Sidereal Time: Standard sidereal time & local sidereal time 7. Daily Phenomenon: Rise-Transit-Culmination-Set 8. Atmospheric Refraction 9. Geocentric Parallax 10. Aberration of Light 11. Precession and Nutation 12. Introduction to Sundial 13. Astronomy Project 14. Individual/Group Presentations  The final mark will be weight as follow:  Study/exam achievements:		Intermediate Transformation Coordinate Systems II							
7. Daily Phenomenon: Rise-Transit-Culmination-Set 8. Atmospheric Refraction 9. Geocentric Parallax 10. Aberration of Light 11. Precession and Nutation 12. Introduction to Sundial 13. Astronomy Project 14. Individual/Group Presentations  The final mark will be weight as follow:  Study/exam achievements:	Content:			ie solai time & mea	n solar time (stand	iaiu iiiie &			
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10. Aberration of Light 11. Precession and Nutation 12. Introduction to Sundial 13. Astronomy Project 14. Individual/Group Presentations  The final mark will be weight as follow:  Study/exam achievements:									
12. Introduction to Sundial 13. Astronomy Project 14. Individual/Group Presentations  The final mark will be weight as follow:  Study/exam achievements:		10. Aberration of Light							
13. Astronomy Project 14. Individual/Group Presentations  The final mark will be weight as follow:  Study/exam achievements:									
The final mark will be weight as follow:  Study/exam achievements:  Assessment Assessment									
Study/exam achievements:  Assessment Assessment									
		The final	mark will be	weight as follow:					
No CLO Object Techniques Wei	Study/exam achievements:	No	CLO			Weight			

	1	CLO1 - CLO13	1 , 1					
Forms of media:	Whiteboard, LCD Projector, Laptop/Computer, Video Conference tools (Zoom, Google Meeting)							
Literature:	<ol> <li>Roy, A., &amp; Clarke, D. (2003). Astronomy: Principles and practice, 4<sup>th</sup>-ed. CRC Press.</li> <li>National Research Council. Commission on Physical Sciences; Mathematics; and Applications, Space Studies Board, Board on Physics and Astronomy, &amp; Astronomy and Astrophysics Survey Committee. (2001). Astronomy and astrophysics in the new millennium. National Academies Press.</li> <li>Savoie, D. (2009). Sundials: Design, Construction and Use. Praxis Publishing</li> <li>Dorling Kindersley Publishing Staff. (2017). The astronomy book: Big ideas simply explained. DK.</li> </ol>							

## **PLO and CLO mapping**

	PLO1	PLO	PLO3	PLO4	PLO5	PLO6	PLO7	PLO8	PLO9	PLO10	PLO11	PLO12
		2										
CLO1		$\sqrt{}$										
CLO2												
CLO3		$\sqrt{}$										
CLO4		$\sqrt{}$										
CLO5		$\sqrt{}$										
CLO6		$\sqrt{}$										
CLO7		$\sqrt{}$										
CLO8		$\sqrt{}$										
CLO9												
CLO10												
CLO11		$\sqrt{}$										
CLO12		$\sqrt{}$										
CLO13												