SEMESTER LEARNING ACTIVITY PLANS (SLAP) SEMESTER ODD 2022/2023



Theoretical Acoustics MFF5431 / 2 Credits

Lecturer Coordinator:

Dr. Mitrayana, S.Si., M.Si.

UNIVERSITAS GADJAH MADA FACULTY OF MATHEMATICS AND NATURAL SCIENCE 2022

	Universitas Gadjah Mada Faculty of Mathematics and Natural Science Physics Department / Study Program Master Physics Semester Odd 2022/2023							
SEMESTER LEARNING ACTIVITY PLANS (SLAP)								
Code	Course Name	Credits (credits)	Semester	Status	Prerequisite			
MFF5431	Theoretical Acoustics	2	Odd	Elective	None			
Short Description Program Learning Outcomes (PLO)	Theoretical Acoustics course is Elective course 2 credits (Theory) in the 2022 Curriculum Master Physics Study Program, Faculty of Mathematics and Natural Science UGM.The syllabus of this course is as follows: Basic linear acoustics; Acoustic propagation in the atmosphere; Underwater acoustics; Physical acoustics; Photoacoustic; Thermo acoustic; Nonlinear acoustics in fluids; Acoustic signal processing; Acoustics and Structural Vibration; Medical acoustics; Photoacoustic tomography; Modulated ultrasound optical tomography.The courses are held in class for 14 weeks, each week's session last for 2 x 50 minutes. Four weeks of course period is used for Midterm Exam and Final Exam, each held for two weeks as scheduled.Student evaluation for course assessments is performed summative and formative. The summative evaluation is implemented as written exams, both Midterm and Final Exam, which take a maximum of 120 minutes. The formative evaluation is implemented as individual assignments for each student in the form of completing an assignment individually. Monitoring is carried out by observing student activities during the course, such as attendance, Q&A and discussion about the material presented, and student performance in completing individual assignments.Mastering further knowledge of classical and modern physics theory, and its relationship with other disciplines, and has mastered an advanced field of physics specialization that allows him to keep up with the latest international research developments.							
the Course	PLO 4 PLO 6	Mastering various mathematical disciplines related to an advanced field of physics, and able to develop physical models using various mathematical and computational tools with an inter or multidisciplinary approach to solving problems related to an advanced field of physics. Able to apply knowledge to analyze, synthesize, formulate problems and solve problems comprehensively in one of advanced field of physics, through experimental or theoretical research, then be able to classify and draw conclusions about their findings for the development of science and technology.						
Course	Upon comple	tion of this cours	e, students sh	ould be able to:				
Outcomes (CO)	<i>C01</i>	Analyze concept in the classical en		ses related to Acoustic Th	eory and Applications			

	<i>CO2</i>	Analyze concepts and solve cases of Acoustic Theory and Applications in the modern era.					
	<i>CO3</i>	Work in groups in reviewing the latest developments in Acoustic Theory and Applications.					
	<i>CO4</i>						
	<i>CO5</i>						
	<i>CO6</i>						
	<i>C07</i>						
	CO8						
The Correlation of CO to		Learning Materials	Learning Methods	Time Allocation			
Learning	<i>C01</i>	Introduction: Acoustics The	Lecture discussion	2 - 50			
Materials and	01	Science of Sound, Sounds We	Lecture, discussion	2 x 50 minutes			
Methods, and		Hear, Sounds We Can't Hear:		minutes			
Time		Ultrasound and Infrasound, Sounds					
Allocation		We Shouldn't Hear.					
	<i>CO1</i>	Environmental Noise Control,	Lecture, discussion	2 x 50			
	001	Sound Aesthetics: Music, Human		minutes			
		Voices: Speech and Singing, How		minuces			
		We Hear: Physiological and					
		Psychological Acoustics,					
		Architectural Acoustics,					
		Harnessing Sound: Physical and					
		Engineering Acoustics, Medical					
		Acoustics, Sounds from the Sea.					
	CO1	Basic linear acoustics: Continuum	Lecture, discussion	2 x 50			
		Mechanics Equations, Linear		minutes			
		Acoustic Equations, Variation					
		Formulation, Constant Frequency					
		Waves, Plane Waves.					
	<i>CO2</i>	Sound Attenuation, Acoustic	Lecture, discussion	2 x 50			
		Intensity and Power, Impedance,		minutes			
		Reflection and Transmission,					
		Spherical Waves, Cylindrical					
		Waves, Simple Sound Sources, Integral Equations in Acoustics,					
		Waveguides, Channels and					
		Resonators, Ray Acoustics,					
		Diffraction, Parabolic Equation					
		Methods.					
	<i>CO2</i>	Atmospheric Sound Propagation: A	Lecture, discussion	2 x 50			
		Brief History of Outdoor Acoustics,		minutes			
		Applications of Outdoor Acoustics,					
		Diffusion Losses, Atmospheric					
		Absorption, Diffraction and					
		Resistance, Soil Effects,					
		Attenuation Through Trees and					
		Foliage, Effects of Wind and					
		Temperature Gradients on Outdoor					
		Sound.					

<i>CO2</i>	Underwater Acoustics: Marine Acoustic Environment, Physical Mechanisms, SONAR and SONAR Equations, Sound Propagation Models, Quantitative Description of Propagation, SONAR Array Processing, Acoustics and Marine Animals.	Lecture, discussion	2 x 50 minutes
<i>CO2</i>	Physical Acoustics: Theoretical Overview, Physical Acoustic Applications, Equipment, Surface Acoustic Waves, Nonlinear Acoustics.	Lecture, discussion	2 x 50 minutes
СО3	Thermoacoustics: History, Common Concepts, Engines, Dissipation, Cooling, Separation of Mixtures.	Lecture, discussion	2 x 50 minutes
С03	Acoustic signal processing: definition, Fourier series, Fourier transform, Power, Energy and Power Spectrum, Statistics, Noise, Sample data, Discrete Fourier transform.	Lecture, discussion	2 x 50 minutes
СОЗ	Medical Acoustics: Introduction to Medical Acoustics, Medical diagnosis; Physical Examination, Basic Physics of Ultrasound Propagation in Tissue, Ultrasound Medical Examination Methods, Medical Contrast Agents, Hyperthermia Ultrasound in Fission Therapy, High Intensity Focused Ultrasound (HIFU) in Surgery, Kidney Stone Lithotripsy, Thrombolysis, Low Frequency Therapy, Ultrasound Safety.	Lecture, discussion	2 x 50 minutes
<i>CO4</i>	Photoacoustics: Introduction, Inventions by Bell, Photophone and Early Days, Rise as an Optoacoustic Effect and Early 20th Century Applications, The Physics behind Photophonic Effects.	Lecture, discussion	2 x 50 minutes
<i>CO4</i>	Thermal Piston Model, Pulsating Effect, Rediscovery of Intensity- Modulated Photophonic Effects in Solids as Photoacoustic Effects, Evolution of Biomedical Applications, Sources of Modern Naming Conventions.	Lecture, discussion	2 x 50 minutes

	<i>CO4</i>	Photoacoustic Tomography:	Lecture, discussion	2 x 50			
	Introduction, Motivation for			minutes			
		Photoacoustic Tomography, Initial					
		Photoacoustic Pressure, General					
		Photoacoustic Equations, General					
		Forward Solutions, Delta-Pulse					
		Excitation of the Slab, Delta-Pulse					
		Excitation of the Sphere.					
	<i>CO4</i>	Finite-Duration Pulse Excitation	Lecture, discussion	2 x 50			
	0.04	from Thin Slabs, Finite-Duration	minutes				
				minutes			
		Pulse Excitation from Small Balls,					
		Dark Field Confocal Photoacoustic					
		Microscopes, Synthetic Aperture					
		Image Reconstruction, General					
		Image Reconstruction.					
		Final Exam/ Project Task Result	ts/ Case Analysis Results				
Learning	Lecture, discu	ussion					
Methods							
Student	Learn to analy	ze and review: Introduction: Acoustics The	Science of Sound, Sounds We	Hear, Sounds			
Learning	We Can't Hear	: Ultrasound and Infrasound, Sounds We Sl	houldn't Hear., Environmental N	Noise Control,			
Experience	Sound Aesthet	ics: Music, Human Voices: Speech and Sin	ging, How We Hear: Physiolog	ical and			
Lapertence	Psychological	Acoustics, Architectural Acoustics, Harnes	sing Sound: Physical and Engin	eering			
	Acoustics, Medical Acoustics, Sounds from the Sea., Basic linear acoustics: Continuum Mechanics Equations, Linear Acoustic Equations, Variation Formulation, Constant Frequency Waves, Plane Waves.						
		tion, Acoustic Intensity and Power, Impeda					
		rical Waves, Simple Sound Sources, Integr					
		Channels and Resonators, Ray Acoustics, Diffraction, Parabolic Equation Methods., Atmospheric Sound Propagation: A Brief History of Outdoor Acoustics, Applications of Outdoor Acoustics, Diffusion					
		pheric Absorption, Diffraction and Resistar					
		ffects of Wind and Temperature Gradients					
		tic Environment, Physical Mechanisms, SO					
		lodels, Quantitative Description of Propaga					
		ls., Physical Acoustics: Theoretical Overvie					
	Surface Acoustic Waves, Nonlinear Acoustics., Thermoacoustics: History, Common Concepts Dissipation, Cooling, Separation of Mixtures., Acoustic signal processing: definition, Fourier						
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and Online Percentage								
Assessment Methods and Synchronizati	Assessment Methods		Assessment Percentage	Criteria/In dicators	n CO1	CO2	CO3	CO4
on with CO	Participator Activity* Project Resu Case Study Results/ PBI Deculta*	ılts/						
	Results* Cognitive							
	Assignment		30%		7,5%	7,5%	7,5%	7,5%
	Quiz							
	Midterm Ex	am	35%		17,5%	17,5%		
	Final Exam		35%				17,5%	17,5%
	activities or	^{*)} can also be obtained from the Midterm or Final Exam as the result of participatory activities or project/ case study results. According to IKU 7, the percentage of project results/ case study/ PBL results is at least 50%.						
References	 Main references: 1. Rossing T.D., 2007, Handbook of Acoustics, Springer Science BusinessMedia, LLC New York. 2. Lihong V. Wang and Hsin-i Wu, 2007, Biomedical Optics, John Wiley & Sons, Inc. 3. Mitrayana, M.Ali Joko W., and R. Ikhsan, 2017, Laser Photoacoustic Spectroscopy and Its Applications, Gadjah Mada University Press. 							
Lecturers (Team Teaching)	 Dr. Mitrayana, S.Si., M.Si. Dr. Moh. Ali Joko Wasono, M.S. 4. 							
Authorization	Date of Drafting	Leo	turer Coordin	ator H	lead of Cur Commi			d of Study rogram
		Dr. N	Iitrayana, S.Si.	, <i>M.Si</i> . D	Dr.Ing. Ari S	Setiawan	Mirza Sa	atriawan, M.Si., Ph.D