		Faculty of Natural Sciences and Mathematics Chemistry Department Chemistry Education Study Program			
Module Name		Instrumental Chemistry			
Module level, if applicable		2nd year			
Code, if applicable		SPK-427			
Semester (s) in which the module is taught		4th semester			
Person responsible for the module		Prof. Riyanto, M.Si., Ph.D			
Lecturer(s)		Prof. Riyanto, M.Si., Ph.D Muhaimin, M.Sc.			
Language		Indonesia			
Relation to curriculum		Compulsory			
Types of teaching and learning	Class size	Forms of active participation	Workload 136 hours		
Lecture and discussion	50 – 60	Discussion	Lecture: 150 (min) x 16 (meeting)	40 hours	
			Assignment: 180 (min) x 16 (week)	48 hours	
			Independent study: 180 (min) x 16 (week)	48 hours	
ECTS credit		4.86			
Credit points		3 SCU			
Requirements according to examination regulations		Minimum attendance at lectures is 75% (according to UII regulation)			
Recommended prerequisites		Analytical Chemistry II			
Related course		-			
Module objectives/intended learning		On successful completion of the course students should be able to: 1. explain the theoretical concepts of the basic principles of spectroscopy 2. explain the theoretical concepts of sample preparation techniques 3. explain the theoretical concepts of the basic principles and applications of UV-Vis spectrophotometry 4. explain the theoretical concepts of the basic principles and applications of Atomic Absorption Spectrophotometry (AAS) 5. explain the theoretical concepts of the basic			

	principles and applications of ICP-MS 6. explain the theoretical concepts of the basic principles and applications of FT-IR 7. explain the theoretical concepts of the basic principles and applications of NMR 8. explain the theoretical concepts of the basic principles and applications of MS 9. explain the theoretical concepts of the basic principles and applications of X-ray Diffraction (ERD) 10. explain the theoretical concepts of the basic principles and applications of X-ray Fluorescence (XRF) 11. explain the theoretical concepts of the basic principles and applications of Transmission Electron Microscopy (TEM) 12. explain theoretical concepts about the basic principles and applications of SEM and Energy Dispersive X-ray (EDX/EDS) 13. explain theoretical concepts about the basic principles and applications of X-ray photoelectron spectroscopy (XPS), Inductively coupled plasma mass spectrometry (ICP-MS), neutron activation analysis (NAA) and alpha and gamma spectroscopy, analytical radiometer, polarimeter, refractometer and density meter. 14. explain theoretical concepts about the basic principles and types of chromatography, selection of stationary and mobile phases, aspects of gas-liquid chromatography instrumentation, aspects of high performance liquid chromatography instrumentation, as well as applications of HPLC in research, industry and the environment.
Content	Spectroscopic theory, electromagnetic radiation, matter, the interaction of electromagnetic radiation with matter. UV-Vis spectrophotometry, basic principles of UV-Vis spectrophotometry, parts of the tool, schematic of the tool, how the tool works, steps of analysis and application of UV-Vis spectrophotometry. Atomic Absorption Spectrophotometry (AAS), basic principles of Atomic Absorption Spectrophotometry (AAS), parts/components in AAS, basic principles of AAS, how AAS works, steps of analysis with AAS, sample destruction and AAS applications. FTIR, basic principles of FTIR, FTIR chart/component, how FTIR works, analysis method, sample preparation. NMR, basic

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<tr><td></td><td colspan="3">principles of NMR, charts/components of NMR, how NMR works, analysis methods, sample preparation. MS, MS basic principles, MS charts/components, how MS works, how to analyze with MS, preparation of samples for analysis with MS.
X-ray Diffraction (ERD), X-Ray Fluorescence (XRF), Image Analyzer, Transmission Electron Microscopy (TEM), SEM and Energy Dispersive X-ray (EDX/EDS), X-ray photoelectron spectroscopy (XPS), Inductively coupled plasma mass spectrometry (ICP-MS), neutron activation analysis (NAA) and alpha and gamma spectroscopy, analytical radiometer, polarimeter, refractometer and density meter. All instrumentation is learned about the basic principles, the parts of the tool, the schematic of the tool, how the tool works, the steps of analysis, the application and how to read the data from the analysis.</td></tr>
<tr><td rowspan="10">Study and examination requirements and forms of examination</td><td colspan="3">Final score (NA) is calculated as follows:</td></tr>
<tr><td>Intended learning outcomes</td><td>Weight (%)</td><td>Technique of assessment</td></tr>
<tr><td>1</td><td>7</td><td>Written test: assignment, midterm</td></tr>
<tr><td>2</td><td>7</td><td>Written test: assignment, midterm</td></tr>
<tr><td>3</td><td>7</td><td>Written test: assignment, midterm</td></tr>
<tr><td>4</td><td>7</td><td>Written test: assignment, midterm</td></tr>
<tr><td>5</td><td>7</td><td>Written test: assignment, midterm</td></tr>
<tr><td>6</td><td>7</td><td>Written test: assignment, midterm</td></tr>
<tr><td>7</td><td>8</td><td>Written test: assignment, midterm</td></tr>
<tr><td>8</td><td>7</td><td>Written test: assignment, final examination</td></tr>
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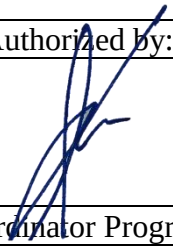
	9	7	Written test: assignment, final examination
	10	7	Written test: assignment, final examination
	11	7	Written test: assignment, final examination
	12	7	Written test: assignment, final examination
	13	7	Written test: assignment, final examination
	14	8	Written test: assignment, final examination
Media employed	Powerpoint slide presentation, video, Google classroom		
Reading lists	1. Willard JH.H., Merit, L.L., J.A dan Settle, F.A., 1998, Instrumental Methods Analysis, 7th ed., Wadsworth Publisher, Belmont, California. 2. Khopkar, S.M., 1990, Konsep Dasar Kimia Analitik, Penerbit Universitas Indonesia, Jakarta. 3. Snyder, L.R., Kirkland, J.J., and Dolan, J.W., 2009, Introduction to Modern Liquid Chromatography, John Welly and Sons Inc., New Jersey. 4. Miller, J.M., 2009, Chromatography: Concepts and Contrasts, John Welly and Sons Inc., New Jersey. 5. Sparkman, O.D., Penton, Z., and Kitson, F.G., 2011, Gas Chromatography and Mass Spectrometry: A Practical Guide, 2nd ed., John Welly and Sons Inc., New Jersey. 6. Hagel, L., Jagschies, G., and Sofer, G.K., 2007, Handbook of Process Chromatography, 2nd ed.: Development, Manufacturing, Validation and Economics, Academic Press, An Imprint Of Elsevier, Belgium. 7. Harris, D., 1994, Quantitative Chemical Analysis, W. H. Freeman & Co. 8. Robard, K., 1994, Principles and Pratice of Modern Chromatographic Methods, Academic Press, UK 9. Scott, RPW, 2003, Book 1: Principles and Practice of Chromatography, Chrom-Ed e-book series, Library for Science Publishing, LLC. 10. Skoog, D.A., Holler, F.J., Crouch, 2006, Principles		

	of Instrumental Analysis, John Willey & Sons, New York. 11. Donald L. Pavia, Gary M. Lampman, George S. Kriz

Prepared by:	Verified by:	Authorized by:
		
Person responsible for the module	Student representative	Coordinator Program