

## Module Handbook of Chemical Analysis and Molecular Biology

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| Module designation                                            | Chemical Analysis and Molecular Biology course introduces analytical techniques in the field of molecular biology which include: an explanation of the aims and objectives of lectures, lecture evaluation methods, basic principles of biology, preparation for protein analysis, protein separation techniques, centrifugation and ultracentrifugation, electrophoresis, types of microscopes, culture growing techniques cell and preparation of cell culture growth, polymerase chain reaction (PCR), flow cytometry, fluorescent labelling, extraction and characterization of secondary metabolites, gas chromatography-spectrometry (GCMS), and high-performance chromatography (HPLC, LCMS). |
| Semester(s) in which the module is taught                     | Fifth Semester                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                       |
| Person responsible for the module                             | M. Saifur Rohman, S.P., M.Si., M.Eng., Ph.D.                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                         |
| Language                                                      | Bahasa Indonesia/Indonesian Language                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                 |
| Relation to curriculum                                        | <i>Elective Course</i>                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                               |
| Teaching methods                                              | <p>Lecture are conducted in the class with 20-30 students. In every meeting, there will be delivered interactive lecture and discussion. In some topics there will be quizzes, individual and/or group assignment.</p> <p>Details:</p> <ol style="list-style-type: none"> <li>1. Lectures</li> <li>2. Assignment (Individual and Group)</li> <li>3. Discussion</li> <li>4. Midterm</li> <li>5. Final Exam</li> </ol>                                                                                                                                                                                                                                                                                 |
| Workload (incl. contact hours, self-study hours)              | <ul style="list-style-type: none"> <li>- Lectures = 2 SKS x 50 minutes x 16 meetings = 1.600 minutes<br/>= 26,67 hours<br/>= 26,67 hours/27,1 hours<br/>= 0,98 ECTS</li> <li>- Assignment = 2 SKS x 60 minutes x 16 meetings = 1.920 minutes<br/>= 32 hours<br/>= 32 hours/27,1 hours<br/>= 1,18 ECTS</li> <li>- Self Study = 2 SKS x 60 minutes x 16 meetings = 1.920 minutes<br/>= 32 hours<br/>= 32 hours/27,1 hours<br/>= 1,18 ECTS</li> </ul> <p>Total Workload = 3,34 ECTS</p>                                                                                                                                                                                                                 |
| Credit points                                                 | <i>2/0 Credit Points</i>                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                             |
| Required and recommended prerequisites for joining the module | <i>Organic Chemistry, Inorganic Chemistry, Biochemistry, Genetics, Microorganism Biology, Microbial Physiology</i>                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                   |

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| Module objectives/intended learning outcomes | <p><i>Program Learning Outcomes (PLO):</i></p> <p><i>PLO1: Able to explain theoretical concepts of biology microorganism and develop microbial-based technology to increase plant production and environmental services.</i></p> <p><i>PLO2: Able to describe the latest methodology in the field of microbiology to create environmentally friendly and sustainable agricultural development.</i></p> <p><i>PLO3: Able to create, retrieve and present data obtained in research, and able to utilize biological data banks.</i></p> <p><i>Course Learning Outcomes (CLO):</i></p> <p><i>CLO1: Able to explain theoretical concepts and working principles of several chemical and molecular biology analysis techniques</i></p> <p><i>CLO2: Able to practice the operation of several chemical and molecular biology analysis methods and able to process data from analysis results introduced in this course.</i></p> <p><i>CLO3: Able to practice and give examples of chemical and biological microbiology analysis techniques in general or specifically in the field of agricultural microbiology</i></p> |
| Content                                      | <ol style="list-style-type: none"> <li>1. Course objectives, lecture evaluation methods and basic principles of biological samples (1 meeting)</li> <li>2. Protein preparation (1 meeting)</li> <li>3. Protein separation technique (1 meeting)</li> <li>4. Centrifugation and ultracentrifugation techniques (1 meeting)</li> <li>5. Electrophoresis (1 meeting)</li> <li>6. Light microscope and electron microscope (1 meeting)</li> <li>7. Cell culture techniques and preparation of cell culture growing media (1 meeting)</li> <li>8. Principles of polymerase chain reaction (PCR), preparation and use of PCR (1 meeting)</li> <li>9. Flow cytometry and fluorescent labelling (1 meeting)</li> <li>10. Extraction and characterization of secondary metabolites (2 meetings)</li> <li>11. Gas Chromatography-Mass Spectrometry (GCMS) data analysis and interpretation techniques (1 meeting)</li> <li>12. High Performance Chromatography (HPLC) data analysis and interpretation techniques (1 meeting)</li> </ol>                                                                                    |

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| Examination forms                  | High order thinking skill examination                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                          |
|                                    | Grade and Score                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                |
|                                    | GradeScoreGradeScore                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                           |
|                                    | A≥ 85C+64,0-66,9                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                               |
|                                    | A-82,0-84,9C61,0-63,9                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                          |
|                                    | A/B79,0-81,9C-58,0-60,9                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                        |
|                                    | B+76,0-78,9C/D55,0-57,9                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                        |
|                                    | B73,0-75,9D+52,0-54,9                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                          |
|                                    | B-70,0-72,9D49,0-51,9                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                          |
| B/C67,0-69,9E<49                   |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                |
| Study and examination requirements | To be able to take the final exams, the minimum of student attendance is 70% out of effective meetings. From 14 meetings, students must take a minimum of 10 meetings to take the exam.                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                        |
| Reading list                       | Main References:<br><br>1. Flow Cytometry in Microbiology (David Lloyd (Ed)); Year 2013<br>2. Handbook of Chemical and Biological Plant Analytical Methods (K. Hostettmann) Year 2014<br>3. Fundamentals of Analytical Chemistry, Ninth Edition (Douglas A. Skoog, Donald M. West, F. James<br>4. Holler, Stanley R. Crouch); Year 2014<br>5. Wilson and Walker's Principles and Techniques of Biochemistry and Molecular Biology (Andreas Hofmann, John M. Walker, Keith Wilson, Samuel Clokie) Year 2018<br><br>Additional References:<br><br>1. Scientific journal references regarding chemical analysis and molecular biology<br>2. Video tutorials on the use of various chemical and molecular biology analysis tools which can be accessed via YouTube |