Module Descriptions

A **module** is a self-contained **learning unit** within a higher education program that includes thematically related courses and is assigned a **fixed number of credits**. It follows specific **learning objectives**, includes an **assessment component**, and contributes to achieving the qualifications of a degree program. In some countries, “modules” are also named “courses”.

Please provide a module description for each module. In addition to the compulsory and elective modules, this also includes credited internships and the final thesis.

Please summarize all module descriptions in one document (Module Handbook) and create a table of contents so that the modules can be found easily.

Module designation	*Agricultural Biotechnology*
Semester(s) in which the module is taught	*3*
Person responsible for the module	*Prof. Dr. Rinaldi Sjahril, M.Agr., Ph.D.*
Language	*Bahasa Indonesia*
Relation to curriculum	*Compulsory*
Teaching methods	*Face-to-face lectures and independent learning*
Workload (incl. contact hours, self-study hours)	1. *Lectures: 2 × 50 × 16 = 1,600 minutes (26.67 hrs)* 2. *Structured assignments: (total 2 × 60 × 16) = 1,920 minutes (32 hrs)* - *Individual assignments: 2 × 120 × 3 = 720 minutes (12 hrs)* - *Group assignments: 2 × 120 × 3 = 720 minutes (12 hrs)* - *Quiz: 2 × 15 × 8 = 240 minutes (4 hrs)* - *Discussion: 2 × 30 × 4 = 240 minutes (6 hrs)* 3. *Independent study: (total 2 × 60 × 16) = 1,920 minutes (32 hrs)* - *Accessing SIKOLA, participating in online discussion forums, reading materials, etc.* 4. *Practicum: (total: 1 × 170 × 16) = 2,720 minutes (45.33 hrs)* - *Laboratory work: 1 × 170 × 16 = 2,720 minutes (45.33 hrs)*
Credit points	*3 credits equal to 4.86 ECTS*
Required and recommended prerequisites for joining the module	-

Module objectives/intended learning outcomes	*In terms of knowledge:* - *Students are able to explain the definition, scope, historical development of biotechnology, and its role in sustainable agriculture.* - *Students are able to understand the fundamentals of plant tissue culture development, including types of media, physiological/environmental factors, and in vitro plant propagation techniques.* - *Students are able to master microbial propagation techniques, formulation development, and the field application of biopesticides and biofertilizers.* - *Students are able to analyze the application of biotechnology in plant breeding, understand the basic concepts and techniques of genetic engineering, and the stages of developing transgenic plants.* - *Students are able to evaluate the potential, benefits, and challenges of biotechnology implementation in sustainable agricultural systems.*
Content	1. *Definition, scope, historical development of biotechnology, and its role in agriculture* 2. *Fundamentals and techniques of plant tissue culture* 3. *Types of tissue culture media and physiological/environmental factors* 4. *Techniques used in plant tissue culture* 5. *Microbes and their roles, and the development of biopesticide and biofertilizer formulations* 6. *Roles of microbes in bioremediation* 7. *Biotechnology applications in plant breeding* 8. *Breeding techniques and basic concepts of genetic engineering and recombinant DNA* 9. *Stages of developing transgenic plants* 10. *Potential applications of biotechnology in sustainable agriculture*
Examination forms	*Quiz, individual assignment, group assignment, discussion*
Study and examination requirements	*To successfully pass the module, students must attend at least 80% of the classes, complete all assignments and exams, and obtain a final grade of at least 45%* (minimum passing grade: D).

Reading list	1. *Brown, T.A. (2003). Introduction to Gene Cloning. In Soemanti Ahmad M. & Praseno (Eds.), Yogyakarta: Yayasan Essentia Medica.* 2. *Campbell, N.A., Mitchell, L.G., & Reece, J.B. (2002). Biology, Volume I (5th ed.). Jakarta: Penerbit Erlangga.* 3. *Campbell, R. (1989). Biological Control of Microbial Plant Pathogens. Cambridge: Cambridge University Press.* 4. *Clark, M.S. (1997). Plant Molecular Biology: A Laboratory Manual. Berlin, Heidelberg, New York: Springer-Verlag, pp. 158–200; 305–328.* 5. *Evans, G.M., & Furlong, J.C. (2003). Environmental Biotechnology: Theory and Application. England: John Wiley and Sons LTD.* 6. *Gnanamanickam, S.S. (2009). Biological Control of Rice Diseases. Dordrecht, Heidelberg, London, New York: Springer Science and Business Media BV.* 7. *Smith, J.E. (2004). Biotechnology (4th ed.). Cambridge: Cambridge University Press.* 8. *Muladno. (2002). Seputar Teknologi Rekayasa Genetika. Bogor: Pustaka Wirausaha Muda.* 9. *Singh, A., Parmar, N., & Kuhad, R.C. (2011). Bioaugmentation, Biostimulation and Biocontrol. Berlin, Heidelberg: Springer-Verlag.*