Module Handbook of Microbial Bioremediation in Agriculture

(International Class)

Module designation	This course is a course with the language of instruction using English aimed for international students and students of the Faculty of Agriculture. This course discusses and describes various methodologies in order to bioremediate agricultural waste.
Semester(s) in which the module is taught	Third/Fifth Semester
Person responsible for the module	Prof. Ir. Irfan D. Prijambada, M.Eng., Ph.D.
Language	English Language
Relation to curriculum	*Elective Course*
Teaching methods	Lecture are conducted in the class with 30-40 students. In every meeting, there will be delivered interactive lecture and discussion. In some topics there will be quizzes, individual and/or group assignment. Details: 1. Lectures 2. Assignment (Individual and Group) 3. Discussion 4. Midterm 5. Final Exam
Workload (incl. contact hours, self-study hours)	- Lectures = 2 SKS x 50 minutes x 16 meetings = 1.600 minutes = 26,67 hours = 26,67 hours/30hours = 0,89 ECTS - Assignment = 2 SKS x 60 minutes x 16 meetings = 1.920 minutes = 32 hours = 32 hours/30hours = 1,07 ECTS - Self Study = 2 SKS x 60 minutes x 16 meetings = 1.920 minutes = 32 hours = 32 hours/30hours = 1,07 ECTS Total Workload = 3,03 ECTS
Credit points	*2/0 Credit Points*
Required and recommended prerequisites for joining the module	*None*

Module objectives/intended learning outcomes	*Program Learning Outcomes (PLO):* *PLO1: Able to implement science and technology in the field of agricultural microbiology in order to produce solutions, ideas, compile scientific descriptions of the results of their studies and be able to use at least one international language for oral and written communication.* *PLO2: Able to explain theoretical concepts of biology microorganism and develop microbial-based technology to increase plant production and environmental services.* *PLO3: Able to identify, design, implement, and solve problems that arise in the implementation of agricultural businesses.* *Course Learning Outcomes (CLO):* *CLO1: Students are able to identify common pollutants in agricultural land and their impact on environmental health and the sustainability of other organisms.* *CLO2: Students are able to mention cases of using microorganisms to degrade agricultural waste and explain the degradation mechanisms of each pollutant by microorganisms.* *CLO3: Students are able to develop plans for the application of potential microorganisms for remediating agricultural land contaminated by waste or pollutants.*
Content	1. *Introduction: Course contract, Introduction to agricultural waste: sources, implications, and sustainable management (1 meeting)* 2. *Agricultural Wastes and its Applications in Plant-Soil Systems (1 meeting)* 3. *Impact of Agriculture on Soil Health (1 meeting)* 4. *Global Scenario of Remediation Techniques to Combat Pesticide Pollution (1 meeting)* 5. *Woodchip Bioreactors for Nitrate Removal in Agricultural Land Drainage (1 meeting)* 6. *Consolidation of Green Chemistry into Biorefineries: A Pavement for Green and Sustainable Products (1 meeting)* 7. *Microbial Interventions and Biochemistry Pathways for Degradation of Agricultural Waste (1 meeting)* 8. *Mushroom Cultivation Technology for Conversion of Agro-Industrial Wastes into Useful Products (1 meeting)* 9. *Bioremediation Technologies for The Management of Agricultural Waste (1 meeting)* 10. *Biological Methodologies for Monitoring Bioremediation (1 meeting)* 11. *Students Seminar (3 meetings)* 12. *Materials Review (1 meeting)*
Examination forms	*High Order Thinking Skills Examination*
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:* *Bioremediation of Agricultural Soils, J.C. Sanchez-Hernandez (2019), CRC Press, New York.* *Agricultural Waste Threats and Technologies for Sustainable Management, R.A. Bhat, K.R. Hakeem, H. Qadri, M.A Dervash (2019), CRC Press, New York.* *Additional References:* *Interactive video on bioremediation on YouTube*