USK UNIVERSITAS SYIAH KUALA

# FACULTY OF AGRICULTURE

## DEPARTMENT OF SOIL SCIENCE

**UNDERGRADUATE PROGRAM** **MODULE HANDBOOK**

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| Module designation | Soil Bioremediation (SSOL6016) |
| Semester(s) in which the module is taught | 6th semester |
| Person responsible for the module | Dr. Ir. Fikrinda, M.Si. |
| Language | Indonesian, English |
| Relation to curriculum | Elective module for Soil Science Department |
| Teaching methods | Lecture, small group discussion, presentation |
| Workload (incl. contact hours, self-study hours) | ✔ 100 minutes lecture and discussion per week<br>✔ 120 minutes structured tasks per week<br>✔ 120 minutes learn to be independent per week |
| Credit points | 2 SKS = 3.2 ECTS |
| Required and recommended prerequisites for joining the module | - |
| Module objectives/intended learning outcomes | ✔ Students understand the importance of studying soil bioremediation and know the types and techniques for managing soil pollutants (organic and inorganic)<br>✔ Students understand the techniques of using microbes, plants, and their metabolite products in the bioremediation of contaminated land.<br>✔ Students can make appropriate decisions in the context of solving environmental problems by using relevant bioremediation methods. |
| Content | The course covers the concepts and management of inorganic and organic pollutants; factors influencing bioremediation; types of in-situ and ex-situ bioremediation; enzymatic bioremediation; and case studies on the bioremediation of organic compounds and heavy metals. |
| Exams and assessment formats | Case method, quiz, Assignments, Midterm exam, Final exam |
| Study and examination requirements | ✔ Case method: 50%<br>✔ Quiz: 10%<br>✔ Assignment: 25%<br>✔ Midterm exam: 6%<br>✔ Final exam: 9% |

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| Reading list | 1. Anekwe, I. M. S. and Isa, Y. M. 2023. Comparative evaluation of wastewater and bioventing system for the treatment of acid mine drainage contaminated soils. Water-Energy Nexus 4: 134-140<br>2. Chauhan, S., Mahawar, S., Jain, D., Udpadhay, Sudhir K., Mohanty, S. R., Singh, A., and Maharjan, E. 2022. Boosting Sustainable Agriculture by Arbuscular Mycorrhiza under Stress Condition : Mechanism and Future Prospective. Review. Hindawi BioMed Research International. 2022. 28 p.<br>3. Khodaverdiloo, H., Han, F.X., Hamzenejad Taghlidabad, R., Karimi, A., Moradi, N., and Kazery, J.A. 2020. Potentially toxic element contamination of arid and semi-arid soils and its phytoremediation. Arid Land Research and Management 34(4): 361-391<br>4. Latef, A.A.H A., Zayed, E.M. & Omar, A.A. (Eds). 2025. Sustainable Remediation for Pollution and Climate Resilience. Springer<br>5. Matilda, M.I. and Samue, H.S. 2024. Bioremediation of oil spill: concept, methods and applications. Discover Chemistry. 1(42 ): 1-18<br>6. Riaz, M., Kamran, M., Fang, Y., Wang, Q., Cao, H., Yang, G., Deng, L., Wang, Y., Zhou, Y., Anastopoulos, I. and Wang, X. 2021. Arbuscular mycorrhizal fungi-induced mitigation of heavy metal phytotoxicity in metal contaminated soils: A critical review. Hazardous Materials 402: 123919<br>7. Sadasivam, S. and Jawaharlal, M. 2023. Role of Ornamental Plants in Phytoremediation -An Overview Role of Ornamental Plants in Phytoremediation – An Overview. Chem Sci Rev Lett 2022, 11 (44), 478-488<br>8. Saxena, G., Kumar, V and Shah, M.P. (Eds.). 2020. Bioremediation for Environmental Sustainability? Toxicity, Mechanisms of Contaminants Degradation, Detoxification, and Challenges. Elsevier Inc. |