

**Educational and thematic plan of the Program**  
**“Ecological Engineering: Soil and Sediment remediation”**

№	Sections, purpose, topics (short descriptions)	Total hours	Including	
			Lectures	Practice lessons
1	<p><b>Current and future trend of national and international policies on land (soil and sediment) remediation in aspect of desertification and land degradation</b></p> <p><u>Purpose:</u> to acquire information about the current and future trends of national and international land reclamation, protection policy to understand the crucial importance of remediation and make reasonable choice of technologies and approaches for remediation.</p> <p><u>Topics (Description):</u> Learn current and future trend of national and international policies on regulating the environment protection, contamination levels for lands, including soils and sediments. United Nations Convention to Combat Desertification, The United Nations Framework Convention on Climate Change, The Convention on Biological Diversity, The Economics of Land Degradation, Multilateral international agreements on environmental protection: Goals, objectives. Pathways to decarbonization.</p>	2	2	
2	<p><b>Fundamentals on Ecological Engineering</b></p> <p><u>Purpose:</u> Understand Fundamentals on ecology and engineering for forecasting, design, remediation and restoration, as well as ecosystem management.</p>	4	4	
2.1	Engineering design: the problem, goals, the analysis of the problem, the search for alternative solutions. A set of scientific and engineering principles for improving the environment.	1	1	
2.2	Ecosystems; functions and sustainability of ecosystem components. Type of interaction or interrelationship in ecosystems. Terrestrial succession and the dynamics of plant-microbe interaction. Design of sustainable natural and artificial ecosystems. Ecosystem components and processes within the design, utilize renewable energy and resources, and increase sustainability.	2	2	
2.3	Engineering design to obtain a holistic view of the interactions within and between society and nature. Ecological economics.	1	1	
3	<p><b>Soils and sediments: main characteristics. Aspects of degradation and desertification</b></p> <p><u>Purpose:</u> Acquire the knowledge of composition and the main properties of soils and sediments, the processes of their contamination and degradation, defining the choice of the reasonable remediation approaches</p>	4	4	
3.1	The soil as a highly complex ecosystem and a non-renewable resource. Soils and their characteristics and functions. Soil properties and parameters for assessment as	2	2	

	indicators of soil health. Sediments and their specific characteristics.			
3.2	Types of anthropogenic loads and violations. Main contaminants. The main processes, mechanisms of degradation and contamination for soils and sediments.	2	2	
4	<b>Environmental Rationing: Quality Standards, Guidelines</b> <u>Purpose:</u> Acquire the knowledge in set of Quality Standards, Quality Guidelines and criteria to choose reasonable remediation approaches for soils and sediments; protect lands from degradation and harmful effects of contaminants.	2	2	
4.1	No uniform definition in the legislative systems around the world. Quality Standards, Quality Guidelines and criteria.	1	1	
4.2	Contamination Control Criteria for soils and sediments	1	1	
5	<b>Remediation Approaches</b> <u>Purpose:</u> Examine the remediation mechanisms, including physical, chemical and biological remediation processes; learn approaches and methods, choose the most effective, “eco-green” and economically effective in relation to definite environmental conditions.	20	20	
5.1	Types of remediation: In-situ, Ex-situ	1	1	
5.2	Remediation Methods: excavation and removal, reactive barrier, capping, solidification, stabilization, extraction washing, oxidation, thermal treatment, electrochemical method.	4	4	
5.3	Amendments for in situ remediation of soils and sediments.	2	2	
5.4	Wastes and their use to construct artificial soils (technosoils), safe involving to function in the environment.	2	2	
5.5	Biological treatment. Phytoremediation: phytoextraction phytostabilization, phytodegradation.	3	3	
5.6	Biological treatment. Bioremediation. Use of microorganisms to clean up contaminated soils and sediments. Biologicals. Use of earthworms for the removal of contaminants	4	4	
5.7	Innovative Remediation Technologies	2	2	
5.8	Nanotechnology: Applications for Environmental Remediation	2	2	
6	<b>Choice of soil remediation approaches. Design a cost-effective remediation plan to restore the degraded/contaminated soils and sediments</b> <u>Purpose:</u> Learn to design a cost-effective remediation plan to restore the degraded/contaminated soils and sediments, have skill to make a reasonable choice of remediation approach.	4	1	3
	<b>Total</b>	<b>36</b>	<b>33</b>	<b>3</b>