Politechnika Wrocławska
Wydział Inżynierii Środowiska

# Topics for the diploma exam
# Master's Degree Studies in Environmental Quality Management

I. Diploma exam topics in field of **Environmental Management**:

1. Characterization of five management functions and managerial skills.
2. Definition of environmental management.
3. Characterization of five environmental management principles.
4. Definition of environmental sustainability, sustainable development, Agenda 21, sections of Agenda 21.
5. Definition of an EMS (ISO 14001), how to develop EMS.
6. The main elements of planning.
7. The main elements of implementation and operation.
8. The main elements of checking and corrective action.
9. The main goal of management review.
10. Definition of “continual improvement” (ISO 14001).
11. Definition of: Environmental Policy, Environmental Aspects (examples), Impacts (examples), Objective and Target.

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II. Diploma exam topics in field of **Waste Management**:

1. The recovery, recycling, organic recycling, disposal - an explanation of the terms in accordance with the Waste Framework Directive.
2. The composition and properties of the waste. What basic materials are present in municipal waste, which have the highest shares. Which fractions of waste suitable for energy recovery and why. Which fraction of mixed waste is biologically processed and for what purpose.
3. Reuse, material recycling and organic recycling – explain terms.
4. The waste composting, conditions, methods, quality of compost. Which waste are subjected to composting. Conditions of composting: process temperatures, microorganisms, pH value, aeration, moisture, C/N ratio etc. What is produced by composting? Methods to determine stability / maturity of compost.
5. Mechanical-biological treatment. Which waste is subjected to a mechanical-biological processing, and for what purpose. What are the goals of the mechanical processing? The roles of ballistic separators, Eddy current separator, screens, etc. What fraction goes to the biological part of the MBP plants and for what purpose. What is stabilate and what was happens with it? What parameters must be met, by stabilate so that it could be landfilled.
6. Methane fermentation of waste, operating conditions, products. Wet / dry fermentation, the biogas composition. Mesophilic / thermophilic fermentation.
7. Comparison of biological methods of waste treatment. Composting / fermentation of separately collected biowaste, biological treatment of fractions separated from mixed municipal waste in the mech.-biological treatment plant. What are the objectives of these processes, substrates and products of processing. What emissions occur during composting, and which during fermentation?
8. Incineration of waste. Fuel properties of waste – what parameters are used to describe them? Conditions of incineration of municipal waste / hazardous waste containing >1% of chlorine. What pollutants are emitted during incineration process. Why waste can be burned in the incinerator, but not in the house oven?
9. Technical solutions of landfills. Natural / mineral sealing, synthetic liners – when are they required? Leachate – what are leachate properties, how can we get rid of it? Gas recovery systems at landfills – what are the main components of landfill gas. Why do we recover it from landfills? Landfill covers – why do we need them, how are they made?
10. Impact of waste management to the environment, methods to reduce it. Emissions from biological methods of waste processing, emissions from sorting, landfills and incinerators. What happens in a biofilter, where are they used?

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III. Diploma exam topics in field of **Water and Wastewater Treatment**:

1. Principles of filtration in water treatment (mechanism of pollutants removal, technological parameters, types of filters) coagulation and adsorption, as well as multifunctional filters.
2. Principles of coagulation in water treatment (mechanism of pollutants removal, technological parameters, types of coagulants, technical solutions of coagulation process).
3. Principles of adsorption in water treatment (mechanism of pollutants removal, technological parameters, types of adsorbents and adsorption systems).
4. Multifunctional filters in water treatment (mechanism of pollutants removal, technological parameters).
5. Mechanism of self-purification of natural waters (oxygen-sag curve).
6. Removal of Fe and Mn from ground water (available methods and mechanism of pollutants removal).
7. Principles of nitrification and denitrification (substrates, products, process conditions).
8. Removal of phosphorous and A2O system (mechanism and process conditions).
9. Principles of pressure membrane processes (driving force, types of processes, parameters, application examples).
10. Principles of electromembrane processes (driving force, types of processes, parameters, application examples).