MODULE 1: INTRODUCTION TO MEDICAL ECOLOGY - PRACTICAL GUIDELINES

PC 1. Subject of Medical Ecology as a Science and a Field of Practice

- **Title:** Defining the Scope of Medical Ecology

- **Objective:** To differentiate medical ecology from related sciences (ecology, medicine, public health) and define its practical applications.

- **Tasks:**

    1. Create a Venn diagram showing the overlap and unique areas of Ecology, Medicine, and Public Health. Shade the area that represents "Medical Ecology."

    2. From a list of 15 provided case studies (e.g., a heatwave in a city, an outbreak of waterborne disease, a study on air pollution and asthma, conservation of a national park), identify which fall under the purview of medical ecology and justify your choice.

    3. List at least five distinct professional roles or workplaces for a medical ecologist (e.g., environmental health officer, researcher, consultant for urban planning).

- **Report:** A one-page summary defining medical ecology, its scope, and its practical importance, supported by the diagram and case study analysis.

PC 2. Modern Concepts and Trends in Medical Ecology

- **Title:** Analyzing Current Trends in Environmental Health

- **Objective:** To research and present on a modern trend or concept in medical ecology.

- **Tasks:**

    1. In small groups, select one contemporary trend from a provided list (e.g., One Health, Planetary Health, Microplastics and Human Health, Endocrine Disruptors, Climate Resilience, Urban Health).

    2. Research the chosen trend using scientific databases and reputable sources (WHO, UNEP).

    3. Prepare a 5-minute presentation addressing: the definition of the trend, its driving factors, its specific link to human health, and one key research study or real-world example.

- **Outcome:** Group presentation and a one-page handout summarizing the key points for classmates.

PC 3. The Quality of the Human Environment

- **Title:** Assessing Environmental Quality in a Micro-Environment

- **Objective:** To apply a checklist method for assessing the quality of a defined human environment.

- **Tasks:**

1. Students will be provided with a standardized environmental quality checklist covering physical (lighting, noise, temperature), chemical (odors, visible fumes), and biological (mold, pests, cleanliness) parameters.

2. Choose a specific microenvironment to assess (e.g., a university classroom, a library, a dormitory room, a local cafe). Obtain permission if necessary.

3. Spend 30 minutes observing and completing the checklist, noting any potential hazards or deficiencies.

4. Based on the checklist, assign a preliminary "Environmental Quality Score" and write a brief report with recommendations for improvement.

- **Report:** Completed checklist, environmental quality score, and a short report with justified recommendations.

PC 4. Influence and Adaptation of the Human Organism to Ecological Environmental Factors

- **Title:** Case Study Analysis: Human Adaptation to Environmental Stressors

- **Objective:** To analyze how the human body responds and adapts to specific environmental factors.

- **Tasks:**

  1. Students will be given two contrasting case studies:

     - *Case A:* High-altitude residents in the Andes (hypoxia).

     - *Case B:* A person moving from a temperate climate to a hot, humid tropical climate.

  2. For each case study, identify the primary environmental stressor.

  3. Describe the short-term physiological responses (acclimatization) and, where applicable, the long-term genetic adaptations (acclimation) that occur.

  4. Discuss the limits of these adaptations and the potential for negative health outcomes if exposure exceeds adaptive capacity (maladaptation).

- **Report:** A structured analysis for each case study, outlining stressors, responses, and limits of adaptation.

MODULE 2 HEALTH PROMOTION

PC 6. Methods of Risk Assessment and Impact of Environmental Factors on Public Health

- **Title:** Conducting a Simplified Environmental Health Risk Assessment

- **Objective:** To apply the four-step risk assessment paradigm to a hypothetical scenario.

- **Tasks:**

  1. **Scenario:** A community draws its drinking water from a well located near a former industrial site. Trace amounts of a known industrial solvent (Trichloroethylene - TCE) have been detected in the well water.

2. **Task:** Students will work through the four steps of risk assessment:

- **Hazard Identification:** Is TCE confirmed as a human health hazard? (Students will research or be provided with its toxicological profile).

- **Dose-Response Assessment:** Given a provided graph/data on TCE exposure and health effects (e.g., liver toxicity), describe the relationship.

- **Exposure Assessment:** Assume an adult drinks 2L of this water per day. Calculate the daily dose based on the given water concentration (e.g., 5 µg/L).

- **Risk Characterization:** Compare the calculated dose to a reference dose (RfD) or guideline value (provided). Is there a potential for non-cancer risk? What is the margin of exposure?

- **Report:** A completed risk assessment worksheet with calculations, conclusions, and recommendations for risk management.

PC 7. Regulatory Documents for Assessment of Maximum Permissible Concentrations (MPCs)

- **Title:** Navigating Regulatory Standards for Environmental Pollutants

- **Objective:** To become proficient in using national and international regulatory documents to find MPCs.

- **Tasks:**

  1. Students will be provided with excerpts from national sanitary norms (e.g., from SanPiN in some countries) or WHO guidelines for drinking water quality and ambient air quality.

  2. Using these documents, complete a table for the following substances: Lead, Cadmium, Formaldehyde, and PM2.5.

Substance	MPC in Drinking Water (mg/L)	MPC in Ambient Air (µg/m^3)	Reference Document
Lead			
...			

  3. For two of the substances, compare the national MPC with the WHO guideline value. Note any differences and suggest a reason for them (e.g., different methodologies, socio-economic considerations).

- **Report:** Completed data table and a short comparison analysis.

PC 8. Assessment of the Impact of Environmental Pollution (General & Hydrosphere) on Public Health

- **Title:** Investigating a Waterborne Disease Outbreak

- **Objective:** To link hydrosphere pollution to a specific public health outcome using epidemiological principles.

- **Tasks:**

    1. **Scenario:** Over one week, 50 cases of acute gastrointestinal illness are reported in a small town. Most cases live in the same neighborhood.

    2. Provide students with a "line list" (anonymized data on cases: age, date of onset, symptoms, address) and a map of the town showing the water distribution network and potential pollution sources (e.g., a factory, a failing septic tank uphill from a water main).

    3. **Tasks:**

        - Plot the cases on the map (spot map). Is there geographic clustering?

        - Draw an epidemic curve from the onset dates. What does the shape suggest about the exposure (point source vs. continuous)?

        - Based on the map and curve, formulate a hypothesis about the source and cause of the outbreak.

        - Recommend immediate control measures and two specific water quality tests to confirm the hypothesis.

- **Report:** A completed outbreak investigation worksheet including the spot map, epidemic curve, hypothesis, and recommendations.

PC.9. Conducting health education work on the prevention of foodborne infectious diseases.

PC 10. Assessment of Lithosphere and its Polluting Factors on Public Health

- **Title:** Soil Contamination and the Food Chain: A Case Study on Cadmium

- **Objective:** To trace the pathway of a soil pollutant from source to human health effect.

- **Tasks:**

    1. **Scenario:** In the 1950s-60s, the Jinzu River basin in Japan was polluted with cadmium from a mining operation. The water was used to irrigate rice paddies. Local residents developed *Itai-itai disease* (osteomalacia and kidney failure).

    2. Students will be provided with data on cadmium levels in river water, soil, and rice from the affected area compared to a control area.

    3. **Tasks:**

        - Diagram the pathway of cadmium from the mine to the affected residents.

        - Calculate the bioconcentration factor of cadmium from soil to rice.

        - Describe the mechanism of toxicity for cadmium in the human body, explaining why it leads to the symptoms of *Itai-itai disease*.

        - Propose remediation strategies for cadmium-contaminated agricultural soil.

- **Report:** A diagram of the exposure pathway, calculations, explanation of toxicity, and remediation proposals.

PC 11. Assessment of Physical Environmental Factors and Their Evaluation

- **Title:** Measuring and Evaluating Noise Pollution

- **Objective:** To practically measure environmental noise and evaluate it against established standards.

- **Tasks:**

    1. Students will be provided with a sound level meter (or a calibrated smartphone app) and a data sheet.

    2. Select two locations with different noise profiles (e.g., a quiet library corner vs. a street corner near traffic; a classroom during a lecture vs. a cafeteria during lunch).

    3. At each location, take at least 10 separate A-weighted decibel (dBA) readings over a 5-minute period.

    4. Calculate the equivalent continuous sound level (Leq) – a time-averaged mean – using a simplified method (e.g., logarithmic average or using meter's built-in function).

    5. Compare the calculated Leq to national or WHO guidelines for community noise (e.g., WHO recommends < 55 dBA for outdoor residential areas).

    6. Propose an action plan with at least three specific measures to reduce noise exposure for the noisier location (e.g., barriers, source control, administrative controls).

- **Report:** Completed data sheet with raw data and Leq calculation, comparison to standards, and a detailed action plan.

PC 12. Assessment of Chemical Environmental Factors and Their Impact

- **Title:** Indoor Air Quality Assessment: The Case of Formaldehyde

- **Objective:** To assess potential chemical exposure in an indoor environment and propose mitigation strategies.

- **Tasks:**

    1. **Scenario:** A family moves into a newly renovated apartment with new particleboard furniture. They complain of eye, nose, and throat irritation, especially in the bedrooms.

    2. Students are provided with background information on formaldehyde: its sources (pressed wood products, paints, adhesives), health effects (irritant, carcinogen), and indoor air quality guidelines (e.g., WHO guideline of 0.1 mg/m^3 for 30-minute average).

    3. **Tasks:**

- Identify all potential sources of formaldehyde in the described apartment.

- Propose a simple, low-cost method to measure relative formaldehyde levels (e.g., passive diffusion tubes or using a photoionization detector (PID) if available).

- Develop a detailed action plan to reduce formaldehyde concentrations. The plan must include:

  - **Source Control:** Specific recommendations for materials or actions.

  - **Ventilation:** Specific advice on how to increase air exchange.

  - **Air Cleaning:** Discussion on the efficacy of different types of air purifiers for formaldehyde.

- **Report:** A source assessment, proposed monitoring method, and a comprehensive, prioritized action plan for the family.

PC 13. Assessment of Nutrition and Impact of Harmful Substances

- **Title:** Analyzing Dietary Exposure to Food Contaminants

- **Objective:** To estimate the potential health risk from a chemical contaminant in a common food item.

- **Tasks:**

  1. **Scenario:** Methylmercury is a neurotoxicant found in varying levels in different fish species. Pregnant women are particularly vulnerable.

  2. Students will be given a table of average mercury concentrations (mg/kg) for different fish (e.g., shark, tuna, salmon, shrimp) and a set of consumption scenarios (e.g., "A 60kg woman eats one 150g can of tuna per week").

  3. **Tasks:**

     - For two different consumption scenarios, calculate the weekly intake of methylmercury in µg/kg body weight/week.

     - Compare this calculated intake to the Provisional Tolerable Weekly Intake (PTWI) established by the WHO/FAO (e.g., 1.6 µg/kg bw).

     - If the intake exceeds the PTWI, calculate the Hazard Quotient (Intake / PTWI). An HQ > 1 indicates a potential concern.

     - Based on these calculations, create a simple advisory leaflet for the public on safe fish consumption, listing fish to avoid and fish that are safer to eat.

- **Report:** Completed intake calculations, HQ values, and a draft public advisory leaflet.

PC 15. Climate Change and Its Impact on Public Health

- **Title:** Developing a Local Climate Change and Health Adaptation Plan

- **Objective:** To project the local health impacts of climate change and propose adaptive strategies.

- **Tasks:**

  1. Students will be assigned a specific city or region and provided with climate projections for that area (e.g., increased average temperature, more frequent heatwaves, changes in precipitation leading to flooding or drought).

  2. Using this data, they will:

     - Identify the three most significant climate-sensitive health risks for that region (e.g., heatstroke, vector-borne diseases like dengue, respiratory issues from wildfires or increased pollen, mental health impacts from flooding).

     - For each health risk, describe the pathway from the climate hazard to the health outcome.

     - Propose a public health adaptation plan with at least two specific actions for each identified risk. Actions could include early warning systems, public education campaigns, green infrastructure projects, or changes to disease surveillance.

- **Report:** A structured report outlining the projected climate hazards, associated health risks (with pathways), and a detailed, prioritized adaptation plan for the local health authority.