

Name of the Programme: **Post Graduate diploma Course in Analysis of Soil and Water**

Programme Code: **PGDASW**

Level of Programme: Post Graduate Diploma

Duration of the Programme: one year

Eligibility Criteria: BSc Pass in any Science Stream

Papers: 6 T + 2L + 2 FW + 2 PW

Medium of instruction: English

Scheme of examination: Six Theory papers = 6 X 80= 480

Project+ Lab course X 2+ Field work X 2 : 720

Semester	Course Code	Name of the Course
Semester I	PGDASW-T1-21	Fundamentals of Soil Analysis
	PGDASWLS-T2-21	Laboratory skills-I
	PGDASW-T3-21	Advanced Soil Analysis
	PGDASW-L1-21	Laboratory training on Soil Analysis
	PGDASW-FW-1-21	Field work
	PGDASW-PW-1-21	Project and Viva voce
Semester II	PGDASW-T4-21	Fundamentals of Water Analysis
	PGDASWLS-T5-21	Laboratory skills-II
	PGDASW-T6-21	Advanced water Analysis
	PGDASW-L2-21	Laboratory training on Water Analysis
	PGDASW-FW-2-21	Field work
	PGDASW-PW-2-21	Project and Viva voce

Credit distribution:

Course Total: 30 credits

- Theory= 12 credits
- Skill component=18 credits
 - (a) Field work = 6 credits
 - (b) Practical training = 6 credits
 - (c) Project work= 6 credits

Syllabus:

Semester I:

Part A: Theory Paper I- Fundamentals of Soil Analysis- PGDASW-T1-21

Unit – I :

Definition of Soil, Concept of Lithosphere, Soil as a natural body, Soil Components: Air, Water, inorganic and organic solids, Formation of Soil, Types of Soils & Basic Concepts, macro and micro nutrients present in soil. Properties of Soil. Composition, Soil Texture, Structure, Density, Colour, Porosity Land capability, pH, Inorganic and organic matter, colloidal properties, Soil reactions, Buffering action ,Acidity in soil materials. Acid neutralization capacity and the quantification of the soil acidity. Cation exchange capacity.

Unit – II :-

Acidic, saline, sodic and physically degraded soils; origin and basic concept of problematic soils, and factors responsible. Morphological features of saline, sodic and saline-sodic soils; characterization of salt-affected soils - soluble salts, ESP, pH; physical, chemical and microbiological properties. Management of salt-affected soils; salt tolerance of crops - mechanism and ratings; monitoring of soil salinity in the field; management principles for sandy, clayey, red lateritic, calcareous and dry land soils. Acid soils - nature of soil acidity, sources of soil acidity; effect on plant growth, lime requirement of acid soils; management of acid soils; biological sickness of soils and its management.

Unit-III :-

Soil pollutants - their CPC standards and effect on plants, animals and human beings. Sewage and industrial effluents – their composition and effect on soil properties/health, and plant growth and human beings; soil as sink for waste disposal. Pesticides – their classification, behavior in soil and effect on soil microorganisms. Toxic elements – their sources, behavior in soils, effect on nutrients availability, effect on plant and human health. Pollution of water resources due to leaching of nutrients and pesticides from soil. Scope of soil testing in INDIA.

Part A: Theory Paper II- Laboratory Skills I- PGDASWLS-T2-21

Paper 1: Laboratory Safety Guidelines and Rules - I [CCLSM-1]

Module I: Chemical Hygiene Plan Responsibilities:

Regulations Pertaining to the Chemical Hygiene Plan - Chemical Hygiene Plan Accessibility - Applicability to Students - Chemical Laboratory - Chemical and Non-Chemical Hazards - Responsibilities: Chemical Management Types of chemicals: Corrosives - Flammables - Oxidisers - Water Reactives - Pyrophorics - Toxics - Peroxide forming chemicals - Routes to entry and effects - Basic laboratory safety practices - Chemical Inventory and MSDSs/SDSs - Chemical Procurement - Chemical labelling - Special chemical hazards.

Module II: Chemical Handling and Processing

Transporting Chemicals - Chemical Storage and Compatibility - Flammable Chemicals - Corrosive Chemicals - Highly Reactive and Explosive Chemicals - Dark Room Chemicals - Cryogenic Liquids and Dry Ice - Mercury and other metals - Compressed Gas Cylinders - Controlled Substances and Acute Toxins - Chemical Waste Disposal - Laboratory close-outs. Waste minimization - - Chemical waste of particular concern - Solid waste and recycling - Sharps, lab glass and plastics - Biological/radioactive waste - Mixed waste -. Laboratory Equipment and Facilities Emergency shower and eyewashes - Fire safety equipment - Laboratory signs - Laboratory ventilation - Other facility - Pressure vessels and systems

Module III: Employee Health and Personal Protective Equipment (PPE)

Environmental monitoring and medical surveillance - Personal Protective Equipment - Eye protection - Personal apparel - Gloves - Respirators - Hearing protectors - PPE outside the laboratory Standard Operating Procedures (SOP) SOP components: Process Identification - Chemicals and Hazards - Personal Protective Equipment (PPE) - Environmental/Ventilation Controls - Special Handling Procedures & Storage Requirements - Spill and Accident Procedures - Waste Disposal - Special Precautions for Animal Use (if applicable) - Approval Required - Decontamination - Designated Area - Example SOPs - Step to develop the SOPs.

Part A: Theory Paper III- Advanced Soil Analysis - PGDASW-T3-21

Unit I : Analytical Techniques and Instrumental Methods for soil analysis. Principles of visible, ultraviolet and infrared spectrophotometry, atomic absorption, flame-photometry, inductively coupled plasma spectrometry; chromatographic techniques, mass spectrometry and X-ray diffractometry; identification of minerals by X-ray by different methods.

Unit II: identification of minerals by different methods. Determination of cation and anion exchange capacities of soils. determination of cation and anion exchange capacities of soils; estimation of exchangeable cations (Na, Ca, Mg, K); estimation of root cation exchange capacity. Analysis of soil and plant samples for N, P, K, Ca, Mg, S, Zn, Cu, Fe, Mn, B and Mo; analysis of plant materials by digesting plant materials by wet and dry ashing and soil by wet digestion methods. Determination of lime and gypsum requirement of soil. Analysis of soil extracts and irrigation waters for their soluble cations and anions

Unit III: Preparation of solutions for standard curves, analytical reagents, qualitative reagents, indicators and standard solutions for acid-base, oxidation reduction and complexometric titration; soil, water and plant sampling techniques, their processing and handling. Determination of nutrient potentials and potential buffering capacities of soils for phosphorus and potassium; estimation of phosphorus, ammonium and potassium fixation capacities of soils.

Part B : Practical Paper I- Laboratory training on Soil Analysis PGDASW-L1-21-90hrs

1. Preparation of soil samples
- 2) Determination of pH
- 3) Determination of WHC (water holding capacity)

- 4) Determination of sand ,silt and clay per cent
- 5) Determination of SOC (Soil organic carbon)
- 6) Determination of nutrient status of soils
Macro nutrients (N,P,Ca, Mg and K) and b) micro nutrients (Fe, Mn, Zn, Na & Cu)
- 7) Determination of EC(Electrical conductivity) of soil samples.
- 8) Determination of CEC (cation exchange capacity)
- 9) Determination of heavy metals content (Pb)in soil

Semester II:

Part A: Theory Paper II- Water Analysis- PGDASW-T4-21

Unit I

Introduction: Water and its Quality Parameters – Chemistry of water – Water resources – Hydrological cycle – Water quality parameters and drinking standard – Physical, Chemical quality of drinking water – Biological quality of drinking water.

Unit II Water Analysis – Water composition analysis – Hardness testing – pH- Salinity- Turbidity – TDS – Conductivity testing – Minerals – BOD, COD, DO, Coli forms – Culture identification – MPN test -Microscopy: principles and practices – Staining methods. Water borne pathogen: Types and Detection – Potability of water.

Unit III

Water Pollution and Management – Environmental pollution – Definition -Types – Water pollution – Causes- Industrial and domestic effluents – Pesticides – Health hazards – Waterborne diseases. Control measures- Agencies of water quality testing- – Pollution Control Boards (State and Central) –Duties and responsibilities – Water testing labs- Environmental law: concepts.

Unit IV

Water treatment –Treatment of water: Flowchart of water treatment plant, Treatment methods (Theory and Design) – Physico-chemical treatments: Sedimentation, Coagulation-flocculation, Settling tanks, Disinfection systems: Chemicals- Chlorination and other disinfection methods, UV, Ozonation, aeration and gas transfer; precipitation; softening; adsorption and ion exchange; Reverse osmosis technologies membrane processes, Ultra filtration.

Part A: Theory Paper II- Laboratory Skills II- PGDASWLS-T5-21

Module I: Record Keeping in the Laboratory

Current record maintained in the laboratory: Chemical Hygiene Plan - Chemical Inventory - Material Safety Data Sheets/Safety Data Sheets (MSDSs/SDSs) - Incident/Accident Reports - Safety Training Records - Shipping Papers - Chemical Treatment Log Exposure Monitoring Records - Obsolete and superseded records from the laboratory: Obsolete Exposure Information - Other Obsolete Documents - Records from Decommissioned Laboratories - EH&S Records: Records Concerning Individuals - Centralized records.

Module II: Emergency Awareness and Response Before an emergency:

Planning and Prevention - Spill, First Aid and Disaster Kits - Response to specific incidents and accidents: Accidents Causing Serious Personal Injury or Exposure - Fires and Explosions - Spills - Earthquake Response - Gas Leaks or other odours - Utility 6 outage - Laboratory floods - Inclement weather - Intruders, Suspicious Packages and Demonstrators.

Module III : Moving In / Moving Out the Laboratories Moving in: Engaging a new remodelled laboratory - Before the move: Clearing of laboratory by previous occupants - Laboratory design - Ordering specialized equipment - Transporting and storing hazardous materials - After the Move - Checklist for Moving Into a Laboratory - Moving out: Vacating a laboratory - Responsibilities: Principal Investigator - Project Manager - Department - EH&S - Transportation Requirements and Logistics: Moving Equipments/Freezers/Hazardous/Non-Hazardous/Radioactive/Biological materials - Checklist for Laboratory Move outs.

Part A: Theory Paper II- Advanced Water Analysis - PGDASW-T6-21

Unit-I Groundwater quality monitoring:

Planning groundwater monitoring program. Installing groundwater monitoring wells. Withdrawing water samples from monitoring wells. Chemical analysis of natural water. Major ion chemistry. Interpretation of physical and chemical data of water; Methods of illustration pictorial stiff diagram, horizontal and vertical scale diagram. Plotting of piper diagram, Willcox, Gibbs and Durov plots. Outline of global hydrochemical software wateq, PHREEQ, AQUACHEM, MINTEQAZ.

Unit II Water Quality Deterioration: Natural Pollutants-Man-made Pollutants, Municipal wastes Industrial wastes, Agricultural wastes. Pollution in relation to water use. Various water borne diseases. Water quality standards. Microbiology of drinking water. Ecological classification of waters. Biological factors of water self purification.

Unit III Main process in water purification-Removal of suspended particles coagulation, disinfection of water. Reverse Osmosis process of water purification. Corrosion of metals, Action of sea water on concrete. Removal of gas, smack and odour from water. Softening and desalting of water. Removal of Fe, Mn, silica, fluorine and other metals from water. Purification of water from radio-active substances. Magnetic treatment of water.

Part B: Practical Paper II- Water Analysis- PGDASW-L2-21-

Practical Analytical Methods –

1. Introduction to analytical laboratory – Safety, Equipments and techniques used in laboratory,
- 2 To determine Total Alkalinity of Water
- 3 To determine the total hardness of the water sample
- 3 To determine pH and conductance of waste water
- 4 To determine Dissolved oxygen of waste water
- 5 To determine Biological and Chemical oxygen demand of waste water
- 6 To determine Acidity of Water

- 7 To determine TS, TSS, TDS of water
- 8 To determine salinity of the given water sample
- 9 Analysis of metals and ions
- 10 Microbiological analysis.

Expected outcomes for the course:

Specific job titles related to the course include:

Resource Conservationist

Natural Resources Manager

Soil Scientist

Erosion Control Specialist

Soil Chemist

Soil Physicist

Hydrologist

Plant Manager/Supervisor

Grant Coordinator

Laboratory Technician

Environmental Consultant

Environmental Manager

Community Educator

Soil Conservationist

Reclamation Specialist

Soil Conservation District Manager/Technician

Environmental Lawyer

Lobbyist Consultant

Agency Director

Policy Analyst

Students can have a scope in entering into the above mentioned posts in India and Abroad both in government and Private Industries and institutions