

POSTGRADUATE INSTITUTE OF SCIENCE
UNIVERSITY OF PERADENIYA



M.Sc. in Water Resources Management
2011/2012

1. INTRODUCTION

Water management traditionally has focused on manipulating the world's vast freshwater resources to meet the needs of humans. Constraints such as increased development costs and increasing concern for the environment have forced water managers to consider alternative approaches. Although water is a renewable resource, worldwide demand for water increases exponentially while quality and quantity of fresh water in many regions is deteriorating fast.

Water engineers, managers and sector relevant professionals therefore require a much broader understanding of water issues than previously.

The purpose of this postgraduate program in water resources assessment evaluation, development and management is to provide engineers and scientists with expert, up-to-date knowledge in the fields of:

- Water Resources
- Hydraulics and
- Water Resources Assessment ,Evaluation, Development and Management

2. OBJECTIVES OF THE PROGRAMME

The program is designed to provide the students with a sound theoretical and practical knowledge of the principles of water resources assessment, evaluation development and management. The program is also intended to enable students to update their hydraulics and computational expertise, to appreciate the environmental implications of water resources, and to develop management skills.

3. PROGRAMME ELIGIBILITY

Candidates possessing the following educational and Professional qualifications are eligible to apply for the program

- (i) Bachelors degree in Science, Engineering, Agriculture or Natural science from a recognized university
- (ii) Any other equivalent qualifications acceptable to PGIS

Candidates who meet the eligibility requirements will be called for an aptitude test and interview and selected candidates will be admitted to the program. Employed candidates should show evidence of leave granted to follow the program and a letter of release from the head of the department /institution.

4. PROGRAMME FEE

(N.B. The programme fees given below may be revised.)

	<i>M.Sc. programme fee</i>
<i>Local candidates</i>	<i>Rs. 100000/-</i>
<i>SAARC countries</i>	<i>US \$ 3300/-</i>
<i>Other countries</i>	<i>US \$ 6600/-</i>

Programme fee shall be paid in two installments (50% at registration and the next 50% within six months from registration). Other payments including registration fee, medical fee, library subscription, examination fee and deposits (science and library) should be paid according to the procedure stipulated by the PGIS.

5. PROGRAMME STRUCTURE AND DURATION

This is a full time programme consisting of coursework and a research project. Coursework will be conducted over a period of two semesters of 15 weeks each, during Fridays (if necessary), Saturdays and Sundays. The entire programme duration will be about 15-18 months inclusive of 3 - 6 months for the research project. Satisfactory completion of a minimum of 24 credits of course work (with a GPA of not less than 3.00) is required for the programme in addition to the 6 credits allocated for the full-time research project. The student who does not satisfy the above criteria but obtains a GPA in the range 2.75 to 2.99 for course work is eligible for the Diploma in Water Resources Management but not the M.Sc. Degree. Continuous attendance on full-time basis is compulsory during the period of research work. After successful completion of the research project, the student is eligible for the award of the M.Sc. Degree.

The title, number of lecture/practical hours and the credit value of each course are given in the following table.

Course Code	Course	Lecture Hrs.	Practical Hrs.	No. of Credits
Semester I				
ESW 501	Introduction to Water Resources	20	20	2
ESW 502	Applied Environmental Hydrology	25	10	2
ESW 503	Groundwater Hydrology	25	10	2
ESW 504	Catchment Processes and Water Shed Management	20	20	2
ESW 505	Geochemistry of Natural Water, Pollution and Water Quality Monitoring	25	10	2
ESW 506	Economics of Water	15	-	1
ESW 507	Fluid dynamics*	15	30	2
ESW 508	Water resources of Sri Lanka	15	-	1

ESW 509	Hydraulic Civilization of Sri Lanka*	15	-	1
ESW 510	Integrated Catchment Modeling*	15	30	2
Semester II				
ESW 511	Geo-Information Systems in Water Resources Management	15	30	2
ESW 512	Water and Irrigation*	25	10	2
ESW 514	Water and Wastewater Treatment	25	10	2
ESW 515	Application of Geophysics in Groundwater exploration*	15	30	2
ESW 516	Computer Applications in Hydrology and Hydrogeology*	15	30	2
ESW 517	Water Resources Planning and Evaluation, Water Law, Policy and Legislation	30	-	2
ESW 519	Wetlands*	15	-	1
ESW 520	Floods and Flood management*	15	-	1
ESW 597	Seminar			1
ESW 599	Research Project	(3 – 6 months)		6

* *Optional courses*

F - *Fieldwork*

Number of credits for Compulsory (10) courses 16

Number of credits for Optional (8) courses 13

Number of credits for seminar (1) - compulsory 01

Number of credits for Research project 06

6.0 COURSE CONTENTS

ESW 501: Introduction to Water Resources (2 credits)

Distribution of water on planet Earth , Hydrologic cycle, Renewable water resources, Time and space variability, Initial data and methodological approaches Continents, Natural-economic regions and countries, River basins, Inflow to the world Oceans. River runoff and underground water. Use of water resources, Principal water users and tendencies of their development, Assessing and forecasting global water use. Water availability and water resources deficit, Historical perspective of water and development, Anthropogenic changes in global climate and water resources. Ways of eliminating fresh water deficit in the world.

ESW 502: Applied Environmental Hydrology (2 credits)

Hydrologic processes, Methods for quantifying hydrologic parameters and processes. Soil water hydrology, Precipitation, Evapotranspiration, Infiltration Groundwater flow, Surface runoff, Soil erosion, Flow in channels, Forest and wetland hydrology, Remote sensing applications in hydrology, Modeling hydrologic systems, Environmental impacts related to Hydrological systems. Environmental impacts on water resources.

ESW 503: Groundwater Hydrology (2 credits)

Subsurface environment, Role of Groundwater in the hydrologic cycle, Water bearing properties of rocks and soils, Aquifer types: Principles of groundwater movement, Recharge, Groundwater development, Groundwater withdrawal, Well hydraulics and Determination of aquifer parameters. Groundwater quality, Groundwater in coastal zones, Saline water intrusion, Hydrogeological mapping, Groundwater development in Sri Lanka.

ESW 504: Catchment Processes and Water Shed Management (1credit)

Introduction to watersheds, watershed functions, classifying, and evaluating watersheds, Ecology, geology, soils and geomorphology of water sheds, Basic Elements of watershed management, Soil and Vegetation management. Soil erosion/sediment control, Native species and re vegetation, Data collection, Wetland monitoring, Meteorological monitoring, Hydrological monitoring, Damage assessment, Range management

ESW 505: Geochemistry of Natural Waters, Pollution and Water Quality Monitoring (2credits)

Geochemical cycle, Composition of rainwater, Surface water and groundwater, Equilibrium thermodynamics, Activity-concentration relationships, Carbonate systems and pH control, Silicate-water reactions, Weathering and water chemistry, Clay minerals and cation exchange, Adsorption, Organic compounds in natural waters, Redox conditions in natural waters, Quality of water, Water quality standards, Causes and concepts of pollution of water, Groundwater and Base Flow contamination, Mass transport, Transformation, retardation and attenuation of solutes, Inorganic chemicals and organic compounds in water, Urban and highway diffuse pollution, Industrial water pollution, Agricultural diffuse pollution, Water quality and health, Water quality monitoring as an information system: Sample collection, laboratory analysis, data handling, data analysis, reporting, and information utilization.

ESW 506: Economics of Water (1 credit.)

Worlds water supply and demand, Surpluses and deficits, Potential functions of water, Value of water, extractive values and insitu values, Valuation methods, Contingent Valuation Method(CVM), Hedonic Price Model (HPM), Travel Cost Method (TCM), Production costs, Conservation and Protection, Conservation by pricing, Risk costs and value of reduction of contamination. Downstream impacts from up stream decisions.

ESW 507: Fluid dynamics (1 credit)

Introduction to fluids, Physical aspects of flow, Laminar flow theory and applications, Turbulence theory and applications, Incompressible and compressible flow, Fluid flow in porous media.

ESW 508: Water resources of Sri Lanka (1 credit)

Sri Lanka and Global climatic Zones, Hydrometeorology of Sri Lanka, Climatic zones, Precipitation, Evaporation and Evapo-transpiration. Surface runoff and infiltration, Surface water resources of Sri Lanka, Major rivers and river basins, Groundwater resources of Sri Lanka, Main Hydrogeological units, Cold and thermal water springs of Sri Lanka. Water quality and environmental impacts on water resources of Sri Lanka.

ESW 509: Hydraulic Civilization of Sri Lanka (1 credit)

Hydraulic technology of Sri Lanka, Ancient reservoirs and irrigation channels Tanks and tank Builders, Tank and Village, Water ways and Folk ways , Water and water gardens, Water and its functions, Rain makers, water across religion.

ESW 510: Integrated Catchment Modeling (1 credit)

Catchment modeling techniques, Traditional and advanced approaches, Real-time flow forecasting, Mathematical modeling of integrated catchment responses in water flow, sediment and contaminant transport, Mathematical modeling for predicting impacts of future climate and land use changes. Parameterizing, Running and Validation of specific models, Limitations of catchment models.

ESW 511: Geo-information Systems in water resources Evaluation and Management (2 credits)

Introduction to remote sensing, Principles of remote sensing, Remote sensing systems, Digital image processing, Concepts of GIS, Spatial data: sources, acquisition and entry, Database, Vector and raster data, Data analysis, GIS output, Integration of remote sensing and GIS, Application of remote sensing and GIS in water resources modeling and management.

ESW 512: Water and Irrigation (2 credits)

Soil-plant-water relations, Water requirement of crops, Cropping pattern, Irrigation of lowland rice and upland crops, Irrigation management: methods, conveyance, measurement and control, efficiency and sustainability, Droughts and alleviation strategies, Crop drainage: requirements, drainage coefficient, design considerations, Fertilizers and their management, Irrigation water quality requirements, Chemical pollution, Rainwater harvesting.

ESW 514: Water and Wastewater Treatment (2 credits)

Physical, chemical and microbiological quality of water, Water quality management strategies. Fundamentals of chemical reactions. Chemical oxidation and reduction, Coagulation, Mixing, and Flocculation, Gravity Separation, Granular filtration, Membrane Filtration, Disinfection, Reverse osmosis. Ion exchange .Introduction to wastewater, Wastewater constituents, Wastewater characteristics, Wastewater treatment processes, Wastewater removal plants, Nutrient removal from waste water .Sludge handling and disposal, Industrial wastewater source control, Urban storm water Management.

ESW 515: Application of Geophysics in Groundwater exploration (2 credits)

Subsurface geophysical parameters, Surface geo physical methods in groundwater exploration, principles and applications of Resistivity, Seismic, electromagnetic and gravity methods, Geo physical well logging techniques.

ESW 516: Computer Applications in Hydrology and Hydrogeology (2 credits)

Two available computer packages one on hydrology and the other on hydrogeology will be will be selected based on students background and will be conducted as combined theory and laboratory practical assignment.

ESW 517: Water Resources Planning and Evaluation, Water Law, Policy and Legislation

(2 credits)

Planning fundamentals and processes, Water resources systems, Sustainable development, Water policy, Water sharing, Sectoral demands and resource allocation, Management of water demand and use, Water conservation and augmentation, Multi-criteria analysis, Planning under risk and uncertainty, Institutional aspects and people's participation. Water use and water market, Water and ethics, Water and poverty, Water and gender issues, Water conflicts and corporation, Water policies and procedures, Legal and Institutional requirements for water resource management, Water allocation laws, Environmental issues of water quality and quantity.

ESW 519: Wetlands (1credit)

Definitions and classification of wetlands, Wetlands of the World. Wetland Environment, Wetland Hydrology. Wetland Ecosystems, Tidal Salt marshes, Tidal fresh water marshes, Mangrove swamps, Fresh water marshes, Peat lands, Riparian Ecosystems, Wetland Management, Wetland laws and protection.

ESW 520: Floods and flood Management (1 credit)

Floods as natural hazards, Causes, dynamics and consequences of river and coastal floods, Study of floods and their effects on landforms, Sediments, human works, and populations, Impacts and interpretations of flood hazard, Spatial characteristics and form of river floods and coastal floods, Common alluvial systems leading to flood plains. Flood estimation, Flood forecasting and warning. Policies and prospects.

ESW 597: Seminar

Students will be guided to survey for the literature on current topics related to their research topics. All students pursuing a M.Sc. degree will be required to present the findings at an oral presentation which will be of 30 minutes duration followed by another 30 minutes questions/discussion session. A hard copy of the presentation must be submitted to the PGIS.

7.0 PROGRAMME EVALUATION

Programme evaluation will be as stipulated in the PGIS Handbook.

8.0 TEACHING PANEL

- Dr. Christina Shanthi De Silva, Department of Agricultural Engineering, Open University, Nugegoda
B.Sc. (Ceylon), M.Phil. (Perad.), Ph.D. (Cranefield)
- Dr. R. P. De Silva, Department of Agricultural & Plantation Engineering, Open University, Nugegoda
B.Sc. (Ceylon), M.Sc. (Cranefield), Ph.D. (Cranefield)
- Dr. H. A. Dharmagunawardhane, Department of Geology, University of Peradeniya
B.Sc. (Perad.), M.Phil. (Perad.), Ph.D. (Copenhagen)
- Prof. C. B. Dissanayake, Department of Geology, University of Peradeniya
B.Sc. (Ceylon), Ph.D. (Oxon.), D.Sc. (Oxon.)
- Dr. J. Goonatilleke, Department of Geology, University of Peradeniya
B.Sc. (Perad.), M.Sc. (AIT), Ph.D. (Saga)
- Prof. O. A. Ileperuma, Department of Chemistry, University of Peradeniya
B.Sc. (Ceylon), Ph.D. (Arizona)
- Mr. H. A. H. Jayasena, Department of Geology, University of Peradeniya
B.Sc. (Perad.), M.Sc. (Colorado)
- Prof. C. M. Maddumabandara, Department of Geography, University of Peradeniya
B.A. (Cey.), Ph.D. (Cambridge)
- Dr. Ranjith Premalal, Department of Agriculture Engineering, University of Peradeniya
B.Sc. (Perad.), M.Sc. (AIT), PG. Cert (Italy), Ph.D. (Cranefield)
- Prof. A. L. Ramanathan, School of Environmental Sciences, Jawaharlal Nehru University, New Delhi, India
M.Sc., M.Phil., Ph.D.
- Dr. Per Sander, Department of Geology, Chalmers University of Technology, Gothenburg, Sweden
M.Sc. (Chalmers), Ph.D. (Chalmers)
- Dr. A. Senaratne, Department of Geology, University of Peradeniya
B.Sc. (Perad.), Pg.Dip. (London), M.Sc. (London), Ph.D. (Mainz)
- Dr. J. Wijethunga, Department of Civil Engineering, University of Peradeniya
B.Sc.Eng. (Moratuwa), Ph.D. (Cambridge)
- Prof. P. Wikramagama, Department of Geography, University of Peradeniya
B.A. (Perad.), Ph.D. (London)

PROGRAMME COORDINATOR

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