

**Institute of Water and Environment (IWE)**  
**Dhaka University of Engineering & Technology, Gazipur**

**Proposed Postgraduate Degrees**

- Doctor of Philosophy in Water and Environmental Management
- Master of Science in Water and Environmental Management
- Master in Water and Environmental Management
- Postgraduate Diploma in Water and Environmental Management

## **Tentative Courses for Ph D./M Sc./Master/PG Dip. at IWE, DUET**

### **WE 6000: Thesis/Dissertation**

Students are supported throughout the Research Dissertation by an allocated supervisor. There is no formal syllabus; the research process is supported by the IWE with on line resources including written guidance material on aspects of good practice in preparing the research project work. Students are introduced to the research dissertation requirements early in the semester and are guided in the preparation of a research proposal.

### **WE 6001: Project**

Students are supported throughout the Project period by an allocated supervisor. There is no formal syllabus; the research project is supported by the IWE with on line resources including written guidance material on aspects of good practice in preparing the research work. Students are introduced to the project requirements early in the semester and are guided in the preparation of a research proposal.

### **WE 6002: Special Study**

Technical report writing: different steps and layout; project proposal writing; referencing in technical writing; plagiarism; presentation skill development; assignment; case studies: design and methods, field work, report submission, oral presentation.

### **WE 6003: Research Methodology and Ethics**

Research formulation and design; defining and formulating research problem; literature review in defining research problems; types of research; research methodologies; technical writing on research proposal, report, journal and conference articles; different steps and layout in technical writing; referencing in technical writing; oral presentation; research ethics: ethical issues, ethical committees (human & animal); intellectual property rights and patent law, commercialization, copy right, royalty, trade related aspects of intellectual property rights; scholarly publishing, citation and acknowledgement, plagiarism, reproducibility and accountability.

### **WE 6101: Water Sensitive Urban Design**

Concept of water sensitive urban design (WSUD); principle and benefits of WSUD; WSUD measures; urban water cycle and its components; analysis methods: water balance calculations, water end-use analysis; social, environmental and economic impacts of WSUD planning and design; operation and maintenance; design tools and software (e.g. music, urban developer, house water expert); integration between water and other urban design elements; case study.

### **WE 6102: Water Supply and Hydrologic Design**

Water supply network designs (water supply, soil/waste/vent systems); loading units for water supply; rainwater system; water distribution practice; challenges and solution for hydrologic design; assessment of water demand; uncertainty in hydrologic estimation and water demand; storage and drought; selection of design event; estimation of reservoir capacity: supply demand, runoff detention; estimation of in-stream requirements: navigation, river morphology, salinity control, ecology; water conservation strategies and technologies.

### **WE 6103: Groundwater and Pollution Management**

Occurrence and movement of groundwater; flow in subsurface environment; estimation of groundwater flow; stream-aquifer interflows; evaluation of aquifer properties; surface and subsurface exploration of groundwater; hydraulics of pumping and recharging wells; recharge estimation; impacts of groundwater withdrawal; groundwater modeling; groundwater pollution and control; saline water intrusion and control; source and characteristics of pollutants; fate and transport of pollutants in subsurface; contaminant transport modeling.

### **WE 6104: Surface Water Pollution Management**

Surface water flow dynamics; stream flow estimation; hydrologic forecasting; uncertainty in hydrologic analysis; water quality and pollution; physical, biological and chemical properties of water; pollution sources and transport processes; eutrophication of water resources; water pollution and management; pollution abatement and treatment methods; quality control techniques; application of two-dimensional flood inundation models in practice; assessing and mapping of flood risk; flood control measures; flood damage quantification; flood disaster prevention and management; flood plain development and management; water legislations, standard and instructions.

### **WE 6105: Integrated Water Management**

Concept of integrated water management; sources of water; planning fundamentals and processes; multi-criteria analysis; functions of water resources system; conceptual models of hydrologic processes in watershed; watershed properties; runoff, hydrograph; evapotranspiration; flood routing; flow routing; watershed modeling; water management and sustainable development; national development and water policy; basin-wide management and water sharing; multiple users, water rights and conflicts; sectorial demands and resource allocation; water use efficiency and productivity; management of water demand and allocation; institutional aspects and people's participation; policy and legislation in Bangladesh.

### **WE 6106: Coastal Risk Management**

Historical context of coast and coastal features; coastal environment; understanding coastal behavior systems; tides and current; small amplitude wave theory: basic definitions, derivation of airy wave equations, water particle motions, approximations for 'deep' and 'shallow' water, energy, power and group velocity; wind wave; coastal water level variations and coastal hazards; storm surge, tsunami, oil spill consequences and cleanup technologies; long term water level changes; estuary and estuary control; conceptual coastal design: the wider context of design environment, shore protection works, hard and soft engineering options for coastal defense.

### **WE 6107: Remote Sensing and GIS Applications in Water and Environmental Management**

Types and importance of Remote Sensing (RS); RS platforms; sensors; digital image processing and functions; concepts of GIS; coordinate systems; spatial data: sources, acquisition and entry; database; data analysis; vector and raster data; GIS output; integration of remote sensing and GIS; application of remote sensing and GIS: water resources, Urban Analysis, Watershed Management, Environmental studies; case studies.

### **WE 6108: Environmental Hydrology and Water Resources**

Hydrometeorological data collection, analysis and interpretation; environmental flow assessment and modeling; evaporation and evapotranspiration modeling, simulate runoff hydrographs using simple conceptual rainfall-runoff models, stochastic approaches in water resources studies; low streamflow data analysis for reservoir planning and design; uncertainty analysis in water resources planning; groundwater occurrence, evaluation and management.

### **WE 6109: Urban Drainage and Sewerage System**

Urban hydrological cycle; effects of urbanization on catchment hydrology; stormwater volume estimation: storm hyetographs, rainfall excess calculations, time of concentration; methods for estimation of volume of stormwater; population forecasting; need for urban drainage system; approaches to urban drainage; types of urban sewerage system; components of sewerage system; design and planning of sewerage systems; sewage volume estimation: discharge, design period, design discharge; hydraulic design of sewers and stormwater drains: hydraulic formulae for determining flow velocities, hydraulic characteristics of circular sewer running full or partially full; important points for design sewer materials; laying of sewer pipes; hydraulic testing of sewers; sewer appurtenances; maintenance, cleaning and ventilation of sewers; stormwater pumping stations: types of pumps and pumping stations, pumping system design.

### **WE 6110: Sediment Management**

Fundamentals of open channel flow; alluvial geomorphology; stream form and classification; regimes of flow; mechanics of bed formation; sediment properties; bed load, suspended load, total load; sediment measurements; sediment transport: degradation, aggradation and scour; erosion and deposition processes; erosion prediction modeling; river training; reservoir sedimentation and impact on river process; sediment control; dredging.

### **WE 6111: Ecohydraulics**

Concept of ecohydraulics; river ecology; land-water interactions; benthic and suspended organic matter; stream ecosystem; hydraulic processes pertaining to aquatic ecosystems; ecological processes and the biodiversity patterns present in rivers; biogeochemical and microbial processes; aquatic insects; modern environmental flow methods, integrated modeling of river systems for environmental analysis; estimate the consequences of anthropic interventions (hydraulic works, spills, water resource exploitation, etc.); restoration and rehabilitation of rivers.

### **WE 6112: Environmental and Social Impact Assessment**

Types, identification, evaluation and managing of environmental and social aspects; social impacts and equity; objectives and framework of environmental impact assessment (EIA); methodologies of EIA; environmental and social impact assessment planning and project management; stakeholder engagement; scoping and baseline studies; law, policy, legal triggers and pathways to approvals; institutional arrangements; public involvement; data acquisition (desktop and field); theories and components in environmental risk assessment; scoping and screening risks and impacts; environmental impact statement; impact mitigation and management; project execution; implementation and principles of contract management; environmental rules and regulations in Bangladesh; case study.

### **WE 6113: Environmental Planning and Management**

Theories of sustainable development; theories of governance and management; design and management of urban green space; management of ecosystems; urban water management: concept of hydrological unit management and river basin management plans; integrated water resource management; integrated coastal zone management; understanding flood risk and flood risk management; sustainable urban drainage systems; pollution and risk management; understanding of pollution; transnational regulation; approaches to regulation and control; interface between pollution regulation and planning regimes; assessment and remediation of contaminated land; planning for the modern globalized waste industry; zero-waste approaches and their challenges for infrastructure development.

### **WE 6114: Water, Energy and Environment**

Energy sources and availability; energy necessity and crisis; energy scenario of Bangladesh; hydropower: site selection, classification of hydropower plants, advantages and disadvantages of hydroelectric power plants; ecological imbalance, catchment area treatment; tidal energy: basic principles of tidal power, components of tidal power plant, methods of ocean thermal electric power generation; solar energy: solar constants, solar radiation, physical principles of conversion of solar radiation into heat; wind energy: basic principles of wind energy conversion, wind energy collectors; gas power plants: classification and comparison of different gas turbine power plants, associated environmental effects; nuclear energy: necessity, general components of nuclear reactors, different types of reactors, breeding reactors, location of nuclear power plants, disposal of nuclear wastes, associated environmental effects; water requirements for power plants; geo-thermal energy and associated environmental effects.

### **WE 6115: Aquatic Environment**

Aquatic environments: their origins, physical and chemical properties and structure, major groups of aquatic life and the structure and processes that regulate life in waters; integration of the major processes that affect life in water; important causal linkages between the physical, chemical and biological properties of different aquatic systems; pollution of aquatic environments: eutrophication, oil pollution, acid-rain, and acidification effects, radioactivity; problems with measurement and interpretation of effects, monitoring methods and feedback monitoring; colonization and distribution of aquatic organisms; trophic interactions in aquatic ecosystems; ecological management and decision-making principles.

### **WE 6116: Wastewater Treatment**

Wastewater treatment: historical background; municipal and industrial wastewater; environmental issues; wastewater characteristics and constituents; bioreactors; microbiological processes; methods for waste water treatment; sedimentation and sludge treatment; modeling, design and optimization of the activated sludge process; flow reactors design and modeling; automatic control and controlling of wastewater treatment plants; low-energy and sustainable wastewater treatment systems; sludge handling, treatment and disposal; effluent disposal including re-use; effluent treatment plant (ETP) design.

### **WE 6117: Statistical Methods in Water and Environment**

Characteristics of water and environmental data; exploratory data analysis; data collection and experimental design; descriptive statistics; statistical dispersion; random variable; probability; expectation; probability distribution (discrete) and density (continuous); joint and multivariate distribution and density; statistical model; explanatory and response variable; correlation; linear and multiple regression model; logistic regression; binomial regression and poisson regression; time-series analysis and forecasting; moving average and smoothing; stationary; seasonality; trend analysis.

### **WE 6118: Environmental Risk Management**

Numerical aspects of risk calculations: role of estimation, variability and uncertainty; risk assessment methods; toxicological and epidemiological data analyses; risk factor in environmental management; economic, social and environmental costs of risk; spatial and temporal shifting of risk; risk decision principles; risk mitigation measures: hazard reduction, vulnerability reduction, zoning, standards, regulations and economic incentives; risk cost in decision making, allocation of shelters; residual risk and preparedness measures; disaster response; institutional aspects of risk management.

### **WE 6119: Solid Waste Management**

Solid waste generation; waste quantity and quality; composition of waste; waste collection and transport; machine park planning; treatment/disposal technologies: dumping, sanitary landfills, mechanical-biological treatment, incineration, anaerobic digestion and composting; recycling of plastics, batteries and e-waste; energy recovery; landfill sites characteristics of waste; landfill gas and leachate generation; site selection; containment design; Environmental Protection Act; financial, social and institutional aspects: costs of collection, separation, management, equipment costs, social costs, stake holders, scavengers; public health issues; policy and legislation; case studies of municipal, mining and industrial wastes.

### **WE 6120: Treatment and Distribution of Drinking Water**

Raw water sources: rivers, lakes, reservoirs and groundwater; basic drinking water chemistry; introduction to common methods for drinking water treatment from different sources: sand and membrane filtration, coagulation/flocculation, sedimentation, softening, ion exchange, adsorption on granular activated carbon, different disinfection methods; different types of municipal water treatment plants; chemical parameters that are relevant to the national drinking water quality standard; design of pipe networks; estimation of hydraulic dimensions of water and sewage distribution systems.

### **WE 6121: Climate Change Risks Management**

Global climate system: global heat and water balance, ocean-atmospheric processes and circulation; land surface and atmospheric interaction; climate variability and climate change; trend analysis; energy issues and climate change; greenhouse gases (GHGs) and their emission sources; quantification of CO<sub>2</sub> emission; global warming potential of GHGs; kyotoprotocol: importance, significance and its role in climate change; modeling climate change; impacts of climate change on water and environment; role of countries and citizens in containing global warming; adaptation and mitigation of climate change effects; forecasts and scenarios development; economic, social and environmental implications; Intergovernmental Panel on Climate Change (IPCC).

**WE 6122: Air and Noise Pollution**

Air pollution; key pollutants and their sources; air pollution effects on human health and the environment; factors affecting dispersion of pollutants; plume behavior; air pollution measurement; modeling of air pollutants; air pollution control; indoor air quality; air pollution and global climate change; air quality legislations; acoustic principles; noise pollution; noise measurement; noise-induced hearing loss; effects of noise on human health; environment related noise; workplace related noise; aircraft related noise; pubs and clubs related noise; traffic noise; noise control engineering; vibration control.

**WE 6123: Environment and Agriculture**

Environmental basis for agriculture; land use and landscape changes; water quality issues; irrigation, fertilizer and pesticides impacts on soil, water and air; management of irrigation water; point and non-point source pollution; erosion and deposition problem in irrigation systems; agricultural drainage and downstream impacts; stream modification; change of water cycles; soil pollution and remediation; biodiversity impacts of agriculture; soil and land use conservation legislation.