

Institute of Water and Flood Management (IWFM)
BUET, Dhaka

Approved Postgraduate Course content

PG.Dip (WRD):

WFM 5000: PG.Dip. Project (Credit Hour: variable, cumulative 6 max.)

WFM 5101: Watershed Hydrology (Credit Hour: 3)

Watershed characteristics; Hydrologic cycle; Characteristics of hydrologic data; Rainfall-runoff; Stream characteristics; Hydrometry; Water balance analysis; Hydrologic processes in different land covers: agricultural, forest, urban, floodplain and wetlands; Types of watershed models; Effects of landuse change; Climate change.

WFM 5102: Soils and Soil Water (Credit Hour: 3)

Physical properties of soil; Classification of soil; Agroecological zones; Soil-air-water interactions; Water movement in soil; Soil-plant interactions; Soil colloids; Nutrient availability and soil water regimes; Micronutrients; Soil salinity; Soil strength, compaction and consolidation; Soil pressure; Soil erosion and conservation.

WFM 5103: Hydrogeology and Groundwater (Credit Hour: 3)

Subsurface environment; Water bearing properties of rocks and soils; Principles of groundwater movement; Recharge; Groundwater withdrawal; Groundwater quality; Groundwater in coastal zones; Hydrogeological mapping; Groundwater management; Conjunctive use; Groundwater models; Groundwater development in Bangladesh.

WFM 5201: Data Management and Statistical Analysis (Credit Hour: 3)

Data requirement for water resources development; Types and sources of data; Time series data; Database management; Exploratory data analysis; Homogeneity and stationarity of data; Descriptive statistics; Statistical interval, inference and hypothesis testing; Statistical sampling; Analysis of variance; Correlation and regression; Frequency analysis; Statistical software.

WFM 5202: Socio-economic Analysis (Credit Hour: 3)

Purpose of social survey; Social indices; Philosophy of Science; Development and Society Social Stratification, Integrated Research, Stakeholders and Participatory Management; Social Research methods; Conventional and Participatory; Value and price of water; Pricing theory-Impact of flood/drought on price; Role of flood control, irrigation projects in price regime; Water allocation-theory of equi-marginal principle, Water markets – Regulation of monopoly; Benefit-cost analysis – Private and public sector decision making, Consumer surplus and opportunity cost; Contribution of water sector to GDP & poverty alleviation; Impact of economic development on water demand and role of water resources management.

WFM 5203: Environmental Analysis (Credit Hour: 3)

Ecological resources, cultural heritage, socio-economic profile; Environmental impacts of water resources projects; Measurements of environmental variables; Environmental rules and regulations; Environmental impact assessment. Guidelines and manuals; Environmental management; Case studies.

WFM 5204: Survey in Water Resources Projects (Credit Hour: 3)

Importance and classification of surveying; Topographic survey; Hydrographic survey; Geological survey; Use of satellite technology in surveying; Earthwork computation; Estimation of brick and concrete structures; Project surveying.

WFM 5205: Principles of Hydraulics (Credit Hour: 0)

Physical properties of water; Hydrostatic pressure and forces; Classification of flows; Conservation of mass, energy and momentum; Principles of flow through pipes; Pipe network; Principles of flow through open channels; Wetland and floodplain hydraulics; Flow measurements.

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M.Sc. (WRD) / Ph.D.:

WFM 6000: Thesis (Credit Hour: variable; cumulative 18 max. for M.Sc., 45 max. for Ph.D.)

WFM 6002: Special Studies (Credit Hour: 3)

WFM 6101: Alluvial River Processes (Credit Hour: 3)

Fundamentals of open channel flow; Alluvial geomorphology; Stream form and classification; Regimes of flow; Sediment transport; Degradation, aggradation and scour; Bank erosion; River training; Dredging; Morphological characteristics of Ganges-Brahmaputra-Meghna Delta.

WFM 6102: Advanced Watershed Hydrology (Credit Hour: 3)

Conceptual models of hydrologic processes in watershed; Uncertainty in hydrologic analysis; Flow routing; Watershed simulation; Hydrologic forecasting; Contaminant transport; Hydrologic effects of land use change; Impact of climate change.

WFM 6103: Hydrologic Information System (Credit Hour: 3)

Introduction to hydrologic information system; Importance and advancement of hydrologic science; Hydrologic data: source, classification, acquisition; Hydrologic metadata; Hydrologic Information database; Analysis and visualization of data; Sharing and retrieval of hydrologic information through Web and other sources; Application of hydrologic information system for water resources management.

WFM 6104: Water, Gender and Society (Credit Hour: 3)

Water and civilization; Socio-cultural structures and values; Water and development; Water, culture and religion; national and international water rights regime; water and governance; water and equity; Concept of gender; Theories about gender relations; feminism and development; Gender in water related policies; Gender issues in water and water induced disaster management; Gender assessment tools; Gender mainstreaming in water management.

WFM 6105: Water and Ecosystem (Credit Hour: 3)

Definition of ecosystem; Freshwater ecosystems – river, wetlands, floodplains; Coastal ecosystems - mangrove, inter-tidal, estuarine; Ecosystem functions and services; Ecosystem valuation; Ecosystem and IWRM; Eco-hydrology and eco-hydraulics - concepts, principles and application; Assessment of environmental flow; Eco-friendly water structures; Ecosystem approach to water management.

WFM 6201: Hazards and Risk Analysis (Credit Hour: 3)

Natural hazards: climate, riverine and coastal; Man made hazards; Presentation of hazards data; Hazards assessment; Expected damage; Risk analysis; Risk reduction measure: structural and non-structural; Operation and maintenance of mitigation

facilities; Reliability analysis; Risk-based zoning; Forecasting and warning; Hazard management planning; Case studies.

WFM 6202: Remote Sensing and GIS in Water Management (Credit Hour: 3)

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.

WFM 6203: Environmental Economics (Credit Hour: 3)

Scope and objectives of environmental economics; Validation of environmental resources; Cost effectiveness analysis; The concept of market mechanism and efficiency; Failure of market mechanism: public bads (pollution) and externalities; Correcting market failure through property rights; Controlling pollution through incentives, price mechanism and government intervention; Economic development and environment: national and international perspectives.

WFM 6204: Hydrologic Statistics (Credit Hour: 3)

Characteristics of hydrologic data; Probability and statistics; Probabilistic analysis; Multiple regression and correlation; Regional analysis; Analysis of hydrologic time series; Stochastic models; Sequential generation of hydrologic information; Statistical decisions. 3

WFM 6205: Hydrologic Design for Water Use (Credit Hour: 3)

Issues in hydrologic design; Assessment of water demand; Uncertainty in hydrologic estimates and water demand; Storage and drought related statistics; Selection of design event; Estimation of reservoir capacity: water supply, runoff detention; Design for hydropower; Estimation of in-stream requirements: navigation, river morphology, salinity control, ecology.

WFM 6206: Groundwater Resource Assessment (Credit Hour: 3)

Flow in subsurface environment; Surface and subsurface exploration of groundwater; Hydraulics of pumping and recharging wells; Evaluation of aquifer properties; Groundwater pollution and saline water intrusion; Impacts of groundwater withdrawal; Modeling of aquifer systems.

WFM 6207: Water Resources System Analysis (Credit Hour: 3)

Characteristics of water resources systems; Concept of systems analysis; Systems techniques: linear, nonlinear, dynamic and multi-objective programming; Analytical and computational frameworks for decision making; Applications in water resources management.

WFM 6208: Choice of Water Management Technology (Credit Hour: 3)

Role of technology in water management; Technology imperatives: society, culture and indigenous knowledge; Technology management: assessment, appropriateness, transfer, forecasting, risk, innovation & diffusion; Development strategies; Choice of technology for water resources management: flow control, irrigation, water supply, pumps, flood management, drainage, river training, hydropower, navigation, dredging, land reclamation, wetland conservation; Case studies.

WFM 6209: Interdisciplinary Field Research Methodology in Water Management

(Credit Hour: 3)

Research and research methods in water management: inter-disciplinarity, multi-disciplinarity and cross-disciplinarity in research; Tools and techniques: socio-economic, hydrological, physico-chemical and agro-ecological investigations; Stakeholder analysis: stakeholder perceptions, stakeholder diagramming; Integrated research concept development: Situation-Problem-Question-Response, conceptual and methodological framework, research questions; Research ethics; Research execution in the field.

WFM 6301: Agricultural Water Management (Credit Hour: 3)

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; Chemical pollution.

WFM 6302: Water Development Project Planning (Credit Hour: 3)

Use of water: conjunctive and non-conjunctive; Types of projects; Structural and non-structural components of projects; Project life cycle; Optimization techniques; Feasibility study; Risk and reliability; Project appraisal; Project management; Operation, maintenance and monitoring.

WFM 6303: Integrated Water Resources Management (Credit Hour: 3)

IWRM concepts and principles; Planning fundamentals and processes; Multi-criteria analysis; Functions of water resources system; Water management and sustainable development; National development and water policy; Basin-wide management and water sharing; Multiple users, water rights and conflicts; Sectoral demands and resource allocation; Water use efficiency and productivity; Management of water demand and use; Institutional aspects and people's participation.

WFM 6304: River and Floodplain Management (Credit Hour: 3)

Resources, functions and ecology of river-floodplain system; Flood flow and low flow analysis; Flood damage mitigation: structural and non-structural measures; Waterways; Instream flow requirement; River pollution; River and floodplain restoration; Land and water use conflicts. 4

WFM 6305: Coastal Zone Management (Credit Hour: 3)

Definition and delineation of the coastal zone; Coastal zone management: concepts, issues, prospects; Coastal, estuarine and delta processes; Coastal hazards: storm surge, sea level rise, tsunami; Linkages among coastal systems; Coastal ecosystem and environment; Socio-economic, political and institutional considerations; Coastal infrastructure: erosion protection, embankment, polder, cyclone shelter, cross-dam, port and waterway; Coastal population and livelihood; Marine and coastal resources; Coastal zone policy and strategy; Case studies on Integrated Coastal Zone Management.

WFM 6306: Urban Water Management (Credit Hour: 3)

Hydrologic cycle in urban environment; Demographic and socio-economic features; Urban water systems in different landscapes; Basic concepts in overland, pipe and channel flows; Data requirement for water management; Water demand, supply and access; Management of stormwater and wastewater; Water quality and ecology of urban water bodies; Flood risk management; Institutional aspects; Master plan for urban water management.

WFM 6307: Water Control Structures (Credit Hour: 3)

Various types of hydraulic structures; Water lifting devices; Planning of water control structures: irrigation, drainage, flood management, navigation, river training; Operation and maintenance; Failures; Remedial measures.

WFM 6308: Risk Management (Credit Hour: 3)

Risk factor in water resources; Economic, social and environmental costs of risk; Spatial and temporal shifting of risk; Risk decision principles; Risk assessment methods; Risk mitigation measures: hazard reduction, vulnerability reduction, zoning, standards, regulations and economic incentives; Risk cost in decision making: selection of capacity of hydraulic structures, allocation of shelters; Residual risk and preparedness measures; Disaster response; Institutional aspects of risk management.

WFM 6309: Water Quality Management (Credit Hour: 3)

Physical, biological and chemical properties of water; Source and characteristics of pollutants; Fate and transport of pollutants in aquatic systems- lakes, rivers, estuaries, aquifers; Impact of pollutants on aquatic systems; Management of point and non-point sources of pollution; Economic and regulatory instruments of water quality management; Pollution abatement and treatment methods; Water quality monitoring.

WFM 6310: Water Disaster Management (Credit Hour: 3)

Definition of disaster; Types of water related disasters; Disaster-development linkages; Disaster management framework – Prevention, Preparedness, Response and Recovery; Tools and techniques; Structural and non-structural measures; Indigenous coping mechanisms; Organizational initiatives; Community participation and mobilization.

WFM 6311: Climate Change Risk Management (Credit Hour: 3)

The global climate system: global heat and water balance, atmospheric circulation, ocean circulation, coupled ocean and atmospheric processes; Climate variability and climate change; Assessment of climate change risks; Forecasts and scenarios development; Impact of climate change on water related hazards; Economic, social and environmental implications; Mitigation measures and adaptation techniques, Mainstreaming climate change risk management.