

Approved Courses

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 land use 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; Social methods; Sampling techniques; Questionnaire development; Data analysis and interpretation; Basic economic principles; Market economy; Benefit-cost analysis; Financial analysis; Public goods models; Social welfare functions and Pareto optimality.

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.

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: Gender and Water (Credit Hour: 3)

Introduction to the concept of gender; Theories about gender relations, feminism and development; Understanding the household: gender integration and separation; Socio-cultural structures and values; Gender in water related policies; Water rights in relation to gender; Community management, voice and participation; Gender assessment tools; Gender mainstreaming; Exploring the linkages between water and gender; Gender and integrated water resources management; Gender issues in domestic water supply, sanitation and hygiene, agricultural water, coastal resource, wetland, water pollution and water related hazard 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.

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, tsunamis; 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. 5

***Note:**

1. PG.Dip. and M.Sc. students normally register for 5000- and 6000-level courses, respectively. PG.Dip. students must register for one of the four 6000-level courses: WFM 6301 (Agricultural Water Management), WFM 6303 (Integrated Water Resources Management), WFM 6304 (River and Floodplain Management), or WFM 6305 (Coastal Zone Management).
2. M.Sc. and Ph.D. students must register for WFM 6303 (Integrated Water Resources Management).
3. WFM 5101 (Watershed Hydrology) and WFM 5202 (Socio-economic Analysis) are compulsory non-credit (audit) courses for M.Sc. students having a non-engineering background.
4. WFM 5202 (Socio-economic Analysis) is a compulsory non-credit (audit) course for M.Sc. students having an engineering background.
5. WFM 5205 (Principles of Hydraulics) is a non-credit course.

Updated: February 10, 2009