



**MASTERS OF ENGINEERING MANAGEMENT WITH
SPECIALIZATION IN
URBAN WATER MANAGEMENT (MEM UWM)**

Detailed Course Contents



**PANJWANI-HISAAR WATER INSTITUTE
NED UNIVERSITY OF ENGINEERING TECHNOLOGY**

Table 1 The Scheme of studies for MEM (UWM)

No.	Course Name	Course Code	Credit Hours
	Elective Courses		
1	Urban Water Engineering and Management	WI-5012	3
2	Integrated Urban Water Resources Management	WI-5013	3
3	Water Services Management	WI-5014	3
4	Water Resources Planning and Management	WI-5007	3
5	Legal & Financial Aspects of Water Resources	WI-5008	3
6	Sustainable Water Resources Management (SWRM)	WI-5009	3
7	Remote Sensing in Water Resources	WI-5010	3
8	Water Resources Modelling	WI-5011	3
9	Water and Sanitation Infrastructure in Developing Countries	WI-5020	3
10	Urban Water Supply and Sewer System Design	WI-5021	3
11	Drainage Engineering	WI-5022	3
12	Water Quality Management	WI-5023	3
13	Thesis	WI-5002	6

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COURSE DESIGN FORM



WI -5012 Urban Water Engineering and Management

F/QSP 07/05/01

EXISTING				PROPOSED				☒ New Course ☐ Revised Course ☐ Compulsory Course ☒ Elective Course Applicable from <i>Spring 2024</i>
				WI -5012 Urban Water Engineering and Management				
	Cr. Hrs.	Contact Hrs.	Exam Marks		Cr. Hrs.	Contact Hrs.	Exam Marks	
Th.	-	-	-	Th.	3	3	100	
Pr.	-	-	-	Pr.	-	-	-	
				REMARKS				
				Urban Water Cycle, Interaction of Climatic, Hydrologic Process, and Urban Component, urban water Infrastructure Management, urban water Cycle Management, Governance and urban water Planning, urban water Hydrology, urban water Supply and Demand, urban water Demand Management, urban water Drainage System, Environmental Impacts of Urbanization, Simulation Techniques, Optimization Techniques, urban water Infrastructure, urban water System Dynamics and Conflict Resolution, urban water Disaster Management, Climate Change impact on urban water.				
Recommended book(s) for the proposed course (Author's name, "Title", edition, publisher, publication year). Text and Reference Book(s) 1. Mohammad Karamouz, Ali Moridi, Sara nazif Urban Water Engineering and Management ISBN 9781439813102. Published January 25, 2010 by CRC Press								Other Equivalent Courses <i>(offered in this University)</i> Not Applicable

WI -5013 Integrated Urban Water Resources Management

EXISTING				PROPOSED				☒ New Course ☐ Revised Course ☐ Compulsory Course ☒ Elective Course Applicable from <i>Spring 2024</i>
				WI -5013 Integrated Urban Water Resources Management				
	Cr. Hrs.	Contact Hrs.	Exam Marks		Cr. Hrs.	Contact Hrs.	Exam Marks	
Th.	-	-	-	Th.	3	3	100	
Pr.	-	-	-	Pr.	-	-	-	REMARKS
				Framework and Scenarios of IWRM, Integrated Urban Water Systems, Purposes and Systems of Water Management, Challenges in management of urban water resources, Protection of urban water resources, Challenges in urban water supply, Coping with risk and uncertainty, Watersheds as Social-Ecological Systems, Urban drainage and water bodies, Wastewater network, Urban infrastructure modelling, Economic and Decision Tools for IWRM, Challenges and solutions, Emerging contaminants, Circular economy.				
Recommended book(s) for the proposed course (Author’s name, “Title”, edition, publisher, publication year). Text and Reference Book(s) 1. Integrated Water Resource Management, An Interdisciplinary Approach Authors: Neil S. Grigg, Hardcover ISBN 978-1-137-57614-9 Published: 02 November 2016 2. Book: Monzur Alam Imteaz, urban water resources, ISBN 9780367779276, published March 31, 2021 by CRC Press								Other Equivalent Courses (offered in this University) Not Applicable

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COURSE DESIGN FORM

WI -5014 Water Services Management

F/QSP 07/05/01

EXISTING				PROPOSED				☒ New Course ☐ Revised Course ☐ Compulsory Course ☒ Elective Course Applicable from <i>Spring 2024</i>
				WI -5014 Water Services Management				
	Cr. Hrs.	Contact Hrs.	Exam Marks		Cr. Hrs.	Contact Hrs.	Exam Marks	
Th.	-	-	-	Th.	3	3	100	
Pr.	-	-	-	Pr.	-	-	-	
				Water Supply and Sanitation Systems; options, standards and developments with sustainable performance and technical reliability. Water Supply Systems; raw water quality (surface and groundwater) and abstraction, pre-treatment and storage, water treatment processes and plants, water transport and distribution, Sanitation Systems; on-site and off-site sanitation systems, ecological sanitation concepts, sewerage and drainage systems wastewater treatment processes and plants, sludge management (treatment, disposal and reuse), Institutional arrangements and management options for providing water services. Finance issues at the utility level; financing water organizations and undertaking cost-recovery.				REMARKS

Recommended book(s) for the proposed course (Author's name, "<i>Title</i>", edition, publisher, publication year).	Other Equivalent Courses (<i>offered in this University</i>)
Reference Book(s) 1. Tapio S. Katko; Petri S. Juuti; Klaas Schwartz; Riikka P. Rajala Water Services Management and Governance Volume 11 IWA Publishing DOI: https://doi.org/10.2166/9781780400730 ISBN electronic: 9781780400730 Publication date: November 2012 2. Simon J. Dadson, Dustin E. Garrick, Edmund C. Penning-Rowsell, Jim W. Hall, Rob Hope, Jocelyne Hughes Water Science, Policy, and Management: A Global Challenge First published: 25 October 2019 Print ISBN:9781119520603 Online ISBN:9781119520627 John Wiley & Sons Ltd. 3. Tapio S. Katko Water Services Management and Governance: Lessons for a Sustainable Future ISBN 101780400225 ISBN 139781780400228 Publisher IWA PUB Date Published 2013	Water Services Management (EN -576)

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COURSE DESIGN FORM



WI -5007 Water Resources Planning and Management

F/QSP 07/05/01

EXISTING				PROPOSED				☒ New Course ☐ Revised Course ☐ Compulsory Course ☒ Elective Course Applicable from <i>Spring 2024</i>
				WI -5007 Water Resources Planning and Management				
	Cr. Hrs.	Contact Hrs.	Exam Marks		Cr. Hrs.	Contact Hrs.	Exam Marks	
Th.	-	-	-	Th.	3	3	100	
Pr.	-	-	-	Pr.	-	-	-	
				Introduction, History of water resources planning and development, Importance of water resources planning, Planning objectives, Protocols employed at local, provincial, federal, regional and international levels, Investigation data and analysis, Demand projection, Water productivity parasites and constraints, Land-Water-Human resources interaction, Plan formulation, evaluation and approval, Comprehensive regional planning, Stakeholder involvement in water resources planning, Social and environmental impact assessment, Institutional arrangements for planning and implementation, Engineering economy in water resources planning, Introduction to surface water/groundwater / conjunctive water management.				REMARKS <i>Brief description of proposed changes</i>
Recommended book(s) for the proposed course (Author's name, "Title", edition, publisher, publication year). Text and Reference Book(s) 1. Andrew A. Dzurik; Tara Shenoy Kulkarni and Bonnie Kranzer Boland Water Resources Planning: Fundamentals								Other Equivalent Courses <i>(offered in this University)</i>

for an Integrated Framework, Fourth Edition Rowman & Littlefield Publishers. October 2018; ISBN: 978-1-4422-5399-5 2. Ana Milanović Pešić and Dejana Jakovljević Water Resources Management: Methods, Applications and Challenges; Nova Science Publisher 2020; ISBN: 978-1-53618-297-2	1. Water Resources Planning and Management (CE-556)
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F/QSP 07/05/01

WI -5008 Legal & Financial Aspects of Water Resources

E X I S T I N G				P R O P O S E D				☒ New Course ☐ Revised Course ☐ Compulsory Course ☒ Elective Course Applicable from <i>Spring 2024</i>
				WI -5008 Legal & Financial Aspects of Water Resources				
	Cr. Hrs.	Contact Hrs.	Exam Marks		Cr. Hrs.	Contact Hrs.	Exam Marks	
Th.	-	-	-	Th.	3	3	100	
Pr.	-	-	-	Pr.	-	-	-	
Riparian and prior appropriation doctrines, Legal schemes for securing and allocating water rights in surface water and groundwater for private and public uses in Pakistan, Water Treatise and Accords (Indus Waters Treaty, Water Apportionment Accord, similar case studies), Institutional Framework, Groundwater management regimes, Issues and national water sector strategy, Evolving role of science, economics, and policy in water allocation law, Major paradigm shifts in water governance through integrated water resource management. Legislation on harmful effects of water.				<i>Brief description of proposed changes</i>				
Recommended book(s) for the proposed course (Author's name, "Title", edition, publisher, publication year). Text and Reference Book(s) 1. Erkki J. Hollo, Professor Emeritus, University of Helsinki, Finland Water Resource Management and the Law Publication Date: 2017 ISBN: 978 1 78536 982 7 Extent: 432 pp 2. Andrew A. Dzurik; Tara Shenoy Kulkarni and Bonnie Kranzer Boland								Other Equivalent Courses <i>(offered in this University)</i> Legal & Financial Aspects of Water Resources (CE -557)

Water Resources Planning: Fundamentals for an Integrated Framework, Fourth Edition Rowman & Littlefield Publishers October 2018 978-1-4422-5399-5. 3. Alex Gardner, Richard Bartlett, Janice Gray, Rebecca Nelson Water Resources Law, 2nd edition ISBN/ISSN: 9780409337945 Release Date: December 01, 2017	
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F/QSP 07/05/01

WI -5009 Sustainable Water Resources Management (SWRM)

EXISTING				PROPOSED				☒ New Course ☐ Revised Course ☐ Compulsory Course ☒ Elective Course Applicable from <i>Spring 2024</i>
				WI -5009 Sustainable Water Resources Management (SWRM)				
	Cr. Hrs.	Contact Hrs.	Exam Marks		Cr. Hrs.	Contact Hrs.	Exam Marks	
Th.	3	3	100	Th.	3	3	100	
Pr.	-	-	-	Pr	-	-	-	
								REMARKS
				Historical perspective of water use and development, Water facts and trends, Introduction to sustainable development and its importance, Related terminologies, SWRM strategies, Sustaining healthy freshwater ecosystems, Hydrologic aspects of water sustainability, Human impacts on hydrologic ecosystem and mitigation, Water resources – agriculture, environment, and society, Flood control management strategies, Economics of water; value of water, water affordability and marketing. Emerging water management issues and resolutions Sources of Water, Uses of Water, General concepts of water governance, International Laws				<i>Brief description of proposed changes</i>
Recommended book(s) for the proposed course (Author's name, "Title", edition, publisher, publication year). Reference Book(s) A. Zaman, Md. Hedayetullah Sustainable Water Resource Development and Management, 1st Edition Copyright 2022; ISBN 9781774630099 240 Pages by Apple Academic Press Published on May 19, 2022								Other Equivalent Courses (offered in this University) Sustainable Water Resources Management (SWRM) (CE -558)

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COURSE DESIGN FORM



WI -5010 Remote Sensing in Water Resources

F/QSP 07/05/01

EXISTING				PROPOSED				☒ New Course ☐ Revised Course ☐ Compulsory Course ☒ Elective Course Applicable from <i>Spring 2024</i>
				WI -5010 Remote Sensing in Water Resources				
	Cr. Hrs.	Contact Hrs.	Exam Marks		Cr. Hrs.	Contact Hrs.	Exam Marks	
Th.				Th.	3	3	100	
Pr.				Pr.	-	-	-	
				REMARKS				
				History and scope of remote sensing, Concepts of remote sensing, Photogrammetry, Satellite characteristics, Remote sensing imagery types, Remote sensing satellites, Image resolution, Preprocessing, Image rectification, enhancement and classification, Accuracy assessment, Applications of satellite remote sensing in water resources i.e., for identifying drainage basin networks, for watershed dynamics analysis, flood inundation modelling and mapping, Evaluation of surface and groundwater resources, Image processing software exercises, Introduction to Geographical Information Systems (GIS).				

Recommended book(s) for the proposed course (Author's name, "<i>Title</i>", edition, publisher, publication year). Text and Reference Book(s) 1. A. Cazenave, N. Champollion, J. Benveniste, J. Chen Remote Sensing and Water Resources Published by Springer, 2016. 2. Prasad S. Thenkabail Remote Sensing of Water Resources, Disasters, and Urban Studies, 1st Edition Published in 2015 CRC Press eBook ISBN 9780429089435 3. Hongjie Xie and Xianwei Wang, Applications of Remote Sensing/ GIS in Water Resources and Flooding Risk Management Published: June 2018 Pages: 230 © 2018 by the authors; CC BY-NC-ND license ISBN 978-3-03842-982-1 (paperback); ISBN 978-3-03842-981-4 (PDF)	Other Equivalent Courses (<i>offered in this University</i>) Remote Sensing in Water Resources (CE -559)
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COURSE DESIGN FORM

WI -5011 Water Resources Modelling

EXISTING				PROPOSED				☒ New Course ☐ Revised Course ☐ Compulsory Course ☒ Elective Course
				WI -5011 Water Resources Modelling				
	Cr. Hrs.	Contact Hrs.	Exam Marks		Cr. Hrs.	Contact Hrs.	Exam Marks	
Th.				Th.	3	3	100	Applicable from <i>Batch Spring 2024</i>
Pr.				Pr	-	-	-	REMARKS
				Interpretation of hydrologic/hydraulic principles and underlying procedures for surface water modelling; Quantification of water quantity (e.g. floods, droughts, climate change impacts etc.) and quality (e.g. contamination of groundwater, lakes and rivers due to the point and non-point sources) problems using computer models. Classify and evaluate the methodology for the hydrological process and preparation of input data files for different models (e.g. HEC-HMS, SWAT, HSPF, RUSLE, etc.) to actual watersheds. Model Evaluation: Uncertainty and Sensitivity Analysis, Calibration, and Validation Model Applications: Impact estimation of drought, flood, erosion, contaminant, climate change etc. Water Quality Assessment: Different process representations of contaminant and sediment transport.				<i>Brief description of proposed changes</i>



Recommended book(s) for the proposed course (Author's name, " <i>Title</i> ", edition, publisher, publication year).	Other Equivalent Courses <i>(offered in this University)</i>
Text and Reference Book(s) Daniel P. Loucks, Eelco van Beek Water Resource Systems Planning and Management: An Introduction to Methods, Models, and Applications Springer 2017 ISBN: 978-3-319-44232-7 2. C. Fai Fung (Editor), Ana Lopez (Editor), Mark New (Editor) Modelling the Impact of Climate Change on Water Resources December 2010, Wiley-Blackwell ISBN: 978-1-405-19671-0	Water Resources Modelling (CE -582)

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COURSE DESIGN FORM

WI -5020 Water and Sanitation Infrastructure in Developing Countries

F/QSP 07/05/01

EXISTING				PROPOSED				☒ New Course ☐ Revised Course ☐ Compulsory Course ☒ Elective Course Applicable from <i>Spring 2024</i>
				WI -5020 Water and Sanitation Infrastructure in Developing Countries				
	Cr. Hrs.	Contact Hrs.	Exam Marks		Cr. Hrs.	Contact Hrs.	Exam Marks	
Th.	-	-	-	Th.	3	3	100	
Pr.	-	-	-	Pr.	-	-	-	
				Principles of Infrastructure Planning in Developing Countries, Appropriate and Sustainable Technologies for Water and Sanitation, Incorporation of Technical, Socio-culture, Public Health and Economic Factors into the Planning, Design and Construction of Water and Sanitation Systems, Case Studies from Karachi and Rural Sindh, Service Pricing, Alternative Institutional Structures including Privatization, the Role of Consumer Demand and Community Participation in the Planning Process, Environmental and Public Health Considerations, and Strategies for Serving Low-income Households.				<i>Brief description of proposed changes</i>
Recommended book(s) for the proposed course (Author's name, "Title", edition, publisher, publication year). Text and Reference Book(s) 1. Thomas Clasen Water and sanitation https://doi.org/10.1093/med/9780199661756.003.0011 Published: February 2015				Other Equivalent Courses <i>(offered in this University)</i> Water and Sanitation Infrastructure in Developing Countries (WI -539)				

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COURSE DESIGN FORM

F/QSP 07/05/01

WI -5021 Urban Water Supply and Sewer System Design

EXISTING				PROPOSED				☒ New Course ☐ Revised Course ☐ Compulsory Course ☒ Elective Course Applicable from <i>Batch Spring 2024</i>
				WI -5021 Urban Water Supply and Sewer System Design				
	Cr. Hrs.	Contact Hrs.	Exam Marks		Cr. Hrs.	Contact Hrs.	Exam Marks	
Th.	-	-	-	Th.	3	3	100	REMARKS
Pr.	-	-	-	Pr	-	-	-	
s.				Water requirement, Sources of water supply, Water Transmission, Hydraulics, Water distribution Components, Methods of analysis, Water conservation, Wastewater and stormwater collection, Hydraulics of sewer systems, Design of sewer systems, Materials and appurtenances, Pumps and pumping station				Other Equivalent Courses <i>(offered in this University)</i> Urban Water Supply and Sewer System Design (EN - 528)
Recommended book(s) for the proposed course (Author's name, "Title", edition, publisher, publication year). Reference Book(s) 1. Mohammad Karamouz Water Systems Analysis, Design, and Planning Urban Infrastructure ISBN 9780367528454 958 Pages Published December 29, 2021 by CRC Press Mackenzie L. Davis, Water and Wastewater Engineering: Design Principles and Practice, 2nd Edition ISBN: 9781260132274 Publication Date & Copyright: 2020								

2. Jahangir Chowdhury STANDARD DESIGN CRITERIA AND MANUAL FOR URBAN WATER SUPPLY AND SANITATION 1st Edition, Excel Book Writing, 2022) ISBN-10 : 1957837535 ISBN-13 : 978-19578375362022	
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COURSE DESIGN FORM

WI -5022 Drainage Engineering

EXISTING				PROPOSED				☒ New Course ☐ Revised Course ☐ Compulsory Course ☒ Elective Course Applicable from Spring 2024
				WI -5022 Drainage Engineering				
	Cr. Hrs.	Contact Hrs.	Exam Marks		Cr. Hrs.	Contact Hrs.	Exam Marks	
Th.	-	-	-	Th.	3	3	100	
Pr.	-	-	-	Pr.	-	-	-	
				Drainage Concepts: Need and benefits of drainage, sources of excess water, surface and subsurface drainage. Drainage Investigations: Purpose and scope of drainage investigations, based on data collection (Topography, slope, soil profile, soil characteristics, salinity, water table, crops, climate, surface runoff, hydraulic conductivity, infiltration rate), diagnosis and nature of drainage problem, drainage coefficient, stage of project preparation-Identification, reconnaissance, feasibility and final Stage. Field Drainage System and Methods: Surface drainage, vertical drainage, pipe drainage, layout patterns for groundwater drainage; organic, natural and synthetic drainage envelop materials, drain pipes, construction equipment, design, construction and operational problems. Stormwater management: Design of storm sewers and detention, Highway drainage and culverts. Design Methods: Pipe drainage flow patterns, components of head loss, Homogenous and non-				<i>Brief description of proposed changes</i>

	homogenous soils, Hooghoudt formula, Earnst formula and Glover-Dumm formulae. Application of drainage design methods to selected problems: Use of nomographs for drainage design. Surface drainage factors affecting, design formula, safe velocity and grades. Performance Assessment of drainage systems: Need, performance parameters and criteria. System Problems: Backfilling, installation below the water table, blocking and clogging, sediment outflow and performance efficiency.	
Recommended book(s) for the proposed course (Author's name, "<i>Title</i>", edition, publisher, publication year). Reference Book(s) 1. S.N. Ghosh Flood Control and Drainage Engineering, 3rd edition 374 Pages Published August 10, 2018 by Taylor & Francis ISBN 9781138372511 Rajan Aggarwal. Fundamentals of Groundwater and Drainage Engineering Astral International Pvt. Limited, 2018 ISBN 9388173023, 9789388173025 Alaa Nabil El-Hazek Concise Irrigation and Drainage Engineering 2nd Edition, Researchgate, 2021.		Other Equivalent Courses (<i>offered in this University</i>) Drainage Engineering (CE - 584)



COURSE DESIGN FORM

F/QSP 07/05/01

WI -5023 Water Quality Management

EXISTING				PROPOSED				☒ New Course ☐ Revised Course ☐ Compulsory Course ☒ Elective Course Applicable from <i>Batch Spring 2024</i>
	Cr. Hrs.	Contact Hrs.	Exam Marks		Cr. Hrs.	Contact Hrs.	Exam Marks	
Th.	-	-	-	Th.	3	3	100	REMARKS
Pr.	-	-	-	Pr	-	-	-	
				Fundamentals of Water Quality including Water Bodies and their Natural Setting, Water Uses and Waste Input, Water Quality Cause Effects Relationships, Water Quality Parameters, Criteria and Standards, Principles of Water Quality Systems Analysis, both in the Formulation and Application of Water Quality Models, Engineering Controls and Socio-economic Concepts of Water Quality Management and Control, including Cost / Benefit Analysis and Management Modeling.				

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COURSE DESIGN FORM



WI -5002 Thesis

E X I S T I N G				P R O P O S E D				☒ New Course ☐ Revised Course ☐ Compulsory Course ☒ Elective Course Applicable from <i>Batch Spring 2024</i>
				WI -5002 Thesis				
	Cr. Hrs.	Contact Hrs.	Exam Marks		Cr. Hrs.	Contact Hrs.	Exam Marks	
Th.	-	-	-	Th.	6	6	100	
Pr.	-	-	-	Pr	-	-	-	
<i>Contents of the existing course</i>				<i>Contents of the proposed course</i>				REMARKS <i>Brief description of proposed changes</i>
Recommended book(s) for the proposed course (Author's name, "Title", edition, publisher, publication year). Reference Book(s)								Other Equivalent Courses <i>(offered in this University)</i>