



MASTERS OF ENGINEERING MANAGEMENT WITH SPECIALIZATION IN CLIMATE CHANGE MANAGEMENT (MEM CCM)

Detailed Course Contents



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

Table 1 The Scheme of studies for MEM (CCM)

No.	Course Name	Course Code	Credit Hours
	Elective Courses		
1	Climate science, policy and society	WI-5001	3
2	Climate Modeling and simulation	WI -5003	3
3	Climate change mitigation and adaptation strategies	WI -5004	3
4	Climate data analysis and visualization	WI -5005	3
5	Hydro Climatology	WI -5006	3
6	Water Resources Planning and Management	WI -5007	3
7	Legal & Financial Aspects of Water Resources	WI -5008	3
8	Sustainable Water Resources Management (SWRM)	WI -5009	3
9	Remote Sensing In Water Resources	WI -5010	3
10	Water Resources Modelling	WI -5011	3
11	Thesis	WI -5002	6

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COURSE DESIGN FORM



WI-5001 Climate Science, Policy and Society

F/QSP 07/05/01

EXISTING				PROPOSED				☒ New Course ☐ Revised Course ☐ Compulsory Course ☒ Elective Course Applicable from Spring 2024
				WI-5001 Climate Science, Policy and Society				
	Cr. Hrs.	Contact Hrs.	Exam Marks		Cr. Hrs.	Contact Hrs.	Exam Marks	
Th.	-	-	-	Th.	3	3	100	
Pr.	-	-	-	Pr.	-	-	-	
				Basic concepts in weather and climate, including atmospheric data, solar radiation, scenario stability, precipitation, winds, fronts, forecasting, and severe weather. Applied topics include global warming, ozone depletion, world climates and weather safety. The climate system of our planet. How nature and our actions alter the existing energy balance leading to climate change. Past climates on our planet. The influence of climate on society and resource availability during the Holocene (~ 11,000 years ago to present) with a focus on changes post-industrial revolution. Significant climate events have altered our way of life in the past. Projected changes in future climate and potential impacts on society, environment and resources. Adaption to and mitigation of climate change.				<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) - Stephen H. Schneider and Randi Londer Climate and Society: Climate as Resource, Climate as Risk, Publisher : World Scientific Publishing Company (August 18, 2009) - Stehr, Nico, Von Storch, Hans Climate and Society: Climate as Resource, Climate as Risk:: 9789814280532:				Other Equivalent Courses (offered in this University) Not Applicable				



COURSE DESIGN FORM

WI-5003 Climate Modeling and Simulation

F/QSP 07/05/01

EXISTING				PROPOSED				☒ New Course ☐ Revised Course ☐ Compulsory Course ☒ Elective Course Applicable from Spring 2024
				WI-5003 Climate Modeling and Simulation				
	Cr. Hrs.	Contact Hrs.	Exam Marks		Cr. Hrs.	Contact Hrs.	Exam Marks	
Th.				Th.	3	3	100	
Pr.	-	-	-	Pr.	-	-	-	
				Distribution and causes of different climates around the world. Effects of climate and climate variations on human activities including society, economy and agriculture. Current issues such as climate change and international efforts to assess and mitigate the consequences of a changing climate. Developing and working with climate models based on fundamental physical principles that govern the climate systems of the Earth. Emphasis on coupled, nonlinear-system interactions of physical processes such as circulation dynamics, radiative transfer, and cloud/precipitation physics, starting with fairly simple 0- and 1-dimensional analytical and numerical models based on energy, mass, and momentum conservation. Observational study of seasonally evolving weather patterns that form climates around the world.				<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. Kendal McGuffie, Ann Henderson-Sellers The Climate Modelling Primer, 4th Edition: The Climate Modelling Primer, 4th Edition, Wiley								Other Equivalent Courses (offered in this University) Not Applicable

2. David-Neelin Climate Change and Climate Modeling Publisher: Cambridge University Press; Illustrated edition (January 31, 2011) 3. T. Stocker Introduction to Climate Modelling Published: 15 July 2013 Publisher Springer Berlin, Heidelberg. Softcover ISBN978-3-642-26837-3	
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COURSE DESIGN FORM



WI -5004 Climate Change Mitigation and Adaptation Strategies

F/QSP 07/05/01

EXISTING				PROPOSED				☒ New Course ☐ Revised Course ☐ Compulsory Course ☒ Elective Course Applicable from Spring 2024
				WI -5004 Climate Change Mitigation and Adaptation Strategies				
	Cr. Hrs.	Contact Hrs.	Exam Marks		Cr. Hrs.	Contact Hrs.	Exam Marks	
Th.	-	-	-	Th.	3	3	100	
Pr.	-	-	-	Pr	-	-	-	
				The ecological dimension, how to enhance and protect natural ecosystems, forests, and agricultural lands, understanding the vulnerability of climate change impact, how to restore greenhouse gases and soils, the social dimension, establishing frameworks for monitoring and evaluating the effectiveness of mitigation and adaptation strategies, update and create new laws, improved policies for economic measures to reduce environmental and social injustice, the technological dimension, how to move towards 100% clean renewable energy, carbon patterns and storage technologies, transforming agricultural practices, process, and food consumption, biodiversity conservation,				<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. Ted Simon Environmental Risk Assessment 1st Edition 1 st Edition Publication date, 2016 ISBN-10978113803383 2. Peter P. Calow Handbook of Environmental Risk Assessment and Management ISBN: 978-0-865-42732-7 January 1998 Wiley-Blackwell								Other Equivalent Courses <i>(offered in this University)</i> Not Applicable

COURSE DESIGN FORM

WI-5005 Climate Data Analysis and Visualization

F/QSP 07/05/01

EXISTING				PROPOSED				☒ New Course ☐ Revised Course ☐ Compulsory Course ☒ Elective Course
				WI-5005 Climate Data Analysis and Visualization				
	Cr. Hrs.	Contact Hrs.	Exam Marks		Cr. Hrs.	Contact Hrs.	Exam Marks	
Th.	-	-	-	Th.	3	3	100	Applicable from Spring 2024
Pr.	-	-	-	Pr.	-	-	-	
				Data sources, Importance of climate data, ethics of data collection and analysis, understanding of common climatic models, methodology of collecting data, qualitative/quantitative analysis of major drivers of climate, Time series analysis, comparison of climatic trends/behavior local/regional, Artificial Intelligence (AI) application in climate data analysis, case studies and applications				<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. John J. Berger Solving the Climate Crisis: Frontline Reports from the Race to Save the Earth Publication date, October 24th, 2023 ISBN: 9781644213223.								Other Equivalent Courses <i>(offered in this University)</i> Not Applicable

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WI -5006 Hydro Climatology

F/QSP 07/05/01

EXISTING				PROPOSED				☒ New Course ☐ Revised Course ☐ Compulsory Course ☒ Elective Course Applicable from <i>Spring 2024</i>
				WI -5006 Hydro Climatology				
	Cr. Hrs.	Contact Hrs.	Exam Marks		Cr. Hrs.	Contact Hrs.	Exam Marks	
Th.				Th.	3	3	100	
Pr.	-	-	-	Pr.	-	-	-	
				Hydro-Climatic Systems; Hydrologic Cycle: Applications, Components of hydrologic cycles and estimation Surface Water Hydrology: Methods of measuring surface runoff, stream flow, base flow etc. Climate and Stream flow forecasting, Verification measures, Watershed Geomorphology: Basin characteristics, Soil characteristics, Land use Routing Methods: Muskingham etc. Continuous and event-based Modelling Climate Change Impact and Modelling: Water Resources System Effect, Case Studies Climate Change, Floods (Types Analysis, Prediction); Droughts (Climatic, Hydrologic, Agriculture); Risk Assessment				<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. Nigel W. Arnell Hydrology and Global Environmental Change" Understanding Global Environmental Change: Publisher: Routledge (January 16, 2002) "Hydro-Climatology: Perspectives and Applications" by M. Meaden Publisher : Cambridge University Press; Illustrated edition (January 12, 2009) Hydro-Climatology: Perspectives and... by Shelton, Marlyn L. 2. "Climatology" by Robert V. Rohli and Anthony J. Vega Publisher : Jones & Bartlett Learning; 4th edition (June 22, 2017)								Other Equivalent Courses <i>(offered in this University)</i> Hydro Climatology (CE-581)

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WI -5007 Water Resources Planning and Management

F/QSP 07/05/01

E X I S T I N G				P R O P O S E D				☒ New Course ☐ Revised Course ☐ Compulsory Course ☒ Elective Course
	Cr. Hrs.	Contact Hrs.	Exam Marks		Cr. Hrs.	Contact Hrs.	Exam Marks	
Th.	-	-	-	Th.	3	3	100	Applicable from Spring 2024 R E M A R K S
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.				<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
Text and Reference Book (s) 1. Andrew A. Dzurik; Tara Shenoy Kulkarni and Bonnie Kranzer Boland Water Resources Planning: Fundamentals 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.	<i>(offered in this University)</i> Water Resources Planning and Management (CE -556)

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WI -5008 Legal & Financial Aspects of Water Resources

F/QSP 07/05/01

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 Spring 2024
				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, Water Resource Management and the Law Publication Date: 2017 ISBN: 978 1 78536 982 7								Other Equivalent Courses <i>(offered in this University)</i> Legal & Financial Aspects of Water Resources (CE - 557)

2. Andrew A. Dzurik; Tara Shenoy Kulkarni and Bonnie Kranzer Boland Water Resources Planning: Fundamentals for an Integrated Framework, Fourth Edition Rowman & Littlefield Publishers October 2018 ISBN: 978-1-4422-5399-5 3. Alex Gardner, Richard Bartlett, Janice Gray, Rebecca Nelson Water Resources Law, 2nd edition Release Date: December 01, 2017 ISBN/ISSN: 9780409337945	
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WI -5009 Sustainable Water Resources Management (SWRM)

F/QSP 07/05/01

EXISTING				PROPOSED				☒ New Course ☐ Revised Course ☐ Compulsory Course ☒ Elective Course Applicable from Spring 2024
				WI -5009 Sustainable Water Resources Management (SWRM)				
	Cr. Hrs.	Contact Hrs.	Exam Marks		Cr. Hrs.	Contact Hrs.	Exam Marks	
Th.				Th.	3	3	100	
Pr.	-	-	-	Pr.	-	-	-	
				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, " <i>Title</i> ", edition, publisher, publication year).	Other Equivalent Courses
Text and Reference Book (s) 1. A. Zaman, Md. Hedayetullah Sustainable Water Resource Development and Management, 1st Edition Apple Academic Press Published on May 19, 2022 ISBN 9781774630099	<i>(offered in this University)</i> Sustainable Water Resources Management (SWRM) (CE -558)

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F/QSP 07/05/01

WI -5010 Remote Sensing in Water Resources

EXISTING				PROPOSED				☒ New Course ☐ Revised Course ☐ Compulsory Course ☒ Elective Course Applicable from Spring 2024
				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 <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) 1. A. Cazenave, N. Champollion, J. Benveniste, J. Chen Remote Sensing and Water Resources Published by Springer, 2016								Other Equivalent Courses (offered in this University) Remote Sensing in Water Resources (CE - 559)

2. Prasad S. Thenkabail Remote Sensing of Water Resources, Disasters, and Urban Studies 1st Edition Published in 2015 CRC Press eBook ISBN9780429089435 3. Hongjie Xie and Xianwei Wang, Applications of Remote Sensing/ GIS in Water Resources and Flooding Risk Management Published: June 2018 © 2018 by the authors; CC BY-NC-ND license ISBN 978-3-03842-982-1 (paperback); ISBN 978-3-03842-981-4 (PDF).	
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F/QSP 07/05/01

WI -5011 Water Resources Modelling

EXISTING				PROPOSED				☒ New Course ☐ Revised Course ☐ Compulsory Course ☒ Elective Course Applicable from Spring 2024
				WI -5011 Water Resources Modelling				
	Cr. Hrs.	Contact Hrs.	Exam Marks		Cr. Hrs.	Contact Hrs.	Exam Marks	
Th.				Th.	3	3	100	
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 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, HSPE, 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>

	<i>Contents of the proposed course</i>	
Recommended book(s) for the proposed course (Author's name, "<i>Title</i>", edition, publisher, publication year). Reference Book (s)1. Tapio S. Katko; Petri S. Juuti; Klaas Schwartz; Riikka P. Rajala Water Services Management and Governance Volume 11 IWA Publishing 2012 ISBN electronic: 9781780400730 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.		Other Equivalent Courses <i>(offered in this University)</i> Water Resources Modelling (CE -582)

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WI -5002 Thesis

F/QSP 07/05/01

EXISTING				PROPOSED				☐ New Course ☐ Revised Course ☐ Compulsory Course ☒ Elective Course Applicable from Spring 2024
WI -5011 Thesis				<i>Course Code and Title</i>				
	Cr. Hrs.	Contact Hrs.	Exam Marks		Cr. Hrs.	Contact Hrs.	Exam Marks	
Th.	6	6	100	Th.	-	-	-	
Pr.	-	-	-	Pr	-	-	-	
								R E M A R K S
<i>Contents of the existing course</i>				<i>Contents of the proposed course</i>				<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) 1. Joseph Edward Shigley, "Machine Design", 3rd edition, McGraw-Hill, 2005. 2. 3.								Other Equivalent Courses (offered in this University) 1. Course Title (Course Code) 2. Course Title (Course Code) 3. Course Title (Course Code)