

M.Sc. INTEGRATED WATER RESOURCES MANAGEMENT

BICULTURAL MASTER PROGRAMME IN JORDAN AND GERMANY



IMPRINT

This guidebook is written specifically for the students of the MSc IWRM Program between the University of Jordan (UJ) and Cologne University of Applied Sciences (CUAS). The guidebook aims at giving the student an overview about contents, procedures and examination matters of the master program.

All the information is given to our best knowledge, however the examination regulations of UJ and CUAS are the legally binding documents.

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„We wish you an exiting study, full of joy and rich experiences!“

INTRODUCTION

This booklet provides an overview of the MSc in Integrated Water Resources Management. It sets out the aims of the course, the content of the study program and the various component parts of the course, including lectures, options, seminars, dissertation, etc. The booklet also contains important information about handing in coursework, attending examinations and procedures, and other aspects of course management. You should read through the booklet carefully and ensure that you understand your obligations throughout the course. We will provide you with more detailed material for particular parts of the course as appropriate during the year.

Most of all, we would like to thank you for choosing this new bicultural Master Program. Everyone involved with the course believes that sustainable water management is one of the most important challenges facing humanity; one that requires the active participation of dedicated professionals who are comfortable with the interdisciplinary nature of the subject. Our generation has the unenviable task of making hard, possibly irrevocable decisions on water supply and sanitation issues and we aim to equip you with all the skills necessary to go out and make a significant contribution to the future of water on our planet.

We designed this MSc, after considerable consultation with international and national water organizations, water service companies and consulting companies, to equip you with the academic and practical skills required by a modern water manager. After finishing the course we expect that you will be specialized enough to be accepted onto PhD programs while also possessing enough breadth and technical expertise to find employment with outside water organizations. We aim to produce expert graduate students well equipped to deal with complex water problems through integrating the natural and social science approaches with the study of economics, legislation, culture, and management.

Yours truthfully,

the IWRM Course Coordinators



THE ITT IN COLOGNE

The Institute for Technology and Resources Management in the Tropics and Subtropics (ITT) has offered postgraduate education since 1976. Today it carries out various international master courses together with partners worldwide (Jordan, Mexico and Vietnam).

Students will study with participants of these master courses during common courses in Cologne. They may as well take part in study or research periods at one of the many partner universities of the ITT.

Scientists and lecturers from various disciplines and origins work together at the ITT in education and research. The projects and educational programs cover a wide range of integrated natural resources management topics. Current research projects take place in Latin America, the Middle East and South-East Asia.

POSTGRADUATE EDUCATION

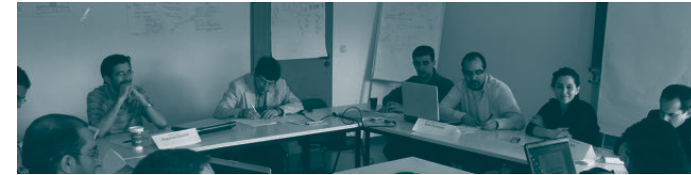
The master programs of the ITT are related to natural resources management with special reference to tropical and subtropical regions. Some of the master programs are offered together with partners abroad providing students the chance to study in different settings gaining insights into other cultural, environmental and social realities. These partners are currently University of Jordan, University San Luis Potosi (Mexico) and the Vietnam Academy of Water Resources.

All postgraduate programs of the ITT emphasize an interdisciplinary approach covering technological, economic, social and ecological aspects of natural resources management. The following provides an overview of the master programs currently offered by the ITT and partners:

- International Master Course “Technology and Resources Management in the Tropics and Subtropics”
- Exported Master Course in Vietnam “Technology and Resources Management in the Tropics and Subtropics”, with focus on water resources management
- German-Latin American Master Course “Environment and Resource Management”
- German- Arab- Master Course “Integrated Wate Resources Management”

RESEARCH FIELDS

A particular challenge of research related to sustainable resources management is the close interrelation of technological, environmental, economic, social and political aspects. It has to address complex human-environmental systems at various spatial scales which are situated in a highly dynamic world.



The ITT is meeting this challenge with adequate methodological approaches like systems analysis and integrated modelling as well as interdisciplinary cooperation within worldwide partner networks. It emphasizes at all stages of research the incorporation of stakeholders from administration, private sector and public. Furthermore, it is concerned with the adequate dissemination of results.

The research of the ITT focuses on four core themes:

- Theme 1: Integrated water resources management
- Theme 2: Land use dynamics, natural resources management and biodiversity
- Theme 3: Energy management and natural resources
- Theme 4: Urban, regional management and housing

The linkages in-between these four themes are of utmost importance following the interdisciplinary approach of the ITT. Each theme considers Global Change, governance and economic development as crosscutting issues.

The research projects at ITT typically comply with the following principles:

- to analyse human-environment systems at the various scales following the approach on interdisciplinary research
- to develop systemic solutions and concepts to implement the results
- to involve relevant stakeholders in defining research topics, conducting research and disseminating results

Ongoing research of the ITT is realized with partners in Latin America, in the MENA Region and in South-East Asia.

THE INSTITUTES

THE WEEC IN AMMAN

Realizing the importance of the water sector in the overall economic and social development of Jordan, the University of Jordan established the Water and Environment Research and Study Center as a research unit in 1982. The WEEC of the University of Jordan was established as a result of merging the Centers of Water, Energy and Environment in 2011.

The WEEC's objectives include:

- conducting scientific research related to protecting and managing water resources and protecting the environment
- creating a fruitful scientific atmosphere to encourage interaction and joint research between faculty members from different disciplines, as well as improving the performance of the centre's own employees
- identifying and analyzing water- and environment-related issues in Jordan and find solutions
- creating public awareness about issues related to water, the environment and development
- knowledge and technology transfer
- providing technical consultation to the local community in areas related to water and the environment

POSTGRADUATE EDUCATION

The WEEC provides a number of different types of training courses to both students and professionals. This includes courses on topics such as:

- Watershed management
- Reservoir management & dam safety
- Land development and drought management
- Water harvesting and artificial groundwater recharge
- GIS-based water resource management
- Hydrologic modeling
- Water economics
- Environmental Impact Assessment
- Water quality analysis
- Hazardous waste management



MSC IWRM PROGRAM



Apart from these, the WEEC offers the "IWRM Master of Science for Arab and German Young Professionals" in collaboration with the Cologne University of Applied Sciences, Germany and a specific training program on "Transboundary IWRM" in cooperation with Ramboll Natura and SIWI, Sweden.

RESEARCH FIELDS

Since its establishment, the WERSC has been a leading research institute in the water and environment sector in the whole region. More recent research projects include:

- Mediterranean Development of Innovative Technologies for Integrated Water Management (MEDITATE)
- The effects of pesticides on the environment (water, soil and dam sediments)
- Anaerobic treatment of concentrated domestic sewage using UASB-digester system at low temperature conditions
- Anaerobic sewage treatment for sustainable water reclamation in Jordan
- Fate of disinfectants and their by-products in Amman's water distribution system

THE MSC. IWRM - A BICULTURAL MASTER PROGRAM

Water resources, indispensable basis for development, food supply and health, become ever scarcer and more polluted. The concept of Integrated Water Resources Management (IWRM) offers solutions to the water crisis in linking water to other vital resources. It regards the whole water cycle in connection with human interventions as the basis for sustainable water management. Worldwide exists a high and growing demand for experts adequately trained in the concepts of IWRM.

Next to the technical and managerial knowledge related to water resources, these experts should also be familiar with the practices of project funding and international cooperation. Bilateral projects between Germany and Arab countries need experts who are familiar with the culture, language and politics of both sides and are well trained in intercultural communication.

OBJECTIVES OF THE PROGRAM

The overall objective is to educate experts in the field of Integrated Water Resource Management who are high on demand for leading positions in the water sector and are able to manage complex projects for international institutions and companies operating in the Arab region.

OUR SHARED VISION

The MSc IWRM Program forms part of a wider concept of WEEC and ITT to promote IWRM. This concept is expressed by a shared vision:

“We, the Amman-Cologne School of IWRM, empower professionals to manage water systems sustainably.”

We do so by...

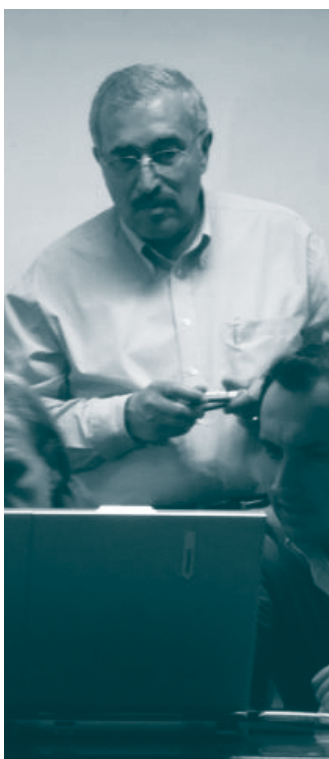
- providing an innovative, adaptive and pro-active learning environment
- promoting interdisciplinary thinking and holistic understanding
- ensuring the transfer of knowledge & experiences, and intercultural exchange.

GRADUATE PROFILE

For a successful implementation and realization of projects in the field of IWRM in the MENA region, an increasing number of Arab and German experts are needed, with a strong understanding for holistic planning, proficient analytical and conceptual skills, management and communication capacities.

After a successful participation in the IWRM Master Program, scholars should have the competence to:

- Understand global change impacts
- Comprehensively assess water resources
- Appraise economic consequences
- Understand legal frameworks and policies
- Implement plans and plan how to meet goals
- Promote awareness



STAFF, COMMITTEES AND LECTURERS

THE COURSE COORDINATION COMMITTEE (CCC)

The Course Coordination Committee is the central institution of the IWRM Master Program. It is responsible for implementing and managing the IWRM Program, communicating between students, lecturers, advisory board members, donors and other interested parties. On regular meetings, the CCC discusses scientific, organizational, financial and marketing issues, constantly trying to further develop the quality and services of the IWRM Master Program.

Currently the Course Coordination Committee consists of:

Project Leaders and Scientific Coordination:

Prof. Dr. Manar Fayyad	UJ
Prof. Dr. Lars Ribbe	CUAS

Course Coordination:

Prof. Dr. Ahmad Al-Salaymeh	UJ
Dr. Maha Halalshe	UJ
Dipl. Geoökol. Jörn Trappe	CUAS
MSc Aline Bussmann	CUAS

The Course Coordination Team is furthermore strongly supported by Mohammad Al-Saidi (IWRM research), Dr. Abbas Al Omari (IWRM research), Silke Meilwes (examination affairs), and our precious student assistants at both universities.

THE ADVISORY BOARD

THE ADVISORY BOARD

The advisory board consists of representatives of Arab, German and international Institutions active in the field of IWRM. Members of the advisory board are supporting the universities in implementing the master program by providing advise in scientific and organizational issues. Furthermore, the Advisory Board is supporting students in selecting appropriate master thesis topics and provides consultation for future occupational career steps.

Currently, the advisory board consists of the following institutions and their representatives:



PROF. DR. MATTHIAS WEITER

Humboldt University of Berlin
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Prof. Weiter is the chairman of the advisory board and initiator of the MSc IWRM Master Program. Prof. Weiter is the former head of BMZ unit 325: Regional Development Policies; Middle East. Currently he is a lecturer at the Humboldt University Berlin and Advisor to Middle East Department of the Federal Ministry for Economic Cooperation and Development (BMZ). Prof. Weiter also teaches in the 4 Arab-German MSc Programs.



DR. MOHAMAD AL-HAMDI

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Dr. Al-Hamdi is the Vice Chairman of the advisory board in the MSc IWRM Master Program. Mr. Mohamed Al-Hamdi is First Economic Affairs Officer within the Sustainable Development and Productivity Division (SDPD) at ESCWA. ESCWA takes the lead role in program and project coordination among United Nations entities involved in development work at the regional level.



PROF. ODEH AL-JAYYOUSI

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Prof. Al-Jayyousi was the Regional director for IUCN for West Asia. The mission is to influence and assist governments and societies to conserve natural resources and ensure sustainability. In his job, Prof. Odeh oversaw the program for West Asia for IUCN and developed initiatives to support environment. He also represented the Development Goals in policy and diplomatic matters.

THE ADVISORY BOARD



PROF. DR. DR.H.C. PETER FRITZ

Helmholtz Centre for Environmental Research - UFZ
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Prof. Fritz is the former Scientific Director of UFZ Centre for Environmental Research. He currently has a mandate from BMBF to moderate the interdisciplinary German forestry program "sustainable forestry". He is a Member of the international scientific advisory board of the Alberta Water Research Institute (Canada), and Chairman of the scientific advisory board of the Zuckerberg Institute of Water Research at Ben Gurion University, Israel.



RÜDIGER HEIDEBRECHT

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Mr. Heidebrecht is the head of department "Training and International Cooperation". With his department he is engaged in projects with China, Bulgaria, Palestine, Egypt and Jordan in the field of water resources management, waste water technology and solid waste, training 35 000 people per year in more than 200 topics. Mr. Heidebrecht is also member of the Administrative Board of DED.



ANKE STAHL

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Since 2006, Anke Stahl is the head of DAAD section "Development-related Postgraduate Courses". She currently coordinates 42 postgraduate courses at German institutions of higher education, and 4 bi-cultural Master's Programs - among them the IWRM MSc Program. DAAD supports a carefully chosen selection of programs which is of particular interest to junior executives from developing and transitional countries.



PROF. KHALED ABU-ZEID

Centre for Environment & Development for the Arab Region & Europe (CEDARE) - Reg. Water Resources Program Manager
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Dr. Abu-Zeid has about 17 years of international experience in water resources planning and management traveling to about 30 countries. Today, Dr. Abu-Zeid is the head of the Regional Water Resources Management Program at CEDARE, that aims at maximizing the economic, social and environmental benefits of water utilization through the implementation of IWRM together with several national and international partners.

THE ADVISORY BOARD



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Ms. Schwarz is a Hydrogeologist with longstanding experience in international water politics and Member of the Advisory Board to UNDP "Water Governance Program for Arab States". Currently she is head of the Sub-Department International Cooperation and responsible for the international projects of BGR world wide together with 50 colleagues. Projects cover mainly geoscientific subjects: groundwater, environmental geology, mining, georisks, geothermal energy and mineral resources.



DR. UDO KACHEL

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Udo Kachel is the Regional Director of Dorsch International Consultants, located in Amman, by profession a water engineer with post-graduate studies on privatisation of water utilities in developing countries. With more than 18 years of professional work in the Middle East (Jordan, Syria, Egypt, Yemen, Lebanon, Iraq), a profound experience on practical implementation of efficiency improvement in water utilities has been gained.



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Khaldon Khashman is a senior water utilities management expert, who served the water sector in Jordan for more than 25 years. Since 2009 and currently Eng. Khashman is working as the Secretary General for the Arab Countries Water Utilities Association (ACWUA), where he strongly believes in the importance of knowledge and experience transfer between Arab water utilities and promoting ACWUA as regional center of excellence which will partner with water supply and wastewater utilities in Arab countries to provide best practice service delivery to their customers.



GUY HONORE

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Mr. Guy Honore is the Head of German-Jordanian Programme Management of Water Resources at the German International Corporation (GIZ). As a civil engineer with a special focus on water resources

THE ADVISORY BOARD

management he coordinates programmes in the water sector of the department in Amman, Jordan.



DR. MANUEL SCHIFFLER

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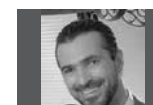
Dr. Manuel Schiffler works as a Senior Sector Economist at the Sector and Policy Division Water for the KfW Entwicklungsbank. He worked for 10 years in the in the Middle East and North Africa (MENA) region with field experience in nine countries of the region.



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Abdalla Khair is an Environmental Consultant who obtained his Master Degree in IWRM from CUAS and UJ. Mr. Khair joined the Advisory Board as the elected Alumni Representative of the MSc IWRM Program. Currently he is working as a Project Consultant for US AID in Jordan.

THE LECTURERS

THE LECTURERS

In order to assure the interdisciplinary and bicultural approach of the MSc IWRM Program, lecturers of different backgrounds from the Arab World and Germany are engaged in teaching. Thereby, each module has been designed and developed by a mixed team of Arab and German experts and lecturers. The lecturers of the MSc IWRM Program are:



ABBASI, GHALEB

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Prof. Dr. Ghaleb Abbasi obtained his PhD in Engineering Management from George Washington University, USA. His research interests are in the field of project management, decision making, and the economics of projects. He is currently involved in projects dealing with the economical analysis of maintenance management, project risk management, financial evaluation and investment strategies.



ABDULLA, FAYEZ

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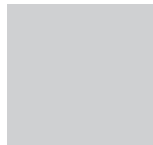
Prof. Fayeza Abdulla holds a PhD in Civil Engineering/ Water Resources & Environmental Engineering from University of Washington, Seattle. His research interests concentrate on climate change impacts on water resources and land systems, drought assessment and management, and the development of hydrological models for arid and semi-arid environments.



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Dr. Lina Abu-Ghunmi is an Assistant researcher at the WERSC of the University of Jordan. She received her Ph.D. degree in Environmental Engineering from Wageningen University, the Netherlands in 2009. Her research interests include sustainable management of water and sewerage, cost-effective biological and physical treatment technologies, reuse options, manure management, and biogas production.



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Dr. Amani Alassaf holds a PhD in Agricultural Economics from Hohenheim University, Stuttgart, Germany. She is assistant professor at the Agriculture economics and Agribusiness de-

THE LECTURERS

partment / University of Jordan. Dr Alassaf research interests lies in the fields of Economics of Ecology, water and resources economics. She has carried out different assignments in socioeconomics studies and rural development.



AL-OMARI, ABBAS

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Prof. Abbas Al-Omari obtained his PhD in Civil and Environmental Engineering from Washington State University. His areas of expertise lie in the field of water quality modeling in distribution systems, surface water quality modeling, water and wastewater treatment, and reuse of treated wastewater in irrigation.



AL-BAKRI, JAWAD

EGIS "GIS & Remote Sensing"
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Dr. Jawad Al-Bakri holds a PhD in Remote Sensing and Environmental Monitoring from Cranfield University, Silsoe, Bedfordshire, UK. His interests are in the field of land and water resources management with tools of GIS and remote sensing. Currently, Dr. Jawad Al-Bakri is involved in a project on the Assessment and monitoring of desertification in Jordan using remote sensing and bioindicators.



AL-KARABLIEH, EMAD

BWEC "Water Economics"
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Prof. Emad Al-Karablieh is the Head of the Department of Agricultural Economics and Agribusiness at the University of Jordan. He holds a PhD in Agribusiness Management from the Department of Agricultural Economics, Christian-Albrechts-University, Kiel. His academic interests include project appraisal, financial analysis, water economics, optimal water allocation, risk analysis and IWRM.



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Dr Alraggad is an assistant researcher at the WERSC of the University of Jordan; he received a Ph.D. degree from University of Jordan in August 2009 in the domain of groundwater. His main research interests are: Climatic change effects on water resources, Managed Aquifer Recharge (MAR), groundwater quality, GIS tools in water management, groundwater monitoring and groundwater systems.



AL-SAIDI, MOHAMMAD

BMAN "Management"
Private Sector, Com.e Partners
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Mohammad Al-Saidi is an economist and political scientist educated at the University of Heidelberg, Germa-

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ny. He specialized in analyzing the political economy of water governance reforms in the Middle East. As a part of the ITT staff of Cologne University of Applied Sciences, Mr. Al-Saidi is the scientific coordinator of the university Research Focus on the Water, Energy and Food Security Nexus. Besides, he is involved in teaching subjects like Water Policy and Legislations, Water Economics and Scientific Work.



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Prof. Adnan Al-Salihi received his PhD in Civil Engineering from Strathclyde University, Glasgow, Scotland. His areas of expertise are decision support systems for mitigation measures of drought impacts in the Mediterranean region, regional water supply and demand studies, artificial groundwater recharge, rainwater harvesting, and dam construction.



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Prof. Munjed M. Al-Sharif is the coordinator for the United Nations team on climate change adaptation in Jordan. He received his PhD in water resources and environmental engineering from Kansas State University. His research interests include water allocation and reservoir management modeling, climate change, and decentralized wastewater management.

DALDRUP, ULRICH

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The former mayor of the city of Aachen obtained a PhD degree in natural sciences from the Technical University of Aachen (RWTH). He is CEO of GFE Consulting and founder of the energy cluster "Energy Hills". Prof. Ulrich Daldrup is teaching international law and business administration at Cologne University of Applied Sciences. His research focuses on humanitarian aid and development cooperation.



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Dr. Hans Dembowski received a doctor's degree in Sociology from Bielefeld University. Currently he is the editor in chief of INWENT's D+C/E+Z (Development + Cooperation) magazine. His fields of interests are rule of law, governance, development, writing skills, and media



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Appointed by the University of Jordan Prof. Mohammad Duqqah lectures at the Land, Water and Environment department. His area of expertise are wastewater treatment and reuse in irrigated agriculture as well as irrigation and water use efficiency.

THE LECTURERS



FAYYAD, MANAR

BWRM "IWRM Principles"
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Prof. Manar Fayyad is the project leader of the IWRM master course at University of Jordan, and head of the Chemistry Department. She received her PhD in chemistry from the University of Bonn. Research interests are water quality, environmental pollution, monitoring studies in the field of water, soil, wastewater treatment and reuse.



FROHBERG, KLAUS

EWAP "Allocation & Pricing"
Prof.em. University of Bonn, ZEF
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Prof. Klaus Frohberg holds a PhD from the University of Illinois. He is the former director of the Center for Development Research at the University of Bonn (ZEF). Research interests are agricultural policies in transition countries, agricultural economics, rural development, environmental policies and economic modelling.



GAESE, HARTMUT

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Prof. Hartmut Gaese is the former director of the Institute for Technology and Resources Management in the Tropics and Subtropics (ITT) at Cologne University of Applied Sciences. He received his doctoral degree from Hohenheim University

in agricultural economics. Research interests are economics of agricultural production and project management.



HALALSHEH, MAHA

ESAN "Sanitation & Health"
University of Jordan, WERSC
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Prof. Maha Halalshe received a doctorate in environmental technology from Wageningen University, Netherlands. Her research focuses on low cost wastewater treatment technologies and anaerobic wastewater treatment. Currently she is working on different integrated anaerobic treatment systems and on the characterization of rural wastewater.



HAMHABER, JOHANNES

BMAN "Management"
Cologne University of Applied Sciences (CUAS), ITT
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Prof. Johannes Hamhaber holds a PhD in natural sciences from University of Cologne. His research interests are regional and urban management (governance and planning), renewable energy and efficiency (buildings and urban design), urban and political geography, empirical social sciences methods, environmental planning, Impact assessment, participation, and GIS.

THE LECTURERS



HAMAIDEH, ARWA

BWRM "IWRM Principles"
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Prof. Arwa Hamaideh received her Ph.D. degree from Cottbus Technical University. In cooperation with Technical University of Karlsruhe she implemented within the SMART project rain-water harvesting systems in Jordan. Her fields of interest are in water harvesting, EIA, resources management, desertification and environmental management.

HAMDI, MOSHRIK

EIRA "Irrigation & Agriculture"
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Dr. Moshrik Hamdi lectures at the Water, Energy and Environment Center in the field of irrigated agriculture. He holds a PhD in water resources & environmental engineering from Colorado State University, USA.

In addition to the lecturers, external experts from relevant institutions are being invited into the program for guest lectures. External experts may come from any of the institutions represented in the Advisory Board, public and private sector or ongoing research projects in fields relevant to the MSC IWRM Program.



HINDIEH, MUNA

ESAN "Sanitation & Health"
German-Jordanian University (GJU)
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Prof. Muna Hindiyeh is assistant professor and chairman of water and environmental engineering at the German Jordanian University. She received her doctoral degree in environmental health and sanitation from England. She is a specialist in environmental and sanitary microbiology.

HUSSEIN, IYAD

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Dr. Iyad Hussein, PhD graduate of Colorado State University, is the Head of Water and Environment Department at CEC Controls, Jordan. The Department is providing environmental services in the field of water supply and wastewater treatment, solid waste collection and treatment, storm water drainage, effluent reuse, hazardous waste treatment and storage.

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Prof. Amer Jabarin holds a PhD in Agricultural Economics from Oklahoma State University, Stillwater, OK. He is a specialist in environmental economics, water and resource economics, monitoring and evaluation, and economic policy analysis. He has carried out many assignments related to environmental issues through participating in the preparation of NAP for combating determination and biodiversity in Jordan.



JAMRAH, AHMAD

EEIA "Env. Impact Assessment"
University of Jordan, Civil Engineering Department
jamrah@ju.edu.jo

Prof. Ahmed Jamrah is a PhD graduate in Water and Environmental Engineering of University of Delaware, Newark. Amongst his areas of expertise are: Water Quality and Wastewater Characterization; Environmental Planning and Management, Environmental and Health Impact Assessment; Transport of Contaminants, and Fate of Pollutants in the Environment.



KASSAB, GHADA

ESUP "Water Supply"
University of Jordan, WERSC
ghada.kassab@ju.edu.jo

Dr. Kassab is an assistant researcher at the Water and Environment Research and Study Center (WERSC) of the University of Jordan. She received her Ph.D. degree in environmental engineering from Wageningen University in June 2009. Dr. Kassab research interests lies in the fields of integrated water management, low cost wastewater treatment technologies and bio-energy recovery.



MAJDALAWI, MOHAMMAD

BWEC "Water Economics"
University of Jordan, Dept. of Agricultural Economics
m.majdalawi@ju.edu.jo

Dr. Mohammad Majdalawi obtained his Phd in Agricultural Socio-Economics from Institute for Agricultural Economics and Social Sciences in the Tropics and Subtropics, University of

THE LECTURERS

Hohenheim. He is a specialist in water, resources and environmental economics. His dissertation in his PhD was about socio-economic impacts of re-used water in agriculture in Jordan.



PRINZ, DIETER

ECON "Water Conservation"
Prof.em. University of Karlsruhe
prof.prinz@t-online.de

Prof. emeritus Dieter Prinz received his PhD in Tropical Crop Science from Göttingen University, Germany. As a researcher at the Department of Civil Engineering, Geo and Environmental Sciences, University of Karlsruhe, he specialized in water and land resources development, water conservation, soil conservation, small scale irrigation, and water harvesting in agriculture.



RIBBE, LARS

BWRM "IWRM Principles"
Cologne University of Applied Sciences (CUAS), ITT
lars.ribbe@fh-koeln.de

Prof. Ribbe obtained his PhD from University of Jena, Faculty of Chemistry and Earth Sciences, Department of Hydroinformatics. As Director of ITT, he focuses his research on integrated land water resources management, science and policy aspects of water quality, water resources assessment and monitoring, land and water resources interactions; diffuse pollution, and transboundary watershed management.



ROEHRIG, JACKSON

EGIS "GIS & Remote Sensing"
Cologne University of Applied Sciences (CUAS), ITT
jackson.roehrig@fh-koeln.de

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Prof. Roehrig holds a PhD from Ruhr-University Bochum, Faculty of Civil Engineering, Department of Structures and Simulation Techniques. His expertise includes water system analysis and modelling, Hydrology, Information management, geographical information systems, Integrated urban water management, water demand management, flood and drought management, risk assessment and catastrophe management.



SALAMEH, LENA

UNESCO IHP, Paris
L.Salame@unesco.org

Léna Salamé is a jurist and trained mediator, who has been working for the UNESCO's Division of Water Sciences since 1999. She is currently the coordinator of the PCCP project, a water conflict resolution component of UNESCO-IHP. Issues related to shared water resources, international conflicts and cooperation, as well as alternative dispute resolution techniques, at international and national events are her field of lecturing.



SALMAN, AMER

BWEC "Water Economics"
University of Jordan, WERSC
asalman@ju.edu.jo

Prof. Salman is the director of the Water and Environment Research and Study Center. He focuses his work on socio-economic studies. He performed economic analyses for most of the dams in Jordan Valley at the request of the Jordan Valley Authority. His dissertation at University of Hohenheim about economics of water and irrigation lead him to the field of allocative forecasting techniques and environmental economics.

SCHEUMANN, WALTINA

BICO "Intl. Cooperation"
German Development Institute, Bonn (DIE)
waltina.scheumann@die-gdi.de



Dr. Scheumann is a research fellow at DIE in the department "Environmental Policy and Management of Natural Resources". Her PhD at Technische Universität Berlin was about "Managing Salinization. Institutional Analysis of Public Irrigation Systems", a subject that took her through several carrier steps to today's work area: Organization of the Dialogues on Water.

WEITER, MATTHIAS

BICO "Intl. Cooperation"
Humboldt University of Berlin
matthiasweiter@gmail.com



Prof. Weiter is the initiator of the MSc IWRM Master Program. Prof. Weiter is the former head of BMZ unit 325: Regional Development Policies; Middle East. Currently he is a lecturer at the Humboldt University Berlin and FH-Köln. Prof. Weiter also teaches in the 4 Arab-German MSc Programs and Aspects of International Cooperation.

WOLLERS, MATTHIAS

BMAN "Management"
Private Sector, Come Partners
wollers@come-partner.de



Matthias Wollers is an Agricultural Engineer that spe-

THE LECTURERS

cialised throughout his career on organisational development and learning, strategic change management, project management (IPMA) and conflict management. With his company he is offering training concepts and quality assurance, open space and workshop facilitation, project monitoring and evaluation.

In addition to the lecturers, external experts from relevant institutions are being invited into the program for guest lectures. External experts may come from any of the institutions represented in the Advisory Board, public and private sector or ongoing research projects in fields relevant to the MSC IWRM Program.

QUALITY MANAGEMENT

In order to assure the quality of contents and services within the MSc IWRM Program, internal and external evaluation mechanisms are established.

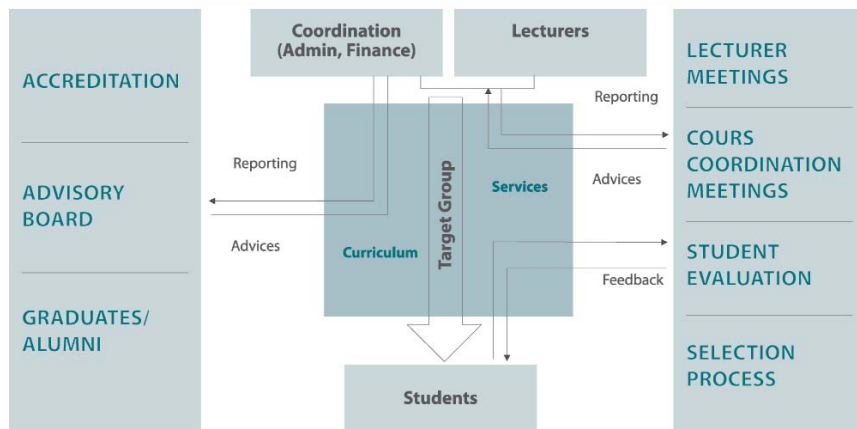
INTERNAL EVALUATION

The quality of the MSc IWRM Program is assured through four internal mechanisms: The selection process of scholarship holders and lecturers, regular student evaluations, course coordination meetings and an annual lecturer meeting. The internal mechanisms are of interacting nature: Students are evaluating course modules and reporting to the course coordination committee as well as to the lecturers and advisory board members. Outcomes from the course coordination meetings, lecturer meetings and advisory board meetings are shared among all instances.

EXTERNAL EVALUATION

External evaluation of the MSc Program takes place through the accreditation committee, the advisory board and active alumni members. Thereby, all three instances have a focus on quality of contents and integrity of the curriculum.

EXTERNAL EVALUATION PARTICIPANTS INTERNAL EVALUATION



CURRICULUM

COURSE DESCRIPTION

Participants of the MSc IWRM Program receive a double degree Master of Science »Integrated Water Resources Management«, issued by the Cologne University of Applied Sciences and the University of Jordan.

The course covers a preparatory phase, followed by three semesters. The first semester takes place in Amman, the second semester in Cologne and the third semester is dedicated to the master thesis. Overall, the program is equivalent to 90 Credit Points, (one CP equals 30 hours of workload) according to the European Credit transfer System (ECTS). As for the Jordanian system, this is equivalent to 33 credit hours.



COURSE STRUCTURE

PREPARATORY PHASE

In the preparatory phase (mid-July to early September), students will have the opportunity to acquire the necessary knowledge defined as prerequisite to the master program, acknowledging the fact that participant have a wide range of professional backgrounds.

Prerequisites to the master program are achieved through:

Readers: To achieve a “levelling of knowledge” and common scientific language, readers will be made available through the course website to each participant for self-study.



Tutors will be available during the preparatory phase in order to clarify questions arising during the self-study phase. At the end of each reader, the group meets for one afternoon together with a reader-expert and discusses open questions. Readers aim at giving a basic introduction into Water Sciences & Technology, International Cooperation and Governance, and Economic Principles.

Language Courses: Students have the opportunity to study Arabic or German Language. Arab-German tandems will be set up with the aim of stimulating bilateral exchange on cul-

ture and language and to promote habits of studying and working together.

Communication and Soft Skills: At the very beginning, a workshop on intercultural communication shall bring the group together and encourage team building.

Scientific Work: A workshop on scientific work will be held, in order to recall adequate researching-, writing- and presentation skills. Students will present and discuss their project ideas to each other.

Field trip: A socio-cultural field trip takes place during the preparation phase, in order to strengthen group dynamics, sensitize students for water issues and to consolidate knowledge gained from the readers.

Additionally, Expert Seminars, Alumni Seminars, and Introduction to the Team Project can be organized during the preparation phase.

FIRST AND SECOND SEMESTER

The first and second semester consist of a sequence of basic and elective modules. Generally, a module comprises lecturing, exercises and a field visits and presentations of professionals from the Arab and German water sector relevant to the module topic.

The basic modules, "Principles of IWRM", "Water Science", "Water Economics" and "Water Governance", have the aim of providing the student with a general overview over the topics relevant to integrated water resources management. Further compulsory modules on "International Cooperation", "Management" and "Water System Management" aim at further deepening the knowledge.

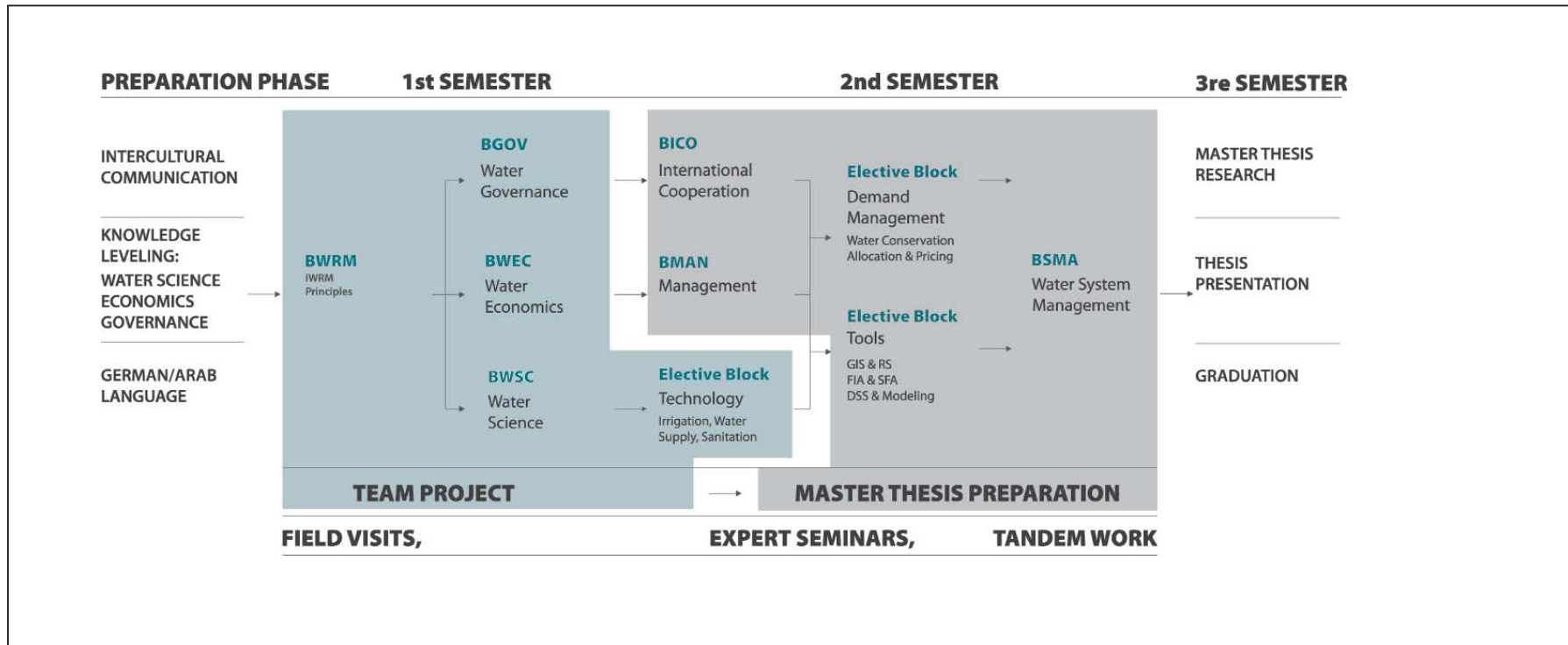
The elective modules are organized into three thematic blocks: "Water Technology", "Tools" and "Demand Management". Out of each block the participants select one specialized module. The elective blocks consist of a common introduction giving an overview of the topic as a whole. At the end of each elective block, a seminar will be organized, in which the students can present and discuss their assignments.

In addition to the basic and elective modules, students also engage in a **team project**, where bicultural groups will elaborate an interdisciplinary case study. Throughout the second semester students are working on their **preparation of master thesis** by preparing a research proposal.

Special topics are covered through the student's participation in events, conferences, fairs, or summer schools if these happen to fall in a suitable time frame. Together with the team project and expert seminars, they are building the bridge from academic teaching to applied training.

THIRD SEMESTER

The third semester focuses on the preparation and writing of the master thesis. Internships and research stays predominantly in an Arab country guarantee the practical orientation of the master research, which is preferably done in cooperation with an ongoing project of an institution or company. Arab students should have the opportunity to realize their research in Germany if funding is secured. Tutors pay particular attention that the knowledge acquired in the first two semesters is applied in the individual projects. Tandem thesis work involving an Arab and a German student are encouraged.



MODULE FLOWCHART

For a comprehensive understanding of the course structure, the sequence and interrelation of modules is shown in the following module flowchart. After the introductory module of "IWRM Principles", modules consequently build up on each other, covering societal, economic and environmental contents, and concluding in a comprehensive and holistic understanding of "Water System Management".

MODULE DESCRIPTIONS

The following module descriptions provide a guideline and do not necessarily represent the content of teaching in detail. They are based on the preceding academic year and are updated in the process of implementation. The section on "Prerequisites" explains basic knowledge a lecturer can assume to be present among the group of students. To register for the master thesis, the achievement of 55 CP (ECTS) and the passing of the module MTPR (Master Thesis Preparation) are compulsory.

BWRM	Principles of Integrated Water Resources Management			
ECTS Points	Credit Hours	Lectures (h)	Applications (h)	Individual study (h)
5	3	40	50	60
Prerequisites	Readers 1, 2, 3: Water Science and Technology, Water Economics, Water Governance			
Learning Objectives	<p>After the completion of this course, the participants will be able to:</p> <ul style="list-style-type: none"> Define causes and impacts of the most relevant water resources related problems in a global context and in the Arab Region Distinguish current IWRM concepts and principles and reflect them critically. Have a clear understanding of the possible levels of integration (sectoral, multi-sectoral, holistic) and the regional extension of integrated concepts (trans-boundary, national, river basin, local) Describe the role of water for development processes of societies; Express the value of water applying monetary and non-monetary concepts Distinguish different approaches to ownership and right to use water Explain the roles of international organisations and policies regarding water resources management Describe water resources problems using the system approach Understand the interactions between the natural and human factors within and outside of water resources systems 			
Content	<p>1. Water Problems and Issues of Concern</p> <p>1.1 Global and regional water crisis (specific reference to the Arab Region): water availability and scarcity, water & food security, water & environmental degradation, water & health, floods and droughts, climate change, conflicts over water between users, sectors, countries.</p> <p>1.2 Solutions inside and outside the water box. Demand for alternative approaches in water management</p> <p>2. IWRM: Definitions, Concept and Status</p> <p>2.1 Comparing different approaches and definitions (integrated/adaptive/sustainable WRM)</p> <p>2.2 Elements and levels of integration in IWRM</p> <p>2.3 implementation of IWRM</p> <p>3. IWRM and Sustainable Development</p> <p>3.1 Water and development: water and poverty; equity; governance, gender; participation, MDGs</p> <p>3.2 Value, ownership and management of water (monetary vs non-monetary; public vs. private, water rights)</p> <p>3.3 International institutions, guidelines and policies (UNCED, WWC, WWAP etc)</p>			

4. Water Resources Systems: Interactions between human and natural factors

- 4.1 System definition and analysis; application to water resources (boundaries, elements, interactions, DPSIR, problem analysis);
- 4.2 Water cycle and water bodies, water quantity and quality concepts, water and its relation to other natural resources
- 4.3 The hydro-social cycle; human impacts on quantity and quality; storage, transport, distribution, uses of water.
- 4.4 Water system management: external factors of water resources systems: environmental, economic and social realities and demands outside the water system; options to steer water systems

Field Trip	Azraq Oasis: "Conflicting uses of water in the Azraq Basin": The severely degraded wetland and the Azraq Dialogue for Restoration, IUCN.
Assignments	Term Paper (40%); Field Trip Report & Presentation (20%); Final Written Examination (40%)
Lecturers	Manar Fayyad, Lars Ribbe
Recommended Reading	<p>Allan, Tony: 2003, IWRM/IWRAM: a new sanctioned discourse? Occasional papers 50 SOAS Water Issues Study Group, School of Oriental and African Studies / Kings College London. University of London, April 2003</p> <p>Biswas, A.K. 2005. Integrated Water Resources Management: a reassessment. In A.K. Biswas, O. Varis, & C. Tortajada (Eds.) Integrated Water Resources Management in South and Southeast Asia . pp. 325-341. New Delhi : Oxford University Press</p> <p>CapNet: IWRM tutorial: http://www.cap-net.org/iwrm_tutorial/mainmenu.htm</p> <p>Cech, T.V. 2004, Principles of Water Resources: History, Development, Management, and Policy. John Wiley and Sons: New York</p> <p>GWP, 2000, Integrated Water Resources Management, TAC background paper No.4, GWP Stockholm</p> <p>GWP-INBO, 2009 A Handbook for Integrated Water Resources Management in Basins</p> <p>Heathcote IW. 2009. Integrated Watershed Management: Principles and Practice. Wiley. Second edition</p> <p>UNESCO 2006; 2009: World Water Development Reports 2 and 3 (selected chapters)</p> <p>UNESCO 2009 IWRM guidelines at River Basin Level</p>

BGOV	Water Governance			
ECTS Points	Credit Hours	Lectures (h)	Applications (h)	Individual study (h)
5	2	40	50	60
Prerequisites	Reader 3 “Water Governance”; Module BWRM: IWRM Principles			
Learning Objectives	<p>After thte completion of this course, the participants will be able to:</p> <ul style="list-style-type: none"> • be familiar with the definitions and basic elements of water resources policy and law, and legislation • know the key elements of effective water governance and policy • be able to analyse the institutional landscape related to water issues at a national scale • be able to explain the importance of public participation and stakeholder participation in water resources planning and management • be familiar with international laws and conventions with relation to water resources. • to gain basic knowledge related to quantitative policy analysis tools 			
Content	<p>1. Introduction</p> <p>1.1 Defining Terms: Governance, Policy and Legislation, Law, Regulation</p> <p>1.2 Demands on for water governance in IWRM; relation to values of water, scarcity, allocation and pollution problems</p> <p>1.3 Principles of effective water governance (transparency, equity, coherence, inclusive, accountable, efficient, responsive);</p> <p>1.4 Theoretical concepts of multi-level governance, “good governance”, the rule of law, participatory approaches and international relations theories</p> <p>2. Water Policy in the IWRM context</p> <p>2.1 International policy frameworks and recommendations (GWP, World Bank, ADB etc)</p> <p>2.2 National water policies; relation with other sector policies: agriculture, energy, tourism, health, etc.; water and development</p> <p>2.3 Water sector analysis (comparative analysis of water sector approaches and reforms), policy formation and reform (policy cycle)</p> <p>2.4 IWRM and water policy (vertical lines vs horizontal integration); Country and EU Water Policy case studies.</p> <p>3. National Water Law</p> <p>3.1 Principles. water law in history; legal pluralism</p> <p>3.2 Water as a public and private good; water rights, entitlements</p> <p>3.3 Role of the state in water management</p> <p>3.4 National water legislations (examples)</p> <p>3.5 Special regulations and mechanisms regarding control and enforcement</p>			

	3.6 Corruption in the water sector; regulations related to tender, contract, procurement processes (example South Africa etc), professional service providers (PSP).
	4. International Water Law
	4.1 Principles of international water law (surface and groundwater)
	4.2 Helsinki/Berlin rules and United Nations Convention on the Law of Non-Navigational Uses of International Watercourses
	4.3 Case studies of transboundary legislation and management
	5. Water Institutions and Administration in the IWRM context
	5.1 Institutional roles and landscapes
	5.2 Performance, management and reform of institutions
	5.3 Stakeholder processes and participation
	5.4 Decentralisation, privatisation,
	5.5 International networks and global institutions
	6. Socio-economic Aspects of Water Management
	6.1 Public participation
	6.2 Stakeholder involvement
	6.3 Public awareness
	7. Economic Policy Analysis
	7.1 Essential tools in economic policy analysis
	7.2 Economic parameters calculation and interpretation
Assignments	Written Exam (40%), Conference Protocol (20%), Report/Presentation (40%)
Lecturers	Amer Jabarin, Musa Stewi, Munjed Al-Sharif
Recommended Reading	<p>Agenda 21 chapter 18</p> <p>Caponera, D.A.(1992) Principles of water law and administration. Balkema Publishers, Rotterdam</p> <p>Dellapenna, Joseph W., (2001) The Customary International Law of Transboundary Fresh Waters, 1 Int’l J. Global Env’tl Issues 264</p> <p>EU Water Framework Directive</p> <p>Global Water Partnership (2004) TEC 7 Effective Water Governance, Sweden.</p> <p>Heathcote (1998) Integrated Watershed Management, Chapter 9, John Wiley & Sons, New York.</p> <p>Jordanian Water Sector Strategy</p> <p>Stålgren, P. 2006 Corruption in the Water Sector: Causes, Consequences and Potential Reform. Swedish Water House Policy Brief Nr. 4. SIWI, 2006.</p> <p>The Berlin rules (2004) on non navigational use of international freshwaters. Norton, Roger D., (2004), Agricultural Development Policy, Concepts and Experiences. FAO and John Wily & Sons, Ltd. Ch1, 2, and Annex 1.</p> <p>...</p>

BWEC	Water Economics			
ECTS Points	Credit Hours	Lectures (h)	Applications (h)	Individual study (h)
5	3	40	50	60
Prerequisites	Reader 2: Water Economics; Module BWRM: IWRM Principles			
Learning Outcomes	<p>After the completion of this course, the participants will be able to:</p> <ul style="list-style-type: none"> • apply principles of economics in water resource management • solve problems of water allocation over time and among various sectors of the economy • to conduct analyses of competing demands for water among various sectors. • know about water markets, efficiency and equity and the basics of policy making 			
Content	<p>1. Economic concepts</p> <ol style="list-style-type: none"> Economics of production economics Input-Output relations Output-Input relations <p>2. Economic-institutional principles of water resources</p> <ol style="list-style-type: none"> Economic research supporting water research The value of water Social relations Institutions for managing resources <p>3. Water allocation</p> <ol style="list-style-type: none"> Water use in agriculture Water use in industry and tourism <p>4. Water market and marketing</p> <ol style="list-style-type: none"> Pricing of water Market equilibrium Producer surplus Consumer surplus and willingness to pay Market failure Cost and benefit of water externalities <p>5. Environmental valuation of water project related issues</p> <ol style="list-style-type: none"> Types of values (use and non-use values) Dollar-based ecosystem valuation methods Contingent valuation method 			

- Contingent choice method
 - Habitat equivalence method (HEA)
 - Damage cost avoided, replacement cost, and substitute cost method
 - Benefit transfer method
- 6. Economics of water use at farm level**
- Water as an input: optimal intensity
 - Gross margins and income analysis
 - Land use, land rights and water rights
- 7. Project appraisal of water projects**
- Investment, operational and maintenance cost and revenues
 - Discounted measures in evaluating water projects
 - Case studies: Large water reservoirs and distributions systems

Field Trip	Agriculture in the Jordan Valley: Backbone to Jordan’s Economy or Dissipater of Scarce Water Resources?
Assignments	Written Exam (40%), Term Paper (30%), Exercises (30%)
Lecturers	Amani Assaf, Mohammad Majdalawi, Emad Karablieh
Recommended Reading	<p>DOPPLER, W. et al (1997). Planning and Appraising Agricultural Programmes and Projects. Economic, Social and Environmental Appraisal. In: UPTON, M. et al (edit.): Agricultural Economics and Rural Development. EC, NATURA/NECTAR. Montpellier.</p> <p>Green, Colin H. (2003). Handbook of Water Economics: Principles and Practice, Wiley, J.</p> <p>HIJAWI, Th. (2003). Economics and Management of the Use of Different Water Qualities in Irrigation in the West Bank. Published in: W. DOPPLER and S. BAUER (Eds.): Farming and Rural Systems Economics, Vol. 50. Margraf Verlag, Weikersheim.</p> <p>Linz, T. and Tsegai, D. W. (2009). Industrial Water Demand Analysis in the Middle Olifants Sub-basin of South Africa: The Case of Mining. ZEF Discussion Papers on Development Policies, No. 130, Center for Development Research, University of Bonn.</p> <p>Kloos, J. and Tsegai, D. W. (2009). Preferences for domestic water services in the Middle Olifants sub-basin of South Africa. Discussion Papers on Development Policies, No. 131, Center for Development Research, University of Bonn.</p> <p>Young, Robert A. (2005). Determining the Economic Value of Water: Concepts and Methods, Resources for the Future</p> <p>SATTARASART, A. (1999). Socio- Economic Implications of Water Resource Management in Northern Thailand. Published in: DOPPLER, W. (Hrsg.): Farming Systems and Resource Economics in the Tropics, Vol. 33. Wissenschaftsverlag Vauk: Kiel</p>

BWSC	Water Science			
ECTS Points	Credit Hours	Lectures (h)	Applications (h)	Individual study (h)
5	3	40	50	60
Prerequisites	Reader 1: Water Science & Technology; Module BWRM: IWRM Principles			
Learning Outcomes	<p>After completion of the module the participants are able to:</p> <ul style="list-style-type: none"> describe the different climate and weather parameters and quantify the water balance of a watershed. characterize watersheds, including the analysis of the natural (topography, land use, geology, etc) and the human (institutions, society, economy) environment. know about measuring and modeling techniques, relevant to rainfall-runoff relationships, infiltration and storage. distinguish different parameter groups of water quality and natural/anthropogenic sources of pollution. 			
Content	<p>1. Climate and Hydrology</p> <p>1.1 Climate/weather elements and their dimensions</p> <p>1.2 Water bodies and their interrelation</p> <p>1.3 Surface water hydrology</p> <p>1.4 Groundwater hydrology</p> <p>2. Watershed Characterization and Processes</p> <p>2.1 shape, topography and delineation</p> <p>2.2 geology, soil and land use/land cover</p> <p>2.3 Geomorphology, erosion and sedimentation</p> <p>3. Hydrometry and Hydrosystems</p> <p>3.1 Measurement of precipitation, runoff & groundwater recharge</p> <p>3.2 Transmission, treatment and storage of hydrological data</p> <p>3.3 Conceptual models of watershed systems, Rainfall-runoff relationships and modelling principles of runoff collection, infiltration, storage, and flood control</p> <p>4. Water Quality and Ecology</p> <p>4.1 Water bodies and their basic water quality and ecological features</p> <p>4.2 Natural and anthropogenic causes of water quality</p> <p>4.3 Variables of water quality</p> <p>4.4 Water quality monitoring and data interpretation</p>			
Field Trip	Water Quality Monitoring Stations in Jordan			

Assignments	Exam (40%); Exercises (25%); Field Trip attendance (5%); Term Paper (30%)
Lecturers	Abbas Al-Omari, Marwan Al-Raggad
Recommended Reading	<p>Heathcote, I. 1998 integrated Watershed Management: Principles and Practice, Wiley</p> <p>Helweg, O. J. 1985, Water Resources Planning and Management. John Wiley & Sons, New York.</p> <p>DeBarry, P. Watersheds: Processes, Assessment and Management, Wiley 2004</p> <p>WMS v7.0, 2002. Watershed Modeling System. Environmental Modeling Research Laboratory, Brigham Young University. Provo, Utah 84602.</p> <p>Hystad Methods, Dyhouse G., Hatchett J., and Benn, J., 2003. Flood Plain Modeling Using HEC-RAS, First Edition. HAESTAD Press, Waterberry, CT USA.</p> <p>Viessman, W. Jr., and Lewis, G.L, 1995. Introduction to Hydrology, Fourth Edition. Addison-Wesley Educational Publishers, Inc.:http://www.aw.com/cseng.</p> <p>Shaw, E.M., 1994, Hydrology in Practice, Third Edition. Chapman & Hall, London.</p> <p>Chow, V.T., Maidment, D.R., and Mays, L.W., 1988. Applied Hydrology. McGraw-Hill International Editions, NW.</p> <p>Linsley, R.K., Franzini, J.B., Freyberg, D.L., and Tchobanoglous, G., 1992. Water-Resources Engineering. McGraw-Hill International Editions, NW.</p>

BMAN	Management			
ECTS Points	Credit Hours	Lectures (h)	Applications (h)	Individual study (h)
5	3	70	40	40
Prerequisites	Reader 2: "Water Economics", Module BWRM: "IWRM Principles", Module BWEC: "Water Economics", Module BGOV: "Water Governance"			
Learning Objectives	<p>After completion of the module the participants are able to:</p> <ul style="list-style-type: none"> • know and explain the important phases of project management • identify tools and software adequate to support decision making and planning processes • to explain the concepts of participation in the context of IWRM issues • to select and apply appropriate participation methods • to conduct a stakeholder analysis. • Students will implement Human Resource Development solutions to real water institutions problems. • Students will identify organizational situations (water institutions) that would benefit from organization development interventions. 			
Content	<p>1. Participation and Awareness</p> <p>1.1 Public and Private Participation</p> <p>1.2 Governance Styles and roles of stakeholder groups</p> <p>1.3 Levels of participation</p> <p>1.4 Gender aspects in participation</p> <p>1.5 Tools for public participation</p> <p>1.6 Public Private partnerships (PPP)</p> <p>1.7 Private sector participation (PSP)</p> <p>1.8 Awareness assessment & tools</p> <p>2. Project Management</p> <p>2.1 Basic concepts and definitions</p> <p>2.2 Project cycle & phases, objectives</p> <p>2.3 Project planning & risk management</p> <p>2.4 Project monitoring & evaluation</p> <p>2.5 Budgeting, procurement and funding options</p> <p>2.6 Information Management</p> <p>3. Business Administration</p> <p>3.1 Enterprises: legal forms</p> <p>3.2 Financing/Financing instruments</p>			

- 3.3 Cost accounting, cost calculation
- 3.4 Human resources management
- 3.5 Organization and decision making
- 3.6 Business Planning
- 3.7 Legislation related to enterprise management

Assignments	Multiple Choice Exam (Abbasi, 33%), Term Paper (Hamhaber, 33%), Business Plan (Daldrup, 33%)
Lecturers	Johannes Hamhaber, Ulrich Daldrup, Ghalib Abbasi
Recommended Reading	<p>Arnstein, Sherry R. „A Ladder of Citizen Participation,“ JAIP, Vol. 35, No. 4, July 1969, pp. 216-22</p> <p>Berkun, Scott (2005). Art of Project Management. Cambridge, MA: O'Reilly Media.</p> <p>Cech, T.V. 2004, Principles of Water Resources: History, Development, Management, and Policy. John Wiley and Sons: New York</p> <p>Deresky, H. (2003). International Management Managing Across Borders and Cultures, 4th edition, Prentice Hall</p> <p>Hickey, S., and Mohan, G. (2004). Towards participation as transformation: critical themes and challenges. In S. Hickey, and G. Mohan, Participation - from tyranny to transformation?: Exploring new approaches to participation in development (pp. 3-24). London: Zed Books.</p> <p>Lewis, James (2002). Fundamentals of Project Management, 2nd ed., American Management Association.</p> <p>Participation: The New Tyranny? Bill Cooke and Uma Kothari (eds), 2001, Zed London</p> <p>Project Management Institute (2003). A Guide To The Project Management Body Of Knowledge, 3rd ed., Project Management Institute.</p> <p>Robert Chambers. Whose Reality Counts? Putting the First Last Intermediate Technology Publications, London, 1997, p. 106.</p> <p>Rural Development: Putting the Last First, Robert Chambers, 1983, Longmans</p> <p>Successful Organizations of the Future. The Design of the New Organization by Joseph H. Boyett and Jimmie T. Boyett, based on their book, Beyond Workplace 2000. First, the authors describe four principles for the new organization of the future</p> <p>Schaap, W., and Steenbergen, F. v. (2002). Ideas for water awareness campaigns. Global Water Partnership (GWP).</p> <p>Thomas G. Cummings, Christopher G. Worley. Organization Development and Change Biswas, A.K. 2005. Integrated Water Resources Management: a re-assessment. In A.K. Biswas, O. Varis, & C. Tortajada (Eds.) Integrated Water Resources Management in South and Southeast Asia . pp. 325-341. New Delhi : Oxford University Press</p> <p>http:// www.howtowriteabusinessplan.org/</p>

BICO	International Cooperation			
ECTS Points	Credit Hours	Lectures (h)	Applications (h)	Individual study (h)
5	3	40	70	40
Prerequisites	Reader 3: Water Governance; Module BGOV: Water Governance			
Learning Outcomes	<p>After completion of the course participants will be able to:</p> <ul style="list-style-type: none"> Realise scope and intensity of political, economic and cultural objectives and instruments of German-Arab relations. Understand the institutional set-up of bilateral and multilateral development cooperation with special reference to the Arab World. Acquire the ability of critical assessment of instruments and institutions and their impacts. 			
Content	<p>Berlin-Week: German-Arab Cooperation in Development, Business, Culture and Politics</p> <p>1. Objectives and instruments of German-Arab relations</p> <p>1.1 Historic and present cultural and political relations between Germany and the Middle East</p> <p>1.2 Institutions and networks of German-Arab relations</p> <p>1.3 Nature and volume of German-Arab trade and investments</p> <p>2. Institutional set-up of development cooperation</p> <p>2.1 Definition of development and international cooperation</p> <p>2.2 Framework of bilateral and multilateral dev. organisations</p> <p>2.3 Financing of programmes</p> <p>2.4 Guiding principles (UN Millennium Declaration, Paris Agenda).</p> <p>3. Critical assessment of instruments and institutions</p> <p>3.1 Role of Parliaments, Governments and Arab embassies in shaping and cultivating European-Arab relations</p> <p>3.2 Characteristics of organisations</p> <p>3.3 German aid organisations: History and employment aspects</p> <p>Cologne-Week:</p> <p>4. Bidding and contracting in development cooperation projects</p> <p>4.1 Project Cycle, procurement guidelines, standard tender/bidding documents, considerations for successful bidding</p> <p>4.2 legal aspects in international contracts</p> <p>4.3 examples; a) calls: KfW, WB, AfDB, EBRD; b) bids from German consultancies</p>			

5. International Cooperation on Transboundary Water Bodies

- 5.1 Reasons for conflict and cooperation in international river basins
- 5.2 Political dimensions of cooperation in international basins
- 5.3 Economic aspects of cooperation; benefit sharing
- 5.4 Examples of institutional settings for transboundary water management
- 5.5 Negotiation and conflict resolution
- 5.6 The role of international organizations in the water sector

Field Trip	Berlin Module: German-Arab Relations in Development, Politics, Business and Culture
Assignments	Berlin-Module Report (Weiter, 50%), Scientific Poster (Scheumann, 50%)
Lecturers	Matthias Weiter, Waltina Scheumann, various guest lecturers
Recommended Reading	Middle East/North Africa Concept of the German Ministry of Development Cooperation (2008) UN Millennium Declaration (2000)

BSMA	Water System Management			
ECTS Points	Credit Hours	Lectures (h)	Applications (h)	Individual study (h)
5	3	40	50	60
Prerequisites	Knowledge of all modules			
Learning Outcomes	<p>After completion of the course participants will be able to:</p> <ul style="list-style-type: none"> • conduct a comprehensive analysis of the water sector: social, environmental, and economic factors • conduct a comprehensive water resources assessment at the watershed level • name and critically analyse the steps needed to implement a comprehensive IWRM strategy at the national level • set up general goals for the future development of a watershed and know participatory methods to achieve these goals • select adequate instruments and methods in order to plan a project at national and international level. • translate the methods and theories into a case study (group work) that will be presented to the class 			
Content	<p>1. Overview on the IWRM relevant assessment and planning process</p> <p>2. Water Utility Management (Sachsenwasser)</p> <p>2.1 Transformation Experience and Organizational Structures of Water Utilities in Germany</p> <p>2.2 Steering Control and Leakage Management</p> <p>2.3 Water Production</p> <p>2.4 Pricing and Tariffs</p> <p>2.5 Customer Relations and Accounting</p> <p>3. Water Resources System Analysis</p> <p>3.1 Preparatory analysis</p> <p>3.2 Stakeholder analysis</p> <p>3.3 Policy analysis</p> <p>3.4 Problem analysis</p> <p>3.5 Analysis of objectives and strategies</p> <p>4. Water Resources Planning and Management</p> <p>4.1 Revisited: Project Cycle Management</p> <p>4.2 The Logical Framework Approach</p> <p>4.3 Activity, resource and cost schedules</p>			

Lecturers	Trainers (Sachsenwasser), Lars Ribbe
Recommended Reading	<p>CapNet: IWRM tutorial: http://www.cap-net.org/iwrm_tutorial/mainmenu.htm</p> <p>Cech, T.V. 2004, Principles of Water Resources: History, Development, Management, and Policy. John Wiley and Sons: New York/GWP (2001). Tool Box for Integrated Water Resources Management , Stochholm, Sweden.</p> <p>Heun, J. (2000), Water Resources Planning – A framework for analysis, Volume 2 supporting examples, IHE.</p> <p>Hussein, I. A., "Application of Expert Decision Support Systems for Optimizing Water Supply in the Jordan Valley; The case of King Abdallah Canal" Water International, Volume 30, Number 3, September 2005, pp294-302.</p> <p>Hussein, I. A., Trainers Manual, " ToT Manual in Integrated Water Resources Management" under the supervision and fund of UNESCO – Cairo Office, May 2006.</p> <p>United Nations Agencies: UNEP/ROWA, ESCWA and UNESCO-Cairo Office, Water Resources Management in the Arab World: Problems and Prospective. Journal of Water Resources Planning and Management ASCE, Reston VA, USA</p>

EIRA	Irrigation & Agriculture			
ECTS Points	Credit Hours	Lectures (h)	Applications (h)	Individual study (h)
5	3	40	50	60
Prerequisites	Reader1: Water Science & Technology; Module BWRM: IWRM Principles; Module BWSC: Water Science			
Learning Objectives	<p>After the completion of this course, the participants will be able to:</p> <ul style="list-style-type: none"> • know the various water resources for irrigated agriculture and their respective interdependencies. • know the relevant physical and chemical soil properties for irrigation, including leaching and drainage. • know the importance and demands for the various irrigated crops. • know the various irrigation methods, their efficiencies and their influence on the soils and the groundwater. • Students are aware of the water use in irrigated agriculture in comparison with the other sectors and the relation to the IWRM-concept. 			
Content	<p>1. Introduction</p> <p>1.1 Rainfed versus irrigated agriculture: global and regional importance regarding i) water demand, ii) economic, environmental and social impact and iii) food security</p> <p>1.2 IWRM relation: conflicts over land and water uses between agriculture and other sectors (housing, energy)</p> <p>2. Irrigated Crops</p> <p>2.1 The history of irrigation and irrigated agriculture in the Arab region.</p> <p>2.2 The current extent of irrigated agriculture in the Arab region.</p> <p>3. Water use and productivity</p> <p>3.1 Climatic factors and influences by climatic change</p> <p>3.2 The role of effective rainfall</p> <p>4. Soil Characteristics</p> <p>4.1 Physical and chemical soil characteristics and their relation to soil water, irrigation and drainage.</p> <p>4.2 The various approaches to determine the potential evapotranspiration (PET), the crop water and irrigation requirement as well as the pre-irrigation requirement</p> <p>4.3 Diagnosis of the salinisation process. Determinations of the leaching requirement and combination with the overall farm water requirement.</p> <p>5. Irrigation, groundwater and drainage technologies and systems</p> <p>5.1 Irrigation technologies and systems</p> <p>5.2 Water resources for irrigation and their qualities</p>			

	5.3 Water lifting devices, including pumps.
	5.4 Water storage, conveyance and distribution systems.
	5.5 Water losses and water use efficiencies (system and field).
	5.6 Options to increase efficiencies
	6. Water allocation principles in agriculture
	6.1 continuous versus intermittent irrigation
	6.2 irrigation on demand versus rotational irrigation
	6.3 deficit irrigation
	6.4 Plant nutrients and fertilization management
	6.5 Water re-use options
	6.6 Organisational aspects of agriculture; participation, water user groups, water user associations.
	6.7 Maintenance of irrigation and drainage infrastructure.
	6.8 Environmental aspects.
	6.9 Water use conflicts in irrigation systems and outside; relation to IWRM-concepts.
Field Trip	Agricultural Research Station, Jordan Valley
Assignments	Written Examination (40%), Individual Assignment (30%), Presentation (30%)
Lecturers	Mohammed Duqqah, Moshrik Hamdi
Recommended Reading	<p>ABDEL-JABBAR, S. et al. (2006): Guidelines for reclaimed water irrigation in the Jordan Valley. Practical recommendations for farmers and extension workers - Reclaimed water project, 81 p., fig., tab., Jordan Valley Authority (JVA), GTZ, Amman, 2006</p> <p>ACHTNICH, W. (1980): Bewässerungslandbau. Agrotechnische Grundlagen der Bewässerungslandwirtschaft - 621 p., 390 fig., 292 tab., 70 maps, Verlag Eugen Ulmer, Stuttgart, 1980</p> <p>ALLEN, R. G. et al. (1998): Crop evapotranspiration. Guidelines for computing crop water requirements - FAO Irrigation and Drainage Paper, 56, 300 p.m, fig., tab., Rome 1998</p> <p>FAO-Irrigation and Drainage Paper Serie, mainly Nr. 24, 25, 26, 27, 29, 33, 40, 47, 48, 53, 55, 61</p> <p>FAO (1993): Prevention of water pollution by agricultural and related activities. Proceedings of the FAO Expert Consultation, Santiago, Chile, 20-23 October 1992 - FAO Water Reports, 1, 357 p., fig., tab., Rome, 1993</p> <p>FAO-Water Reports Serie, mainly Nr. 2, 5, 8, 9, 10, 12, 13, 14, 17, 19, FAO, Rome, 1994 - 1999</p> <p>FAO/UNESCO (1973): Irrigation, Drainage and Salinity - 510 p., fig., tab., Hutchinson & Co. (Publishers) LTD, London, UK</p> <p>WITHERS, B. & S. VIPOND (1974): Irrigation: design and practice - 306 p., fig., tab., B T Batsford Ltd., London, 1974</p>

ESUP	Water Supply			
ECTS Points	Credit Hours	Lectures (h)	Applications (h)	Individual study (h)
5	3	40	50	60
Prerequisites	Reader1: Water Science and Technology, Module BWSC: Water Science			
Learning Objectives	<p>After the completion of this course, the participants will be able to:</p> <ul style="list-style-type: none"> • Understand the issues of water catchments • Estimate domestic water demand • Understand different demand management techniques • Know water distribution systems, components and appurtenances, operation and maintenance, security and administration • Distinguish different water treatment methods • Understand and analyse flows, pressures and water quality in distribution systems • Be aware of the different water quality issues that may arise during treatment and distribution 			
Content	<p>1. Introduction</p> <p>1.1 Role of safe water supply for economic development, culture (gender) and health; relation to MDG 7</p> <p>1.2 Relation and conflicts with other sectors (competition with irrigation, energy demands of water pumping, transport, treatment)</p> <p>2. Water Sources</p> <p>2.1 Ground water and surface water</p> <p>2.2 Sea water</p> <p>2.3 Water harvesting (definition, types)</p> <p>2.4 Water reuse (definition, types)</p> <p>3. Drinking Water Quality</p> <p>3.1 Parameters (microbiological, chemical)</p> <p>3.2 Water quality standards (WHO-Guidelines)</p> <p>4. Water Treatment</p> <p>4.1 Air stripping and aeration (gas transfers, techniques)</p> <p>4.2 Coagulation processes (colloids, flocculation, coagulation)</p> <p>4.3 Sedimentation and flotation (mechanisms, Stokes, reactors)</p> <p>4.4 Filtration (mechanisms, slow filters, rapid filters)</p> <p>4.5 Adsorption of organic compounds (theory, activated carbon)</p> <p>4.6 Disinfection (physical, chemical)</p>			

5. Water Distribution

- 5.1 Water demand, water losses
- 5.2 Systems (decentralised, centralised)
- 5.3 Water transport (pipes, valves...)
- 5.4 Pumping (hydraulic, types, characteristics)
- 5.5 Operation and maintenance
- 5.6 Modelling water distribution systems (EPANET2)

6. Water Storage

- 6.1 Storage types
- 6.2 Dimensioning

Field Trip	Zai Water Treatment Plant
Assignments	Written Examination (40%), Individual Assignment (30%), Presentation (30%)
Lecturers	Abbas Al-Omari; Ghada Kassab, Lina Abu Gunmi,
Recommended Reading	<p>American Waterworks Association: Water Quality and Treatment. McGraw-Hill, 2003.</p> <p>Water distribution system operation and maintenance by California State University, Sacramento, School of Engineering, U.S.A., 2000.</p> <p>Advanced water distribution modeling and management, by Haestad Methods, Thomas, M. Walski, Donald V. Chase, Dragan, A. Savic, Walter, Grayman, Stephen Beckwith, and Edmundo Koelle. 1st edition 2003.</p> <p>Drinking water quality: Problems and solutions by N. F. Gary. John Wiley & Sons, Ltd, Baffins Lane, Chichester, West Sussex PO 19 1 UD, England, 1994</p> <p>G. White. Handbook of Chlorination and Alternative Disinfectants. John Wiley & Sons Inc. (1999).</p> <p>Water Supply and pollution control, by Warren Viessman Jr. and Mark J. Hammer, 7th edition</p>

ESAN	Public Health and Sanitation			
ECTS Points	Credit Hours	Lectures (h)	Applications (h)	Individual study (h)
5	3	40	50	60
Prerequisites	Reader: Water Science and Technology, Module BWSC			
Learning Outcomes	<p>After the completion of this course, the participants will be able to:</p> <ul style="list-style-type: none"> • Understand major environmental factors and influences in wastewater treatment plants and public health interactions for wastewater reuse • Understand basic theoretical aspects of wastewater microbiology and pathogen removal and wastewater reuse impact on human health • Estimate wastewater flow rates • Distinguish different wastewater characteristics and know how they are measured or quantified • Know wastewater collection system components, appurtenances, operation and maintenance; know the basics of sewer design • Know wastewater treatment options for small communities • Understand the concept of water chain • Distinguish the concepts of centralized and decentralized systems • Know the concepts and the existing varieties of biological treatment systems 			
Content	<p>1. Introduction</p> <p>1.1 Role of sanitation for economic development, environment and health, relation to MDGs</p> <p>1.2 Relation to other sectors: housing, energy, environment</p> <p>2. Public Health</p> <p>2.1 Water borne diseases</p> <p>2.2 Water supply and public health</p> <p>2.3 Sewage disposal and public health</p> <p>2.4 Water reuse and public health</p> <p>2.5 Interactions for wastewater</p> <p>3. Wastewater composition and quantity</p> <p>3.1 Domestic wastewater characteristics</p> <p>3.2 Industrial wastewater characteristics</p> <p>3.3 Storm water characteristics</p> <p>3.4 Flow rates</p> <p>4. Environmental aspects of wastewater</p> <p>4.1 Quality issues in watercourses</p> <p>4.2 Quality demands for treated wastewater (regulations)</p>			

5. Wastewater collection	
5.1 Components	
5.2 Appurtenances	
5.3 Design	
5.4 Construction	
5.5 Operation and maintenance	
5.6 Centralized and decentralized systems	
6. Wastewater treatment	
6.1 Mechanical treatment	
6.2 Biological treatment (aerobic and anaerobic treatment systems)	
6.3 Nutrient removal (P,N)	
6.4 Disinfection	
6.5 Ponds and wetlands	
6.6 Decentralized and centralized treatment	
6.7 Wastewater reuse	
6.8 Effluent ultimate disposal options	
6.9 Wastewater treatment options for small communities	
Field Trip	Assamra Wastewater Treatment Plant
Assignments	Written Examination (40%), Individual Assignment (30%), Presentation (30%)
Lecturers	Maha Halalsheh, Muna Hindyiah,
Recommended Reading	McGhee, Terence J., Water Supply and Sewerage, 6th edition, McGraw-Hill series in Water Resources and Environmental Engineering, 1991 Metcalf and Eddy, Wastewater Engineering, 3rd edition, McGraw-Hill, Inc. 1991 California State University, Sacramento, Office of Water Programs, Operation and Maintenance of Wastewater Collection Systems, 5th edition, 1999. Feachem et al. (1983). Sanitation and diseases.

EGIS	GIS and Remote Sensing			
ECTS Points	Credit Hours	Lectures (h)	Applications (h)	Individual study (h)
5	3	40	50	60
Prerequisites	Reader 1: "Water Science and Technology", Module BWRM: "IWRM Principles, Module BWSC: "Water Science"			
Learning Objectives	<p>After the completion of this course, the participants will be able to:</p> <ul style="list-style-type: none"> to access the main sources of geospatial data required for water management. obtain and process spatial and non-spatial information related to water and land resources management. to use different instruments for analysing and presenting spatial data to understand the main steps of data modelling: analysis, design and implementation of Information Systems. 			
Content	<p>1. Introduction</p> <p>1.1 Role of RS and GIS as tools for IWRM: data generation, limitations and outlook</p> <p>2. Geospatial data required for water management</p> <p>2.1 Introduction: remote sensing components.</p> <p>2.2 Platforms and sources of RS-GIS data.</p> <p>2.3 GIS components: spatial data, coordinates and projection.</p> <p>2.4 Building a GIS Database: maps and spatial data.</p> <p>3. Spatial and non-spatial data processing</p> <p>3.1 Image pre-processing techniques: Geometric correction, enhancement, noise removal and filtering.</p> <p>3.2 Information extraction: Digital and visual interpretation principles of digital classification.</p> <p>3.3 Basic spatial analysis: operations and output, spatial selection operations, Dissolve, Proximity functions and buffering - Overlay: Raster overlay, vector overlay, clip, intersect and union</p> <p>4. Data analysis and presentation</p> <p>4.1 Remote sensing applications in IWRM, monitoring and mapping of natural resources.</p> <p>4.2 Spatial estimation, interpolation, prediction and core area delineation. Sampling and sampling patterns.</p> <p>4.3 Interpolation Methods: Nearest Neighbour, Fixed Radius and Inverse Distance Weighted</p>			

5. Analysis, design and implementation of Information Systems

- 5.1 Applications of RS data for monitoring vegetation, water and land use/cover mapping.
- 5.2 Terrain Analysis and hydrologic models in GIS: slope and aspect, hydrologic functions, watershed and viewsheds

Assignment	Individual GIS-Application on a Case Study (Roehrig, 100%)
Lecturers	Jackson Roehrig, Jawad Al-Bakri
Recommended Reading	<p>Antenucci, J. C., Brown, K., Croswell, P. L., and Kevany, M. J. 1991. Geographic Information Systems, A Guide to the Technology. Chapman & Hall.</p> <p>Bernhardsen, T. 2002. Geographic Information Systems.</p> <p>Bolstad, P., 2008. GIS fundamentals: A first text on Geographic Information Systems. 3rd edition, Eider Press, White Bear Lake, Minnesota.</p> <p>Chang, K. T., 2008. Introduction to Geographic Information Systems, 4th edition, McGraw Hill, NY.</p> <p>Clarke, K.C., 2006. Getting Started With Geographic Information Systems, Forth Edition. (http://prenhall.com/clarke/).</p> <p>Demers, M. N., 2005. Fundamentals of Geographic information Systems, 3rd edition, John Wiley & sons, NJ.</p> <p>Jensen, J.R., 2007. Remote Sensing of the Environment: An earth Resources perspectives, 2nd edition, Pearson Prentice Hall, Upper Saddler River.</p> <p>Lillesand, T.M., Kiefer, R.W., Chipman, J.W. 2003. Remote sensing and image interpretation. Fifth Edition.</p> <p>Meijerink, A.M.J., de Brouwer, H.A.M., Mannaerts, C.M., and Valenzuela, C. 1994. Introduction to the Use of Geographic Information Systems for Practical Hydrology. ITC, Enschede, The Netherlands. Publication No. 23.P.</p>

EDSS	Decision Support Systems and Modeling			
ECTS Points	Credit Hours	Lectures (h)	Applications (h)	Individual study (h)
5	3	40	50	60
Prerequisites	Reader 1: "Water Science & Technology"; Module BWRM: "IWRM Principles", Module BWSC: "Water Science"; Elective Block "Technology".			
Learning Objectives	<p>After the completion of this course, the participants will be able to:</p> <ul style="list-style-type: none"> understand the basic principles of modelling and the necessary steps for a successful model application. distinguish different options of modelling, their requirements and complexity Know about various models with respect to different fields of application Run at least one mathematical model and one decision support system independently 			
Content	<p>1. Introduction</p> <p>1.1 Hydrologic Modeling Principles</p> <p>1.2 Definitions: Process; System; Model; Decision Support System</p> <p>1.3 Roles of models and DSS in the context of IWRM</p> <p>1.4 Examples of commonly used models</p> <p>2. Principles of Mathematical Modeling</p> <p>2.1 Collection and Analysis of Data (Pre-test)</p> <p>2.2 Conceptual Design of a Model</p> <p>2.3 Mathematical formulation of the conceptual design</p> <p>2.4 Calibration of the Model</p> <p>2.5 Validation of the Model</p> <p>2.6 Model Application: Forecast vs. Prediction</p> <p>2.7 Classification of Models</p> <p>3. Software Packages for Modelling & Decision Support</p> <p>MIKE BASIN, MIKE 11, MIKE SHE, - documentation & presentation</p> <p>4. Exercises</p> <p>...Saturated Zone</p> <p>...Unsaturated Zone</p> <p>...Channel Flow</p> <p>...Integrated Modeling</p> <p>5. Decision Support Systems – Practical Training</p> <p>5.1 Introduction to WEAP: Idea, Concept & Basic Tools</p> <p>5.2 Data handling & scenario building in WEAP</p>			

	5.3 Calculation of crop water and irrigation requirements
	5.4 Demand & supply analysis, reservoirs & power production, water quality, financial analysis
	5.5 Groundwater: The WEAP-MODFLOW linkage
	5.6 WEAP application in the ACSAD Region
	5.7 Case Study: Creating a DSS for the Zarqa Basin
Assignments	Homework (Paetsch, 50%); WEAP Software Examination (Maßmann, 50%)
Lecturers	Lars Ribbe; Representative of BGR
Recommended Reading	<p>Jacques W. Delleur. „Frontmatter“ The Handbook of Groundwater Engineering Editor-in-Chief Jacques W. Delleur Boca Raton: CRC Press LLC,1999: ftp://58.192.112.18/Pub2/EBooks/Books_from_EngnetBase/pdf/2698/2698fm.pdf (15.03.2011)</p> <p>Fundamentals of Ground Water [Paperback] Franklin W. Schwartz, Hubao Zhang , 2003; ISBN 0-471-13785-5 2010, Gupta, S. K. Modern Hydrology and Sustainable Water Development, ISBN-10: 1-4051-7124-3 ISBN-13: 978-1-4051-7124-3 - John Wiley & Sons</p> <p>Loucks, D.P., and E. van Beek. 2005. Water Resources Systems Planning and Management: An Introduction to Methods, Models, and Applications. Paris, France: UNESCO Press. Available online at http://ecommons.library.cornell.edu/handle/1813/2798.</p> <p>WEAP Tutorial: http://www.weap21.org/downloads/WEAP_Tutorial.pdf WEAP Manual: http://www.weap21.org/downloads/WEAP_User_Guide.pdf</p>

ECON	Water Conservation			
ECTS Points	Credit Hours	Lectures (h)	Applications (h)	Individual study (h)
5	3	40	50	60
Prerequisites	Modules BGOV, BICO, BMAN			
Learning Outcomes	<p>After the completion of this course, the participants will be able to:</p> <ul style="list-style-type: none"> • Be familiar with the term “water conservation” and discuss it critically • Distinguish various kinds of application and the necessity of suitable framework conditions • Know the differences between “in-situ water efficiency” and “watershed water efficiency” • Be acquainted with water saving strategies and methods in agriculture, in the domestic sector, and in industrial production • Know examples of how to apply water conservation in practice • Understand various ways of integration of water conservation into land and water development plans and on implementation strategies • Identify the relevant stakeholders. 			
Content	<p>1. Water Conservation Framework Conditions</p> <p>1.1 Overview</p> <p>1.2 Concept of water efficiency, recycling and reuse</p> <p>1.3 In-situ-rainwater use, water harvesting and water conservation in irrigation</p> <p>1.4 Adaption strategies to impacts of global change</p> <p>2. In-Situ water efficiency vs. watershed water efficiency</p> <p>2.1 Definitions</p> <p>2.2 Short term measures</p> <p>2.3 Long term measures</p> <p>3. Water saving strategies in agriculture</p> <p>3.1 in-situ rainwater use</p> <p>3.2 water harvesting</p> <p>3.3 losses and inefficiencies</p> <p>3.4 conservation in irrigated agriculture</p> <p>4. Water saving strategies in domestic and industrial sectors</p> <p>4.1 in-door saving technologies</p> <p>4.2 ECOSAN concept</p> <p>4.3 Outdoor / landscape waster use efficiency</p> <p>4.4 Urban water distribution networks</p> <p>4.5 Industrial production units</p> <p>4.6 Water quality aspects</p>			

5. Applied Water Conservation

- 5.1 Planning steps
- 5.2 Water audits
- 5.3 Cost-Benefit Analysis
- 5.4 Pricing techniques
- 5.5 Incentives
- 5.6 Framework conditions for successful implementation

6. Water Conservation in IWRM

- 1.1 Relationship to IWRM concept
- 1.2 Integration into land and water development plans
- 1.3 Implementation strategies

Assignment	Written Exam (70%), Water Audit (10%), Presentation (20%)
Lecturers	Dieter Prinz (Uni Karlsruhe), Fayez Abdulla (JUST)
Recommended Reading	<p>Asano, T., 1998. Wastewater Reclamation and Reuse (Water Quality Management Library), CRC Press</p> <p>Fangmeier, W., Elliot, W.J. & Worrman, S.R., 2005. Soil and Water Conservation Engineering, Delmar Thomson Learning Publ., 5th ed.</p> <p>Goodarzi, M.& Daghig, Y., 2004. Floodwater Harvesting, a Key to Sustainable Development in Arid and Semi Arid Areas. In: ICID - FAO International Workshop on Water Harvesting and Sustainable Agriculture, Moscow, 7 September 2004, http://www.fao.org/ag/agl/aglw/wh/default.htm</p> <p>Goosen, M. F. A. & Shayya, W.H., 2001. Water Management, Purification, and Conservation in Arid Climates, Three Volume Set. CRC Press, Boca Raton, Fla., USA</p> <p>Gould, J. & Erik Nissen-Petersen, E., 1999. Rainwater Catchment Systems for Domestic Supply: Design, Construction and Implementation, ITDG Publ.</p> <p>Haddadin, M.J. 2006. Water Resources in Jordan: Evolving Policies for Development, the Environment, and Conflict Resolution. Resources for the Future Press (RFF Press)</p> <p>Lancaster, B., 2006. Rainwater Harvesting for Drylands, Vol. I and Vol. II, Chelsea Green Publ. Comp.</p> <p>Mann, J. & Liu, A.Y.,1999. Industrial Water Reuse and Wastewater Minimization, McGraw-Hill Publ.</p> <p>Napier, T.A. & Napier, L. (ed.), 2002. Soil and Water Conservation Policies. Successes and Failures. CRC Press, Boca Raton, Fla, USA</p> <p>Nasri, S., 2002. Hydrological effects of water harvesting techniques. Doctoral thesis, Department of Water Resources Engineering, Lund Institute of Technology, Sweden.</p> <p>Oweis, T., Hachum, A., Bruggeman, A., (eds), 2004. Indigenous Water Harvesting Systems in West Asia and North Africa. ICARDA, Aleppo, Syria. 173 pp.</p> <p>...</p>

EWAP	Water Allocation and Pricing			
ECTS Points	Credit Hours	Lectures (h)	Applications (h)	Individual study (h)
5	3	40	50	60
Prerequisites	Reader 2: Water Economics, Modules: BWEC, BGOV, BICO, BMAN			
Learning Outcomes	<p>After the completion of this course, the participants will be able to:</p> <ul style="list-style-type: none"> Understand policies with regard to issues of improving the use of the scarce resource water know about equity and efficiency issues and related pricing and tariff mechanisms critically analyse key elements of water allocation, like quality, time and place of delivering for water as a productive input apply policy instruments in demand management 			
Content	<p>1. Issues of efficiency and equity</p> <p>1.1 Economic efficient water allocation</p> <p>1.2 Reasons for inefficient water allocation</p> <p>1.3 Criteria of equity</p> <p>1.4 Measuring inequity</p> <p>2. Principles of integrated water resources management</p> <p>2.1 Water supply</p> <p>2.2 Water demand</p> <p>2.3 Waste water treatment</p> <p>3. Factors determining water demand</p> <p>3.1 Residential water demand, issues of metering and measuring</p> <p>3.2 Responsiveness of water demand to price changes, way of water supply etc.</p> <p>3.3 Policy options for managing water demand</p> <p>3.3.1 Tinbergen's rule and other considerations in policy design</p> <p>3.3.2 Policies for residential water demand</p> <p>3.3.3 Policies for water demand for productive uses</p> <p>3.3.4 Interdependencies of water demand policies</p> <p>3.3.5 Franchising</p> <p>3.4 Organisational issues</p> <p>3.4.1 Water users associations etc</p> <p>3.4.2 Franchising</p> <p>3.5 Policy instruments affecting sector, seasonal and regional water use</p> <p>3.6 Policies for waste water treatment</p> <p>3.7 Issues of monitoring water policies</p>			

- 3.8 Issues of enforcing water policies
- 3.9 Discussion of transboundary issues
- 4. Conservation methods**
- 4.1 Project appraisal
- 4.1.1 Measuring costs related to water use
- 4.1.2 Measuring benefits of water use
- 4.1.3 Cost effectiveness
- 4.1.4 Cost benefit
- 4.1.5 Equity considerations
- 4.2 Discussions of various conservation methods
- 5. Final discussions**

Assignment	Written Examination (100%)
Lecturers	Klaus Froberg (ZEF), Sabine Schlüter (ITT), Mohammad Al-Saidi (ITT)

TEPR	Team Project			
ECTS Points	Credit Hours	Lectures (h)	Applications (h)	Individual study (h)
5	1		60	90
Rationale	<p>In their future professional career graduates of the MSc IWRM will frequently need to work in expert-teams to assess water resources system, to identify and assess ongoing water related problems, to develop and evaluate solutions and to sketch and formulate comprehensive water resources plans. These teams will typically be multi-disciplinary and often multi-cultural. In order to be an efficient member of such a team, the participants need to bring along the necessary technical qualifications and at the same time the communicative and managerial skills necessary for successful group work. Thus, a case study will be offered during the first semester in Jordan. Here, students apply the knowledge they acquire from the “basic” and “specialized” modules and practice team work, communication, reporting, presentation, and management skills.</p>			
General Objective of the module	<p>Apply the various tools and methods of comprehensive water resources assessment to a particular case; analyse the water resources problems and dilemma in the given case study area and discuss, document and present their findings to the rest of the master course students.</p>			
Learning Outcomes	<p>A graduate of the case study modules should be able to:</p> <ul style="list-style-type: none"> • apply tools to assess water availability, quality and demand, identify water resources issues • apply tools to analyse the legal and political framework of a given study area • draft an institutional landscape of a given study area • identify stakeholders for a given water resources system with defined water resources issues • describe, assess, evaluate and discuss water related problems • organise a team defining the roles and rules of each team member • develop a project management plan for an interdisciplinary team, work including definition of tasks, milestones, deadlines and indicators of success • draw up a data and information management plan for a project • use internet based tools to communicate in interdisciplinary teams • develop a project monitoring plan and conduct self evaluation of the team work • present the relevant findings adequately in written and oral form 			
Content	<ul style="list-style-type: none"> • The students will work in teams of 5-6 members • each team can suggest a real case study, additional case studies will be provided. • The team should solve the problem rather independently. Tutors will provide certain support to the team in questions on team organisation and management. 			

- Each team will self-organise their work by dividing tasks (according to specialties of the team members), defining roles (facilitation, documentation, literature research, project scheduling, M&E, reporting, presentation etc), the tutors role is merely that of a back stopper.
- Each team will write a comprehensive document reporting on the assessment and problem analysis of the study area or project.
- Each team presents the findings to the rest of the course for discussion and comparison.

Coordinators Manar Fayyad, Lars Ribbe

MTPR	Master Thesis Preparation			
ECTS Points	Credit Hours	Lectures (h)	Applications (h)	Individual study (h)
5	1	20	20	110
Learning Outcomes	<p>After the completion of this module, the participants will be able to:</p> <ul style="list-style-type: none"> • Formulate the scope and context of a scientifically relevant problem • Derive objectives of an independent research work to solve a defined problem • Select and describe adequate methods to meet the stated objectives • Define the required resources and time schedule to successfully implement a research project • Adequately present a scientific project 			
Content	<ol style="list-style-type: none"> 1. Principles of scientific work 2. Literature research methods 3. Analyse and evaluate the state of the art and research demands 4. Scientific writing 5. Research planning and scheduling 6. Effective presentation of a research project 			
Lecturers	Lars Ribbe, Manar Fayyad, Aline Bussmann, Mohammed Al-Saidi			

MT	Master Thesis and Colloquium			
ECTS Points	Credit Hours	Lectures (h)	Applications (h)	Individual study (h)
30	9	0	0	900
Prerequisites	Achievement of 55 Credit Points, Module MTPR: Master Thesis Preparation			
Learning Outcomes	The topic of the Master thesis shall enable the students to apply their IWRM-knowledge to analyse a complex problem situation in a water related field, and to develop sustainable concepts for improvement of the situation. The students are encouraged to produce the Master thesis in a mixed team of two to three people. The Arab-European mix will enable the learning effect in intercultural co-operation. The mix of social and natural sciences will enable an inter-disciplinary approach.			
Content	The students shall find the topic of their Master thesis in a country which is not their home country, so that they have a chance to work in a different physical, institutional and social framework and will be able to compare this with their own country. The topic of the thesis should be applied to a real project and shall be developed with local partners in the Arab region. The thesis must be submitted within 4 month after starting date.			
Assessment method	Thesis Report			
Supervision	Thesis will be supervised by the lecturer/professor who proposed the topic. In case of cooperation with external institutions and organisations, the supervision will be shared.			

STUDY AND EXAMINATION REGULATIONS

OVERVIEW

Being a participant in the IWRM Program means studying and graduating from two universities on different continents and with different educational systems. Consequently, the universities had to find an agreement on allowing the student to study abroad and approving the equivalence of examinations and credits. Nevertheless, the IWRM Program has to obey to two study and examination regulations, that essentially differ from each other. The reason for that is the awarding of a double degree instead of a joint degree to graduates of the MSc IWRM Program.

Generally speaking, for all modules taken in Jordan students have to refer to the regulations of the University of Jordan. All modules offered in Germany obey to the Regulations of Cologne University of Applied Sciences.



EXAMINATIONS

TYPES OF ASSIGNMENTS

Within the IWRM Master Program, each module is graded based on a range of individual assignments, group work and participation in class. Individual assignments may be in the form of essays (field reports, term papers), presentations (oral, powerpoint, poster), written exams (essays, multiple choices), exercises (written, computer based) and role plays (individual performance). Group assignments are assessed based on the overall quality of the group work delivered. According to the UJ examination regulation, the minimum criterion to pass a module requires 80% of participation in class.

EXAMINATION DATES

Written exams and presentations are usually scheduled at the last day of each module. Essays or exercises may be due at a later date, depending on the required work load.

The results of the exams will be accessible through the ILLIAS website or sent by e-mail. Normally they are posted no later than six weeks after the exam. There are only two opportunities to take an exam in the same module, after that the course lecturer should be contacted and the matter discussed with the examination board. Once registered for an exam, students are using one of their two opportunities of taking an exam, even if they are not present in the actual exam.

EXAMINATION BOARD

All examinations are graded by the lecturers of the respective module, the final grades of each semester are approved by the Examination Board. Currently the Examination Boards have the following composition:

Cologne University of Applied Sciences:

- Prof. Dr. Sabine Schlüter (Chairman)
- Prof. Dr. Lars Ribbe (Dep. Chairman)
- M. Sc. Aline Bussmann
- M. Eng. Silke Meilwes (Dep. of Aline Bussmann)
- One student repres. of IWRM

University of Jordan:

A committee of graduate studies is set up at the WEEC that has to agree on the proposals submitted by the students, on the committees of defenses and on endorsing the results of defenses conducted by the examination committee of each student.

GRADING SYSTEM

The two universities involved in the IWRM Master program use different grading systems that are presented below. Note that the minimum pass grade for each module at the University of Jordan is C+, The minimum aggregate pass average to obtain a master of science degree is B. At the Cologne University of Applied Sciences, the minimum pass grade for both modules and aggregate average is 4,0.

THE GRADING SYSTEM AT COLOGNE UNIVERSITY OF APPLIED SCIENCES:

Grade	Designation	Translation
1.0	sehr gut	Very good
1.3		
1.7	gut	Good
2.0		
2.3		
2.7	befriedigend	Satisfactory
3.0		
3.3		
3.7	ausreichend	Sufficient
4.0		
5.0	nicht ausreichend	Fail

THE GRADING SYSTEM AT UNIVERSITY OF JORDAN:

Grade	Point Rating	Designation
A	4.0	Excellent
A-	3.75	
B+	3.5	Very Good
B	3.0	
B-	2.75	Good
C+	2.5	
C	2.0	Satisfactory
C-	1.75	
D+	1.5	Weak
D	1.0	
D-	0.75	
F	Zero	

For further information regarding the grading systems and examination matters, please refer to the Study and Examination Regulations of the Universities that are available on ILIAS: [Magazin>ITT>IWRM>Administration>Student_service>Examination.](#)



REGULATIONS

TRANSFER SYSTEM

In order to cope with different grading systems of the two universities, a common transfer system has been developed and is presented below. For each individual assignment, grades are determined by "Points out of 100". The overall module grade is composed of each individual grade, together with a respective weight (% out of 100). For all modules that are offered in the IWRM MSc Program, points will be transferred into letter grades for the University of Jordan, and into German Grades for the Cologne University of Applied Sciences according to the following transfer table:

Cologne University of Applied Sciences			The University of Jordan		
Points	German Grade	Transfer to Jordan	Points	Jordanian Grade	Transfer to Germany
100 - 95	1,0	A	relative distribution	A	1,0
94 - 90	1,3	A-		A-	1,3
89 - 85	1,7	B+		B+	1,7
84 - 80	2,0	B		B	2,0
79 - 75	2,3				
74 - 70	2,7	B-		B-	2,7
69 - 65	3,0	C+		C+	3,0
64 - 60	3,3				
59 - 55	3,7				
54 - 50	4,0				
49 - 0	5,0	F	F	5,0	

MASTER THESIS

At the University of Jordan, the registration for the master thesis can be done earliest in the third semester. At Cologne University of Applied Sciences, the registration can be done after achieving 55 ECTS credit points through modules offered or recognized through the IWRM course coordination committee. At least 11 modules, including the module "Preparation of master thesis" must be completed.

EXAMINATION

Each university has different examination regulations regarding the master thesis. While the details are specified in the examination regulations the most important points are repeated here:

Jordan: For the UJ a minimum of five examiners is required. The exam commission must consist of the thesis supervisor, three internal examiners (UJ) and one external examiner. The thesis supervisor represents the chair of commission and appoints the other examiners.

Cologne: For the ITT a minimum of two examiners is required. One examiner is usually member of the supervisory team. The second examiner should be from outside the supervisory team. He or she is usually suggested by the main supervisor of the thesis and may be external to the university. The examiners will be recommended by the main supervisor and appointed by the examination board of the ITT. Examiners: Supervisor, two or more examiners (from inside or outside ITT).

In order to avoid the double submission and to defend the thesis twice, CUAS and UJ agreed to a common procedure related to the examination of the thesis. At the end of the third semester, joint evaluation committees will meet and listen to the presentation of the candidate (20 minutes) followed by questions of each examiner to the candidate. The committee will then decide on the grade (for ITT purposes) or on the type of pass or fail (for UJ purposes).

GRADING

At Cologne University of Applied Sciences, the thesis grade is made up of the arithmetic mean of the individual grades of all examiners. If no consensus on the grade can be reached within the exam committee the examination board will appoint an additional examiner to evaluate the thesis. In this case, the grade is determined as the arithmetic mean of the single grades. However, the master thesis can be graded as having passed only if all examiners give a grade of 4.0 or better.

The grade of the written master thesis represents 30% of the final MSc degree, the grade of the oral master thesis exam (thesis defence) represents 10% of the final MSc degree. The remaining 60% are composed of all modules during the course of studies.

At the University of Jordan, students have to register 9 credit hours. The result of the defence (oral exam) is “pass”, “fail”, or “amendment” of thesis. In case of “amendment”, the student is asked to do corrections according to suggestions from the exam commission within a time frame of 2 weeks to 4 months, depending on the magnitude of deficiencies. The corrected thesis is to be handed in on time without having to be defended orally.

For further information on the examination and grading of master thesis, please refer to the examination regulations on ILIAS. Furthermore a common master thesis guideline has been developed and is accessible on the ILIAS platform. All documents can be found on ILIAS:

Magazin>ITT>IWRM>Administration>Student_
service>Examination.



