

**Ministry of Higher Education and Scientific Research
Scientific Supervision and Scientific Evaluation Apparatus
Directorate of Quality Assurance and Academic Accreditation
Accreditation Department**



Academic Program and Course Description Guide

2026

Introduction:

The MSc in Water Resources and Environment Engineering is an advanced academic program designed to provide graduate students with specialized knowledge, research skills, and professional competencies in the fields of water resources management, hydraulic engineering, environmental protection, and sustainable development. The program integrates theoretical foundations, advanced analytical techniques, and practical applications to address contemporary challenges related to water scarcity, climate change, environmental pollution, and the sustainable utilization of natural resources.

The program offers a comprehensive framework of coursework, research activities, and scientific experiences aimed at developing highly qualified engineers and researchers capable of contributing effectively to academic, industrial, and governmental sectors. Through advanced study and independent research, students acquire the ability to analyze complex engineering problems, develop innovative solutions, apply modern technologies, and conduct scientific investigations that support sustainable water and environmental management.

The academic program description provides a concise overview of the program's structure, objectives, learning outcomes, and educational strategies. It reflects the program's commitment to quality assurance, continuous improvement, and alignment with national and international standards for postgraduate education. Furthermore, it serves as an

essential document for academic accreditation and program evaluation processes.

This description has been prepared in accordance with the guidelines of the Ministry of Higher Education and Scientific Research and incorporates recent developments in postgraduate education and quality assurance systems. It aims to ensure the effective implementation of the educational process, enhance academic excellence, and support the preparation of graduates who can contribute to scientific advancement and sustainable development at the local, regional, and international levels.

Academic Program Description Form

University Name: Wasit University

Faculty/Institute: College of Engineering

Scientific Department: Civil Engineering

Academic or Professional Program Name: Water Resources and Environment
Engineering

Final Certificate Name: MSc in Water Resources and Environment
Engineering

Academic System: Course

Description Preparation Date: 1/9/2026

File Completion Date: 9/9/2026

Signature:

Head of Department Name:

Asst. Prof. Dr. Alaa Kharbat Shadhar

Date: 9/9/2026

Signature:

Scientific Associate Name:

Asst. Prof. Dr. Mohammed Ghalib

Date: 9/9/2026

The file is checked by: Asst. Prof. Dr. Haider Majid Hasan

Department of Quality Assurance and University Performance

Director of the Quality Assurance and University Performance Department:

Date: 9/9/2026

Signature:

Approval of the Dean

Prof. Dr. Thaer Saoud Salman

Date: 9/9/2026

1. Program Vision

To achieve excellence in postgraduate education, scientific research, and innovation in the fields of water resources and environmental engineering, and to become a leading academic program that contributes to sustainable water management, environmental protection, and the development of engineering solutions that support societal well-being and sustainable development.

2. Program Mission

The mission of the MSc program in Water Resources and Environment Engineering is to prepare highly qualified engineers and researchers through advanced education, scientific research, and practical applications. The program seeks to develop graduates capable of addressing complex challenges related to water resources, hydraulic systems, environmental sustainability, pollution control, and climate change adaptation through innovative and sustainable engineering solutions.

3. Program Objectives

1. Provide students with advanced theoretical and practical knowledge in water resources and environmental engineering.
2. Develop the ability to conduct independent scientific research and apply advanced analytical and computational techniques to solve engineering problems.
3. Prepare graduates to design, manage, and optimize water resources systems and environmental infrastructure in accordance with sustainability principles.
4. Enhance graduates' capabilities in identifying, assessing, and mitigating environmental impacts associated with engineering activities.
5. Strengthen communication, leadership, teamwork, and professional ethics necessary for multidisciplinary engineering practice and research.
6. Promote innovation and lifelong learning to keep pace with emerging technologies and developments in water and environmental engineering.
7. Support collaboration with governmental agencies, research institutions, and industry sectors to address local, regional, and global water and environmental challenges.

8. Contribute to sustainable development through research and engineering solutions that improve water security, environmental quality, and resource management.

4. Program Accreditation

The MSc in Water Resources and Environment Engineering is committed to meeting the requirements of national academic quality assurance standards and the regulations of the Ministry of Higher Education and Scientific Research. The program continuously reviews and improves its curriculum, research activities, and educational outcomes in preparation for academic accreditation and alignment with international standards for postgraduate engineering education.

5. Other external influences

Ministry of Higher Education and Scientific Research

Master's degree in Water Resources and Environment Engineering

General notes:

1. The duration of study to obtain a master's degree in Water Resources and Environment Engineering is two calendar years after the initial university study until the end of the thesis defense. The College Council has the right to extend it for six months, and the University Council has the right, according to its conviction, to extend it for another six months only.
2. The number of study units during this period is (36) study units, including the thesis, (24) units for the total of the two semesters, and (12) study units including the thesis.
3. Units are calculated based on what was stated in Articles 19 and 20 of Chapter Two of the Postgraduate Studies Instructions and their amendments, as follows: (Every theoretical hour = one unit, every two hours in the applied project = one unit).
4. The admission plan according to the new innovation includes the following: (2) a student on the public channel, (1) a student on private expense, and the admission plan is determined for each academic year according to the academic contexts.

Curriculum First Semester

Code	Subject (Eng.)	Subject (Ar.)	Hour	Units
MWRE-702	Integrated Water Resources Management	الإدارة المتكاملة للموارد المائية	3	3
MWRE-708	Open Channel Flow	القنوات المفتوحة	2	2
MWRE-710	Advanced Wastewater Treatment	معالجة متقدمة لمياه الصرف	2	2
MWRE-705	Advanced Applied Hydrology	هيدرولوجيا تطبيقي متقدم	2	2
MWRE-728	English Language	لغة إنكليزية	2	0
MWRE-731	Water Sustainability and Conservation	استدامة المياه والحفاظ عليها	3	3
Total			12	12

Curriculum Second Semester

Code	Subject (Eng.)	Subject (Ar.)	Hour	Units
MWRE-706	Advanced Hydraulic Structures	منشآت هيدروليكية متقدمة	2	2
MWRE-726	Ground Water	المياه الجوفية	2	2
MWRE-714	River Pollution	تلوث انهار	2	2
MWRE-727	Advanced Fluid Mechanics	ميكانيك موائع متقدم	2	2
MWRE-730	Research Methodology	طرق بحثية	2	2
MWRE-732	Water Risk Assessment under Climate Change	تحليل المخاطر المائية تحت تأثير تغير المناخ	2	2
Total			12	12

6. Expected learning outcomes of the program	
Knowledge	
1A	The ability to identify, formulate, and solve engineering problems using the principles of mathematics, science, and engineering
2A	The ability to conduct experiments, analyze data, and interpret results to reach sound engineering conclusions
Skills	
1B	The ability to design engineering systems or components that meet specified needs within realistic constraints
2B	The ability to communicate effectively, both orally and in writing, with diverse audiences
3B	The ability to work effectively in teams and manage projects efficiently in multidisciplinary environments
Ethics	
1C	Understanding ethical and professional responsibilities and the impact of engineering solutions on society and the environment
2C	The ability for continuous self-directed learning and keeping up with scientific and technological developments

7. Teaching and Learning Strategies
1. Theoretical Lectures: Serving as the primary means of delivering fundamental scientific knowledge. 2. Projects and Assignments: Particularly graduation projects and reports, aimed at developing design and innovation skills. 3. Presentations and Classroom Discussions: To strengthen communication and teamwork skills. 4. Field Visits: To connect students with real-world engineering practice. 5. E-Learning / Learning Management Systems (LMS): Through the use of electronic platforms and digital materials. 6. Self-Learning: Encouraging students to engage in independent research and utilize scientific resources

8. Evaluation methods
Implemented at all stages of the program in general.
Quizzes
Assignments
Projects
Report
Midterm Exam

9. Faculty					
Faculty Composition		Specialization		Academic Rank	
PT	FT			General	
	Permanent	Specific Specialization	Major	PhD, MSc, etc	Name
	Permanent	Environment	Civil Engineering	PhD	احمد حميد شهاب
	Permanent	Environment	Civil Engineering	PhD	احمد عادل ناجي
	Permanent	Environment	Civil Engineering	PhD	صلاح لفقة فرحان
	Permanent	Project management	Civil Engineering	PhD	علاء خرياط شذر
	Permanent	Environment	Civil Engineering	PhD	علي جويد جعيل
	Permanent	Water resources	Civil Engineering	PhD	علي ناصر حلو
	Permanent	Environment	Civil Engineering	PhD	علي وحيد نعيمش
	Permanent	roads	Civil Engineering	PhD	مقداد منذر عبدالغني
	Permanent	Water resources	Civil Engineering	PhD	نذير صلاح الدين أيوب
	Permanent	Water resources	Civil Engineering	PhD	نور قاسم صبري
	Permanent	environment	Civil Engineering	PhD	نورالهدى علاء الدين جاسم

10. Professional Development
Mentoring new faculty members
☐ Orientation Program: An introductory session upon appointment covering the college mission, program objectives (PEOs), and learning outcomes (GOs). Explanation of department systems: Outcome-Based Education (OBE), quality assurance, and assessment mechanisms.
☐ Academic Advising:

Assignment of an experienced faculty member as an academic supervisor/mentor for each new member.

Providing support in lecture preparation, teaching strategies, and classroom management.

☐ Training in Teaching and Learning Strategies:

Involving new members in workshops on:

Effective teaching methods.

Preparing exams and rubrics for student assessment.

☐ Research Preparation and Publication:

Workshops on how to write and publish research papers.

☐ Continuous Professional Development:

An annual plan for each faculty member, including participation in workshops and training courses.

☐ Administrative Support:

Familiarization with university regulations, rights, and responsibilities.

11. Professional development of faculty members

☐ Workshops and Training Courses:

On teaching strategies and active learning.

On the use of e-learning systems (LMS) and distance learning tools.

On preparing rubrics and modern assessment tools.

☐ Scientific Conferences and Seminars:

Participation in research presentations or attendance at local and international conferences.

Exchange of expertise with other universities.

Participation in external training programs.

☐ Scientific Research and Publication:

Support for applied research and community-related projects.

Encouragement of publication in reputable scientific journals (Scopus, WoS).

Provision of financial or time support to facilitate research completion.

☐ Self-Assessment and Feedback:

Student surveys on faculty performance.

Annual performance evaluation.

12. Acceptance Criterion

1. He obtained a bachelor's degree in Civil Engineering.
2. Implementing the provisions of the conditions for applying for postgraduate studies in force in the Iraqi Ministry of Higher Education and Scientific Research

13. The most important sources of information about the program

1. The official website of the college/university.
2. Publication on the notice board.
3. Sending via the official email upon request.

14. Program Development Plan

- 1 .Curriculum and Course Development
- 2 .Achievement of Learning Outcomes (GOs)
- 3 .Development of Teaching and Assessment Methods
- 4 .Capacity Building for Faculty Members
- 5 .Development of Infrastructure and Laboratories
- 6 .Strengthening the Relationship with the Labor Market and the Community
7. Continuous Improvement

Program Skills Map										
Program Learning Outcomes										
Values		Skills			Knowledge		Core, supportive or basic	Name	Code	Level
2C	1C	3B	2B	1B	2A	1A				
★		★			★		Core	Integrated Water Resources Management	MWRE-702	First Semester
★			★		★		Core	Open Channel Flow	MWRE-708	
	★	★				★	Core	Advanced Wastewater Treatment	MWRE-710	
★				★	★		Core	Advanced Applied Hydrology	MWRE-705	
	★	★				★	Core	English Language	MWRE-728	
★		★			★		Core	Water Sustainability and Conservation	MWRE-731	

Program Skills Map										
Program Learning Outcomes										
Values		Skills			Knowledge		Core, supportive or basic	Name	Code	Level
2C	1C	3B	2B	1B	2A	1A				
	★	★				★	Core	Advanced Hydraulic Structures	MWRE-706	Second Semester
★		★			★		Core	Ground Water	MWRE-726	
★		★				★	Core	River Pollution	MWRE-714	
★		★			★		Core	Advanced Fluid Mechanics	MWRE-727	
	★	★				★	Core	Research Methodology	MWRE-730	
★				★	★		Core	Water Risk Assessment under Climate Change	MWRE-732	

MODULE DESCRIPTION FORM

نموذج وصف المادة الدراسية

Module Information معلومات المادة الدراسية			
Module Title	Advanced Applied Hydrology	Credits	3
Administering Department	Water Resources and Environmental	College	Engineering
Module Leader	Dr. Laith B. Al-Baderanee	E-mail	laithbder@uowasit.edu.iq
Module Leader's Acad. Title	Lect. Dr.	Module Leader's Qualification	PhD in water resources and environmental engineering

Module Aims, Learning Outcomes and Indicative Contents أهداف المادة الدراسية ونتائج التعلم والمحتويات الإرشادية	
Module Aims أهداف المادة الدراسية	The aim of this course is to introduce the students to the area of hydrological processes and practices including introduction to the Hydrology. The course will cover discussion of the basic physical principles of the water cycle, different climate factors and components (evaporation, condensation, precipitation, runoff, stream flow). At the end of the course the students will have a working knowledge for estimating Precipitation in different methods as well as Abstraction from Precipitation, Evapotranspiration, Stream flow Measurement, Run-Off, Hydrograph, and Flood Routing and have the skills of analytical skills (analyze data collected in the field and examine the results) and Communication skills (prepare detailed reports that document their research methods and findings). This will be achieved through descriptive lectures with Preparing hydrological reporting and supervised tutorials. Also the tools for verifying and evaluating flow rates and flood hydrograph. Detailed hydrological studies or statistical methods for hydrology and numerical modelling applications for hydrology are addressed during the teaching. To understand water expenditures and forecasting future water expenditures. And to determine the volume of reservoirs and simple hydraulic components.
Module Learning Outcomes مخرجات التعلم للمادة الدراسية	The module aims to deepen the topics related to the hydrological inflow-outflows modelling and to apply the tools of statistical hydrology in order to provide the student with criteria and technical guidelines for the verification and evaluation of flow rates and flood hydrographs. In the Advanced Applied Hydrology module, probabilistic methods will be applied for the direct determination of design rainfall and floods and for the verification and re-examination of historical events; furthermore, several indirect methods (Hydrological models) will be developed and applied for the

	determination of discharge and flood hydrograph. Particular attention will be paid to the determination of flood hydrographs needed in the assessment of the hydraulic hazard. So The course aims to provide students with the tools for verifying and evaluating flow rates and flood hydrograph. Detailed hydrological studies or statistical methods for hydrology and numerical modelling applications for hydrology are addressed during the teaching, also the students will learn the theory of water infiltration and evaporation and their effects on estimation of available water and flood analysis also the students will learn theories of flood routing including reservoir and channel routing in flood forecasting. also the students will learn theories of unit hydrograph and applications on flood forecast including peak discharge and time of peak occurrence.
Indicative Contents المحتويات الإرشادية	• Indicative content includes the following. • Part A – Introduction and Climate Factors an introduction to the Hydrology. Climate Factors, Precipitation, Evapotranspiration, Abstraction from Precipitation • Part B – CN-SCS • Part C – Stream Flow Measurement, Run-Off, • Part D – hydrologic details Hydrograph, Flood Routing

Learning and Teaching Strategies استراتيجيات التعلم والتعليم	
Strategies	The main strategy that will be adopted in delivering this module has several components that include Lectures: To provide theoretical knowledge and foundational concepts Individual & group assignments. 3 assignments have to be submitted within the deadlines to be admitted to the exams. Field visits and e-learning platforms. Exercises involving the use of computer applications tools to understand the hydrologic processes. Group Discussions and Presentations: To encourage critical analysis and peer learning. Examinations: To assess both theoretical understanding and practical skills.

Delivery Plan (Weekly Syllabus) المنهاج الاسبوعي النظري	
Material Covered	
Week	lecture
Week 1	Theory of frequency analysis for design storms and design floods.
Week 2	Measurement of evaporation and estimation of potential evaporation
Week 3	Infiltration, Factors affecting infiltration, Measurement and estimation of infiltration process
Week 4	Time of concentration , Tr-55
Week 5	Rainfall-runoff relation

Week 6	CN-SCS method
Week 7	Hydrograph, Direct runoff and unit hydrographs analysis, instantaneous unit hydrographs-
Week 8	Theoretical Mid-term Exam
Week 9	Hydrograph application, Time Area Models and Synthetic Unit Hydrographs
Week 10	Frequency analysis normal distribution, gamble-person distributions.
Week 11	Applications to hydrographic extremes-floods and droughts.
Week 12	Flood control measures, flood forecasting techniques.
Week 13	Flood routing-river routing and reservoir routing methods.
Week 14	Statistical distributions and their applications in flood analysis.
Week 15	Rainfall-Runoff processing

Learning and Teaching Resources مصادر التعلم والتدريس		
	Text	Available in the Library?
Required Texts	Chow V.T., Maidment D.R., Mays L.W., Applied hydrology, New York, McGraw-Hill, 1988.	Available
Recommended Texts	Kottegoda N.T., Rosso R., Statistics, Probability, and Reliability for Civil and Environmental Engineers, New York, McGraw-Hill, 1997	Available

MODULE DESCRIPTION FORM

نموذج وصف المادة الدراسية

نموذج وصف المادة الدراسية

Module Information معلومات المادة الدراسية			
Module Title	Modern Irrigation Techniques	Credits	3
Administering Department	Water Resources and Environmental	College	Engineering
Module Leader	Laith B. Al-Baderanee	E-mail	laithbder@uowasit.edu.iq
Module Leader's Acad. Title	Lect.Dr.	Module Leader's Qualification	PhD in water resources and environmental engineering

Module Aims, Learning Outcomes and Indicative Contents أهداف المادة الدراسية ونتائج التعلم والمحتويات الإرشادية	
Module Aims أهداف المادة الدراسية	1- To take up the basic concepts of irrigation and construction of various hydraulic structures. 2. To introduce students to basic concepts of water, plants, their interactions, as well as irrigation and drainage systems design, planning and management. 3. The structures involved the elementary hydraulic design of different structures and the concepts of maintenance shall also form part. 4. To develop analytical skills relevant to the areas mentioned above, particularly the design of irrigation and drainage projects - Supply scientific and technical knowledge on soil hydrology and irrigation techniques. - The course provides criteria for design and management of irrigation systems, with particularly reference to sprinkler and drip irrigation system (surface and subsurface).
Module Learning Outcomes مخرجات التعلم للمادة الدراسية	On the completion of the course, one should be able to understand: - Concepts of irrigation and different hydraulic structures. - How to estimate the quantity of water required by crops. - Be able to plan and design irrigation projects. - Design channels and other irrigation structures required for irrigation, drainage, soil conservation, flood control and other water-management projects

Indicative Contents المحتويات الإرشادية	• Indicative content includes the following. • 1. Introduction: Necessity of irrigation- scope of irrigation engineering- benefits and ill effects of irrigation-irrigation development in India- types of irrigation systems, Soil-water plant relationship: Classification of soil water- soil moisture contents- depth of soil water available to plants permanent and ultimate wilting point • 2. Water requirements of crops: Depth of water applied during irrigation- Duty of water and delta improvement of duty command area and intensity of irrigation consumptive use of water and evapotranspiration irrigation efficiencies- assessment of irrigation water • 3. Methods of Irrigation: Classification- choice of method of irrigation- surface and subsurface irrigation methods, Sprinkler and Drip Irrigation • 4. Design of Irrigation Channel: Alignment- canal capacity- losses- FSL of canal- design of canal in alluvial soil and non alluvial soils- Kennedy's silt theory- Lacey's regime theory- balancing depth- use of Garrets diagrams and Lacey's Regime diagrams- lining of irrigation channels- design of lined canal drainage behind lining. Water logging: Causes, Measures: surface and subsurface drains, land reclamation • 5. Diversion head works: Types- selection of the suitable site for the diversion headwork components of diversion headwork- Causes of failure of structure on pervious foundation- Khosla's theory- Design of concrete sloping glacis weir • 6. Cross drainage works: Types- selection of suitable type of CD works- aqueduct and Syphon aqueduct determination of maximum flood discharge and waterway for drain, fluming of canal- uplift pressure on underside of barrel roof and at the floor of the culvert- design of bank connections • 7. Canal regulation works: • Canal fall- necessity and location- types of falls- Cross regulator and distributory head regulator- their functions, Silt control devices, Canal escapes- types of escapes.
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Learning and Teaching Strategies استراتيجيات التعلم والتعليم	
Strategies	• The main strategy that will be adopted in delivering this module is to encourage students' participation in the exercises, while at the same time refining and expanding their critical thinking skills. This will be achieved through classes, • Lectures: To provide theoretical knowledge and foundational concepts. • Group Discussions and Presentations: To encourage critical analysis and peer learning. • Project-Based Assignments: Practical application of irrigation process methods to real-world problems.

- **Examinations:** To assess both theoretical understanding and practical skills.

Delivery Plan (Weekly Syllabus) المنهاج الاسبوعي النظري	
Material Covered	
Week	lecture
Week 1	Introduction: Necessity of irrigation- scope of irrigation engineering- benefits and ill effects of irrigation-irrigation development in India- types of irrigation systems
Week 2	Soil-water plant relationship: Classification of soil water- soil moisture contents- depth of soil water available to plants permanent and ultimate wilting point
Week 3	Water requirements of crops: Depth of water applied during irrigation- Duty of water and delta improvement of duty command area and intensity of irrigation consumptive use of water and evapotranspiration irrigation efficiencies- assessment of irrigation water
Week 4	lining of irrigation channels- design of lined canal drainage behind lining. Water logging: Causes, Measures: surface and sub-surface drains, land reclamation
Week 5	Design of Irrigation Channel: Alignment- canal capacity- losses- FSL of canal- design of canal in alluvial soil and non alluvial soils- Kennedy's silt theory- Lacey's regime theory- balancing depth- use of Garrets diagrams and Lacey's Regime diagrams
Week 6	Diversion head works: Types- selection of the suitable site for the diversion headwork components of diversion headwork-
Week 7	fluming of canal- uplift pressure on underside of barrel roof and at the floor of the culvert- design of bank connections
Week 8	Methods of Irrigation: Classification- choice of method of irrigation- surface and subsurface irrigation methods, Sprinkler and Drip Irrigation.
Week 9	Theoretical exam
Week 10	Canal regulation works: Canal fall- necessity and location- types of falls- Cross regulator and distributary head regulator- their functions, Silt control devices, Canal escapes- types of escapes
Week 11	Causes of failure of structure on pervious foundation- Khosla's theory- Design of concrete sloping glacis weir
Week 12	Cross drainage works: Types- selection of suitable type of CD works- aqueduct and Syphon aqueduct determination of maximum flood discharge and waterway for drain
Week 13	Surface Irrigation Localized Irrigation Sprinkler Irrigation Centre Pivot Irrigation Sub Irrigation Manual Irrigation Traditional Methods Modern Methods Sprinkler System Drip System
Week 14	Surface Irrigation Localized Irrigation Sprinkler Irrigation Centre Pivot Irrigation Sub Irrigation Manual Irrigation Traditional Methods Modern Methods Sprinkler System Drip System
Week 15	Surface Irrigation Localized Irrigation Drip Irrigation Sub Irrigation Manual Irrigation

Learning and Teaching Resources مصادر التعلم والتدريس		
	Text	Available in the Library?
Required Texts	Sharma, R.K., Text book of Irrigation Engineering and Hydraulic Structures, Oxford and IBK Publishing House, New Delhi.	available online
Recommended Texts	Modi, P.N., Irrigation Water Resources and Water Power Engineering, Standard Book House, New Delhi	available online

MODULE DESCRIPTION FORM

نموذج وصف المادة الدراسية

Module Information			
معلومات المادة الدراسية			
Module Title	Advanced Fluids Mechanics	Credits	3 units
Administering Department	Civil Engineering Department	College	Collage Of Engineering
Module Leader	Ali Jwied Jaeel	E-mail	alijwaid@uowasit.edu.iq
Module Leader's Acad. Title	Professor	Module Leader's Qualification	PhD

Module Aims, Learning Outcomes and Indicative Contents	
أهداف المادة الدراسية ونتائج التعلم والمحتويات الإرشادية	
Module Aims أهداف المادة الدراسية	- Define and explain in detail the fundamental relationships, laws and equations in fluid and gas dynamics - Provide an in-depth explanation of important advanced fluids concepts such as laminar and turbulent flow, instabilities, vortex formation, and drag and lifting forces.
Module Learning Outcomes مخرجات التعلم للمادة الدراسية	: - apply fluid dynamical equations and conservation laws to solve advanced fluids mechanics problems. - solve in-depth problems in hydrostatics and calculate pressure forces - apply dynamic similarities and dimensional analysis in problem solving - analyze viscous flows in channels and pipes, as well as drag forces and time relaxation. - An ability to distinguish, identify, define, formulate, and solve fluid mechanics engineering problems by applying principles of engineering. - An ability to perceive the continual necessity for professional knowledge growth and how to find, assess, assemble and apply it properly. - Understand how the equations of fluid motion are applied to flows near walls - Understand the importance of the boundary layer in engineering applications - Understand the role of turbulence in engineering applications.
Indicative Contents	This content will cover selected advanced topics in fluid mechanics. Building on previous fluids courses,. Turbulence and boundary layers. Topics covered

المحتويات الإرشادية	include Navier-Stokes equations applied to wall-bounded flows, similarity solutions of the boundary-layer equations, Blasius solution, Falkner-Skan solution, separated flows, turbulent boundary layers, Reynolds-averaged Navier-Stokes equations, dimension analysis, pipe friction, Von Karman momentum integral equation, roughness. It also covers an array of subjects in fluid mechanics: Fundamental laws of conservation for Newtonian fluid flow. Complex potential theory, classical analysis for ideal flow around bodies, Vortex dynamics and conserved quantities of vortices. Fundamentals of stability analysis, classical analysis of important instabilities in fluid flow.
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Learning and Teaching Strategies استراتيجيات التعلم والتعليم	
Strategies	Lectures, Questions and Answers.

Delivery Plan (Weekly Syllabus) المنهاج الاسبوعي النظري	
Material Covered	
Week	lecture
Week 1	Basic Laws: Conservation of Mass, Pressure, Momentum, and Energy
Week 2	Types of fluid flow (steady, unsteady, uniform, non-uniform, laminar and turbulent flow, one dimensional flow, two dimensional flow, three dimensional flow. Rotational and irrotational flows , compressible and incompressible flows
Week 3	Types of fluid flow (steady, unsteady, uniform, non-uniform, laminar and turbulent flow, one dimensional flow, two dimensional flow, three dimensional flow. Rotational and irrotational flows , compressible and incompressible flows
Week 4	Circulation and vorticity theorems
Week 5	Pipes Ideal Flow , Energy Equation (Bernoulli's Equation) , Applications of Energy Equation (Bernoulli's Equation)
Week 6	Pipes Ideal Flow , Energy Equation (Bernoulli's Equation) , Applications of Energy Equation (Bernoulli's Equation)
Week 7	Fluid Kinematics Motion , Velocity Distribution and Mean Velocity , Flow between Two Parallel Plates
Week 8	Pipes Real Flow, The laminar Flow in Pipe, Turbulent Flow- Smooth and Rough Pipes, Shear Stress in laminar and turbulent flow, Fluid Flow past Solid Boundaries, Drag on Immersed Bodies, Velocity Distribution and its Significant, Energy Correction Factor, The Momentum Correction Factor.
Week 9	Pipes Real Flow, The laminar Flow in Pipe, Turbulent Flow- Smooth and Rough Pipes, Shear Stress in laminar and turbulent flow, Fluid Flow past Solid Boundaries, Drag on Immersed Bodies, Velocity Distribution and its Significant, Energy Correction Factor, The

	Momentum Correction Factor.
Week 10	Momentum and Impulse
Week 11	Moment of Momentum Equation
Week 12	Navier Stocks Equation and its applications
Week 13	Navier Stocks Equation and its applications
Week 14	Stream lines, stream functions, velocity potential function,
Week 15	Stream lines, stream functions, velocity potential function,

Learning and Teaching Resources مصادر التعلم والتدريس		
	Text	Available in the Library?
Required Texts	Advanced Fluids Mechanics by W. P. Graebel	No but Available online
Recommended Texts	Advanced Fluids Mechanics by H. C. Franz Durst	No but Available online

MODULE DESCRIPTION FORM

نموذج وصف المادة الدراسية

Module Information معلومات المادة الدراسية			
Module Title	Advanced Hydraulics Structure	Credits	
Administering Department	Civil Engineering	College	Engineering
Module Leader		E-mail	
Module Leader's Acad. Title		Module Leader's Qualification	

Module Aims, Learning Outcomes and Indicative Contents أهداف المادة الدراسية ونتائج التعلم والمحتويات الإرشادية	
Module Aims أهداف المادة الدراسية	The aim of this module is to equip students with a thorough understanding of the theory, design, and functionality of key hydraulic structures. Students will explore the engineering principles and practical applications related to dams, regulators, culverts, drops, chutes, spillways, and energy dissipaters, supported by real-world case studies. The module also emphasizes the principles of reservoir regulation and control, with a focus on addressing reservoir sedimentation and developing strategies for its management. Additionally, it aims to foster skills in water resources planning, enabling students to design sustainable and efficient solutions for managing water resources in diverse environmental and socio-economic contexts.
Module Learning Outcomes مخرجات التعلم للمادة الدراسية	By the end of this module, students will be able to: Understand and Apply Design Principles Demonstrate a comprehensive understanding of the theory and design of hydraulic structures, including dams, regulators, culverts, drops, chutes, spillways, and energy dissipaters. Evaluate and Analyze Hydraulic Structures Assess the functionality and performance of various hydraulic structures through the use of design calculations, modeling, and case studies. Develop Solutions for Reservoir Management Analyze reservoir regulation and control strategies, including methods to address reservoir sedimentation and optimize water storage and flow management. Plan Sustainable Water Resource Systems Apply principles of water resources planning to design sustainable solutions for managing water systems in diverse environmental and socio-economic contexts.

	Integrate Theory and Practice Utilize case studies to connect theoretical knowledge with practical challenges in the design, operation, and maintenance of hydraulic structures and reservoir systems. Engage with Emerging Challenges Critically evaluate contemporary issues and innovative approaches in hydraulic engineering and water resource management.
Indicative Contents المحتويات الإرشادية	Indicative Contents - Introduction to Hydraulic Structures - Dams - Regulators, Culverts, Drops, and Chutes - Spillways and Energy Dissipaters - Reservoir Regulation and Control - Reservoir Sedimentation and its Control - Water Resources Planning - Case Studies - Emerging Trends and Challenges in Hydraulic Engineering This content provides a blend of theoretical foundations, practical applications, and real-world examples to prepare students for professional roles in hydraulic engineering and water resource management.

Learning and Teaching Strategies استراتيجيات التعلم والتعليم	
Strategies	- Lectures - Tutorials and Problem-Solving Sessions - Case Studies and Real-World Applications - Laboratory and Practical Sessions - Field Visits - Project-Based Learning - Seminars and Guest Lectures - Self-Directed Learning - Assessment and Feedback This blend of teaching methods ensures students develop a robust understanding of theoretical concepts while gaining practical, industry-relevant experience.

Delivery Plan (Weekly Syllabus) المنهاج الاسبوعي النظري	
Material Covered	
Week	lecture
Week 1	Theory and design of hydraulic structures
Week 2	Different types of dams
Week 3	Regulators
Week 4	Culverts
Week 5	Drops
Week 6	Chutes
Week 7	Spillways and energy dissipaters
Week 8	Case studies
Week 9	Case studies
Week 10	Reservoir regulation and control
Week 11	Reservoir sedimentation and its control
Week 12	Water resources planning
Week 13	Case studies
Week 14	Case studies
Week 15	Exam

Learning and Teaching Resources مصادر التعلم والتدريس		
	Text	Available in the Library?
Required Texts		
Recommended Texts	Design of Hydraulic Structures by S.K. Garg Hydraulic Design Handbook by Larry W. Mays	

MODULE DESCRIPTION FORM

نموذج وصف المادة الدراسية

Module Information معلومات المادة الدراسية			
Module Title	Decentralized Liquid Waste Management	Credits	
Administering Department	Civil Engineering	College	Engineering
Module Leader		E-mail	
Module Leader's Acad. Title		Module Leader's Qualification	

Module Aims, Learning Outcomes and Indicative Contents أهداف المادة الدراسية ونتائج التعلم والمحتويات الإرشادية	
Module Aims أهداف المادة الدراسية	- To provide students with a detailed understanding of decentralized liquid waste management systems and their role in sustainable urban and rural development. - To explore the design, implementation, and operation of decentralized systems that minimize environmental impact and promote resource recovery. - To equip students with practical knowledge for evaluating, selecting, and designing appropriate decentralized wastewater solutions in diverse contexts. - To highlight policy frameworks, challenges, and technological advancements in decentralized wastewater management.
Module Learning Outcomes مخرجات التعلم للمادة الدراسية	Upon successful completion of this module, students will be able to: Knowledge and Understanding - Describe the principles and necessity of decentralized liquid waste management systems in achieving sustainable water and sanitation goals. - Evaluate the environmental, economic, and social benefits of decentralized wastewater systems compared to centralized systems. - Explain the key technologies and processes used in decentralized liquid waste management, including their design criteria and operational parameters. Practical Skills - Analyze site-specific factors to determine the feasibility and design requirements for decentralized wastewater systems. - Develop conceptual designs for small-scale wastewater treatment systems.

	6. Assess the performance of decentralized liquid waste management systems using case studies and monitoring data.
Indicative Contents المحتويات الإرشادية	1. Introduction to Decentralized Liquid Waste Management 2. Fundamentals of Liquid Waste Characteristics 3. Decentralized Wastewater Treatment Technologies 4. Design and Planning of Decentralized Systems 5. Resource Recovery and Reuse 6. Monitoring, Maintenance, and Operation 7. Case Studies and Real-World Applications

Learning and Teaching Strategies استراتيجيات التعلم والتعليم	
Strategies	The learning and teaching strategies for this module focus on fostering a blend of theoretical knowledge, practical application, and critical thinking skills. The strategies will engage students through diverse pedagogical methods, including interactive lectures, hands-on activities, and real-world case studies. Interactive Lectures and Discussions Purpose: Provide foundational knowledge and theoretical insights into decentralized wastewater management. Case Studies and Problem-Based Learning (PBL) Purpose: Enable students to apply theoretical knowledge to real-world scenarios. Field Visits and Practical Demonstrations Purpose: Provide hands-on exposure to operational decentralized systems. Group Projects and Collaborative Learning Purpose: Foster teamwork and interdisciplinary thinking.

Delivery Plan (Weekly Syllabus) المنهاج الاسبوعي النظري	
Material Covered	
Week	lecture
Week 1	Overview of Water Quality, Stoichiometry
Week 2	Mass, Moles, and Molecular Weight, Mass, mole, Molecular Weight, Balancing Chemical Equations, Limiting Reagents
Week 3	Biological Concepts (Importance of Biology to Decentralized Systems, Organisms and Oxygen
Week 4	Temperature and Biomass Growth, Toxicity
Week 5	Units (Unit Systems, Converting Units, Dimensional Homogeneity)
Week 6	Mass Balance (Conservation of Mass Examples of the Mass Balance Principle)
Week 7	Types of Processes.
Week 8	Using Concentrations Using Percent Composition

Week 9	A Cookbook Procedure for Setting Up Mass Balance Problems
Week 10	Fluid Mechanics (Flow Rate, continuity)
Week 11	Reactions (Reaction Types, Batch Reactors)
Week 12	Continuously Stirred Tank Reactor, Plug Flow Reactors
Week 13	Sedimentation (Uses of Sedimentation, Types of Sedimentation, Influencing Factors)
Week 14	Determining Sedimentation Rates with Stoke's Law, Application to Settling Basins
Week 15	Exam

Learning and Teaching Resources مصادر التعلم والتدريس		
	Text	Available in the Library?
Required Texts	" Wastewater Engineering: Treatment and Resource Recovery " by Metcalf & Eddy, Inc., George Tchobanoglous, H. David Stensel, et al.	
Recommended Texts	" Decentralised Water and Wastewater Systems " by Tao Tao and Aijuan Li. " Small and Decentralized Wastewater Management Systems " by Ronald Crites, E. J. Middlebrooks, and Robert Reilly.	

MODULE DESCRIPTION FORM

نموذج وصف المادة الدراسية

Module Information معلومات المادة الدراسية			
Module Title	English Language I	Credits	
Administering Department	Civil Engineering	College	Engineering
Module Leader		E-mail	
Module Leader's Acad. Title		Module Leader's Qualification	

Module Aims, Learning Outcomes and Indicative Contents أهداف المادة الدراسية ونتائج التعلم والمحتويات الإرشادية	
Module Aims أهداف المادة الدراسية	The aim of the model syllabus outlined above is to develop comprehensive English language skills in students, focusing on building a strong foundation in reading, writing, speaking, listening, and grammar. The primary objectives are: Language Competence: - Equip students with the ability to understand and use English in a variety of contexts, including everyday communication, academic settings, and formal situations. Skill Integration: - Develop proficiency in all four core language skills (reading, writing, speaking, and listening) through integrated and practice-oriented activities. Vocabulary and Grammar Mastery: - Expand students' vocabulary and strengthen their understanding of grammar rules to improve fluency and accuracy. Critical Thinking: - Encourage analytical thinking through reading comprehension, structured writing, and discussion activities. Confidence Building: - Foster confidence in students by providing opportunities to practice speaking, present ideas, and engage in group discussions or debates. Practical Application: - Ensure that students can apply the skills learned to real-life scenarios, such as conversations, writing tasks, and interpreting information. This aim aligns with creating a well-rounded learning experience that supports both academic progress and practical communication.

Module Learning Outcomes مخرجات التعلم للمادة الدراسية	By the end of this course, students will be able to: 1. Reading Skills - Identify the main idea and supporting details in texts of varying complexity. - Employ skimming and scanning techniques to locate specific information. - Analyze tone, purpose, and inferred meanings in written material. 2. Writing Skills - Compose clear, coherent, and grammatically accurate sentences and paragraphs. - Structure different types of written texts, such as narratives, opinion essays, and persuasive writing. - Apply cohesive devices to enhance the flow and logic of written communication. 3. Speaking Skills - Communicate effectively in everyday conversations, group discussions, and formal presentations. - Demonstrate correct pronunciation, stress, and intonation patterns. - Participate in debates or role-playing activities, presenting ideas logically and confidently. 4. Listening Skills - Understand spoken English in various contexts, including conversations, lectures, and media. - Use active listening strategies to identify key points and details. - Summarize and respond appropriately to spoken information. 5. Grammar and Vocabulary - Apply foundational grammar rules, including correct usage of verb tenses, parts of speech, and sentence structure. - Use a broader range of vocabulary with accuracy in both spoken and written forms. - Identify and correct common grammatical errors in personal and peer writing.
Indicative Contents المحتويات الإرشادية	1. Introduction to the English Language - Grammar Fundamentals - Vocabulary Development - Writing Skills - Reading Skills - Speaking Skills - Listening Skills - Integrated Skills Practice - Critical Thinking and Analysis - Final Review and Assessment

Learning and Teaching Strategies

استراتيجيات التعلم والتعليم

Strategies	The teaching strategies for the foundational English Language course are designed to build basic language skills through engaging, practical, and interactive methods. A focus on gradual skill development ensures that students gain confidence and proficiency in a supportive learning environment. 1. Structured Interactive Lectures Purpose: Introduce foundational concepts in grammar, vocabulary, and the four language skills (reading, writing, speaking, listening). 2. Task-Based Learning Purpose: Promote practical application of foundational skills in real-world contexts. 3. Group and Pair Work Purpose: Foster collaboration, teamwork, and communication among peers. 4. Audio-Visual Learning Purpose: Enhance listening skills and expose students to diverse accents and contexts. 5. Practice and Repetition Purpose: Reinforce foundational concepts through consistent practice. 6. Role-Playing and Simulated Conversations Purpose: Develop speaking confidence in a controlled environment. 7. Guided Reading and Writing Workshops Purpose: Build foundational reading and writing skills. 8. Vocabulary Building Games Purpose: Make learning engaging and memorable while expanding vocabulary. 9. Feedback-Centered Learning Purpose: Provide constructive feedback to encourage improvement and build confidence. 10. Technology Integration Purpose: Enhance engagement and accessibility through digital tools. 11. Flipped Classroom for Basic Concepts Purpose: Encourage self-directed learning and maximize in-class interaction. 12. Culturally Relevant Content Purpose: Make learning relatable by using topics from students' cultural or everyday experiences. 13. Differentiated Instruction Purpose: Cater to diverse learning paces and styles. 14. Formative and Summative Assessments Purpose: Monitor progress and evaluate overall learning outcomes. 15. Reflection and Self-Assessment Purpose: Help students track their learning and set improvement goals. These strategies ensure a strong foundation in English language skills, emphasizing gradual development, consistent practice, and learner engagement. This approach prepares students for progression into the more advanced English Language II course.
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Delivery Plan (Weekly Syllabus) المنهاج الاسبوعي النظري	
Material Covered	
Week	lecture
Week 1	Course Introduction & Basics
Week 2	Parts of Speech
Week 3	Verb Tenses (Part 1)
Week 4	Verb Tenses (Part 2)
Week 5	Vocabulary Building
Week 6	Listening & Speaking Skills (Part 1)
Week 7	Reading Comprehension (Part 1)
Week 8	Writing Skills (Part 1)
Week 9	Grammar Review
Week 10	Listening & Speaking Skills (Part 2)
Week 11	Reading Comprehension (Part 2)
Week 12	Writing Skills (Part 2)
Week 13	Speaking & Listening Skills (Part 3)
Week 14	Final Review
Week 15	Exam

Learning and Teaching Resources مصادر التعلم والتدريس		
	Text	Available in the Library?
Required Texts	New Headway Upper Intermediate Student's Book 2014.	
Recommended Texts	English Grammar in Use by Raymond Murphy.	

MODULE DESCRIPTION FORM

نموذج وصف المادة الدراسية

Module Information معلومات المادة الدراسية			
Module Title	English Language II	Credits	
Administering Department	Civil Engineering	College	Engineering
Module Leader		E-mail	
Module Leader's Acad. Title		Module Leader's Qualification	

Module Aims, Learning Outcomes and Indicative Contents أهداف المادة الدراسية ونتائج التعلم والمحتويات الإرشادية	
Module Aims أهداف المادة الدراسية	This module aims to advance students' English proficiency by building on foundational skills and focusing on intermediate-level communication, critical analysis, and academic language use. The specific aims include: Enhancing Core Language Skills - To develop students' abilities in reading, writing, speaking, and listening to handle more complex and context-specific tasks effectively. Building Advanced Grammar Proficiency - To deepen students' understanding of advanced grammatical structures, enabling accurate and fluent language use in diverse contexts. Expanding Vocabulary Range - To introduce students to more sophisticated vocabulary, including idiomatic expressions, collocations, and professional terminology. Developing Academic and Professional Communication - To prepare students for academic writing, formal correspondence, and professional interactions by teaching structured and purpose-driven communication. Fostering Critical Thinking and Analytical Skills - To enable students to critically analyze texts, arguments, and spoken language, identifying implicit meanings, biases, and logical fallacies. Promoting Real-Life Application - To equip students with the skills needed to confidently use English in real-world scenarios, such as presentations, debates, and professional writing. Boosting Confidence and Independence in Language Use

	○ To encourage students to take initiative in learning, expressing their ideas clearly and persuasively, and applying their skills in academic and professional settings. Overall Goal The module aims to provide students with the tools to use English effectively and confidently in intermediate to advanced contexts, preparing them for higher-level academic study, professional environments, and everyday communication.
Module Learning Outcomes مخرجات التعلم للمادة الدراسية	By the end of this module, students will be able to: 1. Advanced Reading Skills • Analyze and evaluate texts to identify arguments, tone, bias, and implied meanings. • Synthesize information from multiple sources for academic or professional purposes. • Demonstrate comprehension of complex written materials through summaries and critiques. 2. Advanced Writing Skills • Write structured and coherent essays, including comparative and argumentative essays. • Produce professional documents such as formal emails, résumés, and cover letters. • Apply academic writing conventions, including citing sources and avoiding plagiarism. 3. Speaking and Presentation Skills • Deliver structured presentations using appropriate visual aids and non-verbal communication techniques. • Engage effectively in debates, articulating logical arguments and responding to opposing views. • Demonstrate improved pronunciation, intonation, and fluency in intermediate-level conversations. 4. Advanced Listening Skills • Understand and critically evaluate spoken language in a variety of contexts, including lectures, debates, and podcasts. • Identify persuasive techniques, logical fallacies, and key points in spoken communication. • Summarize and respond to complex spoken content with accuracy. 5. Grammar and Vocabulary Mastery • Use advanced grammatical structures, including passive voice, conditionals, and reported speech, with accuracy. • Incorporate a wider range of vocabulary, including idiomatic expressions, collocations, and academic terminology, into speech and writing. • Identify and correct errors in grammar, vocabulary, and sentence structure independently.

	6. Critical Thinking and Analytical Skills - Evaluate the effectiveness of arguments and use evidence to support personal opinions in discussions and writing. - Demonstrate the ability to critique and interpret content, identifying strengths and weaknesses in arguments. - Apply reasoning and analysis to synthesize information from various sources.
Indicative Contents المحتويات الإرشادية	- Advanced Grammar - Vocabulary Development - Reading Skills - Writing Skills - Speaking Skills - Listening Skills - Integrated Skills Practice - Academic and Professional Preparation - Critical Thinking and Analysis - Real-Life Application and Reflection - Summative Assessment Preparation

Learning and Teaching Strategies استراتيجيات التعلم والتعليم	
Strategies	The teaching strategies for this course are designed to engage students actively, promote independent learning, and ensure the practical application of skills. A mix of learner-centered, collaborative, and interactive approaches will be employed to support the course objectives and outcomes. Interactive Lectures Purpose: Introduce new concepts and provide a theoretical foundation for grammar, vocabulary, and writing skills. Task-Based Learning Purpose: Help students practice and apply language skills in real-life contexts. Group Work and Peer Collaboration Purpose: Foster teamwork, enhance communication skills, and promote peer learning. Role-Playing and Simulations Purpose: Provide realistic scenarios for practicing speaking and listening skills. Technology-Enhanced Learning Purpose: Leverage digital tools to enhance engagement and access to resources. Reading and Analysis Workshops Purpose: Develop critical reading and analytical skills. Presentation Practice Purpose: Build confidence and improve verbal communication. Flipped Classroom Approach Purpose: Encourage independent learning and active engagement in class. Feedback-Oriented Learning Purpose: Help students identify strengths and areas for improvement. Integrated Skills Activities Purpose: Combine reading, writing, speaking, and listening skills in practical applications.

	11. Differentiated Instruction • Purpose: Address diverse learning needs and proficiency levels. 12. Summative and Formative Assessments • Purpose: Measure progress and provide continuous guidance for improvement. 13. Reflective Practices • Purpose: Encourage students to evaluate their own learning and set goals for improvement. These strategies ensure a balance of theoretical learning, skill application, and reflective practices, making the course engaging, practical, and effective for achieving the module outcomes.
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Delivery Plan (Weekly Syllabus) المنهاج الاسبوعي النظري	
Material Covered	
Week	lecture
Week 1	Introduction to English Language II
Week 2	Complex Sentence Structures
Week 3	Advanced Grammar (Part 1)
Week 4	Advanced Grammar (Part 2)
Week 5	Advanced Vocabulary
Week 6	Reading for Analysis
Week 7	Listening for Understanding
Week 8	Writing for Specific Purposes (Part 1)
Week 9	Writing for Specific Purposes (Part 2)
Week 10	Presentation Skills
Week 11	Debate and Argumentation
Week 12	Listening for Critical Thinking
Week 13	Advanced Reading and Writing
Week 14	Review and Practice
Week 15	Final Assessments and Feedback

Learning and Teaching Resources مصادر التعلم والتدريس		
	Text	Available in the Library?
Required Texts	New Headway Upper Intermediate Student's Book 2014.	
Recommended Texts	English Grammar in Use by Raymond Murphy.	

نموذج وصف المادة الدراسية

Module Information			
معلومات المادة الدراسية			
Module Title	Ground Water	Credits	
Administering Department	Civil Engineering	College	Engineering
Module Leader		E-mail	
Module Leader's Acad. Title		Module Leader's Qualification	

Module Aims, Learning Outcomes and Indicative Contents	
أهداف المادة الدراسية ونتائج التعلم والمحتويات الإرشادية	
Module Aims أهداف المادة الدراسية	• Understand Groundwater Systems: Introduce students to the hydrological cycle, focusing on the occurrence, movement, and distribution of groundwater in various geological formations. • Assess the Role of Groundwater: Highlight the importance of groundwater as a critical resource for drinking water, agriculture, and industrial processes, emphasizing its ecological significance. • Analyze Aquifer Dynamics: Teach the principles of aquifer properties, groundwater flow, and interactions with surface water systems. • Explore Groundwater Quality: Develop an understanding of groundwater contamination, including sources, transport mechanisms, and remediation techniques. • Promote Sustainable Management: Introduce strategies for the sustainable use and management of groundwater resources, with a focus on mitigating over-extraction and pollution. • Foster Practical Skills: Equip students with the knowledge of field and laboratory techniques for groundwater exploration, monitoring, and analysis. • Apply Knowledge to Real-World Problems: Encourage the application of theoretical and practical knowledge to address contemporary groundwater challenges, such as climate change impacts and water security.
Module Learning Outcomes مخرجات التعلم للمادة الدراسية	Upon successful completion of this module, students will be able to: Knowledge and Understanding 1. Explain the Role of Groundwater: Describe the role of groundwater in the hydrological cycle and its importance as a natural resource for various human and ecological systems.

	2. Characterize Aquifer Systems: Identify and explain the properties of aquifers, including porosity, permeability, and storage, as well as factors influencing groundwater flow and recharge. 3. Evaluate Groundwater Quality: Analyze the factors affecting groundwater quality, including contamination sources, transport mechanisms, and natural filtration processes. Practical and Professional Skills 4. Apply Field Techniques: Demonstrate proficiency in key field and laboratory techniques used for groundwater exploration, sampling, and monitoring. Transferable Skills 5. Communicate Findings: Present hydrogeological findings clearly through written reports, graphical data representation, and oral presentations. 6. Solve Complex Problems: Employ problem-solving and critical-thinking skills to propose solutions for groundwater-related challenges, such as resource depletion and contamination. 7. Work Collaboratively: Collaborate effectively within a team to conduct field investigations or case studies related to groundwater management.
Indicative Contents المحتويات الإرشادية	1. Introduction to Groundwater 2. Hydrogeological Principles 3. Groundwater-Surface Water Interaction 4. Groundwater Exploration and Monitoring 5. Groundwater Management and Sustainability 6. Case Studies and Applications

Learning and Teaching Strategies استراتيجيات التعلم والتعليم	
Strategies	A well-rounded approach to teaching and learning in the "Ground Water" module involves combining theoretical knowledge with practical application and fostering active student engagement. Below are strategies tailored to achieve the module's aims and outcomes: 1. Lectures Purpose: Provide foundational knowledge of hydrogeological principles, groundwater systems, and management techniques. 2. Tutorials and Problem-Solving Sessions Purpose: Reinforce key concepts and develop problem-solving skills. 3. Laboratory Sessions Purpose: Develop hands-on skills in groundwater quality testing and aquifer property analysis. 4. Fieldwork Purpose: Provide practical experience in groundwater exploration and monitoring. 5. Independent Learning Purpose: Encourage self-directed exploration of topics to deepen understanding.

	6. Group Projects and Collaborative Learning Purpose: Foster teamwork and multidisciplinary approaches to problem-solving.
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Delivery Plan (Weekly Syllabus) المنهاج الاسبوعي النظري	
Material Covered	
Week	lecture
Week 1	Fundamentals of ground water flow
Week 2	Velocity and permeability
Week 3	Darcy law
Week 4	General hydrodynamic equations, velocity potential
Week 5	Two-dimensional flow
Week 6	Stream functions
Week 7	Streamlines and equipotential lines
Week 8	Laplace equation
Week 9	The flow net, Confined flow problems, Solutions by analysis
Week 10	Graphical and analogue or numerical relaxation techniques
Week 11	Dupuit theory for unconfined flow problems
Week 12	Conformed mapping techniques, velocity hydrograph solutions
Week 13	Seepage from canals and ditches, Seepage toward wells, fully penetrating and partially penetrating
Week 14	Filter, types of filters
Week 15	Exam

Learning and Teaching Resources مصادر التعلم والتدريس		
	Text	Available in the Library?
Required Texts	"Groundwater Hydrology" by David Keith Todd and Larry W. Mays	
Recommended Texts	"Handbook of Groundwater Engineering" edited by Jacques W. Delleur "Global Groundwater: Source, Scarcity, Sustainability, Security, and Solutions" edited by Abhijit Mukherjee et al.	

MODULE DESCRIPTION FORM

نموذج وصف المادة الدراسية

Module Information معلومات المادة الدراسية			
Module Title	Integrated Water Resources Management	Credits	
Administering Department	Civil Engineering	College	Engineering
Module Leader		E-mail	
Module Leader's Acad. Title		Module Leader's Qualification	

Module Aims, Learning Outcomes and Indicative Contents أهداف المادة الدراسية ونتائج التعلم والمحتويات الإرشادية	
Module Aims أهداف المادة الدراسية	This module aims to equip students with advanced knowledge and practical skills in Integrated Water Resources Management (IWRM) , focusing on the application of systems analysis and optimization techniques to address challenges in water resources planning and management. Students will learn to develop and apply simulation and optimization models to improve decision-making in reservoir operations, water allocation, and conjunctive use of surface and groundwater resources. Additionally, the module introduces engineering economics principles to evaluate the cost-effectiveness and sustainability of water resource projects.
Module Learning Outcomes مخرجات التعلم للمادة الدراسية	By the end of this module, students will be able to: Understand Systems Analysis in Water Resources - Explain the concepts of systems analysis and systems approaches in water resources management, including optimization models and their components. Apply Simulation Techniques - Use simulation methods for planning and managing reservoir systems, optimizing single reservoir operations, and developing water resource allocation strategies. Utilize Linear Programming Models - Formulate and solve linear programming problems using graphical and simplex methods, including advanced topics like duality and sensitivity analysis, for water resources applications. Implement Dynamic Programming

	• Apply principles of optimality and recursive dynamic programming techniques to solve resource allocation and reservoir operation problems. 5. Integrate Engineering Economics into Water Resource Planning • Conduct benefit-cost analyses and economic evaluations to assess the feasibility and sustainability of water resources projects. 6. Develop Holistic IWRM Solutions • Design and implement integrated solutions that balance technical, economic, and environmental objectives in water resources planning.
Indicative Contents المحتويات الإرشادية	1. Introduction to IWRM and Systems Analysis • Concepts and principles of Integrated Water Resources Management. • Systems analysis and its role in water resources planning. • Objective functions, constraints, and types of optimization techniques. 2. Simulation and Water Resources Management • Techniques for reservoir system planning and operations. • Optimization of cropping patterns and water allocation. • Conjunctive use of surface and groundwater resources. 3. Linear Programming • Formulating and solving linear programming models. • Graphical method and simplex algorithm. • Advanced topics: Revised simplex method, duality, and sensitivity analysis. 4. Dynamic Programming • Forward and backward recursive techniques. • Addressing the curse of dimensionality. • Applications in resource allocation and multi-reservoir systems. 5. Water Resources Economics • Fundamentals of engineering economics in water resource projects. • Conditions for project optimality and economic viability. • Benefit-cost analysis and its application in project evaluation.

Learning and Teaching Strategies استراتيجيات التعلم والتعليم	
Strategies	• Lectures and Conceptual Discussions ○ Delivery of core concepts, systems analysis methods, and economic principles. • Practical Sessions and Tutorials ○ Problem-solving exercises in simulation, linear programming, and dynamic programming. ○ Use of software tools for optimization and economic evaluation. • Case Studies and Real-World Applications ○ Analysis of IWRM strategies in regional and global contexts.

	○ Lessons learned from successful and challenged water resource projects. • Project-Based Learning ○ Group projects focused on developing IWRM plans using modeling and optimization techniques. • Field Visits and Industry Engagement ○ Site visits to reservoirs or water management facilities. ○ Interaction with professionals to understand practical challenges in IWRM. • Self-Directed Learning ○ Guided exploration of literature, technical manuals, and IWRM frameworks.
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Delivery Plan (Weekly Syllabus) المنهاج الاسبوعي النظري	
Material Covered	
Week	lecture
Week 1	Introduction: Concepts of systems analysis, definition
Week 2	Systems approach to water resources planning and management, role of optimization models
Week 3	Objective function and constraints, types of optimization techniques
Week 4	Simulation and management: Application of simulation techniques in water resources
Week 5	Planning of reservoir system, optimal operation of single reservoir system, allocation of water resources
Week 6	Optimal cropping pattern, conjunctive use of surface and ground water resources
Week 7	Linear programming: Formulation of linear programming models, graphical method, simplex method
Week 8	Application of linear programming in water resources
Week 9	Revised simplex method, duality in linear programming, sensitivity analysis
Week 10	Dynamic programming: Principles of optimality
Week 11	Forward and backward recursive dynamic programming
Week 12	Curse of dimensionality, application for resource allocation
Week 13	Water resources economics: Basics of engineering economics
Week 14	Economic analysis, conditions of project optimality, benefit and cost analysis
Week 15	Exam

Learning and Teaching Resources مصادر التعلم والتدريس		
	Text	Available in the Library?
Required Texts		
Recommended Texts	Water Resources Systems Planning and Management" by Loucks, D.P., and van Beek, E.	

MODULE DESCRIPTION FORM

نموذج وصف المادة الدراسية

Module Information معلومات المادة الدراسية			
Module Title	Open Channel Hydraulics	Credits	
Administering Department	Civil Engineering	College	Engineering
Module Leader		E-mail	
Module Leader's Acad. Title		Module Leader's Qualification	

Module Aims, Learning Outcomes and Indicative Contents أهداف المادة الدراسية ونتائج التعلم والمحتويات الإرشادية	
Module Aims أهداف المادة الدراسية	1. To introduce the fundamental principles of fluid flow and critical flow conditions relevant to open-channel hydraulics. 2. To develop a thorough understanding of hydraulic jumps, natural flow concepts, and their applications in engineering. 3. To provide the knowledge required for designing stable channels and understanding channel behavior under various flow regimes. 4. To analyze gradually varied flow and apply theoretical frameworks for its evaluation in practical scenarios. 5. To explore the concepts and methodologies for designing channel transitions to ensure efficient and safe flow conditions. 6. To understand the dynamics of unsteady flow and flood waves, with an emphasis on prediction and management. 7. ☐ To examine rapid varied flow phenomena and perform their analysis for engineering purposes.
Module Learning Outcomes مخرجات التعلم للمادة الدراسية	Module Learning Outcomes (MLOs): • Knowledge and Understanding ○ Demonstrate a comprehensive understanding of the fundamental concepts of fluid flow, critical flow conditions, and their practical significance. ○ Explain the mechanisms behind hydraulic jumps, natural flow, and their implications in channel hydraulics. ○ Analyze gradually varied flow and identify the factors influencing flow profiles in open channels. • Intellectual Skills

	○ Evaluate the stability of channels and design parameters to ensure efficient channel operation. ○ Apply analytical and computational methods to study flow regimes, transitions, and rapid varied flow phenomena. ○ Interpret the effects of unsteady flow and flood waves, utilizing modeling techniques for real-world applications. • Practical and Professional Skills ○ Design stable channels and channel transitions based on hydraulic principles and flow conditions. ○ Solve practical problems involving the analysis of natural and engineered channel systems under diverse flow conditions. • Transferable Skills ○ Employ critical thinking to approach hydraulic flow challenges and propose effective solutions. ○ Communicate technical analysis and design concepts clearly through both written and verbal formats. ○ Work collaboratively in a team setting to address complex engineering problems in open-channel hydraulics.
Indicative Contents المحتويات الإرشادية	1. Introduction to Fluid Flow in Open Channels • Basic principles of fluid mechanics. • Types of flow: laminar, turbulent, uniform, and non-uniform. • Flow measurement techniques. 2. Critical Flow Conditions • Concepts of critical depth and velocity. • Froude number and its significance. • Applications in hydraulic engineering. 3. Hydraulic Jump Analysis • Phenomena of hydraulic jumps and energy dissipation. • Classification of hydraulic jumps. • Design considerations for hydraulic structures. 4. Natural Flow Concepts • Characteristics of natural streams and rivers. • Flow resistance in natural channels. • Sediment transport and its impact on flow behavior. 5. Design of Stable Channels • Principles of channel stability. • Channel lining and erosion control measures. • Design methodologies for engineered channels. 6. Gradually Varied Flow (GVF) Analysis • Types of GVF profiles and their computation. • Application of the direct step method and standard step method.

	• Analysis of backwater curves and drawdown curves. 7. Channel Regimes and Transitions • Behavior of channels in different flow regimes. • Design and analysis of channel transitions. • Applications in irrigation and drainage systems. 8. Unsteady Flow and Flood Wave Dynamics • Characteristics and causes of unsteady flow. • Flood wave propagation: kinematic and dynamic wave theory. • Mitigation measures and floodplain management. 9. Rapid Varied Flow (RVF) Analysis • Definition and characteristics of RVF. • Practical examples, including spillways and weirs. • Analysis methods and design implications.
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Learning and Teaching Strategies استراتيجيات التعلم والتعليم	
Strategies	Learning and Teaching Strategies Lectures ○ Deliver structured presentations to introduce key theoretical concepts, principles, and applications related to fluid flow and open-channel hydraulics. ○ Utilize visual aids, diagrams, and real-world case studies to enhance comprehension. Tutorials and Problem-Solving Sessions ○ Facilitate small-group sessions focused on solving practical problems, including hydraulic jump analysis, channel design, and flood wave modeling. ○ Encourage active participation and collaborative learning to strengthen problem-solving skills. Laboratory Sessions ○ Conduct experiments to demonstrate critical flow conditions, hydraulic jumps, and varied flow phenomena. ○ Provide hands-on experience with flow measurement techniques and data analysis tools. Computer-Based Simulations ○ Integrate specialized hydraulic modeling software to simulate gradually varied flow, unsteady flow, and rapid varied flow. ○ Teach students to analyze and interpret simulation results for engineering applications. Field Visits

	○ Organize visits to hydraulic structures (e.g., dams, spillways, or irrigation channels) to observe real-world applications. ○ Enhance understanding of natural flow conditions and channel design considerations. 6. Independent Study ○ Assign readings, online resources, and research tasks to foster self-directed learning. ○ Encourage students to explore advanced topics, recent research, and practical case studies in open-channel hydraulics. 7. Group Projects and Design Tasks ○ Engage students in collaborative projects that involve designing stable channels or analyzing flood wave behavior. ○ Promote teamwork, critical thinking, and the application of theoretical knowledge to practical challenges. 8. Assignments ○ Design comprehensive assignments that integrate multiple course components, such as channel design and hydraulic analysis, to demonstrate holistic understanding.
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Delivery Plan (Weekly Syllabus) المنهاج الاسبوعي النظري	
Material Covered	
Week	lecture
Week 1	Course Introduction & Basics
Week 2	Basic concepts of fluid flow
Week 3	Critical flow conditions
Week 4	Hydraulic jump analysis
Week 5	Concepts of natural flow
Week 6	Design of stable channels
Week 7	Gradually varied flow and its analysis
Week 8	Channel in regimes
Week 9	Channel control
Week 10	Design of channel transitions
Week 11	Unsteady flow
Week 12	Flood wave
Week 13	Rapid varied flow and its analysis
Week 14	Case study
Week 15	Exam

Learning and Teaching Resources مصادر التعلم والتدريس		
	Text	Available in the Library?
Required Texts		
Recommended Texts	• “Open Channel Hydraulics” by Ven Te Chow • "Hydraulics of Open Channel Flow" by Hubert Chanson	

MODULE DESCRIPTION FORM

نموذج وصف المادة الدراسية

Module Information معلومات المادة الدراسية			
Module Title	Optimization	Credits	2
Administering Department	Civil Engineering	College	College of Engineering
Module Leader	Asst. Prof. Dr. Alaa Kharbat	E-mail	akhirbat@uowasit.edu.iq
Module Leader's Acad. Title	Assistant Professor	Module Leader's Qualification	Ph.D.

Module Aims, Learning Outcomes and Indicative Contents أهداف المادة الدراسية ونتائج التعلم والمحتويات الإرشادية	
Module Aims أهداف المادة الدراسية	This module is prepared to introduce the students to the theory of mathematical optimization and its applications in science and engineering. The module aims at endowing the students with the necessary mathematical background and a consistent methodological toolbox, to formulate optimization problems and to effectively develop an algorithmic approach to its solution. The module is centered around classical optimization problems such as linear programming and nonlinear regression problems arising in a myriad of areas including operations research, computational data science, and financial mathematics, among many others.
Module Learning Outcomes مخرجات التعلم للمادة الدراسية	A student who completes this module successfully should be able to: 1 - Formulate a mathematical optimization problem by identifying a suitable objective and constraints. 2 - Identify the mathematical structure of an optimization problem (linear/nonlinear, constrained/unconstrained, continuous/discrete, convex/non-convex) and to choose an algorithm approach consistent with this classification. 3 - Implement different computational optimization algorithms. 4 - To analyze the results of a computational optimization method in terms of optimality guarantees, sensitivities, and performance.
Indicative Contents المحتويات الإرشادية	The course covers developments of advanced optimization models and solution methods for technical and economical planning problems. The basis in the course is the optimization process, from a real planning problem to interpretation of the solutions of the underlying optimization problem. In the modeling part we focus on problems with discrete elements, but also knowledge about important classes of optimization problems and their properties will be highlighted.

Learning and Teaching Strategies

استراتيجيات التعلم والتعليم

Strategies	Learning and teaching strategies consist the following: It provides deepened knowledge about mathematical modeling and the formulation of optimization problems. It also provides knowledge about algorithms and solution methods. A special focus is Goal programming The course will provide knowledge to understand basic and advanced theory, models, methods, and concepts within optimization like: - strengths and weaknesses with different ways of formulating technical and economical planning problems - how different formulations and algorithms can be combined to efficient solution methods - theory about linear programming, Goal programming, and stochastic programming.
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Delivery Plan (Weekly Syllabus) المنهاج الاسبوعي النظري

Material Covered	
Week	lecture
Week 1	Introduction to optimization
Week 2	Definition, Objective Function, constraints
Week 3	Problem formulation
Week 4	Linear programming
Week 5	Graphical Method
Week 6	Goal programming
Week 7	Transportation problem
Week 8	Assignment problem
Week 9	1 st Mid Exam
Week 10	Network Optimization Models
Week 11	Decision Analysis Using Decision Trees
Week 12	Markov Chains
Week 13	Introduction to Non-linear optimization
Week 14	Multi Objective Function
Week 15	2 nd Mid Exam

Learning and Teaching Resources			مصادر التعلم والتدريس
	Text	Available in the Library?	
Required Texts	Introduction to operations research. Frederick S. Hillier, Gerald J. Lieberman. 9th ed. by McGraw-Hill. 2010.	/	
Recommended Texts	Handbook of Formal Optimization. Anand J. Kulkarni (editor), Amir H. Gandomi. Springer. 2024.	/	

MODULE DESCRIPTION FORM

نموذج وصف المادة الدراسية

Module Information معلومات المادة الدراسية			
Module Title	Principle of Water resource and water Quality Legislations	Credits	
Administering Department	Civil Engineering	College	Engineering
Module Leader		E-mail	
Module Leader's Acad. Title		Module Leader's Qualification	

Module Aims, Learning Outcomes and Indicative Contents أهداف المادة الدراسية ونتائج التعلم والمحتويات الإرشادية	
Module Aims أهداف المادة الدراسية	The "Principles of Water Resource and Water Quality Legislation" module aims to provide students with a comprehensive understanding of the legal, policy, and regulatory frameworks governing water resources and water quality. The focus is on equipping students with the knowledge and tools needed to navigate the complexities of water law and apply these principles in real-world environmental and management contexts.
Module Learning Outcomes مخرجات التعلم للمادة الدراسية	Upon successful completion of this module, students will be able to: Knowledge and Understanding Explain Legal Frameworks: Describe the key international, national, and regional legal frameworks governing water resource management and water quality, including relevant treaties, regulations, and standards. Understand Water Quality Standards: Identify and explain the major water quality standards and regulations designed to protect public health, ecosystems, and industrial uses of water. Outline Institutional Roles: Summarize the roles of various institutions, such as governmental agencies, international organizations, in water law enforcement and policy-making. Discuss the Link between Water Rights and Environmental Protection: Understand the legal relationship between water rights, sustainable water use, and environmental protection, including the role of human rights in ensuring access to safe water.

	intellectual Skills Critically Analyze Legal Frameworks: Critically evaluate the effectiveness of current water resource and water quality legislations in addressing contemporary water issues like scarcity, contamination, and equitable distribution. Interpret Legislation: Analyze and interpret water-related legal documents, including water management plans, quality standards, and compliance reports, to inform decision-making processes. Evaluate the Impact of Legislation on Water Resources: Assess how different legal frameworks influence water resource management practices and the long-term sustainability of water systems. Practical Skills Apply Water Law to Case Studies: Apply knowledge of water resource and quality legislation to real-world case studies, identifying legal and regulatory issues in water management, contamination, and governance. Propose Legal Solutions: Develop informed legal solutions or recommendations for improving water resource management and addressing water quality challenges in a specific geographic or social context. Engage in Policy Development: Design or critique policy proposals for sustainable water management, incorporating relevant legal principles and addressing emerging challenges such as climate change and population growth.
Indicative Contents المحتويات الإرشادية	The module content focuses on understanding the legal, institutional, and policy frameworks governing water resources and water quality management. It provides students with the tools to assess, interpret, and apply water-related legislation in real-world scenarios. The following topics outline the key areas of study: - Introduction to Water Legislation - International Water Law - National and Regional Water Legislation - Water Quality Legislation - Water Allocation and Management - Institutional and Regulatory Frameworks - Emerging Legal Challenges in Water Law - Case Studies in Water Legislation - Legal Tools for Water Quality and Resource Management

Learning and Teaching Strategies استراتيجيات التعلم والتعليم	
Strategies	To achieve the module's learning outcomes, the following strategies will integrate theoretical understanding, practical application, and critical thinking. The approach aims to engage students in both the legal and environmental aspects of water resource and quality legislation while developing their analytical, communication, and problem-solving skills. Lectures Purpose: Deliver core knowledge on the principles of water resource and water quality legislation Case Study Analysis Purpose: Apply legal principles to real-world water resource and quality issues.

	3. Interactive Seminars and Tutorials • Purpose: Deepen understanding through active learning and peer discussions 4. Legal Research and Report Writing • Purpose: Develop students' research, writing, and analytical skills related to water legislation. 5. Formative Assessments • Purpose: Monitor student progress and provide feedback. 6. Summative Assessments • Purpose: Evaluate overall student learning and understanding of water law.
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Delivery Plan (Weekly Syllabus) المنهاج الاسبوعي النظري	
Material Covered	
Week	lecture
Week 1	General Principles of Systems Analysis to Problems in Water Resources Engineering, Objectives of Water Resources Planning and Development
Week 2	Nature of Water Resources Systems, Socio Economic Characteristics. Economic Analysis of Water Resources System
Week 3	Principles of Engineering Economy, Capital, Interest and Interest Rates, Time Value of Money, Depreciation, Benefit Cost Evaluation, Discounting Techniques, Economic and Financial Evaluation, Socio-Economic Analysis.
Week 4	Linear Programming Models, Simplex Method, Sensitivity Analysis
Week 5	Dual Programming, Dynamic Programming Models, Classical Optimization Techniques
Week 6	Non-linear Programming, Gradient Techniques, Genetic Algorithm
Week 7	Stochastic Programming, Simulation
Week 8	Search Techniques, Multi Objective Optimization
Week 9	Surface Water Storage Requirements, Storage Capacity and Yield, Reservoir Design
Week 10	Water Allocations for Water Supply, Irrigation, Hydropower and Flood, Reservoir Operations
Week 11	Planning of an Irrigation System, Irrigation Scheduling, Groundwater management, Conjunctive Use of Surface and Subsurface Water Resources
Week 12	Water Quality Objectives and Standards, Water Quality Control Models, Wastewater Transport Systems, River Water Quality Models and Lake Quality models
Week 13	Legal Aspects of Water & Environment Systems: Principles of Law applied to Water Rights and Water Allocation
Week 14	Water Laws, Environmental Protection Law, Environmental Constraints on water Resources Development
Week 15	Exam

Learning and Teaching Resources مصادر التعلم والتدريس		
	Text	Available in the Library?

Required Texts	"Water Law: A Practical Approach to Resources and Regulation" by John C. S. Wilson	
Recommended Texts	"Principles of Water Resources: History, Development, Management, and Policy" by Thomas V. Cech "International Water Law and the Quest for Common Security" by Laurence Boisson de Chazournes	

MODULE DESCRIPTION FORM

نموذج وصف المادة الدراسية

Module Information معلومات المادة الدراسية			
Module Title	Research Methodology	Credits	2
Administering Department	Civil Engineering	College	College of Engineering
Module Leader	Asst. Prof. Dr. Alaa Kharbat	E-mail	akhirbat@uowasit.edu.iq
Module Leader's Acad. Title	Assistant Professor	Module Leader's Qualification	Ph.D.

Module Aims, Learning Outcomes and Indicative Contents أهداف المادة الدراسية ونتائج التعلم والمحتويات الإرشادية	
Module Aims أهداف المادة الدراسية	This module is prepared to standardize the teaching of research methods course mainly for MSc postgraduate students. It can also be used as a resource for anyone who is interested in research.
Module Learning Outcomes مخرجات التعلم للمادة الدراسية	After studying this module, students will be able to: ☐ Discuss what is meant by the term 'research' and describe the stages of the research process ☐ Identify and formulate a research problem using literature review as sources of information ☐ Access resources and use the proper citations and references ☐ Formulate and write research questions or hypotheses and research objectives ☐ Construct reliable research tools for data collection on the basis of other researchers
Indicative Contents المحتويات الإرشادية	• Identify a problem to be researched • Write a thesis/research proposal • Conduct research • Write a thesis report • Write a manuscript • Critical appraise evidence

Learning and Teaching Strategies

استراتيجيات التعلم والتعليم

Strategies	Learning and teaching strategies consist the following:
	• Formulating the Research Problem • Extensive Literature Review • Developing the objectives • Preparing the Research Design including Sample Design • Collecting the Data • Analysis of Data • Generalization and Interpretation

Delivery Plan (Weekly Syllabus) المنهاج الاسبوعي النظري

Material Covered	
Week	lecture
Week 1	Research article: Abstract, aim and objectives
Week 2	Research article: Critical Evaluation of Literature Review
Week 3	Research article: Methodology
Week 4	Research article: Results and discussion
Week 5	Research article: Conclusions, Further work and limitations
Week 6	Review paper: how to find the gap, how to summarise research articles, structure
Week 7	How to Publish in High Impact Factor Journal
Week 8	How to Answer Reviewers Response: Norms and Principles for Writing a Response Letter
Week 9	Solid publisher and journals as well as predators and hanging journals
Week 10	Presentation and poster: contain, types, top tips for effective presentations
Week 11	Dissertations the writing process
Week 12	Dissertation defense and dissertation marking scheme
Week 13	References styles and tool (i.e., End Note)
Week 14	General Functions
Week 15	Exam

Learning and Teaching Resources

مصادر التعلم والتدريس

	Text	Available in the Library?
Required Texts	Research Methodology: Concept and Cases. Dr Deepak Chawla & Dr Neena Sondhi. 2016	/
Recommended Texts	Research Methodology and Scientific Writing. C. George Thomas. 2021	/

MODULE DESCRIPTION FORM

نموذج وصف المادة الدراسية

Module Information معلومات المادة الدراسية			
Module Title	Advanced Statistics	Credits	3
Administering Department	Civil Engineering	College	Engineering
Module Leader	Salah L. Zubaidi	E-mail	salahlafta@uowasit.edu.iq
Module Leader's Acad. Title	Assit. Prof.	Module Leader's Qualification	PhD in environmental engineering

Module Aims, Learning Outcomes and Indicative Contents أهداف المادة الدراسية ونتائج التعلم والمحتويات الإرشادية	
Module Aims أهداف المادة الدراسية	- To provide advanced knowledge in statistical analysis techniques. - To equip students with practical skills in data processing, analysis, and visualization using SPSS. - To introduce students to regression, time series analysis, and neural network applications in statistics. - To develop critical thinking and analytical skills for interpreting and presenting data in environmental and water engineering contexts
Module Learning Outcomes مخرجات التعلم للمادة الدراسية	- Apply numerical and inferential statistical methods for data description and analysis. - Utilize SPSS for data preprocessing, regression, and principal component analysis. - Interpret residual plots for improving regression models. - Demonstrate understanding of metaheuristic algorithms and neural networks. - Analyze survey data with SPSS coding techniques.
Indicative Contents المحتويات الإرشادية	- Descriptive and Inferential Statistics - Introduction to SPSS and Data Preprocessing Techniques - Time Series Analysis - Regression Analysis (Linear and Stepwise) - Principal Component Analysis (PCA) - Metaheuristic Algorithms Overview

	• Survey Analysis and Coding in SPSS • Neural Network Fundamentals • Data Visualization Techniques
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Learning and Teaching Strategies استراتيجيات التعلم والتعليم	
Strategies	• Lectures: To provide theoretical knowledge and foundational concepts. • Laboratory Sessions: Hands-on practice with SPSS for data analysis. • Group Discussions and Presentations: To encourage critical analysis and peer learning. • Project-Based Assignments: Practical application of statistical methods to real-world problems. • Examinations: To assess both theoretical understanding and practical skills.

Delivery Plan (Weekly Syllabus) المنهاج الاسبوعي النظري	
Material Covered	
Week	lecture
Week 1	Analysis Description
Week 2	Numerical Methods for Describing Data
Week 3	Inferential Statistics Summarizing Bivariate Data
Week 4	Introduction to SPSS Program with application the above subjects
Week 5	Data Preprocessing: Concepts and Techniques
Week 6	Application Data preprocessing by SPSS program
Week 7	Introduction to Time Series Analysis
Week 8	Interpreting Residual Plots to Improve Your Regress
Week 9	Neural Network: A Brief Overview
Week 10	Results and Data Visualisation
Week 11	Application linear and stepwise regression, and principal component analysis technique
Week 12	Metaheuristic Algorithm
Week 13	Introduction to survey and SPSS coding
Week 14	Analysis survey by SPSS coding
Week 15	Practical and theoretical exam

Learning and Teaching Resources مصادر التعلم والتدريس		
	Text	Available in the Library?
Required Texts	Using Multivariate Statistics SPSS SURVIVAL MANUAL: A step by step guide to data analysis using SPSS	
Recommended Texts	Any reliable reference related to the topics	

MODULE DESCRIPTION FORM

نموذج وصف المادة الدراسية

Module Information معلومات المادة الدراسية			
Module Title	Environmental Impact Assessment	Credits	2
Administering Department	Civil Engineering	College	Engineering
Module Leader	Salah L. Zubaidi	E-mail	salahlafta@uowasit.edu.iq
Module Leader's Acad. Title	Assit. Prof.	Module Leader's Qualification	PhD in environmental engineering

Module Aims, Learning Outcomes and Indicative Contents أهداف المادة الدراسية ونتائج التعلم والمحتويات الإرشادية	
Module Aims أهداف المادة الدراسية	- To introduce students to the principles and processes of environmental impact assessment (EIA). - To provide practical knowledge on impact prediction, evaluation, and mitigation techniques. - To develop skills in preparing and reviewing EIA reports. - To understand the importance of participation and strategic environmental assessment.
Module Learning Outcomes مخرجات التعلم للمادة الدراسية	- Explain the origins and development of EIA as a regulatory tool. - Demonstrate an understanding of the EIA process, including impact prediction, evaluation, and mitigation. - Apply EIA methodologies to real-life case studies. - Critically assess EIA reports and participate in review processes. - Analyze and compare EIA practices and strategies for improving project assessment effectiveness.
Indicative Contents المحتويات الإرشادية	- Introduction to EIA: Principles, Origins, and Development - Early Stages of EIA: Setting up and Scoping - Impact Prediction, Evaluation, Mitigation, and Enhancement - Participation, Presentation, and Review of EIA - Monitoring and Auditing after Decision-Making - Preparing the EIA Report and Submission Process - Case Studies in EIA Application

	• Comparative Practices in EIA • Strategic Environmental Assessment (SEA) • Enhancing the Effectiveness of EIA in Project Assessment • Student-Led Case Studies
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Learning and Teaching Strategies استراتيجيات التعلم والتعليم	
Strategies	

Delivery Plan (Weekly Syllabus) المنهاج الاسبوعي النظري	
Material Covered	
Week	lecture
Week 1	Introduction and principles
Week 2	Origins and development
Week 3	Starting up: early stages
Week 4	Impact prediction, evaluation, mitigation and enhancement
Week 5	Participation, presentation and review
Week 6	Monitoring and auditing: after the decision
Week 7	Before submission of the EIA Report
Week 8	Case studies of EIA in practice
Week 9	Comparative practice
Week 10	Widening the scope: strategic environmental assessment
Week 11	Improving the effectiveness of project assessment
Week 12	Student case study
Week 13	Student case study
Week 14	Student case study
Week 15	exam

Learning and Teaching Resources مصادر التعلم والتدريس		
	Text	Available in the Library?

Required Texts	Different reliable references related to the topics	
Recommended Texts	Any reliable reference related to the topics	

MODULE DESCRIPTION FORM

نموذج وصف المادة الدراسية

Module Information معلومات المادة الدراسية			
Module Title	Sediment Transport	Credits	3
Administering Department	Water Resources and Environmental	College	Engineering
Module Leader	Laith B. Al-Baderanee	E-mail	laithbder@uowasit.edu.iq
Module Leader's Acad. Title	Lect.Dr.	Module Leader's Qualification	PhD in water resources and environmental engineering

Module Aims, Learning Outcomes and Indicative Contents أهداف المادة الدراسية ونتائج التعلم والمحتويات الإرشادية	
Module Aims أهداف المادة الدراسية	Aims of the module 1. Provide an understanding of sedimentary processes and resultant sedimentary products; 2-To provide advanced knowledge in sediments transports analysis techniques. 3-To equip students with practical skills in sediments transports processing, on-line software. 4-To develop critical thinking and analytical skills for interpreting and presenting data in sediments transports processing 5- To design the stable channel with take of sediments in consideration
Module Learning Outcomes مخرجات التعلم للمادة الدراسية	On successful completion of this module, the students you should be able to: 1- Module Specific Skills and Knowledge 2- Understand the principles of sedimentology covering weathering, fluid flows at the Earth's surface, mechanisms of sediment erosion, transportation and deposition. 3-Apply numerical and inferential sediments transports processing methods for data description and analysis. 4-Understand the basis for commonly used methods of stability channel design against sedimentation..
Indicative Contents المحتويات الإرشادية	• Introduction to on-line software and sediments calculation models • Sediment's processes Analysis • Hydraulic channel design processes with the advanced stable channel design take in account the sediments effects

Learning and Teaching Strategies

استراتيجيات التعلم والتعليم

Strategies	Lectures: To provide theoretical knowledge and foundational concepts. Laboratory Sessions: Hands-on practice with on-line specific sediments software for data analysis. Group Discussions and Presentations: To encourage critical analysis and peer learning. Project-Based Assignments: Practical application of sediments transports methods to real-world problems. Examinations: To assess both theoretical understanding and practical skills.
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Delivery Plan (Weekly Syllabus) المنهاج الاسبوعي النظري

Material Covered	
Week	lecture
Week 1	outline, introduction; weathering and soil formation, sediment transport and deposition. sedimentary basins, Nature of sedimentation problems-erosion, sediment transport and deposition,
Week 2	Dimension methods analysis and units.
Week 3	water and sediments properties - Sediment transport, fluid dynamics and sedimentary structures
Week 4	Erosion, type of erosion , application and type of erosion ,and protection
Week 5	Soil loss estimation and control by Universal soil loss equation (usle), obtaining amounts of erosion, using mathematical models (USLE),
Week 6	River morphology- Sedimentary environments and processes: alluvial to fluvial Sedimentary environments and processes: Aeolian and lacustrine, morphology of river basins, age stages of rivers, sediment transport in river basins and methods of reducing them, hydraulics of rivers, flow in irregular sectors, unstable flow of rivers and streams Water, runoff and sediment resistance,
Week 7	Resisting of Bed form, and flow with examples
Week 8	Theoretical midterm exam
Week 9	Incipient motion of sed.
Week 10	Channel term, channel curvature , design open channel hydraulic, mechanics of sediment transportation-hydraulics,
Week 11	Design of stable channels
Week 12	Estimation of bed, suspended, and total sediment loads transport (anchin's theory and de bois's method....etc.) for bottom load and suspended load,
Week 13	Relative movement of sediments (Lan method, Shield method, Peter Meyer method...etc.), Beginning of relative motion, bottom resistance, bottom load, suspended load and total load, movement of coastal sedimentary materials, beach currents, change of shore line, erosion and sedimentation,
Week 14	sediment discharge, sediment measure techniques-valley deposits.
Week 15	Computer uses to analyze different water curves and sediment transport proposal (USLE).

Learning and Teaching Resources مصادر التعلم والتدريس		
	Text	Available in the Library?
Required Texts	Wolfgang Summer and Desmond E. Walling, “Modelling erosion, sediment transport and sediment yield”, IHP-VI , Technical Documents in Hydrology □ No. 60, UNESCO, Paris, 2002	Available on line
Recommended Texts	Any reliable reference related to the topics	

MODULE DESCRIPTION FORM

نموذج وصف المادة الدراسية

Module Information معلومات المادة الدراسية			
Module Title	Wells and Pumps	Credits	3
Administering Department	Water Resources and Environmental	College	Engineering
Module Leader	Laith B. Al-Baderanee	E-mail	laithbder@uowasit.edu.iq
Module Leader's Acad. Title	Lect. Dr.	Module Leader's Qualification	PhD in water resources and environmental engineering

Module Aims, Learning Outcomes and Indicative Contents أهداف المادة الدراسية ونتائج التعلم والمحتويات الإرشادية	
Module Aims أهداف المادة الدراسية	1. Preparing and analyzing hydrological data for groundwater and using them in solving practical problems 2. Learning about the different types of pipes, valves, pumps, and fittings used in pipe networks and their selection criteria. 3. Developing the skills to design, analyze, and optimize pipe networks for various applications, such as water distribution. 4. Developing critical thinking and problem-solving skills to address complex engineering challenges in pipe network projects.
Module Learning Outcomes مخرجات التعلم للمادة الدراسية	The expected outcomes after completing this course can be summarized in the following points: 1- The student has the ability to identify the different types of underground reservoirs and wells and the method of calculating the water well yields using many different theories and according to each case individually. And To develop problem solving skills and understanding of groundwater hydrology application. To determine the volume of reservoirs, aquifers and hydraulics wells, . To develop problem solving skills and understanding of groundwater hydrology application about wells. 2.The student has the ability to identify the types of pumps and methods of calculating the variables related to discharge and pump head for the purpose of suitable pumps selection. 3-Identify the pipes networks attached to pumping stations such as pipes and valves. 4- Develop methods of analysis of fluid flow in pipelines and pumped distribution networks for urban areas 5-Analyze flow in closed pipes, and design pipes including the selection of sizes. 6-Use techniques and graphs for the analysis of system performance and characteristics

Indicative Contents المحتويات الإرشادية	-Importance of groundwater, Groundwater Hydrology Definitions, What Groundwater Scientists Do - Aquifer Basic definitions: (aquifers, Aquitard, Aquiclude, Aquifuge Unsaturated zone and saturated zone) -Confining Beds and Covers, Confined Aquifers, Unconfined Aquifers. - Properties Basic definitions: (Soil Texture, Soil as a Phase System, Porosity, Porosity and Effective Porosity, Void Ratio, Particle Density, Bulk Density) -Water Content, Volumetric Water Content, Degree of Saturation. -Aquifer General Properties, Permeability, Hydraulic Conductivity, Homogeneous Aquifers, Heterogeneity. - Transmissivity, Storage Coefficient in Aquifers (confined and unconfined aquifers) - Darcy Law, Hydraulic Head, Hydraulic Gradient, Hydraulic Gradient and Flow Direction. -Darcy's Law, Velocity, Validity of Darcy's Law. - Groundwater Steady Flow, Applications/ Confined Aquifers and Unconfined Aquifers. - Unconfined Aquifers with Recharge, Hydrologic budget and groundwater sources. - Groundwater wells, Basic definitions: (Well Components, Well Casing, Well Screen, Gravel Packing, Grouts), Well Drawdown, Cone of Depression, Yield and Specific Capacity. Well Hydraulics, Steady State Analysis (Confined Aquifers), Basic Assumptions, Steady versus Transient, Steady Radial Flow to a Well in Confined Aquifers, Steady State Analysis (Unconfined Aquifers). Unsteady State Analysis - Analyze flow in closed pipes, and design pipes including the selection of sizes. And selection of pumps
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Learning and Teaching Strategies استراتيجيات التعلم والتعليم	
Strategies	The main strategy that will be adopted in delivering this module is to encourage students' participation in the exercises, while at the same time refining and expanding their critical thinking skills. This will be achieved through classes, interactive tutorials and by considering types of simple experiments involving some sampling activities that are interesting to the students. Such as Lectures: To provide theoretical knowledge and foundational concepts. Group Discussions and Presentations: To encourage critical analysis and peer learning. Examinations: To assess both theoretical understanding and practical skills.

Delivery Plan (Weekly Syllabus) المنهاج الاسبوعي النظري	
Material Covered	
Week	lecture
Week 1	Introduction: The hydrologic cycle, Importance of groundwater, Groundwater Hydrology Definitions, Analysis of groundwater resources
Week 2	Basic definitions: (aquifers, Aquitard, Aquiclude, Aquifuge Unsaturated zone and saturated zone), Confining Beds and Covers, Confined Aquifers, Unconfined Aquifers.
Week 3	Basic definitions: (Soil Texture, Soil as a Phase System, Porosity, Porosity and Effective Porosity, Void Ratio, Particle Density, Bulk Density), Water Content, Volumetric Water Content, Degree of Saturation, Aquifer General Properties, Permeability, Hydraulic Conductivity, Homogeneous Aquifers, Heterogeneity

Week 4	Transmissivity, Storage Coefficient in Aquifers (confined and unconfined aquifers), Hydraulic Head, Hydraulic Gradient, Hydraulic Gradient and Flow Direction
Week 5	Darcy's Law, Velocity, Validity of Darcy's Law. Applications/ Confined Aquifers and Unconfined Aquifers, Unconfined Aquifers with Recharge
Week 6	. Basic definitions: (Well Components, Well Casing, Well Screen, Gravel Packing, Grouts), Well Drawdown, Cone of Depression, Yield and Specific Capacity
Week 7	Steady State Analysis (Confined Aquifers), Basic Assumptions, Steady versus Transient. Steady Radial Flow to a Well in Confined Aquifers, Steady State Analysis (Unconfined Aquifers). Unsteady State Analysis-Groundwater hydraulics, -Confined and Unconfined Aquifer Practice -Coopers-Jacob method, Chow method, -Theis Recovery method -Well losses and well efficiency, -Study of artificial ground water recharge structures
Week 8	Theoretical exam
Week 9	Module-II -Pumping systems: water lifting devices; different types of pumps
Week 10	Component and parts of centrifugal pumps., -Working of Centrifugal pump -Study of radial flow and mixed flow centrifugal pumps, -Installation of centrifugal pump; testing of centrifugal pump and study of cavitation's
Week 11	-Submersible Pump Practice
Week 12	Pipe sizing and pump stations
Week 13	Pipe Network Components and Materials -Types of valves, pumps, and fittings used in pipe networks and their selection criteria
Week 14	Pipe Network Analysis and Design; Pipe network analysis using network theory and hydraulic models and design considerations for pipe networks
Week 15	Introduction to EPANET software for pumps and pipelines design, Application of relevant codes, standards, and regulations in pipe network design

Learning and Teaching Resources

مصادر التعلم والتدريس

	Text	Available in the Library?
Required Texts	Water Supply And Sewerage , E.W.Steel & Terence J .McGhee , Fifth Edition	
Recommended Texts	Any reliable reference related to the topics	