NCE/20/2000087 — Apresentação do pedido - Novo ciclo de estudos

1. Caracterização geral do ciclo de estudos

1.1.Instituição de Ensino Superior:
Universidade Do Algarve

1.1.a.Outra(s) Instituição(ões) de Ensino Superior (proposta em associação):

1.2.Unidade orgânica (faculdade, escola, instituto, etc.):
Faculdade de Ciências e Tecnologia (UAlg)

1.2.a.Outra(s) unidade(s) orgânica(s) (faculdade, escola, instituto, etc.) (proposta em associação):

1.3.Designação do ciclo de estudos:
Ecohidrologia Aplicada

1.3.Study programme:
Applied Ecohydrology

1.4.Grau:
Mestre

1.5.Área científica predominante do ciclo de estudos:
Ciências do Ambiente

1.5.Main scientific area of the study programme:
Environmental Sciences

1.6.1Classificação CNAEF – primeira área fundamental, de acordo com a Portaria n.º 256/2005, de 16 de Março (CNAEF-3 dígitos):
422

1.6.2Classificação CNAEF – segunda área fundamental, de acordo com a Portaria n.º 256/2005, de 16 de Março (CNAEF-3 dígitos), se aplicável:
851

1.6.3Classificação CNAEF – terceira área fundamental, de acordo com a Portaria n.º 256/2005, de 16 de Março (CNAEF-3 dígitos), se aplicável:
<sem resposta>

1.7.Número de créditos ECTS necessário à obtenção do grau:
120

1.8.Duração do ciclo de estudos (art.º 3 DL n.º 74/2006, de 24 de março, com a redação do DL n.º 65/2018, de 16 de agosto):
2 anos

1.8.Duration of the study programme (article 3, DL no. 74/2006, March 24th, as written in the DL no. 65/2018, of August 16th):
2 years

1.9.Número máximo de admissões:
25

1.10.Condições específicas de ingresso.

Para além das condições constantes do art.º 17.º do Dec-Lei n.º 65/2018, de 16.8, titulares de uma licenciatura na área das ciências biológicas e do ambiente, designadamente: Biologia, Biologia Marinha, Ciências do Mar, Ciências do Ambiente, Engenharia Biológica, Engenharia do Ambiente, Engenharia Biofísica, ou outras afins.

1.10.Specific entry requirements.

In addition to the conditions contained in article 17 of Dec-Law no. 65/2018, of 16.8, holders of a degree in the area of biological and environmental sciences, namely: Biology, Marine Biology, Marine Sciences, Environmental Sciences, Biological Engineering, Environmental Engineering, Biophysical Engineering, or similar areas.

1.11.Regime de funcionamento.

Diurno

1.11.1.Se outro, especifique:

<sem resposta>

1.11.1.If other, specify:

<no answer>

1.12.Local onde o ciclo de estudos será ministrado:

1.º ano/1.º semestre - Universidade do Algarve
1.º ano/1.º semestre - University of Lodz (ULO, Poland)
1.º ano/2.º semestre - Technische Hochschule Lübeck (THL, Germany)
2.º ano/1.º semestre - Universiteit Antwerpen (UAntwerpen, Belgium)

1.12.Premises where the study programme will be lectured:

1st year / 1st semester - University of Algarve
1st year / 1st semester - University of Lodz (ULO, Poland)
1st year / 2nd semester - Technische Hochschule Lübeck (THL, Germany)
2nd year / 1st semester - Universiteit Antwerpen (UAntwerpen, Belgium)

1.13.Regulamento de creditação de formação académica e de experiência profissional, publicado em Diário da República (PDF, máx. 500kB):

1.13._Reg Creditação Formação e E Prof-UAlg-2019.pdf

1.14.Observações:

Este curso é suportado financeiramente pelo programa ERASMUS MUNDUS da União Europeia, e tem por base um consórcio de instituições de ensino superior: University of Lodz (ULO, Poónia), Technische Hochschule Lübeck (THL, Alemanha) e Universiteit Antwerpen (UAntwerpen, Bélgica), coordenadas pela Universidade do Algarve.
O curso apresenta objectivos e estrutura que são únicas a nivel mundial na nova área cientifica do desenvolvimento de soluções de base natural para reverter a degradação dos ecossistemas, especificamente em ecohidrologia. O curso de mestrado articula três vertentes fundamentais para a análise, remediação e sustentabilidade dos ecossistemas aquáticos: ecohidrologia, engenharia da água e gestão integrada de bacias hidrográficas.
De entre as várias inovações que o curso integra, salienta-se a unidade curricular (uc) obrigatória de "projecto integrador com o mundo do trabalho" em que empresas e outros stakeholders, participarão na definição dos conteúdos e projetos a serem desenvolvidos na UC, nomeadamente, em Portugal (AGUAS DO ALGARVE SA, AGENCIA PORTUGUESA DO AMBIENTE, INSTITUTO PORTUGUES DO MAR E DA ATMOSFERA IP e The Portuguese Association for Aquatic Resources (APRH)), na Polónia (EUROPEJSKIE REGIONALNE CENTRUM EKOHYDROLOGII POLSKIEJ AKADEMII NAUK , ILTER PL , DHI Polska sp. z o.o. PL, FPP Enviro sp. z o. o. PL), na Alemanha (TRUEBNER GmbH, Hydroisotop GmbH) e na Bélgica (Flanders Knowledge Center Water, VLAAMSE MILIEUMAATSCHAPPIJ BE (The Flanders Environment Agency MMV), AQUAFIN N.V., Protos BE). Esta unidade curricular decorrerá em todas as universidades, de forma progressiva e integrada, de forma a assegurar aos estudantes um contacto com diferentes realidades. Estas unidades curriculares assentam na colaboração com empresas e outras instituições.
Do ponto de vista do funcionamento do curso, existirá uma colaboração efectiva na leccionação das várias UCS pelos docentes das várias instituições parceiras, o que se baseia em acordos de mobilidade ERASMUS já firmados entre todas as instituições parceiras. A mobilidade dos docentes entre as várias instituições parceiras assegura que não haverá repetição de matérias ou que algumas fiquem em falta. Assegura-se, assim, que as matérias serão leccionadas de forma progressiva e que a aprendizagem dos estudantes será fluida e coerente.

Os centros de investigação referidos no item 8.1 são apenas os dos docentes da UAlg

1.14.Observations:

This course is financially supported by the European Union's ERASMUS MUNDUS program, and is based on a consortium of higher education institutions: University of Lodz (ULO, Poonia), Technische Hochschule Lübeck (THL, Germany) and Universiteit Antwerpen (UAntwerpen, Belgium) , coordinated by the University of Algarve.
The course presents objectives and structure that are unique worldwide in the new scientific area of the development of natural-based solutions to reverse the degradation of ecosystems, specifically in eco-hydrology. The master's course articulates three fundamental aspects for the analysis, remediation and sustainability of aquatic ecosystems: eco-hydrology, water engineering and integrated management of watersheds.

Among the various innovations that the course integrates, the mandatory curricular unit (uc) of "integrating project with the world of work", in which companies and other stakeholders, will participate in the definition of the contents and projects to be developed in the UC stands out namely in Portugal (AGUAS DO ALGARVE SA, AGENCIA PORTUGUESA DO AMBIENTE, INSTITUTO PORTUGUES DO MAR E DA ATMOSFERA IP e The Portuguese Association for Aquatic Resources (APRH)), Poland (EUROPEJSKIE REGIONALNE CENTRUM EKOHYDROLOGII POLSKIEJ AKADEMII NAUK , ILTER PL , DHI Polska sp. z o.o. PL, FPP Enviro sp. z o. o. PL), Germany (TRUEBNER GmbH, Hydroisotop GmbH) and Belgium (Flanders Knowledge Center Water, VLAAMSE MILIEUMAATSCHAPPIJ BE (The Flanders Environment Agency MMV), AQUAFIN N.V., Protos BE). This curricular unit will take place in all universities, in a progressive and integrated way, in order to ensure students contact with different realities. These courses are based on collaboration with companies and other institutions, which have already been filed.
From the point of view of the functioning of the course, there will be an effective collaboration in the teaching of the various UCS by the teachers of the various partner institutions, which is based on ERASMUS mobility agreements already signed between all partner institutions. The mobility of teachers between the various partner institutions ensures that there will be no repetition of subjects or that some are missing. Thus, it is ensured that the subjects will be taught in a progressive way and that the students' learning will be fluid and coherent

The research centers referred to in item 8.1 are only those of UAlg professors

2. Formalização do Pedido

Mapa I - Conselho Científico

2.1.1.Órgão ouvido:
Conselho Científico

2.1.2.Cópia de ata (ou extrato de ata) ou deliberação deste órgão assinada e datada (PDF, máx. 100kB):
2.1.2._CC-Extrato_ata_reuniao_8_2020_ratificacao_NCE_Ecohidrologia_Aplicada_compressed.pdf

Mapa I - Senado Universitário

2.1.1.Órgão ouvido:
Senado Universitário

2.1.2.Cópia de ata (ou extrato de ata) ou deliberação deste órgão assinada e datada (PDF, máx. 100kB):
2.1.2._Declaração Senado Universitário_compressed.pdf

Mapa I - Associação de Estudantes

2.1.1.Órgão ouvido:
Associação de Estudantes

2.1.2.Cópia de ata (ou extrato de ata) ou deliberação deste órgão assinada e datada (PDF, máx. 100kB):
2.1.2._Assoc Estudantes-Parecer-Mestrado-EcoHidrologia_compressed (2).pdf

Mapa I - Empresas

2.1.1.Órgão ouvido:
Empresas

2.1.2.Cópia de ata (ou extrato de ata) ou deliberação deste órgão assinada e datada (PDF, máx. 100kB):
2.1.2._2 cartas-Unesco e APortugal_compressed (1).pdf

Mapa I - Conselho Pedagógico

2.1.1.Órgão ouvido:
Conselho Pedagógico

2.1.2.Cópia de ata (ou extrato de ata) ou deliberação deste órgão assinada e datada (PDF, máx. 100kB):
2.1.2._CP-Parecer Mestrado Erasmus Mundus Ecohidrologia Aplicada.pdf

3. Âmbito e objetivos do ciclo de estudos. Adequação ao projeto educativo, científico e cultural da instituição

3.1.Objetivos gerais definidos para o ciclo de estudos:

O consórcio MAEH foi construído com o objectivo de combinar conhecimentos de diferentes instituições europeias de ensino superior, para abordar a temática da recuperação de ecossistemas aquáticos, usando ferramentas de base natural. O programa oferece aprendizagem centrada no estudante e orientada por competências e experiências práticas de campo, laboratório e do mundo do trabalho. Funde Ecohidrologia, (uma subdisciplina das ciências da água que visa usar processos naturais para aumentar a resiliência dos ecossistemas e restaurar a capacidade de carga dos ecossistemas degradados), com engenharia da água para o desenho e uso harmonizado de tecnologias e infraestruturas da água, e, com a gestão integrada da água, como a base para a implementação bem-sucedida de soluções ecohidrológicas, conciliando as necessidades de vários stakefolders. O programa MAEH associa parceiros académicos, profissionais e institucionais, nacionais e internacionais.

3.1.The study programme's generic objectives:

The MAEH consortium was built with the aim of combining knowledge from different European institutions of higher education, to address the issue of restoring aquatic ecosystems, using natural-based tools. The program offers student-centered learning and guided by practical skills and experiences from the field, laboratory and the world of work. Merges Ecohidrology, (a subdiscipline of water sciences that aims to use natural processes to increase the resilience of ecosystems and restore the carrying capacity of degraded ecosystems), with water engineering for the harmonized design and use of water technologies and infrastructures, and with integrated water management, as the basis for the successful implementation of eco-hydrological solutions, reconciling the needs of various stakeholders. The MAEH program brings together academic, professional and institutional partners, both national and international.

3.2.Objetivos de aprendizagem (conhecimentos, aptidões e competências) a desenvolver pelos estudantes:

Os objectivos da aprendizagem são considerados em diferentes níveis progressivos: conhecimento - o que os alunos aprenderão em diferentes disciplinas científicas, aptidões - o que os estudantes aprenderão e serão capazes de executar e competência - combinando o conhecimento nas disciplinas-chave com um conjunto de aptidões.
Conhecimento – incide no conhecimento científico avançado de ecohidrologia, engenharia da água e gestão integrada da água.
Aptidões – incide nas soluções de base natural e tecnológicas de acordo com a gestão integrada da água, considerando o contexto ecológico, espacial e socioeconómico. Confere capacidade para resolução de problemas e investigação independente.
Competências – conjugar diferentes abordagens científicas em equipes interdisciplinares, escolher ferramentas e métodos científicos adequados, para recolher, analisar e interpretar informações (qualitativas e quantitativas) sobre os problemas da água.

3.2.Intended learning outcomes (knowledge, skills and competences) to be developed by the students:

Learning objectives are considered at different progressive levels: knowledge - what students will learn in different scientific disciplines, skills - what students will learn and be able to perform and competence - combining knowledge in key subjects with a set of skills .
Knowledge - focuses on advanced scientific knowledge of eco-hydrology, water engineering and integrated water management.
Skills - focuses on natural and technological solutions according to integrated water management, considering the ecological, spatial and socioeconomic context. Provides problem solving and independent investigation capabilities.
Competences - to combine different scientific approaches in interdisciplinary teams, choose appropriate scientific tools and methods, to collect, analyze and interpret information (qualitative and quantitative) on water problems.

3.3.Inserção do ciclo de estudos na estratégia institucional de oferta formativa, face à missão institucional e, designadamente, ao projeto educativo, científico e cultural da instituição:

A UAlg é uma entidade de ensino superior com 41 anos de existência, que na área das Ciências Aquáticas dispõe de um corpo docente próprio qualificado, constituído por titulares do grau de doutor, de elevada competência profissional. Dispõe de dois centros de investigação o CCMAR - Centro de Ciências do Mar doAlgarve e o CIMA - Centro de Investigação Marinha e Ambiental, com inúmeros projetos de investigação científica nacionais e internacionais, em diferentes domínios de ecologia aquática, hidrologia, biotecnologia marinha, pescas, aquacultura, poluição e ecotoxicologia, oceanografia e ambiente.
O mestrado em Ecohidrologia Aplicada insere-se na estratégia de internacionalização da universidade do Algarve. Essa estratégia tem por objectivo oferecer formação ao mais alto nível académico e cientifico mas, também, através do enquadramento com as principais linhas orientadoras e temas de âmbito nivel global, contribuir para as respostas societais globais que servirão de base para o desenvolvimento sustentável em várias partes do mundo.
O mestrado em ecohidrologia aplicada, contribuirá para a troca de experiências aos níveis científicos e educativos. Por ser um mestrado Erasmus mundus com financiamento da União Europeia, facilita a colaboração com docentes, investigadores e gestores de universidades, instituições e empresas, da Europa e fora da Europa. Por outro lado, o facto de a Universidade do Algarve receber estudantes de todas as regiões do mundo fomenta o desenvolvimento de uma cultura de tolerância e respeito intercultural.
A capacidade científica e educativa da UALG na área da ecohidrologia é reforçada pelo facto de a UNESCO ter atribuído à UALG uma Cátedra em "Ecohidrologia: água para os ecossistemas e sociedades".

3.3.Insertion of the study programme in the institutional educational offer strategy, in light of the mission of the institution and its educational, scientific and cultural project:

UAlg is a 41-year-old higher education institution, which in the area of Aquatic Sciences has its own qualified teaching staff, consisting of holders of a PhD degree, with high professional competence. It has two research centers, CCMAR - Center for Marine Sciences of the Algarve and CIMA - Center for Marine and Environmental Research, with numerous national and international scientific research projects, in different domains of aquatic ecology, hydrology, marine biotechnology, fisheries, aquaculture, pollution and ecotoxicology, oceanography and environment.
The master's degree in Applied Ecohydrology is part of the internationalization strategy of the University of Algarve. This strategy aims to offer training at the highest academic and scientific level, but also, through the framework with the main guidelines and themes of global scope, contribute to the global societal responses that will serve as a basis for sustainable development in various parts of the world.
The master's degree in applied eco-hydrology will contribute to the exchange of experiences at scientific and educational levels. As an Erasmus mundus master's degree with European Union funding, it facilitates collaboration with teachers, researchers and managers from universities, institutions and companies, from Europe and outside Europe. On the other hand, the fact that the University of Algarve receives students from all regions of the world promotes the development of a culture of tolerance and intercultural respect.
UALG's scientific and educational capacity in the area of eco-hydrology is reinforced by the fact that UNESCO has assigned UALG a Chair in "Eco-hydrology: water for ecosystems and societies".

4. Desenvolvimento curricular

4.1. Ramos, opções, perfis, maior/menor ou outras formas de organização em que o ciclo de estudos se estrutura (a preencher apenas quando aplicável)

4.1. Ramos, opções, perfis, maior/menor ou outras formas de organização em que o ciclo de estudos se estrutura (a preencher apenas quando aplicável) / Branches, options, profiles, major/minor or other forms of organisation (if applicable)

Ramos, opções, perfis, maior/menor ou outras formas de organização em que o ciclo de estudos se estrutura:	Branches, options, profiles, major/minor or other forms of organisation:
<sem resposta>	

4.2. Estrutura curricular (a repetir para cada um dos percursos alternativos)

Mapa II - NA

4.2.1.Ramo, opção, perfil, maior/menor ou outra (se aplicável):
NA

4.2.1.Branch, option, profile, major/minor or other (if applicable):
NA

4.2.2. Áreas científicas e créditos necessários à obtenção do grau / Scientific areas and credits necessary for awarding the degree

Área Científica / Scientific Area	Sigla / Acronym	ECTS Obrigatórios / Mandatory ECTS	ECTS Minímos optativos* / Minimum Optional ECTS*	Observações / Observations
Ciências do Ambiente/ Environmental Sciences	CAMB	44		
Tecnologias de Proteção Ambiental/environmental protection technologies	TPAM	25		
Ciências do Ambiente ou Tecnologias de Protecção Ambiental / Environmental Sciences or environmental protection technologies	CAMB/TPAM		30	
Qualquer Área Científica/Any other scientific area	QAC		21	
(4 Items)		**69**	**51**	

4.3 Plano de estudos

Mapa III - NA - 1.º/1.º semestre/1st year / 1st semester

4.3.1.Ramo, opção, perfil, maior/menor ou outra (se aplicável):
NA

4.3.1.Branch, option, profile, major/minor or other (if applicable):
NA

4.3.2.Ano/semestre/trimestre curricular:
1.º/1.º semestre/1st year / 1st semester

4.3.3 Plano de Estudos / Study plan

Unidade Curricular / Curricular Unit	Área Científica / Scientific Area (1)	Duração / Duration (2)	Horas Trabalho / Working Hours (3)	Horas Contacto / Contact Hours (4)	ECTS	Opcional	Observações / Observations (5)
Applied practical field and laboratory training in Ecohydrology	CAMB	Semestral/Semester	286	T-4; TP-8; PL-22; TC-30; S-12; OT-8;	11		
Ecohydrology and dynamics of aquatic ecosystems	CAMB	Semestral/Semester	156	T-12; TP-9; TC-18; S-5; OT-3;	6		
Fundamentals of hydrology and hydrogeology	CAMB	Semestral/Semestral	78	T-8; TP-12; OT-4;	3		
Integrated project in Portugal- World of work 1	TPAM	Semestral/Semester	104	T-2; TC-10; S-4; OT-16;	4	1	Inclui 5 dias de visitas de estudo
MAEH Webinar in Ecohydrology	CAMB	Semestral/Semester	78	T-3; S-14; OT-7;	3		
Options	QAC	Semestral/Semester	78	T-1;	3	1	Estudante escolhe um mínimo de 3 Ects de entre conjunto uc's definidas pelo consórcio

(6 Items)

Mapa III - NA - 1.º/2.º semestre/1st year / 2nd semester

4.3.1.Ramo, opção, perfil, maior/menor ou outra (se aplicável):
NA

4.3.1.Branch, option, profile, major/minor or other (if applicable):
NA

4.3.2.Ano/semestre/trimestre curricular:
1.º/2.º semestre/1st year / 2nd semester

4.3.3 Plano de Estudos / Study plan

Unidade Curricular / Curricular Unit	Área Científica / Scientific Area (1)	Duração / Duration (2)	Horas Trabalho / Working Hours (3)	Horas Contacto / Contact Hours (4)	ECTS	Opcional	Observações / Observations (5)
Hydraulic Simulation and Modeling	TPAM	Semestral/Semester	156	T-16; TP-12; PL-8; TC-6; S-3; OT-3;	6		
Hydrological engineering	TPAM	Semestral/Semester	156	T-12; TP-12; PL-9; TC-6; S-6; OT-3;	6		
Integrated project in Germany - World of work 2	TPAM	Semestral/Semester	78	TP-3; S-5; OT-16;	3		
Sustainable Urban Systems	TPAM	Semestral/Semester	156	T-12; PL-12; TC-6; S-12; OT-6;	6		

Options	QAC	Semestral/Semester	234	T-1;	9	1	O estudante escolhe um mínimo de 9 Ects de entre o conjunto de uc's definidas pelo consórcio

(5 Items)

Mapa III - NA - 2.º/1.º semestre/2nd year / 1st semester

4.3.1.Ramo, opção, perfil, maior/menor ou outra (se aplicável):
NA

4.3.1.Branch, option, profile, major/minor or other (if applicable):
NA

4.3.2.Ano/semestre/trimestre curricular:
2.º/1.º semestre/2nd year / 1st semester

4.3.3 Plano de Estudos / Study plan

Unidade Curricular / Curricular Unit	Área Científica / Scientific Area (1)	Duração / Duration (2)	Horas Trabalho / Working Hours (3)	Horas Contacto / Contact Hours (4)	ECTS	Opcional	Observações / Observations (5)
Global water problems and integrated water management	CAMB	Semestral/Semester	78	T-16; TP-6; S-10;	3		
Groundwater management and remediation	CAMB	Semestral/Semester	78	T-12; TP-4; PL-8; TC-8;	3		
Integrated assessment of water and sediment quality	CAMB	Semestral/Semester	78	T-14; TP-3; PL-8; TC-5; OT-2;	3		
Integrated modeling and design of basin management plans	CAMB	Semestral/Semester	78	T-16; TP-12; S-4;	3		
Integrated project in Belgium- World of work 3	CAMB	Semestral/Semester	156	T-6; TC-36; S-14; OT-6;	6	1	Inclui 7 dias de visitas de estudos
Nature-based solutions	CAMB	Semestral/Semester	78	T-15; TP-5; S-6; OT-6;	3		
Options	QAC	Semestral/Semester	234	T-1;	9	1	O estudante escolhe um mínimo de 9 Ects de entre o conjunto de uc's definidas pelo consórcio

(7 Items)

Mapa III - NA - 2.º/2.º semestre/2nd year / 2nd semester

4.3.1.Ramo, opção, perfil, maior/menor ou outra (se aplicável):
NA

4.3.1.Branch, option, profile, major/minor or other (if applicable):
NA

4.3.2.Ano/semestre/trimestre curricular:
2.º/2.º semestre/2nd year / 2nd semester

4.3.3 Plano de Estudos / Study plan

Unidade Curricular / Curricular Unit	Área Científica / Scientific Area (1)	Duração / Duration (2)	Horas Trabalho / Working Hours (3)	Horas Contacto / Contact Hours (4)	ECTS	Opcional	Observações / Observations (5)
Thesis	CAMB/TPAM	Semestral/Semester	780	OT-234;	30		

(1 Item)

4.4. Unidades Curriculares

Mapa IV - Global water problems and integrated water Management

4.4.1.1.Designação da unidade curricular:
Global water problems and integrated water Management

4.4.1.1.Title of curricular unit:
Global water problems and integrated water Management

4.4.1.2.Sigla da área científica em que se insere:
CAMB

4.4.1.3.Duração:
Semestral/Semester

4.4.1.4.Horas de trabalho:
78

4.4.1.5.Horas de contacto:
32

4.4.1.6.ECTS:
3

4.4.1.7.Observações:
Unidade curricular da responsabilidade da Universidade de Antuérpia

4.4.1.7.Observations:
responsability University Antwerpen

4.4.2.Docente responsável e respetiva carga letiva na Unidade Curricular (preencher o nome completo):
Stefan Van Damme 16T, 6 TP; 10 S

4.4.3.Outros docentes e respetivas cargas letivas na unidade curricular:
n/a

4.4.4.Objetivos de aprendizagem (conhecimentos, aptidões e competências a desenvolver pelos estudantes):
At the end of the course the student must have an insight in the complexity of the water system and understand the need for a holistic approach. They must have an insight in the different demands for water and methods to reconcile all the demands in a sustainable way

4.4.4.Intended learning outcomes (knowledge, skills and competences to be developed by the students):
At the end of the course the student must have an insight in the complexity of the water system and understand the need for a holistic approach. They must have an insight in the different demands for water and methods to reconcile all the demands in a sustainable way

4.4.5.Conteúdos programáticos:
Integrated water resources management is the concept that tries to integrate all different functions of water systems taking into account supply and demand and this within the context of the physical, chemical and ecological characteristics of the system. The main aim is to provide enough and high quality water for all life.
Within this module the different aspects of integrated water resources management are discussed.

4.4.5.Syllabus:
Integrated water resources management is the concept that tries to integrate all different functions of water systems taking into account supply and demand and this within the context of the physical, chemical and ecological characteristics of the system. The main aim is to provide enough and high quality water for all life.
Within this module the different aspects of integrated water resources management are discussed.

4.4.6.Demonstração da coerência dos conteúdos programáticos com os objetivos de aprendizagem da unidade curricular:
After a general introduction about global water problems, virtual water etc. a generic description of both biotic and abiotic aspects of a water system is given to show the close interrelationship between all aspects of the water system. The interaction between men and the water system is discussed in different parts. Next the different water uses are

analysed: water and agriculture, water and man and water and ecosystems. In these different parts the demands for water and the potential role of technologies are analysed as well as how we have changed the water system to fulfill these demands and what the impact of these changes is. The final part of the course is a description of how to bring all different aspects together in a river basin management plan, illustrating the need to find a balance between ecological functioning and adequate use of water technology.

4.4.6.Evidence of the syllabus coherence with the curricular unit's intended learning outcomes:

After a general introduction about global water problems, virtual water etc. a generic description of both biotic and abiotic aspects of a water system is given to show the close interrelationship between all aspects of the water system. The interaction between men and the water system is discussed in different parts. Next the different water uses are analysed: water and agriculture, water and man and water and ecosystems. In these different parts the demands for water and the potential role of technologies are analysed as well as how we have changed the water system to fulfill these demands and what the impact of these changes is. The final part of the course is a description of how to bring all different aspects together in a river basin management plan, illustrating the need to find a balance between ecological functioning and adequate use of water technology.

4.4.7.Metodologias de ensino (avaliação incluída):

Teaching methods:
• Class contact teaching
• Lectures
• Guest lectures
• Assignments In group
• Directed self-study

Evaluation Methods:
Examination
• Written with oral presentation
Continuous assessment
• Case studies
• Participation in classroom activities

4.4.7.Teaching methodologies (including students' assessment):

Teaching methods:
• Class contact teaching
• Lectures
• Guest lectures
• Assignments In group
• Directed self-study

Evaluation Methods:
Examination
• Written with oral presentation
Continuous assessment
• Case studies
• Participation in classroom activities

4.4.8.Demonstração da coerência das metodologias de ensino com os objetivos de aprendizagem da unidade curricular:

Course material is taught in a combination of lectures and guest lectures. The re sposible professor for the course bring the students basic understanding of the global water problems, the water system and how all aspects are interrelated. Guest lecturers add in depth knowledge. A guest lecturer for the Institute of Tropical Medicine explain the relationship between water and health. A guest lecturer from the NGO Join for Water explains how integrated water management can be applied in South and shows good practices and succes stories. Furthermore, students have to work in group on real lif water management problems. Several cases will be analysed by the students as examples. For a case, they have to set-up a rviver basin management plan and present and discuss their results.

The methodologies of this already accredited course in Belgium is designed to obtain the learning outcomes. https://www.highereducation.be/education?id=6c419913-c941-4354-a2af-0a8501aa8fd3:171ad1f5ec5

4.4.8.Evidence of the coherence between the teaching methodologies and the intended learning outcomes:

Course material is taught in a combination of lectures and guest lectures. The re sposible professor for the course bring the students basic understanding of the global water problems, the water system and how all aspects are interrelated. Guest lecturers add in depth knowledge. A guest lecturer for the Institute of Tropical Medicine explain the relationship between water and health. A guest lecturer from the NGO Join for Water explains how integrated water management can be applied in South and shows good practices and succes stories. Furthermore, students have to work in group on real lif water management problems. Several cases will be analysed by the students as examples. For a case, they have to set-up a rviver basin management plan and present and discuss their results.

The methodologies of this already accredited course in Belgium is designed to obtain the learning outcomes. https://www.highereducation.be/education?id=6c419913-c941-4354-a2af-0a8501aa8fd3:171ad1f5ec5

4.4.9.Bibliografia de consulta/existência obrigatória:
Lenton R & M. Muller (Eds), 2009. Integrated Water Resources Management in Practice: Better Water Management for Development. Earthscan

Mapa IV - Groundwater management and remediation

4.4.1.1.Designação da unidade curricular:
Groundwater management and remediation

4.4.1.1.Title of curricular unit:
Groundwater management and remediation

4.4.1.2.Sigla da área científica em que se insere:
CAMB

4.4.1.3.Duração:
Semestral/Semester

4.4.1.4.Horas de trabalho:
78

4.4.1.5.Horas de contacto:
32

4.4.1.6.ECTS:
3

4.4.1.7.Observações:
Unidade curricular da responsabilidade da Universidade de Antuérpia

4.4.1.7.Observations:
Under responsability of University of Antwerpen

4.4.2.Docente responsável e respetiva carga letiva na Unidade Curricular (preencher o nome completo):
Goedele Verreydt - 12 T; 4 TP; 8 PL; 8 TC

4.4.3.Outros docentes e respetivas cargas letivas na unidade curricular:
N/A

4.4.4.Objetivos de aprendizagem (conhecimentos, aptidões e competências a desenvolver pelos estudantes):
With this course we want to provide insight in the basic transport processes related to groundwater and to groundwater-surface water interactions. This course entails basis fluid dynamics and also geochemistry, both of these aspects in relation to monitoring tools and models and to soil- and groundwater remediation & management. This will results in course applicants that are better capable to evaluate and manage groundwater and groundwater-surface water related problems & engineering works.

4.4.4.Intended learning outcomes (knowledge, skills and competences to be developed by the students):
With this course we want to provide insight in the basic transport processes related to groundwater and to groundwater-surface water interactions. This course entails basis fluid dynamics and also geochemistry, both of these aspects in relation to monitoring tools and models and to soil- and groundwater remediation & management. This will results in course applicants that are better capable to evaluate and manage groundwater and groundwater-surface water related problems & engineering works.

4.4.5.Conteúdos programáticos:
The objective of this course is to teach groundwater management from the key methodologies to collect hydrogeochemical data to build a conceptual site model (CSM), through selecting and managing remediation systems based on chemical, geological and biological site conditions and regulations. This all in the broad context of a groundwater system that is related to a surface water stream, flowing from source to mouth.

4.4.5.Syllabus:

The objective of this course is to teach groundwater management from the key methodologies to collect hydrogeochemical data to build a conceptual site model (CSM), through selecting and managing remediation systems based on chemical, geological and biological site conditions and regulations. This all in the broad context of a groundwater system that is related to a surface water stream, flowing from source to mouth.

4.4.6.Demonstração da coerência dos conteúdos programáticos com os objetivos de aprendizagem da unidade curricular:

In order to achieve this objective, the following topics are presented:
1) 'Refresher of the Basics' (theory):
Day 1: Aquifer systems & introduction to groundwater management

2) 'Systemic approach source to mouth'
Day 2: Groundwater hydrology in watersheds & groundwater characterization
(principles + characterization methods)

Day 3: Groundwater geochemistry & groundwater transport (theory + practice)
Groundwater-surface water interactions, Introduction to mass flux, groundwater modelling)

Day 4: Groundwater pollution & groundwater remediation methods
+ guest lecture by Prof. Poul Løgstrup Bjerg, Department of Environmental Engineering, Technical University of Denmark (DTU)

3)'Integration and application'
Dag 5: Case study: Excursion Lippenbroek (1/2 day) + group task on case (different topics/aspects within one case study)

4.4.6.Evidence of the syllabus coherence with the curricular unit’s intended learning outcomes:

In order to achieve this objective, the following topics are presented:
1) 'Refresher of the Basics' (theory):
Day 1: Aquifer systems & introduction to groundwater management

2) 'Systemic approach source to mouth'
Day 2: Groundwater hydrology in watersheds & groundwater characterization
(principles + characterization methods)

Day 3: Groundwater geochemistry & groundwater transport (theory + practice)
Groundwater-surface water interactions, Introduction to mass flux, groundwater modelling)

Day 4: Groundwater pollution & groundwater remediation methods
+ guest lecture by Prof. Poul Løgstrup Bjerg, Department of Environmental Engineering, Technical University of Denmark (DTU)

3)'Integration and application'
Dag 5: Case study: Excursion Lippenbroek (1/2 day) + group task on case (different topics/aspects within one case study)

4.4.7.Metodologias de ensino (avaliação incluída):

Teaching methods:
Class contact teaching
• Lectures
• Practice sessions
• Seminars/Tutorials
• Guest lectures
Skills training
Excursions
Project in group

Evaluation methods:
Examination
• Written with oral presentation
Continuous assessment
• Exercises
• Participation in classroom activities

4.4.7.Teaching methodologies (including students' assessment):

Teaching methods:
Class contact teaching
• Lectures
• Practice sessions
• Seminars/Tutorials
• Guest lectures

Skills training
Excursions
Project in group

Evaluation methods:
Examination
• Written with oral presentation
Continuous assessment
• Exercises
• Participation in classroom activities

4.4.8.Demonstração da coerência das metodologias de ensino com os objetivos de aprendizagem da unidade curricular:
The methodologies of this already accredited course in Belgium is designed to obtain the learning outcomes. https://www.highereducation.be/education?id=6c419913-c941-4354-a2af-0a8501aa8fd3:171ad1f5ec5

4.4.8.Evidence of the coherence between the teaching methodologies and the intended learning outcomes:
The methodologies of this already accredited course in Belgium is designed to obtain the learning outcomes. https://www.highereducation.be/education?id=6c419913-c941-4354-a2af-0a8501aa8fd3:171ad1f5ec5

4.4.9.Bibliografia de consulta/existência obrigatória:
Investigating Groundwater, CRC Press, ISBN: 9781138542495
Groundwater vulnerability and pollution risk assessment, CRC Press, ISBN: 978-0-367-82292-7
Groundwater, Freeze & Cherry, ISBN: 0-13-365312-9, https://www.un-igrac.org/sites/default/files/resources/files/Groundwater%20book%20-%20English.pdf
Hydrogeology: Groundwater Science and Engineering, Dassargues, ISBN: 9781498744003
ITRC, Technologies, Characterization and Monitoring, https://clu-in.org/characterization/
ITRC, Remediation Technologies, https://clu-in.org/remediation/
EPA Series: A Citizen's Guide to Cleanup Technologies, https://clu-in.org/products/citguide/
BOSS- Soil Remediation Techniques, https://emis.vito.be/en/tools-overview/boss?language=en

Mapa IV - Integrated assessment of water and sediment quality

4.4.1.1.Designação da unidade curricular:
Integrated assessment of water and sediment quality

4.4.1.1.Title of curricular unit:
Integrated assessment of water and sediment quality

4.4.1.2.Sigla da área científica em que se insere:
CAMB

4.4.1.3.Duração:
Semestral/Semester

4.4.1.4.Horas de trabalho:
78

4.4.1.5.Horas de contacto:
32

4.4.1.6.ECTS:
3

4.4.1.7.Observações:
Unidade curricular da responsabilidade da Universidade de Antuérpia

4.4.1.7.Observations:
Under responsability of the University

4.4.2.Docente responsável e respetiva carga letiva na Unidade Curricular (preencher o nome completo):
Johannes Teuchies 14T; 3 TP; 8 PL; 5 TC; 2 OT;

4.4.3.Outros docentes e respetivas cargas letivas na unidade curricular:

N/A

4.4.4.Objetivos de aprendizagem (conhecimentos, aptidões e competências a desenvolver pelos estudantes):

nowledge:
List the most important classes of pollutants with their characteristics and possible effects.
Define different monitoring techniques including their advantages and disadvantages.
Give an overview of legislation related to pollutants.
Explain how sediment and water quality guidelines are developed.
Understanding:
Describe the processes that determine the bioavailability of pollutants in sediment and water.
Explain how pollutants are interacting with living organisms (uptake, transformation, elimination) on different levels of organization.
Application:
Use existing computer tools to perform an integrated risk assessment of a contaminated aquatic environment.
Calculate ecological indices based on identified biota in a stream.
Apply the theory of the course to work out a monitoring strategy to define the risks of existing pollution in an aquatic environment.

4.4.4.Intended learning outcomes (knowledge, skills and competences to be developed by the students):

Knowledge:
List the most important classes of pollutants with their characteristics and possible effects.
Define different monitoring techniques including their advantages and disadvantages.
Give an overview of legislation related to pollutants.
Explain how sediment and water quality guidelines are developed.
Understanding:
Describe the processes that determine the bioavailability of pollutants in sediment and water.
Explain how pollutants are interacting with living organisms (uptake, transformation, elimination) on different levels of organization.
Application:
Use existing computer tools to perform an integrated risk assessment of a contaminated aquatic environment.
Calculate ecological indices based on identified biota in a stream.
Apply the theory of the course to work out a monitoring strategy to define the risks of existing pollution in an aquatic environment.

4.4.5.Conteúdos programáticos:

• An introduction to general concepts of ecotoxicology.
• An overview of most important classes of pollutants: sources, characteristics and effects.
• Factors and processes that determine the bioavailability of pollutants in aquatic ecosystems.
• European legislation related to pollutants in aquatic ecosystems: frameworks, applicability and background on sediment and water quality guidelines.
• The kinetics of interactions between pollutants and organisms on different levels of organization.
• An overview of different monitoring strategies to identify risks of pollutants in aquatic environments: chemical, toxicological, biological and ecological monitoring.
• Examples of different existing monitoring tools and frameworks.
• Examples of different case studies where the theory of the course is applied to perform an environmental risk assessment of a polluted aquatic environment.

4.4.5.Syllabus:

• An introduction to general concepts of ecotoxicology.
• An overview of most important classes of pollutants: sources, characteristics and effects.
• Factors and processes that determine the bioavailability of pollutants in aquatic ecosystems.
• European legislation related to pollutants in aquatic ecosystems: frameworks, applicability and background on sediment and water quality guidelines.
• The kinetics of interactions between pollutants and organisms on different levels of organization.
• An overview of different monitoring strategies to identify risks of pollutants in aquatic environments: chemical, toxicological, biological and ecological monitoring.
• Examples of different existing monitoring tools and frameworks.
• Examples of different case studies where the theory of the course is applied to perform an environmental risk assessment of a polluted aquatic environment.

4.4.6.Demonstração da coerência dos conteúdos programáticos com os objetivos de aprendizagem da unidade curricular:

The content of this already accredited course in Belgium is designed to obtain the learning outcomes.
https://www.highereducation.be/education?id=6c419913-c941-4354-a2af-0a8501aa8fd3:171ad1f5ec5

4.4.6.Evidence of the syllabus coherence with the curricular unit's intended learning outcomes:

The content of this already accredited course in Belgium is designed to obtain the learning outcomes.
https://www.highereducation.be/education?id=6c419913-c941-4354-a2af-0a8501aa8fd3:171ad1f5ec5

4.4.7.Metodologias de ensino (avaliação incluída):
Teaching methods:
Class contact teaching
• Lectures
• Laboratory sessions

Personal work
• Exercises
• Case studies In group

Evaluation methods:
• Written examination without oral presentation

4.4.7.Teaching methodologies (including students' assessment):
Teaching methods:
Class contact teaching
• Lectures
• Laboratory sessions

Personal work
• Exercises
• Case studies In group

Evaluation methods:
• Written examination without oral presentation

4.4.8.Demonstração da coerência das metodologias de ensino com os objetivos de aprendizagem da unidade curricular:
The methodologies of this already accredited course in Belgium is designed to obtain the learning outcomes. https://www.highereducation.be/education?id=6c419913-c941-4354-a2af-0a8501aa8fd3:171ad1f5ec5

4.4.8.Evidence of the coherence between the teaching methodologies and the intended learning outcomes:
The methodologies of this already accredited course in Belgium is designed to obtain the learning outcomes. https://www.highereducation.be/education?id=6c419913-c941-4354-a2af-0a8501aa8fd3:171ad1f5ec5

4.4.9.Bibliografia de consulta/existência obrigatória:
Van Leeuwen & Vermeire (2007) Risk Assessment of chemicals: an introduction. Springer.

European Commission: Environment Directorate General (2007). Reach in brief. https://ec.europa.eu/environment/chemicals/reach/pdf/publications/2007_02_reach_in_brief.pdf

Mapa IV - Integrated modeling and design of basin management plans

4.4.1.1.Designação da unidade curricular:
Integrated modeling and design of basin management plans

4.4.1.1.Title of curricular unit:
Integrated modeling and design of basin management plans

4.4.1.2.Sigla da área científica em que se insere:
CAMB

4.4.1.3.Duração:
Semestral/Semester

4.4.1.4.Horas de trabalho:
78

4.4.1.5.Horas de contacto:
32

4.4.1.6.ECTS:
3

4.4.1.7.Observações:
Unidade curricular da responsabilidade da Universidade de Antuérpia

4.4.1.7.Observations:
Under responsability of the University of Antwerpen

4.4.2.Docente responsável e respetiva carga letiva na Unidade Curricular (preencher o nome completo):
Piet Seuntjes 16 T; 12 TP; 4 S

4.4.3.Outros docentes e respetivas cargas letivas na unidade curricular:
N/A

4.4.4.Objetivos de aprendizagem (conhecimentos, aptidões e competências a desenvolver pelos estudantes):
Familiarise the student with several modelling aspects one is confronted with in a river basin management framework. The integrated approach demonstrates the interdependencies between the different subsystems which allows the student to think in river basin scale including all its aspects.

4.4.4.Intended learning outcomes (knowledge, skills and competences to be developed by the students):
Familiarise the student with several modelling aspects one is confronted with in a river basin management framework. The integrated approach demonstrates the interdependencies between the different subsystems which allows the student to think in river basin scale including all its aspects.

4.4.5.Conteúdos programáticos:
1: WWTP modelling. Different aspects of WWTP modelling will be highlighted. This includes: (1) a description of popular models for biological processes, settling tanks, anaerobic digesters, MBRs,…; (2) influent characterisation and (3) measuring/evaluating plant performance and (4) a basic introduction to control.
2: Hydrological modelling. The most important hydrologic processes will be described, as well as the combination of these processes into hydrologic models.
3: River water quality modelling. how water quality models integrate river processes, i.e., hydrology, chemical transport, biological and chemical transformations, inclusion of point and diffuse sources. In the session, examples will be given of various models that simulate water quality at different levels of complexity and scale. Short attention will be paid to tools that are used or preferred by national authorities and the EU commission to built water management plans

4.4.5.Syllabus:
1: WWTP modelling. Different aspects of WWTP modelling will be highlighted. This includes: (1) a description of popular models for biological processes, settling tanks, anaerobic digesters, MBRs,…; (2) influent characterisation and (3) measuring/evaluating plant performance and (4) a basic introduction to control.
2: Hydrological modelling. The most important hydrologic processes will be described, as well as the combination of these processes into hydrologic models.
3: River water quality modelling. how water quality models integrate river processes, i.e., hydrology, chemical transport, biological and chemical transformations, inclusion of point and diffuse sources. In the session, examples will be given of various models that simulate water quality at different levels of complexity and scale. Short attention will be paid to tools that are used or preferred by national authorities and the EU commission to built water management plans

4.4.6.Demonstração da coerência dos conteúdos programáticos com os objetivos de aprendizagem da unidade curricular:
ntegrative simulation exercise for a real-life case in West®: WWTP, hydrology and river quality modelling. Hands-on exercise with application of integration of aspects of WWTP and river quality modelling, demonstrating the impact of a certain technology on water quality of a single river stretch. The exercise aims at familiarising the students with the impact of a treatment technology, impact of pollution sources, impact of changing boundary conditions (rainfall, temperature, ...) on water quality.

The content of this already accredited course in Belgium is designed to obtain the learning outcomes. https://www.highereducation.be/education?id=6c419913-c941-4354-a2af-0a8501aa8fd3:171ad1f5ec5

4.4.6.Evidence of the syllabus coherence with the curricular unit's intended learning outcomes:
Integrative simulation exercise for a real-life case in West®: WWTP, hydrology and river quality modelling. Hands-on exercise with application of integration of aspects of WWTP and river quality modelling, demonstrating the impact of a certain technology on water quality of a single river stretch. The exercise aims at familiarising the students with the impact of a treatment technology, impact of pollution sources, impact of changing boundary conditions (rainfall, temperature, ...) on water quality.

The content of this already accredited course in Belgium is designed to obtain the learning outcomes. https://www.highereducation.be/education?id=6c419913-c941-4354-a2af-0a8501aa8fd3:171ad1f5ec5

4.4.7.Metodologias de ensino (avaliação incluída):
Teaching Methods:
Class contact teaching
• Lectures
• Seminars/Tutorials

Personal work
• Exercises

Evaluation metods:
Examination
• Written examination without oral presentation
• Open book

4.4.7.Teaching methodologies (including students' assessment):
Teaching Methods:
Class contact teaching
• Lectures
• Seminars/Tutorials

Personal work
• Exercises

Evaluation metods:
Examination
• Written examination without oral presentation
• Open book

4.4.8.Demonstração da coerência das metodologias de ensino com os objetivos de aprendizagem da unidade curricular:
The methodologies of this already accredited course in Belgium is designed to obtain the learning outcomes.
https://www.highereducation.be/education?id=6c419913-c941-4354-a2af-0a8501aa8fd3:171ad1f5ec5

4.4.8.Evidence of the coherence between the teaching methodologies and the intended learning outcomes:
The methodologies of this already accredited course in Belgium is designed to obtain the learning outcomes.
https://www.highereducation.be/education?id=6c419913-c941-4354-a2af-0a8501aa8fd3:171ad1f5ec5

4.4.9.Bibliografia de consulta/existência obrigatória:
Chapra (1997) Surface Water Quality modeling. Waveland Press.
https://www.researchgate.net/publication/48447645_Surface_Water-Quality_Modeling

Mapa IV - Integrated project in Belgium - World of work 3

4.4.1.1.Designação da unidade curricular:
Integrated project in Belgium - World of work 3

4.4.1.1.Title of curricular unit:
Integrated project in Belgium - World of work 3

4.4.1.2.Sigla da área científica em que se insere:
CAMB

4.4.1.3.Duração:
Semestral/Semester

4.4.1.4.Horas de trabalho:
156

4.4.1.5.Horas de contacto:
62

4.4.1.6.ECTS:
6

4.4.1.7.Observações:
Unidade curricular da responsabilidade da Universidade de Antuérpia

4.4.1.7.Observations:
Under University of Antwerpen responsability

4.4.2.Docente responsável e respetiva carga letiva na Unidade Curricular (preencher o nome completo):
Patrick Meire; 6 T; 36 TC; 14 S; 6 OT

4.4.3.Outros docentes e respetivas cargas letivas na unidade curricular:
N/A

4.4.4.Objetivos de aprendizagem (conhecimentos, aptidões e competências a desenvolver pelos estudantes):
The objective of the course is to provide progressive learning and training regarding the reality of the world of work in the thematic area of ecohydrology, water engineering and water management. The module will consider internships at stakeholders companies and institutions, research internships at University or associated research centers, or development of projects with the participation of stakeholders, at the University.

4.4.4.Intended learning outcomes (knowledge, skills and competences to be developed by the students):
The objective of the course is to provide progressive learning and training regarding the reality of the world of work in the thematic area of ecohydrology, water engineering and water management. The module will consider internships at stakeholders companies and institutions, research internships at University or associated research centers, or development of projects with the participation of stakeholders, at the University.

4.4.5.Conteúdos programáticos:
1 – identification of practical solutions for stakeholders real water ecosystem situations, by the stakeholders
2 – develop, conceptually, the solutions
3 – Present and discuss the proposals with the stakeholders

4.4.5.Syllabus:
1 – identification of practical solutions for stakeholders real water ecosystem situations, by the stakeholders
2 – develop, conceptually, the solutions
3 – Present and discuss the proposals with the stakeholders

4.4.6.Demonstração da coerência dos conteúdos programáticos com os objetivos de aprendizagem da unidade curricular:
The program contents will be adapted to the stakeholders proposals and the development of the solutions will be taught in a progressive and articulated way so as to provide students with the theoretical knowledge and training that allows them to fulfill the objectives indicated for the discipline.

4.4.6.Evidence of the syllabus coherence with the curricular unit's intended learning outcomes:
The program contents will be adapted to the stakeholders proposals and the development of the solutions will be taught in a progressive and articulated way so as to provide students with the theoretical knowledge and training that allows them to fulfill the objectives indicated for the discipline.

4.4.7.Metodologias de ensino (avaliação incluída):
The course will be based on field visits and meetings with stakeholders to select the topics to be developed and on tutorial classes to support the development of the students projects
There is an articulation of matters and classes to ensure the appropriate sequence of the project development, between theoretical, practical and theoretical-practical classes. Course assessment comprises a report on the case that will be studied. The course assessment will consider the valuation from the stakeholders (50%)
Evaluation:
1. A group work written with individual presentation on practical project
2. A final written exam if group work evaluation is below 10/20 points

4.4.7.Teaching methodologies (including students' assessment):
The course will be based on field visits and meetings with stakeholders to select the topics to be developed and on tutorial classes to support the development of the students projects
There is an articulation of matters and classes to ensure the appropriate sequence of the project development, between theoretical, practical and theoretical-practical classes. Course assessment comprises a report on the case that will be studied. The course assessment will consider the valuation from the stakeholders (50%)
Evaluation:
1. A group work written with individual presentation on practical project
2. A final written exam if group work evaluation is below 10/20 points

4.4.8.Demonstração da coerência das metodologias de ensino com os objetivos de aprendizagem da unidade curricular:
The teaching methodologies aims to enable and support students to understand the concepts set out in the program objectives and in developing the conceptual project. Audiovisual resources will be used, based on the power point presentation. The field work will serve to visit the stakeholders institutions and learn, in situ their realities. Seminar will be used to students presentations and also for bringing experts in the field for lectures.
The knowledge provided during the theoretical lectures is complemented with seminars taught by specialists in various subjects related to UC objectives. This knowledge will be cemented through the realization of a practical project. This training component will be developed in tutorial classes to assure a greater follow-up in the realization of the project. The evaluation focuses on the understanding and application of the theoretical fundaments of ecohydrology and also on the project work that students will develop and present as a written report and oral presentation.

4.4.8.Evidence of the coherence between the teaching methodologies and the intended learning outcomes:
The teaching methodologies aims to enable and support students to understand the concepts set out in the program objectives and in developing the conceptual project. Audiovisual resources will be used, based on the power point presentation. The field work will serve to visit the stakeholders institutions and learn, in situ their realities. Seminar will be used to students presentations and also for bringing experts in the field for lectures.
The knowledge provided during the theoretical lectures is complemented with seminars taught by specialists in various subjects related to UC objectives. This knowledge will be cemented through the realization of a practical project. This training component will be developed in tutorial classes to assure a greater follow-up in the realization of the project. The evaluation focuses on the understanding and application of the theoretical fundaments of ecohydrology and also on the project work that students will develop and present as a written report and oral presentation.

4.4.9.Bibliografia de consulta/existência obrigatória:
Chicharo, L. Wagner, I., Chicharo, M. A Lapsinka, M. Zalewski, M. (2009) Practical experiments guide for Ecohydrology (Eds.Chicharo et al.). UNESCO Manual ISBN: 978-989-20-1702-0. Faro, 121 pp
Zalewski M, Wagner-Lotkowska I. & Robarts D. R. (eds). 2004. Integrated Watershed Management – Ecohydrology and Phytotechnology-Manual. UNESCO IHP, UNEP
IETC.246pp.;http://www.unep.or.jp/letc/Publications/Water_Sanitation/integrated_watershed_mgmt_manual
Wolanski, E., L. Chicharo, M.A. Chicharo (2008) Estuarine Ecohydrology. In Sven Erik Jørgensen and Brian D. Fath (Editor-in-Chief), Ecological Engineering. Vol. [2] of Encyclopedia of Ecology, 5 vols. pp. [1413-1422] Oxford: Elseier.

Mapa IV - Nature based solutions

4.4.1.1.Designação da unidade curricular:
Nature based solutions

4.4.1.1.Title of curricular unit:
Nature based solutions

4.4.1.2.Sigla da área científica em que se insere:
CAMB

4.4.1.3.Duração:
Semestral/Semester

4.4.1.4.Horas de trabalho:
78

4.4.1.5.Horas de contacto:
32

4.4.1.6.ECTS:
3

4.4.1.7.Observações:
Unidade curricular da responsabilidade da Universidade de Antuérpia

4.4.1.7.Observations:
Under responsability of University of Antwerpen

4.4.2.Docente responsável e respetiva carga letiva na Unidade Curricular (preencher o nome completo):
Tom Ysebaert 15 T; 5 TP; 6 TC; 6 OT

4.4.3.Outros docentes e respetivas cargas letivas na unidade curricular:
N/A

4.4.4.Objetivos de aprendizagem (conhecimentos, aptidões e competências a desenvolver pelos estudantes):
• describe the ecological role and societal importance of natural ecosystems in a global perspective
• apply the concept of ecosystem services as a tool to describe the value of ecosystems for nature and society
• develop conceptual nature-based designs by acquiring and integrating information on physical processes, biogeomorphological processes, and ecological processes; carry out first-order detailing of conceptual designs (e.g. application of simple design rules, order of magnitude analysis, feasibility check, assessment of ecological and societal effects)
• have an overview of the different applications of nature-based solutions using a systemic approach along the entire continuum of river and sea.

4.4.4.Intended learning outcomes (knowledge, skills and competences to be developed by the students):
• describe the ecological role and societal importance of natural ecosystems in a global perspective
• apply the concept of ecosystem services as a tool to describe the value of ecosystems for nature and society
• develop conceptual nature-based designs by acquiring and integrating information on physical processes, biogeomorphological processes, and ecological processes; carry out first-order detailing of conceptual designs (e.g. application of simple design rules, order of magnitude analysis, feasibility check, assessment of ecological and societal effects)
• have an overview of the different applications of nature-based solutions using a systemic approach along the entire continuum of river and sea.

4.4.5.Conteúdos programáticos:
Nature Based Solutions (NbS) is an emerging concept. . It covers a range of approaches and technologies, which use natural processes and ecosystems to address societal challenges, especially climate adaptation and mitigation and sustainable development. Of particular relevance are applications in the field of water management. These include water resources management, stormwater management, coastal/river flood protection, water supply, wastewater treatment and pollution prevention. We will discuss the application of nature-based solutions using a systemic approach along the entire continuum of river and sea. This will include stream valley restoration (e.g. role of buffer strips, dispersal barriers, re-introduction of ecosystem engineers, etc.), reconnecting rivers to floodplains, ecosystem-based coastal defence in the face of global change, and the role of blue-green infrastructure in managing urban water resources.

4.4.5.Syllabus:
Nature Based Solutions (NbS) is an emerging concept. . It covers a range of approaches and technologies, which use natural processes and ecosystems to address societal challenges, especially climate adaptation and mitigation and sustainable development. Of particular relevance are applications in the field of water management. These include water resources management, stormwater management, coastal/river flood protection, water supply, wastewater treatment and pollution prevention. We will discuss the application of nature-based solutions using a systemic approach along the entire continuum of river and sea. This will include stream valley restoration (e.g. role of buffer strips, dispersal barriers, re-introduction of ecosystem engineers, etc.), reconnecting rivers to floodplains, ecosystem-based coastal defence in the face of global change, and the role of blue-green infrastructure in managing urban water resources.

4.4.6.Demonstração da coerência dos conteúdos programáticos com os objetivos de aprendizagem da unidade curricular:
The content of this already accredited course in Belgium is designed to obtain the learning outcomes. https://www.highereducation.be/education?id=6c419913-c941-4354-a2af-0a8501aa8fd3:171ad1f5ec5

4.4.6.Evidence of the syllabus coherence with the curricular unit's intended learning outcomes:
The content of this already accredited course in Belgium is designed to obtain the learning outcomes. https://www.highereducation.be/education?id=6c419913-c941-4354-a2af-0a8501aa8fd3:171ad1f5ec5

4.4.7.Metodologias de ensino (avaliação incluída):
Teaching methods:
Class contact teaching
• Lectures
• Guest lectures

Personal work
• Assignments Individually
• Assignments In group

4.4.7.Teaching methodologies (including students' assessment):
Teaching methods:
Class contact teaching
• Lectures
• Guest lectures

Personal work
• Assignments Individually
• Assignments In group

Directed self-study
Excursions

Evaluation methods:
Examination
• Written with oral presentation

Continuous assessment
• Assignments
• Case studies
• Participation in classroom activities

4.4.8.Demonstração da coerência das metodologias de ensino com os objetivos de aprendizagem da unidade curricular:
The methodologies of this already accredited course in Belgium is designed to obtain the learning outcomes. https://www.highereducation.be/education?id=6c419913-c941-4354-a2af-0a8501aa8fd3:171ad1f5ec5

4.4.8.Evidence of the coherence between the teaching methodologies and the intended learning outcomes:
The methodologies of this already accredited course in Belgium is designed to obtain the learning outcomes. https://www.highereducation.be/education?id=6c419913-c941-4354-a2af-0a8501aa8fd3:171ad1f5ec5

4.4.9.Bibliografia de consulta/existência obrigatória:
Temmerman, Meire, Bouma, Herman, Ysebaert, De Vriend (2013) Ecosystem-based defence. Nature 504: 79-83
Mitsch (2012) What is Ecological Engineering Ecological Engineering 45: 5-12.

Mapa IV - Hydraulic Simulation and Modeling

4.4.1.1.Designação da unidade curricular:
Hydraulic Simulation and Modeling

4.4.1.1.Title of curricular unit:
Hydraulic Simulation and Modeling

4.4.1.2.Sigla da área científica em que se insere:
TPAM

4.4.1.3.Duração:
Semestral/Semester

4.4.1.4.Horas de trabalho:
156

4.4.1.5.Horas de contacto:
48

4.4.1.6.ECTS:
6

4.4.1.7.Observações:
Esta unidade curricular é da responsabilidade the University of Technische Hochschule Lübeck (Alemanha)

4.4.1.7.Observations:
Under responsability of the University of Technische Hochschule Lübeck (Alemanha)

4.4.2.Docente responsável e respetiva carga letiva na Unidade Curricular (preencher o nome completo):
Mario Oertel 16T; 12TP; 8PL; 6TC; 3S; 3OT

4.4.3.Outros docentes e respetivas cargas letivas na unidade curricular:
N/A

4.4.4.Objetivos de aprendizagem (conhecimentos, aptidões e competências a desenvolver pelos estudantes):

• Students are able to develop complex numerical surface water models, including
• parameter estimation, model calibration, validation and application to non-steady
• problems
• Students can create flood maps and risk areas for river flood areas
• Students can design and analyze hydraulic structures via numerical models
• Students can analyze numerical model results concerning structure's efficiencies
• Students are able to apply, modify and validate analytical models

4.4.4.Intended learning outcomes (knowledge, skills and competences to be developed by the students):

• Students are able to develop complex numerical surface water models, including
• parameter estimation, model calibration, validation and application to non-steady
• problems
• Students can create flood maps and risk areas for river flood areas
• Students can design and analyze hydraulic structures via numerical models
• Students can analyze numerical model results concerning structure's efficiencies
• Students are able to apply, modify and validate analytical models

4.4.5.Conteúdos programáticos:

• Basic knowledge of hydraulic terms
• Properties of river systems, physical laws of motion and flow of surface water
• Numerical modeling in hydraulic engineering, e.g. flood simulation or hydraulic
• structure design (fish steps, weirs)
- 1D models
- 2D depth averaged models
- 3D CFD models
• Parameter estimation
• Discretization, calibration, validation
• Result analysis

4.4.5.Syllabus:

• Basic knowledge of hydraulic terms
• Properties of river systems, physical laws of motion and flow of surface water
• Numerical modeling in hydraulic engineering, e.g. flood simulation or hydraulic
• structure design (fish steps, weirs)
- 1D models
- 2D depth averaged models
- 3D CFD models
• Parameter estimation
• Discretization, calibration, validation
• Result analysis

4.4.6.Demonstração da coerência dos conteúdos programáticos com os objetivos de aprendizagem da unidade curricular:

The program contents are taught in a progressive and articulated way so as to provide students with the theoretical knowledge and training that allows them to fulfill the objectives indicated for the discipline.

4.4.6.Evidence of the syllabus coherence with the curricular unit’s intended learning outcomes:

The program contents are taught in a progressive and articulated way so as to provide students with the theoretical knowledge and training that allows them to fulfill the objectives indicated for the discipline.

4.4.7.Metodologias de ensino (avaliação incluída):

A hybrid teaching method, which combines conceptual lectures and practical exercises on the computer, will be used in this curricular unit. The fundamental knowledge about hydrodynamic numerical flow simulation and its background will be provided in theoretical lectures, aiming to develop a systematic understanding about the basic concepts.
In practical exercises various software products from 1D to 3D CFD will be introduced and students will be guided step by step through different training projects to learn and practice how to preprocess data, run the models, and analyze the results accurately. Tutorial classes will be arranged for the students in case of unexpected difficulties.
Course assessment comprises a group project work and a presentation, which counting for 85% and 15% of the final grade, respectively.
All relevant information will be made available in the electronic tutoring.

4.4.7.Teaching methodologies (including students' assessment):

A hybrid teaching method, which combines conceptual lectures and practical exercises on the computer, will be used in this curricular unit. The fundamental knowledge about hydrodynamic numerical flow simulation and its background will be provided in theoretical lectures, aiming to develop a systematic understanding about the basic concepts.
In practical exercises various software products from 1D to 3D CFD will be introduced and students will be guided step by step through different training projects to learn and practice how to preprocess data, run the models, and analyze the results accurately. Tutorial classes will be arranged for the students in case of unexpected difficulties.

Course assessment comprises a group project work and a presentation, which counting for 85% and 15% of the final grade, respectively.
All relevant information will be made available in the electronic tutoring.

4.4.8.Demonstração da coerência das metodologias de ensino com os objetivos de aprendizagem da unidade curricular:
The teaching methodologies aims to enable students to understand the concepts set out in the program objectives. Fundamental knowledge about numerical flow simulation will be systematically explained in the theoretical lectures. Audiovisual resources will be used, based on the power point presentation and screencasts. The practical classes will help to demonstrate relationships and concepts previously explained in theoretical lectures. Classes will be used to analyze the results from practical exercises. Seminars will be used for student presentations.
The evaluation focuses on a project work which includes data processing (pre- and post-processing), final report and result presentation.

4.4.8.Evidence of the coherence between the teaching methodologies and the intended learning outcomes:
The teaching methodologies aims to enable students to understand the concepts set out in the program objectives. Fundamental knowledge about numerical flow simulation will be systematically explained in the theoretical lectures. Audiovisual resources will be used, based on the power point presentation and screencasts. The practical classes will help to demonstrate relationships and concepts previously explained in theoretical lectures. Classes will be used to analyze the results from practical exercises. Seminars will be used for student presentations.
The evaluation focuses on a project work which includes data processing (pre- and post-processing), final report and result presentation.

4.4.9.Bibliografia de consulta/existência obrigatória:
Ferziger, J.H., Peric, M. (2002) Computational Methods for Fluid Dynamics. 3rd ed., Springer, Berlin Heidelberg New York
Wesseling, P. (2001) Principles of Computational Fluid Dynamics, Springer Series in Computational Mathematics, Vol. 29

Mapa IV - Hydrological Engineering

4.4.1.1.Designação da unidade curricular:
Hydrological Engineering

4.4.1.1.Title of curricular unit:
Hydrological Engineering

4.4.1.2.Sigla da área científica em que se insere:
TPAM

4.4.1.3.Duração:
Semestral/Semester

4.4.1.4.Horas de trabalho:
156

4.4.1.5.Horas de contacto:
48

4.4.1.6.ECTS:
6

4.4.1.7.Observações:
Esta unidade curricular é da responsabilidade the University of Technische Hochschule Lübeck (Alemanha)

4.4.1.7.Observations:
Under responsability of the University of Technische Hochschule Lübeck (Alemanha)

4.4.2.Docente responsável e respetiva carga letiva na Unidade Curricular (preencher o nome completo):
Chris Kuells 12T; 12TP; 9PL; 6TC; 6S; 3OT

4.4.3.Outros docentes e respetivas cargas letivas na unidade curricular:
N/A

4.4.4.Objetivos de aprendizagem (conhecimentos, aptidões e competências a desenvolver pelos estudantes):

Compute Hydro-meteorology: apply equations to calculate precipitation and evaporation
Model Hydrological Processes: different runoff processes and are able to apply models to assess runoff in various climates and vegetation zones and environments for surfaces, hill-slopes and basins at different scales
Measure Hydrological Components: perform hydrometric measurements and can develop monitoring networks
Analyze Hydrological Data: execute and select methods for hydrological data analysis with statistical, parametric and conceptual models
Engineer Hydrological Solutions: develop design for flood retention, artificial recharge of groundwater, and environmentally friendly hydro-power solutions
Develop Ecohydrological Engineering: Students are able to develop solutions for artificial wetlands, natural attenuation, and remediation schemes
Manage Water Sustainably: Students are able to integrate hydrological engineering solutions into a sustainable water management strategy

4.4.4.Intended learning outcomes (knowledge, skills and competences to be developed by the students):

Compute Hydro-meteorology: apply equations to calculate precipitation and evaporation
Model Hydrological Processes: different runoff processes and are able to apply models to assess runoff in various climates and vegetation zones and environments for surfaces, hill-slopes and basins at different scales
Measure Hydrological Components: perform hydrometric measurements and can develop monitoring networks
Analyze Hydrological Data: execute and select methods for hydrological data analysis with statistical, parametric and conceptual models
Engineer Hydrological Solutions: develop design for flood retention, artificial recharge of groundwater, and environmentally friendly hydro-power solutions
Develop Ecohydrological Engineering: Students are able to develop solutions for artificial wetlands, natural attenuation, and remediation schemes
Manage Water Sustainably: Students are able to integrate hydrological engineering solutions into a sustainable water management strategy

4.4.5.Conteúdos programáticos:

The course hydrological engineering covers the following program contents:
PC 1 – Hydrometeorology:
• Rainfall statistics, correction of rainfall data,
• Calculation of evaporation from lakes, rivers and soils
PC 2 – Runoff generation:
• Runoff generation by excess rainfall (Horton), and by saturation
• River infiltration and exfiltration
PC 3 – Modern Hydrometry:
• Adequate hydrometry in rivers, springs, lakes with meters, ADCP
• Tracers methods
PC 4 – Hydrological data analysis:
• Parametric statistical methods, conceptual models,
• Drought and flood statistics
PC 5 – Principles of hydrological engineering:
• Safety and risk concepts, variant analysis
• Calibration, consistency and reliability
PC 6: Design of eco-hydrological engineering for improving water quality:
• Artificial wetlands, natural attenuation
• Remediation methods
PC 7: Integrated Water Management:
• Integrated and sustainable water management
• Strategic environmental and economic assessment for water

4.4.5.Syllabus:

The course hydrological engineering covers the following program contents:
PC 1 – Hydrometeorology:
• Rainfall statistics, correction of rainfall data,
• Calculation of evaporation from lakes, rivers and soils
PC 2 – Runoff generation:
• Runoff generation by excess rainfall (Horton), and by saturation
• River infiltration and exfiltration
PC 3 – Modern Hydrometry:
• Adequate hydrometry in rivers, springs, lakes with meters, ADCP
• Tracers methods
PC 4 – Hydrological data analysis:
• Parametric statistical methods, conceptual models,
• Drought and flood statistics
PC 5 – Principles of hydrological engineering:
• Safety and risk concepts, variant analysis
• Calibration, consistency and reliability
PC 6: Design of eco-hydrological engineering for improving water quality:
• Artificial wetlands, natural attenuation

• Remediation methods
PC 7: Integrated Water Management:
• Integrated and sustainable water management
• Strategic environmental and economic assessment for water

4.4.6.Demonstração da coerência dos conteúdos programáticos com os objetivos de aprendizagem da unidade curricular:
Be able to apply correctly and reliably
Evaluate own and other computations and reports critically, detect errors
Develop adequate methods for specific cases
Develop solutions for specific cases and conditions

4.4.6.Evidence of the syllabus coherence with the curricular unit's intended learning outcomes:
Be able to apply correctly and reliably
Evaluate own and other computations and reports critically, detect errors
Develop adequate methods for specific cases
Develop solutions for specific cases and conditions

4.4.7.Metodologias de ensino (avaliação incluída):
Students will acquire the basic and necessary knowledge of a program content through a theoretical introduction. The understanding and apprehension is supported by exercises in class and online and by tutoring. Students will be offered online exercises for self-evaluation of the apprehension. In a third step, students will have the opportunity to apply the content to case studies to strengthen the skill of applying methods (step 3: application). In a fourth step, students will be given the opportunity to evaluate their own work and the work of others (step 4: capacity to critically evaluate). This component will be strengthened by splitting groups for cross-evaluation of solutions presented other groups. Finally, the last step of the learning process is to give opportunities to actively develop own creative solutions based on applied principles. This five-step approach will be applied to each learning content

4.4.7.Teaching methodologies (including students' assessment):
Students will acquire the basic and necessary knowledge of a program content through a theoretical introduction. The understanding and apprehension is supported by exercises in class and online and by tutoring. Students will be offered online exercises for self-evaluation of the apprehension. In a third step, students will have the opportunity to apply the content to case studies to strengthen the skill of applying methods (step 3: application). In a fourth step, students will be given the opportunity to evaluate their own work and the work of others (step 4: capacity to critically evaluate). This component will be strengthened by splitting groups for cross-evaluation of solutions presented other groups. Finally, the last step of the learning process is to give opportunities to actively develop own creative solutions based on applied principles. This five-step approach will be applied to each learning content

4.4.8.Demonstração da coerência das metodologias de ensino com os objetivos de aprendizagem da unidade curricular:
The teaching methodology is based on an active learning concept. The teaching methodology creates a terminological basis for the learning by providing definitions and creating a basis knowledge first during the presence lectures. This phase is supported by e-learning material (moodle with glossary, papers, documents), by proving a detailed script and relevant textbooks). Following the active learning concept students can check, whether they have internalized the terminology and definitions by short tests during the class and after the class (self-evaluation modules on moodle). The understanding of hydrological concepts also uses active learning elements and methodology: Besides explanations during the presence class, student groups have the opportunity to solve problems in class and after class with online tests provided in an e-learning environment, students get exercises and have the opportunity to ask and validate their understanding with a tutor. The course integrates laboratory and field experiments during which students also asked to solve practical tasks to try out their theoretical knowledge: A hydrometric training in the field will be used to train hydrological measurements. The critical evaluation is trained by splitting the students into groups and by letting them evaluate solutions of other student groups. Students are also asked to evaluate, whether their own solutions are correct (probability that the answer is correct). A high degree of self-awareness of errors is aimed at. This self-awareness will be trained by work in small groups in which a controller will check the work of the partner and by error detection training in which students will be asked to assess, whether a solution is correct or not. Finally, students are actively encouraged to develop solutions on their own by design contests and by projects during an advanced state of the course, in which small groups develop more complex hydrological engineering solutions

4.4.8.Evidence of the coherence between the teaching methodologies and the intended learning outcomes:
The teaching methodology is based on an active learning concept. The teaching methodology creates a terminological basis for the learning by providing definitions and creating a basis knowledge first during the presence lectures. This phase is supported by e-learning material (moodle with glossary, papers, documents), by proving a detailed script and relevant textbooks). Following the active learning concept students can check, whether they have internalized the terminology and definitions by short tests during the class and after the class (self-evaluation modules on moodle). The understanding of hydrological concepts also uses active learning elements and methodology: Besides explanations during the presence class, student groups have the opportunity to solve problems in class and after class with online tests provided in an e-learning environment, students get exercises and have the opportunity to ask and validate their understanding with a tutor. The course integrates laboratory and field experiments during which students also asked to solve practical tasks to try out their theoretical knowledge: A hydrometric training in the field will be used to train hydrological measurements. The critical evaluation is trained by splitting the students into groups and by letting them evaluate solutions of other student groups. Students are also asked to evaluate, whether their own solutions are correct (probability that the answer is correct). A high degree of self-awareness of errors is aimed at. This

self-awareness will be trained by work in small groups in which a controller will check the work of the partner and by error detection training in which students will be asked to assess, whether a solution is correct or not. Finally, students are actively encouraged to develop solutions on their own by design contests and by projects during an advanced state of the course, in which small groups develop more complex hydrological engineering solutions.

4.4.9.Bibliografia de consulta/existência obrigatória:

Brutsaert W. (2013) Hydrology. Cambridge Univ. Press.
Chicharo & Müller (2016) Ecosystem Services and River Basin Ecohydrology, Springer
Davie & Quinn (2019) Fundamentals of Hydrology, Routledge
Maliva (2019) Anthropogenic Aquifer Recharge, Springer

Mapa IV - Integrated project in Germany - World of work 2

4.4.1.1.Designação da unidade curricular:

Integrated project in Germany - World of work 2

4.4.1.1.Title of curricular unit:

Integrated project in Germany - World of work 2

4.4.1.2.Sigla da área científica em que se insere:

TPAM

4.4.1.3.Duração:

Semestral/Semester

4.4.1.4.Horas de trabalho:

78

4.4.1.5.Horas de contacto:

24

4.4.1.6.ECTS:

3

4.4.1.7.Observações:

Esta unidade curricular é da responsabilidade the University of Technische Hochschule Lübeck (Alemanha)

4.4.1.7.Observations:

Under responsability of the University of Technische Hochschule Lübeck (Alemanha)

4.4.2.Docente responsável e respetiva carga letiva na Unidade Curricular (preencher o nome completo):

Chris Kuells 3 TP; 5 S; 16 OT

4.4.3.Outros docentes e respetivas cargas letivas na unidade curricular:

N/A

4.4.4.Objetivos de aprendizagem (conhecimentos, aptidões e competências a desenvolver pelos estudantes):

The objective of the course is to provide progressive learning and training regarding the reality of the world of work in the thematic area of ecohydrology, water engineering and water management. The module will consider internships at stakeholders companies and institutions, research internships at University or associated research centers, or development of projects with the participation of stakeholders, at the University.

4.4.4.Intended learning outcomes (knowledge, skills and competences to be developed by the students):

The objective of the course is to provide progressive learning and training regarding the reality of the world of work in the thematic area of ecohydrology, water engineering and water management. The module will consider internships at stakeholders companies and institutions, research internships at University or associated research centers, or development of projects with the participation of stakeholders, at the University.

4.4.5.Conteúdos programáticos:

1 – identification of practical solutions for stakeholders real water ecosystem situations, by the stakeholders
2 – develop, conceptually, the solutions
3 – Present and discuss the proposals with the stakeholders

4.4.5.Syllabus:

1 – identification of practical solutions for stakeholders real water ecosystem situations, by the stakeholders
2 – develop, conceptually, the solutions
3 – Present and discuss the proposals with the stakeholders

4.4.6.Demonstração da coerência dos conteúdos programáticos com os objetivos de aprendizagem da unidade curricular:

The program contents will be adapted to the stakeholders proposals and the development of the solutions will be taught in a progressive and articulated way so as to provide students with the theoretical knowledge and training that allows them to fulfill the objectives indicated for the discipline.

4.4.6.Evidence of the syllabus coherence with the curricular unit's intended learning outcomes:

The program contents will be adapted to the stakeholders proposals and the development of the solutions will be taught in a progressive and articulated way so as to provide students with the theoretical knowledge and training that allows them to fulfill the objectives indicated for the discipline.

4.4.7.Metodologias de ensino (avaliação incluída):

The course will be based on field visits and meetings with stakeholders to select the topics to be developed and on tutorial classes to support the development of the students projects
There is an articulation of matters and classes to ensure the appropriate sequence of the project development, between theoretical, practical and theoretical-practical classes. Course assessment comprises a report on the case that will be studied. The course assessment will consider the valuation from the stakeholders (50%)
Evaluation:
1. A group work written with individual presentation on practical project
2. A final written exam if group work evaluation is below 10/20 points

4.4.7.Teaching methodologies (including students' assessment):

The course will be based on field visits and meetings with stakeholders to select the topics to be developed and on tutorial classes to support the development of the students projects
There is an articulation of matters and classes to ensure the appropriate sequence of the project development, between theoretical, practical and theoretical-practical classes. Course assessment comprises a report on the case that will be studied. The course assessment will consider the valuation from the stakeholders (50%)
Evaluation:
1. A group work written with individual presentation on practical project
2. A final written exam if group work evaluation is below 10/20 points

4.4.8.Demonstração da coerência das metodologias de ensino com os objetivos de aprendizagem da unidade curricular:

The teaching methodologies aims to enable and support students to understand the concepts set out in the program objectives and in developing the conceptual project. Audiovisual resources will be used, based on the power point presentation. The field work will serve to visit the stakeholders institutions and learn, in situ their realities. Seminar will be used to students presentations and also for bringing experts in the field for lectures.
The knowledge provided during the theoretical lectures is complemented with seminars taught by specialists in various subjects related to UC objectives. This knowledge will be cemented through the realization of a practical project. This training component will be developed in tutorial classes to assure a greater follow-up in the realization of the project. The evaluation focuses on the understanding and application of the theoretical fundaments of ecohydrology and also on the project work that students will develop and present as a written report and oral presentation.

4.4.8.Evidence of the coherence between the teaching methodologies and the intended learning outcomes:

The teaching methodologies aims to enable and support students to understand the concepts set out in the program objectives and in developing the conceptual project. Audiovisual resources will be used, based on the power point presentation. The field work will serve to visit the stakeholders institutions and learn, in situ their realities. Seminar will be used to students presentations and also for bringing experts in the field for lectures.
The knowledge provided during the theoretical lectures is complemented with seminars taught by specialists in various subjects related to UC objectives. This knowledge will be cemented through the realization of a practical project. This training component will be developed in tutorial classes to assure a greater follow-up in the realization of the project. The evaluation focuses on the understanding and application of the theoretical fundaments of ecohydrology and also on the project work that students will develop and present as a written report and oral presentation.

4.4.9.Bibliografia de consulta/existência obrigatória:

Chicharo, L. Wagner, I., Chicharo, M. A Lapsinka, M. Zalewski, M. (2009) Practical experiments guide for Ecohydrology (Eds.Chicharo et al.). UNESCO Manual ISBN: 978-989-20-1702-0. Faro, 121 pp
Zalewski M, Wagner-Lotkowska I. & Robarts D. R. (eds). 2004. Integrated Watershed Management – Ecohydrology and Phytotechnology-Manual. UNESCO IHP, UNEP
IETC.246pp.;http://www.unep.or.jp/letc/Publications/Water_Sanitation/integrated_watershed_mgmt_manual
Wolanski, E., L. Chicharo, M.A. Chicharo (2008) Estuarine Ecohydrology. In Sven Erik Jørgensen and Brian D. Fath (Editor-in-Chief), Ecological Engineering. Vol. [2] of Encyclopedia of Ecology, 5 vols. pp. [1413-1422] Oxford: Elseier.

Mapa IV - Sustainable Urban Systems

4.4.1.1.Designação da unidade curricular:
Sustainable Urban Systems

4.4.1.1.Title of curricular unit:
Sustainable Urban Systems

4.4.1.2.Sigla da área científica em que se insere:
TPAM

4.4.1.3.Duração:
Semestral/Semester

4.4.1.4.Horas de trabalho:
156

4.4.1.5.Horas de contacto:
48

4.4.1.6.ECTS:
6

4.4.1.7.Observações:
Esta unidade curricular é da responsabilidade the University of Technische Hochschule Lübeck (Alemanha)

4.4.1.7.Observations:
Under responsability of the University of Technische Hochschule Lübeck (Alemanha)

4.4.2.Docente responsável e respetiva carga letiva na Unidade Curricular (preencher o nome completo):
Frank Schwartze 12 T; 12 PL; 6 TC; 12 S; 6 OT

4.4.3.Outros docentes e respetivas cargas letivas na unidade curricular:
N/A

4.4.4.Objetivos de aprendizagem (conhecimentos, aptidões e competências a desenvolver pelos estudantes):
• Students understand the concept of sustainability in urban systems and are acquainted with related formal and informal planning policies, strategies and instruments and their implementation
• Students have the ability to develop and design integrated planning solutions for water management in urban areas in different contextes and scales
• Students are able to develop and apply solutions of integrated water management with a specific regard on water and climate related adaptation measures in urban areas

4.4.4.Intended learning outcomes (knowledge, skills and competences to be developed by the students):
• Students understand the concept of sustainability in urban systems and are acquainted with related formal and informal planning policies, strategies and instruments and their implementation
• Students have the ability to develop and design integrated planning solutions for water management in urban areas in different contextes and scales
• Students are able to develop and apply solutions of integrated water management with a specific regard on water and climate related adaptation measures in urban areas

4.4.5.Conteúdos programáticos:
• Introduction to sustainability in urban areas and the concept of integrated planning
• Basic knowledge on urban systems in different regions and processes of urbanisation
• Urban improvment programs, projects and tools to analysis and evaluate urban areas and systems as well as methods of participation in urban decision making and community-based concept for urban upgrading and development
• Function and dimensioning of urban stormwater systems
• Calculation of the urban water balance and deduction of measures for robust catchment areas
• Protection of urban areas from extreme storm events

4.4.5.Syllabus:
• Introduction to sustainability in urban areas and the concept of integrated planning
• Basic knowledge on urban systems in different regions and processes of urbanisation
• Urban improvment programs, projects and tools to analysis and evaluate urban areas and systems as well as

methods of participation in urban decision making and community-based concept for urban upgrading and development
• Function and dimensioning of urban stormwater systems
• Calculation of the urban water balance and deduction of measures for robust catchment areas
• Protection of urban areas from extreme storm events

4.4.6.Demonstração da coerência dos conteúdos programáticos com os objetivos de aprendizagem da unidade curricular:
Based on a theoretical framing provided by lectures and literature review the students will analyse a case study representative for different types of urban areas and typical challenges in urban environments related to water issues. The results of the case studies will be presented by the students in workshop. The workshop aim is to provide an comparative overview of challenges and best practice in different urban areas and global regions and allow the students reflect the appropriateness of applied strategies and instruments to solve urban water issues in relation to local framework conditions as for instances urban structure types, climate, governance, regulatory framework. In a second part the students will develop in a practical class for a given case a solution for a urban water or storm water management and protection systems by using calculation and modelling tools and applying water sensitive urban design methods

4.4.6.Evidence of the syllabus coherence with the curricular unit's intended learning outcomes:
Based on a theoretical framing provided by lectures and literature review the students will analyse a case study representative for different types of urban areas and typical challenges in urban environments related to water issues. The results of the case studies will be presented by the students in workshop. The workshop aim is to provide an comparative overview of challenges and best practice in different urban areas and global regions and allow the students reflect the appropriateness of applied strategies and instruments to solve urban water issues in relation to local framework conditions as for instances urban structure types, climate, governance, regulatory framework. In a second part the students will develop in a practical class for a given case a solution for a urban water or storm water management and protection systems by using calculation and modelling tools and applying water sensitive urban design methods

4.4.7.Metodologias de ensino (avaliação incluída):
The course embraces lectures, group work and student presentations as well as a practical class. Course assessment comprises a compulsory oral exam and the evaluation of the results of the practical class submitted as a report by the students. Evaluation also includes a group report on the urban case study and the presentation to the class. The evaluation of the final report counts 50% and the oral exam as well as the presentation will count each 25% for the overall examination result.
All relevant information will be made available in the electronic tutoring (eg, class schedule, PDF files, lesson slides and all information necessary to follow up and carry out the proposed work).

Evaluation:
1. An oral exam
2. A oral presentation of a case study
2. A written report on the practical project

4.4.7.Teaching methodologies (including students' assessment):
The course embraces lectures, group work and student presentations as well as a practical class. Course assessment comprises a compulsory oral exam and the evaluation of the results of the practical class submitted as a report by the students. Evaluation also includes a group report on the urban case study and the presentation to the class. The evaluation of the final report counts 50% and the oral exam as well as the presentation will count each 25% for the overall examination result.
All relevant information will be made available in the electronic tutoring (eg, class schedule, PDF files, lesson slides and all information necessary to follow up and carry out the proposed work).

Evaluation:
1. An oral exam
2. A oral presentation of a case study
2. A written report on the practical project

4.4.8.Demonstração da coerência das metodologias de ensino com os objetivos de aprendizagem da unidade curricular:
The teaching methodologies aims to enable students to understand the concepts set out in the program objectives. Audiovisual resources will be used, based on the power point presentation. The practical classes will help to demonstrate relationships and concepts previously explained in lectures. The work on case studies and the presentation in Workshops shall enable students to reflect the complex nature of urbans environments and the challenges of integrated planning and also for bringing experts in the field for lectures. The work on the practical case shall provide hands-on knowledge and the ability to apply methods, tools and instrument provided in the lectures.

4.4.8.Evidence of the coherence between the teaching methodologies and the intended learning outcomes:
The teaching methodologies aims to enable students to understand the concepts set out in the program objectives. Audiovisual resources will be used, based on the power point presentation. The practical classes will help to demonstrate relationships and concepts previously explained in lectures. The work on case studies and the presentation in Workshops shall enable students to reflect the complex nature of urbans environments and the

challenges of integrated planning and also for bringing experts in the field for lectures. The work on the practical case shall provide hands-on knowledge and the ability to apply methods, tools and instrument provided in the lectures.

4.4.9.Bibliografia de consulta/existência obrigatória:
Mostafavi, Mohsen et al. (Ed.) (2010) Ecological Urbanism. Lars Müller Publ., Baden Pahl-Weber, Elke & Schwartze, Frank (Ed.) (2014) Space Planning and Design.
Integrated Planning and Design Solutions for future Megacities, Jovis, Berlin Sharma, Ashock et al (ed.) (2018) Approaches to Water Sensitive Urban Design - Potential, Design, Ecological Health, Economics, Policies and Community Perceptions, Elsevier

Mapa IV - MAEH webinar in Ecohydrology

4.4.1.1.Designação da unidade curricular:
MAEH webinar in Ecohydrology

4.4.1.1.Title of curricular unit:
MAEH webinar in Ecohydrology

4.4.1.2.Sigla da área científica em que se insere:
CAMB

4.4.1.3.Duração:
Semestral/Semester

4.4.1.4.Horas de trabalho:
78

4.4.1.5.Horas de contacto:
24

4.4.1.6.ECTS:
3

4.4.1.7.Observações:
Unidade curricular da responsabilidade da UAlg

4.4.1.7.Observations:
Responsability of the University of Algarve

4.4.2.Docente responsável e respetiva carga letiva na Unidade Curricular (preencher o nome completo):
Dina Cristina Fernandes Rodrigues da Costa Simes - 3T; 4S

4.4.3.Outros docentes e respetivas cargas letivas na unidade curricular:
Maria Margarida da Cruz Godinho Ribau Teixeira - 4S; 2 OT
Luís Manuel Zambujal Chícharo - 2S; 2 OT
Duarte Nuno Ramos Duarte - 4S; 3 OT

4.4.4.Objetivos de aprendizagem (conhecimentos, aptidões e competências a desenvolver pelos estudantes):
Os webinars de Ecohidrologia visam aumentar o conhecimento geral dos alunos sobre as realidades e questões globais da água. O curso consistirá num conjunto de seminários, presenciais ou à distância, utilizando ferramentas web online. Os seminários serão ministrados por HEs parceiras, mas principalmente por parceiros associados, como Cátedras UNESCO.

4.4.4.Intended learning outcomes (knowledge, skills and competences to be developed by the students):
Ecohydrology webinars aimed to increase the general knowledge of the students about global water realities and issues. The course will consist in a set of seminars, presential or at distance using web online tools. Seminars will be delivered by partners HEIs, but mainly by associated partners, as UNESCO Chairs.

4.4.5.Conteúdos programáticos:
Tópicos gerais sobre ecohidrologia e temas relacionados (biodiversidade, gestão, economia, diplomacia da água, água e género, etc)

4.4.5.Syllabus:

General topics on ecohydrology and related themes (biodiversity, management, economics, water diplomacy water and gender, etc)

4.4.6.Demonstração da coerência dos conteúdos programáticos com os objetivos de aprendizagem da unidade curricular:

O conteúdo do programa será adaptado para fornecer uma compreensão geral da aplicação da eco-hidrologia em todo o mundo, bem como para fornecer aos alunos o conhecimento sobre tópicos relacionados.

4.4.6.Evidence of the syllabus coherence with the curricular unit's intended learning outcomes:

The program contents will be adapted to provide a general understanding of the ecohydrology application worldwide as well as to provide students the knowledge about related topics.

4.4.7.Metodologias de ensino (avaliação incluída):

O curso será baseado em Seminários e aulas tutoriais.
Será solicitado aos alunos que desenvolvam um projeto sobre um dos temas apresentados nos seminários, e as aulas tutoriais serão utilizadas para apoiar o desenvolvimento do projeto que apresentarão e servirão para avaliação da unidade curricular.
Avaliação:
1. Trabalho de grupo escrito com apresentação individual de projeto prático
2. Um exame final escrito, se a avaliação do trabalho de grupo for inferior a 10/20 pontos

4.4.7.Teaching methodologies (including students' assessment):

The course will be based on Seminars and tutorial classes.
Students will be asked to develop a project on one of the topics presented at the seminars, and the tutorial classes will be used to support the development of the project they will present and will serve for evaluation of the course.
Evaluation:
1. A group work written with individual presentation on practical project
2. A final written exam, if group work evaluation is below 10/20 points

4.4.8.Demonstração da coerência das metodologias de ensino com os objetivos de aprendizagem da unidade curricular:

As metodologias de ensino pretendem capacitar e apoiar os alunos na compreensão dos conceitos enunciados nos objetivos do programa e no desenvolvimento do projeto conceptual. O seminário será utilizado para apresentações de convidados convidados e para apresentações dos alunos. Serão utilizados recursos audiovisuais, sobretudo em power point.
Os conhecimentos proporcionados durante os seminários serão cimentados através da realização de um projeto desenvolvido durante as aulas tutoriais. A avaliação centra-se na compreensão e aplicação dos fundamentos teóricos da eco-hidrologia e também no trabalho de projeto que os alunos irão desenvolver e apresentar na forma de relatório escrito e apresentação oral.

4.4.8.Evidence of the coherence between the teaching methodologies and the intended learning outcomes:

The teaching methodologies aims to enable and support students to understand the concepts set out in the program objectives and in developing the conceptual project. Seminar will be used to invited scholars and for students presentations. Audiovisual resources will be used, based on the power point presentation.
The knowledge provided during the seminars will be cemented through the realization of a project developed during the tutorial classes to support students during the realization of the project. The evaluation focuses on the understanding and application of the theoretical fundaments of ecohydrology and also on the project work that students will develop and present as a written report and oral presentation.

4.4.9.Bibliografia de consulta/existência obrigatória:

Chicharo, L. Wagner, I., Chicharo, M. A Lapsinka, M. Zalewski, M. (2009) Practical experiments guide for Ecohydrology (Eds.Chicharo et al.). UNESCO Manual ISBN: 978-989-20-1702-0. Faro, 121 pp
Zalewski M, Wagner-Lotkowska I. & Robarts D. R. (eds). 2004. Integrated Watershed Management – Ecohydrology and Phytotechnology-Manual. UNESCO IHP, UNEP
IETC.246pp.;http://www.unep.or.jp/letc/Publications/Water_Sanitation/integrated_watershed_mgmt_manual
Wolanski, E., L. Chicharo, M.A. Chicharo (2008) Estuarine Ecohydrology. In Sven Erik Jørgensen and Brian D. Fath (Editor-in-Chief), Ecological Engineering. Vol. [2] of Encyclopedia of Ecology, 5 vols. pp. [1413-1422] Oxford: Elseier.

Mapa IV - Ecohydrology and dynamics of aquatic ecosystems

4.4.1.1.Designação da unidade curricular:

Ecohydrology and dynamics of aquatic ecosystems

4.4.1.1.Title of curricular unit:

Ecohydrology and dynamics of aquatic ecosystems

4.4.1.2.Sigla da área científica em que se insere:
CAMB

4.4.1.3.Duração:
Semestral/Semester

4.4.1.4.Horas de trabalho:
156

4.4.1.5.Horas de contacto:
47

4.4.1.6.ECTS:
6

4.4.1.7.Observações:
Unidade curricular da responsabilidade da UALG

4.4.1.7.Observations:
Responsability of the University of the Algarve

4.4.2.Docente responsável e respetiva carga letiva na Unidade Curricular (preencher o nome completo):
Luís Manuel Zambujal Chícharo - 12T; 9TP; 18TC; 5 S; 3 OT

4.4.3.Outros docentes e respetivas cargas letivas na unidade curricular:
N/A

4.4.4.Objetivos de aprendizagem (conhecimentos, aptidões e competências a desenvolver pelos estudantes):
Ecohidrologia é um curso introdutório ao conceito de ecohidrologia. Os alunos devem:
1 - compreender os fundamentos da dinâmica dos ecossistemas aquáticos;
2- compreender o conceito de dupla regulação da eco-hidrologia e sua aplicação em diferentes tipos de sistemas;
3 - compreender a necessidade de integração dos processos ecohidrológicos em toda a bacia hidrográfica, para desenho de soluções sustentáveis;
4 - compreender a necessidade de transdisciplinaridade para aplicação de soluções de ecohidrologia e
5 - compreender e desenvolver conceitos e exemplos práticos de soluções aplicadas de ecohidrologia

4.4.4.Intended learning outcomes (knowledge, skills and competences to be developed by the students):
Ecohydrology is an introductory course to the ecohydrology concept. Students are expected to:
1 - understand the basics of aquatic ecosystem dynamics;
2- understand the ecohydrology dual regulation concept and its application in different types of systems;
3 – understand the need for integration of ecohydrologic processes at the entire river basin, for design of sustainable solutions;
4 – understand the need for transdisciplinarity for applying ecohydrology solutions and
5 –understand and develop concepts and practical examples of ecohydrology applied solutions

4.4.5.Conteúdos programáticos:
1 - O conceito de Ecohidrologia. A dupla regulação entre hidrologia e biota como cerne do conceito.
2 - Recursos hídricos e ecossistemas aquáticos. Perspectivas globais e evolução, pressões e impactos nos recursos hídricos globais.
3 - Dinâmica do lago, rio e litoral
4 - Restaurar a dinâmica aquática e os ciclos biogeoquímicos para aumentar a resiliência do ecossistema
5 - Biota para regular a hidrologia: exemplos aplicados de eco-hidrologia
6 - Hidrologia para regular a biota: exemplos aplicados de eco-hidrologia
7 - Ecohidrologia urbana e ecohidrologia de áreas secas
8 - Serviços ecossistêmicos e ecohidrologia
9 - Locais de demonstração global de Ecohidrologia da UNESCO

4.4.5.Syllabus:
1 – The Ecohydrology concept. The dual regulation between hydrology and biota as the core of the concept.
2 – Water resources and aquatic ecosystems. Global perspectives and evolution of global water resources status, pressures and impacts.
3 – Lake, river and coastal dynamics
4 - Restoring aquatic dynamics and biogeochemical cycles to increase ecosystem resilience
5 - Biota to regulate hydrology: applied ecohydrology examples
6 – Hydrology to regulate biota: applied ecohydrology examples

7 – Urban ecohydrology and dry areas ecohydrology
8 - Ecosystem services and ecohydrology
9 – Global UNESCO Ecohydrology demonstration sites

4.4.6.Demonstração da coerência dos conteúdos programáticos com os objetivos de aprendizagem da unidade curricular:
Os conteúdos programáticos são ministrados de forma progressiva e articulada de forma a proporcionar aos alunos conhecimentos teóricos e uma formação que lhes permita cumprir os objetivos indicados para a disciplina.

4.4.6.Evidence of the syllabus coherence with the curricular unit's intended learning outcomes:
The program contents are taught in a progressive and articulated way so as to provide students with the theoretical knowledge and training that allows them to fulfill the objectives indicated for the discipline.

4.4.7.Metodologias de ensino (avaliação incluída):
Todas as informações relevantes serão disponibilizadas na tutoria eletrônica (ex: horário das aulas, arquivos em PDF, slides das aulas e todas as informações necessárias para o acompanhamento e realização do trabalho proposto).
A UC é baseada em componentes de:
Sala de aula:
Neste caso, três tipos de classes são considerados:
1 - palestras: onde serão ministrados os conhecimentos fundamentais sobre os serviços ecossistêmicos
2 - seminários: para os quais serão convidados colegas nacionais e internacionais (neste caso para seminários de videoconferência)
3 - aulas tutoriais para realização de trabalho de estudo de caso durante o qual os conhecimentos ministrados serão aplicados e formados
B - estudo autónomo, para aprofundamento das matérias leccionadas na componente teórica e seminários, um projecto prático será desenvolvido nas aulas tutoriais
Avaliação:
1. Um exame final escrito
2. Um trabalho de grupo escrito com apresentação individual de projeto prático

4.4.7.Teaching methodologies (including students' assessment):
All relevant information will be made available in the electronic tutoring (eg, class schedule, PDF files, lesson slides and all information necessary to follow up and carry out the proposed work).
The UC is based on components of:
A - classroom:
In this case, three types of classes are considered:
1 - lectures: where will be given the fundamental knowledge on ecosystem services
2 - seminars: for which national and international colleagues will be invited (in this case to videoconference seminars)
3 - tutorial classes to carry out work on a case study during which the knowledge provided will be applied and trained
B - autonomous study, to deepen the subjects taught in the theoretical component and seminars, and fundamentally for the development of a practical that will be developed in the tutorial classes
Evaluation:
1. A final written exam
2. A group work written with individual presentation on practical project

4.4.8.Demonstração da coerência das metodologias de ensino com os objetivos de aprendizagem da unidade curricular:
As metodologias de ensino têm como objetivo permitir aos alunos a compreensão dos conceitos definidos nos objetivos do programa. Serão utilizados recursos audiovisuais, a partir da apresentação em power point. As aulas práticas ajudarão a demonstrar relações e conceitos previamente explicados nas aulas teóricas. As aulas práticas - teóricas serão utilizadas para a análise dos resultados das aulas práticas. O seminário será utilizado para apresentações de alunos e também para trazer especialistas da área para as palestras. O trabalho de campo será usado para amostragem de campo e visitas a locais de restauração de ecossistemas.
Os conhecimentos ministrados nas aulas teóricas são complementados com seminários ministrados por especialistas nas várias disciplinas relacionadas com os objetivos da UC. Este conhecimento será cimentado através da realização de um projeto prático sobre serviços ecossistêmicos aplicados a um ecossistema de escolha dos alunos. Este componente formativo será desenvolvido em aulas tutoriais para garantir um maior acompanhamento na realização do projeto. A avaliação incide sobre a componente teórica dos conceitos (exame escrito) e também sobre a componente de trabalho de projeto e aulas tutoriais (relatório escrito e apresentação oral do projeto)

4.4.8.Evidence of the coherence between the teaching methodologies and the intended learning outcomes:
The teaching methodologies aims to enable students to understand the concepts set out in the program objectives. Audiovisual resources will be used, based on the power point presentation. The practical classes will help to demonstrate relationships and concepts previously explained in lectures. Practical –theoretical classes will be used to analyse the results from practical classes. Seminar will be used to students presentations and also for bringing experts in the field for lectures. The field work will be used for field sampling and visits to ecosystem restoration sites.
The knowledge provided during the theoretical lectures is complemented with seminars taught by specialists in various subjects related to UC objectives. This knowledge will be cemented through the realization of a practical project on ecosystem services applied to an ecosystem of students' choice. This training component will be developed in tutorial classes to assure a greater follow-up in the realization of the project. The evaluation focuses on the theoretical

component of the concepts (written exam) and also on the component of the project work and lessons tutorials (written report and oral presentation of the project)

4.4.9.Bibliografia de consulta/existência obrigatória:

Chicharo, L. Wagner, I., Chicharo, M. A Lapsinka, M. Zalewski, M. (2009) Practical experiments guide for Ecohydrology (Eds.Chicharo et al.). UNESCO Manual ISBN: 978-989-20-1702-0. Faro, 121 pp
Zalewski M, Wagner-Lotkowska I. & Robarts D. R. (eds). 2004. Integrated Watershed Management – Ecohydrology and Phytotechnology-Manual. UNESCO IHP, UNEP
IETC.246pp.;http://www.unep.or.jp/letc/Publications/Water_Sanitation/integrated_watershed_mgmt_manual
Wolanski, E., L. Chicharo, M.A. Chicharo (2008) Estuarine Ecohydrology. In Sven Erik Jørgensen and Brian D. Fath (Editor-in-Chief), Ecological Engineering. Vol. [2] of Encyclopedia of Ecology, 5 vols. pp. [1413-1422] Oxford: Elseier.

Mapa IV - Applied practical field and laboratory training in Ecohydrology

4.4.1.1.Designação da unidade curricular:
Applied practical field and laboratory training in Ecohydrology

4.4.1.1.Title of curricular unit:
Applied practical field and laboratory training in Ecohydrology

4.4.1.2.Sigla da área científica em que se insere:
CAMB

4.4.1.3.Duração:
Semestral/Semester

4.4.1.4.Horas de trabalho:
286

4.4.1.5.Horas de contacto:
84

4.4.1.6.ECTS:
11

4.4.1.7.Observações:
Unidade curricular da responsabilidade da UAlg

4.4.1.7.Observations:
Under responsability of the University of the Algarve

4.4.2.Docente responsável e respetiva carga letiva na Unidade Curricular (preencher o nome completo):
Luís Manuel Zambujal Chícharo - 2 T; 2 TP; 6 PL; 15 TC; 4 S; 2 OT;

4.4.3.Outros docentes e respetivas cargas letivas na unidade curricular:
Maciej Zalewski (ULO) 2 T; 6 TP; 16 PL; 15 TC; 8 S; 6 OT

4.4.4.Objetivos de aprendizagem (conhecimentos, aptidões e competências a desenvolver pelos estudantes):

Os estudantes aprenderão:
-a selecionar e aplicar técnicas de amostragem de campo
-a aplicar soluções de campo para ecossistemas degradados
- a processar e analisar amostras em laboratório
- a tratar e analisar dados
-a desenvolver e implementar soluções práticas ecohidrológicas para lagos, rios e estuários

4.4.4.Intended learning outcomes (knowledge, skills and competences to be developed by the students):
Students will learn:
To select and apply field sampling techniques
To apply field solutions for degraded ecosystems
To process and analyse samples in laboratory
To treat and analyse data
To develop and implement ecohydrologic practical solutions for lakes, rivers and estuaries

4.4.5.Conteúdos programáticos:

O curso consistirá em 3 partes:
EH COSTEIRA - tecnicas de campo e laboratoriais de intervenção marinha e ambiental.viagem de campo à costa do Báltico e trabalho de campo na foz do rio Vístula.
EH de ÁGUA DOCE tecnicas de campo e de laboratório sobre em aspectos-chave de tecnologias de remediação usando para recuperação de ecossistemas urbanos e rurais (curso de fitotecnologias e fitorremediação) e novos métodos de bioavaliação e restauração de rios (avaliação baseada em peixes e restauração de rios curso). Ex.: Demosites URBAN EH: Lodz-Sokolowka River-POLÔNIA (demosite UNESCO, EU 7 FP SWITCH); Lodz-Ner River-POLÔNIA (demonstração da UNESCO; projeto Lodz-Arturówek LIFE EH-REK LIFERADOMKLIMA).
EH URBANA: reservatório Sulejow-Rio Pilica-POLÓNIA (demosite UNESCO; LIFE EKOROB - LIFE 2016).
Trabalho individual do aluno em relatórios, ensaios e preparação para exames

4.4.5.Syllabus:

The course will consist of 3 parts:
COASTAL EH field training course with laboratory techniques of marine and environmental intervention. Field trip to the Baltic coast and field work at the mouth of the Vistula river.
FRESHWATER EH – URBAN and RURAL DEMOSITES: field training course with laboratory techniques focusing on key aspects of remediation technologies using for urban and rural ecosystem restoration (Phytotechnologies and phytoremediation course) and novel methods of bioassessment and river restoration (Fish-based assessment and River restoration course).
URBAN EH demosites: Lodz-Sokolowka River-POLAND (UNESCO demosite, EU 7 FP SWITCH); Lodz-Ner River-POLAND (UNESCO demosite; Lodz-Arturówek LIFE EH-REK LIFERADOMKLIMA project).
Rural EH demosites: Sulejow reservoir-Pilica River-POLAND (UNESCO demosite; LIFE EKOROB - best of the 2016 LIFE projects).
Student's individual work on reports, essays and preparation for exams

4.4.6.Demonstração da coerência dos conteúdos programáticos com os objetivos de aprendizagem da unidade curricular:

O conteúdo do programa é adaptado para fornecer uma compreensão geral do desenvolvimento prático e aplicação da ecohidrologia para diferentes ecossistemas.
As experiencias serão desenvolvidas de acordo com o conteúdo da disciplina.

4.4.6.Evidence of the syllabus coherence with the curricular unit's intended learning outcomes:

The program contents is adapted to provide a general understanding of the practical development and application of ecohydrology for different ecosystems.
The experiments will be developed according to the discipline content.

4.4.7.Metodologias de ensino (avaliação incluída):

O curso será baseado em aulas práticas de laboratório e trabalhos de campo. Serão ministrados seminários e aulas tutoriais de apoio aos projetos práticos e experimentais. Os alunos serão solicitados a desenvolver um projeto prático que apresentarão e servirá para avaliação do curso.
Avaliação:
1. Trabalho de grupo escrito com apresentação individual de projeto prático
2. Um exame final escrito se a avaliação do trabalho de grupo for inferior a 10/20 pontos

4.4.7.Teaching methodologies (including students' assessment):

(1000 caracteres)
The course will be based on practical laboratory classes and field work. Seminars and tutorial classes will be taught to support the practical projects and experiments. Students will be asked to develop a practical project they will present and will serve for evaluation of the course.
Evaluation:
1. A group work written with individual presentation on practical project
2. A final written exam if group work evaluation is below 10/20 points

4.4.8.Demonstração da coerência das metodologias de ensino com os objetivos de aprendizagem da unidade curricular:

As metodologias de ensino pretendem capacitar e apoiar os alunos na compreensão dos conceitos enunciados nos objetivos do programa e no desenvolvimento do projeto conceitual. As aulas teóricas serão utilizadas para a exposição das técnicas e metodologias. Serão utilizados recursos audiovisuais, a partir da apresentação em power point. Aulas práticas laboratoriais e de campo serão utilizadas para treino experimental específico. Os seminários serão usados para reuniões gerais para discussão de projetos e apresentações finais dos alunos.

Os conhecimentos proporcionados durante os seminários serão cimentados através da realização de um projeto desenvolvido durante as aulas tutoriais. A avaliação centra-se na compreensão e aplicação prática dos fundamentos teóricos da eco-hidrologia e também no trabalho de projeto que os alunos irão desenvolver e apresentar na forma de relatório escrito e apresentação oral.

4.4.8.Evidence of the coherence between the teaching methodologies and the intended learning outcomes:

The teaching methodologies aims to enable and support students to understand the concepts set out in the program objectives and in developing the conceptual project. Theoretical classes will be used to explain the techniques and

methodologies. Audiovisual resources will be used, based on the power point presentation. Practical laboratory and field classes will be used for specific experimental training. Seminars will be used for general meetings for discussion on projects and students final presentations.

The knowledge provided during the seminars will be cemented through the realization of a project developed during the tutorial classes. The evaluation focuses on the understanding and practical application of the theoretical fundaments of ecohydrology and also on the project work that students will develop and present as a written report and oral presentation.

4.4.9.Bibliografia de consulta/existência obrigatória:

Zalewski M, Wagner-Lotkowska I. & Robarts D. R. (eds). 2004. Integrated Watershed Management – Ecohydrology and Phytotechnology-Manual. UNESCO IHP, UNEP IETC.246pp.;
http://www.unep.or.jp/letc/Publications/Water_Sanitation/integrated_watershed_mgmt_manual
Wolanski, E., L. Chicharo, M.A. Chicharo (2008) Estuarine Ecohydrology. In Sven Erik Jørgensen and Brian D. Fath (Editor-in-Chief), Ecological Engineering. Vol. [2] of Encyclopedia of Ecology, 5 vols. pp. [1413-1422] Oxford: Elseier.
Chicharo, L. Wagner, I., Chicharo, M. A Lapsinka, M. Zalewski, M. (2009) Practical experiments guide for Ecohydrology (Eds.Chicharo et al.). UNESCO Manual ISBN: 978-989-20-1702-0. Faro, 121 pp

Mapa IV - Fundamentals of hydrology and hydrogeology

4.4.1.1.Designação da unidade curricular:
Fundamentals of hydrology and hydrogeology

4.4.1.1.Title of curricular unit:
Fundamentals of hydrology and hydrogeology

4.4.1.2.Sigla da área científica em que se insere:
CAMB

4.4.1.3.Duração:
Semestral/Semester

4.4.1.4.Horas de trabalho:
78

4.4.1.5.Horas de contacto:
24

4.4.1.6.ECTS:
3

4.4.1.7.Observações:
Unidade curricular da responsabilidade da UAlg

4.4.1.7.Observations:
Responsability of the University of the Algarve

4.4.2.Docente responsável e respetiva carga letiva na Unidade Curricular (preencher o nome completo):
José Paulo Patrício Geraldes Monteiro - T 8; TP 12; OT 4

4.4.3.Outros docentes e respetivas cargas letivas na unidade curricular:
N/A

4.4.4.Objetivos de aprendizagem (conhecimentos, aptidões e competências a desenvolver pelos estudantes):
Compreensão dos processos físicos e químicos activos que estão na base do funcionamento do ciclo hidrologico e dos aquíferos.

Será trabalhada a familiarização com métodos analíticos e numéricos aplicados a problemas práticos de gestão de aquíferos à escala local e regional. Familiarização com as implicações do uso da água e exploração de aquíferos no caudal de base dos rios e balanço das águas superficiais em geral.

4.4.4.Intended learning outcomes (knowledge, skills and competences to be developed by the students):

Understanding of the physical and chemical active processes that underlie the functioning of the hydrological cycle and aquifers.

Familiarization with analytical and numerical methods applied to practical aquifer management problems at local and regional scale will be worked. Familiarization with the implications of water use and exploration of aquifers on the base flow of rivers and balance of surface water in general.

4.4.5.Conteúdos programáticos:

O ciclo hidrológico. Fluxos e quantificação
Principios de meteorologia
• Precipitação
• Evapotranspiração
• Infiltração
• Utilização modelos matemáticos simples para precipitação
• Coupling simulação modelos superficie e águas subterraneas
Compreensão e aplicação dos princípios de hidrogeologia física aplicados à identificação, quantificação e uso sustentado de águas subterrâneas.
- Balance hidrológico e equilíbrio dinâmico de aquíferos;
- Recarga, escomento regional e modelos conceptuais;
- Sustentabilidade da exploração de recursos hídricos;
- Dimensionamento de captações às escala locadl (modelos analitícos);
- Métodos numéricos para a resolução de problemas hidrogeológicos à escala local e regional;
- Casos de estudo de gestão de aquíferos;
- Planeamento de projectos hidrogelógicos;

4.4.5.Syllabus:

he hydrological cycle. Flows and quantification
Principles of meteorology
• Precipitation
• Evapotranspiration
• Infiltration
• Use simple mathematical models for precipitation
• Coupling simulation of surface and groundwater models
Understanding and application of the principles of physical hydrogeology applied to the identification, quantification and sustainable use of groundwater.
- Hydrological balance and dynamic balance of aquifers;
- Recharge, regional waste and conceptual models;
- Sustainability of the exploitation of water resources;
- Dimensioning of abstractions at the local scale (analytical models);
- Numerical methods for solving hydrogeological problems at the local and regional scale;
- Case studies of aquifer management;
- Planning of hydrogelogical projects;

4.4.6.Demonstração da coerência dos conteúdos programáticos com os objetivos de aprendizagem da unidade curricular:

Articulação entre os conceitos teóricos referidos nos objectivos de aprendizagem da unidade curricular são essenciais para tornar possível o desenvolvimentos dos tópicos, mais operativos e práticos que se abordam nos conteúdos programáticos. A familiarização com ferremantas informáticas que permite transpor para a prática os conceitos teóricos é uma forma directa de articulação dos conteúdos com os objectivos de aprendizagem.

4.4.6.Evidence of the syllabus coherence with the curricular unit's intended learning outcomes:

Articulation between the theoretical concepts referred to in the learning objectives of the curricular unit are essential to make possible the development of topics, more operational and practical that are addressed in the syllabus. Familiarization with computer tools that allows the theoretical concepts to be put into practice is a direct way of articulating the contents with the learning objectives.

4.4.7.Metodologias de ensino (avaliação incluída):

Aulas teóricas expositivas
Aulas teórico-práticas com recurso à utilização de software de modelação e sistemas de informação geográfica
Seminários e aulas tutoriais para acompanhamento e discussão de casos de estudo

Avaliação
Trabalho teorico pratico
Exame escrito

4.4.7.Teaching methodologies (including students' assessment):

Theoretical lectures
Theoretical-practical classes using modeling software and geographic information systems
Tutorials and seminars for monitoring and discussing case studies

Evaluation
Theoretical practical work
Written Exam

4.4.8.Demonstração da coerência das metodologias de ensino com os objetivos de aprendizagem da unidade curricular:
A articulação entre os conceitos teóricos referidos nos objetivos de aprendizagem é essencial para possibilitar o desenvolvimento dos tópicos operativos e práticos abordados no programa. A familiarização com as ferramentas informáticas permite a aplicação prática dos conceitos teóricos dos conteúdos do programa e dos objetivos de aprendizagem. Em relação ao uso dessas ferramentas, atenção particular será dada aos modelos numéricos e sistemas de informação geográfica.

4.4.8.Evidence of the coherence between the teaching methodologies and the intended learning outcomes:
The articulation between the theoretical concepts referred in the learning objectives are essential to make possible the development of the operative and practical topics approached in the topics of the program. The familiarization with informatics tools allows the practical implementation of the theoretical concepts of the contents of the program and the learning objectives. Regarding the use of these tools particular attention will be given to numerical models and geographic information systems

4.4.9.Bibliografia de consulta/existência obrigatória:
Freeze, A.; Cherry, J. (1979) - Groundwater. Prentice-Hall. New Jersey U.S.A.
Custódio,E., Llamas, M.R. (1983).- Hidrologia Subterranea. Tomo I e Tomo II. Ediciones Omega.
Lencastre, A., Franco, F.M. (1984).- Lições de Hidrologia. Univ. Nova de Lisboa, Fac. Ciências e Tecnologia. Lisboa.
Domenico, P.A. and Schwartz F.W. 1990, physical and chemical hydrogeology, John Wiley & Sons.
Ingebritsen, S.; Sanford, W. (1998) – Groundwater in Geologic Processes. Cambridge University Press.Cambridge. Great Britain.
Mostafa M Soliman. Engineering Hydrology of Arid and Semi-Arid Regions.

Mapa IV - Integrated project in Portugal - World of work 1

4.4.1.1.Designação da unidade curricular:
Integrated project in Portugal - World of work 1

4.4.1.1.Title of curricular unit:
Integrated project in Portugal - World of work 1

4.4.1.2.Sigla da área científica em que se insere:
TPAM

4.4.1.3.Duração:
Semestral/Semester

4.4.1.4.Horas de trabalho:
104

4.4.1.5.Horas de contacto:
32

4.4.1.6.ECTS:
4

4.4.1.7.Observações:
Unidade curricular da responsabilidade da UAlg

4.4.1.7.Observations:
Unidade curricular da responsabilidade da UAlg

4.4.2.Docente responsável e respetiva carga letiva na Unidade Curricular (preencher o nome completo):
Maria Margarida da Cruz Godinho Ribau Teixeira - 2T; 4 TC; 8 OT

4.4.3.Outros docentes e respetivas cargas letivas na unidade curricular:
Duarte Nuno Ramos Duarte - 4 TC

Dina Cristina Fernandes Rodrigues da Costa Simes - 2TC; 2 OT

Luís Manuel Zambujal Chícharo - 4S; 6 OT

4.4.4.Objetivos de aprendizagem (conhecimentos, aptidões e competências a desenvolver pelos estudantes):

O objetivo da unidade curricular é fomentar o contacto com stakeholders da área da água para proporcionar aos alunos uma verdadeira aprendizagem e formação face à realidade do mundo do trabalho na área temática da eco-hidrologia, engenharia da água e gestão da água. O módulo contemplará estágios em empresas e instituições interessadas, estágios de investigação na Universidade ou centros de investigação associados, ou o desenvolvimento de projetos com a participação de stakeholders, na Universidade.

4.4.4.Intended learning outcomes (knowledge, skills and competences to be developed by the students):

The objective of the course is to foster the contact with stakeholders from water sector to give students a real learning and training regarding the reality of the world of work in the thematic area of ecohydrology, water engineering and water management. The module will consider internships at stakeholders companies and institutions, research internships at University or associated research centers, or development of projects with the participation of stakeholders, at the University.

4.4.5.Conteúdos programáticos:

1- identificação de soluções práticas para situações reais apresnentadas pelos stakeholders do sector da agua e gestão de ecossistemas aquaticos
2 - desenvolver, conceitualmente, as soluções
3 - Apresentar e discutir as propostas desenvolvidas para os stakeholders

4.4.5.Syllabus:

1 – identification of practical solutions for stakeholders real water ecosystem situations, by the stakeholders
2 – develop, conceptually, the solutions
3 – Present and discuss the proposals with the stakeholders

4.4.6.Demonstração da coerência dos conteúdos programáticos com os objetivos de aprendizagem da unidade curricular:

Os conteúdos programáticos serão adaptados às propostas dos stakeholders e o desenvolvimento das soluções será ministrado de forma progressiva e articulada de forma a dotar os alunos de conhecimentos teóricos e de formação que lhes permitam cumprir os objetivos indicados para a disciplina.

4.4.6.Evidence of the syllabus coherence with the curricular unit's intended learning outcomes:

The program contents will be adapted to the stakeholders proposals and the development of the solutions will be taught in a progressive and articulated way so as to provide students with the theoretical knowledge and training that allows them to fulfill the objectives indicated for the discipline.

4.4.7.Metodologias de ensino (avaliação incluída):

O curso será baseado em visitas de campo e reuniões com stakeholders para seleção dos temas a serem desenvolvidos e em aulas tutoriais para apoiar o desenvolvimento dos projetos dos alunos
Existe uma articulação de matérias e aulas para garantir a sequência adequada de desenvolvimento do projeto, entre aulas teóricas, práticas e teórico-práticas. A avaliação do curso compreende um relatório do caso a ser estudado. A avaliação do curso irá considerar a avaliação das partes interessadas (50%)
Avaliação:
1. Trabalho de grupo escrito com apresentação individual de projeto prático
2. Um exame final escrito se a avaliação do trabalho de grupo for inferior a 10/20 pontos

4.4.7.Teaching methodologies (including students' assessment):

The course will be based on field visits and meetings with stakeholders to select the topics to be developed and on tutorial classes to support the development of the students projects
There is an articulation of matters and classes to ensure the appropriate sequence of the project development,, between theoretical, practical and theoretical-practical classes. Course assessment comprises a report on the case that will be studied. The course assessment will consider the valuation from the stakeholders (50%)
Evaluation:
1. A group work written with individual presentation on practical project
2. A final written exam if group work evaluation is below 10/20 points

4.4.8.Demonstração da coerência das metodologias de ensino com os objetivos de aprendizagem da unidade curricular:

As metodologias de ensino pretendem capacitar e apoiar os alunos na compreensão dos conceitos enunciados nos objetivos do programa e no desenvolvimento do projeto conceptual. Serão utilizados recursos audiovisuais, a partir da apresentação em power point. O trabalho de campo servirá para visitar as instituições interessadas e conhecer, in loco, as suas realidades. O seminário será utilizado para apresentações de alunos e também para trazer especialistas da área.
Os conhecimentos ministrados nas aulas teóricas são complementados com seminários ministrados por especialistas nas várias disciplinas relacionadas com os objetivos da UC. Este conhecimento será cimentado através da realização de um projeto prático. Este componente formativo será desenvolvido em aulas tutoriais para garantir um maior

acompanhamento na realização do projeto. A avaliação centra-se na compreensão e aplicação dos fundamentos teóricos da eco-hidrologia e também no trabalho de projeto que os alunos irão desenvolver e apresentar na forma de relatório escrito e apresentação oral.

4.4.8.Evidence of the coherence between the teaching methodologies and the intended learning outcomes:

The teaching methodologies aims to enable and support students to understand the concepts set out in the program objectives and in developing the conceptual project. Audiovisual resources will be used, based on the power point presentation. The field work will serve to visit the stakeholders institutions and learn, in situ their realities. Seminar will be used to students presentations and also for bringing experts in the field for lectures.
The knowledge provided during the theoretical lectures is complemented with seminars taught by specialists in various subjects related to UC objectives. This knowledge will be cemented through the realization of a practical project. This training component will be developed in tutorial classes to assure a greater follow-up in the realization of the project. The evaluation focuses on the understanding and application of the theoretical fundaments of ecohydrology and also on the project work that students will develop and present as a written report and oral presentation.

4.4.9.Bibliografia de consulta/existência obrigatória:

Chicharo, L. Wagner, I., Chicharo, M. A Lapsinka, M. Zalewski, M. (2009) Practical experiments guide for Ecohydrology (Eds.Chicharo et al.). UNESCO Manual ISBN: 978-989-20-1702-0. Faro, 121 pp
Zalewski M, Wagner-Lotkowska I. & Robarts D. R. (eds). 2004. Integrated Watershed Management – Ecohydrology and Phytotechnology-Manual. UNESCO IHP, UNEP
IETC.246pp.;http://www.unep.or.jp/letc/Publications/Water_Sanitation/integrated_watershed_mgmt_manual
Wolanski, E., L. Chicharo, M.A. Chicharo (2008) Estuarine Ecohydrology. In Sven Erik Jørgensen and Brian D. Fath (Editor-in-Chief), Ecological Engineering. Vol. [2] of Encyclopedia of Ecology, 5 vols. pp. [1413-1422] Oxford: Elseier.

Mapa IV - Thesis

4.4.1.1.Designação da unidade curricular:

Thesis

4.4.1.1.Title of curricular unit:

Thesis

4.4.1.2.Sigla da área científica em que se insere:

CAMB/TPAM

4.4.1.3.Duração:

Semestral/Semester

4.4.1.4.Horas de trabalho:

780

4.4.1.5.Horas de contacto:

234

4.4.1.6.ECTS:

30

4.4.1.7.Observações:

A tese decorrerá numa das universidades do consorcio, podendo ser co supervisionada por elementos de outras instituições parceiras, ou outras, de reconhecida competência na área da tese

4.4.1.7.Observations:

The thesis will take place at one of the consortium universities, and may be co-supervised by elements from other partner institutions, or others, of recognized competence in the area of the thesis

4.4.2.Docente responsável e respetiva carga letiva na Unidade Curricular (preencher o nome completo):

Luis Chicharo, Chris Kuells, Patrick Meire, Maciej Zalewski. Depende univ onde decorrem trab. tese

4.4.3.Outros docentes e respetivas cargas letivas na unidade curricular:

Depende do tema das teses e da universidade responsável

4.4.4.Objetivos de aprendizagem (conhecimentos, aptidões e competências a desenvolver pelos estudantes):
Análise de problemas, desenvolvimento/aplicação de metodologias para a análise, tratamento dos dados e elaboração de relatório critico
Fomento da capacidade de análise e escrita cientifica autónoma

4.4.4.Intended learning outcomes (knowledge, skills and competences to be developed by the students):
Problem analysis, development / application of methodologies for the analysis, data treatment and preparation of written report
Development of the autonomous scientific analysis and scientific writing skills

4.4.5.Conteúdos programáticos:
A tese integra-se nas áreas desenvolvidas durante o curso

4.4.5.Syllabus:
Topics developed or related with ones taught during the course

4.4.6.Demonstração da coerência dos conteúdos programáticos com os objetivos de aprendizagem da unidade curricular:
A tese integra-se nas áreas desenvolvidas durante o curso

4.4.6.Evidence of the syllabus coherence with the curricular unit's intended learning outcomes:
Topics developed or related with ones taught during the course

4.4.7.Metodologias de ensino (avaliação incluída):
O relatório da tese será avaliado na sua componente escrita e discutido com um juri. As caracteristicas do processo de defesa da tese adequar-se-ão às normas e regulamentos da Universidade onde decorrem os trabalhos de tese

4.4.7.Teaching methodologies (including students' assessment):
The thesis report will be evaluated in its written component and discussed with a jury.
The characteristics of the thesis defense process will de adapted to the University's rules and regulations where the thesis will take place

4.4.8.Demonstração da coerência das metodologias de ensino com os objetivos de aprendizagem da unidade curricular:
Topics developed or related with ones taught during the course

4.4.8.Evidence of the coherence between the teaching methodologies and the intended learning outcomes:
Topics developed or related with ones taught during the course

4.4.9.Bibliografia de consulta/existência obrigatória:
Depende do tema do trabalho de tese

4.5. Metodologias de ensino e aprendizagem

4.5.1.Adequação das metodologias de ensino e aprendizagem aos objetivos de aprendizagem (conhecimentos, aptidões e competências) definidos para o ciclo de estudos:
Usar-se-ão as seguintes metodologias de ensino-aprendizagem:
• Ensino híbrido – atividades decorrem com e sem o professor, por forma a que o estudante desenvolva capacidades de estudo autónomo, fomentando-se o pensamento crítico e autonomia.
• Aprendizagem baseada em projetos cientificos, como a UC de "Applied practical field and laboratory training in Ecohydrology" que visa fomentar a aquisição do conhecimento por meio da solução colaborativa de desafios, com o objectivo de promover capacidades críticas e de investigação.
• Aprendizagem baseada em problemas, como a UC "Integrated project - World of work", que visa tornar o estudante capaz de estruturar uma solução para problemas reais, o que o expõe a situações motivadoras e o prepara para o mundo do trabalho.
• Estudo de caso, como na UC "Webinars" em que são apresentados relatos de situações do mundo real, com diferentes aproximações e técnicas usadas em várias partes do mundo, preparando os estudantes para a situações reais.

4.5.1.Evidence of the teaching and learning methodologies coherence with the intended learning outcomes of the study programme:
The following teaching-learning methodologies will be used:
• Hybrid teaching - activities take place with and without the teacher, so that the student develops autonomous study skills, fostering critical thinking and autonomy.
• Learning based on scientific projects, such as the "Applied practical field and laboratory training in Ecohydrology" UC, which aims to promote the acquisition of knowledge through the collaborative solution of challenges, with the aim

of promoting critical and research skills.
• Problem-based learning, such as the UC "Integrated project - World of work", which aims to make the student able to structure a solution to real problems, which exposes him to motivating situations and prepares him for the world of work.
• Case study, as in UC "Webinars" in which reports of real-world situations are presented, with different approaches and techniques used in various parts of the world, preparing students for real situations

4.5.2.Forma de verificação de que a carga média de trabalho que será necessária aos estudantes corresponde ao estimado em ECTS:

No sistema de Garantia de Qualidade do MAEH, no questionário que os estudantes preenchem sobre cada unidade curricular, existe um ponto com informação relativa a estes aspectos. Assim, para além dos inquéritos que serão efectuados no final de cada semestre, o esforço (carga de trabalho) será monitorizado através de reuniões regulares com os estudantes e quaisquer correções necessárias serão implementadas. Paralelamente à avaliação da carga horária, pelos estudantes, será avaliada em reuniões dos docentes responsáveis pelas UC no inicio do semestre, de forma a que as cargas sejam balanceadas e articuladas entre as várias UCs.

4.5.2.Means to verify that the required students' average workload corresponds the estimated in ECTS.:

No sistema de Garantia de Qualidade do MAEH, no questionário que os estudantes preenchem sobre cada unidade curricular, existe um ponto com informação relativa a estes aspectos. Assim, para além dos inquéritos que serão efectuados no final de cada semestre, o esforço (carga de trabalho) será monitorizado atraves de reuniões regulares com os estudantes e quaisquer correções necessárias serão implementadas. Paralelamente à avaliação da carga horária, pelos estudantes, será avaliada em reuniões dos docentes responsáveis pelas UC no inicio do semestre, de forma a que as cargas sejam balanceadas e articuladas entre as várias UCs.

4.5.3.Formas de garantia de que a avaliação da aprendizagem dos estudantes será feita em função dos objetivos de aprendizagem da unidade curricular:

A aprendizagem dos estudantes será feita em função dos objectivos da aprendizagem de cada UC em particular, mas considerando as matérias da UC no contexto global do curso. Os estudantes terão acesso a questionários para avaliação da qualidade e a todo o momento têm acesso à coordenação do curso, para análise de qualquer situação. De forma a assegurar que os objectivos da aprendizagem são fluidos e contínuos, apesar das mobilidades para outras universidades, as matérias serão ensinadas de forma coerente e integrada nos tempos (semestres) adequados para a formação dos estudantes (apesar das matérias poderem decorrer posteriormente ou mais cedo nos planos curriculares dos cursos nas universidades parceiras). Assim, foram já estabelecidos acordos bilaterais Erasmus entre todas as universidades do consorcio para assegurar a mobilidade dos docentes e a colaboração de docentes das universidades do consorcio, na leccionação de UCs, em cada universidade.

4.5.3.Means of ensuring that the students assessment methodologies are adequate to the intended learning outcomes:

Student learning will be done according to the learning objectives of each UC in particular, but considering UC subjects in the global context of the course. Students will have access to quality assessment questionnaires and at all times they have access to the course coordination, to analyze any situation. In order to ensure that the learning objectives are fluid and continuous, despite the mobility for other universities, the subjects will be taught in a coherent and integrated manner at the appropriate times (semesters) for the training of students (although the subjects may take place later or more curricular plans of courses at partner universities). Thus, bilateral Erasmus agreements have already been established between all universities in the consortium to ensure the mobility of teachers and the collaboration of teachers from the universities in the consortium, in the teaching of UCs, in each university.

4.5.4.Metodologias de ensino previstas com vista a facilitar a participação dos estudantes em atividades científicas (quando aplicável):

Está previsto usar as seguintes metodologias:
• treino experimental de campo e laboratório em tecnicas de ecohidrologia aplicada, para treino de tecnicas e metodologias de trabalho de campo e laboratório, individuais e em grupo
• estágios de curta duração em entidades parceiras
• uma UC de projecto integrado, que a metodologia de ensino baseia-se na partilha de informações e de objectivos com stakeholders na definição de temas a serem tratados pelos estudantes

4.5.4.Teaching methodologies that promote the participation of students in scientific activities (as applicable):

It is planned to use the following methodologies:
• experimental field and laboratory training in applied eco-hydrology techniques, for training field and laboratory techniques and methodologies, individually and in groups
• short internships at partner entities
• an integrated project UC, which the teaching methodology is based on sharing information and objectives with stakeholders in the definition of topics to be addressed by students

4.6. Fundamentação do número total de créditos ECTS do ciclo de estudos

4.6.1.Fundamentação do número total de créditos ECTS e da duração do ciclo de estudos, com base no determinado nos artigos 8.º ou 9.º (1.º ciclo), 18.º (2.º ciclo), 19.º (mestrado integrado) e 31.º (3.º ciclo) do DL n.º 74/2006, de 24 de março,com

a redação do DL n.º 65/2018, de 16 de agosto:

O número de ECTS, 120, para o ciclo de estudos resulta do conhecimento prévio com a coordenação de outro mestrado Erasmus Mundus em Ecohidrologia que também foi coordenado pela Universidade do Algarve. Também permite um enquadramento nos cursos de mestrado das universidades parceiras. Para além disso, assegura uma formação de qualidade necessária, para os estudantes.

4.6.1.Justification of the total number of ECTS credits and of the duration of the study programme, based on articles 8 or 9 (1st cycle), 18 (2nd cycle), 19 (integrated master) and 31 (3rd cycle) of DL no. 74/2006, republished by DL no. 65/2018, of August 16th:

The number of ECTS, 120, for the cycle of studies results from prior knowledge with the coordination of another Erasmus Mundus Masters in Ecohydrology, which was also coordinated by the University of Algarve. It also allows a qualification in the master's courses of partner universities. In addition, it provides the necessary quality training for students.

4.6.2.Forma como os docentes foram consultados sobre a metodologia de cálculo do número de créditos ECTS das unidades curriculares:

As UCs deste mestrado, excepto as UC que são propostas de novo, estão ou estiveram, na sua grande maioria, em funcionamento nas várias universidades. Os cursos que suportam este mestrado estão acreditados pelas respetivas agências nacionais de acreditação, pelo que foram previamente feitas as consultas aos docentes responsáveis pelas vários UCS.

No caso de UCS novas (não existentes em algum dos mestrados que deram origem ao presente mestrado) os vários parceiros internacionais definiram o numero de ECTS adequado, em concertação com o coordenador do curso em cada universidade parceira e considerando os objectivos gerais do mestrado.

4.6.2.Process used to consult the teaching staff about the methodology for calculating the number of ECTS credits of the curricular units:

The UCs of this master's degree, except the UCs that are proposed again, are or have been, for the most part, in operation at the various universities. The courses that support this master's degree are accredited by the respective national accreditation agencies, so consultations with the professors responsible for the various UCS were previously made.

In the case of new UCS (not existing in any of the master's degrees that gave rise to this master's degree), the various international partners have defined the appropriate number of ECTS, in consultation with the course coordinator at each partner university and considering the general objectives of the master's degree.

4.7. Observações

4.7.Observações:

Os estudantes serão agrupados numa turma única pelo que as mobilidades serão de uma turma.

Os estudantes iniciam o curso, semestre 1, na Universidade do Algarve onde serão abordadas as bases da ecohidrologia numa perspectiva sobretudo ecológica e do estudo dos ecossistemas naturais. Os estudantes terminam o primeiro semestre com uma mobilidade para a Universidade de Lodz para a realização de um estágio prático de trabalho de campo e de laboratório em ecohidrologia aplicada. Este estágio decorrerá na estação de campo e laboratórios do centro europeu de ecohidrologia sob os auspícios da UNESCO na Polónia.

No 2.º semestre do curso (ano 1) os estudantes farão uma mobilidade para a Universidade TH Lubeck, na Alemanha, onde serãos abordadas temáticas que incidem sobre engenharia da água

Para o terceiro semestre (semestre 1 do ano 2), os estudantes têm uma mobilidade para a Universidade de Antuérpia, Bélgica, onde as matérias incidirão sobre aspectos da gestão integrada de bacias hidrográficas.

No último semestre do curso, 2ª semestre do 2º ano, os estudantes fazem a tese numa das universidades do consórcio à escolha, dentro de parâmetros de equilíbrio entre as várias instituições parceiras.

4.7.Observations:

Students will be grouped into a single class so the mobility will be in one class.

Students begin the course, semester 1, at the University of Algarve, where the bases of eco-hydrology will be approached in a mainly ecological perspective and the study of natural ecosystems. Students finish the first semester with a mobility to the University of Lodz to carry out a practical internship in field and laboratory work in applied eco-hydrology. This internship will take place at the field station and laboratories of the European eco-hydrology center under the auspices of UNESCO in Poland.

In the 2nd semester of the course (year 1), students will take a mobility trip to the TH Lubeck University, in Germany, where topics that focus on water engineering will be addressed

For the third semester (semester 1 of year 2), students have a mobility to the University of Antwerp, Belgium, where the subjects will focus on aspects of integrated watershed management.

In the last semester of the course, 2nd semester of the 2nd year, students do their thesis at one of the universities in the consortium of their choice, within parameters of balance between the various partner institutions.

5. Corpo Docente

5.1. Docente(s) responsável(eis) pela coordenação da implementação do ciclo de estudos.

5.1.Docente(s) responsável(eis) pela coordenação da implementação do ciclo de estudos.

Luís Manuel Zambujal Chícharo – Professor Associado (Diretor);
Dina Cristina Fernandes Rodrigues da Costa Simes, Professora Auxiliar;
Maria Margarida da Cruz Godinho Ribau Teixeira, Professora Auxiliar

5.3 Equipa docente do ciclo de estudos (preenchimento automático)

5.3. Equipa docente do ciclo de estudos / Study programme's teaching staff

Nome / Name	Categoria / Category	Grau / Degree	Especialista / Specialist	Área científica / Scientific Area	Regime de tempo / Employment regime	Informação/ Information
Luís Manuel Zambujal Chícharo	Professor Associado ou equivalente	Doutor		Ciências Biológicas, especialidade Ecologia	100	Ficha submetida
Dina Cristina Fernandes Rodrigues da Costa Simes	Professor Auxiliar ou equivalente	Doutor		Química, especialidade de Bioquímica	100	Ficha submetida
Duarte Nuno Ramos Duarte	Professor Auxiliar ou equivalente	Doutor		Ciências do Mar, especialidade de Geologia Marinha	100	Ficha submetida
José Paulo Patrício Geraldes Monteiro	Professor Auxiliar ou equivalente	Doutor		Docteur Sciences (Hidrogeologia)	100	Ficha submetida
Maria Margarida da Cruz Godinho Ribau Teixeira	Professor Auxiliar ou equivalente	Doutor		Ciências e Tecnologias do Ambiente, especialidade de Tecnologias do Ambiente	100	Ficha submetida
Goedele Verreydt	Professor Associado ou equivalente	Doutor		Sciences	100	Ficha submetida
Johannes Teuchies	Professor Auxiliar ou equivalente	Doutor		Biology	80	Ficha submetida
Patrick Meire	Professor Catedrático ou equivalente	Doutor		Sciences - Biology	100	Ficha submetida
Piet Seuntjens	Professor Auxiliar ou equivalente	Doutor		Sciences	100	Ficha submetida
Stefan Van Damme	Professor Associado ou equivalente	Doutor		Sciences	80	Ficha submetida
Tom Ysebaert	Professor Auxiliar ou equivalente	Doutor		Biological sciences	100	Ficha submetida
Chris Kuells	Professor Catedrático ou equivalente	Doutor		Hydrogeology	100	Ficha submetida
Frank Schwartze	Professor Auxiliar ou equivalente	Doutor		Urban and Regional Planning	100	Ficha submetida
Mario Oertel	Professor Catedrático ou equivalente	Doutor		Civil Engineering / Hydraulics	100	Ficha submetida
Maciej Zalewski	Professor Catedrático ou equivalente	Doutor		Biological sciences	100	Ficha submetida
					1460	

<sem resposta>

5.4. Dados quantitativos relativos à equipa docente do ciclo de estudos.

5.4.1. Total de docentes do ciclo de estudos (nº e ETI)

5.4.1.1.Número total de docentes.

15

5.4.1.2.Número total de ETI.

14.6

5.4.2. Corpo docente próprio - Docentes do ciclo de estudos em tempo integral

5.4.2. Corpo docente próprio – docentes do ciclo de estudos em tempo integral.* / "Full time teaching staff" – number of teaching staff with a full time link to the institution.*

Corpo docente próprio / Full time teaching staff	Nº / No.	Percentagem / Percentage
Nº de docentes do ciclo de estudos em tempo integral na instituição / No. of teaching staff with a full time link to the institution:	13	89.041095890411

5.4.3. Corpo docente academicamente qualificado – docentes do ciclo de estudos com o grau de doutor

5.4.3. Corpo docente academicamente qualificado – docentes do ciclo de estudos com o grau de doutor* / "Academically qualified teaching staff" – staff holding a PhD*

Corpo docente academicamente qualificado / Academically qualified teaching staff	ETI / FTE	Percentagem / Percentage
Docentes do ciclo de estudos com o grau de doutor (ETI) / Teaching staff holding a PhD (FTE):	14.6	100

5.4.4. Corpo docente do ciclo de estudos especializado

5.4.4. Corpo docente do ciclo de estudos especializado / "Specialised teaching staff" of the study programme.

Corpo docente especializado / Specialized teaching staff	ETI / FTE	Percentagem* / Percentage*	
Docentes do ciclo de estudos com o grau de doutor especializados nas áreas fundamentais do ciclo de estudos (ETI) / Teaching staff holding a PhD and specialised in the fundamental areas of the study programme	8.8	60.27397260274	14.6
Especialistas, não doutorados, de reconhecida experiência e competência profissional nas áreas fundamentais do ciclo de estudos (ETI) / Specialists not holding a PhD, with well recognised experience and professional capacity in the fundamental areas of the study programme	0	0	14.6

5.4.5. Estabilidade e dinâmica de formação do corpo docente.

5.4.5. Estabilidade e dinâmica de formação do corpo docente. / Stability and development dynamics of the teaching staff

Estabilidade e dinâmica de formação / Stability and tranning dynamics	ETI / FTE	Percentagem* / Percentage*	
Docentes do ciclo de estudos em tempo integral com uma ligação à instituição por um período superior a três anos / Teaching staff of the study programme with a full time link to the institution for over 3 years	5	34.246575342466	14.6
Docentes do ciclo de estudos inscritos em programas de doutoramento há mais de um ano (ETI) / FTE number of teaching staff registered in PhD programmes for over one year	0	0	14.6

Pergunta 5.5. e 5.6.

5.5.Procedimento de avaliação do desempenho do pessoal docente e medidas conducentes à sua permanente atualização e desenvolvimento profissional.

A avaliação de desempenho do pessoal docente decorre do estabelecido no estatuto da carreira docente, tendo como vetores de avaliação o ensino, a investigação, as atividades de extensão e também de gestão.
A operacionalização deste procedimento na FCT rege-se pelo regulamento geral de avaliação de desempenho do pessoal docente da UAlg, aprovado pelo Reitor (Regulamento n.º 4319/2019, publicado no DR, 2ª s, n.º 80, de 24 de abril de 2019) e pelo regulamento específico para avaliação dos docentes da FCT (Regulamento n.º 861/2019, publicado no DR, 2ª s, n.º 213, de 6 de novembro, e, retificado pela Declaração de retificação n.º 940/2019, publicada no DR, 2ª s, n.º N.º 231, de 2 de dezembro de 2019
A Coordenadora da Avaliação dos Docentes da UAlg, composta pelos diretores das unidades orgânicas e pelo Reitor, acompanha todo o processo. Nas faculdades há uma Comissão Coordenadora de Avaliação dos Docentes, sendo os respetivos conselhos científicos a ratificar as classificações finais

5.5.Procedures for the assessment of the teaching staff performance and measures for their permanent updating and professional development.

The performance evaluation of teaching staff results from what is established in the teaching career statute, having teaching, research, extension and management activities as vectors of evaluation.
The operationalization of this procedure at the FCT is governed by the general regulation of performance evaluation of the teaching staff of UAlg, approved by the Rector (Regulation no. 4319/2019, published in the DR, 2, no. 80, of 24/4/2019) and the specific regulation for the evaluation of FCT professors (Regulation no. 861/2019, published in the DR, 2nd s, no. 213, of 6 November, and, corrected by Statement of rectification no. 940 / 2019, published in the DR, 2nd s, No. Nº 231, of December 2,2019
The UAlg Faculty Evaluation Coordinator, composed of the directors of the organic units and the Rector, monitors the entire process. In the faculties there is a Coordinating Commission for the Evaluation of Teachers, with the respective scientific councils ratifying the final classifications

5.6.Observações:

No corpo docente foi incluído todo o pessoal docente envolvido nas disciplinas da responsabilidade da Universidade do Algarve, que inclui para além dos docentes da FCT/UAlg o docente Maciej Zalewski (ULO). Quanto aos docentes das outras UNIVERSIDADES do consórcio, apenas foram considerados os responsáveis pelas uc's obrigatórias, exceptuando o docente atrás referido.

No item 5.4.5 - Foram considerados apenas os docentes da UAlg

5.6.Observations:

The teaching staff included all teaching staff involved in the disciplines under the responsibility of the University of Algarve, which includes, in addition to FCT / UAlg teachers, professor Maciej Zalewski (ULO). As for the teachers of the other UNIVERSITIES of the consortium, only those responsible for the mandatory units were considered, except for the teacher mentioned above.

item 5.4.5 - Only UAlg professors were considered

6. Pessoal Não Docente

6.1.Número e regime de tempo do pessoal não-docente afeto à lecionação do ciclo de estudos.

Para apoio geral, a Faculdade tem o Gabinete de Apoio ao Estudante, composto por 2 trabalhadores, que tratam de assuntos sobre os 1.º ciclos e dos mestrados integrados.
A Faculdade também tem um Gabinete de Mobilidade com 1 Técnico Superior para tratar assuntos sobre mestrados e apoiar os estudantes na área da mobilidade (incoming e outgoing).
Os trabalhadores para apoio específico (ensino e investigação) são em n.º de 22 (6 Assistentes Operacionais, 6 Assistentes Técnicos e 10 Técnicos Superiores) e estão afetos às unidades de investigação e Departamentos que é o órgão que faz a gestão das unidades curriculares, por área científica, isto é, independentemente do curso, pelo que todos partilham todos os cursos que funcionam na Faculdade, ainda que com funções diferenciadas

6.1.Number and work regime of the non-academic staff allocated to the study programme.

The Faculty has an administrative office for student support, composed for 2 workers dedicated the 1st cycles and the integrated master's degrees.
The Faculty also has a Mobility Office with 1 Senior Technician to deal with master's subjects and support students in the field of mobility (incoming and outgoing).
Teaching and research are supported by 22 workers (6 operational assistants, 6 technical assistants and 10 senior technicians), with functions and activities defined by the departments they are allocated to. Because courses share curricular units, it is not possible to differentiate work load per technician per course.

6.2.Qualificação do pessoal não docente de apoio à lecionação do ciclo de estudos.

Mestre: 2 (1 Ciência e Tecnologia de Alimentos e 1 Arquitetura Paisagista)
Licenciado 9 (2 Biologia Marinha; 2 Química; 1 Eng Química; 1 Eng Hortofrutícola ; 1 Tradução; 1 Eng Eletrotécnica; 1 Eng Física)
12º Ano-8
11º Ano-3
9º Ano-2
4º Ano-1

6.2.Qualification of the non-academic staff supporting the study programme.

Master: 2 - (1 Food Science and Technology; 1 Landscape Architecture);
Bachelor-9 (2 Marine Biology; 2 Chemistry and Chemical;1 Enginee ring; 1 Garden and horticultural Eng; 1 translation; 1 Eng Electrical; 1 Eng Physics)
12º Year-9
11º Year-3

9º Year-2
4º Year-1

6.3.Procedimento de avaliação do pessoal não-docente e medidas conducentes à sua permanente atualização e desenvolvimento profissional.

Sistema integrado de gestão e avaliação do desempenho na administração pública (SIADAP), aplicado aos trabalhadores (Lei n.º 66-B/2007, de 28 de dezembro)

6.3.Assessment procedures of the non-academic staff and measures for its permanent updating and personal development

Integrated management system for performance evaluation in public administration (the SIADAP), applied to the workers (Law No. 66-B/2007, of 28 December)

7. Instalações e equipamentos

7.1.Instalações físicas afetas e/ou utilizadas pelo ciclo de estudos (espaços letivos, bibliotecas, laboratórios, salas de computadores, etc.):

O consórcio possui excelentes espaços letivos, adequadamente equipados para o funcionamento do curso. A UAlg, além das salas de aulas e da biblioteca (com acesso online às revistas fundamentais na área), possui vários laboratórios de aulas para ensino pratico. Alguns espaços laboratoriais foram recentemente melhorados, incluindo a compra de um número significativo de lupas, microscópios e de um espectrofotómetro. Existem várias salas de computadores a operar com VDIs (Virtual desktop infrastructure) ligadas a um cluster central permitindo maior rapidez e maior eficácia de computação. Os estudantes possuem acesso gratuito aos softwares necessários (ex. Matlab, ArcGIS). Todos os estudantes podem, ainda, usar as infraesturuturas computacionais e de biblioteca remotamente, através dos seus computadores.

7.1.Facilities used by the study programme (lecturing spaces, libraries, laboratories, computer rooms, ...):

The consortium has excellent teaching spaces, adequately equipped to run the course. UAlg, in addition to the classrooms and library (with online access to the fundamental magazines in the area), has several classrooms for practical teaching. Some laboratory spaces have recently been improved, including the purchase of a significant number of magnifiers, microscopes and a spectrophotometer. There are several computer rooms operating with VDIs (Virtual desktop infrastructure) connected to a central cluster allowing for faster and more efficient computing. Students have free access to the necessary software (eg Matlab, ArcGIS). All students can also use the computer and library infrastructures remotely, through their computers.

7.2.Principais equipamentos e materiais afetos e/ou utilizados pelo ciclo de estudos (equipamentos didáticos e científicos, materiais e TIC):

Na UAlg, os estudantes utilizarão, sobretudo, equipamentos informáticos e softwares, mas também espaços laboratoriais apetrechados para aulas praticas. Para os trabalhos de campo e de tese serão usados os equipamentos e espaços adequados a cada projecto. Existem já os equipamentos necessários para garantir o funcionamento do curso, adstritos a centros de investigação, mas está prevista a aquisição de equipamentos complementares no âmbito do financiamento pelo programa Erasmus Mundus.

7.2.Main equipment or materials used by the study programme (didactic and scientific equipment, materials, and ICTs):

At UAlg, students will mainly use computer equipment and software, but also laboratory spaces equipped for practical classes. For field and thesis work, the appropriate equipment and spaces for each project will be used. The necessary equipment already exists to guarantee the functioning of the course, allocated to research centers, but the acquisition of complementary equipment is foreseen in the scope of the financing by the Erasmus Mundus program.

8. Atividades de investigação e desenvolvimento e/ou de formação avançada e desenvolvimento profissional de alto nível.

8.1. Centro(s) de investigação, na área do ciclo de estudos, em que os docentes desenvolvem a sua atividade científica

8.1. Mapa VI Centro(s) de investigação, na área do ciclo de estudos, em que os docentes desenvolvem a sua atividade científica / Research centre(s) in the area of the study programme where teaching staff develops its scientific activity

Centro de Investigação / Research Centre	Classificação (FCT) / Classification FCT	IES / HEI	N.º de docentes do CE integrados / Number of study programme teaching staff integrated	Observações / Observations
CCMAR-Centro de Ciências do Mar	Excelente	Universidade do Algarve	1	

CIMA-Centro de Investigação Marinha e Ambiental	Muito Bom	Universidade do Algarve	2
CERIS-Civil Engineering Research and Innovation for Sustainability	Excelente	Universidade Lisboa - Instituto Superior Técnico	1
CENSE-Centro de Investigação em Ambiente e Sustentabilidade	Excelente	Universidade Nova LIsboa- Fac Ciências e Tecnologia	1

Pergunta 8.2. a 8.4.

8.2.Mapa-resumo de publicações científicas do corpo docente do ciclo de estudos, em revistas de circulação internacional com revisão por pares, livros ou capítulos de livro, relevantes para o ciclo de estudos, nos últimos 5 anos.
https://a3es.pt/si/iportal.php/cv/scientific-publication/formId/7ee6c434-a571-7bd0-6312-5f68756dc17a
8.3.Mapa-resumo de atividades de desenvolvimento de natureza profissional de alto nível (atividades de desenvolvimento tecnológico, prestação de serviços ou formação avançada) ou estudos artísticos, relevantes para o ciclo de estudos:
https://a3es.pt/si/iportal.php/cv/high-level-activities/formId/7ee6c434-a571-7bd0-6312-5f68756dc17a
8.4.Lista dos principais projetos e/ou parcerias nacionais e internacionais em que se integram as atividades científicas, tecnológicas, culturais e artísticas desenvolvidas na área do ciclo de estudos.

Principais parcerias:
Programa de ecohidrologia da UNESCO
Catedra UNESCO em Ecohidrologia: água para os ecossistemas e sociedades
Sociedade Internacional de Ecohidrologia

Principais projectos:
MEDSAL Salinization of critical groundwater reserves in coastal Mediterranean areas: Identification, Risk Assessment, and Sustainable Management EU Project in the PRIMA Initiative with Greece, Italy, Cyprus, Tunisia, Algeria, 2019-2022;
IsoMed - Isotope techniques for water management in the Mediterranean EU Project in the ERANET initiative with Cyprus and Jordan, 2018-2021;
BEST4CA - The Nexus approach for the Development of Hydro-Power in Central Asia – Environmental Flow and Transboundary Issues EU Project, Research & Innovation, Demonstration Project, 2020;
LIFE08-ENV/PL/000517, 2010-2015 EH-REK, Ecohydrologic rehabilitation of recreational reservoirs “Arturówek” (Łódź);
LIFE08-ENV/PL/000519, 2010-2015, EKOROB: Ecotones for reducing diffuse pollution; www.ekorob.pl) (Best Environmental Project 2016-2017);
LIFE14CCA/PL/000101, 20015-2020 LIFERADOMKLIMA;
2016-2020 AMBER - Adaptive Management of Barriers in European Rivers H2020-SC5-2014-2015/H2020-SC5-2015-two-stage-689682-AMBER. http://www.amber.international

8.4.List of main projects and/or national and international partnerships underpinning the scientific, technologic, cultural and artistic activities developed in the area of the study programme.

Main partnerships:
UNESCO eco-hydrology program
UNESCO Chair in Ecohydrology: water for ecosystems and societies
International Society of Ecohydrology

Main projects:
MEDSAL Salinization of critical groundwater reserves in coastal Mediterranean areas: Identification, Risk Assessment, and Sustainable Management EU Project in the PRIMA Initiative with Greece, Italy, Cyprus, Tunisia, Algeria, 2019-2022;
IsoMed - Isotope techniques for water management in the Mediterranean EU Project in the ERANET initiative with Cyprus and Jordan, 2018-2021;
BEST4CA - The Nexus approach for the Development of Hydro-Power in Central Asia - Environmental Flow and Transboundary Issues EU Project, Research & Innovation, Demonstration Project, 2020;
LIFE08-ENV / PL / 000517, 2010-2015 EH-REK, Ecohydrologic rehabilitation of recreational reservoirs “Arturówek” (Łódź);
LIFE08-ENV / PL / 000519, 2010-2015, EKOROB: Ecotones for reducing diffuse pollution; www.ekorob.pl) (Best Environmental Project 2016-2017);
LIFE14CCA / PL / 000101, 20015-2020 LIFERADOMKLIMA;
2016-2020 AMBER - Adaptive Management of Barriers in European Rivers H2020-SC5-2014-2015 / H2020-SC5-2015-two-stage-689682-AMBER. http://www.amber.international

9. Enquadramento na rede de formação nacional da área (ensino superior público)

9.1.Avaliação da empregabilidade dos graduados por ciclo de estudos similares com base em dados oficiais:
No final de cada ano lectivo, será feita uma avaliação formal do programa através de um questionário on-line, da responsabilidade da coordenação do MAEH, e para o qual todos os estudantes e professores são solicitados a colaborar. Além disso, as entidades parceiras do “mundo do trabalho” serão solicitados a avaliar a relevância e

aplicabilidade do programa, bem como as aptidões e potencial empregabilidade dos estudantess com quem contactaram durante as palestras, projetos e estágios. O consórcio tem uma estratégia para alcançar a empregabilidade através da ligação ao mundo do trabalho, cooperando com entidades, associações de água, empresas regionais, nacionais e internacionais, durante o programa de estudos. Além disso, a coordenação manterá contato principalmente por e-mail, com ex-estudantes, para feedback sobre sua situação profissional, por forma a ser possival avaliar a empregabilidade dos graduados deste curso, por comparação com ciclos de estudo similares.

9.1.Evaluation of the employability of graduates by similar study programmes, based on official data:

At the end of each academic year, a formal evaluation of the program will be carried out through an online questionnaire, which is the responsibility of the MAEH coordination, and for which all students and teachers are asked to collaborate. In addition, partner entities from the "world of work" will be asked to assess the relevance and applicability of the program, as well as the skills and potential employability of students with whom they contacted during lectures, projects and internships. The consortium has a strategy to achieve employability by connecting to the world of work, cooperating with entities, water associations, regional, national and international companies, during the study program. In addition, the coordination will maintain contact mainly by e-mail, with alumni, for feedback on their professional situation, in order to be able to assess the employability of graduates of this course, by comparison with similar study cycles.

9.2.Avaliação da capacidade de atrair estudantes baseada nos dados de acesso (DGES):

A humanidade depara-se com graves problemas no acesso á água e na sua utilização sustentável que limtam a disponibilidade e qualidade de água para os ecossistemas aquaticos, com perda dos serviços associados. Estes factos são preocupação a nivel mundial. :"Água para o Desenvolvimento Sustentável, 2018-2028" da ONU, os planos estratégicos da UNESCO IHP "Segurança da água: Respostas aos desafios locais, regionais e globais, 2014-2021", economia circular, a estratégia da UE sobre 'soluções baseadas na natureza e re-naturing cidades' e a ambição europeia "Green Deal". A necessidade de profissionais na area de ecohidrologia é presente (o PHI da UNESCO, considera a ecohidrologia como umas das 6 áreas prioritárias, a nivel mundial, o que, associado as redes de contactos que cada instituição tem, (nomeadamente o acesso à rede da UNESCO), a que se junta o apoio financeiro da União europeia para bolsas para estudantes durante os primeiros 5 anos do curso certamente atrairá estudantes.

9.2.Evaluation of the capability to attract students based on access data (DGES):

Humanity is faced with serious problems in access to water and its sustainable use that limit the availability and quality of water for aquatic ecosystems, with the loss of associated services. These facts are a worldwide concern. : "Water for Sustainable Development, 2018-2028" by the UN, UNESCO IHP strategic plans "Water security: Responses to local, regional and global challenges, 2014-2021", circular economy, the EU strategy on 'solutions based on nature and re-naturing cities' and the European ambition "Green Deal". The need for professionals in the field of eco-hydrology is present (UNESCO's PHI, considers eco-hydrology as one of the 6 priority areas, worldwide, which, associated with the networks of contacts that each institution has, (namely access to the network of UNESCO), in addition to the European Union's financial support for student grants during the first 5 years of the course will certainly attract students.

9.3.Lista de eventuais parcerias com outras instituições da região que lecionam ciclos de estudos similares:

Não temos outras instituições na região.

9.3.List of eventual partnerships with other institutions in the region teaching similar study programmes:

No other similar institutions in the region

10. Comparação com ciclos de estudos de referência no espaço europeu

10.1.Exemplos de ciclos de estudos existentes em instituições de referência do Espaço Europeu de Ensino Superior com duração e estrutura semelhantes à proposta:

Analisaram-se os cursos nas áreas de engenharia ambiental relacionada com a água, incluindo os cursos de mestrados ERASMUS+. Encontraram-se 33 programas internacionais de estudos de mestrado existentes na Europa, 14 dos quais focam apenas água, enquanto os 19 restantes consideram aspectos adicionais como energia, energias renováveis e recursos, ou engenharia de processo e outras disciplinas além das com enfoque no tema da água.

10.1.Examples of study programmes with similar duration and structure offered by reference institutions in the European Higher Education Area:

The courses in the areas of environmental engineering related to water were analyzed, including the ERASMUS + masters courses. There were 33 international master's degree programs existing in Europe, 14 of which focus only on water, while the remaining 19 consider additional aspects such as energy, renewable energies and resources, or process engineering and other disciplines besides those focusing on the theme of Water

10.2.Comparação com objetivos de aprendizagem de ciclos de estudos análogos existentes em instituições de referência do Espaço Europeu de Ensino Superior:

Verificou-se que a maioria dos programas de estudo se foca em numa disciplina (área científica), no enquadramento e na ligação com a história e formação do departamento que suporta cada curso, ou sejam sem apresentarem uma visão integradora e transdisciplinar

Na verdade, os estudos em ciências da água e engenharia são frequentemente especializações de departamentos de arquitetura ou engenharia civil (14) e baseiam-se nos respectivos programas de bacharelado (engenharia civil e ambiental), ou em ciências agrícolas ou do solo (agricultura e engenharia ambiental) (9), ou são baseados na ciência em geociências (6), ou em ecologia e biologia (4). Existem 6 EMJMD nas áreas de hidroinformática, política e gestão, águas subterrâneas, gestão costeira dedicada e gestão sustentável, engenharia ambiental e energias renováveis; nenhum tem a abordagem temática interdisciplinar do Mestrado em Ecohidrologia Aplicada.

10.2.Comparison with the intended learning outcomes of similar study programmes offered by reference institutions in the European Higher Education Area:

It was found that most study programs focus on one discipline (scientific area), on the framework and connection with the history and training of the department that supports each course, that is, without presenting an integrative and transdisciplinary vision

In fact, studies in water sciences and engineering are often specializations in departments of architecture or civil engineering (14) and are based on their respective bachelor's programs (civil and environmental engineering), or in agricultural or soil sciences (agriculture and environmental engineering) (9), or are based on science in geosciences (6), or on ecology and biology (4). There are 6 EMJMD in the areas of hydroinformatics, politics and management, groundwater, dedicated coastal management and sustainable management, environmental engineering and renewable energies; none has the interdisciplinary thematic approach of the Master in Applied Ecohydrology.

11. Estágios e/ou Formação em Serviço

11.1. e 11.2 Estágios e/ou Formação em Serviço

Mapa VII - Protocolos de Cooperação

Mapa VII - Protocolos de Cooperação

11.1.1.Entidade onde os estudantes completam a sua formação:

<sem resposta>

11.1.2.Protocolo (PDF, máx. 150kB):

<sem resposta>

11.2. Plano de distribuição dos estudantes

11.2.Plano de distribuição dos estudantes pelos locais de estágio e/ou formação em serviço demonstrando a adequação dos recursos disponíveis.(PDF, máx. 100kB).

<sem resposta>

11.3. Recursos próprios da Instituição para acompanhamento efetivo dos seus estudantes nos estágios e/ou formação em serviço.

11.3.Recursos próprios da Instituição para o acompanhamento efetivo dos seus estudantes nos estágios e/ou formação em serviço:

<sem resposta>

11.3.Institution’s own resources to effectively follow its students during the in-service training periods:

<no answer>

11.4. Orientadores cooperantes

11.4.1. Mecanismos de avaliação e seleção dos orientadores cooperantes de estágio e/ou formação em serviço, negociados entre a instituição de ensino superior e as instituições de estágio e/ou formação em serviço (PDF, máx. 100kB).

11.4.1Mecanismos de avaliação e seleção dos orientadores cooperantes de estágio e/ou formação em serviço, negociados entre a instituição de ensino superior e as instituições de estágio e/ou formação em serviço (PDF, máx. 100kB).

<sem resposta>

11.4.2. Orientadores cooperantes de estágio e/ou formação em serviço (obrigatório para ciclo de estudos com estágio obrigatório por lei)

11.4.2. Mapa X. Orientadores cooperantes de estágio e/ou formação em serviço (obrigatório para ciclo de estudos com estágio obrigatório por Lei) / External supervisors responsible for following the students' activities (mandatory for study programmes with in-service training mandatory by law)

Nome / Name	Instituição ou estabelecimento a que pertence / Institution	Categoria Profissional / Professional Title	Habilitação Profissional (1)/ Professional qualifications (1)	Nº de anos de serviço / Nº of working years

<sem resposta>

12. Análise SWOT do ciclo de estudos

12.1.Pontos fortes:

• Abordagem interdisciplinar do conhecimento dinâmico dos ecossistemas (base natural da ecohidrologia), como base para desenvolvimento de soluções de engenharia cuja implementação pratica, necessita de considerar a gestão das bacias hidrográficas. Assim este mestrado é único a fornecer um conhecimento verdadeiramente integrador da problemática da recuperação e sustentabilidade dos ecossistemas aquáticos, o que suporta os serviços dos ecossistemas para as sociedades.
• Fluidez e coerência nos conteúdos programáticos - as UCs são leccionadas no momento adequado para a formação dos estudantes, o que será efectuado através da mobilidade de docentes. Desta forma, elimina-se situações de duplicação ou gaps na matéria devido à adequação aos ciclos de estudo do mestrado nas várias universidades.
• Ligação efectiva à prática científica de campo e laboratorial bem como ao mundo do trabalho através de UC integradora.
• Articulação com parceiros internacionais através da cátedra UNESCO em Ecohidrologia, da UALG e da articulação com o PHI da UNESCO, que suporta uma UC de webinars sobre temas relacionados com o curso dando uma perspectiva da situação e soluções nesta área a nível global.

12.1.Strengths:

• Interdisciplinary approach to the dynamic knowledge of ecosystems (natural basis of eco-hydrology), as a basis for the development of engineering solutions whose practical implementation, needs to consider the management of watersheds. Thus, this master's degree is unique in providing a truly integrated knowledge of the problem of the recovery and sustainability of aquatic ecosystems, which supports ecosystem services for societies.
• Fluidity and consistency in the syllabus - UCs are taught at the appropriate time for the training of students, which will be done through the mobility of teachers. In this way, situations of duplication or gaps in the matter are eliminated due to the suitability for the master's study cycles in the various universities.
• Effective connection to scientific field and laboratory practice as well as to the world of work through an integrative UC.
• Articulation with international partners through the UNESCO Chair in Eco-hydrology, UALG and articulation with the UNESCO PHI, which supports a UC of webinars on topics related to the course, giving a perspective of the situation and solutions in this area at a global level.

12.2.Pontos fracos:

Falta de uma estação de campo para experimentação e de laboratório dedicado, na Universidade do Algarve
Valor elevado das propinas

12.2.Weaknesses:

We miss a training field station and a dedicated lab at the UAlg
High cost of fees

12.3.Oportunidades:

A agenda europeia e mundial nomeadamente: o Green Deal da EU, o programa estratégico do PHI da UNESCO para 2014-2021 ou os objectivos do desenvolvimento sustentável da UN, salientam a necessidade de recuperar e proteger

os sistemas aquáticos. Essa recuperação e conservação podem ser conseguidas usando tecnicas de base natural as denominadas "nature based solutions" (World Water Assessment Program, 2018), com vantagens em termos da sustentabilidade, impacto e custo económico das soluções aplicadas. Assim, esta área tem vindo a merecer uma atenção crescente a nível global, o que tem sido verificável pelas acções de formação em todas as regiões, no âmbito da cátedra UNESCO em Ecohidrologia. Para a Universidade do Algarve, como coordenadora bem como para as Universidades parceiras este curso consiste numa oportunidade de liderar esta área no espaço do ensino universitário europeu. A necessidade de técnicos e investigadores com este tipo de formação transdisciplinar constitui uma oportunidade para os futuros profissionais com este mestrado, no mercado de trabalho.

12.3.Opportunities:

The European and global agenda, namely: the EU's Green Deal, UNESCO's strategic PHI program for 2014-2021 or the UN's sustainable development objectives, highlight the need to recover and protect aquatic systems. This recovery and conservation can be achieved using natural based techniques called "nature based solutions" (World Water Assessment Program, 2018), with advantages in terms of sustainability, impact and economic cost of the solutions applied. Thus, this area has been receiving increasing attention at a global level, which has been verified by the training actions in all regions, within the scope of the UNESCO Chair in Ecohydrology. For the University of Algarve, as a coordinator as well as for the partner Universities, this course is an opportunity to lead this area in the space of European university education. The need for technicians and researchers with this type of transdisciplinary training constitutes an opportunity for future professionals with this master's degree, in the job market.

12.4.Constrangimentos:

Não se antecipam constrangimentos ao funcionamento do mestrado

12.4.Threats:

There are no anticipated constraints to the functioning of the Master's

12.5.Conclusões:

O consórcio MAEH foi construído com a visão de harmonizar diferentes disciplinas em ciências da água para criar um programa de ciências da água altamente atraente e impactante. O MAEH visa formar profissionais com uma perspectiva holística e conhecimento cientifico necessários para resolver os problemas complexos e multifatoriais de segurança e sustentabilidade da água, agora e no futuro. As Universidades do consorcio, lideradas pela Universidade do Algarve compreendem a necessidade de uma educação mais integrativa em ciências da água, pelo que aportam a experiência de ensino e investigação em cada uma das várias áreas temáticas que são integradas. Acreditamos que os novos profissionais em ciências da água precisam combinar um conhecimento profundo dos sistemas eco-hidrológicos (rios, lagos, águas subterrâneas) com as aptidões técnicas e competência para desenvolver e projectar soluções baseadas na natureza, sendo também capazes de gerir ecossistemas aquáticos e sistemas de água de forma integrada. Assim, decidimos harmonizar e integrar as experiências e competências individuais de cada Universidade para desenvolver um novo e altamente inovador curso de mestrado conjunto: o Mestrado em Ecohidrologia Aplicada

12.5.Conclusions:

The MAEH consortium was built with the vision of harmonizing different disciplines in water sciences to create a highly attractive and impacting water sciences program. MAEH aims to train professionals with a holistic perspective and scientific knowledge necessary to solve the complex and multifactorial problems of water safety and sustainability, now and in the future. The Universities of the consortium, led by the University of the Algarve understand the need for a more integrative education in water sciences, so they contribute the teaching and research experience in each of the several thematic areas that are integrated. We believe that new water science professionals need to combine a deep knowledge of eco-hydrological systems (rivers, lakes, groundwater) with technical skills and competence to develop and design solutions based on nature, while also being able to manage aquatic ecosystems and water systems in an integrated manner. Thus, we decided to harmonize and integrate the experiences and individual skills of each University to develop a new and highly innovative joint master's course: the Master in Applied Ecohydrology