Doc. 300.1.2

Higher Education Institution's Response

Date: 13.04.2021

- **Higher Education Institution:**
  University of Central Lancashire, Cyprus (UCLan Cyprus)
- **Town: Larnaca**
- **Programme of study**
  Name (Duration, ECTS, Cycle)

  In Greek:

  Μεταπτυχιακό στην Πληροφορική, 1 year/90 ECTS

  In English:

  MSc in Computing (1 year/ 90 ECTS, Master of Science)
- **Language(s) of instruction: English**
- **Programme's status:** Currently Operating

The present document has been prepared within the framework of the authority and competencies of the Cyprus Agency of Quality Assurance and Accreditation in Higher Education, according to the provisions of the "Quality Assurance and Accreditation of Higher Education and the Establishment and Operation of an Agency on Related Matters Laws of 2015 to 2019" [N. 136 (I)/2015 to N. 35(I)/2019].

A. Guidelines on content and structure of the report

- *The Higher Education Institution (HEI) based on the External Evaluation Committee's (EEC's) evaluation report (Doc.300.1.1) must justify whether actions have been taken in improving the quality of the programme of study in each assessment area.*

- *In particular, under each assessment area, the HEI must respond on, without changing the format of the report:*

    - *the findings, strengths, areas of improvement and recommendations of the EEC*
    - *the deficiencies noted under the quality indicators (criteria)*
    - *the conclusions and final remarks noted by the EEC*

- *The HEI's response must follow below the EEC's comments, which must be copied from the external evaluation report (Doc. 300.1.1).*

- *In case of annexes, those should be attached and sent on a separate document.*

On behalf of the MSc Computing programme team, we would like to extend our appreciation to Professor Sasu Tarkoma, Professor Gregory O'Hare, Professor Kevin Curran and student Prokopis Antoniou for their participation in the External Evaluation Committee (EEC) for the MSc Computing programme at the School of Sciences at UCLan Cyprus. We welcome the evaluation process as a core step towards evolving as a MSc programme in the area of Computing. We would like to thank the EEC for reviewing and examining the accreditation reports and for participating in the remote site visit that took place on the 5th of January 2021. The evaluation process assisted in identifying areas of improvement and celebrated good practices. We would especially like to thank the EEC for their comments and constructive feedback, discussed during their visit, and also included in the evaluation report. In what follows, we address the EEC's recommendations and elaborate on the relevant plans for improvement of the MSc Computing programme.

1. Study programme and study programme's design and development
(ESG 1.1, 1.2, 1.8, 1.9)

EEC REPORT

Findings for Computing (1 year/ ECTS, MSc)

The M.Sc. has a professional focus, and it is motivated by the ACM curriculum. The M.Sc. level courses have been developed for the program and deepen the B.Sc. content. The students receive guidance relating to the degree, courses, and the preparation of the M.Sc. thesis. The guidance and tutoring include ethical and legal matters, sustainable computing, and general information on scientific writing.

Strengths for Computing (1 year/ ECTS, MSc)

The students have a versatile set of modules that can be taken, the modules being shared by the M.Sc. programs. M.Sc. thesis can be prepared in an industry setting and there are procedures supporting this. In all, the industry connection is commendable.

Common strengths for the three programs

The rapid response across all programs to the covid situation was noted and applauded.

The facilities represent the state of the art and provide excellent support for both education and research.

Areas of improvement and recommendations for Computing (1 year / ECTS, MSc)

The degree program offers a versatile set of modules that the students can select. The EEC recommends examining the combination of modules and the core computer science contents of the modules for ensuring that the degree has sufficient coverage and depth of core computer science topics.

The degree program in Computer does not have significant machine learning and AI content. Given that AI is an integral part of digitalisation and the digital infrastructure, the EEC recommends the M.Sc. in Computing to increase machine learning content. For example, the module Exploratory Data Analysis can have more ML focus. In the longer term, the EEC suggests exploring the AI theme as a new program on the B.Sc. level. Experts in AI area are highly sought; however, a new program would need to position itself with the similar programs already offered by other universities.

UCLAN CYPRUS RESPONSE

We appreciate the positive comments from the EEC regarding the MSc Computing as a study programme, together with its design and development elements. We plan to continue offering the versatile set of modules, many of which are shared among the School's MSc programmes, as well as continue our support with the students' Master's thesis project, including the industrial connection option.

In terms of suggested areas of improvement, the EEC mentions that there is benefit in "*examining the combination of modules and the core computer science contents of the modules for ensuring that the degree has sufficient coverage and depth of core computer science topics*". The EEC also identifies the benefit of enhancing the machine learning and AI content of the MSc Computing programme.

We are in agreement with the EEC's recommendations, and we have taken the following actions to address the suggested areas of improvement. The course team has undertaken: (a) a mapping exercise to address the recommendation for examining the combination of modules and the core computing contents, and, (b) a design activity to produce a new descriptor for Artificial Intelligence, describing a semester-long, 3-hour per week module that will be offered as an additional optional module of the MSc Computing programme.

Specifically:

(a) We have completed a mapping exercise of the MSc Computing modules and their core Computer Science contents to re-affirm coverage and depth of core Computer Science topics and relevant skills. The mapping exercise considered recommendations from the ACM, AIS and IEEE-CS in the overview report for Computing Curricula, initially published in 2005[1], revised in 2013[2] and again in 2020[3] with a focus on Computer Science, by ACM, and IEEE-CS.

The Computing Curricula indicate the range of topics that should be covered by Computing education (**Figure 1**) and propose a mapping system based on two dimensions:

1. The first dimension runs from theory, principles, and innovation, to application, deployment, and configuration.

2. The second dimension runs from computer hardware, architecture and application issues to organizational issues and information systems issues.

A mapping of the MSc Computing modules onto this framework indicates the wide coverage of Computing topics (**Figure 2**).

The mapping exercise also considered recommendations for computing skills according to the *Global Competency Model for Graduate Degree Programs in Information Systems* from ACM and AIS, published in 2017[4]. We provide the results of this particular mapping in **Table 1**.

[1] *Shackelford, R., McGettrick, A., Sloan, R., Topi, H., Davies, G., Kamali, R., & Lunt, B. (2006, March). Computing curricula 2005: The overview report. InACM SIGCSE Bulletin (Vol. 38, No. 1, pp. 456-457). ACM.*

[2] *Sahami, M., Roach S., et. al. (2013). Computer Science curricula 2013: Final report. The Joint Task force on Computing Curricula ACM and IEEE-CS. December 2013.*

[3] *Clear, A., Parrish, A., Impagliazzo, J., Wang, P., (eds), (2020).Computing Curricula 2020: Paradigms for Global Computing Education, CC2020 Task Force published by ACM, IEEE-CS and also supported by ACM China, ACM India, AIS, ED-SIG, Informatics Europe, GRIN, SIGCHI, December 2020.*

[4] *Topi, H., Karsten, H., Brown, S. A., Carvalho, J. A., Donnellan, B., Shen, J., Tan, B. C., & Thouin, M. F. (2017). MSIS 2016 Global Competency Model for Graduate Degree Programs in Information Systems. Communications of the Association for Information Systems*

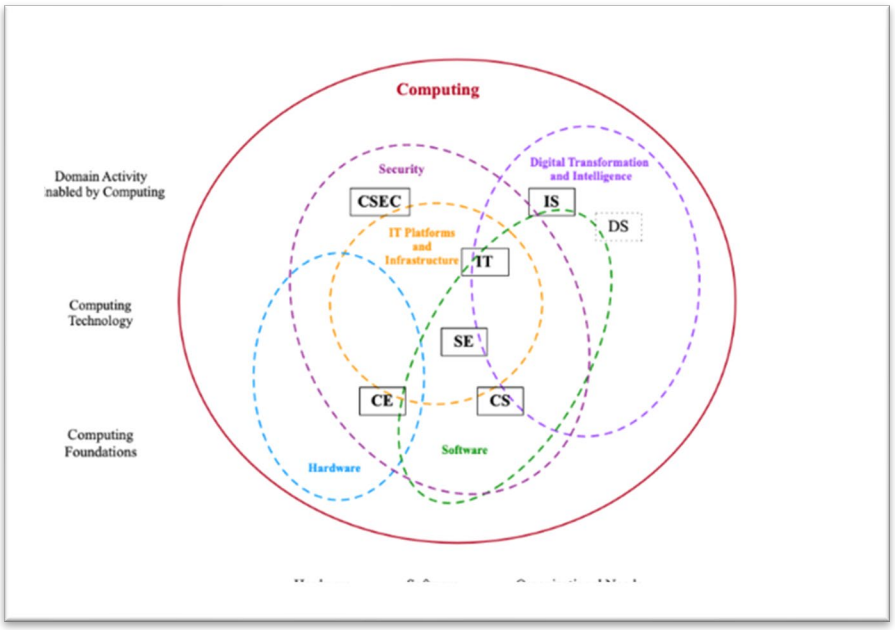


Figure 1: A view of Computing education according to Computing Curricula 2020 [5] **-** Legend CE=computer engineering; CS=computer science; CSEC=cybersecurity; IS=information systems; IT=information technology; SE=software engineering; DS=data science

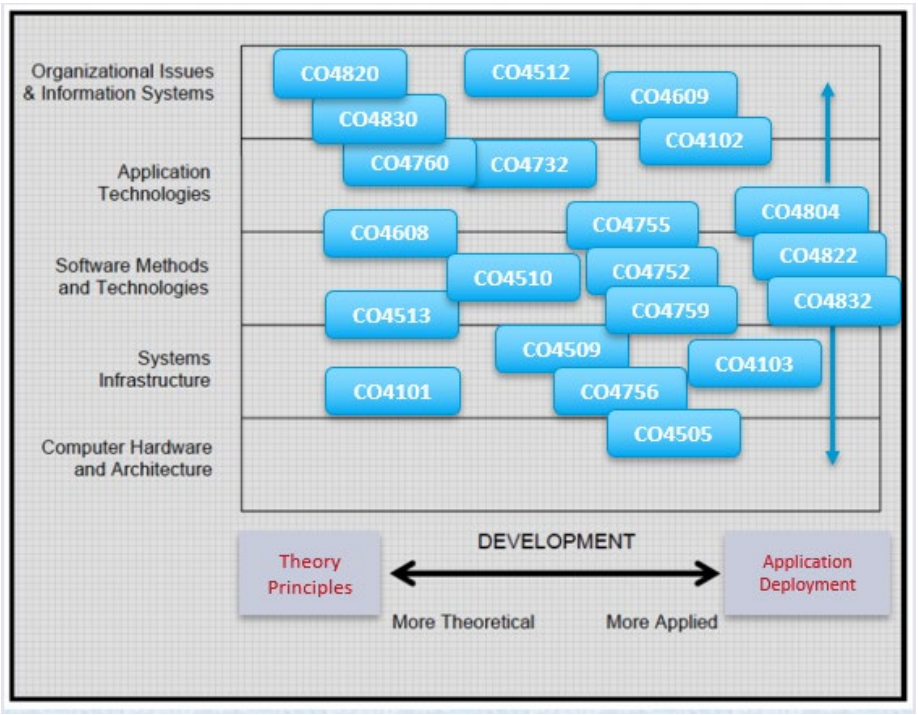


Figure 2: Mapping MSc Computing modules onto the Problem Space Framework proposed by Computing Curricula 2020 [6]

[5] *Clear, A., Parrish, A., Impagliazzo, J., Wang, P., (eds), (2020).Computing Curricula 2020: Paradigms for Global Computing Education, CC2020 Task Force published by ACM, IEEE-CS and also supported by ACM China, ACM India, AIS, ED-SIG, Informatics Europe, GRIN, SIGCHI, December 2020.*

[6] *Clear, A., Parrish, A., Impagliazzo, J., Wang, P., (eds), (2020).Computing Curricula 2020: Paradigms for Global Computing Education, CC2020 Task Force published by ACM, IEEE-CS and also supported by ACM China, ACM India, AIS, ED-SIG, Informatics Europe, GRIN, SIGCHI, December 2020.*

Table 1: Mapping Proposed Competencies (Global Competency Model for Graduate Programs in Information Systems)

Proposed Competencies	Module Code(s)	Module Name	Details
Individual Foundational Competencies			
Critical Thinking	CO4820 {…}	Critical Analysis ALL modules	CO4820 aims to develop students' critical analysis and academic writing skills to Masters level. All modules align with course objective A3, i.e. to critically evaluate computing research literature.
Creativity	CO4732 CO4608	Advanced Topics in UX Agile Systems Development	CO4732 provides tools to encourage students to be creative in order to design and implement a specific user interface that satisfies a general user problem. CO4608 provides creative opportunities to involve stakeholders in order to elicit requirements for prototyping and planning implementation of solutions to emergent issues.
Collaboration and Teamwork	CO4830 CO4822 CO4608	IT Projects & Programmes; Professional Placement; Agile Systems Development	All the mentioned modules align with course objective D4, i.e. to work as part of a team, identifying issues and devising responses.
Ethical Analysis	CO4804 CO4820 CO4830 CO4822 CO4510 CO4608 CO4512 CO4103	Masters Project; Critical Analysis; IT Projects and Programmes; Professional Placement; Advanced Topics in User Experience; Agile Systems Development; Information Security Management; Ethical Hacking	All the mentioned modules align with course objective B3, i.e. to adopt a professional approach to ethical and legal issues relevant to a computing professional and understand the implications of any actions.
Mathematical and Statistical Competencies	CO4820 CO4760	Critical Analysis Exploratory Data Analysis	CO4820 aims to develop students' research, skills to Masters level including statistical analysis competencies. The aim of CO4760 is to provide all the necessary tools for analysing datasets and visualising their properties.
Oral Communication	{…}	ALL modules	All modules include either discussions, oral presentations, or both.
Written Communication	{…}	ALL modules	ALL modules include written deliverables as part of formative or summative assessments.
Problem-Solving	CO4505	Network Communication & Routing	CO4505 looks specifically into ways of troubleshooting systems and offers practical

	{…}	ALL modules	guidelines for approaching problem-solving for such situations. ALL modules challenge students into problem-solving as part of formative or summative assessments.
Information Systems Competencies			
Business Continuity and Information Assurance	CO4102	ERP Systems	The module demonstrates business continuity and information assurance through Enterprise Resource Planning approaches, platforms and software as part of the evolution of Information Systems.
Data, Information and Content Management	CO4759 CO4513	Enterprise Data Management Network Operations & Management	CO4759 addresses the needs of a business for a well-designed information system and studies the design processes in forming both logical and physical database models. CO4513 provides a practical understanding of network operations and management and demonstrates improved quality.
Ethics, Impact and Sustainability	CO4804 CO4510	Masters Project Advanced Topics in IT Security	CO4804 aims to provide students an awareness of appropriate, legal, ethical and professional issues. CO4510 exposes students to the practice of ethical analysis in security scenarios and the examination of organisational and social context.
IS Management and Operations	CO4513	Network Operations and Management	CO4513 aims to provide a practical understanding of network operations and management and to demonstrate how analysing a number of solutions to ensure better management and quality.
IT Infrastructure	CO4101 CO4505	Distributed Systems Network Communication and Routing	CO4101 presents a number of architectural models of distributed systems as well as design, organisation, algorithmic and middleware concepts. CO4505 aims to provide students with hands on experience in the set-up configuration and testing of networks, encouraging them to expand their knowledge of the computer network industry.
Systems Development and Deployment	CO4752 CO4755	Web Application Development Mobile Application Development	The material of CO4752 covers both the practical and theoretical sides of the website development lifecycle, focusing on selected technologies. CO4755 aims to develop an understanding of software technologies and architectures for mobile computing and to enable students to develop software applications for mobile computing environments.
Specialized Competencies			
Knowledge in Security	CO4509	Digital Security	CO4509 aims to examine a range of vulnerabilities and attacks on computer

	CO4510	Advanced Topics in IT Security	systems and networks and to instil a vigilant attitude towards potential system weaknesses. CO4510 studies selected topics in areas such as security in cloud computing, mobile security, and security in social media.
Knowledge in Analytics	CO4759	Enterprise Data Management	CO4759 addresses the needs of a business for a well-designed information system and studies the design processes in forming both logical and physical database models.
	CO4760	Exploratory Data Analysis	The aim of CO4760 is to provide all the necessary tools for analysing datasets and visualising their properties.
Knowledge in Marketing	CO4609	e-Marketing	CO4609 aims to provide learners with the skills and knowledge to understand online marketing concepts and techniques.
Knowledge in Project Management	CO4830	IT Projects & Programmes	CO4830 aims to discuss and compare different styles of project management, and to examine a range of techniques used to tackle the problems of project management.
	CO4804	Masters Project	CO4804 aims to enable students to demonstrate disciplines of time management, project planning, and reporting on progress.

Based on the results summarised in **Figure 2** and **Table 1**, we demonstrate that there is sufficient coverage of core Computing contents with depth of core computer science topics and coverage of corresponding skills.

(b) To address the recommendation for increasing the Machine Learning content and further exploring the AI theme in the programme, we have designed a new Artificial Intelligence module. The module's descriptor, which we incorporated as a new optional module in the MSc Computing programme, is provided in **Appendix 1**. The module aims to demonstrate various AI models and techniques, including machine learning, and to develop understanding of AI solutions for a range of problems. The students will have the opportunity to explore the performance of AI models, and to design and implement specific solutions themselves. The module, eventually, aims to equip the students with the knowledge and skills necessary to allow them to analyse and critically evaluate real-world problems and be able to select appropriate AI approaches for their solutions.

2. Teaching, learning and student assessment
(ESG 1.3)

EEC REPORT

Findings for the three programs

The Department establishes student admission criteria for each programme, which are adhered to. The three programs have excellent industry relevance, and the studies support professional certification. The number of students in the teaching rooms is suitable for theoretical, practical, and laboratory lessons. The teaching materials are up-to-date and of an appropriate standard.

The teaching staff of the Department seems to have regular and effective communication with their students and provide timely and effective feedback to their students. Students were very complimentary of access to staff and appreciate the criteria and the method of assessment as well as the criteria for marking being published in advance. The learning process is properly designed to achieve the expected learning outcomes. The assessment allows students to demonstrate the extent to which the intended learning outcomes have been achieved.

The members of teaching personnel for each course have the relevant formal and fundamental qualifications for teaching the course, as described by the legislation including subject specialisation and publications within their respective disciplines.

Strengths of the three programs

The teaching staff of the Department seems to have regular and effective communication with their students and provide timely and effective feedback to their students.

The ratio of the number of students to the total number of teaching personnel is adequate for the support and safeguarding of the programme's quality.

The great majority of teaching is delivered by resident faculty that are employed on a full-time basis and all full-time staff have Ph.D. qualifications.

Areas of improvement and recommendations for the three programs

The university does not have an instrument for sabbaticals. The EEC recommends developing an instrument for enabling both short-term and longer-term research visits. In addition, inter-sectoral staff mobility with industry would appear to be beneficial in supporting the development and exchange of knowledge and skills building on the synergies between the academic environment and the industry.

The committee would encourage examination of the proportions of full-time faculty and adjunct faculty. The committee would welcome an increase in full-time faculty and their reduction in adjunct faculty, commensurate with the aim of increasing student numbers.

The EEC values the real-life industry relevance of the degree programs; however, recommends strengthening also the research connection of the M.Sc. degree programs.

Faculty research productivity is paramount. In order to facilitate this faculty-student contact hours should be monitored and perhaps reduced. Research output is a key parameter in global university rankings.

UCLan Cyprus does not have a Ph.D. program at the moment. A number of students have continued their Ph.D. studies at UCLan UK. The EEC recommends exploring the possibilities of a joint Ph.D. program with the UK campus. This could motivate research-oriented students to choose the M.Sc. programs at UCLan Cyprus. A Ph.D. program is a very necessary instrument for supporting research in general. This would necessitate dedicated research accommodation for the Ph.D. students. A critical mass of Ph.D. students would help the research student experience. Ph.D. students can help in running laboratories and guiding undergraduate/master's theses as part of the research training. The committee would encourage this.

UCLAN CYPRUS RESPONSE

We appreciate the comments from the EEC regarding the Teaching, Learning, and Student Assessment elements of the MSc Computing programme. We plan to continue aiming for excellent industry relevance and ensuring that teaching materials are up-to-date and of an appropriate standard. Student experience and engagement is a priority for us, thus we will continue to have regular and effective communication with the MSc Computing students and provide timely and effective feedback.

In terms of recommendations, we provide below our response for each.

"The university does not have an instrument for sabbaticals. The EEC recommends developing an instrument for enabling both short-term and longer-term research visits. In addition, inter-sectoral staff mobility with industry would appear to be beneficial in supporting the development and exchange of knowledge and skills building on the synergies between the academic environment and the industry."

We agree with the EEC that an instrument for sabbaticals can be beneficial. Due to its young age, the School/University did not have a Sabbatical Scheme. To this date, the academics had opportunities for short-term and longer-term research visits through the many funded projects they are engaged in and which include research visits. Also, the University participates in the Erasmus+ programme, which funds short-term teaching and internship mobilities to other partner institutions. Already, many of the School's –and the programme's—faculty have taken advantage of this and have participated in such mobilities (e.g. at the Univ. of Lille, France, or at the Univ. of Macedonia, Greece) that offer the opportunity to initiate discussions and exchange ideas on further research collaborations.. Furthermore, depending on its available funds, the School often sponsors training or research visits for each faculty member. Nevertheless, we acknowledge the importance and benefits of a sabbatical scheme, especially in terms of providing additional opportunities for the academics to engage in short- or long-term research mobilities and activities, and thus, further enhancing our research environment. After the recommendation of the EEC during the evaluation visit, a request had been made at the University level to develop a sabbatical scheme for the University. This has already been drafted by the Senior Academic Management Team and it is currently awaiting approval by the University Senate (the draft is expected to be reviewed/approved during the next Senate meeting, on June 3rd, 2021). It is expected that the approved sabbatical scheme will be in effect by the new academic year.

We also agree with the EEC's recommendation that inter-sectoral staff mobility with industry can be beneficial. The School of Sciences fully supports such mobilities and until now, this was materialised primarily through Erasmus mobilities with industry partners. Following the EEC's recommendation and the implementation of the new University Sabbatical Scheme, we anticipate that academics will have more opportunities to strengthen their engagement with the industry.

"The committee would encourage examination of the proportions of full-time faculty and adjunct faculty. The committee would welcome an increase in full-time faculty and their reduction in adjunct faculty, commensurate with the aim of increasing student numbers."

As per the EEC comments, currently, the below is part of the strengths of the programme:
"*The ratio of the number of students to the total number of teaching personnel is adequate for the support and safeguarding of the programme's quality.*
The great majority of teaching is delivered by resident faculty that are employed on a full-time basis and all full-time staff have Ph.D. qualifications."
The School (and the Programme) is committed to continue this good practice. Academic resources are reviewed at the School and programme level every year and necessary provisions/budgets are requested for the hiring of new academic staff as necessary. As the programme grows in terms of student numbers, we agree with the EEC that the hiring of new full-time faculty will become necessary and relevant actions will be taken.

"The EEC values the real-life industry relevance of the degree programs; however, recommends strengthening also the research connection of the M.Sc. degree programs."

In terms of research informed teaching, this is an ongoing goal of the MSc Computing programme and its academics. The programme strives to foster awareness of current trends and research activities in the computing research community through the delivery of the various modules. In fact, the programme has several optional modules that encourage research reviews of scientific state-of-the art in specialised areas (e.g. CO4732, CO4510, CO4102, CO4609, CO4101, etc.), but, also, it is designed such that one of the compulsory modules (CO4820: Critical Analysis) focuses on teaching research and the scientific method, covering a number of scientific publications within the module delivery and encouraging students to attempt their own research reporting. In addition to the optional and compulsory modules mentioned, the students have the opportunity to undertake larger-scale research as part of their Masters project (CO4804), where they can plan, complete and evaluate a substantial research project in Computing. Overall, the programme aims to encourage and enable the students to become reflective and research-aware practitioners. The programme team is committed to continuing and strengthening this practise.

"Faculty research productivity is paramount. In order to facilitate this faculty-student contact hours should be monitored and perhaps reduced. Research output is a key parameter in global university rankings."

We agree with the EEC's comment and we consider it vital for our academics to be productive in research. To ensure and support this, the School (and the University) operates an academic workload model, which as it was observed and noted by the EEC, follows an interactive process of defining the academics' yearly workload and considers each academic's individual plans. As a result, the workload model provides the necessary foundations and processes to be able to adjust the distribution of academics' time between teaching, research and administrative duties. In summary, the workload model is prepared by all academics before the commencement of the academic year, and it is reviewed and discussed with the Head of School. The standard target distribution of the academics' workload hours is 40% teaching, 40% research and 20% administration, but during the annual review, other adjustments can be made according to the academic's research output and engagement. The workload model considers several aspects of the responsibilities of the academics on the aforementioned three areas, along with the time allocated to each. As a result, once the model is prepared, academics who are above the allocated 40% research active, can request a teaching reduction and increase in research allocation hours. It is the responsibility of the academic and the Head of School to ensure during the annual review meeting that academics are allocated the needed time to conduct research and be productive in this area. The workload model has been in operation for the last 6 years and it has proven very effective in assisting the School and the academics to keep a good balance between research, teaching and administrative work. It is a process we consider important for the sustainability and strengthening of our research environment, as well as for ensuring that teaching material is enhanced with the latest research developments, and as such, we are committed in continuing.

Moreover, as it was also observed by the EEC, all full-time academics of the MSc Computing programme are research active and many have successfully received external research funding from international, national and internal funding sources and/or participated in international research projects. A list of successful externally funded research projects with corresponding MSc Computing faculty names is presented in **Table 2**. Additionally, all academics have ongoing high-quality publications in their field of expertise. A list of publications for each academic is available on the university's website (www.uclancyprus.ac.cy). The list includes high-impact journal publications, scientific monographs, conference publications including best paper awards, books, etc.

Table 2: Funding secured by MSc Computing academics

International Funding	
Project Details (i.e. Title, Duration, Funding Authority, Total Amount, UCLan Cyprus Amount)	*MSc Computing Academics Involved*
Responsible Industry (2014-17) – FP7 (€1,496,962/€157,103)	**N. Paspallis, J. Antoniou**
COMPASS (2016-19) – H2020 (€1,499,945/€156,843)	**J. Antoniou**
CSRC (2017-18) – H2020 (€400,708/€5,000)	**I. Polycarpou, P. Andreou, J. Antoniou**
SHERPA (2018-now) – H2020 (€2,800,000/€330,000)	**J. Antoniou**
GReFORM (2018-now) – Erasmus+ (€420,000/€62,000)	**J. Antoniou, C. Karpasitis**
iREEDER (2019-now) – Erasmus+ (€768,627/€42,557)	**N. Paspallis, J. Antoniou, E. Stavrou**
MENTORme (2020-now) – Erasmus+ (€296,360/€49,895)	**J. Antoniou, N. Paspallis**
SLICES-DS (2020-now) – H2020 (€2,914,175/€202,500)	**P. Andreou, I. Polycarpou, J. Antoniou, N. Paspallis**
National Funding	
Project Details (i.e. Title, Duration, Funding Authority, Total Amount, UCLan Cyprus Amount)	*MSc Computing Academics Involved*
2BeConnected (2019-now) – EU Social Fund (€180,000/€99,988)	**P. Andreou, I. Polycarpou, E. Stavrou, N. Paspallis**
2BeConnected (2018-2019) – EU Social Fund (€46,669/€46,669)	**P. Andreou**
IDEALVis (2019-now) – RIF Cyprus (€249,490/€194,575)	**P. Andreou, I. Polycarpou, E. Stavrou, C. Karpasitis**
RegTek (2020-now) – RIF Cyprus (€500,000/€102,406)	**P. Andreou, N. Paspallis, I. Polycarpou**
UCLan Internal Funding	
Project Details (i.e. Title, Duration, Funding Authority, Total Amount, UCLan Cyprus Amount)	*MSc Computing Academics Involved*
Responsible Smart Environments (2019-2020) – CST Research Centre (£5,000/£5,000)	**J. Antoniou**

The Social Impacts of Covid-19 in the UK and Cyprus (2020-2021) – CST Research Centre (£2,500/£2,500)	**J. Antoniou**

"UCLan Cyprus does not have a Ph.D. program at the moment. A number of students have continued their Ph.D. studies at UCLan UK. The EEC recommends exploring the possibilities of a joint Ph.D. program with the UK campus. This could motivate research-oriented students to choose the M.Sc. programs at UCLan Cyprus. A Ph.D. program is a very necessary instrument for supporting research in general. This would necessitate dedicated research accommodation for the Ph.D. students. A critical mass of Ph.D. students would help the research student experience. Ph.D. students can help in running laboratories and guiding undergraduate/master's theses as part of the research training. The committee would encourage this."

The School of Sciences, and UCLan Cyprus in general, does not currently offer PhD degrees. Academics of the School act as PhD supervisors for PhD students from other Universities, primarily UCLan UK. The School is positive in offering its own PhD degrees and we believe that this will be an additional benefit to assist the School in further enhancing its research environment. The School will investigate this possibility and take necessary actions (e.g. validate new PhD programmes through UK and Cyprus Quality Assurance Agencies).

3. Teaching Staff

(ESG 1.5)

EEC REPORT

Findings for Computing (1 year/ ECTS, MSc)

The number of the teaching staff is adequate to support the programme of study. The teaching staff status is appropriate to offer a quality programme of study. The visiting staff number does not exceed the number of the permanent staff. There is sufficient evidence of staff on this programme linking their research to their teaching.
Promotion processes seem transparent and staff engage in professional and teaching skills training.

Strengths for Computing (1 year/ ECTS, MSc)

The team has some very strong programming backgrounds. This is reflected in course content.

Area of improvement for the three programs:

The committee applauds the programs for their close engagement with the companies; however, the counsel a judicious balance between training and education. It is noted that adjunct staff present with specialized industrial knowledge and expertise.

There is a wide range of assessment instruments used in delivering the modules.

Area of improvement for the three programs:

The committee encourages the staff to continue with the production of high-quality research publications. In some cases, research output seemed to be declining given teaching work.

The committee noted a large number of optional modules, however, they recommend consideration of the associated curricula burden for faculty. While this effort is applauded the question remains as to the efficacy of maintaining modules with very low student numbers.

UCLAN CYPRUS RESPONSE

“The committee applauds the programs for their close engagement with the companies; however, the counsel a judicious balance between training and education. It is noted that adjunct staff present with specialized industrial knowledge and expertise.
There is a wide range of assessment instruments used in delivering the modules.”

We thank the EEC for the positive feedback with regards to the programme’s close engagement with the industry as well as the wide range of assessment instruments utilised within the programme.

“The committee encourages the staff to continue with the production of high-quality research publications. In some cases, research output seemed to be declining given teaching work.”

We would like to assure the committee that high quality research is an essential element of our academic work and as reported in Section 2 (pages 12-13), the School operates an academic workload model which is prepared and reviewed on an annual basis and which aims to safeguard academic’s time to conduct

research. It is true that research output may vary from year to year, depending on the research work an academic is working on, but it is definitely not overall declining. A list of publications for each academic is available on the university's website (www.uclancyprus.ac.cy). The list includes high-impact journal publications, scientific monographs, conference publications including best paper awards, books, etc.

"The committee noted a large number of optional modules, however, they recommend consideration of the associated curricula burden for faculty. While this effort is applauded the question remains as to the efficacy of maintaining modules with very low student numbers."

MSc Computing aims to offer modules that cover a variety of computing areas across two dimensions proposed by ACM and IEEE-CS (2020[7]). As discussed in Section 1 (pages 5-6), the 2020 report on Computing Curricula outlines the range of topics that should be covered by Computing education and proposes a mapping system based on two dimensions, i.e. a dimension that covers theory, principles, and innovation, as well as application, deployment, and configuration, and, a dimension that covers computer hardware, architecture and application issues as well as organizational and information systems issues. A mapping of the MSc Computing modules onto this two-dimensional framework has been presented in **Figure 2**.

The students of the MSc Computing programme often select modules that are closely related, in an attempt to specialise in a specific sub-area of Computing, resulting in only a subset of the optional modules being selected and delivered during a given semester. Consequently, those modules enjoy a higher number of students than the minimum number according to CYQAA recommendations (5 students); especially, since several optional modules are shared with other MSc programmes and students from those programmes are part of the modules' cohort.

Given that the University is relatively new and overall student numbers are small, the associated curricula burden for faculty has not exceeded the planned workload guidelines, even with minimum student numbers in some modules, i.e. 5 students. This is often balanced by other popular modules having high numbers of students. Additionally, the sharing of optional modules across MSc programmes further helps with the associated curricula burden for faculty. As the student numbers increase, the programme team will ensure that the workload guidelines are followed and where there is a need for additional faculty to cover the required curricula delivery, that this will be agreed with the School and that additional expert faculty will be hired to support any increased teaching needs.

"The committee recommends exploring the use of blended learning post-covid."

The team is happy to explore the possibility of continuing existing (covid related) and implementing new blended learning approaches for the programme post-covid, always within the guidelines and regulations of the CY QAA and UK QAA.

[7] *Clear, A., Parrish, A., Impagliazzo, J., Wang, P., (eds), (2020).Computing Curricula 2020: Paradigms for Global Computing Education, CC2020 Task Force published by ACM, IEEE-CS and also supported by ACM China, ACM India, AIS, ED-SIG, Informatics Europe, GRIN, SIGCHI, December 2020.*

4. Students

(ESG 1.4, 1.6, 1.7)

EEC REPORT

Findings for the three programmes

In the three degree programs, the students receive dual-degree certificates from UCLan Cyprus and UK, respectively.
Certification includes details on the degree structure, learning goals, and level of achievement. The degree program design has taken the ACM curriculum into account and the programs are aligned with industry certifications such as Cisco CCNA and the Linux professional curriculum. There are excellent synergies in administration functions, planning of teaching, and best practices with the UCLan UK. The students receive help and support from the administration regarding the admission and education-related forms and processes. The Admission Team is responsible for the processes. Approximately 30% of the B.Sc. students continue to the M.Sc. in Computing.

Strengths for the three programs

The student selection process is transparent, and the process is implemented in a consistent manner.
Student study progress is monitored, and feedback is gathered on a systematic basis.

Areas of improvement and recommendations for the three programs

The student selection criteria differ between the Computing and Cybersecurity M.Sc. programs. The committee encourages the internationalization of the M.Sc. programmes.

The first-year CS curriculum seems relatively light. The committee note that this is a four-year degree program; however, it is felt that if further CS module could be introduced in the first year. One suggestion offered was the inclusion of a module offering glimpses of modules to be undertaken in subsequent years.

The programming courses start with imperative Java and object-oriented programming is introduced later. The committee invites the B.Sc. program to consider objects early versus objects late OOP learning strategy. The committee notes the current objects late strategy. Object-oriented concepts are, however, “informally” introduced in the games module in year two. Harmonization of these strategies would strengthen the programming modules.

The committee encourages the introduction of an AI module.

The committee noted a large number of optional modules; however, they recommend consideration of the associated curricula burden for faculty. While this effort is applauded the question remains as to the efficacy of maintaining modules with very low student numbers.

UCLAN CYPRUS RESPONSE

“The student selection criteria differ between the Computing and Cybersecurity M.Sc. programs. The committee encourages the internationalization of the M.Sc. programmes.”

As indicated by the EEC, there was a discrepancy between the MSc Cybersecurity and MSc Computing programme admission criteria. More specifically, there was a discrepancy between the MSc Cybersecurity programme admission criteria and the rest of the post graduate programmes in the School of Sciences. This

has been addressed by aligning the MSc Cybersecurity programme admission criteria with the rest of the programmes within the School of Sciences. No changes have been made to the MSc Computing programme admission criteria.

As highlighted by the EEC, the programme design of MSc Computing considers a number of international curriculum standards as well as consideration of corresponding international professional certifications. As such, the programme continuously strives towards its internationalization. We are in agreement with the committee for this recommendation and we will continue to work towards enhanced internationalization, both through research informed teaching and industry alignments.

"The committee noted a large number of optional modules; however, they recommend consideration of the associated curricula burden for faculty. While this effort is applauded the question remains as to the efficacy of maintaining modules with very low student numbers."

This recommendation has been addressed in Section 3 and our response can be found in page 16.

The rest of the recommendations in this section are not applicable to the MSc Computing.

5. Resources

(ESG 1.6)

EEC REPORT

Findings for all three programs

The degree programs advocate student-centered learning and the programs have a relatively small number of students resulting in a favourable student-teacher ratio. The students appear to enjoy excellent tutoring and mentoring in the programs. Student satisfaction is a key performance indicator and the degree programs have attained top results in this metric. 75-80% of the graduates are being employed within three years. 83% of the students are reported to complete annual studies with very few interruptions or withdrawals.

The degree programs are based on modules. Students have a selection of optional modules depending on the degree program. The students are asked during the enrolment process what modules they plan to take. The B.Sc. and M.Sc. program does not have a significant overlap in the modules. The module offering is based on student participation and a module is not given if the quota is not reached. This results in unpredictability in terms of the modules that are given; however, the uncertainty is mitigated by estimating module popularity and also by the other programs sharing modules.

The staff is well aware of the quality assurance policy and it is an integral part of the everyday operations. The students benefit from a very good student-teacher ratio and student feedback is very positive.

Modules have been aligned with professional certification, such as Cisco CCNA and Linux professional curriculum.

Overall, the programs receive feedback from the industry and the graduating students appear to have excellent career prospects in the industry. The interviewed students emphasized the value of the degrees.

Strengths for Computing (1 year/ ECTS, MSc)

UCLan has good international networks and students have possibilities for internships abroad.

During the discussions, the teaching and administration staff had a positive and forward-looking attitude giving the impression that the degree programs have a solid basis. Interviews with the students supported this view.

Student feedback, complaints, and ideas are taken into account. The students reported that improvement ideas have been considered and there was an example of a course improvement initiated by a student.

The building facilities that were assessed based on the provided videos appear to be excellent and remote education is implemented following good practices. The laboratories and IT infrastructure support studies and research activities.

Areas of improvement and recommendations for Computing (1 year/ ECTS, MSc)

The program is recommended to examine the balance between core computer science and the applied industry-oriented topics. Industry relevance is an important advantage of the program; however, there is a risk of vendor lock-in and losing relevance when technologies and industry requirements change. The EEC recommends expanding the AI and machine learning related topics.

The School aims to increase the number of female students in the degree programs and the staff is active in related ACM activities. The EEC commends the work and recommends continuing these efforts. The EEC

notes the high representation of female faculty members, which is a very good situation at a computer science unit.

UCLAN CYPRUS RESPONSE

We appreciate the comments from the EEC regarding the Resources of the MSc Computing programme. We will continue our efforts towards increasing the number of female students in the degree, and we thank the EEC for recognising our efforts towards this goal.

Regarding the comment on being cautious with introducing the professional alignment, we appreciate the comment and understand the potential risks mentioned by the EEC. As it was noted by the EEC, we do have a number of alignments between our modules and industrial certifications, e.g. Cisco and Linux Professional certifications. However, our primary objective is to deliver universally applicable skills to our students. Thus, we are always careful not to allow the specific tools and vendor technologies to take over the content of the corresponding modules. In fact, the specific alignments provide opportunities for students to practice on tools and equipment widely used in industry, in addition to the overall computing content carefully prepared according to specific learning objectives.

The vendor-specific tools or equipment are available as a supplement to the lectures and labs that satisfy the learning objectives of the modules. We consider it beneficial for the students to practice the computing concepts using a variety of practical approaches (including vendor-specific).

The approach is followed throughout the programme by having programme-specific learning objectives and module-specific learning objectives. We ensure that the programme-specific learning objectives are reflected onto the module-specific learning objectives, and a corresponding teaching and learning strategy is put in place. Within this strategy it is possible to incorporate specific tools, if appropriate, for delivering the learning objectives. The assessment strategies are always focusing on the learning objectives regardless of the specific tools. Any professional certifications that students may want to take because of the partial alignment of the modules with corresponding professional material, are taken outside of module delivery hours.

For clarification, we list the MSc Computing learning Objectives below (**Figure 3**) and we provide a table that matches the programme's learning objectives to the individual modules' learning objectives (**Figure 4**). The learning objectives are organised within four main categories that cover *Knowledge and Understanding*, *Subject-Specific Skills*, *Thinking Skills* and *Other Skills relevant to employability and personal development*. We will continue to set these learning objectives as the priority of module delivery, and accordingly, use the tools provided by any industrial alignments to strengthen the teaching and learning of these objectives.

- **A. Knowledge and Understanding**

The successful student will be able to:

- **A1.** Describe and evaluate principles, practices and techniques relevant to the design and development of computing systems.
- **A2.** Describe and evaluate tools and techniques for the management of computing projects.
- **A3.** Find and critically evaluate computing research literature.
- **A4.** Evaluate and compare techniques and frameworks for developing complex software.

- **B. Subject-specific skills**

The successful student will be able to:

- **B1.** Select and use appropriate tools and techniques to design, build and evaluate software.
- **B2.** Apply principles, practices and techniques to solve complex computing problems in specific domains (through optional modules).
- **B3.** Adopt a professional approach to ethical and legal issues relevant to a computing professional and understand the implications of their actions.
- **B4.** Apply skills, techniques and knowledge to manage, plan, perform and evaluate a substantial Computing project.

- **Thinking Skills**

The successful student will be able to:

- **C1.** Evaluate ideas, methods and systems in a coherent manner.
- **C2.** Analyse and evaluate appropriateness of methods and techniques from a specialist area for the development of computer-based systems in a given situation.
- **C3.** Locate and integrate information from multiple sources.
- **C4.** Analyse and apply abstract concepts to solve problems.

- **D. Other skills relevant to employability and personal development**

The successful student will be able to:

- **D1.** Communicate complex ideas to a diverse audience.
- **D2.** Reflect critically on professional experience, devising and evaluating new approaches.
- **D3.** Develop individual self-management and independent learning skills.
- **D4.** Work as part of a team, identifying issues and devising responses.

10

Figure 3: The intended learning outcomes of the MSc Computing programme

Module Code	Module Title	Programme Learning Outcomes															
		Knowledge and understanding				Subject-specific Skills				Thinking Skills				Other skills relevant to employability and personal development			
		A1	A2	A3	A4	B1	B2	B3	B4	C1	C2	C3	C4	D1	D2	D3	D4
CO4804	Masters Project	✓	✓	✓	✓			✓	✓	✓		✓	✓	✓	✓	✓	
CO4820	Critical Analysis	✓		✓				✓		✓		✓		✓	✓	✓	
CO4830	IT Projects & Programmes	✓	✓	✓	✓	✓	✓	✓		✓		✓		✓	✓	✓	✓
CO4510	Advanced Topics in IT Security	✓		✓		✓	✓			✓	✓	✓	✓	✓	✓		
CO4509	Computer Security	✓		✓			✓			✓	✓	✓	✓	✓			
CO4608	Agile Systems Development	✓	✓	✓	✓	✓	✓	✓		✓	✓	✓		✓	✓	✓	✓
CO4752	Web Application Development	✓	✓	✓	✓	✓	✓			✓	✓	✓	✓	✓			
CO4753	UX Away from the Desktop	✓		✓	✓	✓	✓			✓	✓	✓	✓	✓			
CO4755	Mobile Application Development	✓		✓	✓	✓	✓			✓	✓	✓		✓			
CO4832	Independent Investigation			✓			✓			✓		✓	✓	✓		✓	
CO4822	Professional Placement	✓	✓		✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓
CO4759	Enterprise Data Management	✓	✓	✓	✓	✓	✓		✓	✓	✓	✓	✓	✓	✓	✓	
CO4756	Wireless Networks and Communications	✓		✓			✓			✓	✓	✓	✓	✓			
CO4101	Distributed Systems	✓	✓	✓	✓				✓	✓	✓	✓	✓	✓	v	✓	
CO4732	Advanced Topics in User Experience	✓		✓				✓		✓	✓	✓		✓		✓	
CO4512	Information Security Management	✓		✓				✓	✓	✓		✓		✓	✓	✓	
CO4760	Exploratory Data Analysis	✓	✓	✓			✓			✓		✓	✓	✓			
CO4505	Network Communication & Routing	✓		✓			✓			✓	✓	✓	✓	✓		✓	
CO4513	Network Operations & Management	✓		✓			✓			✓	✓	✓	✓	✓		✓	
CO4103	Ethical Hacking	✓		✓		✓	✓	✓		✓	✓	✓	✓	✓		✓	
CO4102	ERP Systems	✓		✓			✓			✓		✓		✓			
CO4609	e-Marketing	✓		✓			✓			✓		✓		✓	✓	✓	

Figure 4: Mapping of MSc Computing curriculum skills per module

6. Additional for distance learning programmes
(ALL ESG)

Not applicable

7. Additional for doctoral programmes
(ALL ESG)

Not applicable

8. Additional for joint programmes
(ALL ESG)

Not applicable

B. Conclusions and final remarks

EEC REPORT

The EEC evaluated the School of Computing and the B.Sc. program in Computing, M.Sc. in Computing, and M.Sc. in Cybersecurity based on the provided accreditation reports and the remote site visit. The School and the three programs were found to have high standards and meet the quality expectations. Based on the materials and the site visit, the EEC has identified a number of areas in which the School and the three programs can make improvements to strengthening their profile and increasing impact.

UCLan Cyprus and the School of Computing advocate student-centered learning and the three evaluated programs have a relatively small number of students resulting in a favorable student-teacher ratio. The students appear to enjoy excellent tutoring and mentoring in the programs. There would seem to be a significant emphasis upon student learning support and the students themselves seem to both recognize and value such.

As a private university, there is a focus on education with an emphasis on degree programs that are self-sustaining in terms of finances. Thus the workload profile of the staff is teaching-oriented; however, research is an integral part of the strategy and the aspirations of the university, and while this is clearly evident an environment needs to be maintained that fully recognizes, measures and rewards research endeavor.

UCLan Cyprus has excellent synergies with UCLan UK at Preston. Joint planning of education appears to work very well. It is important that UCLan Cyprus continues to leverage resources and skills at UCLan Preston and conversely that UCLan Preston leverages emerging expertise at UCLan Cyprus. This relationship can prove mutually beneficial.

The EEC recommends to further leverage the synergies between UCLan Cyprus and UCLan UK while taking the challenges introduced by Brexit into account, for example differing privacy and other regulations. The joint delivery of education is a significant opportunity that should be explored, and which may yield critical mass in certain programmes and afford better economies of scale.

The School is focused on developing and improving the current programs. The EEC commends this strategy and encourages a strategy of managed growth of the School and its programs by leveraging the synergies with UCLan UK and developing programs based on the current strengths and perceived opportunity.

The assignment of duties follows the regular planning process and cycle of the university and the school. There is an annual meeting for reviewing workloads and preparing for the next academic year. The workload model is based on the 40-40-20 model, in which time is divided between education and research and with a smaller percentage with administrative duties. The assignment is interactive and takes into account the teacher's situation and plans.

Faculty research productivity is paramount. In order to facilitate this faculty-student contact hours should be monitored and perhaps reduced. Research output is a key parameter in the global university rankings.

The School of Computing has ambitions of increasing the student intake during the next years that requires the optimization of resources, especially balancing education and research activities. The School has significant potential in attracting more research funding from Horizon Europe. The integral connection with the UCLan UK can help in establishing more opportunities for international research activities and projects.

The School's three evaluated degree programs have high industry relevance and the studies support competence building by being aligned with industry certifications. The EEC values the real-life industry

relevance of the degree programs; however, recommends strengthening also the research connection of the M.Sc. degree programs.

The School would benefit from more systematic scientific and industrial feedback regarding the degree programmes helping to ensure academic relevance while anticipating near-future industry needs. The degree programs emphasize professional aspects in Computer Science and having a wider scope in this would make the degrees more relevant for the future needs of the industry. To this end, an industry advisory board is recommended as an instrument for supporting the longer-term development of the School and the degree programs.

UCLan Cyprus does not have a Ph.D. program at the moment. A number of students have continued their Ph.D. studies at UCLan UK. The EEC recommends exploring the possibilities of a joint Ph.D. program with the UK campus. This could motivate research-oriented students to choose the M.Sc. programs at UCLan Cyprus. A Ph.D. program is a very necessary instrument for supporting research in general.

The university does not have an instrument for sabbaticals. The EEC recommends developing instruments for enabling both short-term and longer-term research visits. In addition, inter-sectoral staff mobility with industry would appear to be beneficial in supporting the development and exchange of knowledge and skills building on the synergies between the academic environment and the industry.

UCLAN CYPRUS RESPONSE

Once more, the MSc Computing team would like to thank the EEC members for their valuable comments. We appreciate the positive feedback and we will continue to work towards strengthening the profile of the programme. In summary, we have revised a number of elements as recommended by the EEC and have put forward some updates for specific modules, materials and processes.

We strongly agree with the EEC's comment that research should continue being an integral part of our strategy and aspirations, and we are committed to maintain and further strengthen our existing research environment, through the recognition, measurement and reward of research endeavours. As reflected in the School's vision, mission and strategy, this is an integral element for our future success and realisation of our long-term vision to be recognised as one of the premier science schools locally, regionally and internationally.

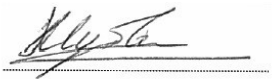
Regarding the collaborations with UCLan UK, the MSc Computing team enjoys a beneficial ongoing collaboration with the corresponding academic team in UCLan UK, and plans to continue its successful collaboration in terms of content design and delivery. As an example, the newly proposed module for Artificial Intelligence was designed in collaboration with the corresponding UCLan UK academic team. We appreciate the EEC's recommendation for exploring a joint delivery of education with UCLan UK colleagues and we are in agreement that it is a significant opportunity indeed. As we do across all academic areas, we will continue our excellent collaboration with UCLan UK, and as recommended, take further advantage of the synergies between the two campuses for the mutual benefit of the two Institutions, and specifically with regards to the sharing of resources for enriching the teaching and research environment. As indicated by the EEC, while the current Brexit situation introduces some challenges in the collaboration of the two Institutions, at the same time, it provides a number of new opportunities on which we can capitalise. Discussions are currently taking place between the two Institutions to ensure that both, challenges and opportunities, are considered and evaluated.

We are also in agreement with the EEC that academic workload should be closely monitored and adjusted (e.g. reduce teaching workload) for academics who are highly research active. As it was observed and noted by the EEC, the process of defining the academics' yearly workload is interactive and considers each academic's individual plans, therefore it provides the necessary foundations and processes to be able to adjust the distribution of academics' time between teaching, research and administrative duties. This process

is something we consider essential for the sustainability and strengthening of our research environment, and as such, we are committed in continuing. Moreover, as recommended by the EEC, a sabbatical scheme can be beneficial to allow academics further research mobilities and focus on research activities. To this end, a proposal has been made to the relevant University bodies, which responded positively. A sabbatical scheme for the University has been developed and it is currently on its final stages for approval (review/approval by the Senate). Offering our own PhD programmes is also another area of future development, which can support and enhance our existing research environment. As per the EEC's recommendation, this has been communicated to the University and discussions are currently taking place to explore the possibility of offering joint PhD programmes between UCLan Cyprus and UCLan UK and/or independent PhD programmes by UCLan Cyprus.

With regards to the industry engagement with the School's programmes, as it is noted by the EEC, this is an integral part of our curriculum development process. Student employability is a key element embedded throughout all of our programmes, and to this end, we ensure that curriculum delivery combines research informed and industry informed teaching, which prepares graduates for diverse careers in the international market. As part of our efforts, through the years, we have established several strategically targeted industrial and academic partnerships, with depth and breadth, many of which resulted in providing students with enhanced knowledge and skills, parallel completion of professional certifications, or professional body accreditations and recognitions, which are in high demand by the industry. We do note and agree with the EEC's recommendation to formalise the contribution of our industry partners to the School and its programmes, therefore all the necessary steps have been taken to form an Advisory Board for the School. We expect that our Advisory Board will be in place and active by the start of the new academic year.

C. Higher Education Institution academic representatives

Name	*Position*	*Signature*
Prof. Irene Polycarpou	Head of School of Sciences Chair of School of Sciences Academic Standards and Quality Assurance Committee	
Assist. Prof. Josephina Antoniou	Course Leader of MSc Computing programme Member of School of Sciences Academic Standards and Quality Assurance Committee	
Assoc. Prof. Nearchos Paspallis	Deputy Head of School of Sciences Course Leader of BSc (Hons) Computing programme Member of School of Sciences Academic Standards and Quality Assurance Committee	
Assoc. Prof. Kalypso Iordanou	Deputy Head of School of Sciences Member of School of Sciences Academic Standards and Quality Assurance Committee	
Dr Cosmina Theodoulou	Chair, University Academic Standards and Quality Assurance Committee	

Date: 13/04/2021

Appendix 1

Course Title	**Artificial Intelligence**				
Course Code	**CO4xxx**				
Course Type	**Optional**				
Level	Level 7				
Year / Semester	Year 1/Semester 2				
Teacher's Name	Josephina Antoniou				
ECTS	10	Lectures / week	1x1hr	Laboratories / week	1x2hr
Course Purpose and Objectives	The module aims to: • Demonstrate various AI models and techniques to develop understanding of AI solutions of a range of problems and explore the expected performance of such models. • Practically explore a wide range of AI techniques, which are being applied in industry and/or research. • To demonstrate an awareness of current and new/future developments in the field of AI and its applications. • Identify and explore real-world problems and determine which AI approaches are suitable for their solutions.				
Learning Outcomes	On successful completion of this module a student will be able to: 1. Research and report on a wide range of AI techniques, which are being applied in industry or research. 2. Describe and critically assess the current and new/future developments in the field of AI and its applications. 3. Design solutions to a range of problems and implement various AI models and techniques to characterise the performance of these solutions as compared to other techniques. 4. Analyse and critically evaluate real-world problems and select the appropriate AI approach for their solutions.				
Prerequisites	None	Required	None		
Course Content	This module provides a broad introduction into AI techniques and a detailed understanding in the application of some critical approaches, so that when students go into industry or research, they will be able to choose and develop a solution using the correct AI techniques for the problems which arise. Specifically, the module will cover all of the following broad areas, but will vary the detail and techniques introduced underneath each area depending on topical issues: **Introduction of AI** • Introduction to AI and Intelligent Agents				

	• Solving Problems by Searching: Informed Search Methods **Knowledge and Reasoning** • Agents that Reason Logically: Logical Reasoning Systems • Practical Planning/Uncertainty/Making Decisions **Learning** • Observations; Belief Networks • Machine Learning; Reinforcement Learning **Communicating, Perceiving and Acting** • Agents that Communicate • Natural Language Processing • Perception/Robotics **Additional Topics** • AI Research Trends and Future Applications • Languages, Algorithms and Complexity
Teaching Methodology	Teaching and Learning Strategy The teaching and learning strategy is designed to encourage a deep approach to learning with an emphasis on collaborative, evidence based and problem based learning suitable to industry through the use of teams (working teams) and problem solving, but will also assess individual skills and independent work. The teaching/learning strategy for this module has been designed to ensure that the learning outcomes will be achieved. Various forms of teaching strategy would be employed to provide stimulation and participation amongst students. Teaching and Learning Methods A workshop approach will be used which integrates lectures with practical activities. Problem based learning will be used, with students working in small groups applying concepts and techniques to examples derived from the particular focus of their degree programme. Feedback Methods Continuous feedback shall be given to students throughout the semester in the following manner: Feedback given to students in response to assessed work: • Feedback discussed as part of a lab session in a generalised manner • Individual feedback on request and after submission of portfolio components • Model answers will be provided in response to portfolio components Developmental feedback generated through teaching activities: • Feedback is given during lab sessions • Dialogue between students and staff in lectures and labs This module will be taught in a semester and will be supported by directed study of textbooks and journal articles. Students will be encouraged to discuss case studies, reading texts or share their experiences on the current topic.

<table>
<tr><td></td><td>Intellectual skills such as critical analysis, synthesis and problem solving will be practiced through active learning processes within group learning activities part of the lectures and labs. Independent thought and understanding of intellectual skills will be examined by questioning students, by allowing for student-led presentations, by preparing completing unseen written examinations at the end of the semester and problem-based exercises as part of their portfolio submission.

For the coursework assessment component, i.e. the portfolio, students do some group work and some individual work. They use a variety of techniques for particular scenarios, and they are asked to critically reflect on their work and to make links with the theory. For their exam assessment, students are asked to critically evaluate techniques, processes and theories. They are also given particular scenarios and asked to make recommendations for practice.</td></tr>
<tr><td>Bibliography</td><td>Russell, S.J. and Norvig, P., 2016. Artificial intelligence: a modern approach. Malaysia; Pearson Education Limited.

Alpaydin, E., 2004. Introduction to machine learning. MIT Press.

Poole, D.L. and Mackworth, A.K., 2010. Artificial Intelligence: foundations of computational agents. Cambridge University Press.

Michael, N., 2005. Artificial intelligence a guide to intelligent systems.

The bibliography for this module is also available via the on-line reading lists – click on the links below:

http://readinglists.central-lancashire.ac.uk/index

http://cypruslists.central-lancashire.ac.uk/index.html</td></tr>
<tr><td>Assessment</td><td>
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<tr><th>Number of Assessments</th><th>Form of Assessment</th><th>% weighting</th><th>Size of Assessment/ Duration/ Word count</th><th>Category of assessment</th><th>Learning Outcomes being assessed</th></tr>
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