

Module Specification

CSCK514 – Cloud Computing

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1. Module Details

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| Module Title: | Cloud Computing |
| Short Title: | Cloud Computing |
| Module Code: | CSCK514 |
| Marketing Module Synopsis: | Cloud Computing is an important paradigm in the area of Information Technology (IT) that currently provides a (common) basis for a new wave of technology development such as Big Data and enhanced pervasive computing. Cloud Computing embodies advances in computing, networking, and storage technologies which individually and collectively include major hardware and software breakthroughs. These include computer virtualisation, distributed and replicated storage, and software based networking. Cloud Computing motivates further technology advancement and changes how the modern IT infrastructure is built and evolves. There is a growing demand for specialists with strong technical background and deep knowledge of the Cloud Computing technologies. This module seeks to provide students with this background and knowledge. |
| Credits: | 15 |

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| Level: | Level 7 |
| Delivery Location(s) | Online |
| Semester: | Whole Session |
| Academic Year: | 2021-22 |
| Faculty: | Faculty of Science and Engineering |
| School/Institute (Level 2): | School of Electrical Engineering, Electronics and Computer Science |
| Curriculum Board (level 1): | Computer Science PGT |
| Module Coordinator: | Frans Coenen |
| Other staff: | Helen Mattocks |
| External Examiner(s): | Neil Gordon, Dan Neagu |
| Pre-requisites: | N/A |
| Co-requisites: | N/A |
| Barred Combinations: | N/A |
| CE/CPD Provision: | No |
| Overview: | Cloud Computing is an important paradigm in the area of Information Technology (IT) that currently provides a (common) basis for a new wave of technology development such as Big Data and enhanced pervasive computing. Cloud Computing embodies advances in computing, networking, and storage technologies which individually and collectively include major |

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| | hardware and software breakthroughs. These include computer virtualisation, distributed and replicated storage, and software based networking. Cloud Computing motivates further technology advancement and changes how the modern IT infrastructure is built and evolves. There is a growing demand for specialists with strong technical background and deep knowledge of the Cloud Computing technologies. This module seeks to provide students with this background and knowledge. |
| Notes: | Online module provided in collaboration with Kaplan Open Learning |
| Maximum Places: | 250 |
| Subject: | |
| HESA Cost Centre(s): | MUST BE COMPLETED FOR APPROVAL |
| Status: | Approved |

The table below is automatically completed from programme data held in Curriculum Manager; during 2019/20 it is likely to have no data or incomplete data until all programme records are in Curriculum Manager.

| In Programmes: | Programme Validation Status | Module Status: | Programme Stage / Group / Sub-group |
|--|-----------------------------|----------------|--|
| Big Data Analytics Master of Science (MSc) 2021-22 | Validated | Required | Online Flexible Learning Y1 Online Flexible Learning Y1 Mandatory module 4 |

The table below must be completed for module approval, including confirmation that there are zero costs to the student.

| Student Cost(s) | | | | Costs range: | |
|-----------------|--|--|---------------------------------|---------------|---------------|
| Cost Type: | Description: | Value type (exact, approximate or max/min range): | Cost (exact or approximate): | Minimum Cost: | Maximum Cost: |
| Student Cost | Over the anticipated 8 week module period, an estimated average cost of £12.50 per week for internet access and contribution to the cost of a personal computer (global variations may apply). | Approximate | 100.00 | | |

2. Aims and Content

| Educational Aims: |
|--|
| <p>1. To provide students with the opportunity to investigate cloud architectures and foundations so that they obtain a comprehensive understanding of the process of building cloud based infrastructure services and applications.</p> <p>2. To provide a comprehensive and systematic understanding of cloud architecture models.</p> <p>3. A critical and wide ranging understanding of cloud industry standardisation, middleware platforms and cloud provider platforms.</p> |

| Outline Syllabus: |
|--|
| <p>Week 1: Cloud Computing Foundation .</p> <p>Cloud Computing definition, reference architecture, general use case analysis, cloud scaling. Cloud properties, cloud benefits and cloud challenges. Cloud stakeholders and roles.</p> <p>Week 2: Cloud Architectures and Cloud Platforms.</p> <p>Cloud computing enabling technologies. Virtualisation platforms. Cloud related standards. Topology and Orchestration Specification for Cloud (TOSCA); Open Cloud Computing Interface (OCCI); Lower layer standards.</p> |

Week 3: Cloud Infrastructure as a Service (IaaS)

IaaS architectures and models, cloud management functions and API, security groups and virtual machine images. Storage file system types: persistent object storage and block storage; storage virtualisation. Custom and large scale deployment, deployment management tools. Re-factoring applications for clouds and cloud aware design; example IaaS service design.

Week 4: Cloud Platform as a Service (PaaS)

PaaS architecture components: code containers, queues, data structures, databases, load balancers. PaaS services composition and management. Example Cloud PaaS design, service patterns and custom service composition, service deployment, service monitoring, and adaptive load balancing and elasticity.

Week 5: Cloud Software as a Service (SaaS) and application clouds.

Overview of SaaS and application clouds: components, services and usage models. Overview and analysis of example SaaS applications.

Week 6: Cloud Security, data protection and privacy, access control and identity management. Cloud security and privacy challenges; existing architectures, solutions and methods, access control and security policies. Identity management in clouds. Secure platforms and secure virtualised environment. Overview security models by major cloud providers.

Week 7: Cloud construction, cloud interoperability, migration enterprise infrastructure to clouds. Cloud management software overview covering functionality, components, tools, configuration examples and design patterns.

Week 8: Cloud infrastructure management, system/service compliance and assurance. IT management issues for clouds, cloud economics, cloud compliance, existing standards and industry practices, cloud dependability. Example compliance for clouds.

Reading lists and resources:

| Type | Category | Title | Description |
|------|----------|-------|-------------|
|------|----------|-------|-------------|

3. Module Outcomes (learning outcomes, skills and other attributes)

| Ref No. | Learning Outcome / Skill: | Category: |
|---------|--|-----------------------------|
| M1 | A comprehensive ability to explain key concepts and major application areas in the context of cloud computing. | Learning Outcomes: Master's |
| M2 | An ability to analyse and critically compare cloud computing solutions. | Learning Outcomes: Master's |
| M3 | A deep and systematic understanding of the mechanisms that can be used to realise cloud computing solutions to IT problems | Learning Outcomes: Master's |
| S1 | Communication skills in electronic as well as written form. | Skills |
| S2 | Self-direction and originality in tackling and solving problems. | Skills |
| S3 | An ability to act autonomously and professionally when planning and implementing solutions to computer science problems. | Skills |
| S4 | Experience of working in development teams, respecting others, co-operating, negotiating/persuading, awareness of interdependence with others. | Skills |

4. Assessments

Assessment Strategy:

The module features two broad categories of assessment: discussion questions and practical assessments. The first has a focus on moderated active learning, where the faculty member responsible for the module posts discussion questions to which students respond individually and then consider each other's responses. Each discussion question runs over a three-week period. At the end of the first week each student posts a 400-500 word "initial response". During the second week each student selects two or three responses, made by other students in the first week, and writes a 300-500 word "follow-up" response. In the third week each student reviews the initial and follow-up responses from the previous two weeks and submits a 300-500 word executive critical summary with respect to the main themes identified by the responses. The second, practical assessment, adopts the principle of authentic assessment where the assessment tasks to be undertaken are aligned with the kinds of task that students would be expected to undertake in a professional setting.

1. Due to nature of the on-line mode of instruction work is not marked anonymously.
2. Reassessment opportunities offered in line with Code of Practice on Assessment.

3. Penalties for late submission will be in line with Code of Practice on Assessment.

All fields in the table below must be completed for module approval.

| Method | Description | Type | Units of Length | Length | Min | Max | Description (re length) | Weighting | Assessment period(s) | Group Work | Must Pass | Final Assessment |
|----------------------|---|-----------|-----------------|--------|------|------|-------------------------|-----------|----------------------|------------|-----------|------------------|
| Practical assessment | Group Presentation: Comparative analysis of cloud services resulting in a group video report (10 minutes) describing the approach taken and analysing the results obtained. | Summative | Hours | 12 | 3000 | 4000 | N/A | 30 % | Wk08 | Yes | No | Yes |
| Coursework | Discussion Question 1: Participate actively in an online discussion to critically discuss experiences and opinions within the cohort relating to cloud computing. | Summative | Words | N/A | 1000 | 1500 | N/A | 20 % | Wk03 | No | No | No |
| Coursework | Essay: An individual essay covering security strategy, policy, compliance and legal standards | Summative | Words | 12 | 2000 | 2500 | N/A | 30 % | Wk05 | No | No | No |

| Method | Description | Type | Units of Length | Length | Min | Max | Description (re length) | Weighting | Assessment period(s) | Group Work | Must Pass | Final Assessment |
|------------|---|-----------|-----------------|--------|------|------|-------------------------|-----------|----------------------|------------|-----------|------------------|
| Coursework | Discussion question 2: Actively participate in online discussion concerning a specific topic related to cloud security, data protection and privacy. | Summative | Words | N/A | 1000 | 1500 | N/A | 20 % | Wk07 | No | Yes | No |

Please see Appendix 1 for details of the outcomes tested by the above assessments.

Module Specification Appendix 1: Assessments and the Outcomes Tested

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|--------------|-----------------|
| Module Title | Cloud Computing |
| Module Code | CSCK514 |

In the table below, all fields should be completed for approval, except for the **Weighting** field for a **Formative Type** assessment method.

| Assessment Method | Type | Weighting | Marked out of | Pass Mark | Learning Outcomes / Skills Tested |
|----------------------|-----------|-----------|---------------|-----------|-----------------------------------|
| Practical assessment | Summative | 30 % | 100 | 50 | |
| Coursework | Summative | 20 % | 100 | 50 | |
| Coursework | Summative | 30 % | 100 | 50 | |
| Coursework | Summative | 20 % | 100 | 50 | |

5. Learning and Teaching Methods

Summary of Learning and Teaching Methods:

The mode of delivery is by online learning, facilitated by a Virtual Learning Environment (VLE). This mode of study enables students to pursue modules via home study while continuing in employment. Module delivery involves the establishment of a virtual classroom in which a relatively small group of students (usually 10-25) work under the direction of a faculty member. Module delivery proceeds via a series of eight one-week online sessions, each of which comprises an online lecture, supported by other eLearning activities, posted electronically to a public folder in the virtual classroom. The mode of learning includes a range of required and optional eLearning activities, including but not limited to: lecture casts, live seminars, self-assessment opportunities, and required and suggested further reading and try-for-yourself activities. Communication within the virtual classroom is asynchronous, preserving the requirement that students are able to pursue the module in their own time, within the weekly time-frame of each online session. An important element of the module provision is active learning through collaborative, cohort-based, learning using discussion fora where the students engage in assessed discussions facilitated by the faculty member responsible for the module. This in turn encourages both confidence and global citizenship (given the international nature of the online student body).

The following table must be completed for module approval, accounting for all hours associated with the credit value of the module, e.g. for 15 credits there should be 150 hours of learning and teaching activity, including independent learning.

| Learning and Teaching Method: | Length (Minutes): | Times per Week (if applicable): | Number of Weeks (if applicable): | Calculated Hours (if applicable): | Hours: |
|-------------------------------|-------------------|---------------------------------|----------------------------------|-----------------------------------|--------|
| Self-Directed Learning | N/A | N/A | N/A | N/A | 62 |
| Assignment | N/A | N/A | N/A | N/A | 40 |
| E-lecture | N/A | N/A | N/A | N/A | 24 |
| Online Discussions | N/A | N/A | N/A | N/A | 24 |

6. Supplementary Information



If a risk assessment is required for this module for students under 18, please record a summary of the risks:

N/A