**City University of Hong Kong**
**Course Syllabus**

**offered by Department of Computer Science**
**with effect from Semester B 2016/17**

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## Part I Course Overview

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|---|---|
| **Course Title:** | Cloud Computing: Theory and Practice |
| **Course Code**: | CS5296 |
| **Course Duration:** | One semester |
| **Credit Units**: | 3 credits |
| **Level**: | P5 |
| **Medium of Instruction:** | English |
| **Medium of Assessment:** | English |
| **Prerequisites**: *(Course Code and Title)* | Nil |
| **Precursors**: *(Course Code and Title)* | CS5222 Computer Networks and Internets |
| **Equivalent Courses**: *(Course Code and Title)* | Nil |
| **Exclusive Courses**: *(Course Code and Title)* | Nil |

## Part II Course Details

### 1. Abstract

This course aims to examine the critical technology trends of cloud computing, in particular, the architecture and design of existing deployments, the services and applications that cloud computing can offer, and the challenges that need to be addressed to help cloud computing reach its full potential. In addition to understanding the core technologies in cloud computing, students are expected to apply this knowledge in a critical evaluation of emerging cloud computing platforms and services and to acquire an appreciation of cloud management tools through hands on laboratory exercises.

### 2. Course Intended Learning Outcomes (CILOs)

*(CILOs state what the student is expected to be able to do at the end of the course according to a given standard of performance.)*

| No. | CILOs | Weighting (if applicable) | Discovery-enriched curriculum related learning outcomes (please tick where appropriate) | | |
|---|---|---|---|---|---|
| | | | *A1* | *A2* | *A3* |
| 1. | Explain the overall concepts and underlying technologies of cloud computing applications including the essential characteristics and service models. | 10% | ✓ | ✓ | |
| 2. | Explain the underlying principles of different virtualization technologies, cluster scheduling and management, and job scheduling. | 25% | | ✓ | |
| 3. | Explain the underlying technologies of distributed systems in the cloud, for example storage systems and data center networks, for enabling the cloud to deliver performance to various applications. | 25% | | ✓ | |
| 4. | Apply cloud computing techniques and use relevant tools, such as Hadoop, to design applications in the cloud environment and utilize cloud management tools to provide resources provisioning and monitoring. | 30% | ✓ | ✓ | ✓ |
| 5. | Identify the security issues in both private and public cloud computing systems and possible solutions. | 10% | | ✓ | |
| | | 100% | | | |

*A1: Attitude*
*Develop an attitude of discovery/innovation/creativity, as demonstrated by students possessing a strong sense of curiosity, asking questions actively, challenging assumptions or engaging in inquiry together with teachers.*

*A2: Ability*
*Develop the ability/skill needed to discover/innovate/create, as demonstrated by students possessing critical thinking skills to assess ideas, acquiring research skills, synthesizing knowledge across disciplines or applying academic knowledge to self-life problems.*

A3: *Accomplishments*
*Demonstrate accomplishment of discovery/innovation/creativity through producing /constructing creative works/new artefacts, effective solutions to real-life problems or new processes.*

## 3. Teaching and Learning Activities (TLAs)

*(TLAs designed to facilitate students' achievement of the CILOs.)*

Teaching pattern:
Suggested lecture/tutorial/laboratory mix: 2 hrs. lecture; 1 hr. tutorial.

| TLA | Brief Description | CILO No. | | | | | Hours/week (if applicable) |
|---|---|---|---|---|---|---|---|
| | | 1 | 2 | 3 | 4 | 5 | |
| Lecture | Lectures will cover the essential concept, common platforms and core technologies in mobile application development. | ✓ | ✓ | ✓ | ✓ | ✓ | 2 |
| Tutorial / Laboratory exercises | Tutorials will be in the form of case studies, analytical questions and answers, and hands on laboratory exercises.<br>Case studies and analytical questions are designed to review the material covered in the lectures, widen students' exposure on the related topics and creatively apply concepts learned to new scenarios.<br>Laboratory exercises provide an opportunity for students to use cloud management tools for resources provisioning as well as security and performance monitoring. | ✓ | ✓ | ✓ | | ✓ | 1 |
| Programming assignments | The programming assignment will provide an opportunity for students to use software tools and programming interfaces in common cloud platforms to develop small functional programs to satisfy specific user requirements. | | | | ✓ | | 1 |
| Group project | The group project will test the students, understanding of the key technical issues. Students will choose their own topic of study, and apply their knowledge creatively to analyse the problem and arrive at the solutions. | ✓ | ✓ | ✓ | | ✓ | 1 |

## 4. Assessment Tasks/Activities (ATs)

*(ATs are designed to assess how well the students achieve the CILOs.)*

| Assessment Tasks/Activities | CILO No. | | | | | Weighting | Remarks |
|---|---|---|---|---|---|---|---|
| | 1 | 2 | 3 | 4 | 5 | | |
| Continuous Assessment: 40% | | | | | | | |
| Programming assignment | | | | ✓ | | 20% | |
| Group project | ✓ | ✓ | ✓ | | ✓ | 20% | |
| Examination^: 60% (duration: 2 hours) | | | | | | | |
| | | | | | | 100% | |

^ For a student to pass the course, at least 30% of the maximum mark for the examination must be obtained.

## 5. Assessment Rubrics

*(Grading of student achievements is based on student performance in assessment tasks/activities with the following rubrics.)*

| Assessment Task | Criterion | Excellent (A+, A, A-) | Good (B+, B, B-) | Adequate (C+, C, C-) | Marginal (D) | Failure (F) |
|---|---|---|---|---|---|---|
| 1. Programming assignment | Whether students can independently and correctly write Hadoop programs to solve the given data analytical tasks | The answer is correct. The code is independently written with clear structure. | The answer is mostly correct, with some mistakes. The code is independently written with clear structure. | The answer is mostly incorrect. The code is independently written with clear structure. | The answer is wrong. The code is messy. | No submission/meaningful solution presented in the submission. |
| 2. Group project | Whether students can apply the knowledge learned to creatively analyse a subject of study chosen by themselves, and give a clear presentation about the results | The topic of study is interesting. The analysis is thorough and creative, with a research component. The presentation is clear. | The topic of study is interesting. The analysis is mostly thorough. The presentation is clear. | The topic of study is conventional and does not require much study. The analysis is not interesting. The presentation is clear. | The topic of study is conventional and does not require much study. The analysis is not interesting. The presentation is not good. | No presentation is given. |
| 3. Exam | Whether students can answer all questions correctly. | Depending on the rubrics of the final exam paper | Depending on the rubrics of the final exam paper | Depending on the rubrics of the final exam paper | Depending on the rubrics of the final exam paper | Score less than 30%, or fail to be present for the exam. |

**Part III Other Information** (more details can be provided separately in the teaching plan)

## 1. Keyword Syllabus

*(An indication of the key topics of the course.)*

On-demand self-service and resource pooling; rapid elasticity; measured service; Software as a Service (SaaS), Platform as a Service (PaaS) and Infrastructure as a Service (IaaS); virtualization technologies: hypervisor and virtual machines, full vs paravirtualization; cloud storage architecture; data deduplication; cloud security issues: storage outsourcing versus storage auditing, data encryption versus computing over encrypted data, resource virtualization versus side channel or covert channel attacks; case studies of current cloud computing platforms: Azure, EC2.

## 2. Reading List

### 2.1 Compulsory Readings

*(Compulsory readings can include books, book chapters, or journal/magazine articles. There are also collections of e-books, e-journals available from the CityU Library.)*

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|---|---|
| 1. | N.A. |

### 2.2 Additional Readings

*(Additional references for students to learn to expand their knowledge about the subject.)*

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|---|---|
| 1. | *Guide to Cloud Computing: Principles and Practice*, Richard Hill, Laura Hirsch, Peter Lake and Siavash Moshiri, Springer, 2013. |
| 2. | *Cloud Computing: Concepts, Technology & Architecture*, Thomas Erl, Ricardo Puttini, Zaigham Mahmood, Prentice Hall, 2013. |
| 3. | *Distributed and Cloud Computing: From Parallel Processing to the Internet of Things*, Kai Hwang, Jack Dongarra and Geoffrey C. Fox, Morgan Kaufmann, 2011. |