

Course Title	Cloud Computing				
Course Code	ACSC421				
Course Type	BSc Computer Science: Computer Elective BSc Computer Engineering: Computer Elective				
Level	BSc (Level 1)				
Year / Semester	3rd or 4th year / 6th or 8th semester				
Teacher's Name	Dr Achilleas Achilleos				
ECTS	6	Lectures / week	2	Laboratories/week	2
Course Purpose	<p>The aim of this course is to provide students with critical understanding on the evolution of computing from mainframe to cloud computing. Students in this course are introduced to the concepts of web services, distributed systems, service-oriented computing, SOA, utility computing and cloud computing. The students learn the basics of cloud service models and cloud deployment models, as well as gain a critical understanding of the concepts of abstraction and virtualization, virtual machines, machine images and containers. The students will also be introduced to the added security risks that the companies now face as a result of cloud computing technology. The course has also a practical underpinning, where initially cloud services of different providers will be explored. The students will learn and practice on how companies utilise their private cloud-based servers and how they exploit public cloud resources. Moreover, they will explore the basic cloud components and services of the three major cloud providers: Google, Amazon, Microsoft. Finally, they will become familiar with the OpenStack private cloud and the Azure public cloud and use different cloud management methods.</p>				
Learning Outcomes	<p>Upon successful completion of the course students will be able to:</p> <ul style="list-style-type: none"> <li>• Explain the concepts, as well as the differences between mainframe, distributed, service oriented and cloud computing.</li> <li>• Describe and outline the layers of the cloud computing architecture.</li> <li>• Present and critically discuss the different cloud computing types: cloud deployment and cloud service models.</li> <li>• Learn and understand the concepts of abstraction and virtualization, virtual machines, machine images and containers.</li> <li>• Apply the concepts in practice on the OpenStack private cloud and the Azure public cloud using different cloud management methods.</li> </ul>				
Prerequisites	<b>ACSC372, ACOE323.</b>	Corequisites	<b>None.</b>		
Course Content	<b>1. From Mainframe to Cloud Computing (1 Week)</b>				

	<ul style="list-style-type: none"> <li>- Mainframe Computing. Personal Computing. Client-Server. Peer to Peer. Parallel Computing. Distributed Computing. Service Oriented Computing. Utility and Cloud Computing.</li> </ul> <p><b>2. Service Oriented Computing (1 Week)</b></p> <ul style="list-style-type: none"> <li>- Web Services. The Web Service Model. The WS*-Stack: WSDL, SOAP, XML, UDDI. Restful Services. Web APIs. SOA. Web Services and Cloud Computing.</li> </ul> <p><b>3. Introduction to Cloud Computing (1 Week)</b></p> <ul style="list-style-type: none"> <li>- Defining cloud computing. The different cloud types – cloud deployment and cloud service models. Understanding the paradigm shift of cloud computing. The benefits and disadvantages of cloud systems.</li> </ul> <p><b>4. The Cloud Architecture (1 Week)</b></p> <ul style="list-style-type: none"> <li>- The cloud computing stack and its layers. The cloud computing communication protocols. The new class of cloud-connected clients such as Google Chrome OS.</li> </ul> <p><b>5. Abstraction and Virtualization (1 Week)</b></p> <ul style="list-style-type: none"> <li>- Abstraction and cloud computing. Virtualization and shared resource pools. Hypervisors and virtual machines. System imaging and application portability for the cloud.</li> </ul> <p><b>6. The Basics of Cloud Security (1 Week)</b></p> <ul style="list-style-type: none"> <li>- Cloud Security and Data Privacy concerns. Techniques for Securing the Cloud. Data Privacy Methods. Establishing Identity and Presence in the Cloud.</li> </ul> <p><b>7. Exploring Cloud Services (2 Weeks)</b></p> <ul style="list-style-type: none"> <li>- The Google Application Portfolio. Exploring the Google Toolkit: The Google APIs. Working with the Google App Engine. Amazon Web Service Components and Services. Microsoft Azure Cloud Services. Using Productivity Applications in the Cloud.</li> </ul> <p><b>8. The OpenStack Cloud Environment (2 Weeks)</b></p> <ul style="list-style-type: none"> <li>- Learning the basics of OpenStack. OpenStack Architecture. OpenStack Services. OpenStack Private Cloud Setup. OpenStack Cloud Inventories and Management. OpenStack Documentation. OpenStack Clients. Cloud Management in OpenStack.</li> </ul> <p><b>9. The Azure Public Cloud – Management with Scripting (2 Weeks)</b></p> <ul style="list-style-type: none"> <li>- Learning the basics of Azure. Azure Cloud Management Methods: Web Portal, Azure Tools, Azure CLI and APIs. Cloud Management in Azure.</li> </ul>
Teaching Methodology	<p>The methodology followed in this course is structured around lectures and laboratory exercises, so that students gain theoretical knowledge as well as practical skills. The taught part of course is delivered to the students with the help of computer presentations. Presentations are available through the e-learning system for students to use in combination with the textbooks. Furthermore, theoretical principles are explained by means of specific examples and exercises. The</p>

	<p>material and code for these examples is also made available in the e-learning system.</p> <p>Lectures are supplemented with supervised computer laboratories, which include demonstrations of taught concepts and experimentation with related technologies. Hence, during laboratory sessions, students apply their gained knowledge and identify the principles taught in the lecture sessions by means of working on different tasks on cloud management, cloud security and deploying cloud services. The course includes a midterm test, two assignments that test both the theoretical understanding and the practical application of the taught concepts. Finally, the course assessment is completed by means of a three-hours final exam at the end of the semester.</p>
Bibliography	<p><b>Textbooks:</b></p> <ol style="list-style-type: none"> <li>1. Barrie Sosinsky, "Cloud Computing Bible", Book: Copyright © 2011 by Wiley Publishing, Inc., Indianapolis, Indiana, ISBN: 978-0-470-90356-8.</li> </ol> <p><b>References:</b></p> <ol style="list-style-type: none"> <li>1. Dana Petcu, "Multi Cloud: expectations and current approaches", In Proceedings of the 2013 international workshop on Multi cloud applications and federated clouds (MultiCloud '13). ACM, New York, NY, USA, 1 6. DOI: 10.1145/2462326.2462328.</li> <li>2. M. A. AlZain, E. Pardede, B. Soh and J. A. Thom, "Cloud Computing Security: From Single to Multi clouds", 45th Hawaii International Conference on System Sciences, Maui, HI, 2012, pp. 5490 5499. DOI: 10.1109/HICSS.2012.153.</li> <li>3. K. Hui, D. Radez, "Getting Started With OpenStack", RackSpace, Available Online: <a href="https://www.openstack.org/assets/presentation-media/Getting-Started-With-OpenStack-Icehouse-v2.pptx">https://www.openstack.org/assets/presentation-media/Getting-Started-With-OpenStack-Icehouse-v2.pptx</a>.</li> <li>4. OpenStack.org, "OpenStack Documentation", Available Online: <a href="https://docs.openstack.org/train/">https://docs.openstack.org/train/</a>.</li> <li>5. Microsoft, "Azure Documentation", Available Online: <a href="https://docs.microsoft.com/en-us/azure/">https://docs.microsoft.com/en-us/azure/</a>.</li> <li>6. Paul Castro, Vatche Ishakian, Vinod Muthusamy, Aleksander Slominski, "The Rise of Serverless Computing", Communications of the ACM, December 2019, Vol. 62 No. 12, Pages 44-54. DOI: 10.1145/3368454.</li> </ol>
Assessment	<ul style="list-style-type: none"> <li>• Midterm Test: 20%</li> <li>• Two Assignments: 30%</li> <li>• Final Exam: 50%</li> </ul>
Language	English.