
# Cloud Computing

Do less and achive more

CS516

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Maharishi International University is an Equal Opportunity Institution.

## Course Overview

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| Week 1<br>Cloud Computing Introduction | Week 2<br>Virtual Machine (EC2 & IAM) | Week 3<br>Object Storage (S3) | Week 4<br>Load Balancers (ALB & NLB) | Week 5<br>Auto Scaling (ASG) | Week 6<br>Relational Database (RDS) | Week 7<br>App Integration (SNS & SQS) |
| Week 8 – Midterm exam | | | | | | |
| Week 9<br>Serverless (Lambda) | Week 10<br>NoSQL Database (DynamoDB) | Week 11<br>API Gateway & Cognito | Week 12<br>CloudFormation & Route53 | Week 13<br>Project | Week 14<br>Project | |
| Week 15 – Final Exam | | | | | | |

Important notes:

- You must submit the first assignments by the end of the third week. If there are no submissions, you are subject to course dismissal.
- Midterm and final exams are scheduled in the 8$^{th}$ and 15$^{th}$ weeks accordingly. Sometimes they are subject to change. You will get the exact date and time on Microsoft Teams.

## Course Goal and Objectives

This course provides a systematic introduction to cloud computing and how to build modern distributed systems that are scalable, resilient, efficient, and fault-tolerant in the AWS cloud.

This course will cover a comprehensive understanding of cloud services and technologies. Students will gain the ability to develop secure and robust solutions in the cloud and understand how well-architected distributed systems are built in detail.

Students will practice and work on various web services including virtual machines, load balancers, auto-scaling, object storage, databases, messaging, serverless, and automation in the AWS cloud.

Topics include:

- Importance of cloud computing and different cloud service models.
- Account management, billing, and pricing models.
- Compute services such as AWS EC2 (virtual machine), and Lambda (Serverless).
- Storage services such as EBS, S3, RDS, and DynamoDB.
- Autoscaling, monitoring, securing resources, and best practices.
- Other common services such as IAM, API Gateway, Cognito, and CloudFormation.

## Course Benefits

- Hands-on experience in next-generation modern technologies and architectures in the cloud.
- Ace technical interviews.
- Your personal website with a reliable, highly scalable, cloud-native back end.
- Fundamental knowledge that helps pass highly-reputed exams in the IT industry.
- You will become a shiny software developer to adapt to a real-life environment easily in the US.

## Evaluation Criteria

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| Midterm Exam | 35% |
| Final Exam | 35% |
| Final Project | 16% |
| Assignments | 14% |
| Etiquette | 0 – 3% |

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| A+ | 97 - 100 |
| A | 92 - 96 |
| A- | 88 - 91 |
| B+ | 84 - 87 |
| B | 79 - 83 |
| B- | 75 - 78 |
| C+ | 71 - 74 |
| C | 66-70 |
| C- | 62-65 |

## Important Points

- Take 6 to 12 screenshots of your entire desktop that show datetime and AWS logged-in user while doing assignments. Include all screenshots in **one PDF** then submit.
- You must submit assignments on Sakai. Late submissions are accepted on Sakai and there is a grace week after the due date. Deductions:
    - No submission on Sakai. Email or Microsoft Teams submissions are not accepted.
    - Non-PDF submissions such as Word, zip, txt files.
    - Partial screenshots instead of the entire screen.
    - Most of and main tasks are not completed.
- To succeed in this course, **read slides** regularly and **do assignments** on time. All exam questions are from slides and assignments.
- Don't blindly follow recordings or step-by-step instructions to do assignments. They are there to guide you. They tend to get outdated even though I always update specifications. Understand the big picture. Keep the main steps or configurations in mind. Then do it yourself.
- We use AWS Academy for assignments which gives you $100 credit and has some restrictions. Note that, there are some differences between an AWS Academy account and a regular AWS account such as a preconfigured **LabRole** in AWS Academy. Use your own AWS account if the AWS Academy account keeps throwing errors.
- Don't forget to delete the resources you created in AWS after taking screenshots, especially in the first half of the course. Otherwise, it will incur charges and you will run out of credits. There is a student in a previous class who forgot to delete a resource that cost $200. You are responsible for all costs.
- Microsoft Teams is how we communicate.

## Reading Materials

The main reading materials are the Slides and a series of articles on my Medium, https://medium.com/@unubold0521. AWS has become popular because its official documentation, blog, and YouTube channels are great. There are many enjoyable blogs on Medium as well. Other useful resources are:

- AWS Developers @ YouTube – I prefer watching an hour of videos because they give a complete understanding of the service.
- BeABetterDev @ YouTube – It's a perfect beginner-friendly channel on serverless services. Will be handy in the second half of the course.
- If you are interested in taking an AWS exam, digitalcloud.training is what I suggest.

**Contact Info**

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## Student Testimonials

Every block I receive such testimonials. These are testimonials from the class at the time I am writing this.

“I wanted to express my appreciation for the chance to attend your course. It was an honor to learn from you, as you delivered the material in a manner that was both lucid and comprehensible. I wanted to take a moment to acknowledge the high quality of your lectures. With the current job market being competitive, I recognize the value of the education you provided. Thank you!”

“Thank you, professor. I really enjoyed the course and It helps me with the interview. I did 2 interviews after I had a basic understanding of AWS. And they were happy when I talk about my AWS experience.”

“First of all, I would like to express my gratitude to you, You impressed me not only as a professor but you are also an amazing human being. You are a role model. This course was very interesting, I enjoyed each and every session. I’m so glad to have a professor like you in my life, and I hope we can stay in contact. Thank you for everything.”

“Really appreciate the passion with which you taught us. I really enjoyed this course and learned a whole new world. Thank you so much!”

“I want to thank you for your dedication and for this amazing course. I really enjoyed every bit of it. Every service and concept makes sense. And I'm happy that I got to study it with you. Thank you for the best wishes, and I hope we cross each other's paths again. I hope you have success in your work too”

## Mandatory Student Participation

Because we sometimes had students who were registered in a course, but did not participate and then much later withdrew, after requiring ongoing administrative and faculty attention, we now have a new requirement that **you submit the first assignments given by the end of the 3rd week to indicate that you are indeed active in the course** and intend to continue in it. It will also be necessary for you to show ongoing participation and progress in the course to be able to take the midterm & final exams.

Failure to comply with the above requirements will result in a student’s dismissal from the course with a grade of NC and the cost of the course incurred.

## Main Points in Recordings

These are the main points and what you should learn from recordings.

Lesson 1. Cloud Computing Introduction

- Cloud service models, IaaS, PaaS, FaaS, Container as a Service, SaaS.
- Demo - Launching a server.
- Demo - Lambda backend and deploying the React frontend in S3.

Lesson 2. Virtual Machine

- AWS Global Infrastructure, regions, and AZ.
- EC2 details
- IAM

Lesson 3. Object Storage

- Storage classes
- Presigned URL
- S3 VPC endpoint
- Demo - EC2 and S3
- Demo - S3 Event notification

Lesson 4 - Part 1. Load Balancers

- Load Balancers benefits (traffic distribution and health checks for fault tolerance, connections from client to load balancers, and connections from load balancers to apps)
- Load Balancer components, Listener, Listener Rule, Target Groups
- Differences between ALB and NLB, OSI layers
- Demo ALB
- Don't watch NLB demo because NLB demo is outdated. AWS added a feature and now you can directly use SG for NLB.

Lesson 4 – Part 2. Auto Scaling Group

- Desired number vs current number, how ASG works, and autoscaling policy types (target tracking, predictive, etc)
- Demo ASG

Lesson 5 – Relational Database Service

- This lesson is more theory. Understand read replica, standby, shared storage, and so on.
- RDS demo

Lesson 6 – App Integration

- This lesson is more theory. Please watch recordings carefully and try to understand concepts such as asynchrony, and the difference between the request-response model and message-bus model.
- SNS
- SQS
- Circuit breaker

Lesson 7 – Serverless Lambda

- Mostly theory. Understand concurrency, pricing models, triggers
- Demo Alias and version

Lesson 8 – DynamoDB

- Mostly theory, NoSQL, partition key and sort key, and other DynamoDB details.

Lesson 9 – API Gateway and Cognito

- Mostly demo. Learn how to create, and secure API with Cognito.

Lesson 10 – CloudFormation

- Understand how CloudFormation can play a role in CICD by watching the demo.
- CDK
- Other topics in the lesson.

## DE Course Structure

I presume that you are all familiar with the general structure and process of DE courses, but I do want to make a few additional comments here on this course:

- You are expected to spend enough time on the course so that you'll be able to watch all the video lectures and work on all assignments and labs. Be sure to manage your time, and plan for adequate time each week.
- You need to be sure that you have this attention to time management, so that you are not staying up late to complete any parts of the course. Just as we remind you while on campus, a good schedule and proper rest are vital for maintaining good health, and keeping regular with your TM practice twice-daily is a required part of the course (and all DE courses), and vital for continued happiness and growth in life.
- All students are expected to participate in the Teams discussions, just like on-campus. That means you interact with other students in forum discussions, either by posting or answering questions. Note that any personal issues should be emailed directly to me, not posted to the public forum.
- If you have trouble with any lab, you should contact me, and let me know your situation. But **do not ever submit any copied work as your own** – I will regularly use plagiarism detection tools, and anyone submitting a copied or old version of a lab will fail the course.
- Exams will be on the regular DE office schedule, and no late or rescheduled exams will be allowed without prior approval from me, and this will only be in the case of some personal or medical emergency. We do not allow alternate exam dates for convenience.

## Academic Honesty

Academic dishonesty will not be tolerated at any cost. The purpose of our homework is to give each student practical experience in applying the knowledge gained from lectures and readings. This hands-on experience is needed to learn the details of how to apply the knowledge. Therefore, it is against academic policy to copy, or share with others, any homework or lab projects that are assigned as individual work. You may discuss the course material, concepts, or ideas with other students. You may review together the relevant topics from lectures or readings to help understand the principles required to start a programming assignment. You can prepare for the exam together, discussing and working on various problems and expected questions. In essence, you can collaborate freely in any course-related work that is not required for submission and evaluated by the instructor. Under no circumstances should you post your lab or homework solutions on a course forum, send via email, or in any other way distribute to others. Every student is expected to work individually on his or her own lab, assignment, project, exams, and anything else being evaluated as part of the course grade. If you are found to have violated this policy for assignments, then you will receive no credit for that homework. If the violation occurs for an exam, you will receive no credit for the course, and be subject to disciplinary measures by the Dean of Students, with possible dismissal from the graduate program.