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| COURSE TITLE | CLOUD DEVELOPING |
| COURSE CODE | 01CT0720 |
| COURSE CREDITS | 4 |

Objective:

- 1 The objective of this course is to gain technical expertise in development with cloud technologies. Students would explore a scenario that provides opportunities to build a variety of infrastructures through a guided, and hands-on approach.

Course Outcomes: After completion of this course, student will be able to:

- 1 Write code that interacts with Amazon DynamoDB by using the AWS SDKs
- 2 Configure containers
- 3 Develop solutions with Amazon Simple Queue Service (Amazon SQS) and Amazon Simple Notification Service (Amazon SNS)
- 4 create a REST API using Amazon API Gateway
- 5 Identify the best practices to deploy secure applications

Pre-requisite of course:Cloud computing

Teaching and Examination Scheme

| Theory Hours | Tutorial Hours | Practical Hours | ESE | IA | CSE | Viva | Term Work |
|---------------------|-----------------------|------------------------|------------|-----------|------------|-------------|------------------|
| 3 | 0 | 2 | 50 | 30 | 20 | 25 | 25 |

| Contents : Unit | Topics | Contact Hours |
|------------------------|--|----------------------|
| 1 | Introduction to Developing on AWS Introduction, Systems development lifecycle, Steps to get started developing on AWS, Demonstration: AWS CLI installation, Fundamentals of working with the AWS SDKs | 2 |
| 2 | Developing Flexible NoSQL Solutions Introducing AWS database options, Key concepts for DynamoDB, Partitions and data distribution, Secondary indexes, Read/write throughput, Calculating Read Capacity Units (RCUs) and Write Capacity Units (WCUs), Streams and global tables, Backup and restore, Basic operations for DynamoDB tables | 5 |
| 3 | Developing REST APIs Introducing APIs, Introducing API Gateway, creating a REST API, Integrating with API Gateway, Deploying an API, controlling access to a REST API, Monitoring a REST API, Optimizing API Gateway | 6 |

| Contents : Unit | Topics | Contact Hours |
|------------------------|---|----------------------|
| 4 | Developing Event-Driven Serverless Solutions Introducing serverless computing, Introducing Lambda, Invoking Lambda functions, setting permissions for Lambda, Authoring and configuring Lambda functions, Deploying Lambda functions, Monitoring and debugging tools for application developers, Demonstration: Using X-Ray with Lambda | 6 |
| 5 | Introducing Containers and Container Services Introducing containers, Introducing Docker containers, migrating a Web, Application to Docker Containers, containers for microservices, Introducing AWS container services, Deploying applications with AWS Elastic Beanstalk | 6 |
| 6 | Caching Information for Scalability Introduction, Caching overview, Caching with ElastiCache, Caching Application Data with ElastiCache, Caching with CloudFront, Caching strategies | 5 |
| 7 | Developing with Messaging Services Processing requests asynchronously, Introducing Amazon SQS, Working with Amazon SQS messages, Configuring Amazon SQS queues, Introducing Amazon SNS, Developing with Amazon SNS, Demonstration: Working with Amazon Messaging Services, introducing Amazon Kinesis Data Streams | 2 |
| 8 | Developing Secure Applications on AWS Securing network connections, Authenticating with AWS Security Token Service (AWS STS), Authenticating with Amazon Cognito, Implementing Application Authentication using Amazon Cognito | 4 |
| 9 | Automating Deployment Using CI/CD Pipelines Introducing DevOps, AWS code services for continuous integration and continuous delivery (CI/CD), Deploying applications with AWS Cloud Formation, deploying applications with the AWS Serverless Application Model (AWS SAM), Automating Application Deployment Using a CI/CD Pipeline | 6 |
| Total Hours | | 42 |

Suggested List of Experiments:

| Contents : Unit | Topics | Contact Hours |
|------------------------|--|----------------------|
| 1 | Experiment:1 Setup Cloudshell and cloud9 environment. | 2 |
| 2 | Experiment: 2 Create an IAM role and instance role which can have S3 full access permission. | 2 |
| 3 | Experiment: 3 Create a Dynamo DB database that can have an automatic backup at 12:00 AM. | 2 |

Suggested List of Experiments:

| Contents : Unit | Topics | Contact Hours |
|--------------------|---|------------------|
| 4 | Experiment: 4 Create an API using API gateway in AWS which can trigger lambda function on invoke. | 2 |
| 5 | Experiment: 5 Create any 5 APIs using API gateway. | 2 |
| 6 | Experiment:6 Implementing a Serverless Architecture with AWS Managed Service. | 2 |
| 7 | Experiment: 7 Create a lambda function using SDK. | 2 |
| 8 | Experiment: 8 Implement microservices architecture using containers. | 2 |
| 9 | Experiment: 9 Create any 2-container image and push it to ECR. | 2 |
| 10 | Experiment:10 Application to Docker Containers. | 2 |
| 11 | Experiment:11 On lambda invoke trigger SNS notification to your respective mail. | 2 |
| 12 | Experiment:12 Implementing a Messaging System Using Amazon SNS and Amazon SQS. | 2 |
| 13 | Experiment:13 Implementing Application Authentication Using Amazon Cognito. | 2 |
| 14 | Experiment:14 Create 2 simple websites and push their code to code commit. | 2 |
| 15 | Experiment:15 Automating Application Deployment Using a CI/CD Pipeline. | 2 |
| 16 | Experiment:16 To send a message to SQS from the API. | 2 |
| 17 | Experiment:17 Convert any monolithic architecture to micro-service. | 2 |
| 18 | Experiment:18 Create CI/CD pipeline for deploying any project. | 2 |
| Total Hours | | 36 |

Textbook :

- 1 AWS Cookbook, John Culkin, Mike Zazon, O'Reilly Media, 2021

References:

- 1 Security and Microservice Architecture on AWS, Security and Microservice Architecture on AWS, Gaurav Raje, O'Reilly Media, 2023
- 2 AWS: Amazon Web Services for Beginners, AWS: Amazon Web Services for Beginners, 3. Ralph Kihpehers, Blackstone , 2013

References:

- 3 Learning Amazon Web Services, Learning Amazon Web Services, Mark Wilkins, Addison-Wessley Professional, 2019

Suggested Theory Distribution:

The suggested theory distribution as per Bloom’s taxonomy is as follows. This distribution serves as guidelines for teachers and students to achieve effective teaching-learning process

| Distribution of Theory for course delivery | | | | | |
|--|------------|-------|---------|----------|----------------------------------|
| Remember / Knowledge | Understand | Apply | Analyze | Evaluate | Higher order Thinking / Creative |
| 10.00 | 15.00 | 30.00 | 20.00 | 15.00 | 10.00 |

Instructional Method:

- 1 The internal evaluation will be done on the basis of continuous evaluation of students in the laboratory and class-room.
- 2 Practical examination will be conducted at the end of the semester for evaluation of performance of students in laboratory
- 3 Students may use supplementary resources such as online videos, NPTEL videos, e-courses, Virtual Laboratory, etc.

Supplementary Resources:

- 1 <https://awsacademy.instructure.com/courses/21018>
- 2 <https://aws.amazon.com/kubernetes/>
- 3 https://aws.amazon.com/marketplace/pp/prodview-isd7rfyswfr4s?ref=portal_asin_url
- 4 https://aws.amazon.com/marketplace/pp/prodview-mm6u6prvppowc?sr=0-2&ref_=beagle&applicationId=AWSMPContessa