Course Title: **Cloud Computing**
Course Code: ICT. Ed. 488 (Elective II)
Level: Bachelor
Semester: Eighth

Program: **BICTE**
Nature of Course: Theory + Practical
Credit Hours: 3 (2 + 1)
Teaching Hours: 64 (32 Th +32 Pr)

1. Course Description

This course introduces undergraduate students to the foundational concepts, architecture, and practical applications of cloud computing. Students will explore the different cloud service models (IaaS, PaaS, SaaS) and deployment strategies (public, private, hybrid, and community clouds). The course provides hands-on experience with industry-leading cloud platforms such as Amazon Web Services (AWS), Microsoft Azure, and Google Cloud Platform (GCP).

Students will apply their knowledge to design and deploy scalable, cloud-based solutions, preparing them for careers in cloud computing and related fields. By the end of the course, students will gain the technical and practical skills necessary to leverage cloud technologies effectively in real-world scenarios.

2. General Objectives

The general objectives of this course are as follows:

- Develop an understanding of the fundamental concepts of cloud computing.
- Gain familiarity with cloud service models and deployment strategies.
- Learn to design and deploy basic cloud-based applications.
- Develop an understanding of security and compliance in the cloud.
- Acquire practical experience with leading cloud platforms

3. Specific Objectives and Contents

Specific Objectives	Contents
• Explain the concept of Cloud Computing with characteristics. • Understand the basic terminologies related to cloud and traditional IT infrastructure. • Identify major cloud service providers	**Unit 1: Introduction (4 Hours)** 1.1 History and Evolution of Cloud Computing 1.2 Characteristics of Cloud Computing 1.3 Cloud vs Traditional IT Infrastructure 1.4 Major Cloud Service Providers Overview **Practical Works (4 Hours)** • Compare the services, pricing, and user interfaces offered by different providers. • Analyze a case study where an organization transitioned from traditional IT infrastructure to the cloud, and present the benefits and challenges faced.

• Explain different cloud services model • Compare and contrast different deployment models • Understand the role of virtualization in cloud	**Unit 2: Cloud Computing Architecture (5 Hours)** 2.1 Cloud Service Models: 2.1.1 Infrastructure as a Service (IaaS) 2.1.2 Platform as a Service (PaaS) 2.1.3 Software as a Service (SaaS) 2.2 Deployment Models: 2.2.1 Public, Private, Hybrid, and Community Clouds 2.3 Virtualization and its Role in Cloud Computing **Practical Works (4 Hours)** • Use a PaaS provider (e.g., AWS Elastic Beanstalk, Azure App Service, or Google App Engine) to deploy a simple application, such as a "Hello World" web app. • Sign up for a SaaS application (e.g., Google Workspace, Microsoft 365, or Salesforce) then explore and document its features, benefits, and limitations.
• Explain different cloud platforms. • Apply different cloud tools for computation, storage and data management.	**Unit 3: Cloud Platforms and Tools (5 Hours)** 3.1 Introduction to AWS, Microsoft Azure, and Google Cloud Platform (GCP) 3.2 Overview of cloud tools 3.2.1 Compute 3.2.2 Storage 3.2.3 Database **Practical Works (6 Hours)** • Guide students through the process of setting up a free-tier account for AWS, Azure, and GCP. Ask students to document the steps involved in setting up the free-tier account for each provider, including limitations (e.g., compute hours, storage, or data transfer limits). • Set up cloud storage on AWS (S3), Azure (Blob Storage), and GCP (Cloud Storage) then upload a file (e.g., a text document or image) to each platform and access it through a browser or API. • Perform a basic SQL query (e.g., SELECT, INSERT) on each cloud provider's database service.
• Develop cloud native application.	**Unit 4: Application Development in the Cloud (3 Hours)** 4.1 Basics of Cloud-native Development

• Explain containers and automate container deployment using Kubernetes.	4.2 Introduction to Containers and Kubernetes **Practical Works (6 Hours)** • Develop a simple cloud-native application using a microservices architecture. Implement basic services (e.g., a user service, a product service) that communicate over REST APIs or gRPC. Use a cloud provider (AWS, Azure, or GCP) to host these services, demonstrating key cloud-native principles like scalability and resilience. • Set up a local Kubernetes environment using tools like **Minikube** or **K3s**. Deploy a multi-container application (e.g., front-end and back-end services) to Kubernetes and expose the application through a LoadBalancer or Service.
• Explain the different security challenges in Cloud. • Implement IAM. • Know different compliance standards. • Know pricing models in Cloud Services.	**Unit 5: Cloud Security, Compliance, and Pricing (4 Hours)** 5.1 Security Challenges in Cloud Computing 5.2 Identity and Access Management (IAM) 5.3 Encryption and Data Privacy 5.4 Compliance Standards 5.5 Pricing Models in Cloud Computing **Practical Works (4 Hours)** • Set up security configurations on a cloud platform (e.g., AWS, Azure, or GCP) to demonstrate protections such as: Configuring firewalls or security groups to control network traffic. • Implement IAM in a cloud platform (e.g., AWS IAM, Azure AD, or GCP IAM). Create and assign different roles and permissions to users (e.g., admin, developer, read-only) for accessing specific resources.
• Define Edge computing and serverless architecture • Identify the application of AI and Big Data in Cloud	**Unit 6: Emerging Trends in Cloud Computing (3 Hours)** 6.1 Edge Computing and Serverless Architectures **6.2** Artificial Intelligence (AI) and Big Data in the Cloud

4. Instructional Techniques

The instructional techniques for this course are divided into two groups. First group consists of general instructional techniques applicable to most of the units. The second group consists of specific instructional techniques applicable to specific units.

4.1 General Techniques

- Providing the reading materials to the students to familiarize the units.
- Lecture, question-answer, discussion, brainstorming, practical, hands-on labs, project based learning and flipped classrooms.

4.2 Specific Instructional Techniques

Unit	Activity and Instructional Techniques (48 Hours)
1 to 6	Use Interactive cloud platforms and simulations can be used

5. Evaluation (Internal Assessment and External Assessment):

Nature of course	Internal Assessment	External Practical Exam/Viva	Semester Examination	Total Marks
Theory	40	20	40	100

***Note**: Students must pass separately in internal assessment, external practical exam / viva and or semester examination.*

5.1 Evaluation for Part I (Theory): Internal Evaluation 40%

Internal evaluation will be conducted by course teacher based on following activities:

1) Attendance	5 Marks
2) Participation in Learning Activities	5 Marks
3) First assessment (Written Assignment)	10 Marks
4) Second assessment (Term Examination)	10 Marks
5) Third assessment (Internal Practical Exam/Case Study)	10 Marks
Total	40 Marks

5.2 External Evaluation (Final Examination) 40%

Examination Division, office of the Dean, Faculty of Education will conduct final examination at the end of semester.

1) Objective Type Question (Multiple Choice Questions)	(10 × 1) = 10 Marks
2) Short Answer Questions (6 Questions with 2 Or)	(6× 5) = 30 Marks
Total	40 Marks

5.3 Evaluation for Part II (Practical) 20%

Nature of the Course	Semester Final Examination by External Examiner	Total percent
Practical	100%	100

5.3.1 Practical Examination Evaluation Scheme

a) External assessment 100%
   i) Lab Report/Project Report 20%
   ii) Laboratory Work Exam/Case.....40%
   iii) VIVA.....40%

6. Recommended Books and Reading Materials

- Erl, T. & Monroy, E. (2023). *Cloud Computing: Concepts, Technology, Security and Architecture, 2nd Edition.* Pearson Education
- Hurwitz, J.S. & Kirsch, D. (2020). *Cloud Computing For Dummies, 2nd Edition,* John Wiley and Sons Inc.
- Hoff, T. (2017). *Explain the Cloud Like I'm 10, 1st Edition,* Possibility Outpost Inc.
- Marinescu, D.C. (2022). *Cloud Computing Theory and Practice, 3rd Edition*, Morgan Kaufmann
- Linthicum, D. (2023). *Insider's Guide to Cloud Computing, 1st Edition*, Pearson Education