Cloud Computing

Program: BIT
Course Code: CIT 413
Course Type: TH+PR
Year: Fourth
Semester :6
Credit Hour: 3
Contact Hours: 45

Course Objectives:

The main objectives of this course are

- To provide students a sound foundation of the Cloud Computing so that they are able to start using and adopting Cloud Computing services and tools in their real-life scenarios.
- To provide theoretical as well as practical knowledge of cloud computing including designing, implementing and managing the cloud computing

Course Description:

This course covers different concepts of cloud computing including introduction, architectures, cloud virtualization, programming models, security, and platforms and applications of cloud computing.

Course Outcomes:

After successful completion of this course, student will be able to

- Explain the core concepts of the cloud computing paradigm: how and why this paradigm shift came about, the characteristics, advantages and challenges brought about by the various models and services in cloud computing.
- Analyze various cloud programming models and apply them to solve problems on the cloud.
- Identify resource management fundamentals, i.e. resource abstraction, sharing and sandboxing and outline their role in managing infrastructure in cloud computing.

Course Contents:

Unit 1: Introduction to Cloud Computing **(5 Hrs.)**

1.1 Evolution of Cloud Computing,

1.2 Characteristics of Cloud Computing,

1.3 Benefits and challenges of cloud computing,

1.4 Cloud Storage, Cloud services requirements, Cloud adoption

Unit 2. Cloud Computing Services **(10 Hrs.)**

2.1 Cloud computing service models

2.1.1 Platform as service,

2.2.2 Software as a service,

2.2.3 Infrastructure as service,

2.2 Deployment models

2.2.1 Public clouds

2.2.2 Private clouds

2.2.3 Community cloud

2.2.4 Hybrid clouds,

Unit 3: Cloud Virtualization technology (6 Hrs.)

3.1 Introduction to Virtualization,

3.2 level of Virtualization (Desktop, Hardware, Storage, Application and operating system)

3.3 Benefits of virtualization

3.4 Introduction to virtualization software

3.6 Hypervisor and types

3.7 Overview of Kubernetes

Unit 4: Service Oriented Computing (10 Hrs.)

4.1 Monolithic

4.2 Service SoA, Sjab Services, Microservices

Unit 5: Storage in Cloud computing **(6 hrs.)**

5.1 Database as service, Storage service

5.2 File Storage

5.3 Block storage

5.4 Archive Storage

5.5 Object Storage

5.6 Database: Relational and Non-relational

Unit 6: Resource management in Cloud Computing (7 Hrs.)

6.1 Sealing and its types, Way of scales

6.2 Load Balancing, Redundancy and High availability

6.3 Cloud Monitoring

6.3.1 SLA

6.3.2 Billing

6.3.3 Security

Laboratory work:

The lab should cover at least the concepts given in each chapter.

Textbook(s):

Raj Kumar Buyya, Christian Vecchiola, S. Thamarai Selvi, Mastering Cloud ComputingArshdeep Bahga and Vijay Madiseti Cloud Computing: A hand on Approach

Data Mining and Data Warehousing

Code: CIT 411
Year: Fourth
Semester: VII
Credit: 3
Contact Hours: 45

Course Objectives

The course provides a broad overview of data mining and warehousing, including their application in business intelligence, customer relationship management, marketing, healthcare, and other fields. The course emphasizes practical hands-on experience with data mining and warehousing tools and techniques, enabling students to analyze data and solve real-world problems.

Course Descriptions

Data Mining and Warehousing are essential components of modern data-driven organizations. They help extract valuable insights from large datasets, make informed decisions, and gain a competitive edge in the market. The course aims to equip students with the necessary skills and knowledge to understand, develop, and apply data mining and warehousing techniques in real-world scenarios.

The course will be delivered through a combination of lectures, hands-on exercises, and projects. Students will have access to data mining and warehousing software tools to practice and apply the concepts learned.

Course Outcome:

Upon completing the course on Data Mining and Warehousing, students should be able to:

- Understand the key concepts, principles, and techniques of data mining and warehousing.
- Apply data preprocessing techniques to prepare data for mining and warehousing.
- Apply data mining algorithms, such as association rule mining, classification, and clustering, to extract meaningful insights from data.
- Identify and handle outliers in data.

Content

1. Introduction to Data Mining [5 Hours]

1.1. Introduction to Data Mining
1.2. The Origins of Data Mining
1.3. Data Mining Tasks

1.4. Data and Patterns used in Data Mining
1.5. Technologies Used in Data Mining
1.6. Major Issues in Data Mining

2. Data Preprocessing [7 Hours]

2.1. Data Objects and Attribute Types
2.2. Basic Statistical Descriptions of Data
2.3. Data Preprocessing
2.4. Data Cleaning
2.5. Data Integration
2.6. **Data Reduction:** Principle Component Analysis
2.7. Data Transformation and Data Discretization
2.8. Measures of Similarity and Dissimilarity

3. Data Warehousing and Online Analytical Processing [7 hours]

3.1. **Data Warehouse:** Basic Concepts and features
3.2. Characteristics of Data Warehouse
3.3. Extract, Transform and Load
3.4. Multitiered Architecture
3.5. Conceptual Modeling of Data Warehouse
3.6. **Data Warehouse Modeling:** Data Cube, Data Mart and OLAP

4. Classification [10 hours]

4.1. **Basic Concepts:** General Approach to Classification
4.2. Decision Tree
4.3. Rule-Based Classifier
4.4. Nearest-Neighbor Classifiers
4.5. Naive Bayes Classifier
4.6. **Ensemble Method:** Random Forest
4.7. **Model Evaluation:** Confusion Matrix- Accuracy, Recall, Precision and F1-score.

5. Association Analysis [5 hours]

5.1. Basic Concepts
5.2. Association Rules and Analysis
5.3. Apriori Algorithm
5.4. FP-Growth Algorithm

6. Cluster Analysis [6 hours]

6.1. **Introduction:** Basic Clustering Methods
6.2. K-means Clustering
6.3. Hierarchical Clustering
6.4. DBSCAN Clustering

7. Anomaly Detection [5 hours]

7.1. Introduction to Anomalies
7.2. Issues of Anomaly Detection

7.3. Approaches to Anomaly Detection
7.4. **Statistical Approaches**: Normal distribution and Box plot

Practical: Using either MATLAB or Python or any other Data Mining tools (such as WEKA), students should practice enough on real-world data intensive problems like IRIS or Wiki dataset.

References

1) Jiawei Han, Micheline Kamber, Jian Pei - Data mining concepts and techniques-Elsevier, Morgan Kaufmann
2) P. Tan, M. Steinbach, V. Kumar - Introduction to Data Mining
3) Mark W. Humphries, Michael W. Hawkins, Michelle C. Dy - Data warehousing_ architecture and implementation-Prentice Hall PTR
4) Ponniah P., Reddy P. - Data Warehousing Fundamentals. Volume 1

Software Development and Operations (DevOps)

Program: BIT
Code: CIT 412
Year: Fourth
Semester: VII
Credit Hour: 3+1
Contact Hours: 45

Course Objectives

The key objectives of learning Software Development and Operations (DevOps)are:

1. Learn and understand how various technologies work together in DevOps. Get a firm understanding in DevOps Processes, Tools and Technologies.
2. Learn the basics of working in DevOps environments like Linux, AWS, Bash & Python Scripting, Jenkins, Ansible, Docker, Kubernetes and more

Course Description

This course provides an introduction to the concepts, practices, and tools used in DevOps. Stu- dents will learn about the fundamental principles of DevOps and how they can be used to improve the software development and deployment process. The course will cover a range of topics including automation, continuous integration and delivery, testing, and monitoring.
This course starts from very basics of command line, hands on demonstrations of many tools& technologies. Also most importantly it will show the readers how various technologies in DevOps work together by setting up their own projects.

Course Outcomes

- This course will enable the students to understand the fundamental principles and benefitsof DevOps and how it can improve software development and deployment processes.
- This course will enable students to apply continuous integration and delivery practices to automate the software build, test, and deployment process.

Course Content

1. Introduction (3 Hrs)

1. Introduction to DevOps: Definition, Scope, Application.
2. Introduction to Continuous Integration (CI) and Continuous Delivery(CD).
3. Prerequisites Info and Setup: Chocolatey (Windows), Homebrew (MacOS), AWS Setup, Linux Setup. Server Management in Linux.
4. Basics of Networking

2. DevOps Basics with Virtualization (5 Hrs)

1. Basics of Virtualization: Definition, Types and Hierarchy of Virtualizations.
2. Learn Virtualization: Manual and Automatic. OS Environments: Linux, MacOS, and Win-dows
3. Bash Scripting. Basics of Scripting.
4. Variables, Conditions, Loops etc.
5. Automating day to day Admin Tasks.

3. DevOps on Cloud (6 hrs)

1. Essentials of Cloud Computing
2. Cloud and Virtualization Architecture
3. Cloud Deployment Architecture
4. Cloud Providers - An Overview
5. Introduction to DevOps on Cloud Infrastructure like Amazon Web Service(AWS)

4. GIT- A Version Controlling Tool (6 hrs)

1. Introduction to Version Control
2. Git - A CLI, Essentials of GIT in industry.
3. Practice with GIT: Tracking, Monitoring, Ignoring, Staging, Merging etc.
4. Working with Remotes
5. GIT Workflows

5. Jenkins (5 Hrs.)

1. Essentials of Continues Integration.
2. Architecture of Jenkins.
3. Jenkins Tool Management System.
4. User Management in Jenkins.
5. Jenkins Workshop: Authentication, Authorization.
6. Maven Overview.
7. Creating Jobs and Automatic Build Settings
8. Building Delivery Pipeline. Plugin Management and Notification System.

6. Docker (8 Hrs.)

1. Introduction to Real World Transportation Challenges. Docker Introduction.
2. Architecture of Docker
3. Docker Containers: Creation, Share and Publish.
4. Docker Networking: Network Types, Docker Compose.
5. Docker Swarm: Introduction, Creating and Scaling docker bundles.

7. Kubernetes (4 Hrs.)

1. Introduction to Kubernetes. Kubernetes Cluster Architecture - Brief Overview.
2. Concepts: Pods, Replica Sets, Deployments and Namespaces.
3. Kubernetes Services and Networking
4. Persistent volumes and persistent volume claims - An Overview.
5. Design of PODS.
6. Understanding labels, selectors, jobs and schedulers.

8. Ansible (8 Hrs.)

1. Introduction to Ansible: Basics and Architecture of Ansible. Control Machine and Managed Node Requirements
2. Inventory: Hosts, Groups.
3. Ansible Modules
4. Adhoc Commands
5. YAML script
6. Playbook: Handlers and Variables, Tasks, Privilege Escalation.
7. Roles: Directory Structure, Duplication and Execution, Default Variables, Dependencies, Search Path, Ansible Galaxy
8. Including and Importing: Playbooks, Task Files and Roles.

Case Study

3. Study on different search engines like Google, Bing etc and key business strategies incorporated by those engines.
4. Study of different web development frameworks for SEO.
5. A case study of SEO and digital marketing in a business (choosen by student) domain: Global and Local Perspective.

Textbook(s):

Gene Kim, Patrick Debois, John Willis, Jez Humble and John Allspaw (2021). The DevOps Handbook: How to Create World-Class Agility, Reliability, and Security in Technology Organizations

Gene Kim, Kevin Behr, George Spafford(2018). The Phoenix Project: A Novel about IT, DevOps, and Helping Your Business Win.

Reference(s):

Jennifer Davis and Ryn Daniels(2016). Effective DevOps: Building a Culture of Collaboration, Affinity, and Tooling at Scale .

Jez Humble and David Farley(2010). Continuous Delivery: Reliable Software Releases through Build, Test, and Deployment Automation.

Course: Technology Entrepreneurship

Program: Bachelor of Information Technology
Course Code: BCT 411
Year: Fourth
Semester: VII
Credit: 3
Credit Hours: 45

Objectives:

This study provides students with requisite concepts, skills of entrepreneurship, and factors affecting entrepreneurship so that students are able to apply them while launching and operating technology entrepreneurial ventures.

Course Description:

The course focuses on the fundamentals of technology entrepreneurship which has guided through the changes in the society. This course empowers the students for understanding the key aspects of entrepreneurship and the formation of new technology companies. Different topics allow the students to learn so that they can identify and evaluate innovation opportunities, and access the industry.

Course Outcomes:

After the end of the course, the students will be able to:

- Understand the key concepts of technology entrepreneurship.
- Acquire creativity for finding and evaluating opportunities in technology enterprises.
- Figure out the opportunities that fit students and gather the resources and manage the ventures.

Course Contents:

Unit 1: Introduction to Technology Entrepreneurship 4 hrs

Definition of entrepreneur, Types of Entrepreneur, Fundamentals of entrepreneurship and technology entrepreneurship, Characteristics of Technology entrepreneurship, Technology based firms

Unit 2: Technology Entrepreneur Development 4 hrs.

Technological Entrepreneurship and Economic Development, Role of enterprises foreconomic development

Unit 3: Opportunity identification and Analysis 4 hrs.

Identification of the opportunities, conduction of market research, emerging idea for the probable business concept

Unit 4: Development of IT Business Plan and Modeling **3 hrs.**

Understanding different business models, Creation of sustainable IT business model

Unit 5. Learn StartUp in Software Development **5 hrs.**

Concept of lean startup methodology including minimum viable product, rapid prototyping and customer development in technology.

Unit 6. IT Product Development, Marketing and Financial Management **8 hrs.**

Using ideas for Product development including design, development, testing and validation of the product, Marketing Strategies and tactics, building brand effective selling products and services, basics of financial statements, budgets

Unit 7. Technology Intellectual Property, Legal and Regulatory **7 hrs.**

Issues in Technology

Protection of Intellectual Property including trademark, copyrights, Ideas regarding legal and regulatory issues that impact on startup including corporate formation, contracts, agreements

Unit 8. Pitching and fundraising **4 hrs.**

Build pitch deck, raising capital, Knowledge of fundraising process.

Unit 9. Scaling and growth **3 hrs.**

Approaches for scaling of business including hiring, partnerships.

Unit 10. Technology Entrepreneurial Mindset: **3 hrs.**

Developing the mindsets and skills needed to be a successful entrepreneur.

Case Study: All the students are required to perform a case study.

Textbooks and References:

1.Barringer, B. R. and Ireland, R. D. Entrepreneurship: Successfully Launching New Ventures. Pearson Education, New Delhi.

3. Blundell, R, and Lockett, N. Exploring Entrepreneurship: Practices and Perspectives. Oxford University Press, New Delhi.

4. Kuratko, D. F. and Rao, T. V. Entrepreneurship: A South-Asian Perspective. CengageLearning, New Delhi.

5. Technology Ventures, Richard Dorf and Thomas Byers, 1st Edition The Monk and theRiddle, Randy Komisar

Wireless Communication Systems

Program: BIT

Course Code: CIT 414

Course Type: Theory + Lab

Year: Fourth

Semester: VII

Credit: 3

Contact Hour: 45

Course Objectives:

The main objectives of the course are:

- To provide the basic understanding of Wireless Technology.
- To be familiar with GSM and CDMA System.
- To understand Wireless standard and its future Trend.

Course Description:

The course is intended to prepare the students to understand the underlying theories related to wireless technology. The course includes history/fundamental concept of wireless communication and its future trend of transformation of the technology. The course is focused on architecture, services features and operation of GSM and CDMA technology and the basic fundamentals on the wireless network design.

Course Outcome:

After completion of the course, students will be able to

- Know basics of Wireless Technology.
- Know Architecture of GSM and CDMA Technology.
- Know the facts underlying in the design of wireless communication system.

Course Contents:

1. **Introduction: (6 hrs)**

   Definition and History of wireless communication, Mode of Communication, Communication: TDD, FDD. Wireless Radio Frequency Spectrum, Evolution of Mobile Communication.

2. **Fundamental of Cellular mobile Communication: (6 hrs)**

Concept of Cellular mobile system, Hexagonal Cell Geometry, Frequency Reuse and channel assignment strategy, Handoff, Coverage and capacity enhancement in cellular network: cell splitting, sectoring, Interference: Co-channel & Adjacent channel.

3. **Modulation/Multiple Access Technique: (10hrs)**

Fundamental concept of modulation and its type: A.M, F.M, P.M. Detail study on Amplitude Shift Keying, Frequency Shift Keying, Phase Shift Keying, Pulse Code Modulation, Differential Phase shift Keying (DPSK), Quadri phase Shift Keying (QPSK), Minimum Shift Keying: Gaussian Minimum Shift Keying(GMSK). Multiple Access: Frequency Division Multiple Access (FDMA), Time Division Multiple Access (TDMA), Code Division Multiple Access (CDMA), Spatial Division Multiple Access (SDMA).

4. **Radio wave Propagation/ Propagation Loss in Mobile Network (10hrs)**

Overview of Radio Wave Propagation. Review of Propagation mechanism: large scale path loss, Reflection, Diffraction, Scattering. Practical link budget design using path loss models: Indoor Propagation model (Partition loss, Long distance model), Outdoor Propagation Models(Okumura, Hata model, Longley-Rice model), Parameters of mobile multipath channel (time dispersion, coherence bandwidth, Doppler spread and coherence time), Fading: Small Scale Fading: flat, frequency selective, fast, slow, Rayleigh and Ricean fading distribution.

5. **Global System for Mobile Communication (GSM). (5 hrs)**

Introduction to Global System for Mobile Communication (GSM): System Architecture, radio sub-system, Services and features, channel types (traffic and control), frame structure, Frequency Hopping, Speech Channel, MSC, Call Handover, Transmitters, Authentication, Encryption and User Identification, Different Services.

6. **Recent Trends in Wireless Communication (8 hrs)**

LTE, Evolution beyond 5G, MIMO, NOMA

Laboratory Works:

- Study of AM/FM Modulation System.
- Study of AM/FM Demodulation System.

- Study of PCM System
- Study of ASK, FSK, PSK
- Study of Eye Diagram.
- Field Visit and Report

Text Books:

1. TS Rappoport: Wireless Communications: Principles & Practice. Prentice Hall-1996.
2. S.Haykin, Digital Communication Systems, Latest Edition.
3. B.P Lathi, Analog and Digital Communication Systems, Latest Edition.