



Far Western University
Faculty of Education
Bachelor in Computer Science Education (B.Ed. CSIT)

Course Title: Mobile Application Development
Course No.: CS. Ed. 485
Level: Under Graduate
Semester: Eighth

Nature of the Course: Theory and Practical
Credit Hour: 3
Teaching Hrs: 48+16
Full marks: 40+40+20

1. Course Introduction

This course introduces mobile application development frameworks, architectures, design and engineering issues, techniques, methodologies for mobile application development.

2. Objectives

The main objective of this course is to provide knowledge of understanding characterization and architecture with designing and developing of mobile applications.

3. Specific Objectives and Contents

Specific Objectives	Contents
- Explain the concepts and evolution of mobile computing. - Describe the architecture of mobile computing systems. - Compare different mobile application development frameworks. - Identify the components of the mobile ecosystem and development environment. - Discuss the factors influencing mobile application development and mobile software engineering.	Unit I: Introduction to mobile Computing and Mobile Application (8 hr) 1.1. Introduction to Mobile Computing 1.2. Definition and Characteristics of mobile computing 1.3. History and the evolution of mobile devices (Brick era, Candy bar era, Feature phone era, Smartphone era, Touch era), 1.4. Mobile ecosystem 1.5. Mobile Operating System (Android, iOS, Other Mobile platform) 1.6. Mobile application (Native application, Web application, Hybrid application) 1.7. Mobile web presence (Mobile content, Mobile browser, Mobile websites) 1.8. Benefits and Limitations of Mobile Application 1.9. Factors in Mobile Application Developments (Hardware, Software, Network, User interface, security)
- Explain different architectures used in mobile applications. - Differentiate between centralised, client-server and N-tier architectures. - Explain the role of mobile application frameworks. - Compare native, hybrid and cross-platform development approaches. - Select an appropriate framework based on application requirements.	Unit II: Architecture, Design and Mobile Development Framework (6 hr) 2.1. Mobile application architecture 2.2. Fully centralized and client server architectures, 2.3. 3-tier architecture and N-tier architecture 2.4. Mobile information architecture 2.5. Mobile application architecture components 2.6. Native VS hybrid VS cross platform application 2.7. Mobile application framework (Android SDK, iOS, SDK, React Native, Flutter, Ionic)

• Design mobile applications for different screen sizes and device capabilities. • Apply principles of responsive and adaptive mobile design.	2.8. Development Environments and tools 2.9. Mobile software Engineering 2.10. Selecting Appropriate development framework 2.11. Designing for different devices and screen sizes
• Explain the principles of mobile UI and UX design. • Design interfaces suitable for small screens and touch interaction. • Apply human-computer interaction principles to mobile applications. • Use common mobile UI components and widgets. • Design forms, menus, navigation and interactive components. • Explain event-driven programming in mobile applications. • Apply accessibility and usability principles to mobile interfaces.	Unit III: Mobile User Interface (7 Hrs) 3.1. Introduction to mobile UI and UX 3.2. Characteristics of mobile user interface 3.3. Principles of mobile information design 3.4. Human factors in mobile UI design 3.5. Mobile UI components (Text fields, button, label, image, lists, card, menu, form) 3.6. Mobile layout (linear, relative/constraint, grid layout, scroll view) 3.7. Event-Driven Programming, Themes, Styles and Resource Management 3.8. Navigation and Interaction Design 3.9. Introduction to Voice and Multimodal Interfaces
• Explain the Android operating system and its architecture. • Set up an Android development environment. • Describe the structure and components of an Android application. • Develop Android applications using an appropriate programming language. • Design Android user interfaces using layouts and widgets. • Implement activities, fragments and intents. • Handle user input and application events. • Use menus, dialogues, notifications and other UI components. • Debug and test Android applications.	Unit IV: Android Application Development (10 Hrs) 4.1. Introduction, features and architecture of Android 4.2. Android Development Environment (Android Studio, Android SDK, Emulator, device configuration) 4.3. Android Project Structure (source file, resource file and manifest file) 4.4. Android Application Components (activity, fragment, service, broadcast receiver, content provider) 4.5. User Interface Development (layouts, widgets, recycler view, list view, grid view, toolbar) 4.6. Forms and Form Validation 4.7. Menus and Dialogues 4.8. Toast and Popup Messages 4.9. Building and Running Android Applications
• Explain the importance of data management in mobile applications. • Use local databases for storing application data. • Implement shared preferences and persistent storage. • Explain web services and RESTful APIs. • Use JSON and XML for data exchange. • Connect mobile applications with	Unit V: Data Management and Web Services (8 Hrs) 5.1. Mobile Application Data Management 5.2. Local and Remote Data Storage, Shared Preferences 5.3. SQLite Database, CRUD Operations 5.4. Introduction to Web Services 5.5. XML and JSON Data Formats 5.6. HTTP Methods (GET, POST, PUT, DELETE) 5.7. Networking Libraries and Tools (volley and retrofit) 5.8. Parsing JSON Data 5.9. Web Service Debugging and Testing 5.10. RESTful Web Services and APIs

remote servers. • Integrate third-party APIs into mobile applications. • Retrieve, process and display remote data.	
• Explain wireless communication technologies used in mobile applications. • Describe short-range and long-range wireless connectivity. • Implement location-based services in mobile applications. • Explain GPS and non-GPS location techniques. • Integrate maps and location services into applications. • Implement push notifications and messaging services. • Explain the security and privacy issues associated with location data.	Unit VI: Mobile Connectivity (5 Hrs) 6.1. Wireless Connectivity in Mobile Applications 6.2. Short-Range Communication(Bluetooth, Wi-Fi) 6.3. Mobile IP, SMS and Messaging 6.4. Location-Based Services, GPS and Non-GPS Location Techniques 6.5. Google Maps and Map Integration 6.6. Geolocation and Location Data 6.7. Location-Based Application Architecture 6.8. Firebase Cloud Messaging (FCM) 6.9. Security and Privacy of Location Information
• Explain the importance of mobile application testing. • Apply different testing techniques to mobile applications. • Identify common security threats in mobile applications. • Apply basic security practices to protect mobile applications and data. • Build and package mobile applications for deployment. • Explain the process of publishing applications through app stores. • Understand basic application monetisation methods.	Unit VII: Mobile Application Testing and Security (4 Hrs) 7.1. Mobile Application Testing 7.2. Manual and Automated Testing 7.3. Unit Testing. Black Box and White Box Testing 7.4. Mobile Infrastructure Testing 7.5. Debugging and Performance Testing 7.6. Mobile Application Security (Authentication, Authorization, Data protection) 7.7. Privacy Issues 7.8. Application Build and Delivery 7.9. Application Deployment and App Store Distribution 7.10. Application Maintenance and Updates

4. Methodology and Techniques

Modes of instruction: Lecture, seminar, exercise course, guided personal study, tutorial, independent study, project work, Assignments in different topics, group discussion, reflective writing

Types of learning activities

Attending lectures, performing specific assignments, writing papers, independent and private study, reading books, journals and papers, providing constructive feedback, group study and peer discussion.

5. Evaluation Scheme

5.1 Internal Evaluation 40%

Internal Evaluation will be conducted by course teacher based on following activities.

- a) Attendance and Participation in class activities: 5+5=10 marks
- b) Assignment I: Reflective Notes and Class presentation: 5+5=10 marks
(Reflective notes on 2 to 4 questions given by teacher at the end of the every unit and presentation on any two questions among them)
- c) Assignment II: One Term paper/Essay/Project and Interview: 5+5=10 marks
(Logical essay /term paper /project on the topics chosen by students and approved by the teacher and interview)
- d) Mid-term exam 10 marks

5.2 External Evaluation (Final Examination) 40%

Types of questions	Total questions to be asked	Number of questions to be answered and marks allocated	Total marks
Group A: Multiple choice items	8 questions	8×1	8
Group B: Short answer questions	6 with 2 'or' questions	6×4	24
Group C: Long answer questions	1 with 1 'or' question	1×8	8

5.3 External Practical Evaluation (20%)

Office of the Controller of Examination will conduct final practical examination at the end of final examination. After completing the end semester theoretical examination, practical examination will be held. External examiner will conduct the practical examination according to the following evaluation criteria. There will be an internal examiner to assist the external examiner. Three hours' time will be given for the practical examination. In this examination Students must demonstrate the knowledge of the subject matter.

6. Evaluation System:

Practical	Weightage	Marks
Practical Report Copy	5	20
Viva	5	
Practical Exam	10	

Textbooks

1. B'Far, R. **Mobile Computing Principles: Designing and Developing Mobile Applications with UML and XML**. Cambridge University Press, 2005.
2. Fling, B. **Mobile Design and Development: Practical Concepts and Techniques for Creating Mobile Sites and Web Apps**. O'Reilly Media, 2009.
3. Phillips, B., Stewart, C., Hardy, K., and Marsicano, C. **Android Programming: The Big Nerd Ranch Guide**. Big Nerd Ranch Guides.
4. Griffiths, D. and Griffiths, D. **Head First Android Development**. O'Reilly Media.

Laboratory Work

The laboratory component should provide hands-on experience covering the major concepts taught in the theory course.

Lab 1: Development Environment Setup

- Install and configure Android Studio.
- Configure Android SDK and emulator.
- Create and run a basic project.

Lab 2: Basic Android Application

- Create a "Hello World" application.
- Understand project structure.
- Run the application on an emulator or physical device.

Lab 3: UI and Layout Design

- Design applications using Linear, Constraint and Grid layouts.
- Use TextView, EditText, Button, ImageView and other widgets.

Lab 4: Forms and Validation

- Create a registration/login form.
- Implement input validation.
- Display error messages.

Lab 5: Lists and Advanced UI

- Implement ListView/RecyclerView.
- Create GridView and Card-based interfaces.
- Implement scrolling and navigation.

Lab 6: Activities, Fragments and Intents

- Create multiple activities.
- Pass data between activities.
- Implement fragments.
- Use explicit and implicit intents.

Lab 7: Menus, Dialogues and Notifications

- Create option and context menus.
- Implement AlertDialog and Toast.
- Create basic application notifications.

Lab 8: Data Storage

- Implement Shared Preferences.
- Create an SQLite database.
- Perform basic CRUD operations.

Lab 9: Web Service and API Integration

- Connect a mobile application to a REST API.
- Retrieve JSON data.
- Parse and display API data.

Lab 10: Networking

- Implement API calls using Volley or Retrofit.
- Handle network errors and exceptions.

Lab 11: Maps and GPS

- Integrate Google Maps.
- Obtain the device's current location.
- Display location markers.

Lab 12: Firebase and Push Notifications

- Configure Firebase.
- Implement Firebase Cloud Messaging.

- Send and receive push notifications.

Lab 13: Testing and Debugging

- Debug application errors.
- Perform unit and functional testing.
- Test application on different screen sizes.

Lab 14: Application Security

- Implement basic authentication.
- Apply secure data storage practices.
- Understand secure API communication.

Lab 15: Mini Project

Students will design and develop a complete mobile application that integrates several course concepts, such as:

- User interface design
- Multiple activities/fragments
- Local database
- REST API
- Authentication
- GPS/Maps
- Push notifications



Far Western University
Faculty of Education
Bachelor's in Computer Science Education(B.Ed.CSIT)

Course Title: E-Commerce and E-Governance
Course No.: CS.Ed. 486
Level: Undergraduate
Semester: 8th

Nature: Theory and Practical
Credit Hour: 48
Teaching Hours: 48 + 16
Full Marks: 40 + 40 + 20

1. Course Introduction

This course introduces the concepts, technologies, applications, and practices of E-Commerce and E-Governance in the context of the digital economy and digital public services. The course provides students with theoretical knowledge and practical understanding of electronic business models, online payment systems, digital marketing, cybersecurity, legal and ethical issues, and the technologies supporting electronic commerce. It also explores the principles of e-Governance, digital government, public service delivery, digital transformation, and citizen-centric governance.

Special emphasis is given to Nepal's digital transformation initiatives, including the Digital Nepal Framework, Nagarik App, National Identity Card, Government Integrated Data Center (GIDC), Electronic Transaction Act, and other government digital services. Through case studies, practical exercises, and project work, students will analyse contemporary digital business models and e-Governance initiatives while developing the knowledge and skills required to participate in Nepal's digital economy and public sector digital transformation.

2. Objectives

The general objective of this course is to develop conceptual understanding and practical competency in electronic commerce and electronic governance, enabling students to analyse, implement, and evaluate digital business solutions and digital government services in national and global contexts.

After completing this course, students will be able to:

- i. Explain the concepts, scope, and applications of E-Commerce and E-Governance.
- ii. Analyse various electronic business models and digital marketplaces.
- iii. Understand electronic payment systems and online transaction security.
- iv. Apply legal, ethical, and cybersecurity principles in digital commerce.
- v. Explain models and stages of e-Governance implementation.
- vi. Analyse Nepal's digital governance initiatives and public digital services.
- vii. Evaluate emerging technologies influencing E-Commerce and E-Governance.
- viii. Analyse national and international case studies related to digital commerce and governance.
- ix. Develop simple digital business and e-Governance project proposals.

3. Specific Objectives and Contents

Specific Objectives	Contents
• Explain the concept of digital economy and digital transformation. • Define E-Commerce and describe its evolution. • Explain the concept and importance of E-Governance. • Differentiate E-Commerce and E-Governance. Explain the relationship between digital business and digital government.	Unit I: Introduction to Digital Economy, E-Commerce and E-Governance (6 hrs) 1.1 Digital Economy • Concept and Characteristics • Digital Transformation • Digital Society 1.2 Introduction to E-Commerce • Definition and Features • Evolution of E-Commerce • Advantages and Challenges 1.3 Introduction to E-Governance • Definition • Objectives • Scope and Importance 1.4 E-Commerce vs E-Governance 1.5 Digital Business, Digital Government and Digital Citizenship.
• Explain various E-Commerce business models. • Describe E-Commerce infrastructure. • Explain online marketplaces. • Understand website design principles. • Explain logistics and supply chain concepts. • Describe digital marketing concepts.	Unit II: E-Commerce Technologies and Business Models (8 hrs) 2.1 E-Commerce Business Models • B2B • B2C • C2C • C2B • B2G and G2B 2.2 E-Commerce Infrastructure • Internet and Web Technologies • Web Servers • Domain Names • Hosting Services 2.3 Digital Marketplaces • Amazon • Daraz Nepal • eBay • Alibaba 2.4 E-Commerce Website Components • Product Catalogue • Shopping Cart • Customer Accounts • Order Management 2.5 E-Commerce Logistics • Order Processing • Inventory Management • Delivery Systems • Reverse Logistics 2.6 Introduction to Digital Marketing • SEO (Concept) • Social Media Marketing

	• Email Marketing • Online Advertising
• Explain electronic payment systems. • Describe digital payment platforms used in Nepal. • Explain digital wallets and online transactions. • Explain online transaction security. • Explain digital signatures and PKI. • Understand legal and ethical issues.	Unit III: Electronic Payment Systems, Security and Cyber Laws (8 hrs) 3.1 Electronic Payment Systems • Payment Gateways • Credit/Debit Cards • Internet Banking • Mobile Banking 3.2 Digital Payments in Nepal • eSewa • Khalti • IME Pay • Fonepay • Nepal QR 3.3 Digital Wallets and Electronic Fund Transfer 3.4 E-Commerce Security • SSL/TLS • Encryption (Concept) • Authentication • Authorization 3.5 Digital Signature and Public Key Infrastructure (Introduction) 3.6 Legal and Ethical Issues • Electronic Transaction Act, 2063 • Consumer Protection • Privacy and Data Protection • Cybercrime and Cyber Ethics
• Explain the concepts and objectives of e-Governance. • Describe different interaction models of e-Governance. • Explain the maturity stages of e-Governance. • Identify key components of digital government infrastructure. • Explain e-Readiness and factors affecting successful implementation.	Unit IV: E-Governance Models and Digital Government (8 hrs) 4.1 Foundations of E-Governance • Objectives and Principles • Benefits and Challenges • Good Governance and Digital Governance 4.2 E-Governance Models • Government to Citizen (G2C) • Government to Business (G2B) • Government to Government (G2G) • Government to Employee (G2E) 4.3 Evolution and Maturity Models • Information Stage • Interaction Stage • Transaction Stage • Integration and Transformation Stage 4.4 Digital Government Infrastructure • ICT Infrastructure • Data Centres • Government Networks • Cloud Infrastructure

	4.5 E-Readiness Assessment • Technical Readiness • Institutional Readiness • Human Resource Readiness • Legal Readiness
• Explain the evolution of e-Governance in Nepal. • Describe Nepal's national digital transformation initiatives. • Explain the legal framework supporting e-Governance. • Describe major government digital services. • Explain digital infrastructure supporting government services. • Evaluate the challenges and future opportunities of e-Governance in Nepal.	Unit V: E-Governance in Nepal (8 hrs) 5.1 Evolution of E-Governance in Nepal 5.2 Digital Nepal Framework • Vision and Objectives • Priority Sectors • Digital Transformation Initiatives 5.3 Legal and Policy Framework • Electronic Transaction Act, 2063 • Right to Information Act • National Cyber Security Policy (Overview) • Digital Signature 5.4 Government Digital Services in Nepal • Nagarik App • National Identity Card • Inland Revenue e-Services • Department of Passports Online Services • Online Company Registration • Driving Licence Information System 5.5 Government Digital Infrastructure • Government Integrated Data Centre (GIDC) • National Data Centre • Government Cloud Initiatives 5.6 Issues, Challenges and Future Prospects of E-Governance in Nepal
• Explain emerging trends in digital commerce and governance. • Describe modern technologies influencing digital transformation. • Explain smart governance concepts. • Analyse national and international case studies. • Evaluate future directions of digital business and governance.	Unit VI: Emerging Trends, Case Studies and Future Directions (10 hrs) 6.1 Emerging Trends • Mobile Commerce (m-Commerce) • Mobile Governance (m-Governance) • Social Commerce • Open Government Data 6.2 Emerging Technologies • Artificial Intelligence in Business and Government • Blockchain Applications • Internet of Things (IoT) • Big Data Analytics (Overview) 6.3 Smart Government and Smart Cities • Smart City Concepts • Digital Public Services • Citizen Engagement 6.4 Case Studies Nepal: • Digital Nepal Framework • Nagarik App • Government Electronic Procurement (e-GP)

	• Digital Payment Ecosystem (eSewa, Khalti, Fonepay) International: • Estonia's Digital Government • Singapore Smart Nation • Digital India Mission 6.5 Future Directions • Sustainable Digital Economy • Green ICT • Digital Inclusion • Ethical Issues and Future Challenges
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4. Methodology and Techniques

The course shall be delivered using a combination of student-centred and activity-based teaching-learning methods.

Teaching Methods

- Interactive lectures
- Classroom discussions
- Multimedia presentations
- Demonstration
- Guided laboratory practice
- Case study analysis
- Group discussion
- Seminar presentation
- Project-based learning
- Guest lectures from ICT professionals and government agencies
- Independent learning

Learning Activities

Students will be engaged in:

- Analysis of e-commerce websites
- Exploration of Nepal Government online portals
- Digital payment demonstrations
- Case study analysis
- Group presentations
- Practical laboratory exercises
- Mini project
- Assignment writing
- Report preparation
- Field visit (where feasible)

5. Evaluation Scheme

5.1 Internal Evaluation (40%)

Activities	Marks
Attendance and Class Participation	10

Assignment and Presentation	10
Case Study / Mini Project and Viva	10
Mid-Term Examination	10
Total	40

Assignments may include:

- Comparative analysis of two e-commerce platforms
- Evaluation of Nepal Government digital services
- Case study of a digital payment platform
- Digital business proposal
- Report on Digital Nepal Framework

5.2 External Evaluation (40%)

Types of questions	Total questions to be asked	Number of questions to be answered and marks allocated	Total marks
Group A: Multiple choice items	8 questions	8×1	8
Group B: Short answer questions	6 with 2 'or' questions	6×4	24
Group C: Long answer questions	1 with 1 'or' question	1×8	8

5.3 External Practical Evaluation (20%)

The practical examination shall be conducted by an external examiner with the assistance of an internal examiner. Students shall demonstrate practical knowledge, present laboratory work, and defend their mini project during a three-hour practical examination.

6. Practical Evaluation

Components	Marks
Practical Record Book	5
Viva-Voce	5
Practical Examination	10
Total	20

7. Laboratory Work

Students shall perform laboratory exercises corresponding to the theory covered in the course.

Lab 1: Study of popular E-Commerce websites (Amazon, Daraz, eBay)

Lab 2: Comparison of B2B, B2C and C2C business models

- Lab 3:** Design of a simple E-Commerce website prototype
- Lab 4:** Study of shopping cart, order management and customer account systems
- Lab 5:** Demonstration of online payment systems and payment gateways
- Lab 6:** Study of digital payment platforms in Nepal (eSewa, Khalti, IME Pay, Fonepay)
- Lab 7:** Exploration of SSL certificates and secure online transactions
- Lab 8:** Analysis of cyber security threats in E-Commerce
- Lab 9:** Exploration of Nagarik App and selected online government services
- Lab 10:** Study of Digital Nepal Framework and government digital initiatives
- Lab 11:** Comparative evaluation of government websites using usability and accessibility criteria
- Lab 12:** Case study presentation on a Nepalese e-Governance project
- Lab 13:** Case study presentation on an international e-Governance initiative
- Lab 14:** Preparation of a digital business proposal or e-Governance improvement plan
- Lab 15:** Mini Project: Design a prototype digital solution for a local business or public service (e.g., online shop, municipal information portal, appointment booking system, or citizen service portal), including a written report and presentation.

8. Online Learning Platforms and Software Tools

Students are encouraged to use the following platforms and tools:

1. Google Sites or WordPress (website development)
2. WooCommerce or Shopify (demonstration)
3. Canva (business presentations)
4. Google Forms (online surveys and citizen feedback)
5. Nepal Government Portal (www.nepal.gov.np)
6. Nagarik App
7. Digital Nepal Framework portal
8. eSewa and Khalti (demonstration)
9. Fonepay QR ecosystem (conceptual study)
10. Google Analytics (overview)
11. Moodle or Google Classroom
12. YouTube Learning Resources and Coursera (supplementary learning)

9. Recommended Books

Prescribed Textbooks

1. Turban, E., King, D., Lee, J., Liang, T. P., & Turban, D. (2018). *Electronic Commerce: A Managerial and Social Networks Perspective* (9th ed.). Springer.
2. Laudon, K. C., & Traver, C. G. (2023). *E-Commerce 2023: Business, Technology, Society* (18th ed.). Pearson.
3. Prabhu, C. S. R. (2012). *E-Governance: Concepts and Case Studies*. PHI Learning. (This remains a valuable reference for governance concepts and aligns with the earlier syllabus.)

Reference Books

1. Heeks, R. (2006). *Implementing and Managing e-Government*. SAGE Publications.
2. United Nations. *United Nations E-Government Survey* (latest edition).
3. Government of Nepal. *Digital Nepal Framework*.
4. Government of Nepal. *Electronic Transaction Act, 2063*.
5. Government of Nepal. *National Cyber Security Policy* (latest available version).



Far Western University
Faculty of Education
Bachelor in Computer Science Education (B.Ed.CSIT)

Course Title: Database Administration

Course No.: CS. Ed 487.1

Level: Under Graduate

Semester: Eighth

Nature of the Course: Theory and Practical

Credit Hour: 3

Teaching Hrs: 48+16

Full marks: 40+40+20

1. Course Introduction

This course familiarizes students with different concepts of database administration including DBA Roles and responsibilities, table space and storage management, DB backup, restoration and recovery, security, multitenant, and performance tuning.

2. Objectives

Upon completion of the course, the student can:

- i. Understand the basic role, task and responsibilities of Database Administrator.
- ii. Understand the Oracle database architecture and how its components work and interact with one another
- iii. Be able to install and configure an Oracle Database.
- iv. Be able to administer the Oracle Database, create and manage storage structures and Create and manage the users.
- v. Be able to perform backup and recovery, tuning the oracle database for the better performance.
- vi. Be able to create database objects like tables, views, indexes etc. and able to write PL/SQL Procedures

3. Specific Objectives and Contents

Specific Objectives	Contents
• Understand the different roles and responsibilities of DBA at different environment • Understand the Oracle database architecture and how its components work and interact with one another. • Understand the Oracle Automatic Storage Management • Understand the Oracle Client Application and its use • Use of oracle tools like SQL PLUS,	Unit I: Introduction (12 hr) 1.1 DBA Roles and Responsibilities 1.2 Database Architecture 1.3 ORACLE logical and physical database structure 1.4 Memory and Process Structure 1.5 SQLPLUS Overview 1.6 iSQL*PLUS 1.7 Oracle Database installation, Database creation, starting up and shutting down oracle instance 1.8 Communicating between Databases; Using Dynamic Performance Views, Using the Automatic Diagnostic Repository (ADR), Using the Alert Log and Trace Files, Managing Initialization Parameter Files
• Create and manage storage structures • Understand how table data is stored and the storage structure of Oracle Database.	Unit II: Table Space and Storage Management(8 hr) 2.1. Working with Table spaces and Data Files 2.2. Creating and adding table space and data files 2.3. Managing Control Files, Online Redo Logs and Archive logs

• Creating Table spaces, data files and Space Management in Table spaces • Understand the importance of multiplexing • Understand the importance of database archiving • Understand the Concept of Oracle Managed Files	2.4. Multiplexing control file 2.5. Manage FRA(Flash Recovery Area) 2.6. Oracle Managed Files (OMF)
• Creating tables, views, profiles, Sequences, Synonyms, Indexes • Use of PL/SQL Blocks, procedure, functions • Use of database links for accessing the remote database	Unit III: Creating and Managing Database Objects (10 Hrs) 3.1. Create and Delete a Database 3.2. Password Management 3.3. Describe the stages of database startup 3.4. Use of DML operations on tables 3.5. Creating users and schema 3.6. Working with Tables and Constraints 3.7. Working with Indexes, Views, Synonyms, and Sequences 3.8. Partitioning and Materialized Views 3.9. Introduction of PLSQL, Stored Procedure, Functions, Trigger, package
• Perform basic backup and recovery of a database • Understand the concept of physical backup and logical backup • Understand cold backup and hot backup Learn the recovery process in case of failure • Use of flashback technique to recover the database • Understanding the use of oracle data pump tool for export and import of database	Unit IV: Database Backup and Recovery (8 Hrs) 4.1. Backup and Recovery Overview 4.2. Database backup, restoration and recovery 4.3. Oracle Secure Backup 4.4. Types of Database Failure 4.5. defining a backup and recovery strategy 4.6. Backup and Recovery options 4.7. Data Dump 4.8. User-Managed Backup and Recovery 4.9. Configuring RMAN; RMAN Backups, Restore and Recovery 4.10. High Availability Features; Oracle Data Guard, Flashback operations Database Corruption Detection
• Understand basic concept of database security and auditing • Discuss need of database authentication methods • Understand data encryption technique	Unit V: Database Security and Auditing (5 Hrs) 5.1. Database Security and Auditing 5.2. Database Authentication Methods 5.3. Database Authorization Methods 5.4. Data Encryption Techniques 5.5. Virtual Private Database 5.6. Managing Users and Security: Profiles, managing users, managing privileges, managing roles
• Understand the concept of tuning Learn the use of dynamic performance views to monitor the performance • Use of different tools like	Unit VI: Database Tuning(5 Hrs) 6.1. Tuning Application Design; Tuning Memory Usage; Tuning Data Access; Tuning Data Manipulation 6.2. Reducing Network Traffic; Using Automatic Workload Repository(AWR); Automatic Database

ADDM, SQL Tuning Advisor for the performance optimization • Understand the use of memory component for the best performance	Diagnostic Monitor(ADDM) 6.3. Tuning SQL; SQL Tuning Advisor, Performance Tuning in a Multitenant Environment 6.4. Distributed Databases and Networking Tool
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4. Methodology and Techniques

Modes of instruction: Lecture, seminar, exercise course, guided personal study, tutorial, independent study, project work, Assignments in different topics, group discussion, reflective writing

Types of learning activities

Attending lectures, performing specific assignments, writing papers, independent and private study, reading books, journals and papers, providing constructive feedback, group study and peer discussion.

5. Evaluation Scheme

5.1 Internal Evaluation 40%

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- Assignment I: Reflective Notes and Class presentation:** 5+5=10marks
(*Reflectivenoteson2to4questionsgivenbyteacherattheend of the every unit and presentation on any two questions among them*)
- Assignment II: One Term paper/Essay/Project and Interview:** 5+5=10marks
(*Logical essay /term paper /project on the topics chosen by students and approved by the teacher and interview*)
- Mid-term exam:** 10marks

5.2 External Evaluation (Final Examination) 40%

Types of questions	Total questions to be asked	Number of questions to be answered and marks allocated	Total marks
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5.3 External Practical Evaluation (20%)

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the external examiner. Three hours' time will be given for the practical examination. In this examination Students must demonstrate the knowledge of the subject matter.

6. Evaluation System:

Practical	Weightage	Marks
Practical Report Copy	5	20
Viva	5	
Practical Exam	10	

Laboratory Work

The laboratory work should include all the concepts mentioned in the course using any appropriate DBMS system.

Recommended Books:

1. Pro Oracle Database 18c Administration: Manage and Safeguard Your Organization's Data, Michelle Malcher and Darl Kuhn, Third Edition.
2. Fernandez, I. Beginning Oracle Database 12c Administration. Apress.
3. Press, O. Oracle Database 19 C: Administration Workshop vol-I/II.
4. Oracle Database 12c DBA Handbook, Manage a Scalable, Secure Oracle Enterprise Database Environment, Bob Bryla.
5. Oracle DBA Mentor: Succeeding as an Oracle Database Administrator, Brian Peasland. Elmasri, R. and B. Navathe, S.B.(2010). Fundamentals of Database Systems, 6th Edition, Pearson Addison Wesley.



Far Western University
Faculty of Education
Bachelor's in Computer Science Education(B.Ed.CSIT)

Course Title: System and Network Administration
Course No.: CS.Ed. 487.2
Level: Undergraduate
Semester: 8th

Nature of the Course: Theory and Practical
Credit Hour: 48
Teaching Hours: 48 + 16
Full Marks: 40 + 40 + 20

1. Course Introduction

System and Network Administration is a fundamental course designed to provide students with theoretical knowledge and practical skills required to install, configure, manage, secure, and maintain computer systems and networks. The course introduces the principles of operating system administration, network administration, server management, system security, virtualization, and cloud-based administration. Students will gain hands-on experience in configuring Windows and Linux operating systems, managing users and file systems, administering network services, implementing security mechanisms, and troubleshooting common system and network problems.

Special emphasis is given to educational institutions and small to medium-sized organizational environments where graduates are expected to manage computer laboratories, campus networks, servers, and ICT infrastructure. The course also introduces virtualization, cloud technologies, and emerging trends in system administration to prepare students for modern computing environments. The practical component enables students to develop competency in managing computer systems and networks using contemporary administrative tools and simulation software.

2. Objectives

The general objective of this course is to develop conceptual understanding and practical competency in system and network administration so that students can effectively install, configure, administer, secure, and maintain computer systems and networks in educational institutions and other organizations.

After completing this course, students will be able to:

- i. Explain the concepts, functions, and responsibilities of system and network administration.
- ii. Install, configure, and administer Windows and Linux operating systems.
- iii. Manage users, groups, storage devices, and file systems.
- iv. Configure and troubleshoot computer networks and network services.
- v. Install and manage basic network servers.
- vi. Apply system and network security mechanisms to protect computing resources.
- vii. Perform backup, recovery, monitoring, and preventive maintenance.
- viii. Understand virtualization, cloud administration, and emerging trends in system administration.
- ix. Design and manage ICT infrastructure for educational institutions

3. Specific Objectives and Contents

Specific Objectives	Contents
• Explain the concept of system administration. • Describe network administration and its importance. • Identify the roles and responsibilities of system and network administrators. • Differentiate between client-server and peer-to-peer networks. • Describe various operating systems used for administration. • Identify major network components and services. • Understand documentation and administrative best practices.	Unit I: Introduction to System and Network Administration (5 hrs) 1.1 Introduction to System Administration 1.2 Introduction to Network Administration 1.3 Roles and Responsibilities of System and Network Administrators 1.4 Client-Server and Peer-to-Peer Architecture 1.5 Windows, Linux and Unix Operating Systems Overview 1.6 Basic Network Components and Services 1.7 Administrative Documentation, Ethics and Professional Practices
• Install Windows and Linux operating systems. • Understand the boot process. • Manage disks and partitions. • Manage users and groups. • Configure file permissions and ownership. • Install and manage software packages. • Schedule administrative tasks. • Monitor system resources. • Use command-line administrative tools.	Unit II: Operating System Administration (8 hrs) 2.1 Installation and Configuration of Windows and Linux Operating Systems 2.2 Boot Process and System Startup 2.3 Disk Partitioning and File Systems 2.4 User and Group Administration 2.5 File Permissions and Access Control 2.6 Software Installation and Package Management 2.7 Task Scheduling and System Utilities 2.8 System Monitoring and Performance Management 2.9 Basic Windows Command Prompt and Linux Shell Commands
• Configure computer network interfaces. • Understand IP addressing concepts. • Configure Dynamic Host Configuration Protocol (DHCP). • Configure Domain Name System (DNS). • Configure file and printer sharing. • Perform remote administration. • Troubleshoot network problems. • Understand network monitoring techniques.	Unit III: Network Administration (8 hrs) 3.1 Network Interface Configuration 3.2 IPv4 Addressing and Basic Subnetting Review 3.3 DHCP Concepts and Configuration 3.4 DNS Concepts and Configuration 3.5 Network File and Printer Sharing 3.6 SSH and Remote Desktop Administration 3.7 Network Troubleshooting Tools (Ping, Traceroute, Ipconfig/Ifconfig, Netstat, Nslookup) 3.8 Introduction to Network Monitoring Tools
• Explain the concept and functions of network servers. • Install and configure web server services. • Configure and manage file and print servers.	Unit IV: Server Administration (8 hrs) 4.1 Introduction to Server Administration and Types of Servers 4.2 Web Server Administration (Apache and

• Explain the purpose and configuration of FTP servers. • Describe proxy server concepts and applications. • Explain directory services and domain concepts. • Monitor and maintain server performance. • Troubleshoot common server-related problems.	IIS Basics) 4.3 File Server and Print Server Configuration 4.4 FTP Server Installation and Configuration 4.5 Proxy Server: Concepts, Configuration and Applications 4.6 Introduction to Active Directory and Domain Services 4.7 Server Monitoring, Performance Tuning and Maintenance 4.8 Common Server Troubleshooting Techniques
• Explain the importance of system and network security.	Unit V: System Security and Maintenance (7 hrs) 5.1 Introduction to System and Network Security 5.2 User Authentication, Password Policies and Access Control 5.3 Firewall Concepts and Basic Configuration 5.4 Antivirus, Anti-malware and Endpoint Protection 5.5 Backup Strategies, Data Recovery and Disaster Recovery 5.6 System Monitoring, Logging, Software Updates and Patch Management 5.7 Preventive Maintenance and Troubleshooting Techniques
• Explain the concept and benefits of virtualization. • Compare different hypervisors. • Install and manage virtual machines. • Explain cloud computing concepts. • Describe cloud-based system administration. • Explain containerization and automation concepts.	Unit VI: Virtualization and Cloud Administration (6 hrs) 6.1 Introduction to Virtualization and Virtual Machines 6.2 Type-I and Type-II Hypervisors 6.3 Virtual Machine Creation and Management using VirtualBox or VMware 6.4 Introduction to Cloud Computing (IaaS, PaaS and SaaS) 6.5 Cloud-based Administration and Storage Services 6.6 Introduction to Containers (Docker Concept) and Automation Tools (Overview)
• Explain emerging technologies in system administration. • Describe modern network management approaches. • Explain Green Computing practices. • Design ICT infrastructure for educational institutions.	Unit VII: Emerging Trends and Educational Applications (6 hrs) 7.1 AI-assisted System Administration and Intelligent Monitoring Tools 7.2 Introduction to Software-Defined Networking (Concept Only) and Network

• Evaluate ICT policies and best practices in educational institutions. • Explain future trends in system and network administration.	Automation 7.3 Green Computing and Sustainable ICT Infrastructure 7.4 Planning and Management of Computer Laboratories and Campus Networks 7.5 ICT Policies, Asset Management, Documentation and Ethical Practices 7.6 Future Trends in System Administration, Cloud Services and Artificial Intelligence
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4. Methodology and Techniques

Modes of Instruction

The course will be delivered using a combination of:

- Interactive lectures
- Laboratory demonstrations
- Guided practical sessions
- Tutorials
- Seminar presentations
- Project-based learning
- Case studies
- Group discussions
- Independent study
- Assignment-based learning
- Problem-solving activities

Types of Learning Activities

Students are expected to participate in the following learning activities:

- Attending lectures and laboratory sessions
- Installing and configuring operating systems
- Configuring network devices and services
- Performing system administration tasks
- Solving system and network troubleshooting problems
- Preparing laboratory reports
- Conducting case studies on educational ICT infrastructure
- Group discussion and peer learning
- Independent reading of manuals, journals and technical documentation
- Mini project involving the design and administration of a small computer laboratory or organizational network

5. Evaluation Scheme

5.1 Internal Evaluation (40%)

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

a) Attendance and Participation in Class Activities:

5 + 5 = **10 Marks**

b) Assignment I: Reflective Notes and Class Presentation: $5 + 5 = 10$ Marks

Students will prepare reflective notes on selected topics from each unit and deliver a presentation on any one of the assigned topics.

c) Assignment II: Term Paper / Case Study / Mini Project and Interview: $5 + 5 = 10$ Marks

Students shall prepare a term paper, case study, or mini project related to system or network administration. Suggested topics include:

- Computer Laboratory Management
- Windows vs Linux Administration
- School Network Design
- Network Security Policy
- Backup and Disaster Recovery Plan
- Virtualization in Educational Institutions
- Cloud Computing for Education

The project shall be followed by an interview/viva.

d) Midterm Examination: **10 marks**

5.2 External Evaluation (Final Examination) (40%)

Types of Questions	Total Questions to be Asked	Questions to be Answered	Marks
Group A: Multiple Choice Questions	8	8×1	8
Group B: Short Answer Questions	6 (with 2 OR questions)	6×4	24
Group C: Long Answer Questions	1 (with 1 OR question)	1×8	8
Total			40

5.3 External Practical Evaluation (20%)

The Office of the Controller of Examinations shall conduct the final practical examination after the completion of the theoretical examination. Students shall demonstrate the practical knowledge and skills acquired during the semester. There shall be one External Examiner assisted by one Internal Examiner.

Duration of Practical Examination: Three Hours

6. Practical Evaluation System

Practical Component	Marks
Practical Record Book	5
Viva-Voce	5
Practical Examination	10
Total	20

7. Recommended Books and Reference Materials

1. Limoncelli, T. A., Hogan, C., & Chalup, S. (2017). *The Practice of System and Network Administration* (3rd ed.). Addison-Wesley.
2. Nemeth, E., Snyder, G., Hein, T., & Whaley, B. (2021). *UNIX and Linux System Administration Handbook* (5th ed.). Addison-Wesley.
3. Sobell, M. G. (2021). *A Practical Guide to Linux Commands, Editors, and Shell Programming* (5th ed.). Pearson.

Reference Materials

1. Kurose, J. F., & Ross, K. W. (2022). *Computer Networking: A Top-Down Approach* (8th ed.). Pearson.
2. Microsoft Learn Documentation. Windows Server Administration.
3. Red Hat Enterprise Linux System Administration Guides.
4. Cisco Networking Academy Learning Resources.
5. VMware Documentation.
6. Oracle VirtualBox User Manual.
7. NIST Cybersecurity Framework Documentation.

8. Laboratory Work (Separate Section – 15 Practical Sessions)

Students shall perform guided laboratory exercises using Windows, Linux, Cisco Packet Tracer, VirtualBox/VMware, and related administrative tools.

Lab 1: Installation of Windows Operating System and Basic Configuration

Lab 2: Installation of Linux Operating System and Basic Shell Commands

Lab 3: User Account, Group Management and File Permissions in Windows and Linux

Lab 4: Disk Partitioning, File Systems and Storage Management

Lab 5: IPv4 Configuration, Network Connectivity Testing and Basic Network Commands

Lab 6: Configuration of DHCP and DNS Services (Simulation or Virtual Environment)

Lab 7: Remote Administration using SSH and Remote Desktop

Lab 8: Installation and Configuration of Apache Web Server

Lab 9: Configuration of File Sharing and Print Sharing Services

Lab 10: Basic Firewall Configuration and Security Settings

Lab 11: System Backup, Restore and Recovery Techniques

Lab 12: System Monitoring, Performance Analysis and Task Scheduling

Lab 13: Creating and Managing Virtual Machines using VirtualBox or VMware

Lab 14: Design and Simulation of a School Computer Laboratory Network using Cisco Packet Tracer

Lab 15: Mini Project: Installation, Configuration and Documentation of a Small Computer Laboratory Network including Operating System Installation, User Management, Network Configuration, Shared Resources, Security Measures and Backup Strategy

9. Online Learning Platforms and Simulation Tools

To strengthen theoretical understanding and practical competency in system and network administration, students are encouraged to use the following software, simulation environments and online resources.

1. Cisco Packet Tracer

Simulation software for designing, configuring and troubleshooting computer networks.

2. Oracle VirtualBox

Virtualization software for creating and managing multiple operating systems.

3. VMware Workstation Player

Virtual machine software for operating system installation and administration.

4. Ubuntu Linux

Open-source Linux operating system for learning Linux system administration.

5. Windows Server Evaluation

Microsoft platform for learning Windows Server administration.

6. Microsoft Learn

Official online learning platform for Windows Server, PowerShell and Azure administration.

7. Red Hat Learning Resources

Official documentation and tutorials for Linux system administration.

8. Cisco Networking Academy

Interactive networking courses and laboratories.

9. Wireshark

Network protocol analyzer for monitoring and troubleshooting network traffic.

10. PuTTY

SSH and Telnet client for secure remote administration.

11. Docker (Introductory)

Containerization platform for understanding modern application deployment.

12. GitHub

Repository hosting platform for storing scripts, configuration files and collaborative documentation.



Far Western University
Faculty of Education
Bachelor in Computer Science Education (B.Ed. CSIT)

Course Title: Cloud Computing
Course No.: CS. Ed. 487.3
Level: Undergraduate
Semester: Eighth Semester

Nature of the Course: Theory and Practical
Credit Hour: 3
Teaching Hrs: 48+16
Full marks: 40+40+20

1. Course Introduction

The course introduces the ideas and techniques underlying the principles of cloud computing. This course covers a series of current cloud computing technologies, including technologies for Infrastructure as a Service, Platform as a Service, and Software as a Service. This course is designed to introduce the concepts of Cloud Computing as a new computing paradigm. The students will have an opportunity to explore the Cloud Computing various terminology, principles and applications. The course will expose students to different views of understanding the Cloud Computing such as theoretical, technical and commercial aspects.

2. Objectives

The primary learning outcomes are that the students 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, Discuss system virtualization and outline its role in enabling the cloud computing system model, Analyze various cloud programming models and apply them to solve problems on the cloud.

The main objective of this course is: -

- i. To provide students with the fundamentals and essentials of Cloud Computing.
- ii. 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.
- iii. To provide the knowledge about the SOA, cloud security and cloud disaster management.

3. Specific Objectives and Contents

Specific Objectives	Contents
- Understand basics cloud framework Understand concepts of cloud computing - Understand the features of cloud computing - Understand the cloud deployment models - Understand Service Oriented Architecture (SOA)	Unit I: Introduction to cloud computing and SOA (12 Hrs) 1.1 Evolution of Cloud computing 1.2 Components of cloud computing 1.3 Characteristic of cloud computing 1.4 Benefits and Challenges of cloud computing 1.5 Grid Cloud Computing vs Grid Computing 1.6 Cloud deployment models: Public, Private, Hybrid, Community. 1.7 Cloud Service Models: IaaS, PaaS, SaaS 1.8 Legal issues in cloud computing 1.9 Cloud adoption

• Explore significance of SOA in Cloud Computing	1.10 Service Oriented Architectures (SOA), Characterizing SOA and Importance of SOA to cloud computing
• Understand concepts of virtualization and its approaches • Explore concepts of virtualization in cloud environment	Unit II: Virtualization (8 Hrs) 2.1 Basic Concepts of virtualization, Hardware virtualization, Server virtualization, Storage virtualization, Data Centre virtualization OS virtualization, Para virtualization 2.2 Benefits of virtualization 2.3 Role of virtualization in enabling cloud services, Cloud computing as a virtualized service 2.4 Types of hypervisor and load balancing
• Understand the cloud migration and its need • Explore the cloud migration model • Determine the risks during cloud migration	Unit III: Cloud Programming Models (8 hrs) 3.1. Thread programming 3.2. Task programming 3.3. Map-reduce programming, 3.4. Parallel efficiency of Map-Reduce 3.5. Enterprise batch processing using Map-Reduce 3.6. Comparisons between Thread, Task and Map reduce.
• Understand various cloud service models • Understand and analyze various aspects of the cloud service models • Explore the real world cloud services	Unit IV: Cloud Service Models (10 Hrs) 4.1. Infrastructure-as-a-Service (IaaS) 4.2. Platform-as-a-Service (PaaS), Key Characteristics of PaaS 4.3. Software-as-a-Service (SaaS): SaaS Implementation Issues, Key Characteristics of SaaS, Benefits of the SaaS Model 4.4. Communication-as-a-Service (CaaS): Advantages of CaaS 4.5. Monitoring-as-a-Service (MaaS) 4.6. Jericho Cloud Cube Model 4.7. Amazon's Web Services 4.8. Cloud Computing from the Google Perspective 4.9. Window Azure and Online Services
• Understand security in cloud Understand risk assessment in cloud • Explore various intrusion detection mechanisms in cloud environment. • Understand how to handle cloud disasters and how to mitigate the disaster	Unit V: Cloud Security (10 Hrs) 5.1. Cloud Security Challenges, Dimensions of Cloud Security: Security & Privacy, Compliance, and Legal or Contractual Issues 5.2. Risk Management, Security Monitoring, Incident Response Planning, Security Architecture Design, Vulnerability Assessment, Data and Application Security, Virtual Machine Security 5.3. Handling Disasters in Cloud, Disaster Recovery, Disaster Recovery Planning, Disaster Management.

4. Methodology and Techniques

Modes of instruction: Lecture, seminar, exercise course, guided personal study, tutorial, independent study, project work, Assignments in different topics, group discussion, reflective writing

Types of learning activities

Attending lectures, performing specific assignments, writing papers, independent and private study, reading books, journals and papers, providing constructive feedback, group study and peer discussion.

5. Evaluation Scheme

5.1 Internal Evaluation 40%

Internal Evaluation will be conducted by course teacher based on following activities.

- a) Attendance and Participation in class activities: 5+5=10marks
- b) Assignment I: Reflective Notes and Class presentation: 5+5=10marks
(Reflectivenoteson2to4questionsgivenbyteacherattheend of the every unit and presentation on any two questions among them)
- c) Assignment II: One Term paper/Essay/Project and Interview: 5+5=10marks
(Logical essay /term paper /project on the topics chosen by students and approved by the teacher and interview)
- d) Mid-term exam: 10marks

5.2 External Evaluation (Final Examination) 40%

Types of questions	Total questions to be asked	Number of questions to be answered and marks allocated	Total marks
Group A: Multiple choice items	8 questions	8×1	8
Group B: Short answer questions	6 with 2 'or' questions	6×4	24
Group C: Long answer questions	1 with 1 'or' question	1×8	8

5.3 External Practical Evaluation (20%)

Office of the Controller of Examination will conduct final practical examination at the end of final examination. After completing the end semester theoretical examination, practical examination will be held. External examiner will conduct the practical examination according to the following evaluation criteria. There will be an internal examiner to assist the external examiner. Three hours' time will be given for the practical examination. In this examination Students must demonstrate the knowledge of the subject matter.

6. Evaluation System:

Practical	Weightage	Marks
Practical Report Copy	5	20
Viva	5	
Practical Exam	10	

Laboratory Work

Student should have practical session for realization of cloud services as well as virtualization. The tools and frameworks for the simulation of cloud and virtualized environments can be decided by the instructor.

Prescribed Text

1. Dan C. Marinescu, Cloud Computing: Theory and Practice, Morgan Kaufmann.
2. Dr. Kumar Saurabh, Cloud Computing

Reference Books

1. Rajkumar Buyya, The University of Melbourne and Manjrasoft Pty Ltd., Australia, James Broberg, The University of Melbourne, Australia Andrzej Goscinski, Deakin University, Australia, *Cloud Computing Principles and Paradigm*, John Wiley and Sons Inc. Publication.
2. John W. Rittinghouse and James F. Ransome, *Cloud Computing: Implementation Management and Security*,
3. George Reese, Cloud Application architecture, O'Reilly Media Inc.
4. Judith Hurwitz, Robin Bloor, Marcia Kaufman, Fern Halper, *Cloud Computing for Dummies*, Wiley Publishing Inc.
5. Borko Furht, Armando Escalante, *Handbook of cloud computing*, Springer, 2010
6. David S. Linthicum, *Cloud Computing and SOA Convergence in your Enterprise*, a step by step guide, Addison Wesley.



Far Western University
Faculty of Education
Bachelor in Computer Science Education (B.Ed. CSIT)

Course Title: Management Information System

Course No.: CS. Ed 487.4

Level: Under Graduate

Semester: Eighth Semester

Nature of the Course: Theory and Practical

Credit Hour: 3

Teaching Hrs: 48+16

Full marks: 40+40+20

1. Course Introduction

This course introduces information systems that are used for organizational decision making & problem solving. It discusses the significant managerial aspects of treating information as an organizational resource and its increasing impact on today's organization. Besides this, it will include topic of ethical, social and political issues of IS, securing information systems, enhancing decision making, and project management.

2. Objectives

By the end of this course, it is expected the student will be able to

- i. Highlight information systems and their effectiveness in organization success
- ii. Understand types of MIS applications in organisations
- iii. To provide concepts of new ethical issues, security threats, information system development process
- iv. Analyze the business issues, processes, and techniques associated with organizational information systems;
- v. Select and design MIS systems appropriate to meet management requirements.
- vi. Critically evaluate MIS contributions to the strategic management of organisations
- vii. Identify project management tools, techniques and risks

3. Specific Objectives and Contents

Specific Objectives	Contents
• Discuss the role of information system. • Understand trends in MIS, Challenges & opportunities due to globalization. • Discuss Data vs Information, information system and information technology.	Unit I: Information Systems in Global Business (6 hr) 1.1. Role of Information Systems in Business, How Information Systems are Transforming Business 1.2. New trends in MIS, Globalization Challenges and Opportunities, Emerging Digital Firm 1.3. Data vs Information, Information System, Information technology, Dimensions of IS, Contemporary approaches to IS
• Understand role of information systems to enhance business process • Explore information systems used in different organizational levels & functional areas	Unit II: Business and Information Systems (10 hr) 2.1. Business Processes, Use of Information Technology to Enhance Business Process 2.2. Systems for Different Management Groups: Transaction Processing Systems, Management Information Systems, Decision Support Systems, Executive Support Systems

• Conceptualize role of enterprise applications and collaboration systems in business firms • Define the Enterprise Systems, supply chain management.	2.3. Systems for Different Functional Areas: Finance and Accounting Systems, Sales and Marketing Systems, HR Systems, Manufacturing and Production Systems 2.4. Systems for Linking Enterprise: Enterprise Systems, Supply Chain Management Systems, Customer Relationship Systems, Knowledge Management Systems
• Understand Organization and Impact of IS in Organizations • Discuss competitive advantages of using information systems. • Explain Business value chain and impact of internets in competitive advantages	Unit III: Information Systems & Organizational Strategy(7 hr) 3.1. Definition of Organization, Features of Organization, Impact of IS on Organization and Business Firms 3.2. Information Systems and Competitive Advantages, Porters Competitive Force Model, Using Information System to Deal with Competitive Forces, Impact of Internet on Competitive Advantages. 3.3. Business Value Chain Model, The Value Web
• Relate ethical issues with society and politics • Understand the types of ethical issues raised due to growth of information systems & internet • Describe & exemplify moral dimensions of information age • Identify some ethical dilemmas created due to information systems	Unit IV: Ethical & Social Issues Related to IS (7 hr) 4.1. Understanding Social and Ethical Issues: Ethics, Relationship between Ethical, Social and Political Issues, Moral Dimensions of Information Age, Technology trends that raises Ethical Issues 4.2. Ethics in Information Society: Responsibility, Accountability & Liability, Ethical Analysis 4.3. MIS Hands-on Project: Analyzing Privacy and other Ethical Issues by Analyzing Data, Business Case
• Describe the reasons behind vulnerabilities of information systems • Understand business value of security & control • Identify & explain different tools used for protecting organizational information	Unit V: Securing Information Systems (7 hr) 5.1. Why Systems are Vulnerable, Internet Vulnerabilities, Wireless Security Challenges, Malicious Software, Hackers and Computer Crime, Software Vulnerabilities 5.2. Business value of Security and Control 5.3. Information System Control, Risk assessment, Security Policy, Disaster Recovery and Business Continuity Planning 5.4. Access Control, Firewalls, Intrusion Detection Systems, Antivirus Software, Securing wireless Networks
• Understand different types of decisions and decision making process • Demonstrate the role of DSS, MIS and ESS is Decision making • Discuss importance of GDSS and ESS in firms	Unit VI: Enhancing Decision Making (8 hr) 6.1. Decision Making and Information Systems: Business Value of Improved Decision Making, Types of Decisions, Decision Making Process, Managers and Decision Making 6.2. Systems for Decision Support: Management Information Systems, Decision Support Systems, Executive Support Systems, Web Based Customer Decision Support Systems, Group Decision Support Systems
• Describe the role of information systems in	Unit VII Planning & Building Information Systems (3 hr) 7.1 System development and Organizational Change, Business

organizational changes & improvements • Understand core activities of system development process	Process Reengineering, Process Improvement, Information Systems and Quality Improvements 7.2. System Development Process, Structured and Object Oriented System Modeling and Design Methodologies, Computer Aided Software Engineering
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4. Methodology and Techniques

Modes of instruction: Lecture, seminar, exercise course, guided personal study, tutorial, independent study, project work, Assignments in different topics, group discussion, reflective writing

Types of learning activities

Attending lectures, performing specific assignments, writing papers, independent and private study, reading books, journals and papers, providing constructive feedback, group study and peer discussion.

5. Evaluation Scheme

5.1 Internal Evaluation 40%

Internal Evaluation will be conducted by course teacher based on following activities.

- Attendance and Participation in class activities:** 5+5=10marks
- Assignment I: Reflective Notes and Class presentation: 5+5=10marks
(Reflective notes on 2 to 4 questions given by teacher at the end of the every unit and presentation on any two questions among them)
- Assignment II: One Term paper/Essay/Project and Interview: 5+5=10marks**
(Logical essay /term paper /project on the topics chosen by students and approved by the teacher and interview)
- Mid-term exam:** 10marks

5.2 External Evaluation (Final Examination) 40%

Types of questions	Total questions to be asked	Number of questions to be answered and marks allocated	Total marks
Group A: Multiple choice items	8 questions	8×1	8
Group B: Short answer questions	6 with 2 'or' questions	6×4	24
Group C: Long answer questions	1 with 1 'or' question	1×8	8

5.3 External Practical Evaluation (20%)

Office of the Controller of Examination will conduct final practical examination at the end of final examination. After completing the end semester theoretical examination, practical examination will be held. External examiner will conduct the practical examination according to the following evaluation criteria. There will be an internal examiner to assist the external examiner. Three hours' time will be given for the practical examination. In this examination Students must demonstrate the knowledge of the subject matter.

6. Evaluation System:

Practical	Weightage	Marks
Practical Report Copy	5	20
Viva	5	
Practical Exam	10	

Field Visit/Case Study

First, each student will join a group. The student or student group (at most 4 students) needs to finish a written case study report (2000 – 3000 words) on the effectiveness and limitations of some existing information system. The Field Visit/Case study report must reflect your understanding on basic concepts taught in the course and capability of using them to analyze practical cases.

The case study should be outlined tentatively as follows:

- a) Abstract
- b) Introduction and purpose of Information System
- c) Categorization of the IS
- d) Infrastructures required for the IS
 - ☞ Hardware Infrastructure
 - ☞ Software Infrastructure
 - ☞ Network Infrastructure
- e) Data Sources and Data Analysis required for the IS
- f) Effectiveness of the IS and its Assistance to Management
- g) Conclusion, Limitations of the IS and Recommendations for Enhancements

Prescribed Text

1. *Laudon, K. C. & Laudon, J. P.(2013). Management Information Systems, 12th Edition Pearson.*
2. *James A. O'Brien, George Marakas.(2006). Management Information Systems, 7th Edition McGraw-Hill Companies.*
3. *R. Kelly Rainer, Efraim Turban, Richard E. Potter.(2006). Introduction to Information Systems: Supporting and Transforming Business, Wiley, 1st Edition.*



Far Western University
Faculty of Education
Bachelor of Computer Science Education (B.Ed. CSIT)

Course Title: Net Centric Computing
Course No.: CS.Ed. 488.1
Level: Undergraduate
Semester: 8th

Nature of the Course: Theory and Practical
Credit Hour: 48
Teaching Hours: 48 + 16
Full Marks: 40 + 40 + 20

1. Course Introduction

Net-Centric Computing is the study of computing systems, applications, and services that operate over computer networks, particularly the Internet. The course provides students with theoretical knowledge and practical skills required to design, develop, deploy, and maintain modern web-based applications using contemporary Internet technologies. Students explore client-server architecture, web protocols, client-side and server-side programming, web services, distributed computing, cloud computing, and application security.

Since students have already studied fundamental web technologies such as HTML, CSS, JavaScript, PHP, and relational databases, this course extends their knowledge by introducing the ASP.NET Core MVC framework using C#, enabling them to develop modern enterprise-style web applications. The course also covers RESTful APIs, cloud concepts, web application security, and current trends in Internet-based computing. Through laboratory exercises and a mini project, students will develop practical skills in building secure and scalable net-centric applications.

2. Course Objectives

After completing this course, students will be able to:

- i. Explain the concepts, architecture, and characteristics of Net-Centric Computing.
- ii. Analyze Internet technologies, client-server architecture, and web communication protocols.
- iii. Develop dynamic web applications using ASP.NET Core MVC and C#.
- iv. Design database-driven web applications using Entity Framework Core.
- v. Develop RESTful web services and consume APIs.
- vi. Apply authentication, authorization, and security mechanisms in web applications.
- vii. Explain distributed computing, cloud computing, and modern Internet application architectures.
- viii. Develop and deploy a complete net-centric web application.

3. Specific Objectives and Course Contents

Specific Objectives	Contents
- Explain Net-Centric Computing concepts. - Explain Internet architecture. - Describe communication protocols. - Explain web application architecture.	Unit I: Introduction to Net-Centric Computing and Internet Architecture (6 hrs) 1.1 Introduction to Net-Centric Computing - Definition - Characteristics - Evolution - Applications 1.2 Internet and Web Architecture - Internet Architecture

• Explain current Internet technologies.	• Client-Server Architecture • Multi-tier Architecture 1.3 Internet Communication Protocols • HTTP/HTTPS • URL and URI • DNS Overview 1.4 Web Application Architecture • Static vs Dynamic Websites • Front-end and Back-end Architecture • MVC Architecture (Concept) 1.5 Emerging Internet Technologies • Cloud Services • Web Services • APIs • Progressive Web Applications (Introduction)
• Review client-side technologies. • Develop interactive interfaces. • Exchange asynchronous data. • Explain client-side frameworks. • Design responsive user interfaces	Unit II: Client-Side Technologies for Net-Centric Applications (8 hrs) 2.1 Modern Client-Side Development • HTML5 Features • CSS3 Features • Responsive Design using Bootstrap 2.2 Advanced JavaScript • ES6 Concepts • DOM Manipulation • Event Handling 2.3 AJAX and JSON • AJAX Concepts • JSON Objects • Fetch API 2.4 Introduction to Modern JavaScript Frameworks • React (Overview) • Angular (Overview) • Vue.js (Overview) 2.5 UI/UX Principles for Web Applications
• Explain ASP.NET Core architecture. • Develop MVC applications. • Create dynamic web pages. • Manage routing. • Develop forms. • Perform CRUD operations. • Connect databases.	Unit III: UNIT III: Server-Side Development using ASP.NET Core MVC (10 hrs) 3.1 Introduction to ASP.NET Core MVC • .NET Platform • Visual Studio • Project Structure 3.2 MVC Components • Models • Views • Controllers 3.3 Razor View Engine • Layouts • Partial Views • Tag Helpers 3.4 Routing and Navigation

	3.5 Model Binding and Validation 3.6 Entity Framework Core • DbContext • Migration (Basic) • CRUD Operations 3.7 SQL Server Connectivity
• Explain service-oriented architecture. • Develop RESTful APIs. • Exchange application data. • Consume APIs. • Explain authentication mechanisms.	Unit IV: Cloud Service Models (10 Hrs) 4.1 Service-Oriented Architecture (SOA) 4.2 REST Architecture • Resources • HTTP Methods • Status Codes 4.3 JSON-based Web APIs 4.4 API Integration • Third-Party APIs • API Testing using Postman 4.5 Basics of Authentication and Authorization • Identity Concepts • Session Management • Cookies
• Explain distributed computing. • Describe cloud computing. • Explain web deployment. • Apply web security measures. • Explain performance optimization.	Unit V: Cloud Security (10 Hrs) 5.1 Distributed Computing Concepts 5.2 Cloud Computing • IaaS • PaaS • SaaS 5.3 Web Application Deployment (Conceptual) 5.4 Web Application Security • SQL Injection • Cross-Site Scripting (XSS) • Cross-Site Request Forgery (CSRF) • HTTPS 5.5 Performance and Scalability • Caching (Concept) • Load Balancing (Overview)
• Explain modern Internet technologies. • Describe DevOps concepts. • Develop a complete application. • Analyze current trends.	UNIT VI: Emerging Trends and Project Development (8 hrs) 6.1 Emerging Technologies • Progressive Web Applications (PWA) • Serverless Computing (Concept and application) • Internet of Things (IoT) Integration (Overview and applications) 6.2 Introduction to DevOps • Git and GitHub(Working with GitHub) • Continuous Integration/Continuous Deployment (CI/CD) Concepts 6.3 Mini Project Development • Planning • Design • Implementation

	• Testing • Documentation 6.4 Future Trends in Net-Centric Computing • Artificial Intelligence Integration • Cloud-Native Applications • Edge Computing
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4. Methodology and Techniques

The course will be delivered through a combination of theory, demonstrations, laboratory practice, and project-based learning. Emphasis will be given to developing practical skills in designing, developing, securing, and deploying modern net-centric applications.

Teaching Methods

- Interactive lectures
- Multimedia presentations
- Live coding demonstrations
- Guided laboratory exercises
- Problem-based learning
- Case study analysis
- Group discussions
- Seminar presentations
- Mini project development
- Peer learning and code review
- Independent learning

Learning Activities

Students will participate in:

- Developing client-side web pages
- Building ASP.NET Core MVC applications
- Creating database-driven web applications
- Developing and testing RESTful APIs
- Integrating APIs into web applications
- Implementing authentication and authorization
- Performing security testing
- Developing a complete mini project
- Preparing technical documentation and project reports

5. Evaluation Scheme

5.1 Internal Evaluation (40%)

Activities	Marks
Attendance and Class Participation	10
Assignment and Presentation	10
Mini Project / Case Study and Viva	10

Mid-Term Examination	10
Total	40

Suggested Assignments

Students may be assigned one or more of the following:

- Comparative study of PHP and ASP.NET Core MVC
- Analysis of a modern web application architecture
- Design of an MVC-based web application
- RESTful API documentation and testing
- Cloud deployment case study
- Web application security analysis

5.2 External Evaluation (40%)

Types of questions	Total questions to be asked	Number of questions to be answered and marks allocated	Total marks
Group A: Multiple choice items	8 questions	8×1	8
Group B: Short answer questions	6 with 2 'or' questions	6×4	24
Group C: Long answer questions	1 with 1 'or' question	1×8	8

5.3 External Practical Evaluation (20%)

The practical examination shall be conducted by an External Examiner assisted by an Internal Examiner after completion of the theoretical examination. Students shall demonstrate the practical skills acquired throughout the semester by performing assigned laboratory tasks, presenting the mini project, and attending a viva-voce examination.

Duration: Three Hours

6. Practical Evaluation

Components	Marks
Practical Record Book	5
Viva-Voce	5
Practical Examination	10
Total	20

7. Laboratory Work

Students shall perform the following practical exercises using **Visual Studio, ASP.NET Core MVC, SQL Server, Postman, GitHub, and related development tools.**

- Lab 1:** Installation and configuration of Visual Studio, .NET SDK, and SQL Server Express
- Lab 2:** Creating the first ASP.NET Core MVC project and understanding project structure
- Lab 3:** Creating Models, Views, and Controllers using ASP.NET Core MVC
- Lab 4:** Working with Razor Views, Layout Pages, and Tag Helpers
- Lab 5:** Developing HTML Forms, Model Binding, and Server-side Validation
- Lab 6:** Database connectivity using Entity Framework Core and SQL Server
- Lab 7:** Implementing CRUD (Create, Read, Update, Delete) operations
- Lab 8:** Routing, Navigation, and Partial Views
- Lab 9:** Creating and consuming RESTful Web APIs
- Lab 10:** Testing Web APIs using Postman and JSON data exchange
- Lab 11:** Implementing basic Authentication and Authorization
- Lab 12:** Applying web security practices (HTTPS, input validation, SQL Injection and XSS awareness)
- Lab 13:** Version control using Git and GitHub for collaborative development
- Lab 14:** Deployment of a web application in a local hosting environment (IIS Express or equivalent)
- Lab 15:** Mini Project: Design, develop, test, document, and present a complete ASP.NET Core MVC web application integrating database operations and basic security features.

8. Online Learning Platforms and Development Tools

Students are encouraged to use the following platforms and tools for self-learning and practical activities:

Development Tools

- Visual Studio Community Edition
- .NET SDK
- SQL Server Express / SQL Server Developer Edition
- SQL Server Management Studio (SSMS)
- Visual Studio Code
- Git
- GitHub
- Postman

Learning Platforms

- Microsoft Learn
- Microsoft ASP.NET Documentation
- .NET Documentation
- W3Schools
- MDN Web Docs
- freeCodeCamp
- Coursera
- edX
- YouTube Learning Resources

Supporting Technologies

- Bootstrap
- JSON
- REST API
- Swagger/OpenAPI (Overview)

9. Recommended Books and References

Prescribed Textbooks

1. Freeman, A. (2024). *Pro ASP.NET Core 9* (11th ed.). Apress.
2. Galloway, J., Haack, P., Wilson, B., & Allen, K. (2023). *Professional ASP.NET Core MVC*. Wrox.
3. Deitel, P., & Deitel, H. (2021). *Internet and World Wide Web: How to Program* (6th ed.). Pearson.

Reference Books

1. Kurose, J. F., & Ross, K. W. (2022). *Computer Networking: A Top-Down Approach* (8th ed.). Pearson.
2. Microsoft Learn. *ASP.NET Core Documentation*.
3. Microsoft Learn. *Entity Framework Core Documentation*.
4. Fielding, R. (2000). *Architectural Styles and the Design of Network-based Software Architectures* (REST Dissertation).
5. W3C. *Web Standards and Recommendations*.
6. Mozilla. *MDN Web Docs*.



Far Western University
Faculty of Education
Bachelor of Computer Science Education (B.Ed. CSIT)

Course Title: Data Warehousing and Data Mining
Course No.: CS.Ed.488.2
Level: Undergraduate
Semester: Eighth

Nature: Theory and Practical
Credit : 3
Teaching Hours: 48 + 16
Full Marks: 40 + 40 + 20

1. Course Introduction

Data has become one of the most valuable resources for organizations, educational institutions, businesses, governments, and researchers. Traditional operational databases are designed for day-to-day transactions, whereas decision makers require integrated historical data for planning and analysis. Data Warehousing provides a centralized repository that supports decision making by integrating data from multiple sources. Data Mining enables the extraction of meaningful patterns, trends, relationships, and knowledge from large volumes of data.

This course introduces the concepts, architecture, design principles, and implementation of data warehouses together with fundamental data mining techniques. Students will learn dimensional modelling, ETL (Extract, Transform and Load), OLAP operations, data preprocessing, classification, clustering, association rule mining, and evaluation of mining results. Practical sessions emphasize the use of modern open-source tools to design small data warehouses, perform data analysis, and implement basic mining algorithms.

Upon completion of this course, students will be able to design simple data warehouses, prepare datasets, perform exploratory analysis, and apply basic data mining techniques for decision support in education, business, healthcare, agriculture, and government.

2. Course Objectives

After completing this course, students will be able to:

- i. Explain the concepts and importance of Data Warehousing and Data Mining.
- ii. Differentiate operational databases from data warehouses.
- iii. Design dimensional models using star and snowflake schemas.
- iv. Perform ETL processes for integrating data from multiple sources.
- v. Apply OLAP operations for multidimensional data analysis.
- vi. Perform data preprocessing and data quality improvement.
- vii. Apply fundamental data mining techniques including classification, clustering, and association rule mining.
- viii. Evaluate mining results and interpret discovered knowledge.
- ix. Develop a small data warehouse and perform basic data mining using contemporary tools.

3. Specific Objectives and Course Contents

Specific Objectives	Contents
- Explain the need for Data Warehousing. - Differentiate OLTP and OLAP systems.	Unit I: Introduction to Data Warehousing and Decision Support Systems (6 hrs) 1.1 Introduction to Data Warehousing Definition

• Explain Decision Support Systems. • Describe Data Warehouse Architecture. • Explain metadata and warehouse management.	• Characteristics • Applications 1.2 Operational Database vs Data Warehouse • OLTP • OLAP • Comparison 1.3 Decision Support Systems (DSS) • Components • Business Intelligence Overview 1.4 Data Warehouse Architecture • Data Sources • ETL Layer • Warehouse Repository • Data Marts 1.5 Metadata and Warehouse Administration
• Design dimensional models. • Construct warehouse schemas. • Explain ETL processes. • Perform data cleaning. • Explain warehouse implementation strategies.	Unit II: Data Warehouse Design and ETL (8 hrs) 2.1 Dimensional Modelling • Facts • Dimensions • Measures 2.2 Data Warehouse Schemas • Star Schema • Snowflake Schema • Fact Constellation 2.3 Extract, Transform and Load (ETL) • Data Extraction • Data Transformation • Data Loading 2.4 Data Quality Management • Missing Values • Duplicate Records • Inconsistent Data 2.5 Data Warehouse Development Approaches • Top-down • Bottom-up • Incremental Development
• Perform multidimensional analysis. • Prepare data for mining. • Describe feature selection techniques. • Explain visualization techniques.	Unit III: OLAP and Data Preprocessing (8 hrs) 3.1 Online Analytical Processing (OLAP) 3.2 OLAP Operations • Roll-up • Drill-down • Slicing • Dicing • Pivoting 3.3 Data Preprocessing • Data Cleaning • Data Integration • Data Transformation • Data Reduction 3.4 Attribute Selection and Feature Engineering

• Explain the concept, objectives, and process of Data Mining. • Explain the Knowledge Discovery in Databases (KDD) process. • Classify the major data mining techniques • Apply classification techniques to solve real-world problems. • Apply clustering techniques for grouping similar data. • Explain association rule mining and discover relationships among data. • Explain anomaly detection techniques.	3.5 Data Visualization for Decision Making Unit IV: Fundamentals of Data Mining Techniques (10 hrs) 4.1 Introduction to Data Mining • Definition and Objectives • Importance of Data Mining • Applications of Data Mining • Data Mining vs Data Warehousing 4.2 Knowledge Discovery in Databases (KDD) • Data Selection • Data Preprocessing • Data Transformation • Data Mining • Pattern Evaluation and Knowledge Presentation 4.3 Data Mining Techniques (Overview) • Predictive Mining • Descriptive Mining • Classification • Clustering • Association Rule Mining • Outlier Analysis • Integration and Transformation Stage 4.4 Classification Techniques • Concept of Classification • Decision Tree (Concept and Basic Implementation) • Naïve Bayes (Concept and Basic Implementation) • Applications of Classification 4.5 Clustering Techniques • Concept of Clustering • K-Means Algorithm (Concept and Basic Implementation) • Hierarchical Clustering (Concept) • Applications of Clustering 4.6 Association Rule Mining • Market Basket Analysis • Support • Confidence • Lift (Introduction) • Apriori Algorithm (Concept and Basic Implementation) 4.7 Outlier Detection • Concept of Outliers • Types of Outliers • Applications in Fraud Detection, Intrusion Detection, and Healthcare
• Evaluate mining results. • Explain visualization of mining results. • Describe applications in different sectors. • Explain ethical issues. • Discuss big data concepts.	Unit V: Data Mining Applications and Evaluation (8 hrs) 5.1 Evaluation of Data Mining Models • Accuracy • Precision • Recall • Confusion Matrix (Concept) 5.2 Data Visualization and Reporting

	5.3 Applications of Data Mining • Education • Healthcare • Agriculture • Banking • E-Commerce • Government 5.4 Data Privacy, Security and Ethical Issues 5.5 Introduction to Big Data and Business Analytics
• Explain modern data analytics trends. • Describe AI-supported analytics. • Develop a simple data warehouse project. • Interpret analytical results.	Unit VI: Emerging Trends and Mini Project (8 hrs) 6.1 Modern Data Analytics Ecosystem • Data Lakes (Introduction) • Cloud Data Warehousing (Concept) • Real-Time Analytics (Overview) 6.2 Artificial Intelligence and Data Mining • Predictive Analytics (Concept) • Recommendation Systems (Overview) • Educational Data Mining (Introduction) 6.3 Mini Project • Problem Identification • Warehouse Design • ETL • Analysis • Documentation 6.4 Presentation and Interpretation of Findings

4. Methodology and Techniques

The course will be delivered through interactive lectures, demonstrations, laboratory exercises, project-based learning, and case studies.

Teaching Methods

- Interactive lectures
- Multimedia presentations
- Demonstrations
- Guided laboratory exercises
- Case studies
- Dataset analysis
- Group discussions
- Seminar presentations
- Mini project
- Independent learning

Learning Activities

Students will:

- Design dimensional models
- Build simple data warehouses
- Perform ETL operations

- Analyse multidimensional data
- Implement basic mining algorithms
- Interpret mining results
- Present case studies
- Prepare technical reports

5. Evaluation Scheme

Internal Evaluation (40%)

Activities	Marks
Attendance and Participation	10
Assignment and Presentation	10
Mini Project / Case Study and Viva	10
Mid-Term Examination	10
Total	40

External Evaluation (40%)

Types of questions	Total questions to be asked	Number of questions to be answered and marks allocated	Total marks
Group A: Multiple choice items	8 questions	8×1	8
Group B: Short answer questions	6 with 2 'or' questions	6×4	24
Group C: Long answer questions	1 with 1 'or' question	1×8	8

Practical Evaluation (20%)

Components	Marks
Practical Record Book	5
Viva-Voce	5
Practical Examination	10
Total	20

6. Laboratory Work

Students shall perform the following practical exercises.

1. Installation of **MySQL/PostgreSQL** and **Power BI Community** or **Metabase**.
2. Creation of operational database and sample datasets.
3. Design of Star Schema and Snowflake Schema.

4. Development of Dimension Tables and Fact Tables.
5. ETL using CSV files and SQL queries.
6. Data Cleaning using SQL and spreadsheet tools.
7. OLAP operations (Roll-up, Drill-down, Slice, Dice).
8. Data visualization using Power BI or Metabase.
9. Classification using Decision Tree (Orange Data Mining or Weka).
10. Classification using Naïve Bayes.
11. Clustering using K-Means.
12. Association Rule Mining using Apriori.
13. Analysis of educational datasets (student performance, attendance, examination results).
14. Comparative evaluation of mining techniques.
15. Mini Project: Design a small data warehouse and perform data mining on a real or simulated dataset. Students should document the warehouse design, ETL process, analysis performed, findings, and recommendations.

7. Online Learning Platforms and Software Tools

Data Warehouse and Database Tools

- MySQL Workbench
- PostgreSQL
- SQL Server Express (optional)

Data Analytics and Visualization

- Power BI Desktop (Community)
- Metabase
- Google Looker Studio

Data Mining Tools

- Weka
- Orange Data Mining
- RapidMiner (Community Edition)

Programming and Analysis

- Jupyter Notebook (optional)
- Google Colab (optional for demonstrations)
- Python (Pandas and Scikit-learn – introductory demonstrations only)

8. Learning Platforms

- Kaggle Datasets
- UCI Machine Learning Repository
- Microsoft Learn
- Coursera
- edX

9. Recommended Books

Prescribed Textbooks

1. Han, J., Kamber, M., & Pei, J. (2012). *Data Mining: Concepts and Techniques* (3rd ed.). Morgan Kaufmann.
2. Kimball, R., & Ross, M. (2013). *The Data Warehouse Toolkit* (3rd ed.). Wiley.
3. Connolly, T., & Begg, C. (2015). *Database Systems: A Practical Approach to Design, Implementation, and Management* (6th ed.). Pearson.

Reference Books

1. Inmon, W. H. (2005). *Building the Data Warehouse* (4th ed.). Wiley.
2. Shmueli, G., Bruce, P., Gedeck, P., & Patel, N. (2020). *Data Mining for Business Analytics*. Wiley.
3. Witten, I. H., Frank, E., Hall, M. A., & Pal, C. J. (2017). *Data Mining: Practical Machine Learning Tools and Techniques* (4th ed.). Morgan Kaufmann.



Far Western University
Faculty of Education
Bachelor in Computer Science Education (B.Ed. CSIT)

Course Title: Multimedia Computing

Course No.: CS. Ed. 488.3

Level: Under Graduate

Semester: Eighth Semester

Nature of the Course: Theory and Practical

Credit Hour: 3

Teaching Hrs: 48+16

Full marks: 40+40+20

1. Course Introduction

This course introduces students to the fundamental concepts, technologies, principles, and applications of multimedia computing. It covers various multimedia elements, including text, audio, images, graphics, video, and animation, along with their representation, processing, storage, transmission, and integration. The course also covers data compression, multimedia user-interface design, programming abstractions, multimedia system development, and practical applications such as e-learning, entertainment, telemedicine, video conferencing, and video-on-demand.

2. Objectives

By the end of this course, students will be able to:

- i. Explain the fundamental concepts and characteristics of multimedia computing.
- ii. Identify and describe the components and building blocks of multimedia systems.
- iii. Explain the representation, processing, and transmission of audio, images, graphics, video, and animation.
- iv. Apply appropriate techniques for multimedia data compression and storage.
- v. Use multimedia software tools for creating and editing multimedia content.
- vi. Design effective and user-friendly multimedia interfaces.
- vii. Explain programming abstractions and software architectures used in multimedia applications.
- viii. Apply systematic methodologies for multimedia application development.
- ix. Integrate different media elements into multimedia applications.
- x. Explain the applications, challenges, and future trends of multimedia computing.

3. Specific Objectives and Contents

Specific Objectives	Contents
- Define multimedia and multimedia computing. - Explain the concept of different media types. - Describe the global structure of multimedia systems. - Identify the components and building blocks of multimedia systems. - Explain the characteristics and properties of multimedia systems. - Discuss major challenges involved in multimedia computing. - Identify different areas where	Unit I: Introduction to mobile Computing and Mobile Application (8 hr) 1.1.Introduction to Multimedia (Definition of multimedia, Multimedia computing, Evolution of multimedia) 1.2.Types of Media(Text, Audio, Image, Graphics, Video, Animation) 1.3.Global Structure of Multimedia 1.4.Multimedia Systems (Definition, Properties, Characteristics) 1.5. Components of Multimedia Systems 1.6.Multimedia Building Blocks 1.7.Challenges of Multimedia Systems - Large data volume - Storage requirements - Processing requirements

multimedia technology is applied.	• Network bandwidth • Synchronization • Security 1.8.Scope and Applications of Multimedia Computing
• Explain the basic concepts and characteristics of sound. • Differentiate between analog and digital audio. • Explain the process of converting sound into digital form. • Describe digital audio representation and file formats. • Differentiate between speech and music signals. • Explain speech generation, analysis, and transmission. • Describe MIDI and compare it with digital audio.	Unit II: Sound and Audio Systems (8 hr) 2.1.Introduction to Sound and Audio Systems 2.2.Characteristics of Sound (Frequency, Amplitude, Wavelength, Pitch, Loudness) 2.3.Analog and Digital Audio 2.4.Digital Audio(Sampling, Quantization, Encoding) 2.5.Producing Digital Audio 2.6.Music and Speech, Speech Generation, Speech Analysis, Speech Transmission 2.7.Audio File Representation and Formats 2.8.Computer Music and MIDI 2.9.MIDI versus Digital Audio 2.10.Audio Compression and Streaming
• Explain the fundamentals of digital image representation. • Differentiate between raster and vector graphics. • Describe colour models used in digital images. • Explain common image and graphics file formats. • Apply basic image processing and editing techniques. • Explain image synthesis, analysis, and transmission. • Select appropriate image formats for different applications.	Unit III: Images and Computer Graphics (8 Hrs) 3.1. Introduction to Digital Images and Graphics 3.2. Uses of Images and Graphics 3.3. Digital Image Representation(Pixels, Resolution, Colour depth, Image dimensions) 3.4. Raster and Vector Graphics 3.5. Colour Models(RGB, CMYK, HSV) 3.6. Image and Graphics File Formats(JPEG/JPG, PNG, GIF, BMP, TIFF, SVG) 3.7. Image Synthesis and Image Analysis 3.8. Image Processing and Editing 3.9. Image Transmission 3.10. Introduction to Image Editing Tools
• Explain the fundamentals of digital video. • Describe video signal representation. • Identify common digital video formats. • Explain the principles of computer-based animation. • Differentiate between frame-based and timeline-based animation. • Explain tweening and keyframe animation. • Apply basic techniques for controlling and displaying animation.	Unit IV: Video and Animation (8 Hrs) 4.1. Introduction to Digital Video 4.2. Video Signal Representation 4.3. Digital Video Characteristics(Frame rate, Resolution, Aspect ratio, Bit rate) 4.4. Computer Video Formats(MP4, AVI, MOV, MKV) 4.5. Introduction to Computer Animation 4.6. Principles of Animation and Animation Languages 4.7. Frame-Based Animation and Timeline-Based Animation 4.8. Key frame and Tween-Based Animation 4.9. Methods of Controlling Animation

Describe video transmission and streaming.	4.10. Display and Transmission of Animation, Video Streaming
- Explain the need for multimedia data compression. - Differentiate between lossless and lossy compression. - Explain basic concepts of information and data compression. - Describe source, entropy, and hybrid coding. - Explain transform-based compression. - Describe JPEG and MPEG compression standards. - Analyse the relationship between compression ratio and multimedia quality.	Unit V: Multimedia Data Compression (4 Hrs) 5.1. Need for Multimedia Data Compression 5.2. Compression Fundamentals 5.3. Storage Space and Bandwidth Requirements 5.4. Coding Requirements, Compression Ratio 5.5. Lossless Compression - Run-Length Encoding (RLE) - Huffman Coding - LZW 5.6. Lossy Compression 5.7. Source Coding, Entropy Coding, Hybrid Coding 5.8. DCT-Based Compression, JPEG Compression, MPEG Compression 5.9. Comparison of Multimedia Compression Techniques
- Explain the multimedia application development life cycle. - Identify the roles and responsibilities of multimedia development teams. - Analyse user and system requirements. - Design multimedia content and navigation structures. - Develop and integrate multimedia components. - Test and evaluate multimedia applications. - Apply appropriate principles of multimedia user-interface design.	Unit VI: Multimedia System Design and Development (7 Hrs) 6.1. Multimedia Development Life Cycle 6.2. Multimedia Development Team - Project manager - Content designer - Graphic designer - Audio/video specialist - Programmer - UI/UX designer 6.3. Analysis Phase 6.4. Requirement Analysis 6.5. Design Phase 6.6. Storyboarding and Navigation Design 6.7. Development and Authoring Phase 6.8. Media Integration 6.9. Implementation Phase 6.10. Testing and Evaluation 6.11. Deployment and Maintenance 6.12. Multimedia User Interface Design
- Explain major applications of multimedia computing. - Describe the role of multimedia in education and entertainment. - Explain the use of multimedia in healthcare and telemedicine. - Discuss multimedia-based communication technologies. - Explain video conferencing and video-on-demand systems.	Unit VII: Multimedia Applications and Emerging Technologies (5 Hrs) 7.1. Media Preparation and Composition 7.2. Media Integration and Communication 7.3. Multimedia Entertainment 7.4. E-Learning and Digital Education 7.5. Telemedicine 7.6. Digital Video Editing and Production 7.7. Video Conferencing 7.8. Video-on-Demand

- Describe digital video editing and production systems. - Identify emerging trends in multimedia computing	7.9. Multimedia in Web and Mobile Applications 7.10. Virtual and Augmented Reality 7.11. Interactive Multimedia 7.12. Emerging Trends in Multimedia Computing
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4. Methodology and Techniques

Modes of instruction: Lecture, seminar, exercise course, guided personal study, tutorial, independent study, project work, Assignments in different topics, group discussion, reflective writing

Types of learning activities

Attending lectures, performing specific assignments, writing papers, independent and private study, reading books, journals and papers, providing constructive feedback, group study and peer discussion.

5. Evaluation Scheme

5.1 Internal Evaluation 40%

Internal Evaluation will be conducted by course teacher based on following activities.

- Attendance and Participation in class activities: 5+5=10marks**
- Assignment I: Reflective Notes and Class presentation: 5+5=10marks**
(Reflective notes on 2 to 4 questions given by teacher at the end of the every unit and presentation on any two questions among them)
- Assignment II: One Term paper/Essay/Project and Interview: 5+5=10marks**
(Logical essay /term paper /project on the topics chosen by students and approved by the teacher and interview)
- Mid-term exam: 10marks**

5.2 External Evaluation (Final Examination) 40%

Types of questions	Total questions to be asked	Number of questions to be answered and marks allocated	Total marks
Group A: Multiple choice items	8 questions	8×1	8
Group B: Short answer questions	6 with 2 'or' questions	6×4	24
Group C: Long answer questions	1 with 1 'or' question	1×8	8

5.3 External Practical Evaluation (20%)

Office of the Controller of Examination will conduct final practical examination at the end of final examination. After completing the end semester theoretical examination, practical examination will

be held. External examiner will conduct the practical examination according to the following evaluation criteria. There will be an internal examiner to assist the external examiner. Three hours' time will be given for the practical examination. In this examination Students must demonstrate the knowledge of the subject matter.

6. Evaluation System:

Practical	Weightage	Marks
Practical Report Copy	5	20
Viva	5	
Practical Exam	10	

Textbooks

1. Steinmetz, R. and Nahrstedt, K. **Multimedia: Computing, Communications and Applications**. Pearson Education Asia.
2. Buford, J. F. K. **Multimedia Systems**. Pearson Education Asia

Reference Books

1. Halsall, F. **Multimedia Communications: Applications, Networks, Protocols and Standards**. Pearson Education Asia.
2. Steinmetz, R. and Nahrstedt, K. **Multimedia Fundamentals**. Pearson Education Asia.
3. Vaughan, T. **Multimedia: Making It Work**. McGraw-Hill.
4. Tay Vaughan. **Multimedia: Making It Work**. McGraw-Hill Education.
5. Li, Z.-N., Drew, M. S. and Liu, J. **Fundamentals of Multimedia**. Springer.
6. Fluckiger, F. **Understanding Networked Multimedia: Applications and Technology**. Prentice Hall.

Laboratory Work

The laboratory component should provide students with practical experience in multimedia content creation, processing, editing, integration, and application development.

1. Introduction to multimedia authoring and editing tools.
2. Create and edit digital text and multimedia content.
3. Record and edit digital audio.
4. Convert audio between different formats.
5. Create and edit digital images using an image editing tool.
6. Convert images between different file formats and compare quality and size.
7. Create simple computer graphics.
8. Create a basic animation using keyframes and tweening.
9. Create and edit a short digital video.
10. Convert video into different formats and compare compression quality.
11. Apply image compression using JPEG and compare file sizes.
12. Demonstrate lossless and lossy compression techniques.
13. Design a multimedia user interface.
14. Create an interactive multimedia presentation.
15. Integrate text, audio, images, graphics, video, and animation into a multimedia project.
16. Develop a small multimedia application or interactive project.