Course Title: **MIS and E-Business**
Course Code: **CACS301**
Year/Semester: **III/V**
Class Load: **5Hrs. /Week (Theory: 3Hrs, Practical 2Hrs.)**

Course Description

This course provides the fundamental knowledge of Management Information System and E-Business and its associated infrastructure, security and protection issues, payment system and ultimately live implementation of any web application in Web server.

Objectives: The general objectives of this course is to know fundamental knowledge of MIS/E-Business and implement the web application in Web Server.

Unit 1:

Introduction to E-Commerce: Definitions and Concepts; Defining E-Business; Pure Versus Partial EC; EC Framework, Classification of EC; Benefits of E-Commerce; Electronic Markets; Role of Internet and Web in E-Commerce; The Limitations and Barriers of EC; Social Networks and Social Network Services; **M-Commerce**: Concept, Scope, Attributes, Benefits; Location-based l-commerce, l-Commerce Infrastructure, Location-Based Services and Applications. **7LH**

Unit 2:

The Network Infrastructure for E-Commerce: Introduction to Information Superhighway (I-Way), Components of the I-Way, Internet as a network infrastructure. **Wireless Application Protocol**: Wireless Application Protocol (WAP); Architecture of WAP; Working of WAP; Wireless Technologies: ADSL, WiMAX, WLAN, WMAN Wi-Fi, UMTS (3G), LTE (4G), (5G NR). Security Issues related to Wireless Communications. **8LH**

Unit 3: Introduction to Management Information System: Data, information, computer based information system (CBIS), Information System Resources, Management information system, Transaction processing (TPS) system, decision support system (DSS), and executive information system (EIS), ***SCM, CRMS and International Systems:*** Introduction, Supply Chain Management Systems, Customer Relationships Management Systems, enterprise systems and Challenges of Enterprise Systems Implementations- Managing the implementation, International Information Systems-Outsourcing and off-shoring. **8LH**

Unit 4: E-Commerce Security and Fraud Issues and Protections: Basic EC Security Terminology, The Threats, Attacks, and Attackers, **EC Security Requirements**: Confidentiality, Integrity, and Availability, Authentication, Authorization and Nonrepudiation; Technical Malware attack: Viruses, Worms, and Trojan Horses, Heartbleed, Distributed Denial of Service, Cryptolocker, Page hijacking, Botnets, Malvertising, ransomware, sniffing; Non-Technical Malware attack: Social Phishing, Pharming, Identity

Theft and Identify Fraud, Spam Attacks; EC defense Strategy: access control(Authorization and Authentication, Biometric Systems), encryption and PKI (Symmetric Key Encryption, Asymmetric Key Encryption, Certificate Authority(CA), Secure Socket Layer (SSL). Securing e-commerce networks: Firewalls, Virtual Private Networks, Intrusion Detection Systems (IDS), intrusion prevention System (IPS). **10LH**

Unit 5: E-payment systems:

Online payment cards (credit cards, charge cards, debit cards, smart cards), processing cards in online, credit card payment procedure, e-micropayments, e-checking and its processing in online. Automated clearing house (ACH) network, mobile payments (Digital wallet), mobile payment participants and issues, international payments, emerging EC payment systems and issues: crypto currency, virtual currency. A case study of emerging trends in online payment system in Nepal. **6 LH**

Unit 6: Launching a Successful EC Website:

Planning Online Businesses (Business Plan, The cost-benefit, risk elements of a business case, funding a New Online Business, EC Model selection), The process of building a website, basic hierarchical website structure, website hosting and obtaining a domain name (cPanel management, upload EC site to the web Server), web content creation and management: (Web content, Categories and Types of Content, Content Management and Maintenance, Catalog Content and its Management), Website design criteria, Site Map and Navigation, Web page layout grid, Colors and Graphics, Website Usability, Performance, Website Promotion, implementation of Payments system, Website Promotion, Search Engine Optimization (SEO). **10LH**

Laboratory Works: **32LH**

Laboratory works should be done covering all the topics listed above and a project work should be carried out by individually implementing a fully functioning e-commerce web application along with payment system.

Text Book

Efraim Turban, D. K. (2018). *Electronic Commerce:A Managerial and Social Networks Perspective.* New York: Springer

References Book

Chaffey, D. (2009). *E-Business and E-Commerce Management: Strategy, Implementation and Practice (4th Edition).* Harlow: Prentice Hall.

Kalakota, A. B. (1996). *Frontiers of Electronic Commerce.* Pearson.

Kenneth C. Laudon, C. G. (2014). *E-commerce:business.technology.society.* New York: Pearson Education Limited.

Kenneth C. Laudon, J. P. (2014). *Management Information System: MANAGING THE DIGITAL FIRM.* New York: Pearson Education Limited.

Course Title: **DotNet Technology (3 Cr.)**
Course Code: **CACS302**
Year/Semester: **III/V**
Class Load: **6 Hrs. / Week (Theory: 3 Hrs., Practical: 3 Hrs.)**

Course Description:
This course covers different concepts of .NET framework. It also covers basic to advanced features of C# language including language basics, creating types and inheritance, delegates, events, lambda expressions, LINQ, working with databases, and developing web applications using ASP.NET.

Course Objectives:
The primary objective of this course is to provide concepts of .NET framework and different concepts of C# programming language and make students familiar with their uses and applications.

Course Contents:

Unit 1: Introducing C# and the .NET Framework (7 Hrs.)
Object Orientation; Type Safety; Memory Management; Platform Support; C# and CLR; CLR and .NET Framework; Other Frameworks; Framework Overview; .NET Standard 2.0; Applied Technologies

Unit 2: The C# Language Basics (12 Hrs.)
Writing Console and GUI Applications; Identifiers and Keywords; Writing Comments; Data Types; Expressions and Operators; Strings and Characters; Arrays; Variables and Parameters; Statements (Declaration, Expression, Selection, Iteration, and Jump Statements); Namespaces

Unit 3: Creating Types in C# (12 Hrs.)
Classes; Constructors and Deconstructors; this Reference; Properties; Indexers; Static Consturctors and Classes; Finalizers; Dynamic Binding; Operator Overloading; Inheritance; Abstract Classes and Methods; base Keyword; Overloading; Object Type; Structs; Access Modifiers; Interfaces; Enums; Generics

Unit 4: Advanced C# (14 Hrs.)
Delegates; Events; Lambda Expressions; Exception Handling; Introduction of LINQ; Working with Databases; Writing Web Applications using ASP.NET

Laboratory Work: The laboratory work includes writing console and/or GUI programs in C#

- To implement basic language features
- To create classes and objects and to implement different object-oriented features
- To implement inheritance
- To implement advanced features like delegates, event handling, lambda expressions, exception handling
- To implement LINQ and database applications

Text Books:

1. C# 7.0 in a Nutshell (7th Edition), the Definitive Reference, Joseph Albahari & Ben Albhari, O'Reilly.

2. Microsoft Visual C# Step by Step (9th Edition), John Sharp, Pearson Education.

Reference Books:

1. C# 7.0 All-in-One For Dummies (1st Editiion), John Paul Mueller, Bill Sempf, Chuck Sphar, John Wiley & Sons, Inc.
2. Professional C# 7 and .NET Core 2.0 (7th Edition), Christian Nagel, John Wiley & Sons, Inc.

Teaching Methods:

The teaching faculties are expected to create environment where students can update and upgrade themselves with the current scenario of computing and information technology with the help of topics listed in the syllabus. The general teaching pedagogy that can be followed by teaching faculties for this course includes class lectures, laboratory activity, group discussions, case studies, guest lectures, research work, project work, assignments (Theoretical and Practical), and written and verbal examinations.

Evaluation:

Internal Assessment Format [FM = 20] – Subject Teacher

Term Examination		Assignment	Attendance	Total
Mid-Term	Pre-Final			
5	5	5	5	20

Practical Assessment Format [FM = 20] – External Examiner will be assigned by Dean Office, FOHSS.

Practical	Viva	Lab Reports	Total
10	5	5	20

Note: Assignment may be subject specific case study, seminar paper preparation, report writing, project work, research work, presentation, problem solving etc.

Final Examination Questions Format [FM = 60, Time = 3 Hrs.]

SN	Question Type	Number of Questions	Marks per Question	Total Marks
1	Group – 'A' Objective Type Questions (Multiple Choice Questions) Attempt all the questions.	10	1	10 x 1 = 10
2	Group – 'B' Short Questions (Attempt any **SIX** questions.)	7	5	6 x 5 = 30
3	Group – 'C' Long Questions (Attempt any **TWO** questions.)	3	10	2 x 10 = 20

Course Title: Computer Networking (3 Cr.)
Course Code: CACS303
Year/Semester: III/V
Class Load: 5 Hrs. / Week (Theory: 3Hrs. Practical: 2 Hrs.)

Course Description

This course offers detailed concept and structure of networking standards and principles. It includes introduction, functioning and significance of Physical Layer, Data Link Layer, Network Layer, Transport Layer, Application layer and some security mechanisms. It does not entirely focus on theoretical concept but also strongly focuses on practical skill based learning.

Course objectives

The general objectives of this course are to provide theoretical as well as practical knowledge of computer networking to make students capable of implementing, managing and troubleshooting the issues of computer network in their personal as well professional life.

Course Contents

Unit 1: Introduction **6 Hrs.**

1.1 Network as an infrastructure for data communication
1.2 Applications of Computer network
1.3 Network Architecture
1.4 Types of computer Networks
1.5 Protocols and Standards
1.6 The OSI Reference Model
1.7 The TCP/IP Protocol Suite
1.8 Comparison between OSI and TCP/IP Reference model
1.9 Critiques of OSI and TCP/IP Reference model

Unit 2: The Physical Layer **6 Hrs.**

2.1 Functions of Physical Layer
2.2 Data and Signals: Analog and Digital signals, Transmission Impairment, Data Rate Limits, Performance
2.3 Data Transmission Media: Guided Media, Unguided Media and Satellites
2.4 Bandwidth Utilization: Multiplexing and Spreading
2.5 Switching: Circuit switching, Message switching & Packet switching
2.6 Telephone, Mobile and Cable network for data Communication

Unit 3: The Data Link Layer **8 Hrs.**

3.1 Functions of Data Link Layer
3.2 Data Link Control: Framing, Flow and Error Control
3.3 Error Detection and Correction
3.4 High-Level Data Link Control(HDLC) & Point – to – Point protocol(PPP)
3.5 Channel Allocation Problem

3.6 Multiple Access: Radom Access(ALOHA, CSMA, CSMA/CD, CSMA/CA), Controlled Access(Reservation, Polling, Token Passing), Channelization(FDMA, TDMA, CDMA)
3.7 Wired LAN: Ethernet Standards and FDDI
3.8 Wireless LAN: IEEE 802.11x and Bluetooth Standards
3.9 Token Bus, Token Ring and Virtual LAN

Unit 4: The Network Layer **8 Hrs.**

4.1 Functions of Network Layer
4.2 Virtual circuits and Datagram Subnets
4.3 IPv4 Addresses: Address Space, Notations, Classful addressing, Classless addressing, Subnetting and Network Address Translation(NAT)
4.4 IPv4 Datagram format and fragmentation
4.5 IPv6 Address Structure and advantages over IPv4
4.6 Routing Algorithms: Distance Vector Routing, Link State Routing
4.7 Internet Control Protocols: ARP, RARP, ICMP
4.8 Routing protocols: OSPF, BGP, Unicast, Multicast and Broadcast

Unit 5: The Transport Layer **7 Hrs.**

5.1 Functions of Transport Layer
5.2 Elements of Transport Protocols: Addressing, Establishing and Releasing Connection, Flow Control & Buffering, Error Control, Multiplexing & Demultiplexing, Crash Recovery
5.3 User Datagram Protocol(UDP): User Datagram, UDP Operations, Uses of UDP, RPC
5.4 Principles of Reliable Data Transfer: Building a Reliable Data Transfer Protocol, Pipelined Reliable Data Transfer Protocol, Go-Back-N(GBN), Selective Repeat(SR)
5.5 Transmission Control Protocol(TCP): TCP Services, TCP Features, TCP Segment Header
5.6 Principle of Congestion Control

Unit 6: The Application Layer **5 Hrs.**

6.1 Functions of Application layer
6.2 Application Layer Protocols: DNS, DHCP, WWW, HTTP, HTTPs, TELNET, FTP, SMTP, POP, IMAP
6.3 Concept of traffic analyzer: MRTG, PRTG, SNMP, Packet tracer, Wireshark.

Unit 7: Network Security **5 Hrs.**

7.1 A Model for Network Security
7.2 Principles of cryptography: Symmetric Key and Public Key
7.3 Public Key Algorithm – RSA
7.4 Digital Signature Algorithm
7.5 Communication Security: IPSec, VPN, Firewalls, Wireless Security.

Practical

1. Prepare hardware and software specification for basic computer system.
2. Determine the appropriate placement of networking devices on a network.
3. Identify networking cable standards. Create and test cross – over and straight cables.
4. Configure the IP address of the computer.
5. Create a basic network and share file and folders.
6. Install and configure windows server: Active Directory, User and Group Policy Management.
7. Set the file access permissions and quota in windows server.
8. Configure basic DNS and DHCP services in windows server.
9. Install Linux based OS and practice on basic Linux and networking commands.
10. Configure IP address and subnet in Linux Machine.
11. Install packet tracer and identify the features of packet tracer.
12. Implement the LAN topologies.
13. Demonstrate the use of VLAN.
14. Implement the both static and dynamic router configurations.
15. Install and configure DNS, DHCP, FTP and Web Servers in Linux machine.
16. Capture some packets and analyze the header using Wireshark.
17. Implement the firewall.

Teaching Methods

The teaching faculties are expected to create environment where students can update and upgrade themselves with the current scenario of computing and information technology with the help of topics listed in the syllabus. The general teaching pedagogy that can be followed by teaching faculties for this course includes class lectures, laboratory activity, group discussions, case studies, guest lectures, research work, project work, assignments (Theoretical and Practical), and written and verbal examinations.

Evaluation

Examination Scheme				
Internal Assessment		External Assessment		Total
Theory	Practical	Theory	Practical	
20	20 (3 Hrs.)	60 (3 Hrs.)	-	

Reference Book

1. Andrew S. Tanenbaum, David J. Wetherall, "Computer Networks, 5/e", Prentice Hall, 2011.
2. Behrouz A. Forouzan, "Data Communications and networking" Tata McGraw-Hill.
3. Kurose, Ross, "Computer Networking: A Top-Down Approach", Pearson Education Limited, 2017.
4. Larry L. Peterson and Bruce S. Davie, "Computer Network: A System Approach", Morgan Kaufmann, 5/e, 2012.
5. Matthew Helmke, Andrew Hudson, Paul Hudson "Ubuntu Unleashed 2019 Edition_ Covering 18.04, 18.10, 19.04", 13/e, SAMS _ Pearson Education, 2019.

Course Title: Computer Graphics and Animation (3 Cr.)
Course Code: CACS305
Year/Semester: III/V
Class Load: 6 Hrs. / Week (Theory: 3Hrs. Tutorial: 1 Hrs., Practical: 2 Hrs.)

Course Description

This course is designed to extend students' knowledge and practice in Graphics hardware, software, and applications. It also provides the knowledge of data structures for graphics, graphics languages, and models for 2D and 3D objects, clipping, hidden surface elimination, depth buffer, raster graphics, shading, and rendering.

Course objectives

Upon completion of this course, students should be able to 1. Explain basic principle of computer graphics. 2. Develop 2D and 3D computer graphics applications. 3. Specify lighting and object's materials in computer graphics programming.

Course Contents

Unit 1: Introduction 6

1.1 Advantage of Computer Graphics and Areas of Applications
1.2 Hardware and Software for Computer Graphics. (Hard Copy, Display Technologies),
1.3 Random Scan Display System, Video Controller, Random Scan Display Processor
1.4 Raster Graphics
1.5 Scan Conversion Algorithms (Line, Circle, Ellipse)
1.6 Area Filling (Rectangle, Ellipse), Clipping (Lines, Circle, Ellipse), Clipping Polygons

Unit 2: Two dimensional and three dimensional transformations 7

2.1 2-Dimensional transformation
2.2 2-D Translation, Rotation, Scaling,
2.3 Homogeneous Coordinates, Reflection, Shear transform
2.4 3-dimensional transformation,
2.5 3-D Translation, Rotation Scaling, Reflection, Shear.

3 Unit 3: Clipping 7

3.1 Window to view port transformation
3.2 Clipping, line clipping,
3.3 Cohen –Sutherland line clipping
3.4 Polygon clipping
3.5 Sutherland and Gary Hodgman polygon clipping algorithm

Unit 4: Visible Surface Determination and computer graphics algorithm **15**

4.1 Image space and object space techniques
4.2 Hidden Surface removal—Depth comparison
4.3 Z-Buffer Algorithm
4.4 Back-Face Removal
4.5 The Painter's Algorithm
4.6 Scan-Line Algorithm
4.7 Light and Color and different color models (RGB,CMY, YIQ)

Unit 5: Animation and virtual reality **10**

5.1 Basic Principles of Animation and Types of Animation
5.2 Introduction to the flash interface
5.3 Setting stage dimensions, working with panels, panel layouts
5.4 Layers & Views
5.5 Shaping Objects – Overview of shapes, Drawing & Modifying Shapes
5.6 Bitmap Images & Sounds
5.7 Animation -Principles , Frame by frame animation, tweening, masks
5.8 Introduction to virtual reality

Laboratory Work

Laboratory work should be done covering all the topics listed above and a small project work should be carried out using the concept learnt in this course using Open GL.

Reference Books:

1. Foley, J. D., A. V. Dam, S. K. Feiner, J. F. Hughes, Computer Graphics Principle and Practices, Addison Wesley Longman, Singapore Pvt. Ltd.,
2. Hearn Donald, M. P. Baker, Computer Graphics, 2E, Prentice Hall of India Private Limited, New Delhi
3. Robert R & Snow D Flash CS4 Professional Bible, Wiley Publishing

Course Title: **Introduction to Management (3 cr.)**
Course code: **CAMG 304**
Year/Semester: **III /V**
Class load: **3 Hrs./Week (Theory: 3Hrs)**

Course Objectives

This course aims to impart the basic management knowledge, and skills to the students so as to enhance their managerial capabilities and enable them to apply in the practical field.

Course Description

This course contains Introduction to Management, perspectives in management thought, emerging issues and challenges in management, management functions like planning, leading, controlling, organizational change and development, communication, emerging issues in quality management, technology and management.

Course Contents

Unit 1: Introduction **LH 4**

Management: concepts, meaning and functions. Types of managers. Managerial roles and skills. Organization and management. Changing perspectives of organization.

Unit 2: Perspectives in Management **LH 7**

Classical Perspective: scientific management, administrative management and bureaucracy. Behavioral Perspective: Hawthorne studies, human relations movement, and emergence of organizational behavior. Quantitative Perspective: management science and operations management. Integrating perspectives: systems and contingency perspectives. Emerging management issues and challenges.

Unit 3: Planning and decision making **LH 7**

Concept of planning, Levels of Planning: Strategic, Tactical and operational. Steps in Planning. Tools for planning. Decision Making: meaning, types and process. Decision making conditions – certainty, risk and uncertainty.

Unit 4: Organizing **LH 9**

Concept of organizing, process and principles of organizing. Organization Architecture: vertical differentiation – tall versus flat hierarchies, horizontal differentiation – functional structure, multidivisional structure, geographic structure, and matrix structure. Authority: line authority and staff authority. Delegation of authority. Centralization, Decentralization

and Devolution: meaning, reasons, advantages and disadvantages. Staffing: concept and importance.

Unit 5: Leading and communication **LH 7**

Concept and qualities of leadership. Transformational and transactional leadership, Leadership Styles: autocratic, democratic, and participative. Concept of managerial ethics. Motivation: concept, importance, and techniques. Communication: meaning, process, and networks. Types of communication, Barriers to effective communication.

Unit 6: Controlling and total quality management **LH 5**

Concept, purpose, Process and types of controls. Essentials of effective control systems. Control tools and techniques. Quality: Concept and importance. Total Quality Management: concept, components, principles, tools and techniques. Emerging issues in quality management.

Unit 7: Organizational Change and Development **LH 5**

Concept and nature, forces, paradigm shifts and areas (structure, technology, business process and behaviors) of organizational change. Resistance to change. Overcoming resistance to change. Concept of Organizational Development

Unit 8: Technology, Organization and Management **LH 4**

Concept of technology, approaches to technology and organization, social networking, use of technology in people management,

References

Charles W.L. Hill and Steven L. McShane, ***Principles of Management,*** Tata Mc-Graw-Hill Company, New Delhi.

Griffin, Ricky W., ***Management.*** AITBS Publishers and Distributors, New Delhi.

Hitt, M.A., J.S. Black and Porter, L.W., ***Management,*** Pearson Education, New Delhi

Laurie J. M. ***Management and organizational Behaviour,*** Pearson, New Delhi

Evaluation:

Internal Assessment: 40 marks

External Assessment: 60 marks

Total: 100 marks

Teaching methods: The major teaching methods include the case analysis, project work, term paper, assignments, and quiz. The instructor decides the learning strategies based on the nature of session/class.

Course Title: **Mobile Programming (3 Cr.)**
Course Code: **CACS351**
Year/Semester: **III/VI**
Class Load: **6Hrs. /Week (Theory: 3Hrs, Practical 3Hrs.)**

Course Description
This course provides the comprehensive knowledge related to the Mobile programming, which encompasses integrated development environment, infrastructure, design, and develop and testing of mobile application, which communicate with database to solve real word problem.

Objectives: The general objectives of this course is to develop mobile application that solve real word problem with use of current mobile technology.

Unit -1
Introduction to Mobile and Mobile Programming [2 HRS]
Mobile Device (Features, Categories, History, Brands, Models and Platforms), Introduction to Mobile Programming.

Unit -2
Introduction to Android Programming [4 HRS]
Android Platform, History of Android, Environment Setup, Creating an android project, Laying out the user interface (The view hierarchy, widget attributes, creating string resources, previewing the layout), Creating a new class, Setting up the project, Running on the Emulator.

Unit -3
Designing the User Interface [5 HRS]
Android layout types (Linear, Relative, Table, Absolute, Constraint), Layout attributes, Android widgets (Textview, Edittext, Checkbox, Radiobutton, Spinner etc.) and its attributes, Event Handling, working with string, string array and colors, working with resources and drawable, adding icon to the project.

Unit -4
Android Activity [4 HRS]
The Activity life cycle, Creating multiple activities, Declaring activities in the manifest, Connecting activities with intents, Passing data between activities, Getting a result back from a child activity, Getting and setting data to/from the layout file.

Unit -5
UI Fragments, Menus and Dialogs [6 HRS]
The need for UI flexibility, Introduction to fragments, Lifecycle of fragment, Creating a UI fragment, Creating a fragment class, Wiring widgets in fragment, Introduction to fragment manager, Difference between Activity and Fragments. Menus (Introduction, Types, Implementing menu in an application) Dialogs (Introduction, Creating a dialog fragment, Setting a dialog's content)

Unit -6

Listview, Gridview and Recyclerview [6 HRS]

Listview (Introduction, Features, Implementing listview in an application)
Gridview (Introduction, Features, Implementing gridview in an application)
Recyclerview (Introduction, Features, Implementing recyclerview in an application)

Unit -7

Advance Android Concepts [10 HRS]

Local database with SQLite (Establishing connection, creating database and tables, data manipulation), Introduction to API, API Types, Introduction to JSON, Retrieving contents from remote server, Sending contents to remote server, Implementing Google Maps in android application, Procedure for publishing application on Google Play Store.

Unit -8

Introduction to ios Programming [8 HRS]

Introduction to ios and ios programming, ios platform, Environment setup, Creating an Xcode project, Building the interface, Making connections, Running on the simulator.
Introduction to Swift language, Views and the view hierarchy, Storyboard and view controllers, working with widgets and its attributes, Creating a simple ios application.

Laboratory Works

Laboratory works should be done covering all the topics listed above and a small project work should be carried out using the concept learnt in this course. Project should be assigned on individual basis.

Teaching Methods

The general teaching pedagogy includes class lectures, group discussions, case studies, guest lectures, research work, project work, assignments (theoretical and practical), and examinations (written and verbal), depending upon the nature of the topics. The teaching faculty will determine the choice of teaching pedagogy as per the need of the topics.

References

1. Bill Phillips, Chris Stewart, Brian Hardy, and Kristin Marsicano, *Android Programming: The Big Nerd Ranch Guide*, Big Nerd Ranch LLC, 2nd edition, 2015.
2. 2. Christian Keur and Aaron Hillegass, *iOS Programming: The Big Nerd Ranch Guide*, 5th edition, 2015.
3. Brian Fling, *Mobile Design and Development*, O'Reilly Media, Inc., 2009.
4. Maximiliano Firtman, *Programming the Mobile Web*, O'Reilly Media, Inc., 2nd ed., 2013.

Course Title: Distributed Systems (3 Cr.)
Course Code: CACS352
Year/Semester: III/VI
Class Load: 4 Hrs. / Week (Theory: 3Hrs. Tutorial: 1 Hr.)

Course Description

The course introduces basic knowledge to give an understanding how modern distributed systems operate. The focus of the course is on distributed algorithms and on practical aspects that should be considered when designing and implementing real systems. Some topics covered during the course are causality and logical clocks, synchronization and coordination algorithms, transactions and replication, and end-to-end system design. In addition, the course explores recent trends exemplified by current highly available and reliable distributed systems.

Course objectives

The objective of the course is to make familiar with different aspect of the distributed system, middleware, system level support and different issues in designing distributed algorithms and finally systems.

Course Contents

Unit 1. Introduction **4 Hrs.**
- 1.1 Characteristics
- 1.2 Design Goals
- 1.3 Types of Distributed Systems
- 1.4 Case Study: The World Wide Web

Unit 2. Architecture **4 Hrs.**
- 2.1 Architectural Styles
- 2.2 Middleware organization
- 2.3 System Architecture
- 2.4 Example Architectures

Unit 3. Processes **6 Hrs.**
- 3.1 Threads
- 3.2 Virtualization
- 3.3 Clients
- 3.4 Servers
- 3.5 Code Migration

Unit 4. Communication **5 Hrs.**
- 4.1 Foundations
- 4.2 Remote Procedure Call
- 4.3 Message-Oriented Communication
- 4.4 Multicast Communication
- 4.5 Case Study: Java RMI and Message Passing Interface (MPI)

Unit 5. Naming **5 Hrs.**
- 5.1 Name Identifiers, and Addresses
- 5.2 Structured Naming

5.3 Attribute-based naming
5.4 Case Study: The Global Name Service

Unit 5. Coordination **7 Hrs.**

6.1 Clock Synchronization
6.2 Logical Clocks
6.3 Mutual Exclusion
6.4 Election Algorithm
6.5 Location System
6.6 Distributed Event Matching
6.7 Gossip-based coordination

Unit 7. Consistency and Replication **5 Hrs.**

7.1 Introduction
7.2 Data-centric consistency models
7.3 Client-centric consistency models
7.4 Replica management
7.5 Consistency protocols
7.6 Caching and Replication in Web

Unit 8. Fault Tolerance **5 Hrs.**

8.1 Introduction to fault tolerance
8.2 Process resilience
8.3 Reliable client-server communication
8.4 Reliable group communication
8.5 Distributed commit
8.6 Recovery

Unit 9. Security **4 Hrs.**

9.1 Introduction to security
9.2 Secure channels
9.3 Access control
9.4 Secure naming
9.5 Security Management

Teaching Methods

The teaching faculties are expected to create environment where students can update and upgrade themselves with the current scenario of computing and information technology with the help of topics listed in the syllabus. The general teaching pedagogy that can be followed by teaching faculties for this course includes class lectures, laboratory activity, group discussions, case studies, guest lectures, research work, project work, assignments (Theoretical and Practical), and written and verbal examinations.

Evaluation System

Examination Scheme		
Internal Assessment	**External Assessment**	**Total**
40%	60% (3 Hrs.)	100%

References:

1. A.S. Tanenbaum, M. VanSteen, "Distributed Systems", Pearson Education.
2. George Coulouris, Jean Dollimore, Tim Kindberg, "Distributed Systems Concepts and Design", Third Edition, Pearson Education.
3. Mukesh Singhal, "Advanced Concepts in Operating Systems", McGraw-Hill Series in Computer Science.
4. Ajay D. Kshemkalyani, Mukesh Singhal, "Distributed Computing: Principles, Algorithms, and Systems", Cambridge University Press
5. Christian Cachin, Rachid Guerraoui, Luís, "Introduction to Reliable and Secure Distributed Programming", Springer

Course Title: **Advanced Java Programming (3 Cr.)**
Course Code: **CACS354**
Year/Semester: **III/VI**
Class Load: **6 Hrs. / Week (Theory: 3 Hrs., Practical: 3 Hrs.)**

Course Description:
This course covers advanced features of Java programming language including, GUI programming, database programming, JavaBeans, JSP, Servlet, and Remote Method Invocation (RMI).

Course Objectives:
The primary objective of this course is to provide concepts of advanced features of Java programming and make students familiar with their uses and applications.

Course Contents:

Unit 1: GUI Programming (12 Hrs.)
Introducing Swing; Creating a Frame; Displaying Information in a Component; Working with 2D Shapes; Using Color; Using Special Fonts for Text; Displaying Images; Event Handling: Event Handling Basics, Event Classes, Event Listeners and Adapter Classes; Swing and the MVC Design Pattern; Layout Management; Basic Swing Components

Unit 2: Database Programming (7 Hrs.)
The Design of JDBC: JDBC Driver Types and Typical Uses of JDBC; the Structured Query Language; JDBC Configuration; Working with JDBC Statements; Query Execution; Scrollable and Updatable Result Sets; Row Sets

Unit 3: JavaBeans (7 Hrs.)
What Is a Java Bean? Advantages of Java Beans; Introspection; Properties, Events, and Methods Design Patterns; Using BeanInfo Interface; Bound and Constrained Properties; Persistence; Customizers; the Java Beans API; Writing JavaBeans

Unit 4: Servlets and JSP (14 Hrs.)
Background; The Life Cycle of a Servlet; A Simple Servlet; The Servlet API; The javax.servlet Package; Reading Servlet Parameters; The javax.servlet.http Package; Handling HTTP Requests and Responses; Using Cookies; Session Tracking; Introduction to JSP; Using JSP; Comparing JSP with Servlet; Java Web Frameworks

Unit 5: RMI (5 Hrs.)
What is RMI? The Roles of Client and Server; Remote Method Calls; Stubs and Parameter Marshalling; the RMI Programming Model; Interfaces and Implementations; the RMI Registry; Parameters and Return Values in Remote Methods; Remote Object Activation; Simple Client/Server Application using RMI; Comparing RMI with CORBA

Laboratory Work: The laboratory work includes writing Java programs

- To create GUI applications using swing, event handling, and layout management
- To create applications to work with databases
- To create JavaBeans

- To create server side web programs using Servlet and JSP
- To create distributed applications using RMI

Text Books:

1. Core java Volume I – Fundamentals, Tenth Edition, Cary S. Horstmann, Prentice Hall
2. Core java Volume II – Advanced Features, Tenth Edition, Cary S. Horstmann, Prentice Hall
3. Java: The Complete Reference, 10th, Herbert Schildt, McGraw-Hill

Reference Books:

1. Advanced Java Programming, Uttam K. Roy, Oxford University Press
2. Java: Advanced Features and Programming Techniques, Nathan Clark

Teaching Methods:

The teaching faculties are expected to create environment where students can update and upgrade themselves with the current scenario of computing and information technology with the help of topics listed in the syllabus. The general teaching pedagogy that can be followed by teaching faculties for this course includes class lectures, laboratory activity, group discussions, case studies, guest lectures, research work, project work, assignments (Theoretical and Practical), and written and verbal examinations.

Evaluation:

Internal Assessment Format [FM = 20] – Subject Teacher

Term Examination		Assignment	Attendance	Total
Mid-Term	Pre-Final			
5	5	5	5	20

Practical Assessment Format [FM = 20] – External Examiner will be assigned by Dean Office, FOHSS.

Practical	Viva	Lab Reports	Total
10	5	5	20

Note: Assignment may be subject specific case study, seminar paper preparation, report writing, project work, research work, presentation, problem solving etc.

Final Examination Questions Format [FM = 60, Time = 3 Hrs.]

SN	Question Type	Number of Questions	Marks per Question	Total Marks
1	Group – 'A' Objective Type Questions (Multiple Choice Questions) Attempt all the questions.	10	1	10 x 1 = 10
2	Group – 'B' Short Questions (Attempt any **SIX** questions.)	7	5	6 x 5 = 30
3	Group – 'C' Long Questions (Attempt any **TWO** questions.)	3	10	2 x 10 = 20

Course Title: Network Programming (3 Cr.)
Course Code: CACS355
Year/Semester: III/VI
Class Load: 5 Hrs. / Week (Theory: 3Hrs. Practical: 2 Hrs.)

Course Description

This course is designed to extend students' knowledge and practice in analysis and design of computer networks by focusing on computer network programming. It includes introduction, Internet Address, URLs and URIs, HTTP, URLConnections, Socket Programming, IP Multicast and RMI. The JAVA programming language will be used throughout the course. It does not entirely focus on theoretical concept but also strongly focuses on practical skill based knowledge.

Course objectives

The general objectives of this course are to provide theoretical as well as practical knowledge of network programming to make students capable of developing, implementing, managing and troubleshooting the issues of network programming in their personal as well professional life.

Course Contents

Unit 1: Introduction **3 Hrs.**
- 1.1 Network Programing Features and Scope
- 1.2 Network Programming Language, Tools & Platforms
- 1.3 Client and Server Applications
- 1.4 Client server model and software design

Unit 2: Internet Addresses **4 Hrs.**
- 2.1 The InetAddress Class: Creating New InetAddress Objects, Getter
- 2.2 Methods, Address Types, Testing Reachability and Object Methods
- 2.3 Inet4Address and Inet6Address
- 2.4 The Network Interface Class: Factory Method & Getter Method
- 2.5 Some Useful Programs: SpamCheck, Processing Web Server Logfiles

Unit 3: URLs and URIs **5 Hrs.**
- 3.1 URIs: URLs and Relative URLs
- 3.2 The URL Class: Creating New URLs, Retrieving Data From a URL, Splitting a URL into Pieces, Equality & Comparison and Conversion
- 3.3 The URI Class: Constructing a URI, The Parts of the URI, Resolving Relative URIs, Equality & Comparison and String Representation
- 3.4 x-www-form-urlencoded: URL Encoder and URL Decoder
- 3.5 Proxies: System Properties, The ProxyClass and The ProxySelector Class
- 3.6 Communicating with Server-Side Programs Through GET
- 3.7 Accessing Password-Protected Sites: The Authenticator Class, The PasswordAuthentication Class and The JPasswordField Class

Unit 4: HTTP **2 Hrs.**
- 4.1 The protocol: Keep-Alive
- 4.2 HTTP Methods
- 4.3 The Request Body

4.4 Cookies: CookieManager and CookiesStore

Unit 5: URLConnections **5 Hrs.**

5.1 Openning URLConnections
5.2 Reading Data from Server
5.3 Reading Header: Retrieving specific Header Fields and Retrieving Arbitrary Header Fields
5.4 Cache: Web Cache for Java
5.5 Configuring the Connection: protected URL url, protected boolean connected, protected boolean allowUserInteraction, protected boolean doInput, protected boolean doOutput, protected boolean ifModificationSince, protected boolean useCaches and Timeouts
5.6 Configuring the Client Request HTTP Header
5.7 Security Considerations for URLConnections
5.8 Guessing MIME Media Types
5.9 HttpURLConnection: The Request Methods, Disconnecting from the Server, Handling Server Responses, Proxies and Streaming Mode

Unit 6: Socket for Clients **5 Hrs.**

6.1 Introduction to Socket
6.2 Using Sockets: Investigating Protocols with telnet, Reading from Servers with Sockets, Writing to Servers with Sockets
6.3 Constructing and connecting Sockets: Basic Constructors, Picking a Local Interface to Connect From, Constructing Without Connecting, Socket Addresses and Proxy Servers
6.4 Getting Information about a Socket: Closed or Connected?, toString()
6.5 Setting Socket Options: TCP_NODELAY, SO_LINGER, SO_TIMEOUT, SO_RCVBUF and SO_SNDBUF, SO_KEEPALIVE, OOBINLINE, SO_REUSEADDER and IP_TOS Class of Services
6.6 Socket in GUI Applications: Whois and A Network Client Library

Unit 7: Socket for Servers **5 Hrs.**

7.1 Using ServerSockets: Serving Binary Data, Multithreaded Servers, Writing to Servers with Sockets and Closing Server Sockets
7.2 Logging: What to Log and How to Log
7.3 Constructing Server Sockets: Constructing Without Binding
7.4 Getting Information about Server Socket
7.5 Socket Options: SO_TIMEOUT, SO_RSUMEADDR, SO_RCVBUF and Class of Service
7.6 HTTP Servers: A Single File Server, A Redirector and A Full-Fledged HTTP Server

Unit 8: Secure Socket **4 Hrs.**

8.1 Secure Communication
8.2 Creating Secure Client Sockets
8.3 Event Handlers
8.4 Session Management
8.5 Client Mode
8.6 Creating Secure Server Socket

8.7 Configure SSLServerSockets: Choosing the Cipher Suits, Session Management and Client Mode

Unit 9: Nonblocking I/O **3 Hrs.**

9.1 An Example Client and Server
9.2 Buffers: Creating Buffers, Filling and Draining, Bulk Methods, Data Conversion, View Buffers, Compacting Buffers, Duplicating Buffers, Slicing Buffers, Marking and Resetting, Object Methods
9.3 Channels: SocketChannel, ServerSocketChannel, The Channels Class, Asynchronous Channels, Socket Options
9.4 Readiness Selection: The Selector Class, The SelectionKey Class

Unit 10: UDP **5 Hrs.**

10.1 UDP Protocol
10.2 UDP Clients
10.3 UDP Servers
10.4 The DatagramPacket Class: The Constructor, The get Methods, The setter Methods
10.5 The DatagramSocket Class: The Constructor, Sending and Receiving Datagrams, Managing Connections
10.6 Socket Options: SO_TIMEOUT, SORCVBUF, SO_SNDBUF, SO_RSUMEADDR, SO_BROADCAST and IP_TOS
10.7 UDP Applications: Simple UDP Clients, UDPServer and A UDP Echo Client
10.8 DatagramChannel: Using DatagramChannel

Unit 11: IP Multicast **2 Hrs.**

11.1 Multicasting: Multicast Address and Groups, Clients and Servers, Routers and Routing
11.2 Working with Multicast Sockets: The Constructor, Communicating with a Group

Unit 12: Remote Method Invocation (RMI) **2 Hrs.**

12.1 Defining and Implementing RMI Service Interface
12.2 Creating an RMI Server and Client
12.3 Running the RMI System

Laboratory Work

Laboratory work should be done covering all the topics listed above and a small project work should be carried out using the concept learnt in this course using Java programming Language.

Teaching Methods

The teaching faculties are expected to create environment where students can update and upgrade themselves with the current scenario of computing and information technology with the help of topics listed in the syllabus. The general teaching pedagogy that can be followed by teaching faculties for this course includes class lectures, laboratory activity, group discussions, case studies,

guest lectures, research work, project work, assignments (Theoretical and Practical), and written and verbal examinations.

Evaluation

Examination Scheme				
Internal Assessment		External Assessment		Total
Theory	Practical	Theory	Practical	
20	20 (3 Hrs.)	60 (3 Hrs.)	-	

Reference Books:

1. Elliotte Rusty Harold, "Java Network Programming", O'Reilly, 2014.
2. Douglas E. Comer, David L. Stevens, "Internetworking with TCP_IP, Vol. III_ Client-Server Programming and Applications, Linux_Posix Sockets Version" Addison-Wesley, 2000.
3. David Reilly, Michael Reilly, "Java Network Programming and Distributed Computing", Addison-Wesley Professional, 2002
4. Kenneth L. Calvert, Michael J. Donahoo, "TCP-IP Sockets in Java. Practical Guide for Programmers", Morgan Kaufmann, 2008.
5. Andrew S. Tanenbaum, David J. Wetherall, "Computer Networks, 5/e", Prentice Hall, 2011.
6. Kurose, Ross, "Computer Networking: A Top-Down Approach", Pearson Education Limited, 2017.

Course Title: Applied Economics (3 Cr.)
Course Code: CAEC353
Year/ Semester: III/VI
Class Load: 3 Hrs./Week (Theory: 3 Hrs.; Tutorial: 1Hr.)

Course Description

This course of Applied Economics consists of the introduction to economic theories and application. It consists of theory of demand and supply, theory of consumer's behavior, theory of production, cost and revenue curves, theory of product pricing and factor pricing as well as contemporary macroeconomics like national income accounting, money banking and international trade with reference to Nepal.

Course Objective

This course of Applied Economics aims to enhance understanding of the economic theories and application to develop skills of students in personal and professional decision making related to business, IT and management.

Unit 1: Introduction **6 Hrs.**

a. Concept and types of microeconomics and macroeconomics
b. Distinction between microeconomics and macroeconomics
c. Goals and instruments of macroeconomics

Unit 2: Elasticity of Demand and Supply **6 Hrs.**

a. Concept and types of price, income and cross elasticity of demand
b. Measurement of price, income and cross elasticity of demand: Total outlay method and Point method
c. Uses of price, income and cross elasticity
d. Concept of elasticity of supply and its measurement
(Numerical exercise using excel)

Unit 3: Theory of Consumer Behavior **6 Hrs.**

a. Concept of cardinal and ordinal utility analysis
b. Cardinal utility analysis: assumptions, consumer's equilibrium, criticisms and derivation of demand curve
c. Ordinal utility Analysis: Concept, properties of Indifference curve, marginal rate of substitution, Price Line and consumer's equilibrium, Price effect: Derivation of PCC, Income effect: Derivation of ICC, Substitution effect, Decomposition of price effect into income and substitution effect, Derivation of demand curve (Hicksian approach)
(Numerical exercise)

Unit 4: Cost and Revenue Curves **6 Hrs.**

a. Concept of cost: actual cost and opportunity cost, implicit cost and explicit cost, accounting and economic cost.
b. Derivation of short run and long run cost curves (total, average, marginal) and shape of short run and long run average cost curves.
c. Relationship between short run and long run AC and MC curves

d. Concept of revenue: total revenue, average revenue, and marginal revenue, revenue curves under perfect and imperfect competition, relation between average and marginal revenue
(Numerical exercise using excel)

Unit 5: Market Structure **9 Hrs.**

a. **Perfect competition-** meaning and characteristics of perfect competition, short run and long run equilibrium of the firm and industry(TR-TC approach and MC-MR approach), derivation of short run and long run supply curve of a firm and industry.
b. **Monopoly:** Meaning and characteristic of monopoly; pricing under monopoly: equilibrium of firm in short run and long run (TR-TC approach and MC-MR approach); Price discrimination and degree of price discrimination.
c. **Monopolistic Competition:** Meaning and characteristics of monopolistic competition; Pricing under monopolistic competition: equilibrium of firm in short run and long run; equilibrium of firm under product variation and selling expenses
d. **Oligopoly:** Meaning and characteristic of oligopoly; Pricing under cartel (aiming at joint profit maximization)

(Numerical exercise using excel)

Unit 6: National Income Accounting **6 Hrs.**

a. Circular flow of income and expenditure in two sector, three sector and four sector economy
b. Meaning and different concept of national income: GDP, NDP, GNP, NNP, national income at factor cost (NI), personal income (PI), disposable personal income (DI), per capita income (PCI)
c. Real and nominal GDP, GDP deflator
d. Computation of National income: Product, Income and Expenditure method

(Numerical exercise **using excel)**

Unit 7: Money, Banking and International Trade **6 Hrs.**

a. Concept and functions of money- value of money-money supply –components of money supply (M_1, M_2, etc.)
b. Inflation : Types, causes and effects of inflation
c. Banking: role and functions of commercial banks , role and functions of central bank with reference to Nepal Rastra Bank
d. International Trade: Distinction between internal and international trade, balance of trade and balance of payment.

Reference Books

Ackley, Gardener. (1978). Macroeconomics: Theory and Policy. New York: Mac Milan Publishing Co.

Caves, Frankel, Jones, World Trades and Payments: (9th Ed.) Pearson Education

Dominick Salvatore, International Economics: (8th Ed.) . Wiley India.

Dwibedi, D.N. (2001). Macroeconomic Theory and Policy. Tata McGraw-Hill Publishing Company Limited, New Delhi

G, Mankiw. (2007). Economics: Principles and Applications. South Western of Cengage Learing.

Gupta, S.B. Monetary Economics, S.Chand & Co;New Delhi.

Koutsoyianis, A. (1991). Modern Microeconomics. Hongkong: ELBS

Lipsey and Chrystal. Economics. Oxford University Press. (eleventh edition or latest one).

Mankiw, N. Gregory. (2009). Principles of Microeconomics. Cengage Learning India Private Limited, New Delhi (4th edition)

P. Samuelson and W. Nordhaus. Economics, Mc GrawHill International Editions. (14th edition or latest one)

Paul R. Krugman, Maurice Obstfeld, International Economics: (8th Ed.) Pearson Education

Pindyck, Robort S. and Daniel, Rubinfield. (2001). Microeconomics. New Delhi: Prentice Hall of India

Salvatore, Dominic. (2009). Principles of Microeconomics. Publish in India Oxford University Press, New Delhi

Shapiro, Edward. (2004). Macroeconomic Analysis. New Delhi: Galgotia Publication (P) Ltd.

Practical Works

Excel or other relevant statistical software should be used to compute numerical exercise.

Teaching Methods:

The general teaching pedagogy includes class lectures, presentations, group works, case studies, guest lectures research works, project works, assignments (Theoretical and practical). The teaching faculty will determine the choice of teaching pedagogy and statistical tools as per the requirements of topics.

Evaluation

Examination Scheme				Total
Internal Assessment (40)		External Assessment (60)		100
Theory	Practical	Theory	Practical	
30	10	40	20	

Course Title: Project II (2 Cr.)
Course Code: CAPJ356
Year/Semester: III/VI
Class Load: 4 Hrs. / Week (Practical: 4 Hrs.)

Course Description

To develop small scale project based on the application development platforms and tools (JAVA, visual c++, PHP , Python or plate form of any current trend. This course provides practical skill based knowledge.

Course objectives

The objectives of this course are to provide project management skills (developing, implementing, managing collaboration) and to learn working as a team. The student will also learn about formulating project documentation.

Course Contents

Unit 1: Project Ideas and proposal guidance **4**

1.1 Project concept and Scope
1.2 Proposal writing techniques

Unit 2: Application Development **8**

2.1 Object oriented programming
2.2 Frameworks and APIs
2.3 Programming design patterns
2.4 Data collection for project
2.5 Application of GPUS

Unit 3: Project management, team work and collaboration **8**

3.1 Project management techniques
  3.1.1 Develop project management plan
  3.1.2 Project implementation, monitor and control

3.2 Collaborative development environment

  3.2.1 Communications planning process

  3.2.2 Organizing and conducting effective meeting,

Unit 4: Project Guidance **5**

Unit 5: Project work **30**

Unit 6: Project documentation guidance **5**

4.1 documentation format
4.2 Table writing format
4.3 Figure writing format
4.4 Writing equation
4.5 References and citation techniques
4.6 Abstract writing

Reference Books:

1. The Project Manager's Guide to Software Engineering's Best Practices, M. C. Christensen and R.H. Thayer,IEEE computer Society
2. Angelika H. Hofmann, " Scientific Writing and Communication: Papers, Proposals, and Presentations Oxford University Press; 3 edition (November 17, 2016)

Course Name: Cyber Law & Professional Ethics (3 Cr.)
Course Code: CACS401
Year/Semester: IV/VII
Class Load: 4 Hrs. / Week (Theory: 3Hrs. Tutorial: 1 Hrs.)

Course Description:
This course presents different concepts of cyber law, cybersecurity, and ethics for IT professionals and IT Organizations. This course also presents different concepts related to intellectual properties and their protections, privacy, and social networking issues.

Course Objectives:
The primary objective of this course is to provide knowledge of cyber law, cybersecurity, privacy protection, intellectual property protection, and ethics for IT professionals and IT organizations.

Course Contents:
Unit 1: An Overview of Ethics, Ethics for IT Workers and IT Users (10 Hrs.)
Ethics, Ethics in the Business World; Corporate Social Responsibility; Fostering Corporate Social Responsibility and Good Business Ethics; Improving Business Ethics; Ethical Considerations in Decision Making; Ethics in Information Technology; Managing IT Worker Relationship; Encouraging Professionalism of IT Workers – Professional Codes of Ethics, Professional Organizations, Certifications and Licensing ; Encouraging Ethical Use of IT Resources among Users

Unit 2: Cyberattacks, Cybersecurity, and Cyber Law (12 Hrs.)
Threat Landscape – Computer Incidents, Types of Exploits; CIA Security Triad – Confidentiality, Integrity, Availability, Implementing CIA at Organizational, Network, Application, and End-User Level; Response to Cyberattack - Incident Notification Protection of Evidence and Activity Logs Incident Containment Eradication Incident Follow-Up Using an MSSP, and Computer Forensics; Cyber Law; Provision of Cyber Law and Electronic Transaction Act of Nepal

Unit 3: Privacy and Freedom of Expression (10 Hrs.)
Privacy Protection and the Law - Information Privacy, Privacy Laws, Applications, and Court Rulings; Key Privacy and Anonymity Issues - Consumer Profiling, Electronic Discovery, Workplace Monitoring, Surveillance; First Amendment Rights; Freedom Expressions: Key Issues; Social Networking Ethical Issues

Unit 4: Intellectual Property (8 Hrs.)
Intellectual Property, Copyright; Patient; Trade Secrets; Intellectual Property Issues: Plagiarism, Reverse Engineering, Open Source Code, Competitive Intelligence, Trademark Infringement, and Cybersquatting

Unit 5: Ethical Decision in Software Development and Ethics of IT Organizations (8 Hrs.)
Software Quality and its Importance; Strategies for Developing Quality Software; Use of Contingent Workers; H-1B Workers; Outsourcing; Whistle-Blowing; Green Computing

Teaching Methods
The teaching faculties are expected to create environment where students can update and upgrade themselves with the current scenario of computing and information technology with

the help of topics listed in the syllabus. The general teaching pedagogy that can be followed by teaching faculties for this course includes class lectures, laboratory activity, group discussions, case studies, guest lectures, research work, project work, assignments (Theoretical and Practical), and written and verbal examinations.

Evaluation

Examination Scheme				
Internal Assessment		**External Assessment**		**Total**
Theory	**Practical**	**Theory**	**Practical**	
40		**60**	**-**	

Recommended Books:

1. Ethics in Information Technology, Sixth Edition, George W. Reynolds.
2. Ethics and Technology: Controversies, Questions, and Strategies for Ethical Computing, Fifth Edition, Herman T. Tavani, John Wiley and Sons, 2016.
3. Ethics for Information Age, Eighth Edition, Michael J. Quinn, Pearson.

Course Title: Cloud Computing (3 Cr.)
Course Code: CACS402
Year/Semester: IV/VII
Class Load: 6 Hrs. / Week (Theory: 3Hrs. Practical: 3 Hrs.)

Course Description

This course offers detailed concept, applications, principles and implementation of cloud computing. It includes introduction, Cloud Computing Architecture, Cloud Virtualization, Cloud Programming Models, Cloud security and applications. It does not entirely focus on theoretical concept but also strongly focuses on practical skill based learning.

Course objectives

The general objectives of this course are to provide theoretical as well as practical knowledge of cloud computing to make students capable of designing, implementing and managing the issues of cloud computing in their personal as well professional life.

Course Contents

Unit 1: Introduction to Cloud Computing [6 Hrs.]

1.1 Overview of Cloud Computing
1.2 Evolution of Cloud Computing
1.3 Characteristics of Cloud Computing
1.4 Types of cloud and its Cloud services
1.5 Benefits and challenges of cloud computing
1.6 Applications cloud computing
1.7 Cloud Storage
1.8 Cloud services requirements,
1.9 cloud and dynamic infrastructure
1.10 Cloud adoption

Unit 2: Cloud Computing Architecture [6 Hrs]

2.1 Cloud reference model
2.1.1 Platform as service
2.1.2 Software as a service
2.1.3 Infrastructure as service
2.2 Cloud deployment models
2.2.1Public clouds
2.2.2 Private clouds
2.2.3 Community cloud
2.2.4 Hybrid clouds
2.3 Cloud design and implementation using SOA,
2.4 security, trust and privacy

Unit 3: Cloud Virtualization technology [10 Hrs]

3.1 Overview of Virtualization techniques
3.2 Types of Virtualization
3.3 Implementation Levels of Virtualization Structures
3.4 virtualization benefits

3.5 server virtualization
3.6 hypervisor management software
3.7 virtual infrastructure requirements

Unit 4: MapReduce(8 Hrs)

4.1 Introduction to parallel computing
4.2 Map-reduce model
4.3 Applications of map reduce
4.4 Parallel efficiency of Map-Reduce
4.5. MapReduce infrastructure

Unit 5: Cloud security [6 Hrs]

5.1 Introduction to Security,
5.2 Cloud Security challenges and Risks,
5.3 Software-as-a-Service Security
5.4 Security Monitoring
5.5 Security Architecture Design
5.6 Data Security
5.7 Application Security
5.8 Virtual Machine Security
5.9 Identity Management and Access Control

Unit 6: Cloud platforms and applications [12 Hrs]

6.1 Web services
6.2 AppEngine
6.3 Azures Platform
6.4 Aneka
6.4 Open challenges
6.5 Scientific applications
6.6 Business and Consumer applications

Practical Works

1. The practical work consists of all features of cloud computing and field visit.
2. Visit the cloud service provider (cloud industries) nearby you and prepare a report based on organizational structure and technology implemented consulting with your subject teacher.

Teaching Methods

The teaching faculties are expected to create environment where students can update and upgrade themselves with the current scenario of computing and information technology with the help of topics listed in the syllabus. The general teaching pedagogy that can be followed by teaching faculties for this course includes class lectures, laboratory activity, group discussions, case studies, guest lectures, research work, project work, assignments (Theoretical and Practical), and written and verbal examinations.

Evaluation

Examination Scheme				
Internal Assessment		External Assessment		Total
Theory	Practical	Theory	Practical	
20	20 (3 Hrs.)	60 (3 Hrs.)	-	

Text Books

1. Dr. Kumar Saurabh, Cloud Computing
2. Raj Kumar Buyya, Christian Vecchiola, S. ThamaraiSelvi, Mastering Cloud Computing

Reference Books

1. David S. Linthicum, Cloud Computing and SOA Convergence in your enterprise
2. Barrie Sosinsky, Cloud Computing Bible
3. Saurabh, K. (2011). Cloud Computing – Insights into New -Era Infrastructure, Wiley India.

Course Title: Internship (3 Cr.)
Course Code: CAIN403
Year/Semester: IV/VII
Class Load:

Course Description: The internship course is practical industry experiencing course. This course is expected to provide opportunity for career exploration and development in industry. It includes applying theoretical and practical knowledge for solving real world problems while working in industry.
Course Objectives: The objective of this course is to expose and penetrate final year students into market space industry so as to acquire experience. It gives students the opportunity to enter the real world industry so that students will be pragmatic and able to start their professional career.

Course Details:
Nature of Internship:

The internship work should be related to computer applications and information technologies. The nature of work during internship should impart practical knowledge in computer system and its applications development, administration and management. The internship period should be minimum of 8 (Eight) weeks. Students should start their internship within 3 to 4 weeks of start of seventh semester. The internship can be practiced at government, non-government organizations having appropriate computer system applications and information technology usages. Generally, the internship is an individual activity however can be practiced together in groups in the host organization. However, each student must prepare and submit individual internship report on the basis of his/her work done during the internship period. Students working in group at the same organization should be able to distinguish their nature of work. Each student should be facilitated with a mentor and supervisor. Mentor from the intern providing company is assigned to guide each student during internship in the company. Supervisor from college/campus is assigned to supervise each student during internship.

Phases of Internship:

The following are the phases of internship evaluation:

1. **Proposal Submission:** Students must submit and present project proposal after 2nd week of start of the internship.

2. **Mid-Term:** Students must submit progress report and defend midterm progress of their internship work in the 12th week of the seventh semester.

3. **Final Submission:** Students must submit and orally defend the internship work during last week of the seventh semester but before final board examination. Students must have to submit the internship final report to their respective department before at least ten days of final defence date. The report should be submitted in standard format as prescribed. The hard/soft copy of report should be made available to the external expert before a week of presentation date. A viva voice will be conducted by evaluation committee.

Provision of Supervision:

There should be a regular faculty of campus/college assigned as a supervisor. The role of supervisor is to guide the students throughout the internship and provide constructive suggestions. A supervisor can supervise at most five internship students in a class section.

Provision of Mentorship:

There should be a regular employee in the intern providing organization assigned as a mentor. The role of mentor is to guide the students throughout the internship period at the organization.

Evaluation Scheme:

1. **Proposal Defense** of 5% of total marks based on internship proposal and its presentation.

2. **Midterm** of 75% of total marks based on the progress of the work of internship.

3. **Final Defense** of 20% of total marks based on presentation of internship work and viva-voice.

The 5 marks of the proposal defense will be evaluated by the research c`ommittee formed by HOD/Coordinator/Supervisor as a part of proposal defense. The 75 marks of the midterm will be evaluated by the HOD/Coordinator, Supervisor and Mentor as a part of midterm defense. Out of the 75 marks, the HOD/Coordinator will evaluate for 5 marks, the supervisor will evaluate for 35 marks and the mentor examiner will evaluate for 35 marks. The marks from the mentor should be provided to the corresponding campus/college in confidential manner. The remaining 20 marks of final defense will be evaluated by the external examiner from the university.

Out of 100 marks, the 80 marks (Proposal + Midterm Evaluation) will be considered as internal assessment while the 20 marks (Final Defense) will be considered as external assessment. Each student in the internship should get passed in each of the internal and external assessments individually. Any student failing to pass each of the assessments will be considered as fail.

The evaluation committee and evaluation criteria should be as follow;

a. Evaluation committee
- Internship Supervisor
- Mentor from Intern Company
- HOD/Coordinator
- External Examiner

b. Focus of the evaluation
- Presentation skills
- Level of work done during internship
- Understanding of internship activities
- Internship report
- Viva/Question answer

Report Contents:

1. **Prescribed content flow for the internship proposal**

    1. Introduction
    2. Problem Statement
    3. Objectives
    4. Description of Internship Work/Project (Expected)
    5. Internship Plan (Expected)
    6. Expected Outcome of Internship Activities
    7. References

2. **Prescribed content flow for the internship report**

    1. Cover & Title Page
    2. Certificate Page
        i. Mentors' Recommendation from Company
        ii. Supervisors' Recommendation
        iii. Examiners' Approval Letter
    3. Acknowledgement
    4. Abstract Page / Executive Summary
    5. Table of Contents
    6. List of Abbreviations, List of Figures, List of Tables, List of Abbreviations
    7. Main Report
    8. References
    9. Bibliography (if any)
    10. Appendices (Screen Shots/ Source Codes)

3. **Prescribed chapters in the main report**

    1. **Chapter 1: Introduction**
        1.1. Introduction (Introduce the project/ work done during internship)
        1.2. Problem Statement
        1.3. Objectives
        1.4. Scope and Limitation
        1.5. Report Organization

    2. **Chapter 2: Introduction to Organization**
        2.1. Organization Details
        2.2. Organizational Hierarchy
        2.3. Working Domains of Organization
        2.4. Description of Intern Department/Unit

    3. **Chapter 3: Background Study and Literature Review / Related Works**
        3.1. Background Study (Description of fundamental theories, general concepts and terminologies related to the internship project)
        3.2. Literature Review (Review of the similar projects during internship, theories and results similar the projects during internship)

    4. **Chapter 4: Internship Activities**
        4.1. Roles and Responsibilities
        4.2. Weekly log (Technical Details of Activities)
        4.3. Description of the Project(s) Involved During Internship

4.4. Tasks / Activities Performed

5. **Chapter 5: Conclusion and Learning Outcomes**
   5.1. Conclusion
   5.2. Learning Outcome

While writing above chapters students should avoid basic definitions. They should relate and contextualize the above mentioned concepts with their project work done during internship at the host organization.

Citation and Referencing

The listing of references should be listed in the references section. The references contain the list of articles, books, urls that are cited in the document. The books, articles, and others that are studied during the study but are not cited in the document can be listed in the bibliography section.

The citation and referencing standard should be APA referencing standard. The text inside the document should be cited accordingly. The APA referencing standard can be found in the web at https://apastyle.apa.org/

Report Format Standards

A. Page Number

The pages from certificate page to the list of tables/figures/abbreviations/approvals should be numbered in roman starting from i. The pages from chapter 1 onwards should be numbered in numeric starting from 1. The page number should be inserted at bottom, aligned center.

B. Page Size and Margin

- The paper size must be a page size corresponding to A4. The margins must be set as

  Top = 1; Bottom = 1; Right = 1; Left 1.25

C. Paragraph Style

- All paragraphs must be justified and have spacing of 1.5.

D. Text Font of Document

- The contents in the document should be in Times New Roman font
- The font size in the paragraphs of document should be 12

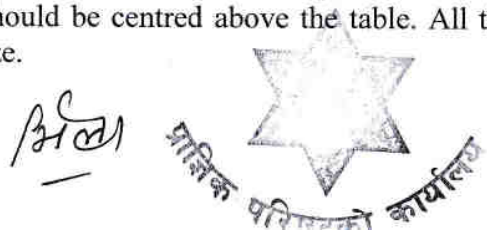
E. Section Headings

- Font size for the headings should be 16 for chapter headings, 14 for section headings, 12 for sub-section headings. All the headings should be bold faced.

F. Figures and Tables

- Position of figures and tables should be aligned center. The figure caption should be centred below the figure and table captions should be centred above the table. All the captions should be of bold face with 12 font size.

Final Report Binding and Submission:



No of Copies: 3 (College Library + Self + Dean Office)

Look and Feel: Golden Embracing with Black Binding

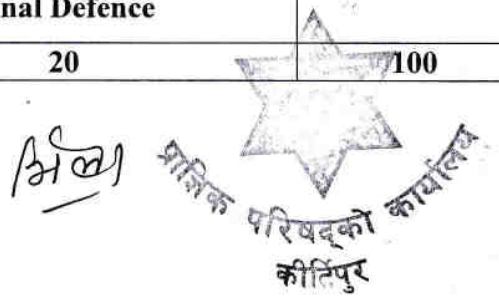
A final approved signed copy of the report should be submitted to the Dean Office, Exam Section, FOHSS.

Teaching Methods:

The major teaching methods that can be followed for this course includes industry practice, class lectures, group discussions, presentations, and demonstrations.

Evaluation

Examination Scheme			
Internal Assessment		**External Assessment**	**Total**
Proposal Defence	**Midterm Defence**	**Final Defence**	
5	**75**	**20**	**100**



Elective Courses

Course Title: Image Processing (3 Cr.)
Course Code: CACS404
Year/Semester: IV/VII
Class Load: 5 Hrs. / Week (Theory: 3Hrs. Practical: 2Hrs.)

Course Description
This course presents introduction to several topics on image processing techniques and their applications. It also explores the students to real-world applications of image processing.

Course objectives
Upon completion of this course, students should be able to 1. Explain the basic concepts of digital image processing and various image transforms. 2. Develop a broad range of image processing techniques and their applications. 3. To familiarize the with the image enhancement, image restoration and image segmentation techniques.

Course Contents

	Hours
Unit 1: Fundamental of Image processing Image representation, basic relationship between pixels, elements of DIP system, elements of visual perception-simple image formation model, Sampling and Quantization, Color fundamentals and models, File Formats, Image operations. Brightness, contrast, hue, saturation, Mach band effect	8
Unit 2: Image Enhancement Image Transforms, Fourier Transform and Discrete Fourier Transform, Fast Fourier Transform. Cosine Transform, Frequency domain image enhancement, low pass filtering, high pass filtering, homomorphic filter, Gaussian filter Spatial domain image enhancement, point processing, contrast stretching, clipping and thresholding, digital negative, intensity level slicing. Histogram processing: equalization, modification, Spatial filtering – averaging, Smoothing and sharpening, median filtering, spatial low, high and band pass filters	12
Unit 3: Image Restoration: Image Restoration - Image degradation model - Noise modeling – Blur, Inverse filtering- removal of blur caused by uniform linear motion, Weiner filtering, Morphological operation, erosion and dilation,	9
Unit4: Image coding and compression Need for compression, redundancy, pixel coding, run length coding, Huffmancoding, Elements of information theory, Error free compression, Lossy compression, Image compression standards- JPEG& MPEG, wavelet based image compression.	9
Unit 5: Image segmentation and feature extraction Image Segmentation: Thresholding, Region based segmentation, edges, line and curve detection, edge operators, Image Features and Extraction ,Types	10

of features, feature extraction , Texture , Feature reduction algorithms, Image classification, clustering techniques,
Case Studies in Image Security, Steganography and Digital watermarking, Visual effects, Case studies in Medical Imaging and remote sensing.

Evaluation

Evaluation Scheme				
Internal Assessment		External Assessment		Total
Theory	Practical	Theory	Practical	100
20	20 (3 Hrs.)	60 (3 Hrs.)	-	

Laboratory Work

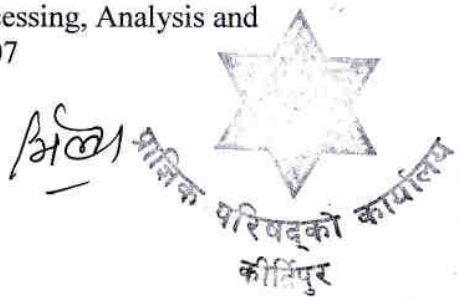
Laboratory work should be done covering all the topics listed above and a small project work should be carried out using the concept learnt in this course using software like matlab, python.

Text Books:

1. Gonzalez Rafel C, Digital Image Processing, Pearson Education, 2009.
2. S.Sridhar, Digital Image Processing, Oxford University Press, 2011

Reference Books:

1. Milan Sonka, Vaclav Hlavac and Roger Boyle, Image Processing, Analysis and Machine Vision, Second Edition, Thompson Learning, 2007



Course Title: Database Administration
Course Code: CACS405
Year/Semester: IV/VII
Class Load: 6 Hrs. /Week (Theory: 3Hrs, Practical 3Hrs.)

Course Description
This course provides the comprehensive knowledge aboutrelational database management system in administrative approach to integrate in enterprise levelof database in network environment which encompasses with oracle databaseInstances Management, database installment in network environment, implementing user role and privileges, multitenant database management, back and recovery.

Objectives: The general objectives of this course is to provide core knowledge of administrative works on relational database management system.

Unit 1Introduction to an Oracle database12Hrs
Overview of the Oracle Database Architecture (process, memory, storage structure), DBA roles and responsibilities, Familiar with SQL*Plus,Accepting Values at Runtime, Overview of SQL Command (DDL (Tables, Constraints, IndexesViews, Synonyms, SequencesPartitioning and Materialized Views), DML, Join and Subquery)

Unit2 Managing Database Instances5Hrs
Oracle Database installation, Database creation,starting up and shutting down oracle instance, Oracle Network component, communicating between Databases; Using Dynamic Performance Views, Using the Automatic Diagnostic Repository (ADR), Using the Alert Log and Trace Files, Managing Initialization Parameter Files.

Unit 3: Tablespace and Storage management **4Hrs**
Working with Tablespaces and Data Files, Creating and adding tablespace and datafiles,Managing Control Files, Online Redo Logsand Archive logs;Multiplexing online redo logs and control files, database archiving.

Unit -4Managing Users, Roles and Privileges 6Hrs
Assigning Quotas to Users, Applying the Principal of Least Privilege, Creating and Assigning Profiles, Administering User Authentication Methods, Managing Oracle Database Users, Privileges, and Roles.

Unit 5: Multitenant Database Architecture **7 Hrs**
Understanding the Multitenant Architecture, Pluggable Architecture; Creating CDB; Creating Pluggable Databases (PDBs) within a CDB; Manage CDBs and PDBs, Backup and Duplicate, Manage Security in Multitenant databases

Unit-6Configure the Oracle Network Environment5Hrs
Overview of Network Configuration, Oracle Net Listener Configuration and Management, Oracle Net Naming Methods, Networking the Net Configuration Assistant, Configure Client Connections with Net Manager, View Listener Configuration, Start and Stop the Oracle Listener, Use TNSPING to Test Oracle Net Connectivity, Connect to the Database, Configure NetServices with Enterprise Manager

Unit -7:Backup and Recovery5Hrs

Backup and Recovery Concepts, Database backup, restoration and recovery, defining a backupand recovery strategy, Backup and Recovery options; Data Dump; User-Managed Backup and Recovery; Configuring RMAN; RMAN Backups, Restore and Recovery, Perform CDB and PDB flashback.

Unit-8

Automate Tasks with the Scheduler4Hrs

Introduction to the Scheduler, Access Rights, Scheduler Components and Workflow, create a Job, Job Classes, Use Time Based, Event-Based Schedules, Create an Event-Based Schedule.

Laboratory Works

Laboratory works should be done covering all the topics listed above and a small work should be carried out using the concept learnt in each unit in the group. Work should be assigned on individual basis.

Teaching Methods

The general teaching pedagogy includes class lectures, group discussions, case studies, guest lectures, research work, project work, assignments (theoretical and practical), and examinations (written and verbal), depending upon the nature of the topics. The teaching faculty will determine the choice of teaching pedagogy as per the need of the topics.

References

1. Fernandez, I. Beginning Oracle Database 12c Administration. Apress.
2. Press, O. Oracle Database 19 C: Administration Workshop vol-I/II.
3. Thomas, B. Oracle Database 12C Administration Certified Associate. Sybex.
4. Pro Oracle Database 18c Administration: Manage and Safeguard Your Organization's Data, Michelle Malcher and Darl Kuhn, Third Edition.
5. Oracle Database 12c DBA Handbook, Manage a Scalable, Secure Oracle Enterprise Database Environment, Bob Bryla.

Course Title: Network Administration (3 Cr.)
Course Code: CACS406
Year/Semester: IV/VII
Class Load: 6 Hrs. / Week (Theory: 3Hrs. Practical: 3 Hrs.)

Course Description: The course introduces the theoretical as well as practical concepts of Network Administration. The course includes concepts of work station, server and services, Network infrastructure, Implementing different network services.

Course Objectives: The objectives of this course is to make the students to design and implement enterprise level network with its services.

Course Contents:

Unit I: Introduction **[4Hrs.]**

Network administrator as a Profession, Network administrator professional ethics, Recent trends in network administration.

Unit I: Work Station, Server and Services **[16Hrs.]**

Workstation: Architecture design, Hardware strategies, OS installation. Servers: Hardware Strategies, Hardware Features & Specifications. Service: Requirements, Planning and Engineering, Service Launch, Disaster Recovery.

Unit II: Infrastructure **[6Hrs.]**

Network Architecture, Network Operations, Datacentres Overview and Running Datacentres.

Unit III: Service Recommendation **[16Hrs.]**

Server Upgrade, centralizing a service, Service Monitoring, Namespaces, Email Service, Print Services, Data Storage, Backup and Restore, Software Repository, Web Services.

Unit IV: **[6Hrs.]**

Preparing procurement plan/document for enterprise level network setup

Laboratory Works:

The laboratory work includes implementation of the mentioned content in syllabus using LINUX and Windows operating system.

Teaching Methods

The major teaching methods that can be followed for this course includes class lectures, laboratory activity, group discussions, presentations and case studies.

Evaluation

Examination Scheme				
Internal Assessment		**External Assessment**		**Total**
Theory	**Practical**	**Theory**	**Practical**	
20	**20 (3 Hrs.)**	**60 (3 Hrs.)**	**-**	

Text Book:

1. The Practice of System and network administration, 3rd Edition, Thomas A. Limoncelli, Christina J. Hogan, Strata R. Chalup
2. Mastering Windows Server 2019: The complete guide for IT professionals to install and manage Windows Server 2019 and deploy new capabilities, 2nd Edition
3. Ubuntu and Centos Linux server administration, MD. Tanvir Rahman, 2019

Course Title: Software Project Management
Course Code: CACS407
Year/Semester: IV/VII
Class Load: 5 Hrs. /Week (Theory: 3Hrs, Practical: 2Hr.)

Course Description
This course provides the comprehensive knowledge about Software Project Management, which encompasses with Software Project Planning, Scheduling, Cost Estimation, Risk management, Quality management and Configuration management.

Objectives: The general objective of this course is to provide fundamental knowledge of software project management and corresponding software tool.

Unit -1
Software Project Management Concepts **8 Hrs**
Introduction, Project and Software project, Software project vs other project, Importance and Problems in software project management, Process of SPM. Characteristics of good project manager, Successful Software Project Manager, Overview of Software Project Planning.

Unit-2
Software Project Scheduling **8 Hrs**
Objectives of activity planning, Work breakdown structure, Network planning model: Critical path method (CPM), Program evaluation and review technique (PERT), Precedence diagramming method (PDM), Shortening project duration, Identifying critical activities. Forward pass and Backward pass

Unit -3
Software Estimation Techniques **7 Hrs**
Software Effort Estimation: Problems with over and under estimations, Basis of software Estimating, Software effort estimation techniques, expert Judgment, Estimating by analogy. Bottoms-up estimating, Top-down approach and parametric models.

Unit -4 **8 Hrs**
Software Evaluation and Costing
Project Evaluation: Strategic Assessment, Technical Assessment, cost-benefit analysis, Cash flow forecasting, cost-benefit evaluation techniques, Risk Evaluation. Selection of Appropriate Report, Project approach: Choosing technologies, choice of process models, structured methods.

Unit -5
Risk Management **5 Hrs**
Risk Identification, Planning, Evaluation and Management, Categories of Risk, Framework for dealing with risk, evaluating Risks to the schedule.

Unit -6
Software Quality Management **5 Hrs**
TQM, Six Sigma, Software Quality: defining and importance software quality, ISO9126, Place of software quality in software planning.

Unit -7

Software Configuration Management **7 Hrs**

Concept, Requirement and Elements of SCM, Baseline, SCM Repository, Versioning and version control, SCM Process, Change Control Process. Configuration Audit and Status Reporting. Case Study: Version Control Software Tools (Git, CVS, SVN)

Laboratory Works

Laboratory works should be done covering all the topics listed above and a small work should be carried out using the concept learnt in each unit in the group. Work should be assigned on individual basis. Student may choose project Management tools like (MS Project, OpenProj, dot Project, Trello, Asana, ClickUp).

Teaching Methods

The general teaching pedagogy includes class lectures, group discussions, case studies, guest lectures, research work, project work, assignments (theoretical and practical), and examinations (written and verbal), depending upon the nature of the topics. The teaching faculty will determine the choice of teaching pedagogy as per the need of the topics.

References

1. Cotterell, B. H. (2018). Software Project Management. McGraw-Hill.
2. Dutt, S. C. (n.d.). Software Project Management. Pearson Education India.
3. A.S. Kelkar (n.d.). Software Project Management. PHI Learning.

Course Title: Advanced .Net Technology (3 Cr.)
Course Code: CACS408
Year/Semester: IV/VII
Class Load: 6Hrs. /Week (Theory: 3 Hrs. Practical: 3 Hrs)

Course Description

This course provides skill to develop modern software program with graphical user interface using the language C# with ASP.net. Student will build Window-based and web-based forms, adding controls and setting properties of these controls.

Course Objective

The objective of this course is to understand the theoretical foundation as well as its practical aspects of Windows Application, ASP.NET Core web application framework and C# language features.

Course Contents

Unit 1: C# Basics **8 Hours**

Introduction to .NET Architecture, Class and Object: Creating class, Interface, Creating Objects, Access Modifiers, Arrays, Inheritance, Exception Handling and Threading: try, catch, finally, throw and throws, Create multithread program, Thread lifecycle. File IO: File Stream, Stream Reader, Stream Writer, Binary.Reader, Binary Writer, Serialization.

Unit 2: Windows Application **6 Hours**

Windows Forms: Benefits, Window Forms Control, Properties and Event, .NET Event, MDI Forms, Form Inheritance. Dialogs, Tooltips, Resizing, Menus and Context Menus, Custom Control Creations, Handling Multiple Events, Graphics and GDI+

Unit 3: Introduction to ADO.NET **7 Hours**

Benefits of ADO.NET, ADD.NET compared to classic ADO, ADO.NET architecture (Connected and Disconnected), Shared and Database-Specific Classes, Using Database connection. Working with DataSets, Managed Providers, Data Binding, Typed DataSets, Working with Data Reader, Transactions

Unit 4: ASP.NET working with Data and Security **12 Hours**

Web Application Using ASP.NET, ASP.NET Architecture, Working with controls, User Interface Elements, Deployments, Web sites, Applications and Virtual Directories in IIS.
Accessing Data using ADO.NET, Connecting to Data, Executing Commands, State management (Page-Level state, using Cookies to preserve state, ASP.NET Session State, Storing Object in Session State, Configuring Session State)
Validation, IIS URL Authorization, Forms Authentication and Config File encryption

Unit 5: ASP.NET AJAX and MVC **10 Hours**

Introduction to ASP.NET AJAX, ASP.NET AJAX Server Control, ASP.NET AJAX Server Data, ASP.NET AJAX Client-side Libraries. Introduction ASP.NET MVC, Web Application Using MVC pattern Razor View and controller, Model

Unit 6: Hosting and Deploying ASP.NET Core Application **5 Hours**

App Servers and Hosting Models: IIS, Nginx, Apache, ASP.NET Core Module, Kestrel, Docker and Containerization, Publish to Azure cloud

Laboratory works

The laboratory work includes writing programs covering most of the concepts of above units using C# and .NET core SDK (3.0 or above)

Teaching Methods

The teaching faculties are expected to create environment where students can update and upgrade themselves with the current scenario of computing and information technology with the help of topics listed in the syllabus. The general teaching pedagogy that can be followed by teaching faculties for this course includes class lectures, laboratory activity, group discussions, case studies, guest lectures, research work, project work, assignments (Theoretical and Practical), and written and verbal examinations.

Evaluation

Examination Scheme				
Internal Assessment		External Assessment		Total
Theory	Practical	Theory	Practical	
20	20 (3 Hrs.)	60 (3 Hrs.)	-	

Reference Books

1. Herbert Shildt, "C#: The Complete Reference", TMH
2. C# 8.0 and .NET Core 3.0 – Modern Cross-Platform Development, Fourth Edition, by Mark J. Price, 2019
3. ASP.NET Core in Action, by Andrew Lock, 2018
4. Ian Griffiths (2012), Programming C# 5.0, O'Reilly Media, Inc.
5. Sharp, J. (2013). Microsoft Visual C# 2013 step by step.
6. Albahari, J., Albahari, B., & Drayton, P. (2012). *C# 5.0 in a nutshell* (5th ed). Beijing ; Sebastopol: O'Reilly.

Course Title: E-Governance (3 Cr.)
Course Code: CACS409
Year/Semester: IV/VII
Class Load: 4Hrs. /Week (Theory: 3 Hrs. Tutorial: 1 Hrs)

Course Description:
This course familiarizes students with different concepts of E-Governance, different E-Governance models and infrastructure development, use of data warehousing and data mining for e-governance, and different case studies of different countries.

Course Objectives:
- To develop knowledge of e-governance
- To know different e-governance models and infrastructure development
- To know to use concepts of data warehousing and mining in e-governance

Course Contents:
Unit 1: Introduction (6 Hrs.)
E-Governance – An Overview; Why E-Governance; Issues in E-Governance Applications and the Digital Divide; Evolution of E-Governance, its Scope and Content; Present Global Trends of Growth in E-Governance; E-Governance Applications; E-Governance Initiatives in Nepal

Unit 2: E-Governance Models (12 Hrs.)
Introduction; Models of Digital Governance – Broadcasting/Wider Dissemination Model, Critical Flow Model, Comparative Analysis Model, Mobilization and Lobbying Model, Interactive Service Model/Government-to-Citizen-to-Government Model (G2C2G); Evolution in E-Governance and Maturity Models – Five Maturity Levels; Characteristics of Maturity Levels; Key Focus Areas; Towards Good Governance through E-Governance Models

Unit 3: E-Governance Infrastructure, Stages in Evaluation and Strategies for Success (8 Hrs.)
E-readiness - Data System Infrastructure, Legal Infrastructural Preparedness, Institutional Infrastructural Preparedness, Human Infrastructural Preparedness, Technological Infrastructural Preparedness; Evolutionary Stages in E-Governance

Unit 4: Applications of Data Warehousing and Data Mining in Government (6 Hrs.)
Introduction; National Data Warehouses - Census Data, Prices of Essential Commodities; Other Areas for Data Warehousing and Data Mining – Agriculture, Rural Development, Health, Planning, Education, Commerce and Trade, Other Sectors

Unit 5: CASE Studies (16 Hrs.)
Nepal (E-Governance Master Plan of Nepal; E-Governance in Local Government of Nepal; Nagarik App)
India (NICNET – Role of Nationwide Networking in E-Governance; Collectorate 2000; Computer-aided Administration of Registration Department (CARD); Smart Nagarpalika – Computerization of Urban Local Bodies (Municipalities); National Reservoir Level and Capacity Monitoring System; Computerization in Andra Pradesh State Trading Corporation; Ekal Seva Kendra; Sachivalaya Vahini or E-Governance Secretariat; Bhoomi; IT in Indian Judiciary; E-Khazana for Government Treasury, Andhra Pradesh; E-Governance in the Offices of Director General for Foreign Trade (DGFT); PRAJA – Rural e-Seva; E-Seva, A New

Paradigm in Citizen Services; E-Panchayat (Electronic Knowledge Based Panchayat); General Information Services of National Informatics Centre)
Other Countries (E-Governance initiative in USA; E-Governance Case Study in China – Beijing Business E-Park; Brazil's Poupatempo or 'Time Saver' Centres; Sri Lanka – Kothamale Community Radio Internet Project)

Recommended Books:

4. E-Governance: Concepts and Case Studies, C.S.R. Prabhu, Second Edition, PHI Learning, 2012.
5. Strategic Planning and Implementation of E-Governance, P.K.Suri and Sushil, Springer, 2019.
6. A Study of the Practice of E-governance in the Developing Countries: A Qualitative Approach In Measuring The Maturity of E-government, Kazi Hassan Robin and Md. Mahmudul Hasan Rafee, 2012.
7. Implementing and managing e-Government, Richard Heeks, 2006.

Teaching Methods:

The teaching faculties are expected to create environment where students can update and upgrade themselves with the current scenario of computing and information technology with the help of topics listed in the syllabus. The general teaching pedagogy that can be followed by teaching faculties for this course includes class lectures, tutorials, group discussions, case studies, guest lectures, research work, project work, assignments (Theoretical and Practical), and written and verbal examinations.

Evaluation

Examination Scheme				
Internal Assessment		External Assessment		Total
Theory	Practical	Theory	Practical	
20	20 (3 Hrs.)	60 (3 Hrs.)	-	

Course Name: Artificial Intelligence (3 Cr.)
Course Code: CACS410
Year/Semester: IV/VII
Class Load: 5 Hrs. / Week (Theory: 3Hrs. Practical: 2 Hrs.)

Course Description: The course introduces basics of artificial intelligent. It covers fundamental concepts artificial intelligence, problem solving, knowledge representation, neural networks, machine learning, natural language processing, machine vision and expert systems.

Objective:
The objective of this course is to introduce the basic principles, techniques, and applications of Artificial Intelligence. Upon the completion students will be able to:

- Gain fundamental concepts of principles of AI toward problem solving, inference, perception, knowledge representation, and learning.
- Investigate applications of AI techniques in expert systems, artificial neural networks and other machine learning models.

Course Contents:

UNIT 1: INTRODUCTION **[6 Hrs.]**

1.1 Intelligence, Intelligent behavior, Artificial Intelligence, Understanding AI based on thought process and behavior, Hard vs. Strong AI, Soft vs. Weak AI
1.2 Foundations of AI
1.3 Applications of AI
1.4 Intelligent Agents: Introduction of agents, Structure of Intelligent agent, Properties of Intelligent Agents,PEAS description of Agents, Types of Agents: Simple Reflexive, Model Based, Goal Based, Utility Based, Learning agent, Environment Types: Deterministic, Stochastic, Static, Dynamic, Observable, Semi-observable, Single Agent, Multi Agent

UNIT 2:PROBLEM SOLVING METHODS **[12Hrs.]**

2.1 Definition of a Problem, Problem as a state space representation, Problem formulation, Well-defined problems,Constraint satisfaction problem, Water jug problem,N-Queen problem, Cryptarithmetic problem, Graph coloring problem
2.2 Problem solving by searching, types of searching, Measuring problem solving performance, General State Space Search
2.3 Uninformed:Breadth-First Search, Depth-First Search,Depth-Limited Search, Iterative Deepening depth first Search, Bidirectional Search, Using uninformed search techniques for solving N-Queens Problem, Puzzle problem etc.
2.4 Informed search:Greedy Best-First Search,A* Search, Optimality of A*, Local search: Hill Climbing, Simulated Annealing, Using informed search techniques for solving N-Queens Problem, Puzzle problem etc.

2.5 Game Playing, Optimal Decisions in Games, Alpha – Beta Pruning, Minimax Algorithm, Tic-Tac –Toe Problem, Stochastic Games

UNIT 3: KNOWLEDGE REPRESENTATION AND REASONING[15Hrs.]

3.1 Definition and importance of Knowledge, Issues in Knowledge Representation, Knowledge Representation Systems, Properties of Knowledge Representation Systems, Types of Knowledge, The Role of Knowledge

3.2 Knowledge representation techniques: Rule Based, Semantic Nets, Frames, Logic based

3.3 Propositional Logic, Syntax and Semantic of propositional logic,Proof by Resolution, Conjunctive Normal Form (CNF), Resolution Algorithm,Limitations of Propositional Logic, Forward and Backward Chaining

3.4 Predicate Logic, FOPL, Syntax, Semantics, Quantification, horn clauses, Inference with FOPL: By converting into PL (Existential and universal instantiation), Rules of inference, Unification and lifting, CNF for FOPL, Inference using resolution, Resolution Refutation System (RRS)

3.5 Handling Uncertain Knowledge, Radom Variables, Prior and Posterior Probability, Inference using Full Joint Distribution, Bayes' Rule and its use, Bayesian Networks, Reasoning in Bayesian Networks

UNIT 4: LEARNING **[4 Hrs.]**

4.1 Concepts ofmachine learning

4.2 Rote learning, learning by analogy, inductive learning, Explanation based learning, Supervised and unsupervised learning,learning by evolution (genetic algorithm)

UNIT 5: NEURAL NETWORKS AND NATURAL LANGUAGE PROCESSING [7Hrs.]

5.1 Introduction to artificial neural network,Mathematical model of neural network, types of neural network: feed-forward, feed-back,Gate realization using neural network, Learning in neural networks: Back propagation algorithm,Hopfield network, Boltzmann machines

5.2 Concepts of natural language understanding and natural language generation, Steps in natural language processing, Syntax analysis, Semantic analysis, Pragmatic analysis

UNIT 6: EXPERT SYSTEM AND MACHINE VISION **[4 Hrs.]**

6.1 Expert System, Architecture of an expert system, Stages of expert systems development.

6.2 Concept of Machine Vision. Steps of machine vision, application of machine vision

Laboratory work:

Laboratory exercises can be conducted in LISP, PROLOG or any other high level programming language. Laboratory exercises must cover theconcepts of rule based intelligent agents, inference and reasoning,search techniques, neural networks, etc.for solving practical problems.

Reference Books:

1. Stuart Russel and Peter Norvig, Artificial Intelligence A Modern Approach, Pearson
2. E. Rich, K. Knight, Shivashankar B. Nair, Artificial Intelligence, Tata McGraw Hill.
3. George F. Luger, Artificial Intelligence: Structures and Strategies for Complex Problem Solving, Benjamin/Cummings Publication
4. D. W. Patterson, Artificial Intelligence and Expert Systems, Prentice Hall.
5. P. H. Winston, Artificial Intelligence, Addison Wesley.

Course Title: Operational Research (3 Cr.)
Course Code: CAOR451
Year/ Semester: IV/VIII
Class Load: 4Hrs. /Week (Theory: 3 Hrs. Tutorial: 1 Hrs)

Course Description

Operations Research is the study of scientific approaches to decision-making. Through mathematical modeling, it seeks to design, improve and operate complex systems in the best possible way. The mathematical tools used for the solution of such models are either deterministic or stochastic, depending on the nature of the system modeled. In addition, the course will learn very powerful modeling and solution techniques for decision-making problems that are used today by many successful companies to help them save/earn millions of dollars. The module covers topics that include: linear programming, transportation, assignment, inventory control, replacement theory and game theory. Analytic techniques and computer packages will be used to solve problems facing business managers in decision environments

Course Objectives

The general objectives of this course to provide a broad orientation of the field of optimization, with emphasis on basic theory and methods for continuous and discrete optimization problems in finite dimension, and it also gives some insight into its use for analyzing practical optimization problems.

Unit 1: Introduction to Operations Research **5 hrs.**

Introduction, History of Operations Research, Stages of Development of Operations Research Relationship between Manager and OR Specialist, OR Tools and Techniques, Applications of Operations Research, Limitations of Operations Research

Unit 2: Linear Programming Problem **10 hrs.**

Introduction to Linear Programming, Linear Programming Problem Formulation, Formulation with Different Types of Constraints, Graphical Analysis of Linear Programming, Graphical Linear Programming Solution, Multiple Optimal Solutions, Unbounded Solution, Infeasible Solution, Basics of Simplex Method, Simplex Method Computation, Simplex Method with More Than Two Variables, Primal and Dual Problems, Economic Interpretation

Unit 3: Transportation and Assignment Problem **8 hrs.**

Transportation Problems definition, linear form, Solution methods: North West corner method, least cost method, Vogel's approximation method. Degeneracy in transportation, Modified Distribution method, unbalanced problems and profit maximization problems. Transshipment Problems. Assignment Problem Structure and Solution: Short-Cut Method (Hungarian Method), Unbalanced Assignment Problem, Infeasible Assignment Problem, Maximization in an Assignment Problem, Crew Assignment Problem.

Unit 4: Queuing Theory **6 hrs.**

Basis of Queuing theory, elements of queuing theory, Kendall's Notation, Operating characteristics of a queuing system, Classification of Queuing models.

Unit 5: Inventory Control **6 hrs.**

Inventory classification, Different cost associated to Inventory, Economic order quantity, Inventory models with deterministic demands, ABC analysis.

Unit 6: Replacement theory **6 hrs.** Introduction, Replacement of capital equipment which depreciated with time, replacement by alternative equipment, Group and individual replacement policy

Unit 7: Game Theory **7 hrs.**

Introduction, Characteristics of Game Theory, Two Person, Zero sum games, pure strategy. Dominance theory, Mixed strategies (2x2, mx2), Algebraic and graphical methods

Teaching Methods

The general teaching pedagogy includes class lectures, presentations, group works, case studies, guest lecturers research works, project works, assignments (Theoretical and Practical). The teaching faculty will determine the choice of teaching pedagogy and encouraged to select software tools as per the requirements of topics for practical activities.

References/ Suggested Readings:

Hillier, F.S.& Lieberman, G.J. (1995). Introduction to Operations Research,7th edition. The McGraw-Hill Companies, Inc.

Natarajan, A. M.; Balasubramani, P. & Tamilarasi, A. (2007). Operations Research. Pearson Education Inc.

Sharma, J.K. (2009). Operational Research: Theory and Application. Macmillan Publishers India Ltd.

Taha, H.A. (2017). Operations Research: A Introduction, 10th edition, Global edition, Pearson Education, Inc. Pearson Prentice Hall.

Wagner, H. N. (2003). Operations Research by, Prentice hall. N D Vohra, Tata McGraw-Hill.

Winston, L.W. (2004). Operations Research: Applications and Algorithms, Indian University, 4th edition.

Evaluation

Examination Scheme				
Internal Assessment		**External Assessment**		**Total**
Theory	**Practical**	**Theory**	**Practical**	
40		**60**		**100**

Course Title: Project III (6 Cr.)
Course Code: CACS452
Year/Semester: IV/VIII
Class Load: Hrs./Week (Practical: 12 Hrs.)

Course Description: This final year project is a practical course where students are expected to implement the concepts learnt during four years of their study so as to build a system. The course includes realization of project management, software development, and programming skills.
Course Objectives: The objective of this course is to make students able to design and develop software applications by following appropriate development methodology.

Course Details:
Nature of Project:

Students should develop a complete functioning system. The system should not be limited to the basic CRUD operations only. Being a final year project, students are highly recommended to implement appropriate algorithms relevant to the project. The project should include precise system analysis, design, implementation and result analysis. The students can work in group of at most two members. The students can choose appropriate language technologies that they have learnt till eighth semester; however it is not limited. While implementing the project, students should be able to write their own program modules rather than relying on predefined APIs or Plugins except in some unavoidable circumstances.

Phases of Project:

The following are the phases of project work:

4. **Proposal Submission:** Students must submit and present project proposal after 3rd week of start of the eighth semester.

5. **Mid-Term:** Students must submit progress report and defend midterm progress of their project work in the 12th week of the eighth semester.

6. **Final Submission:** Students must submit and orally defend the project work during last week of the eight semester but before final board examination. Students must have to submit the project final report to their respective department before at least ten days of final defense date. The report should be submitted in standard format as prescribed. The hard/soft copy of report should be made available to the external expert before a week of presentation date. The final presentation should be followed by the demonstration session, where students have to demonstrate the project. A viva voice will be conducted by evaluation committee.

Provision of Supervision:

There should be a regular faculty of the campus/college assigned as a supervisor. The role of supervisor is to guide the students throughout the project and provide constructive suggestions. A supervisor can supervise at most four groups of the project in a class section. The supervisor should rigorously supervise, monitor and feedback the project groups under supervision.

Evaluation Scheme:

4. **Proposal Defense** of 10% of total marks based on project proposal and its presentation.

5. **Midterm** of 70% of total marks based on;
   a. **Work Done 60%**
      i. System Analysis and Design
      ii. Implementation
      iii. Understanding of methods used in project
      iv. Ability to work with others
      v. Ability to identify problems
      vi. Amount of work performed
   b. **Documentation 10%**
      i. Report Organization
      ii. Writing Style
      iii. Completeness of Report
      iv. Readability
      v. Organization and analysis of data and results

6. **Final Defense** of 20% of total marks based on presentation and project demonstration and viva-voice. Each group member should present about the project followed by the demonstration of project developed. The project should be ready to run for the demo session.

The **10 marks of the proposal defense** will be evaluated by the research committee formed by HOD/Coordinator as a part of proposal defense. The **70 marks of the midterm** will be evaluated by the supervisor and internal examiner as a part of midterm defense. Out of the 70 marks, the supervisor will evaluate for 60 marks and internal examiner will evaluate for 10 marks. The remaining **20 marks of final defense** will be evaluated by the external examiner from the university.

Out of 100 marks, the 80 marks (Proposal + Midterm Evaluation) will be considered as internal assessment while the 20 marks (Final Defense) will be considered as external assessment. Each student in the project should get passed in each of the internal and external assessments individually. Any student failing to pass each of the assessments will be considered as fail.

The evaluation committee and evaluation criteria should be as follow;

c. **Evaluation committee**
   - Project Supervisor
   - HOD/Coordinator
   - Internal Examiner (Regular Faculty)
   - External Examiner

d. **Focus of the evaluation**
   - Presentation Skills
   - Project Demonstration
   - Project Report
   - Viva/Question Answer
   - Level of Work and Understanding

- Teamwork and Contribution

Report Contents:

4. Prescribed content flow for the project proposal

1. Introduction
2. Problem Statement
3. Objectives
4. Methodology
    a. Requirement Identification
        i. Study of Existing System
        ii. Literature Review
        iii. Requirement Analysis
    b. Feasibility Study
        i. Technical
        ii. Operational
        iii. Economic
    c. High Level Design of System (Methodology of the proposed system/ Flow Chart/ Working Mechanism of Proposed System / Description of Algorithms)
5. Gantt Chart (showing the project timeline)
6. Expected Outcome
7. References

5. Prescribed content flow for the project report

11. Cover & Title Page
12. Certificate Page
    iv. Supervisor Recommendation
    v. Internal and External Examiners' Approval Letter
13. Acknowledgement
14. Abstract Page
15. Table of Contents
16. List of Abbreviations, List of Figures, List of Tables, List of Abbreviations
17. Main Report
18. References
19. Bibliography (if any)
20. Appendices (Screen Shots/ Source Codes)

6. Prescribed chapters in the main report

6. Chapter 1: Introduction

6.1. Introduction
6.2. Problem Statement
6.3. Objectives
6.4. Scope and Limitation
6.5. Development Methodology
6.6. Report Organization

7. Chapter 2: Background Study and Literature Review

7.1. Background Study (Description of fundamental theories, general concepts and terminologies related to the project)
7.2. Literature Review (Review of the similar projects, theories and results by other researchers)

8. Chapter 3: System Analysis and Design
8.1. System Analysis
8.1.1. Requirement Analysis
i. Functional Requirements (Illustrated using use case diagram and use case descriptions)
ii. Non Functional Requirements
8.1.2. Feasibility Analysis
i. Technical
ii. Operational
iii. Economic
iv. Schedule
8.1.3. Object Modelling using Class and Object Diagrams
8.1.4. Dynamic Modelling using State and Sequence Diagrams
8.1.5. Process Modelling using Activity Diagrams
8.2. System Design
8.2.1. Refinement of Class, Object, State, Sequence and Activity diagrams
8.2.2. Component Diagrams
8.2.3. Deployment Diagrams
8.3. Algorithm Details (if any)

9. Chapter 4: Implementation and Testing
9.1. Implementation
9.1.1. Tools Used (CASE tools, Programming languages, Database platforms)
9.1.2. Implementation Details of Modules (Description of classes/procedures/functions/methods/algorithms)
9.2. Testing
9.2.1. Test Cases for Unit Testing
9.2.2. Test Cases for System Testing
9.3. Result Analysis

10. Chapter 5: Conclusion and Future Recommendations
10.1. Conclusion
10.2. Future Recommendations

While writing above chapters students should avoid basic definitions. They should relate and contextualize the above mentioned concepts with their project work.

Citation and Referencing

The listing of references should be listed in the references section. The references contain the list of articles, books, urls, etc. that are cited in the document. The books, articles, and others that are studied during the study but are not cited in the document can be listed in the bibliography section. The citation and referencing standard should be IEEE referencing standard. The text inside the document should be cited in IEEE style. The IEEE referencing standard can be found in the web.

Report Format Standards

G. Page Number

The pages from certificate page to the list of tables/figures/abbreviations/approvals should be numbered in roman starting from i. The pages from chapter 1 onwards should be numbered in numeric starting from 1. The page number should be inserted at bottom, aligned center.

H. Page Size and Margin

- The paper size must be a page size corresponding to A4. The margins must be set as

  Top = 1; Bottom = 1; Right = 1; Left 1.25

I. Paragraph Style

- All paragraphs must be justified and have spacing of 1.5.

J. Text Font of Document

- The contents in the document should be in Times New Roman font
- The font size in the paragraphs of document should be 12

K. Section Headings

- Font size for the headings should be 16 for chapter headings, 14 for section headings, 12 for sub-section headings. All the headings should be bold faced.

L. Figures and Tables

- Position of figures and tables should be aligned center. The figure caption should be centred below the figure and table captions should be centred above the table. All the captions should be of bold face with 12 font size.

Final Report Binding and Submission:

No of Copies: 3 (College Library + Self + Dean Office)

Look and Feel: Golden Embracing with Black Binding

A final approved signed copy of the report should be submitted to the Dean Office, Exam Section, FOHSS.

Teaching Methods:

The major teaching methods that can be followed for this course includes class lectures, laboratory activity, group discussions, presentations, and demonstrations.

Evaluation

Examination Scheme			
Internal Assessment		**External Assessment**	**Total**
Proposal Defence	**Midterm Defence**	**Final Defence**	
10	**70**	**20**	**100**

Elective Courses

Course Title: **Database Programming**
Course Code: **CACS453**
Year/Semester: **IV/VIII**
Class Load: **6 Hrs. /Week (Theory: 3Hrs, Practical 3Hrs.)**

Course Description
This course provides the comprehensive knowledge about database programming in relational database management system, which encompasses with overview of fundamental SQL statement, PL/SQL Block, Exception, Cursors, Record, Triggers, Procedures, Functions and Packages

Objectives: The general objectives of this course is to enhance advance programming skills in relational database management system.

Unit -1
Introduction of RDBMS **10 Hrs**
Overview of the Oracle Database Architecture, Familiar with SQL*Plus, SQL*Plus Commands (DESCRIBE, LIST, APPEND, CHANGE, INPUT, DEL, CLEAR BUFFER, Using Script Files), Accepting Values at Runtime, Overview of Fundamental SQL Fundamental Command (DDL, DML, DCL, Join and Subquery)

Unit -2
PL/SQL **13 Hrs**
PL/SQL Concepts, Architecture, Block structure, Executing PL/SQL Script, DBMS_OUTPUT.PUT_LINE Statement, substitution Variable feature, PL/SQL Language fundamentals, DML Statement in PL/SQL, Transaction Control in PL/SQL. Conditional Control (if, nested if, Case), Repetitive Control (While, for, simple loop, Nested, continue, loop label)

Unit -3 **5 Hrs**
PL/SQL Exception
Exception scope, user-defined exception, exception propagation, advance exception concepts (RAISE_APPLICATION_ERROR, EXCEPTION_INIT)

Unit -4
Database Cursors **5 Hrs**
Types of cursors, cursor loop, Nested cursors cursor for loops, parameterized cursors, Nested cursors

Unit -5
Database Triggers **5 Hrs**
Database Triggers BEFORE, AFTER Triggers, row and statement triggers, INSTEAD OF triggers

Unit -6
Record and procedures **5 Hrs**
Record (Record types, Nested record) Procedure (Block Structure, Anonymous Block, creating procedure, IN, OUT parameters in Procedure)
Unit-7

Functions and Package **5 Hrs**

Functions (creating and invoking function and optimizing function in execution, creating packages, extending the package, package instantiation and initialization,

Laboratory Works

Laboratory works should be done covering all the topics listed above and a small work should be carried out using the concept learnt in each unit in individual or group.

Teaching Methods

The general teaching pedagogy includes class lectures, group discussions, case studies, guest lectures, research work, project work, assignments (theoretical and practical), and examinations (written and verbal), depending upon the nature of the topics. The teaching faculty will determine the choice of teaching pedagogy as per the need of the topics.

References

1. Benjamin Rosenzweig, E. R. (2015). Oracle PL/SQL by Example. New Yourk: Prentice Hall.
2. Gupta, S. K. (2016). Advanced Oracle PL/SQL Developer's Guide . Birmingham: Packt Publishing.
3. Lex de Haan, T. G. (2014). Beginning Oracle SQL. Apress.
4. McLaughlin, M. (2014). Oracle Database 12c PL/SQL Programming. New Delhi: McGrawHill Education.

Course Title: Geographical Information System (3 Cr.)
Course Code: CACS454
Year/Semester: IV/VIII
Class Load: 5 Hrs. / Week (Theory: 3Hrs. Practical: 2 Hrs.)

Course Description

This course offers detailed knowledge as well as practical skills on GIS theory, design and implementation. It includes introduction, GIS and Map, GIS data sources and structures, spatial data analysis, GIS data modeling and creating map apart from this this encourages to students to develop a real time basic GIS project.

Course objectives

The general objectives of this course are to provide theoretical knowledge as well as practical skills of geographical information system to make students capable of capturing, analyzing and visualize real world data.

Course Contents

Unit 1: Introduction **6 Hrs.**
- 1.1 Definition, functions and Applications of GIS
- 1.2 Components of GIS
- 1.3 GIS as Information System
- 1.4 Nature & Sources of GIS data
- 1.5 Recent trends and future of GIS

Unit 2: GIS and Map **8 Hrs.**
- 2.1 Map and their characteristics
- 2.2 Mapping concept and Techniques
- 2.3 Map Projection

Unit 3: GIS data Sources & Structures **12 Hrs.**
- 3.1 Capturing GIS data
- 3.2 Sources: Maps, GPS, Images and Databases
- 3.3 Structures: Vector, Raster and TIN data structures
- 3.4 GIS data modeling
- 3.5 GIS database design

Unit 4: Spatial Data Modeling and Analysis **12 Hrs.**
- 4.1 Spatial data modeling
- 4.2 Vector based analysis
- 4.3 Raster based analysis

Unit 5: GIS data modeling & Creating Maps **10 Hrs.**
- 5.1 Surface modeling
- 5.2 Hydrology modeling
- 5.3 Designing and printing the map

Laboratory Works

Students should develop basic GIS project implementing the concepts given in course of study and may add more (if required).

Teaching Methods

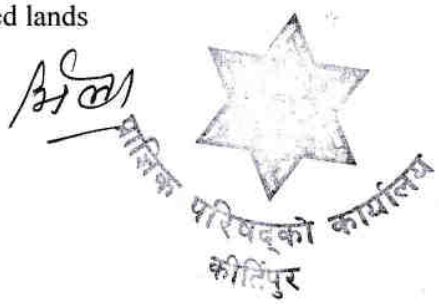
The teaching faculties are expected to create environment where students can update and upgrade themselves with the current scenario of computing and information technology with the help of topics listed in the syllabus. The general teaching pedagogy that can be followed by teaching faculties for this course includes class lectures, laboratory activity, group discussions, case studies, guest lectures, research work, project work, assignments (Theoretical and Practical), and written and verbal examinations.

Evaluation

Examination Scheme				
Internal Assessment		External Assessment		Total
Theory	Practical	Theory	Practical	
20	20 (3 Hrs.)	60 (3 Hrs.)	-	

Reference Books

1. Kang-tsung Chang, (2010). "Introduction to Geographic Information Systems" Tata McGraw Hill, New Delhi.
2. C.P.Lo and Albert K.W.Yeung (2006). "Concepts and Techniques of Geographic Information Systems" Prentice Hall of India, New Delhi.
3. Albert, C.T.L. and Yeung, K.W. (2002). "Concepts and Techniques of Geographical Information Systems", New Delhi: Prentice Hall.
4. Chakraborty, D. and Sahoo, R.N. (2007). Fundamentals of GIS. India: Viva Books.
5. ESRI guide to GIS analysis Andy Mitchell, ESRI press, Red lands



Course Title: **Data Analysis and Visualization (3 Cr.)**
Course Code: **CACS455**
Year/Semester: **IV/VIII**
Class Load: **5 Hrs. / Week (Theory: 3Hrs. Practical: 2Hrs.)**

Course Description

This course introduces to extend student's knowledge and practice in data analysis and visualization, software, and applications. It provides the board overview of techniques of the visualization process, detailed view of visual perception, the visualized data and the actual visualization, interaction and distorting techniques.

Course objectives

Upon completion of this course, students should be able to 1. Explain the concept of visualization in the processing and analysis of data. 2. Develop visualization methods and visualization systems using software applications. 3. Perform creative work in the field of visualization.

Course Contents

	Hours
Unit 1: Introduction to visualization Introduction of visual perception, Visual representation of data, Data Abstraction, Visual Encodings, Use of Color, Perceptual Issues, Information overloads	6
Unit 2: Creating visual representations Visualization reference model, Visual mapping, Visual analytics, Design of Visualization applications.	7
Unit 3: Non spatial data visualization Visualization of one, two and multi-dimensional data, Tabular data, quantitative values (scatter plot), Separate, Order, and Align (Bar, staked Bar, dots and line charts), Tree data, Displaying Hierarchical Structures, graph data, rules for graph drawing and labeling, text and document data, levels of text representation, visualizations of a single text document, word cloud, flow data Time series data, characteristics of time data, visualization time series data, mapping of time	15
Unit 4: Spatial Data Visualization Scalar fields, Isocontours (Topographic Terrain Maps), scalar volumes, Direct Volume Rendering(Multidimensional Transfer Functions) , Maps (dot, pixel), vector fields Defining Marks and Channels	10
Unit 5: Software tools and data for visualization The iris data set, The Detroit Data Set, The Breakfast Cereal Data Set, The Dow Jones Industrial Average Data Set (time series), MS spread sheet, Python, Matlab, Java, Tableau	10

Evaluation

Evaluation Scheme

Internal Assessment		External Assessment		Total
Theory	Practical	Theory	Practical	100
20	20 (3 Hrs.)	60 (3 Hrs.)	-	

Laboratory Work

Laboratory work should be done covering all the topics listed above and a small project work should be carried out using the concept learnt in this course using any one software tools mention in unit 5.

Text Books:

3. Fry, Visualizing Data. O'Reilly Media, 2008, ISBN 0596514557
4. Ware, Information Visualization: Perception for Design, 3rd ed. Morgan Kaufmann, 2012,

Reference Books:

5. Telea, Data Visualization: Principles and Practice. A. K. Peters, Ltd, 2007, ISBN 1568813066.

Course Title: **Machine Learning (3 Cr.)**
Course Code: **CACS456**
Year/Semester: **IV/VIII**
Class Load: **6 Hrs. / Week (Theory: 3Hrs. Practical: 3Hrs.)**

Course Description

This course presents comprehensive introduction to several topics on basic concepts and techniques of Machine Learning (ML). It also explores the understanding of the Supervised and unsupervised learning techniques, probability based learning techniques, performance evaluation of ML algorithms and applications of ML.

Course objectives

Upon completion of this course, students should be able to 1. Explain the concept of supervised, unsupervised and semi-supervised learning. 2. Develop algorithms to learn linear and non-linear models using software. 3. Perform creative work in the field machine learning to solve given problem.

Course Contents

	Hours
Unit 1: Introduction to machine learning History of machine learning, Brain-neuron learning system, Definition and types of learning, need of machine learning, Data and tools, review of statistics, training, validation and test data, theory of learning – feasibility of learning – error and noise – training versus testing, generalization bound – approximation-generalization tradeoff – bias and variance – learning curve	10
Unit 2 Introduction to Supervised Learning Classification problems, Linear Regression- Predicting numerical value, Finding best fit line with linear regression, Perceptron, learning neural networks structures, Decision tree representation, appropriate problems for decision tree learning, basic decision tree algorithm, support vector machines, Separating data with maximum margin, Finding the maximum margin,	11
Unit 3: Bayesian and instance based learning Probability theory and Bayes rule. Classifying with Bayes decision theory, Conditional Probability, Bayesian Belief Network, K-nearest neighbor	11
Unit 4:Introduction to un-supervised learning and dimensionality reduction Introduction to clustering, K- Mean clustering, different distance functions for clustering, Hierarchical clustering, Supervised learning after clustering, dimensionality reduction techniques, Principal component analysis	10
Unit 5: Measures for Performance Evaluation of ML algorithms Classification accuracy, Confusion matrix Misclassification costs, Sensitivity and specificity, ROC curve, Recall and precision, box plot, confidence interval	6

Evaluation

Evaluation Scheme

Internal Assessment		External Assessment		Total
Theory	Practical	Theory	Practical	100
20	20 (3 Hrs.)	60 (3 Hrs.)	-	

Laboratory Work

Laboratory work should be done covering all the topics listed above and a small project work should be carried out using the concept learnt in this course using software like matlab, python.

Text Books:

1. Tom M Mitchell, Machine Learning, First Edition, McGraw Hill Education, 2013.
2. Stephen Marsland, Machine Learning – An Algorithmic Perspective, Second Edition, Chapman and Hall/CRC Machine Learning and Pattern Recognition Series, 2014.

Reference Books:

3. Peter Flach, Machine Learning: The Art and Science of Algorithms that Make Sense of Data, First Edition, Cambridge University Press, 2012.

Course Title: Multimedia System
Course Code: CACS457
Year/Semester: IV/VIII
Class Load: 5 Hrs. / Week (Theory: 3Hrs. Practical: 2 Hrs.)

Course Description

This course offers detailed concept and structure of Multimedia system. It includes introduction, Sound & Audio System, Images and Graphics, Video and Animation, Data Compression, Abstractions for programming , Multimedia design and applications . It does not entirely focus on theoretical concept but also strongly focuses on practical skill based learning

Course objectives

The general objectives of this course are to provide theoretical as well as practical knowledge of Multimedia System, applications and tools to make students capable of implementing, managing and developing the issues of multimedia application in their personal as well professional life.

Course Contents

Unit 1: Introduction **(6 Hrs)**

1.1 Multimedia and its applications
1.2 Global structure of Multimedia
1.3 Medium
1.4 Multimedia system and properties
1.5 Characteristics of a Multimedia system
1.6 Challenges for Multimedia Systems
1.7 Components of Multimedia System
1.8 Multimedia building blocks
1.9 Scope of Multimedia

Unit 2: Sound / Audio System **(5Hrs)**

2.1 Overview sound system
2.2 Producing digital audio
2.2 Music and speech
2.3 Speech Generation
2.4 Speech Analysis
2.5 Speech Transmission
2.6 Representation of audio files
2.7 Computer Music –MIDI
2.8 MIDI versus Digital Audio

Unit 3: Images and Graphics **(5 Hrs)**

3.1 Uses of images and Graphics
3.2 Digital Image Representation
3.3 Image and graphics Format
3.4 Working with image and graphics
3.5 Image Synthesis , analysis and Transmission

Unit 4: Video and Animation **(6 Hrs)**

4.1 Digital Video
4.2 Video signal representation
4.3 Computer Video Format
4.4 Computer- Based animation
4.5 Animation Language
4.6 Timeline and frame based animation
4.7 Timeline and Tween-Based animation

4.8 Methods of controlling Animation
4.9 Display of Animation
4.10 Transmission of Animation

Unit 5: Data Compression **(8 Hrs)**

5.1 Need for Data Compression
5.2 Compression Basics
5.3 Storage Space
5.4 Coding Requirements
5.5 Lossless and Lossy Compression techniques
5.6 Source, Entropy and Hybrid Coding
5.7 Lossy Sequential DCT- based Mode
5.8 Expanded Lossy DCT-based Mode
5.9 JPEG and MPEG Compression

Unit 6: Abstractions for programming **(6 Hrs)**

6.1 Abstractions Levels
6.2 Libraries
6.3 System Software
6.4 Toolkits
6.5 Higher Programming Languages
6.6 Object –oriented approaches

Unit 7: Multimedia design **(6 Hrs)**

7.1 Development phases and development teams
7.2 Analysis phase
7.3 Design Phase
7.4 Development phase
7.5 Implementation Phase
7.6 Evaluation and testing phase
7.7 Multimedia User Interface Design

Unit 8 : Multimedia Application **(6 Hrs)**

8.1 Media preparation and composition
8.2 Media integration and communication
8.2 Media Entertainment
8.4 Telemedicine
8.5 E-learning
8.6 Digital video editing and production systems
8.7 Video conferencing
8.8 Video-on-demand

Laboratory Works

Labs consist of at least 8 practical experiments and two assignments covering the topics of the syllabus.

Teaching Methods

The teaching faculties are expected to create environment where students can update and upgrade themselves with the current scenario of computing and information technology with the help of topics listed in the syllabus. The general teaching pedagogy that can be followed by teaching faculties for this course includes class lectures, laboratory activity, group discussions, case studies, guest lectures, research work, project work, assignments (Theoretical and Practical), and written and verbal examinations.

Evaluation

Examination Scheme				
Internal Assessment		External Assessment		Total
Theory	Practical	Theory	Practical	
20	20 (3 Hrs.)	60 (3 Hrs.)	-	

Text Books

1. Ralf Steinmetz and Klara Nahrstedt , Multimedia: Computing, Communications and Applications, Pearson Education Asia
2. John F. Koegel Buford , Multimedia Systems, Pearson Education Asia

Reference Books

1. Fred Halsall , Multimedia Communications, Applications, Networks, Protocols and Standards, Pearson Education Asia
2. Ralf Steinmetz and Klara Nahrstedt, Multimedia fundamentals, Pearson Education Asia

Course Title: Knowledge Engineering (3 Cr.)
Course Code: CACS458
Year/Semester: IV/VIII
Class Load: 5 Hrs. / Week (Theory: 3Hrs. Practical: 2 Hrs.)

Course Description

This course offers detailed concept about knowledge representation, logic, reasoning and principles. It includes introduction, knowledge acquisition, knowledge representation and reasoning. It does not entirely focus on theoretical concept but also strongly focuses on practical skill based learning.

Course objectives

The general objectives of this course are to provide theoretical as well as practical knowledge of knowledge engineering to make students capable of analysis, design, implementing and managing of knowledge engineering in their personal as well professional life.

Course Contents

Unit 1: Introduction [6 Hrs.]

1.1 Overview of data. Information and knowledge
1.2 Knowledge engineering and Knowledge management
1.3 Artificial intelligence use in knowledge Engineering
1.4 Knowledge based system and its applications

Unit 2: Knowledge Acquisition [8 Hrs]

2.1 Information gathering
2.2 Information retrieval
2.3 Applications of Natural Language processing
2.3.1 Morphology, lexicon, syntax and semantics
2.3.2 Parsing, POS tagging, named entity tagging

Unit3: Machine Learning [12 Hrs]

3.1 Machine Learning and its applications
3.2 Supervised and unsupervised learning
3.3 Classification and clustering
3.4 Classification algorithms
3.4.1 Linear classifiers
3.4.2 nearest neighbor
3.4.3 Support Vector Machines
3.4.4 Decision tree
3.4.5 Random forest
3.4.6 Neural networks
3.4.7 Case based reasoning

Unit 4: Knowledge representation and reasoning [7Hrs]

4.1 Proposition logic, predicate logic and reasoning
4.2 Knowledge representation languages
4.3 Non-monotonic reasoning
4.4 Probabilistic reasoning

Unit 5: Ontology Engineering [6 Hrs]

5.1 Overview to Ontology
5.2 Classifications of ontology
5.3 Methodology use in Ontology

5.4 Ontology VS Language

Unit 6: Knowledge Sharing [9 Hrs]
6.1 Information Distribution and Integration
6.2 Semantic web and its applications
6.2.1 RDF and linked data
6.2.2 Description logic
6.2.3Web Ontology language
6.3 Social web and semantics

Laboratory Works
The practical work consists of all features of knowledge engineering and case studies.

Teaching Methods
The teaching faculties are expected to create environment where students can update and upgrade themselves with the current scenario of computing and information technology with the help of topics listed in the syllabus. The general teaching pedagogy that can be followed by teaching faculties for this course includes class lectures, laboratory activity, group discussions, case studies, guest lectures, research work, project work, assignments (Theoretical and Practical), and written and verbal examinations.

Evaluation

Examination Scheme				
Internal Assessment		**External Assessment**		**Total**
Theory	**Practical**	**Theory**	**Practical**	
20	**20 (3 Hrs.)**	**60 (3 Hrs.)**	**-**	

Text Books

3. Kendal, Simon, Creen, Malcolm, An Introduction to Knowledge engineering, Springer first edition, 2007
4. R.J. Brachman and H.J. Levesque. Knowledge representation and resoning (Elsevier 2004)

Reference Books

1. Stuart Russell and Peter Norvig, Artificial Intelligence: A modern approach (Prentice Hall edition , second edition, 2002)
2. P. Jackson, Introduction to expert systems, Addison Wesley, 1999.
3. John Debenham, Knowledge Engineering: Unifying Knowledge Base and Database Design , Springer , 1998

Course Title: Information Security (3 Cr.)
Course Code: CACS459
Year/Semester:
Class Load: 6 Hrs. / Week (Theory: 3Hrs. Practical: 3 Hrs.)

Course Description: The course introduces the theoretical as well as practical concepts of computer and information security. The course includes concepts of cryptographic algorithms, authentication systems, access controls, malicious logics, network security and security audits.

Course Objectives: The objectives of this course are to familiarize the students with the computer security concepts, security policies and security mechanisms so that students will be able to design, implement and manage the secure computer systems.

Course Contents:

Unit I: Overview of Computer security (4 Hrs)

1.1. Computer Security Concepts
1.2. Computer Security, Information Security, Network Security
1.3. Threats, Attacks and Assets
1.4. Security Requirements
1.5. Security Design Principles
1.6. Attack Surfaces and Attack Trees
1.7. Computer Security Strategy

Unit II: Cryptographic Algorithms (12 Hrs)

2.1. Classical Cryptosystems: Ceasar, Vignere, Playfair, Rail Fence Ciphers
2.2. Modern Ciphers: Block vs. Stream Ciphers, Symmetric vs. Asymmetric Ciphers
2.3. Symmetric Encryption: Fiestel Cipher Structure, Data Encryption Standards (DES), Basic Concepts of Fields: Groups, Rings, Fields, Modular Arithmetic, Galois Fields, Polynomial Arithmetic, Advanced Encryption Standards (AES)
2.4. Number Theory: Prime Numbers, Fermat's Theorem, Primility Testing: Miller-Rabin Algorithm, Euclidean Theorem, Extended Euclidean Theorem, Euler Totient Function
2.5. Asymmetric Encryption: Diffie-Helman Key Exchange, RSA Algorithm

Unit III: Message Authentication and Hash Functions (6 Hrs)

3.1. Message Authentication
3.2. Hash Functions
3.3. Message Digests: MD4 and MD5
3.4. Secure Hash Algorithms: SHA-1
3.5. HMAC
3.6. Digital Signatures

Unit IV: User Authentication (5 Hrs)

4.1. User Authentication Principles
4.2. Password-Based Authentication
4.3. Token-Based Authentication
4.4. Biometric Authentication
4.5. Remote User Authentication
4.6. Two Factor Authentication

Unit V: Access Control (5 Hrs)

5.1. Access Control Principles
5.2. Subjects, Objects and Access Rights
5.3. Access Control Matrix and Capability Lists
5.4. Discretionary Access Control
5.5. Role Based Access Control
5.6. Attribute Based Access Control
5.7. Identity, Credential and Access Management
5.8. Trust Frameworks

Unit VI: Malicious Software and Intrusion (4 Hrs)
6.1. Malicious Software
6.2. Virus and its phases, Virus Classification
6.3. Worm, Worm Propagation Model, State of Worm Technology
6.4. Trojan Horse
6.5. Intrusion and Intruders
6.6. Intrusion Detection System
6.7. Analysis Approaches: Anomaly Based, Signature Based
6.8. Honeypots

Unit VII: Network Security (5 Hrs)
7.1. Overview of Network Security
7.2. Email Security: S/MIME, Pretty Good Privacy (PGP)
7.3. Secure Socket Layer (SSL) and Transport Layer Security (TLS)
7.4. IP Security (IPSec)
7.5. Firewalls and their types

Unit VIII: Security Auditing (7 Hrs)
8.1. Security Audit
8.2. Security Auditing Architecture
8.3. Security Audit Trail
8.4. Implementing Logging Function
8.5. Audit Trail Analysis

Laboratory Works:
The laboratory work includes implementing and simulating the concepts of cryptographic algorithms, hash functions, digital signatures, authentication & authorization systems, and malicious logics. The laboratory work covers implementing programs for following;

- Classical ciphers like Caeser, Playfair, Railfence
- DES, AES
- Primality Testing, Euclidean Algorithm, RSA
- MD5, SHA
- Authentication systems like password based, Captcha, two factor authentication etc.
- Role Based Access Controls
- Malicious Logics

Teaching Methods

The major teaching methods that can be followed for this course includes class lectures, laboratory activity, group discussions, presentations and case studies. For the laboratory work, the instructor can choose any programming language based on comfort level of students.

Evaluation

Examination Scheme				
Internal Assessment		External Assessment		Total
Theory	Practical	Theory	Practical	
20	20 (3 Hrs.)	60 (3 Hrs.)	-	

Text Book:

4. William Stallings and Lawrie Brown, Computer Security: Principles and Practice, Pearson
5. William Stallings, Cryptography and Network Security: Principles and Practice, Pearson.

Reference Books:

1. Mark Stamp, Information Security: Principles and Practices, Wiley
2. Matt Bishop, Introduction to Computer Security, Addison Wesley
3. Matt Bishop, Computer Security, Art and Science, Addison Wesley
4. Charles P. Pfleeger and Shari Lawrence Pfleeger, Security in Computing, Pearson

Course Name: Internet of Things (3 Cr.)
Course Code: CACS460
Year/Semester: IV/VIII
Class Load: 5 Hrs. / Week (Theory: 3Hrs. Practical: 2 Hrs.)

Course Description: The course introduces basics of IoT. It covers introductions of IoT, Devices and platform for developingIoT Systems, Design methodology, Data Analytics for IoT, Servers & Cloud offering and IoT system security.

Objective:
The objective of this course is to introduce the students about the principles, techniques, development and applications of IoT System.

Course Contents:

Unit 1: Introduction to IoT **[8Hrs.]**

1.1 Definition and Characteristics of IoT.
1.2 Physical and Logical Design of IoT.
1.3 IoT Enabled Technologies
1.4 IoT and M2M
1.5 Domain Specific IoTs: Home Automation, Cities, Environment, Energy, Retail, Logistics, Agriculture, Industry, Health and Lifestyle.

Unit 2: Sensor, Actuators and Interfacing **[18 Hrs.]**

2.1 Roles of Sensors and actuators, Types of sensors: Active and passive, analog and digital, Contact and no-contact, Absolute and relative
2.2 Working of sensors: Position, occupancy and motion, velocity and acceleration, force, pressure, flow, Acoustic, Humidity, light, radiation, temperature, chemical, biosensor, camera.
2.3 Development boards: Arduino and Raspberry pi installation, interfacing and programming using python.

Unit 3: IoT Platform Design Methodology **[6 Hrs.]**

Case Study on IoT System for Weather Monitor

Unit 4: Data and Analytics for IoT **[10Hrs.]**

4.1 An Introduction to Data Analytics for IoT
4.2 Machine Learning
4.3 Big Data Analytics Tools and Technology
4.4 Edge Streaming Analytics
4.5 Network Analytics

Unit 5: IoT Physical Servers and Cloud Offering **[3Hrs.]**

Cloud storage models and Communication APIs of IoT Systems

Unit 6: Securing IoT Systems **[3Hrs.]**

6.1 IoT Security Challenges
6.2 IoTSystem's Security Practices

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Laboratory Work:

Implement the concept mentioned in the course using Python as a programming language, Arduino or Raspberry pi as a System board. All sensors mentioned in course should be implemented in a single project or separately to observe their working mechanism.

Evaluation:

Examination Scheme				
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Theory	Practical	Theory	Practical	
20	20	60	-	

Reference Books:

1. ArshdeepBahga, Vijay Madisetti, "Internet of Things (A Hands-on-Approach)", University Press India Pvt. Ltd., 2015.
2. David Hanes, Gonzalo Salgueiro, Patrick Grossetete, Robert Barton, Jerome Henry,"IoT Fundamentals: Networking Technologies, Protocols, and Use Cases for the Internet of Things", Pearson Education (Cisco Press Indian Reprint).
3. Raj Kamal, "Internet of Things: Architecture and Design Principles", McGraw Hill Education, 2017.
4. Gary Smart, "Practical Python Programming for IoT", ISBN-10: 1838982469
5. Gaston C. Hillar Internet of Things with Python, ISBN-10: 1785881388