E-Commerce

Course Title: E-Commerce
Course No: CSC381
Nature of the Course: Theory + Lab
Semester: VI

Full Marks: 60 + 20 + 20
Pass Marks: 24 + 8 + 8
Credit Hrs: 3

Course Description:
This course covers the fundamental concepts of E-commerce and E-business models, and components of E-commerce system.

Course Objectives:
The main objective of this course is to provide basic concepts of E-commerce, E-commerce Business Models, E-Payments, E-commerce Security, Digital Marketing, Search Engine Optimization, and Basics of Recommendation System.

Course Contents:

Unit 1: Introduction (4 Hrs.)
E-commerce, E-business, Features of E-commerce, Pure vs. Partial E-commerce, History of E-commerce, E-commerce Framework (People, Public Policy, Marketing and Advertisement, Support Services, Business Partnerships), Types of E-commerce: B2C, B2B, C2B, C2C, M-Commerce, U-commerce, Social-Ecommerce, Local E-commerce, Challenges in E-commerce, Status of E-commerce in Nepal, Overview of Electronic Transaction Act of Nepal

Unit 2: E-commerce Business Model (8 Hrs.)
E-commerce Business Model, Elements of Business Model, Types of Revenue Models, B2C Business Models: E-tailer, Community Provider, Content Provider, Portal, Transaction Broker, Market Creator, Service Provider, B2B Business Models: Net Market Places (E-distributer, E-procurement, Exchanges, Industry Consortia), Private Industrial Networks (Single Firm, Industry Wide), Electronic Data Interchange (EDI), EDI Layered Architecture, EDI in E-commerce, E-commerce and Industry Value Chain, Firm Value Chain, Firm Value Web, Case Studies of Global and Local E-commerce Systems

Unit 3: Electronic Payment System (9 Hrs.)
E-payment System, Online Credit Card Transaction, Online Stored Value Payment System, Digital and Mobile Wallet, Smart Cards, Social/Mobile Peer-to-Peer Payment Systems, Digital Cash/e-cash, E-Checks, Virtual Currency, Electronic Billing Presentment and Payment (EBPP) System, Auctioning in E-commerce (English, Dutch, Vickery, Double), SET Protocol, Features of SET, Participants in SET, Card Holder Registration, Merchant Registration, Purchase Request, Dual Signature, Payment Authorization, Payment Capture, Status of E-Payment Systems in Nepal, Case Studies of Global and Local Payment Systems

Unit 4: Building E-commerce System (5 Hrs.)
E-commerce Website/Software, Building Catalogs: Static, Dynamic, Building Shopping Cart, Transaction Processing, Development of E-commerce Website/Software: Databases, Application Programs, Integration with ERP Systems, Integration with Payment Gateways, Using Open Source CMS for Development of E-commerce Applications

Unit 5: Security in E-Commerce (7 Hrs.)
E-commerce Security, Dimensions of E-commerce Security: Confidentiality, Integrity, Availability, Authenticity, Nonrepudiation, Privacy, Security Threats in E-commerce: Vulnerabilities in E-commerce, Malicious Code, Adware, Spyware, Social Engineering, Phishing, Hacking, Credit card fraud and Identity theft, Spoofing and Pharming, Client and Server Security, Data Transaction Security, Security Mechanisms: Cryptography, Hash Functions, Digital Signatures, Authentication, Access Controls, Intrusion Detection System, Secured Socket Layer(SSL)

Unit 6: Digital Marketing (7 Hrs.)
Digital Marketing, Online Advertisement, Ad Targeting, Search Engine Marketing, Keyword Advertising, Search Engine Optimization, Display Ad Marketing, Interstitial Ad, Video Ad, Advertising Exchanges, Programmatic Advertising, Real-Time Bidding, E-mail Marketing, Affiliate Marketing, Social Marketing, Mobile Marketing, Local Marketing, Online Marketing Metrics, Pricing Models for Online Advertisements, Case Studies: Facebook Marketing Tools, Twitter Marketing Tools, Pinterest Marketing Tools, Location Based Marketing Tools: Google AdSense

Unit 7: Optimizing E-commerce Systems (5 Hrs.)
Search Engine Optimization, Working mechinaism of Search Engines, On Page SEO, Off Page SEO, Page Ranks, Using Google Aanalytics, Social Media Analytics, Recommendation Systems: Collaborative, Content Based, Use of Recommendation Systems in E-commerce

Laboratory Works:
The laboratory work includes developing E-commerce applications. The students are highly encouraged to use server side and client side scripting for developing the applications with categories, shopping carts, payment gateways. Students can also use open source ecommerce CMS frameworks and configure them to simulate e-commerce systems. The laboratory work for e-comerce optimization includes SEO tools like Google Analytics, Facebook Analytics, Twitter Analytics etc. Students can also implement basic recommendation system in the e-commerce systems.

Text / Reference Books:

1. Kenneth C. Laudon and Carol Guercio Traver, E-commerce Business Technology Society, Pearson
2. Electronic Transaction ACT of Nepal
3. SET Secure Electronic Transaction Specification Book 1: Business Description
4. Efraim Turban, Jon Outland, David King, Jae Kyu Lee, Ting-Peng Liang, Deborrah C. Turban, Electronic Commerce A Managerial and Social Networks Perspective, Springer
5. Gary P. Schneider, Electronic Commerce, Course Technology, Cengage Learning
6. Colin Combe, Introduction to E-business Management and strategy, Elsevier
7. Dave Chaffey, E-Business & E-Commerce Management Strategy, Implementation And Practice, Pearson
8. Cristian Darie and Emilian Balanescu, Beginning PHP and MySQL E-Commerce From Novice to Professional, Apress
9. Cristian Darie and Karli Watson, Beginning ASP.NET E-Commerce in C# From Novice to Professional, Apress
10. Larry Ullaman, Effortless E-commerce with PHP and MySQL, New Riders

11. Eric Enge, Stephan Spencer, Rand Fishkin, and Jessie C. Stricchiola foreword by John Battelle, The Art of SEO: Mastering Search Engine Optimization, O'Reilly
12. Adam Clarke, SEO Learn Search Engine Optimization With Smart Internet Marketing Strategies: Learn SEO with smart internet marketing strategies
13. Charu C. Aggrawal, Recommender Systems, Springer

Automation and Robotics

Course Title: Automation and Robotics
Course No: CSC382
Nature of the Course: Theory + Lab
Semester: VI

Full Marks: 60 + 20 + 20
Pass Marks: 24 + 8 + 8
Credit Hrs: 3

Course Description:
This course provides the detailed idea about fields of robotics and its control mechanisms.

Course Objective:
The main objective is to provide information on various parts of robots and idea on fields of robotics. It also focuses on various kinematics and inverse kinematics of robots, trajectory planning of robots and to study the control of robots for some specific applications.

Course Contents:

Unit 1: Introduction (8 Hrs.)
Definition and Origin of Robotics, Types of Robotics, Major Components, Historical development of Robot, Robotic System and Robot anatomy, Degrees of freedom, Coordinate System and its type Asimov's laws of robotics, Dynamic stabilization of robots

Unit 2: Power Sources and Sensors (8 Hrs.)
Hydraulic, pneumatic and electric drives, determination of HP of motor and gearing ratio, variable speed arrangements, path determination, micro machines in robotics, machine vision, ranging, laser, acoustic, magnetic, fiber optic and tactile sensors.

Unit 3: Manipulators, Actuators, and Grippers (8 Hrs.)
Manipulators, Classification, Construction of manipulators, manipulator dynamics and force control, electronic and pneumatic manipulator control, End effectors, Loads and Forces, Grippers, design considerations, Robot motion Control, Position Sensing

Unit 4: Kinematics and Path Planning (8 Hrs.)
Solution of Inverse Kinematics Problem, Multiple Solution Jacobian Work Envelop, Hill Climbing Techniques, Robot Programming Languages

Unit 5: Process Control (8 Hrs.)
Process Control and Types, On-Off Control Systems, Proportional Control Systems, Proportional Plus Integral (PI) Control Systems, Three Mode Control (PID) Control Systems, Process Control Tuning.

Unit 6: Case Studies (5 Hrs.)
Multiple robots, Machine Interface, Robots in Manufacturing and not-Manufacturing Application, Robot Cell Design, Selection of a Robot

Laboratory Works:
The laboratory work should be focused on implementation of sensors, design of control systems. It should also deal with developing programs related Robot design and control using python.

Text Books:

1. Mikell P. Weiss G.M., Nagel R.N., Odraj N.G., **Industrial Robotics**, McGraw Hill.
2. Ghosh, **Control in Robotics and Automation: Sensor Based Integration**, Allied Publishers.

References:

1. Jain K.C. and Aggarwal B.E., **Robotics – Principles and Practice**, Khanna Publishers
2. Schuler, C.A. and McNamee, W.L. **Modern Industrial Electronics**, Macmillan/McGraw-Hill
3. Klafter R.D., Chimielewski T.A., Negin M., **Robotic Engineering – An Integrated Approach**, Prentice Hall of India.
4. Deb.S.R., **Robotics Technology and Flexible Automation**, John Wiley, USA 1992.
5. Asfahl C.R., **Robots and Manufacturing Automation**, John Wiley, USA 1992
6. Mc Kerrow P.J. **Introduction to Robotics**, Addison Wesley, USA, 1991.
7. Issac Asimov I. **Robot**, Ballantine Books, New York, 1986.

Neural Networks

Course Title: Neural Networks
Course No: CSC383
Nature of the Course: Theory + Lab
Semester: VI

Full Marks: 60 + 20 + 20
Pass Marks: 24 + 8 + 8
Credit Hrs: 3

Course Description:
The course introduces the underlying principles and design of Neural Network. The course covers the basics concepts of Neural Network including: its architecture, learning processes, single layer and multilayer perceptron followed by Recurrent Neural Network

Course Objective:
The course objective is to demonstrate the concept of supervised learning, unsupervised learning in conjunction with different architectures of Neural Network

Course Contents:

Unit 1: Introduction to Neural Network (4 Hrs.)
Basics of neural networks and human brain, Models of a neuron, Neural Network viewed as Directed Graphs, Feedback, Network Architectures, Knowledge Representation, Learning Processes, Learning Tasks

Unit 2: Rosenblatt's Perceptron (3 Hrs.)
Introduction, Perceptron, The Perceptron Convergence Theorem, Relation between the Perceptron and Bayes Classifier for a Gaussian Environment, The Batch Perceptron Algorithm

Unit 3: Model Building through Regression (5 Hrs.)
Introduction, Linear Regression Model: Preliminary Considerations, Maximum a Posteriori Estimation of the Parameter Vector, Relationship Between Regularized Least-Squares Estimation and Map Estimation, Computer Experiment: Pattern Classification, The Minimum -Description-Length Principle, Finite Sample-Size Considerations, The instrumental-Variables Method

Unit 4: The Least-Mean-Square Algorithm (5 Hrs.)
Introduction, Filtering Structure of the LMS Algorithm, Unconstrained Optimization: A Review, The Wiener Filter, The Least-Mean-Square Algorithm, Markov Model Portraying the Deviation of the LMS Algorithm from the Wiener Filter, The Langevin Equation: Characterization of Brownian Motion, Kushner's Direct-Averaging Method, Statistical LMS Learning Theory for Small Learning-Rate Parameter, Virtues and Limitations of the LMS Algorithm, Learning-Rate Annealing Schedules

Unit 5: Multilayer Perceptron (8 Hrs.)
Introduction, Batch Learning and On-Line Learning, The Back-Propagation Algorithm, XOR problem, Heuristics for Making the back-propagation Algorithm Perform Better, Back Propagation and Differentiation, The Hessian and Its Role in On-Line Learning, Optimal Annealing and Adaptive Control of the Learning Rate, Generalization, Approximations of Functions, Cross Validation, Complexity Regularization and Network Pruning, Virtues and Limitations of Back-Propagation Learning, Supervised Learning Viewed as Optimization Problem, Convolutional Networks, Nonlinear Filtering, Small-Scale Versus Large-Scale

Learning Problems

Unit 6: Kernel Methods and Radial-Basis Function Networks (7 Hrs.)
Introduction, Cover's Theorem on the separability of Patterns, The Interpolation problem, Radial-Basis-Function Networks, K-Means Clustering, Recursive Least-Squares Estimation of the Weight Vector, Hybrid Learning Procedure for RBF Networks, Kernel Regression and Its Relation to RBF Networks

Unit 7: Self-Organizing Maps (6 Hrs.)
Introduction, Two Basic Feature-Mapping Models, Self-Organizing Map, Properties of the Feature Map, Contextual Maps, Hierarchical Vector Quantization, Kernel Self-Organizing Map, Relationship between Kernel SOM and Kullback-Leibler Divergence

Unit 8: Dynamic Driven Recurrent Networks (7 Hrs.)
Introduction, Recurrent Network Architectures, Universal Approximation Theorem, Controllability and Observability, Computational Power of Recurrent Networks, Learning Algorithms, Back Propagation through Time, Real-Time Recurrent Learning, Vanishing Gradients in Recurrent Networks, Supervised Training Framework for Recurrent Networks Using Non Sate Estimators, Adaptivity Considerations, Case Study: Model Reference Applied to Neurocontrol

Laboratory works:
Practical should be focused on Single Layer Perceptron, Multilayer Perceptron, Supervised Learning, Unsupervised Learning, Recurrent Neural Network, Linear Prediction and Pattern Classification

Text Book:
1. Simon Haykin, Neural Networks and Learning Machines, 3rd Edition, Pearson

Reference Books:
1. Christopher M. Bishop, Neural Networks for Pattern Recognition, Oxford University Press, 2003
2. Martin T. Hagan, Neural Network Design, 2nd Edition PWS pub co.

Computer Hardware Design

Course Title: Computer Hardware Design
Course No: CSC384
Nature of the Course: Theory + Lab
Semester: VI

Full Marks: 60 + 20 + 20
Pass Marks: 24 + 8 + 8
Credit Hrs: 3

Course Description:
This course provides the detailed idea about the design of computer hardware.

Course Objective:
The main objective is to provide information on various computer hardware and their design. It focuses on various concepts regarding processor, memory and arithmetic operations. It also emphasizes on multicores, multiprocessors and clusters. It also deals with non-functional requirements that play vital role in the design.

Course Contents:

Unit 1: Computer Abstractions and Technology (3 Hrs.)
Introduction, Performance, The Power Wall, The Sea Change: The Switch from Uniprocessors to Multiprocessors, Manufacturing and Benchmarking the AMD Opteron X4

Unit 2: Instructions: Language of the Computer (8 Hrs.)
Introduction, Operations of the Computer Hardware, Operands of the Computer Hardware, Signed and Unsigned Numbers, Representing Instructions in the Computer, Logical Operations,Instructions for Making Decisions, Supporting Procedures in Computer Hardware, MIPS Addressing for 32-Bit Immediates and Addresses, Parallelism and Instructions, Translating and Starting a Program, Arrays versus Pointers, Advanced Material: Compiling C and Interpreting Java, ARM Instructions, x86 Instructions.

Unit 3: Arithmetic for Computers (5 Hrs.)
Introduction, Addition and Subtraction, Multiplication, Division, Floating Point, Parallelism and Computer Arithmetic: Associativity, Real Stuff: Floating Point in the x86.

Unit 4: The Processor (8 Hrs.)
Introduction, Logic Design Conventions, Building a Data path, A Simple Implementation Scheme, An Overview of Pipelining, Pipelined Data path and Control, Data Hazards: Forwarding versus Stalling, Control Hazards, Exceptions, Parallelism and Advanced Instruction-Level Parallelism, Real Stuff: the AMD Opteron X4 Pipeline, Advanced Topic: an Introduction to Digital DesignUsing a Hardware Design Language to Describe andModel a Pipeline and More Pipelining Illustrations.

Unit 5: Large and Fast: Exploiting Memory Hierarchy (8 Hrs.)
Introduction, The Basics of Caches, Measuring and Improving Cache Performance, Virtual Memory, A Common Framework for Memory Hierarchies, Virtual Machines, Using a Finite-State Machine to Control a Simple Cache, Parallelism and Memory Hierarchies: Cache Coherence, Advanced Material: Implementing Cache Controllers, Real Stuff: the AMD Opteron X4 and Intel Nehalem Memory Hierarchies.

Unit 6: Storage and Other I/O Topics (5 Hrs.)
Introduction, Dependability, Reliability, and Availability, Disk Storage, Flash Storage, Connecting Processors, Memory, and I/O Devices, Interfacing I/O Devices to the Processor, Memory, and Operating System, I/O Performance Measures: Examples from Disk and File Systems, Designing an I/O System, Parallelism and I/O: Redundant Arrays of Inexpensive Disks, Real Stuff: Sun Fire x4 Server, Advanced Topics: Networks.

Unit 7: Multicores, Multiprocessors, and Clusters (8 Hrs.)
Introduction, The Difficulty of Creating Parallel Processing Programs, Shared Memory Multiprocessors, Clusters and Other Message-Passing Multiprocessors, Hardware Multithreading, SISD, MIMD, SIMD, SPMD, and Vector, Introduction to Graphics Processing Units, Introduction to Multiprocessor Network Topologies, Multiprocessor Benchmarks, Roofline: A Simple Performance Model, Real Stuff: Benchmarking Four Multicores Using theRoofline Model.

Laboratory Works:
The practical work should focus on use of hardware design language and programming. It should also focus on x86 instructions. There should also be practical related to processor, memory, clusters, multithreading, Interfaces, pipelining.

Text Book:
1. David A. Patterson and John L. Hennessy., Computer Organization and Design: The Hardware/Software Interface, 4th Edition.

References:
1. M. M. Mano., Computer Organization, 3rd Edition
2. M. M. Mano., Computer System Architecture, 3rd Edition

Cognitive Science

Course Title: Cognitive Science
Course No: CSC385
Nature of the Course: Theory + Lab
Semester: VI

Full Marks: 60 + 20 + 20
Pass Marks: 24 + 8 + 8
Credit Hrs: 3

Course Description:
This course covers the fundamental concepts of cognitive science and brain computation.

Course Objectives:
The main objective of this course is to provide basic knowledge of web cognition process, mind theory, physical symbol systems, cognitive systems, concepts of brain mappings and neural network structures.

Course Contents:

Unit 1: Introduction (7 Hrs.)
Cognition Process, Cognitive Psychology, Cognitive Science; Foundations of Cognitive Science, Cognitive Science and Multi-disciplinary; Machines and Minds; Laws thoughts to binary logic; Classical Cognitive Science; Connectionist Cognitive Science; Mind body Problem; Turing Response to Mind Body Problem; Pinker, Penerose and Searle's Responses to Mind Body Problem; Representational Theory of Mind; Theories of Mental Representation: Minimal Analysis of mental representation, Resemblance theories of mental representation, Casual covariation theories of mental representation, internal roles theories of mental representation

Unit 2: Precursors of Cognitive Science (5 Hrs.)
Behaviorism; Theory of Computation and Algorithms; Algorithms and Turing Machines; Marr's Three Level of Computation; Linguistics and Formal Language; Information Processing Models in Psychology

Unit 3: Psycological Perspective of Cognition (5 Hrs)
Cognitive Models of Memory, Atkinson-Shiffrin's Model, Tulving's Model, Mental Imagery, Kosslyn's View, Moyer's View, Peterson's View, Cognitive Maps, Problem Understanding, States of Cognition, Cognition in AI

Unit 4: Physical Symbol System and Language of Thought (7 Hrs.)
Physical Symbol System Hypothesis; Symbol and Symbol Systems; Problem Solving by Symbol Structure; Physical Symbol System to Language of Thoughts; The Computer Model of the Mind; Syntax and the Language of Thought: Fodor's Argument for the Language of Thought Hypothesis; The Chinese Room Argument; Chinese Room and Turing Test; The Symbol Ground Problem

Unit 5: Cognitive System (4 Hrs.)
Cognitive System; Architecture for intelligent agents; Modularity of Mind; Modularity Hypothesis; The ACT-R/PM architecture

Unit 6: Brain Mapping (6 Hrs.)
Structure and Function in Brain; Anatomical Connectivity; Cognitive Functioning Techniques from Neuroscience; Mapping the brain's electrical activity: EEG and MEG; Mapping the brain's blood flow and blood oxygen levels: PET and fMRI; Attention; Visuospatial attention

Unit 7: Mind Reading (5 Hrs.)
Metarepresentation; Metarepresentation, autism, and theory of mind; Mind Reading System; Understanding False Belief; Mind Reading as Simulation

Unit 8: Neural Networks and Distributed Information Processing (6 Hrs.)
Neurally Inspired Models of Information Processing; Single-Layer Networks and Boolean Functions; Multilayer Networks; Information Processing in Neural Networks; Language Learning in Neural Networks; Neural Network Models of Children's Physical Reasoning

Laboratory Works:
The laboratory work includes implementing and simulating the concepts of cognition process, intelligent agents, neural networks. In addition, laboratory work can be extended to use the tools like PSY Toolkit, PsyNeuLink etc.

Text Book / Reference Books:

1. José Luis Bermúdez, Cognitive Science: An Introduction to the Science of the Mind, Cambridge University Press
2. Michael R. W. Dawson , Mind, Body, World: Foundations of Cognitive Science, UBC Press
3. Daniel Kolak, William Hirstein, Peter Mandik, Jonathan Waskan, Cognitive Science, An Introduction to Mind and Brain, Routledge Taylor and Francis Group
4. Amit Konar – Artificial Intelligence and Soft computing: Behavioral and Cognitive Modeling of the Human Brain, CRC Press

Advanced Java Programming

Course Title: Advanced Java Programming
Course No: CSC409
Nature of the Course: Theory + Lab
Semester: VII

Full Marks: 60 + 20 + 20
Pass Marks: 24 + 8 + 8
Credit Hrs: 3

Course Description:
This course familiarizes students with basic as well as advanced features of Java Programming Emphasis will be given to GUI and event-driven programming, Database Connectivity, Socket Programming, Servlets and JSP Technology, and Distributed Programming.

Course Objectives:
The main objective of this course is to

- Introduce basic concepts of Java Programming.
- Exemplify the concept of GUI programming and JDBC
- Demonstrate socket programming. remote objects, and servlet and JSP Technology

Course Contents:

Unit 1: Programming in Java (8 Hrs.)

1.1. Java Architecture, Java Buzzwords, Path and ClassPath variables, Sample Java Program, Compiling and Running Java Programs.
1.2. Arrays, for each loop, Class and Object, Overloading, Access Privileges, Interface, Inner Class, Final and Static Modifiers, Packages, Inheritance, Overriding.
1.3. Handling Exceptions: Try, Catch, Finally, Throws, and Throw keywords, Creating Exception Class
1.4. Concurrency: Introduction, Thread States, Writing Multithreaded Programs, Thread Properties, Thread Synchronization, Thread Priorities
1.5. Working with Files: Byte Stream Classes, Character Stream Classes, Random Access File, Reading and Writing Objects.

Unit 2: User Interface Components with Swing (10 Hrs.)

2.1. Introduction: Concept of AWT, AWT vs Swing, Java Applets, Applet Life Cycle, Swing Class Hierarchy, Component and Containers
2.2. Layout Management: No Layout, Flow layout, Border Layout, Grid Layout, Gridbag Layout, Group Layout.
2.3. GUI Controls: Text Fields, Password Fields, Text Areas, Scroll Pane, Labels, Check Boxes, Radio Buttons, Borders, Combo Boxes, Sliders
2.4. Menu, Menu Item, Icons in Menu Items, Check Box and Radio Buttons in Menu Items, Pop-up Menus, Keyboard Mnemonics and Accelerators, Enabling and Disabling Menu Items, Toolbars, Tooltips
2.5. Option Dialogs, Creating Dialogs, File Choosers, Color Choosers, Internal Frames, Frames, Tables, Trees, and Tables.

Unit 3: Event Handling (4 Hrs.)

3.1. Event Handling Concept, Listener Interfaces, Using Action Commands, Adapter Classes

3.2. Handling Action Events, Key Events, Focus Events, Mouse Event, Window Event, Item Events

Unit 4: Database Connectivity (4 Hrs.)

4.1. JDBC Architecture, JDBC Driver Types, JDBC Configuration, Managing Connections, Statements, Result Set, SQL Exceptions

4.2. DDL and DML Operations using Java, Prepared Statements, Multiple Results, Scrollable Result Sets, Updateable Result Sets, Row Sets and Cached Row Sets, Transactions, SQL Escapes.

Unit 5: Network Programming (5 Hrs.)

5.1. Transmission control Protocol (TCP), User Datagram Protocol (UDP), Ports, IP Address Network Classes in JDK

5.2. Socket programming using TCP, Socket programming using UDP, Working with URL's, Working with URL Connection Class.

5.3. Java Mail API, Sending and Receiving Email

Unit 6: GUI with JavaFX (3 Hrs.)

6.1. Introduction, JavaFX vs Swing, JavaFX Layouts: FlowPane, BorderPane, Hbox, VBox, GridPane

6.2. JavaFX UI Controls: Label, TextField, Button, RadioButton, CheckBox, Hyperlink, Menu, Tooltip, FileChooser.

Unit 7: Servlets and Java Server pages (8 Hrs.)

7.1. Web Container, Introduction to Servlets, Life cycle of servlets, The servlet APIs, Writing Servlet Programs, Reading Form Parameters, Processing Forms, Handling HTTP Request and Response (GET / POST Request), Database Access with Servlets, Handling Cookies and Session.

7.2. Servlet vs JSP, JSP Access Model, JSP Syntax (Directions, Declarations, Expression, Scriplets, Comments), JSP Implicit Objects, Object Scope, Processing Forms, Database Access with JSP.

7.3. Introduction to Java Web Frameworks

Unit 8: RMI and CORBA (3 Hrs.)

8.1 Introduction of RMI, Architecture of RMI, Creating and Executing RMI Applications

8.2 Introduction to CORBA, RMI vs CORBA, Architecture of CORBA, IDL, Simple CORBA Program.

Laboratory Works:

The laboratory work includes writing programs related to basic java programming concepts, Designing GUI, Event Handling, JDBC, Network Programming, Web Programming, and Distributed Programming. They also learn to develop web applications using Java Web Frameworks.

Text Books:

1. Cay S. Horstmann, Core Java Volume I--Fundamentals, Pearson, Eleventh Edition, 2018
2. Cay S. Horstmann, Core Java Volume II-Advance Features, Pearson, Eleventh Edition, 2019
3. Herbert Schildt, Java: The Complete Reference, McGraw-Hill Education, Eleventh Edition, 2018

Reference Book:

1. D.T. Editorial Services, Java 8 Programming Black Book, Dreamtech Press, 2015

Data Warehousing and Data Mining

Course Title: Data Warehousing and Data Mining
Course No: CSC410
Nature of the Course: Theory + Lab
Semester: VII

Full Marks: 60 + 20 + 20
Pass Marks: 24 + 8 + 8
Credit Hrs: 3

Course Description:
This course introduces advanced aspects of data warehousing and data mining, encompassing the principles, research results and commercial application of the current technologies.

Course Objective:
The main objective of this course is to provide knowledge of different data mining techniques and data warehousing.

Course Contents:

Unit 1: Introduction to Data Warehousing (5 Hrs.)
Lifecycle of data, Types of data, Data warehouse and data warehousing , Differences between operational database and data warehouse, A multidimensional data model, OLAP operation in multidimensional data model, Conceptual modeling of data warehouse, Architecture of data warehouse, Data warehouse implementation, Data marts, Components of data warehouse, Need for data warehousing ,Trends in data warehousing

Unit 2: Introduction to Data Mining (2 Hrs.)
Motivation for data mining, Introduction to data mining system, Data mining functionalities, KDD, Data object and attribute types, Statistical description of data, Issues and Applications

Unit 3: Data Preprocessing (3 Hrs.)
Data cleaning, Data integration and transformation, Data reduction, Data discretization and Concept Hierarchy Generation, Data mining primitives

Unit 4: Data Cube Technology (4 Hrs.)
Efficient method for data cube computation, Cube materialization (Introduction to Full cube, Iceberg cube, Closed cube, Shell cube), General strategies for cube computation, Attribute oriented induction for data characterization, Mining class comparison, Discriminating between different classes

Unit 5: Mining Frequent Patterns (6 Hrs.)
Frequent patterns, Market basket analysis, Frequent itemsets, closed itemsets, association rules, Types of association rule (Single dimensional, multidimensional, multilevel, quantitative), Finding frequent itemset (Apriori algorithm, FP growth), Generating association rules from frequent itemset, Limitation and improving Apriori, From Association Mining to Correlation Analysis, Lift

Unit 6: Classification and Prediction (10 Hrs.)
Definition (Classification, Prediction), Learning and testing of classification, Classification by decision tree induction, ID3 as attribute selection algorithm, Bayesian classification, Laplace smoothing, Classification by backpropagation, Rule based classifier (Decision tree to rules, rule coverage and accuracy, efficient of rule simplification), Support vector machine, Evaluating accuracy (precision, recall, f-measure), Issues in classification, Overfitting and underfitting, K-fold cross validation, Comparing two classifier (McNemar's test)

Unit 7: Cluster Analysis (8 Hrs.)
Types of data in cluster analysis, Similarity and dissimilarity between objects, Clustering techniques: - Partitioning (k-means, k-means++, Mini-Batch k-means, k-medoids), Hierarchical (Agglomerative and Divisive), Density based (DBSCAN), Outlier analysis

Unit 8: Graph Mining and Social Network Analysis (5 Hrs.)
Graph mining, Why graph mining, Graph mining algorithm (Beam search, Inductive logic programming), Social network analysis, Link mining, Friends of friends, Degree assortativity, Signed network (Theory of structured balance, Theory of status, Conflict between the theory of balance and status), Trust in a network (Atomic propagation, Propagation of distrust, Iterative propagation), Predicting positive and negative links

Unit 9: Mining Spatial, Multimedia, Text and Web Data (2 Hrs.)
Spatial data mining, Spatial data cube, Mining spatial association, Multimedia data mining, Similarity search in multimedia data, Mining association in multimedia data, An introduction to text mining, natural language processing and information extraction, Web mining (Web content mining, Web structure mining, Web usage mining)

Laboratory Works:
The laboratory should contain all the features mentioned in a course, which should include data preprocessing and cleaning, implementing classification, clustering, association algorithms in any programming language, and data visualization through data mining tools.

Text Book:
1. Data Mining: Concepts and Techniques, 3rd ed. Jiawei Han, Micheline Kamber, and Jian Pei. Morgan Kaufmann Series in Data Management Systems Morgan Kaufmann Publishers, July 2011.

Reference Books:
1. Introduction to Data Mining, 2nd ed. Pang-Ning Tan, Michael Steinbach, Anuj Karpatne, Vipin Kumar. Pearson Publisher, 2019.
2. Mining of Massive Datasets by Jure Leskovec, Anand Rajaraman, Jeffrey D. Ullman, 2014.

Principles of Management

Course Title: Principles of Management
Course No: MGT411
Nature of the Course: Theory
Semester: VII

Full Marks: 80 + 20
Pass Marks: 32 + 8
Credit Hrs: 3

Course Description:
This course contains The Nature of Organizations, Introduction to Management, Evolution of Management Thought, Environmental Context of Management, Planning and Decision Making, Organizing Function, Leadership, Motivation, Communication, Control and Quality Management, Global Context of Management, Management Trends and Scenario in Nepal.

Course Objective:
The basic objective of this course is to give a comprehensive knowledge to students about organization and help them understand the major functions, principles, and techniques of management. The course deals with basic functions like planning, organizing, leading, and controlling with special orientation to modern management practices which are essential to manage business successfully and other organizations.

Course Contents:

Unit 1: The Nature of Organizations (3 Hrs.)

Concept of organization. Organizational goals – concept, purposes, and types. Features of effective organizational goals. Goal formulation – processes and approaches. Goal succession and displacement. Problems of goal formulation. Changing perspectives of organization.

Unit 2: Introduction to Management (3 Hrs.)

Definition, characteristics, and principles of management. Process and functions of management. Managerial hierarchy. Types of managers. Managerial skills and roles. Emerging challenges for management.

Unit 3: Evolution of Management Thought (5 Hrs.)

Introduction, contribution and limitation of Classical theory, Human relations and Behavioural science theories, System theory, Decision theory, Management science theory, and Contingency theory. Emerging management concepts: workforce diversity, outsourcing, knowledge management, learning organization.

Unit 4: Environmental Context of Management (5 Hrs.)

Concept of business environment. Types of business environment – internal and external. Basic components of economic, socio – cultural, political, and technological environments. Social responsibility of business – concept and approaches. Areas of social responsibility. Business ethics – meaning and significance. Emerging business environment in Nepal.

Unit 5: Planning and Decision Making (5 Hrs.)

Concept, types, hierarchy of planning. Process and importance of planning. Strategic planning. Environmental scanning – concept and methods. SWOT analysis. Formulation and

implementation of strategic plans. Quantitative tools for planning. Decision making – definition and approaches. Types of decisions. Decision making under conditions of certainty and uncertainty. Problem solving – concepts, types of problem. Problem solving strategies.

Unit 6: Organizing Function (6 Hrs.)

Concept and principles of organizing. Approaches to organizing – classical, behavioural, and contingency. Process of structuring an organization. Departmentalization – meaning and types. Delegation of authority – meaning, features, advantages, and barriers. Centralization and decentralization – meaning, advantages and disadvantages. Concept of organic and mechanistic views of organization. Types of modern organizational structures – matrix, team, and network.

Unit 7: Leadership & Conflict (3 Hrs.)

Concept and functions of leadership. Leadership styles. Approaches to leadership – trait, behavioral, and situational. Group formation. Types and characteristics of groups. Conflict – meaning and types. Managing conflicts in organization.

Unit 8: Motivation (3 Hrs.)

Concept. Theories of motivation – Need Hierarchy, and Motivation-Hygiene. Reward system to motivate performance. Motivation through employee participation – quality of work life, and self- managed teams.

Unit 9: Communication (3 Hrs.)

Concept, structure, and process. Types of communication – formal and informal. Interpersonal and nonverbal communication. Barriers to effective communication. Enhancing effective communication.

Unit 10: Control and Quality Management (3 Hrs.)

Concept, process, and types of control systems. Characteristics of effective control system. Quality control systems – concept of quality. Total Quality Management (TQM) – concept and tools. Deming management – principles and techniques.

Unit 11: Global Context of Management (3 Hrs.)

Concept of globalization. Methods of globalization. Effects of globalization. Multinational companies – meaning, types, advantages, and disadvantages.

Unit 12: Management Trends and Scenario in Nepal (3 Hrs.)

Growth of business sector in Nepal. Major industries in Nepal – manufacturing, export – oriented, import-substitution, and service sector. Existing management practices and business culture. Major problems of businesses in Nepal.

Recommended Books:

1. Griffin, Ricky W., ***Management***, AITBS Publishers and Distributors, Delhi.
2. Hitt, Michael A., J. Black, Stweart, and Porter, Lyman W., ***Management,*** Pearson, India.
3. Robbins, Stephen P., and Coulter, Mary, ***Management***, Prentice-Hall of India, New Delhi.

Project Work

Course Title: Project Work
Course No: CSC412
Nature of the Course: Project
Semester: VII

Full Marks: 80 + 20
Pass Marks: 32+ 8
Credit Hrs: 3

Course Description: This course covers theoretical and practical concepts needed to develop a real world software system. The course focuses on enabling students with the skills related to software development. The course includes practicing the abilities pertaining to the planning, analysis, design, implementation and testing of software applications.

Course Objectives: The objective of this course is to develop theoretical and practical skills needed to develop real world software applications using different software development tools and techniques.

Course Details:

Nature of Project:

The project work should include development of an application/system software. Students are highly recommended to implement relevant algorithms, theories and concepts that they have learned. The project should be practiced by following analysis, design, implementation and testing phases. The project can be done in group with at most **three members** in each group. For the implementation of the project, students can choose appropriate language technologies as per comfort and skills. 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:

1. **Proposal Submission and Presentation:** Students must submit and present project proposal on 3rd to 4th week of start of the seventh semester.

2. **Mid-Term:** Students must submit progress report and defend midterm progress of their project work on the 10th to 11th week of the seventh semester.

3. **Final Submission:** Students must submit and defend the project work during last week of the seventh semester but before final board examination. The final defense will include a viva voice followed by a demonstration of the project. The final defense will be conducted by an evaluation committee with an external from the university. Students must have to submit the project final report to their respective department of college/campus before at least 10 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 before a week of presentation date.

Provision of Supervision:

The supervisor should be a regular faculty of the campus/college. The role of supervisor is to provide appropriate guidance to the students throughout the project. A supervisor can supervise at most **three groups** of the project in a section. The supervisor should rigorously supervise, monitor, feedback and evaluate the project groups under his/her supervision.

Evaluation Scheme:

1. **Proposal Defense -** 10% Marks of 100 (2 Marks Head/Program Coordinator + 6 Marks Supervisor + 2 Marks Internal Examiner)
2. **Midterm -** 20% Marks of 100 (3 Marks Head/Program Coordinator + 14 Marks Supervisor + 3 Marks Internal Examiner)
3. **Final Defense -** 70% Marks of 100 (5 Marks Head/Program Coordinator + 40 Marks Supervisor + 5 Marks Internal Examiner + 20 Marks External Examiner)

The evaluation committee and evaluation criteria should be as follow;

a. Evaluation committee

- HOD/Coordinator of the campus/college
- Project Supervisor (Regular faculty of the campus/college)
- Internal Examiner (Regular faculty of the campus/college)
- External Examiner (Allocated from university at the final defense)

b. Marks Allocation:

- Head / Program Coordinator – 10
- Project Supervisor – 60
- Internal Examiner – 10
- External Examiner – 20

Total – 100

c. Focus of the evaluation:

- Presentation Skills
- Level of Work and Understanding(Level of Analysis, Design, Implementation, Testing, Result Analysis done for the project)
- Project Report
- Viva/Question Answer
- Demonstration of the project
- Teamwork and Contribution

Roles and Responsibilities:

- **HOD/Coordinator:** The role of HOD/Coordinator is to coordinate with supervisor, internal examiner, external examiner and students. The HOD/Coordinator should monitor the students' project progress in coordination with the respective supervisors. The HOD/Coordinator is responsible for arranging the proposal defense, midterm and final defense. The HOD/Coordinator should participate and evaluate proposal defense, midterm, and final defense.

- **Project Supervisor:** The role of project supervisor is to supervise students' project throughout the semester. The supervisor should rigorously feedback and guide the students. Supervisor is to participate and evaluate proposal defense, midterm, and final defense. The supervisor should monitor the progress of projects under supervision.

- **Internal Examiner:** The role of internal examiner is to evaluate the students' project during different evaluation phases of the project. The internal examiner should participate and evaluate proposal defense, midterm, and final defense.

- **External Examiner:** The role of external examiner is to evaluate the students' project during final defense evaluation. The examiner should participate and evaluate viva voce and demonstration session during the final defense.

- **Student:** The role and responsibilities of student include development of the project, project report preparation, and defending the project work throughout each evaluation phases. Despite of project work being group work, each student should have equal role and responsibilities in the project. Each student will be evaluated individually so student should be able to demonstrate his/her contribution in the project work individually. Students should maintain a log visits with their supervisors at different dates during their work. The log should include technical feedbacks from their supervisors.

Report Contents:

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

    1. Introduction
    2. Problem Statement
    3. Objectives
    4. Methodology
        a. Requirement Identification
            i. Study of Existing System / Literature Review
            ii. Requirement Analysis
        b. Feasibility Study
            i. Technical
            ii. Operational
            iii. Economic
            iv. Schedule (Gantt chart showing the project timeline)

c. High Level Design of System (Methodology of the proposed system/ Flow Charts/ Working Mechanism of Proposed System / Description of Algorithms)

5. Expected Outcome
6. References

2. Prescribed content flow for the project report

1. Cover & Title Page
2. Certificate Page
   i. Supervisor Recommendation
   ii. Head / Program Coordinator, Supervisor, Internal and External Examiners' Approval Letter
3. Acknowledgement
4. Abstract Page
5. Table of Contents
6. List of Abbreviations, List of Figures, List of Tables
7. Main Report
8. References
9. Bibliography (if any)
10. Appendices (Screenshots + Snippets of major source code components + Log of visits to supervisor)

3. Prescribed chapters in the main report

1. Chapter 1: Introduction

1.1. Introduction
1.2. Problem Statement
1.3. Objectives
1.4. Scope and Limitation
1.5. Development Methodology
1.6. Report Organization

2. **Chapter 2: Background Study and Literature Review**

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

3. Chapter 3: System Analysis

3.1. System Analysis
   3.1.1. Requirement Analysis
      i. Functional Requirements (Illustrated using use case diagram/use case descriptions)
      ii. Non Functional Requirements
   3.1.2. Feasibility Analysis
      i. Technical

ii. Operational
iii. Economic
iv. Schedule

3.1.3. Analysis (May be Structured or Object Oriented)

If structured approach:

- Data modelling using ER Diagrams
- Process modelling using DFD

If object oriented approach:

- Object modelling using Class and Object Diagrams,
- Dynamic modelling using State and Sequence Diagrams
- Process modelling using Activity Diagrams

4. Chapter 4: System Design

4.1. Design (May be Structured or Object Oriented as per the approach followed in analysis chapter)

If structured approach:

- Database Design: Transformation of ER to relations and normalizations
- Forms and Report Design
- Interface and Dialogue Design

If object oriented approach:

- Refinement of Class, Object, State, Sequence and Activity diagrams
- Component Diagrams
- Deployment Diagrams

4.2. Algorithm Details

5. Chapter 5: Implementation and Testing

5.1. Implementation

5.1.1. Tools Used (CASE tools, Programming languages, Database platforms)

5.1.2. Implementation Details of Modules (Description of classes/procedures/functions/methods/algorithms)

5.2. Testing

5.2.1. Test Cases for Unit Testing

5.2.2. Test Cases for System Testing

5.3. Result Analysis

6. Chapter 6: Conclusion and Future Recommendations

6.1. Conclusion

6.2. 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:

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 in (2.54 cm)
- Bottom = 1 in (2.54 cm)
- Left = 1.25 in (3.17 cm)
- Right = 1 in (2.54 cm)

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, Institute of Science and Technology, Tribhuvan University

Text Book: None

Information Retrieval

Course Title: Information Retrieval
Course No: CSC413
Nature of the Course: Theory + Lab
Semester: VII

Full Marks: 60 + 20 + 20
Pass Marks: 24 + 8 + 8
Credit Hrs: 3

Course Description:
This course familiarizes students with different concepts of information retrieval techniques mainly focused on clustering, classification, search engine, ranking and query operations techniques.

Course Objective:
The main objective of this course is to provide knowledge of different information retrieval techniques so that the students will be able to develop information retrieval engine.

Course Contents:

Unit 1: Introduction to IR and Web Search (2 Hrs.)
Introduction, Data vs Information Retrieval, Logical view of the documents, Architecture of IR System, Web search system, History of IR, Related areas

Unit 2: Text properties, operations and preprocessing (5 Hrs.)
Tokenization, Text Normalization, Stop-word removal, Morphological Analysis, Word Stemming (Porter Algorithm), Case folding, Lemmatization, Word statistics (Zipf's law, Heaps' Law), Index term selection, Inverted indices, Positional Inverted index, Natural Language Processing in Information Retrieval, Basic NLP tasks – POS tagging; shallow parsing

Unit 3: Basic IR Models (5 Hrs.)
Classes of Retrieval Model, Boolean model, Term weighting mechanism – TF, IDF, TF-IDF weighting, Cosine Similarity, Vector space model , Probabilistic models (the binary independence model ,Language models; · KL-divergence; · Smoothing), Non-Overlapping Lists, Proximal Nodes Mode

Unit 4: Evaluation of IR (2 Hrs.)
Precision, Recall, F-Measure, MAP (Mean Average Precision), (DCG) Discounted Cumulative Gain, Known-item Search Evaluation

Unit 5: Query Operations and Languages (4 Hrs.)
Relevance feedback and pseudo relevance feedback, Query expansion (with a thesaurus or WordNet and correlation matrix), Spelling correction (Edit distance, K – Gram indexes, Context sensitive spelling correction), Query languages (Single-Word Queries, Context Queries, Boolean Queries, Structural Query, Natural Language)

Unit 6: Web Search (6 Hrs.)
Search engines (working principle), Spidering (Structure of a spider, Simple spidering algorithm, multithreaded spidering, Bot), Directed spidering (Topic directed, Link directed), Crawlers

(Basic crawler architecture), Link analysis (HITS, Page ranking), Query log analysis, Handling "invisible" Web – Snippet generation, CLIR (Cross Language Information Retrieval)

Unit 7: Text Categorization (4 Hrs.)
Categorization, Learning for Categorization, General learning issues, Learning algorithms: Bayesian (naïve), Decision tree, KNN, Rocchio)

Unit 8: Text Clustering (4 Hrs.)
Clustering, Clustering algorithms (Hierarchical clustering, k-means, k-medoid, Expectation maximization (EM), Text shingling)

Unit 9: Recommender System (3 Hrs.)
Personalization, Collaborative filtering recommendation, Content-based recommendation

Unit 10: Question Answering (5 Hrs.)
Information bottleneck, Information Extraction, Ambiguities in IE, Architecture of QA system, Question processing, Paragraph retrieval, Answer processing

Unit 11: Advanced IR Models (5 Hrs.)
Latent Semantic Indexing (LSI), Singular value decomposition, Latent Dirichlet Allocation, Efficient string searching, Knuth – Morris – Pratt, Boyer – Moore Family, Pattern matching

Laboratory Works:
The laboratory should contain all the features mentioned in a course. The Laboratory work should contain at least following tasks

1. Program to demonstrate the Boolean Retrieval Model and Vector Space Model
2. Tokenize the words of large documents according to type and token
3. Program to find the similarity between documents
4. Implement Porter stemmer
5. Build a spider that tracks only the link of nepali documents
6. Group the online news onto different categorize like sports, entertainment, politics
7. Build a recommender system for online music store

Recommended Books:

1. Modern Information Retrieval, Ricardo Baeza-Yates, Berthier Ribeiro-Neto.
2. Information Retrieval; Data Structures & Algorithms: Bill Frakes

Database Administration

Course Title: Database Administration
Course No: CSC414
Nature of the Course: Theory + Lab
Semester: VII

Full Marks: 60 + 20 + 20
Pass Marks: 24 + 8 + 8
Credit Hrs: 3

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

Course Objective:
The main objective of this course is to provide knowledge of different concepts of database administration so that the students will be able handle

- Install DBMS Software
- Create and manage databases
- Manage backup and recovery
- Control user security
- Managing database performance and multitenant architecture

Course Contents:

Unit 1: Introduction (5 Hrs.)
DBA Roles and Responsibilities; Database Architecture; ORACLE logical and physical database structure; Memory and Process Structure, SQLPLUS Overview, creating a database;

Unit 2: Tablespace and Storage management (5 Hrs.)
Working with Tablespaces and Data Files, Creating and adding tablespace and datafiles, Managing Control Files, Online Redo Logs and Archive logs; Multiplexing;

Unit 3: Managing Database Objects (8 Hrs.)
Working with Tables and Constraints; Working with Indexes, Views, Synonyms, and Sequences; Partitioning and Materialized Views, Introduction of PLSQL, Stored Procedure, Functions, Trigger, package.

Unit 4: Database Backup, Restore, and Recovery (10 Hrs.)
Backup and Recovery Overview, Database backup, restoration and recovery, defining a backup and recovery strategy, Backup and Recovery options; Data Dump; User-Managed Backup and Recovery; Configuring RMAN; RMAN Backups, Restore and Recovery; High Availability Features; Oracle Data Guard; Flashback operations.

Unit 5: Database Security and Auditing (7 Hrs.)
Database Security and Auditing; Database Authentication Methods; Database Authorization Methods; Data Encryption Techniques, Virtual Private Database; Managing Users and Security: Profiles, managing users, managing privileges, managing roles,

Unit 6: Multitenant Database Architecture (5 Hrs.)
Understanding the Multitenant Architecture, Pluggable Architecture; Creating CDB; Administrating Root Container; Creating Pluggable Databases (PDBs) within a CDB; Administrating Pluggable Databases; Backup and Recovery in multitenant Environment; Databases in the Cloud

Unit 7: Database Tuning (5 Hrs.)
Tuning Application Design; Tuning Memory Usage; Tuning Data Access; Tuning Data Manipulation; Reducing Network Traffic; Using Automatic Workload Repository(AWR); Automatic Database Diagnostic Monitor(ADDM), Tuning SQL; SQL Tuning Advisor, Performance Tuning in a Multitenant Environment; Distributed Databases and Networking Tool

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

Recommended Books:

1. Pro Oracle Database 18c Administration: Manage and Safeguard Your Organization's Data, Michelle Malcher and Darl Kuhn, Third Edition.
2. Oracle Database 12c DBA Handbook, Manage a Scalable, Secure Oracle Enterprise Database Environment, Bob Bryla.
3. Oracle DBA Mentor: Succeding as an Oracle Database Administrator, Brian Peasland.

Software Project Management

Course Title: Software Project Management
Course No: CSC415
Nature of the Course: Theory + Lab
Semester: VII

Full Marks: 60+20+20
Pass Marks: 24+8 + 8
Credit Hrs: 3

Course Description:
This course familiarizes students with different concepts of software project management mainly focusing on project analysis, scheduling, resource allocation, risk analysis, monitoring, control and software configuration management.

Course Objectives:
The main objective of this course is to provide knowledge of different concepts of software project management so that students will be able to understand and handle various projects including very high risky and innovative projects using different project management skills.

Course Contents:

Unit 1: Introduction to Software Project Management (5 Hrs.)
Software engineering problem and software product, software product attributes, Definition of a Software Project (SP), SP Vs. other types of projects activities covered by SPM, categorizing SPs, Project management cycle, SPM framework, types of project plan.

Unit 2: Project Analysis (8 Hrs.)
Introduction, strategic assessment, technical assessment, economic analysis: Present worth, future worth, annual worth, internal rate of return (IRR) method, benefit-cost ratio analysis, including uniform gradient cash flow and comparison of mutually exclusive alternatives.

Unit 3: Activity Planning and Scheduling (7 Hrs.)
Objectives of activity planning, Work breakdown structure, Bar chart, Network planning model: Critical path method (CPM), Program evaluation and review technique (PERT), Precedence diagramming method (PDM), Shortening project duration, Identifying critical activities.

Unit 4: Risk Management (4 Hrs.)
Introduction, nature and identification of risk, risk analysis, evaluation of risk to the schedule using Z-values.

Unit 5: Resource Allocation (4 Hrs.)
Identifying resource requirements, resource allocation, resource smoothening and resource balancing.

Unit 6: Monitoring and Control (4 Hrs.)
Introduction, collecting data, visualizing progress, cost monitoring, earned value analysis, project control.

Unit 7: Managing Contracts and people (5 Hrs.)
Introduction, types of contract, stages in contract, placement, typical terms of a contract, contract management, acceptance, Managing people and organizing terms: Introduction, understanding behavior, organizational behavior: a back ground, selecting the right person for the job, instruction in the best methods, motivation, working in groups, becoming a team, decision making, leadership, organizational structures, conclusion, further exercises.

Unit 8: Software quality assurance and testing (5 Hrs.)
Testing principles and objectives, test plan, types and levels of testing, test strategies, program verification and validation, software quality, SEI-CMM,SQA activities, QA organization structure, SQA plan.

Unit 9: Software Configuration Management (3 Hrs.)
Introduction, need, basic configuration, management function, baseline, configuration management responsibilities.

Laboratory / Project Work:
Students should prepare a project report using different concepts of software project management. The project can be done in groups with at most four members in each group. Each group can select a case study and apply the concepts of software project management focusing on project analysis, scheduling, risk analysis, resource allocation, testing.

Text Book:
1. Software Project Management by Bob Hughes and Mike Cotterell, Latest Publication

Reference Books:
1. "Introduction to Software Project Management & Quality Assurance", Darrel Ince, I. Sharp, M. Woodman, Tata McGraw Hill
2. "Software Project Management: A Unified Framework", Walker Royce, Addison-Wesley, An Imprint of Pearson Education
3. "Managing the Software Process", Watts S. Humphrey, Addison-Wesley, An Imprint of Pearson Education

Network Security

Course Title: Network Security
Course No: CSC416
Nature of the Course: Theory + Lab
Semester: VII

Full Marks: 60 + 20 + 20
Pass Marks: 24 + 8 + 8
Credit Hrs: 3

Course Description:
This course covers the fundamental concepts of network security protocols, wireless security concepts, basics of security in cloud and IoT.

Course Objectives:
The main objective of this course is to provide knowledge of network security so that students will be able to implement a secure network architecture using different security protocols and technologies.

Course Contents:

Unit 1: Computer Network Security Fundamentals (3 Hrs.)
1.1. Introduction
1.2. Securing the Computer Network
1.3. Forms of Protection
1.4. Security Standards

Unit 2: User Authentication (4 Hrs.)
2.1. Remote User-Authentication Principles
2.2. Remote User-Authentication Using Symmetric Encryption
2.3. Remote User-Authentication Using Asymmetric Encryption
2.4. Federated Identity Management

Unit 3: Transport Level Security (6 Hrs.)
3.1. Web Security
3.2. Transport Layer Security (TLS)
3.3. HTTPS
3.4. Secure Shell (SSH)

Unit 4: Wireless Network Security (6 Hrs.)
4.1. Wireless Security
4.2. Mobile Device Security
4.3. IEEE 802.11 Wireless LAN Overview
4.4. IEEE 802.11i Wireless LAN Security

Unit 5: Electronic Mail Security (8 Hrs.)
5.1. Internet Mail Architecture
5.2. E-mail Formats
5.3. Email Threats and Comprehensive Email Security
5.4. S/MIME

5.5. Pretty Good Privacy (PGP)
5.6. DNSSEC
5.7. DNS-Based Authentication of Named Entities
5.8. Sender Policy Framework
5.9. Domain Keys Identified Mail
5.10. Domain-Based Message Authentication, Reporting, and Conformance

Unit 6: IP Security (6 Hrs.)
6.1. IP Security Overview
6.2. IP Security Policy
6.3. Authentication Header
6.4. Encapsulating Security Payload
6.5. Security Associations
6.6. Internet Key Exchange

Unit 7: Network Endpoint Security (5 Hrs.)
7.1. Firewalls
7.2. Intrusion Detection System
7.3. Malicious Software
7.4. Distributed Denial of Service Attacks

Unit 8: Cloud and Internet of Things (IOT) Security (7 Hrs.)
8.1. Cloud Computing
8.2. Cloud Security Concepts
8.3. Cloud Security Risks and Countermeasures
8.4. Cloud Security as a Service
8.5. Open-source Cloud Security Module
8.6. Internet of Things (IoT)
8.7. IoT Security Concepts and Objectives
8.8. Open-source IoT Security Module

Laboratory Works:
The laboratory work includes implementation and simulation of Network Security Protocols, Intrusion Detection Systems, DDoS Attacks, Cloud Security and IoT Security Systems.

Text Books:

1. William Stallings, Cryptography and Network Security: Principles and Practice, 8th Edition, Pearson, 2020
2. Joseph Migga Kizza, Computer Network Security Fundamentals, 5th Edition, Springer, 2020

Reference Books:

1. William Stallings, Network Security Essentials: Applications and Standards, 6th Edition, Pearson, 2017
2. Sarhan M. Musa, Network Security and Cryptography: A Self-Teaching Introduction, Mercury Learning and Information LLC, 2018

Digital System Design

Course Title: Digital System Design
Course No: CSC417
Nature of the Course: Theory + Lab
Semester: VII

Full Marks: 60 + 20 + 20
Pass Marks: 24 + 8 + 8
Credit Hrs: 3

Course Description:
This course contains the introductory part of combinational Logic along with the clear concepts of K-Maps and Quine- Mc Cluskey Method. It also introduces sequential networks with flip flops and FSM. Another concept includes FPGA and VHDL and also testing and verification.

Course Objective:
The course objective is to provide ample knowledge on digital design process and to enhance the knowledge of hardware design in real scenarios.

Course Content:

Unit 1	Introduction of logic design, Digital System and Integration, Electronic Design Automation, IC Manufacturing, Logic Families, IC Design Techniques, IC characteristics: fan-out, power dissipation, propagation delay, and noise margin of TTL and CMOS integrated circuit logic devices	5Hrs
Unit 2	Review of Boolean Algebra and Combinational Logic, Canonical Form, Shannon's Expansion, Minterms, Maxterms, Prime Implication	4 Hrs.
Unit 3	Combinational Network Design: K – Map, Synthesis and Minimization with K – Maps (AND – OR, OR-AND, NAND-NAND, NOR-NOR), Standard Combinational Networks	5 Hrs.
Unit 4	Quine- Mc Cluskey Method, Minimization of Boolean expression with Quine-Mc Cluskey method, PROMs and EPROMs, Programmable Array Logic (PAL), Programmed Logic Array (PLA), Gate Arrays, Programmable Gate Array, Full Custom Design	7 Hrs.
Unit 5	Sequential Networks: Transition from combinational to sequential network, Direct command flip flop, Initialization of sequential network, Level Enabled Flip-Flops, Synchronization of sequential networks, Edge-triggered Flip Flops, Synchronous and Asynchronous Signals	8 Hrs.
Unit 6	Sequential Networks as Finite State Machines: Standard Models, Realization with ASM Diagrams, Synthesis of Synchronous FSM, Time	6 Hrs.

	Behavior of Synchronous FSM, Design of input forming, Logic and Output Forming Logic of state machine.	
Unit 7	Field Programmable Gate Arrays (FPGA), VHDL and its use in programmable logic devices (PLDs) like FPGA	4 Hrs.
Unit 8	Testing and Verification, Testing Logic Circuits, Combinational gate testing, Combinational network testing, Sequential Testing, Test vector generation, fault, fault model and fault detection, SA0, SA1, Design for Testability	6 Hrs.

Laboratory Works:
Laboratory Exercise should cover the implementation of combinational and sequential circuits, FSM, FPGA and VHDL. Testing and verification of circuits.

Project Work:
Design a sample of tool kit by using the design concepts of the course.

Reference Books:

1. Giuliano Donzellini, Luca Oneto, Domenico Ponta, Davide Anguita, Introduction to Digital System Design, Springer
2. Wolf, Wayne, Modern VLSI Design-System on Silicon, Third Edition, Pearson
3. Comer, David J. Digital Logic State Machine Design, Third Edition, Oxford University Press
4. Ashenden, Peter J, The Student's Guide to VHDL, Morgan Kaufman

International Marketing

Course Title: International Marketing
Course No: MGT418
Nature of the Course: Theory
Semester: VII

Full Marks: 80 + 20
Pass Marks: 32 + 8
Credit Hrs: 3

Course Objective:
This course aims to provide an understanding of the process and dynamism of marketing practiced across the international markets.

Course Description:
This is a comprehensive course that deals on the process and challenges of international marketing. The course includes topics such as scope and challenges of international marketing, dynamism in international trade, the cultural, political, and legal international environment, global marketing strategies, regional and multinational trade arrangements, and structure and dynamism in Nepal's international trade.

Course Contents:

Unit 1. Introduction (6 Hrs.)
Concept and growth of international marketing. International marketing tasks. Stages of international marketing involvement. Strategic orientations in international marketing. The dynamism in international trade – trade barriers, balance of payments, protectionism, tariffs, quotas, and embargoes. Movements against trade restrictions – GATT and WTO. Regional trading blocks.

Unit 2. International Marketing Environment (10 Hrs.)
Cultural environment: Concept and origins of culture. Elements of culture. Cultural barriers in international trade. Importance of international cultural knowledge and cultural change in marketing. Political environment: Sovereignty of nations. Political risks of international business. Political vulnerability assessment and risk minimization strategies. Legal environment: Bases of legal systems. Jurisdictions in international legal disputes and dispute resolution methods.

Unit 3: International Marketing Research Global Marketing Information System (8 Hrs.)
Concept and Scope of international marketing research. Process of research – problem identification and research objectives. Concept and components of marketing information system, sources of global marketing information.

Unit 4: International Marketing Management (11 Hrs.)
Product development for international markets – quality, green marketing, and adaptation issues. Marketing opportunities in services. Challenges of managing brands globally. International marketing channels – distribution patterns in international markets. Marketing intermediaries and choice factors. Communications – Integrated marketing communications in international marketing. International advertising goals and strategy. International pricing – approaches to international pricing, price escalation and its effects. Transfer pricing strategy.

Unit 5: Nepal's International Trade (10 Hrs.)

Structural dynamism in Nepal's foreign trade. Import and export sources. Import and export procedures and documentations. Institutional mechanism for international trade – Public, private, and non-governmental agencies for trade and export promotions. Key problems in Nepal's international trade. SAPTA and SAFTA.

Recommended Books:

1. Cateora, Philip, John Graham, and Prasant Salwan, International Marketing, Tata McGraw Hill.
2. Terpstra, Vern and Ravi Sarathy, International Marketing, Dryden Press.
3. Jain, Subhash, International Marketing Management, CBS Publications.

Advanced Database

Course Title: Advanced Database
Course No: CSC475
Nature of the Course: Theory + Lab
Semester: VIII

Full Marks: 60 + 20 + 20
Pass Marks: 24 + 8 + 8
Credit Hrs: 3

Course Description:
This course includes advanced concept of database system. The main topics covered are advanced concept of relational data model, Extended E-R model, new database management technologies, query optimization, NoSQL database and big data processing techniques.

Course Objectives:
At the end of the course students should be able to know new developments in database technology, interpret and explain the impact of emerging database standards, evaluate the contribution of database theory to practical implementations of database management systems. Also, students should be able to develop more advanced application using MapReduce and Hadoop.

Course Contents:

Unit 1: Enhanced Entity Relationship Model and Relational Model (8 Hrs.)
Entity Relationship Model Revised; Subclasses, Superclasses and Inheritance; Specialization and Generalization; Constraints and characteristics of specialization and Generalization; Union Types; Aggregation; Relational Model Revised; Converting ER and EER Model to Relational Model; SQL and Advanced Features; Concepts of File Structures, Hashing, and Indexing

Unit 2: Object and Object Relational Databases (10 Hrs.)
Object Database Concepts; Object Database Extensions to SQL; The ODMG Object Model and the Object Definition Language ODL; Object Database Conceptual Design; Object Query Language OQL; Language Binding in the ODMG Standard

Unit 3: Query Processing and Optimization (7 Hrs.)
Concept of Query Processing; Query Trees and Heuristics for Query Optimization; Choice of Query Execution Plans; Cost-Based Optimization

Unit 4: Distributed Databases, NOSQL Systems, and BigData (12 Hrs.)
Distributed Database Concepts and Advantages; Data Fragmentation, Replication and Allocation Techniques for Distributed Database Design; Types of Distributed Database Systems; Distributed Database Architectures
Introduction to NOSQL Systems; The CAP Theorem; Document-based, Key-value Stores, Column-based, and Graph-based Systems; BigData; MapReduce; Hadoop

Unit 5: Advanced Database Models, Systems, and Applications (8 Hrs.)
Active Database Concepts and Triggers; Temporal Database Concepts; Spatial Database Concepts; Multimedia Database Concepts; Deductive Database Concepts; Introduction to Information Retrieval and Web Search

Laboratory Works:
Students should implement different concepts of database system studied in each unit of the course during lab time and should submit a mini project at the end the course.

Recommended Books:

1. Elmasri and Navathe, Fundamentals of Database Systems, Pearson Education.
2. Raghu Ramakrishnan, Johannes Gehrke, Database Management Systems, McGraw-Hill
3. Korth, Silberchatz, Sudarshan, Database System Concepts, McGraw-Hill.
4. Peter Rob and Coronel, Database Systems, Design, Implementation and Management, Thomson Learning.
5. C. J. Date & Longman, Introduction to Database Systems, Pearson Education
6. Tiwari, Shashank and Safari, professional Nosql, O'Reilly Media Company.
7. Gunarathne, Thilina Hadoop MapReduce v2 Cookbook: Explore the Hadoop MapReduce v2.
8. Ecosystem to Gain Insights from very Large Datasets, 2nd Edition, PACKT Publishing.

Internship

Course Title: Internship
Course No:CSC476
Nature of the Course: Internship
Semester: VIII

Full Marks:160+40
Pass Marks:64 +16
Credit Hrs: 6

Course Description: This course covers the real-world practice in industry. It includes using theoretical and practical knowledge while working in industry together with the understanding of industry culture.

Course Objectives: The objective of this course is to allow students into market industry and gain real world experience. The course is expected to make students more pragmatic and professional.

Course Details:

Nature of Internship:

The internship work should be relevant to the field of computer science and information technology. The nature internship may include design and development of software, hardware, network services, database systems etc. The internship durationshould be minimum of 180 hours or ten weeks. The internship should be started tentatively by the 3rd week of start of eighth semester. The internship host organizations can be software/hardware development companies, telecommunications companies, network and internet service providers, financial organizations, health organizations etc.

The internship is an individual activity. The student should be responsible for the timely completion of all the activities and projects assigned, maintaining the professional quality. Each student should be facilitated with a mentor at the intern organization and a supervisor at the college/campus. Student should inform the status of all assignments to the mentor and supervisor. The student is expected to communicate frequently with the advisors on the progress and status of intern project(s)/activities. 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.

Phases of Internship:

The following are the phases of internship evaluation:

1. **Proposal Submission:** Students must submit and present internship proposal planafter 2nd weekof start of the internship.

2. **Mid-Term Submission:** Students must submit progress report and defend midterm progress of their internship work in the 11thweek of the eight semester.

3. **Final Submission:** Students must submit and defend the internship work during last week of the eight semester but before final board examination. The final defense will be

followed a viva voice conducted by an evaluation committee.Students must have to submit the internship final report to their respective department of college/campus before at least 10 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 before a week of presentation date.

Provision of Supervision:

There should be a regular faculty member of the college assigned as a supervisor. The role of supervisor is to supervise the students throughout the internshipperiod. A supervisor can supervise at most four internship students in a section.

Provision of Mentorship:

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

Evaluation Scheme:

1. **ProposalDefense**- 5% Marks of 200 (5 Marks Head/Program Coordinator + 5 Marks Supervisor)
2. **Midterm**- 15% Marks of 200 (5 Marks Head/Program Coordinator + 25 Marks Supervisor)
3. **Final Defense -** 80% Marks of 200 (100 Marks Mentor + 20 Marks Supervisor + 40 Marks External)

The evaluation committee and evaluation criteria should be as follow;

a. Evaluation committee
- HOD/Coordinator
- Project Supervisor
- Mentor
- External Examiner

b. Marks Distribution:
- Head / Program Coordinator – 10
- Supervisor – 50
- Mentor – 100
- External Examiner – 40
- Total – 200

c. Focus of the evaluation
- Presentation Skills
- Level of Work Done and Understanding of Internship Activities
- Internship Report
- Viva/Question Answer

Report Contents:

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

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

2. **Prescribed content flowfor 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
    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/ Work Logs etc…)

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: Organization Details and Literature Review**
        2.1. Introduction to Organization
        2.2. Organizational Hierarchy
        2.3. Working Domains of Organization
        2.4. Description of Intern Department/Unit
        2.5. Literature Review / Related Study

    3. **Chapter 3: Internship Activities**
        3.1. Roles and Responsibilities
        3.2. Weekly log (Log should contain the list of technical activities performed)
        3.3. Description of the Project(s) Involved During Internship

3.4. Tasks / Activities Performed (Technical details of the activities done during the internship)

4. **Chapter 4: Conclusion and Learning Outcomes**
   4.1. Conclusion
   4.2. Learning Outcome

Students should be able to relate and contextualize the above-mentioned concepts with their project work/activities 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, Institute of Science and Technology, Tribhuvan University

Text Book: None

Advanced Networking with IPv6

Course Title: Advanced Networking with IPv6
Course No: CSC477
Nature of the Course: Theory + Lab
Semester: VIII

Full Marks: 60 + 20 + 20
Pass Marks: 24 + 8 + 8
Credit Hrs: 3

Course Description:
The course covers principles underlying IPv6 Network Design, Internet routing protocols (unicast, multicast and unidirectional) with IPv6, algorithmic issues related to the Internet, IPv6 Migration, measurement and performance, next generation Internet (IPv6, QoS) and applications.

Course Objectives:
The main objective of this course is to provide knowledge of different concepts of advanced networking with IPv6 including network design, routing, migration etc.

Course Contents:

Unit 1: Introduction to Networking (6 Hrs.)
1.1.OSI Model
1.2.IPv4 addressing overview
1.3.VLSM & CIDR
1.4.Operational and managerial issues of Legacy IPv4 networking
1.5.Introduction to smart networking
1.6.Overview of Programmable networks: SDN and NFV
1.7.IPv6 network migration status

Unit 2: IP Next Generation (8 Hrs.)
2.1.Internet Protocol Version 6 (IPv6)
2.2.History of IPv6
2.3.IPv6 Header Format
2.4.Features of IPv6
2.5.IPv6 Addressing
2.5.1. Unicast addressing and its types
2.5.2. Anycast addressing
2.5.3. Multicast addressing and its scope
2.6.Static and Dynamic addressing with IPv6
2.7.IPv6 extension headers

Unit 3: ICMPv6 and Neighbor Discovery (6 Hrs.)
3.1.ICMPv6 General Message Format
3.2.ICMPv6 Error and Information Message Types
3.3.ICMPv6 features and its comparison with ICMPv4
3.4.Neighbor Cache and Destination Cache
3.5.Neighbor Discovery Processes and Messages
3.6.Path MTU Discovery
3.7.MLD overview

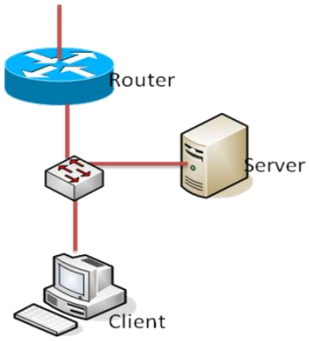
Unit 4: Security and Quality of Service in IPv6 (4 Hrs.)
4.1.Types of Threats
4.2.Security Techniques
4.3.IPSEC Framework
4.4.QoS Paradigms
4.5.QoS in IPv6 Protocols

Unit 5: IPv6 Routing (5 Hrs.)
5.1.RIPng
5.2.OSPF for IPv6
5.3.BGP extensions for IPv6
5.4.PIM-SM & DVMRP for IPv6

Unit 6: IPv4/IPv6 Transition Mechanisms (8 Hrs.)
6.1.Migration Strategies
6.2.Tunneling, dual stack and translations
6.3.Transition techniques
6.3.1. 6RD
6.3.2. Dual-stack lite
6.3.3. Stateful/Stateless AFT
6.3.4. 464XLAT, CGNAT
6.3.5. Other recent techniques

Unit 7: Future networking (8 Hrs.)
7.1.Operation of SDN and NFV
7.2.Introduction to SDN based IPv6 Networking
7.3.SDN migration methods and practices
7.4.Features of Software-Defined IPv6 Networks (SoDIP6)
7.5.SoDIP6 Network Deployment: Challenges and Risks
7.6.SoDIP6 based NGN
7.7.Routing in Multi-Domain SoDIP6 Networks

Laboratory work:
For the lab work, one PC to one student either in virtual environment or real environment will be provided. Students will be divided into group of 3 students. The working environment and machine connectivity will look like the following:



Tools Needed: TCPDUMP & WIRESHARK, VMWare Environment, Linux/FreeBSD, Windows

Lab 1: Enable IPv6 in Windows/Linux
Lab 2: IPv6 Header Analysis
Lab 3: IPv6 Packet analysis (neighbor/router solicitation/discovery)
Lab 4: Unicast Routing Implementation using Zebra-OSPF & OSPF phase analysis
Lab 5: Multicast Routing Implementation using XORP-PIM/SM & PIM/SM phase analysis
Lab 6: SDN enabled IPv6 network implementaion with Mininet
Lab 7: ONOS, SDN-IP implementation for routing implementaiotn in SoDIP6 network

Reference Books:

1. Silvia Hagen: IPv6 Essentials, O'reilly
2. Joseph Davies: Understanding IPv6; eastern economy edition
3. SDN and NFV simplified: A Visual Guide to Understanding Software Defined Networks and Network Function Virtualization, by Jim Doherty

Prerequisite: Networking & Communications Fundamentals

Distributed Networking

Course Title: Distributed Networking
Course No: CSC478
Nature of the Course: Theory + Lab
Semester: VIII

Full Marks: 60 + 20 + 20
Pass Marks: 24 + 8 + 8
Credit Hrs: 3

Course Description:
The course covers overview of distributed networking model, client server model, communication models, internetworking, interprocess communication, fault tolerance, reliability, replication, security issues and new developments in distributed networking.

Course Objectives:
The course objective to make the students familiar with Distributed Network Systems, its models, communication paradigms, related protocols and architectures, its reliability and replication systems, and security issues. It also briefly introduces the current developments in distributed networking.

Course Contents:

Unit 1	Overview: Distributed Systems, Computer Networks, Protocols and QoS, Software for Distributed Computing, Agent – based computing model	4 Hrs.
Unit 2	Client Server Model: Issues, Client Server Model in Distributed Computing System, Cooperation between clients and servers, Extensions to the Client Server Model, Service Discovery, Client Server Interoperability	8 Hrs.
Unit 3	Communication Paradigm: Message and message passing mechanisms, Remote Procedure Calls, Remote Method Invocation, Distributed Shared Memory, its design and implementation and consistency models	6 Hrs.
Unit 4	Internetworking: Communication Protocol Architectures, TCP/IP Protocol Suite, IPv6	5 Hrs.
Unit 5	Interprocess communication using message passing: Developing distributed applications using message passing, sockets and system calls	5 Hrs.
Unit 6	Reliability and Replication Techniques: Fault Tolerance, Reliability, Availability, Failure Classification, Techniques to achieve reliability, Reliability Modelling, Fault Tolerant Distributed Algorithms, Replication and reliability, Replication schemes and consistency	7 Hrs.
Unit 7	Security: Secure Networks, Security Mechanisms on Internet, DDoS Attacks, Active and Passive Defense against DDoS attack	6 Hrs.
Unit 8	Current Developments in Distributed Network System: Introduction and characteristics of Cluster Computing, Grid Computing, P2P Computing, Pervasive Computing	4 Hrs.

Laboratory Works:
Laboratory exercise should consist of tasks related configuration of distributed system, client server applications, message passing, remote method invocation, remote procedure calls, socket and system calls, and reliability and replication techniques.

Text Book:

1. Weijia Jia, Wanlei Zhou, Distributed Network Systems from Concept to Implementation, Springer

Reference Books:

1. HagitAttiya, Jennifer Welch, Distributed Computing: Fundamentals, Simulations and Advanced Topics, 2nd Edition, March 2004
2. Distributed Systems: Principles and Paradigms – Andrew Tanenbaum and Maarten van Steen, Prentice Hall, 2007

Prerequisite: Networking and Communication Fundamentals

Game Technology

Course Title: Game Technology
Course No: CSC479
Nature of the Course: Theory + Lab
Semester: VIII

Full Marks: 60 + 20 + 20
Pass Marks: 24 + 8 + 8
Credit Hrs: 3

Course Description:
This course is a practical and conceptual introduction to game design and development including basic ideas of game design, learn to design a game, and working as a game designer. This course will provide ample opportunities to try out concepts and theories to design, develop and test 2D and 3D games. The main platform will be Unity, a cross-platform game editor and engine widely in use by many companies in the game industry.

Course Objectives:
After completion of the course, students will learn

- basics of game development
- to design games
- to work as a game designer
- to use Unity game editor and engine to develop games

Course Contents:

Unit 1: Game Design Basics (12 Hrs.)
Role of the Game Designer: An Advocate for the Player, Passions and Skills, A Playcentric Design Process, Designing for Innovation; Structure of Games: Engaging the Player, The Sum of the Parts, Defining Games, Beyond Definitions; Working with Formal Elements: Players, Objectives, Procedures, Rules, Resources, Conflict, Boundaries, Outcome; Working with Dramatic Elements: Challenge, Play, Premise, Character, Story, World Building, The Dramatic Arc; Working with System Dynamics: Games as Systems, System Dynamics, Interacting with Systems, Tuning Game Systems

Unit 2: Designing a Game (25 Hrs.)
Conceptualization: Where Do Ideas Come From, Alternative Methods, Editing and Refining, Turning Ideas into a Game, Ideas vs. Designs; Prototyping: Methods of Prototyping, Prototyping Your Original Game Idea, Making the Physical Prototype Better, Beyond the Physical Prototype; Digital Prototyping: Types, Designing Control Schemes, Selecting Viewpoints, Effective Interface Design, Prototyping Tools; Playtesting: Playtesting and Iterative Design, Recruiting Playtesters, Conducting a Playtesting Session, Methods of Playtesting, The Play Matrix, Taking Notes, Basic Usability Techniques, Data Gathering, Test Control Situations, Playtesting Practice; Functionality, Completeness, and Balance: What Are You Testing For? Is Your Game Functional? Is Your Game Internally Complete? Is Your Game Balanced? Techniques for Balancing Your Game; Fun and Accessibility: Is Your Game Fun? Improving Player Choices, Fun Killers, Beyond Fun, Is Your Game Accessible?

Unit 3: Working as a Game Designer (8 Hrs.)

Team Structures: Team Structure, Developer's Team, Publisher's Team, Team Profile, All Contribute to the Design, Team Communication; Stages and Methods of Development: Stages, Using Agile Development; Communication your Designs: Visualization, Flowcharts, Tables and Spreadsheets, Concept Art, Description, Formats, Contents, Design Macros; Understanding the New Game Industry: Size, Platform for Distribution, Genres of Gameplay, Publishers, Developers, The Business of Game Publishing; Selling Yourself and Your Ideas to the Game Industry: Getting a Job at a Publisher or Developer, Pitching Your Original Ideas, Independent Production

Laboratory Works:

The Laboratory work includes designing and developing games using Unity game editor and engine.

Recommended Books:

1. Tracy Fullerton, Game Design Workshop: A Playcentric Approach to Creating Innovative Games, Fourth Edition, CRC Press, 2019.
2. The Digital Gaming Handbook, Edited by Roberto Dillon, CRC Press, 2021.

Distributed and Object Oriented Database

Course Title: Distributed and Object Oriented Database
Course No: CSC480
Nature of the Course: Theory + Lab
Semester: VIII

Full Marks: 60 + 20 + 20
Pass Marks: 24 + 8 + 8
Credit Hrs: 3

Course Description:
This course aims to discuss concepts of distributed and object oriented database management systems. Main focus is given to basic concepts of DDBMS, distributed database design, distributed query processing, distributed concurrency control, concepts of OODBMS, and language and design of object oriented database.

Course Objectives:

- Discuss basic concepts related to distribute DBMS.
- Exemplify design of distributed database.
- Describe distributed query processing and concurrency control.
- Discuss basic concepts of OODBMS.
- Demonstrate language and design for distributed database.

Course Contents:

Unit 1: Introduction to Distributed Database (4 Hrs.)
Distributed Data Processing, Distributed Database Systems, Promises of DDBS, Complicating Factors, Design Issues of DDBMS, and Distributed DBMS Architectures: Autonomy, Distribution, Heterogeneity DDBMS Architecture – Client/Server, Peer to peer, MDBS.

Unit 2: Distributed Database Design and Access Control (4 Hrs.)
Top-Down Design Process, Distribution Design Issues, Fragmentation, Allocation, Data Directory, View Management, Data Security, Semantic Integrity Control.

Unit 3: Query Processing, Decomposition, and Localization (6 Hrs.)
Query Processing Problem, Objectives of Query processing, Complexity of RA Operations, Characterization of Query Processors, Layers of Query Processing, Query Decomposition, Localization of Distributed Data.

Unit 4: Distributed Concurrency Control(8 Hrs.)
Serializability Theory, Taxonomy of Concurrency Control Mechanisms, Lock Based Concurrency Control Algorithms, Time-Stamp Based Concurrency Control Algorithms, Optimistic Concurrency Control Algorithms, Deadlock management.

Unit 5: Object Oriented Database Concepts (6 Hrs.)
Overview of Object-Oriented Concepts, Object Identity, Object Structure, and Type Constructors, Encapsulation of Operations, Methods, and Persistence, Type Hierarchies and Inheritance, Complex Objects, Other Objected-Oriented Concepts

Unit 6: OODBMS Languages and Design (6 Hrs.)
Object Model, Object Definition Language, Object Query Language, Object Database Conceptual Design, Examples of ODBMSs.

Laboratory Works:
Students should implement all the concepts of object oriented and distributed databases mentioned in the course.

Text Books:

1. M. Tamer Özsu and Patrick Valduriez, Principles of Distributed Database Systems, Fourth Edition, Springer, 2019.
2. ElmasriRamez and NavatheShamkant, Fundamentals of Database System, Seventh Edition, Pearson Education, 2017.

Introduction to Cloud Computing

Course Title: Introduction to Cloud Computing
Course No: CSC481
Nature of the Course: Theory + Lab
Semester: VIII

Full Marks: 60 + 20 + 20
Pass Marks: 24 + 8 + 8
Credit Hrs: 3

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

Course Objectives:
The main objective of this course is to provide theoretical as well as practical knowledge of cloud computing including designing, implementing and managing the cloud computing.

Course Contents:

Unit 1: Introduction to Cloud Computing (6 Hrs.)
Evolution of Cloud Computing, Characteristics of Cloud Computing, Types of cloud and its Cloud services, Benefits and challenges of cloud computing, Applications cloud computing, Cloud Storage, Cloud services requirements, cloud and dynamic infrastructure, Cloud adoption

Unit 2: Cloud Computing Architecture (6 Hrs.)
Platform as service, Software as a service, Infrastructure as service, Public clouds, Private clouds, Community cloud, Hybrid clouds, Cloud design and implementation using SOA, security, trust and privacy

Unit 3: Cloud Virtualization technology (10 Hrs.)
Introduction to Virtualization, different types of Virtualization, Implementation Levels of Virtualization Structures, Benefits of virtualization, server virtualization, virtualization software, Types of Hypervisor, and Load balancing, Infrastructure requirement for virtualization

Unit 4: Cloud Programming Models (12 Hrs.)
Thread programming, Task programming, Map-reduce programming, Parallel efficiency of Map-Reduce, Enterprise batch processing using Map-Reduce, Comparisons between Thread, Task and Map reduce

Unit 5: Cloud security (6 Hrs.)
Cloud Security issues, challenges and Risks, Software-as-a-Service Security, Security Monitoring, Security Architecture Design, Data and application Security, Virtual Machine Security, Legal issues and Aspects, Multi-tenancy issues

Unit 6: Cloud Platforms and Applications (12 Hrs.)
Web services, AppEngine, Azures Platform, Aneka, Open challenges, Scientific applications,Business and Consumer applications

Laboratory Works:
The practical work consists of all features of cloud computing.

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.

Geographical Information System

Course Title: Geographical Information System
Course No: CSC482
Nature of the Course: Theory + Lab
Semester: VIII

Full Marks: 60 + 20 + 20
Pass Marks: 24 + 8 + 8
Credit Hrs: 3

Course Description:
The course covers about spatial data structure, modeling and database design, different techniques for capturing the real world, spatial data manipulation, analysis and visualization, spatial data infrastructure and data standardization, overview of open GIS and open source GIS data.

Course Objectives:
The main objective of this course is to provide both theoretical and practical knowledge of Geographical Information System.

Course Contents:

Unit 1: Introduction to Geographic Information System (GIS) (5 Hrs.)

1.1 Overview, concepts of GIS, components of GIS
1.2 Origin of GIS, History of *GIS* and geospatial technology
1.3 Functions and benefits of GIS
1.4 Scope and application areas of GIS
1.5 Data base management system (DBMS) and concept of spatial and attribute data

Unit2: Digital Mapping Concepts and Visualization (5 Hrs.)

2.1 Database and mapping concept: geographic features and attributes, thematic maps, map layers, map scales, resolution and representation
2.2 Map outputs and elements, map design and layout
2.3 Map projection: coordinate systems, projection systems, common map projections in GIS, conversion among coordinate systems

Unit 3: Spatial Data Structure and Database Design (6 Hrs.)

3.1 concepts of geographic phenomena and data modeling, geographic objects and fields
3.2 vector data and raster data model
3.3 spatial relationships and topology
3.4 GIS data formats and data conversion
3.5 Spatial database design with the concepts of geo-database

Unit 4: Data Acquisition, Data Quality and Management (9 Hrs.)

4.1 different methods of data capture
4.2 geo-referencing and digitization
4.3 data preparation, conversion and integration
4.4 spatial data quality and accuracy
4.5 introduction to global navigation and satellite systems (GNSS)
4.6 Basics of remote sensing (RS) technology

4.7 integration of RS and GNSS data into GIS

Unit 5: Spatial Analysis (10 Hrs.)

5.1 vector data analysis: geo-processing, overlay analysis, buffering, network analysis

5.2 raster analysis: local operations, focal operations, zonal operations, re-sampling, mosaic and clip, distance measurement

5.2 spatial interpolation techniques, geo-statistics, GIS modeling

5.3 GIS programming and customization: Opening and exploring Model Builder, Python script tools, Customizing QGIS with Python

Unit 6: Introduction to Spatial Data Infrastructure (3 Hrs.)

6.1 SDI concepts, components of SDI and trends

6.2 The concept of metadata and clearing house

6.3 System Architecture for SDI Interoperability, Client Server Architecture, SDI technologies

6.4 legal aspects of SDI

Unit 7: Open GIS (7 Hrs.)

7.1 Introduction of open concept in GIS

7.2 Open source software for spatial data analysis

7.3 Web Based GIS system

7.4 Open source GIS data

7.5 GIS application case studies

Laboratory work:

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

Recommended Books:

1. Chang, K. T. *Introduction to geographic information systems*. Ninth edition, Boston: McGraw-Hill.
2. Principles of geographic information systems: An introductory textbook, international institute for Geo-information science and Earth observation, the Netherlands- By rolf De By, Richard A. knippers, yuxian sun
3. ESRI guide to GIS analysis Andy Mitchell, ESRI press, Red lands
4. GIS Cook BOOK

Decision Support System and Expert System

Course Title: Decision Support System and Expert System
Course No: CSC483
Nature of the Course: Theory + Lab
Semester: VIII

Full Marks:60+ 20+20
Pass Marks: 24+8+8
Credit Hrs: 3

Course Description:

This course is a study uses of artificial intelligence in business decision making. Emphasis will be given in business decision making process, design and development of decision support systems and expert systems.

Course Objectives:

- Introduce intelligent business decision making
- Discuss design, development and evaluation of DSS Systems
- Discuss various models of building DSS systems
- Explain Concept behind expert systems

Course Contents:

Unit 1: Business Decision Making (10 Hrs.)

1.1. Supporting Business Decision Making: Introduction, History, Conceptual Perspective, Decision Support vs. Transaction Processing System, Categories of DSS Applications and Products, DSS Framework, Building Decision Support Systems
1.2. Gaining Competitive Advantage with Decision Support Systems: Introduction, Technology Trends, Gaining Competitive Advantage, Examples of Strategic DSS, Opportunities and IS Planning, DSS Benefits, Limitations, and Risks, Resistances to Using DSS
1.3. Business Decision Making Process: Introduction, Managerial Decisions, Decision Making Context, Decision Making Process, Good Decision Making, Redesigning Decision Making Process

Unit 2: Designing, Developing, and Evaluating DSS Systems (10Hrs.)

2.1. Designing and Evaluating DSS Systems:Introduction, Design and Development Issues, Decision Oriented Diagnosis, Prepare a Feasibility Study, Choose a Development Approach, DSS Project Management and Participants.
2.2. Designing and Evaluating DSS User Interfaces:Introduction, Overview of User Interface, User Interface Styles, ROMC Design Approach, Building DSS User Interface, Comments on Design Elements, Guidelines of Dialog and UI Design, Factors of UI Design Success.
2.3. DSS Architecture, Networking, and Security Issues:Introduction, DSS Architecture and IT Infrastructure, Networking Issues, Improving Security for Decision Support Systems.

Unit 3: Building DSS Systems (10 Hrs.)

3.1. Implementing Communication-Driven and Group Decision Support Systems, Building Data and Document Driven Decision Support Systems, Building Knowledge Driven Decision Support Systems, Building Model Driven Decision Support Systems, Building Web Based and Interorganizational Decision Support Systems, Evaluating DSS Projects

Unit 4: Expert Systems (8 Hrs.)

4.1. Definition and Features of Expert Systems, Architecture and Components of Expert Systems, Persons Who Interact with Expert Systems, Advantages and Disadvantages of Expert Systems, Expert Systems Development Life Cycle, Error Sources on Expert System Development

Unit 5: Fuzzy Expert Systems (7 Hrs.)

5.1. Fuzzy Rule, Fuzzy Reasoning, Need of Fuzzy Expert Systems, Operations on Fuzzy Expert Systems, Fuzzy Inference Systems, Fuzzy Inference Process, Types of Fuzzy Expert Systems, Fuzzy Controller.

Laboratory Work: Student should study some widely used decision support systems and expert systems. Besides, student need to develop decision support systems or expert systems as a mini-project.

Text Books:

1. Daniel J. Power, Decision Support Systems: Concepts and Resources for Managers, Illustrated Edition,Praeger.
2. I. Gupta and G. Nagpal, Artificial Intelligence and Expert Systems,Mercury Learning & Information, 2020

Mobile Application Development

Course Title: Mobile Application Development
Course No: CSC484
Nature of the course: Theory + Lab
Semester: VIII

Full Marks:60+20+20
Pass Marks:24 + 8 + 8
Credit Hrs: 3

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

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

Course Contents:

Unit 1: Introduction to Mobile Computing (5 Hrs.)
Introduction to Mobile Computing, 3-tier architecture of mobile computing, History of mobile, the evolution of devices (Brick era, Candy bar era, Feature phone era, Smartphone era, Touch era), Introduction to mobile application development frameworks (Swiftic, React Native, Xamarin, Ionic, Sencha, Adobe PhoneGap), Mobile ecosystem, Mobile application development environments, Factors in Developing Mobile Applications (Mobile Software Engineering, Framework and tools, User interface), Adding dimensions of mobile computing

Unit 2: Architecture, Design and Mobile Development Frameworks (10 Hrs.)
Mobile computing architectures, Fully centralized and client server architectures, N-tier architecture, Mobile information architecture, Mobile design, The mobile design tent-pole, Elements of mobile design, Designing for right device and different size screen, Fully centralized framework, N-tier client server framework, Mobile operating system and Virtual machine, Hardware specific tools and frameworks, BREW (Binary Runtime Environment for Wireless), BREW SDK, Building and deploying BREW application, WAP Architecture, WAP UI, WAP proxies and gateways, Multimedia messaging services, WAP push, security, Publishing frameworks (cocoon architecture)

Unit 3: User Interfaces (10 Hrs.)
Generic UI development, Human factors, Elements of the user interfaces (channels, interaction, prompts, response, commands, menus, forms, natural language), Resource files, Using UI widgets, Event driven programming, Context, (Taxonomy of context by domain, Extrinsic and Intrinsic context), User interface components, XForms, Developing mobile GUI, MVC, PAC, VUIs and mobile apps, Qualities of speech, Voice transcription, Voice recognition (Speech Grammar), Text to speech technologies, Speech synthesis, Multichannel and Multimodal UIs

Unit 4: Testing and Publishing Apps (5 Hrs.)
Mobile application build and delivery, Testing mobile applications, Automated versus Manual testing, Testing the mobile infrastructure, Coding standards, Unit testing, Black box testing, White box testing, Regression testing, App distribution through App stores, Monetizing Apps

Unit 5:Mobile Agent and Peer-to-Peer Architectures for Mobile Applications (3 Hrs.)
Basics of Agent technologies, Mobile agents for mobile computing, Peer to peer applications for mobile computing, JXTA

Unit 6:Wireless Connectivity and Mobile Applications (3 Hrs.)
Modulation and Transmission techniques, Short range and long range wireless communication, Security in wireless network, Bluetooth security, Security in long range wireless networking technologies, Mobile IP, SMS

Unit 7:Synchronization and Replication of Mobile Data (3 Hrs.)
Taxonomy of synchronization and replication, Scalability issues, Solving the mobile synchronization, Bluetooth synchronization, Working with the content provider

Unit 8:Location and Sensing (4 Hrs.)
Mobility and location based service, Data acquisition of location information, GPS based solution, Non GPS solution, Using GIS for mobile applications, Location information modeling, Location based service, Architecture for offering location services, Security and privacy of location information

Unit 9:Active Transactions (2 Hrs.)
Active computing and wireless infrastructure, WAP Push, Mobile IP and Push, Session initiation protocol

Laboratory Works: The laboratory should contain all the features mentioned in a course, which should include

- Language overview (Java, Object oriented concept)
- Basic Concept of Android application architecture
    - source, resource folder concept
    - Terminology for android
- Concept of android Layouts
    - Concept of Linear layout, Relative layout, toolbar
    - Concepts of list view, recycler view, grid view, scroll view, view pager, tab Layout
    - Create form and form validation
    - Alert Dialogs, Toast
    - Popup
- Shared Preference
- Menu
    - Option menu, context menu
- Introduction to Activity, Fragment
    - Simple activity information
    - Working with intents
- Theme and Style
- Database
    - Simple overview to database (simple query)
    - SQLite overview

- API Implementation
    - Working with volley
    - Working with Retrofit
- Advanced
    - Thread
    - JSON Parsing
    - Google Play Service (Maps, GPS)
    - FCM (Firebase Cloud Messaging)

Text Books:

1. Mobile Computing Principles: Designing and Developing Mobile Applications with UML and XML, Reza B'Far, Cambridge University Press, 2005
2. Mobile Design and Development, Brian Fling, O'Reilly, 2009

Real Time Systems

Course Title: Real Time Systems
Course No: CSC485
Nature of the Course: Theory + Lab
Semester: VIII

Full Marks: 60+20+20
Pass Marks: 24+8 + 8
Credit Hrs: 3

Course Description:
This course familiarizes students with different concepts of real time systems mainly focusing on scheduling, access control, memory management, optimization, and real time communications.

Course Objective:
The main objective of this course is to provide core knowledge of different concepts of real time system which will enhance the student capacity in building real time systems.

Course Contents:

Unit 1: Introduction (4 Hrs.)
Definition, Hard, Soft and Firm Real Time System, Real Time Vs. Embedded System, Timing Constraints, Application of Real Time System, Brief Survey of Real Time Programming: Ada 95, C, C++, C#, Fortran, Java, Occam 2, Special Real-Time Languages

Unit 2: Reference Model of Real Time System (4 Hrs.)
Processor and Resources, Temporal Parameters of Real-Time Workload, Periodic and Aperiodic Task Model, Precedence Constraints and Data Dependency, Other Dependencies, Functional Parameters, Resource Parameters of Jobs and Parameters of Resources

Unit 3: Periodic Task Scheduling (7 Hrs.)
Clock Driven Scheduling – Definition, Notations and Assumption, Scheduler Concepts, General Scheduling Structure, Cyclic Executives. Priority Driven Scheduling - Notations and Assumption, Fixed Priority Verses Dynamic Priority, Fixed Priority Scheduling Algorithms (RM and DM) and their Schedulability Analysis, Concept of Schedulability Tests – Inexact and Exact Schedulability Tests for RM and DM, Optimality of the RM and DM Algorithms, Practical Factors.

Unit 4: Aperiodic Task Scheduling (7 Hrs.)
Aperiodic Task Scheduling: Assumption and Approaches, Server Based and Non-Server Based Fixed Priority Scheduling Algorithms: Polling Server, Deferrable Server, Simple Sporadic Server, Priority Exchange, Extended Priority Exchange, Slack Stealing. Introduction to Scheduling of Flexible Computations: Flexible Applications, Imprecise Computation Model and Firm Deadline Model. Introduction to Scheduling of Flexible Computations –Flexible Applications, Imprecise Computation Model and Firm Deadline Model.

Unit 5: Real-Time Memory Management (5 Hrs.)
Process Stack Management, Multiple-Stack Arrangements, Memory Management in the Task-Control-Block Model, Swapping, Overlays, Block or Page Management, Memory Locking, Working Sets, Real-Time Garbage Collection, Contiguous File Systems

Unit 6: Resources and Resource Access Control (5 Hrs.)
Assumptions on Resources and their Usage, Effects of Resources Contention and Resource Access Control, Non Preemptive Critical Sections, Basic Priority-Inheritance Protocol, Basic Priority-Ceiling Protocol, Stack-Based, Priority-Ceiling (Ceiling-Priority) Protocol, Use of Priority-Ceiling Protocol In Dynamic-Priority System, Preemption-Ceiling Protocol, Controlling Accesses to Multiple-Unit Resources, Controlling Concurrent Accesses to Data Objects

Unit 7: Performance Analysis and Optimization of Real-Time Systems (6 Hrs.)
Challenges in Analyzing Real-Time Systems, Performance Analysis: Analysis of Round-Robin Systems, Response-Time Analysis for Fixed-Period Systems, Response-Time Analysis: RMA Example, Analysis of Sporadic and Aperiodic Interrupt Systems, Performance Optimization: Compute at Slowest Cycle, Scaled Numbers, Binary Angular Measure, Optimizing Memory Usage; Analysis of Memory Requirements; Reducing Memory Utilization: Variable Selection, Memory Fragmentation

Unit 8: Real Time Communication (7 Hrs.)
Introduction, Model of Real-Time Communication, Real Time Traffic Model, Real Time Connections and Service Disciplines, Priority – Based Service Disciplines for Switched Network, Weighted Round-Robin Service Disciplines, Medium Access-Control Protocols of Broadcast Networks, Internet and Resource Reservation Protocols, Real-Time Protocol

Laboratory Work / Case Study:
The laboratory work should focus on implementation of concepts related to scheduling, memory management, synchronization and optimization using suitable simulators and programming languages. There should also be a case study in group with at most 4 students focusing on any real time system implemented system.

Text Books:
1. Real-Time Systems, Jane W. S. Liu, Pearson Education Asia, Latest Edition
2. Real-Time Systems, Design Principles for Distributed Embedded Applications Kopetz, Hermann, Springer Latest Edition

Network and System Administration

Course Title: Network and System Administration
Course No: CSC486
Nature of the Course: Theory + Lab
Semester: VIII

Full Marks: 60 + 20 + 20
Pass Marks: 24 + 8 + 8
Credit Hrs: 3

Course Description:
The course covers different concepts of network and system administration including subjects ranging from initial installation of OS to day-to-day administrative tasks such as Network and Server Configurations, management of user accounts and disk space, and even imparting the trouble-shooting skills future system administrators will need to cope with unexpected behavior.

Course Objectives:
The main objective of this course is to provide knowledge of different concepts of network and system administration, configuration, and management.

Course Contents:

Unit 1: Networking Overview (4 Hrs.)
1.1 Overview of Reference Model (OSI, TCP/IP)
1.2 Overview of IPv4 and IPv6 addressing
1.3 Windows and Linux Networking Basics
1.4 Switching and Routing basics
1.5 Overview of SDN and OpenFlow

Unit 2: Server Administration Basics (8 Hrs.)
2.1 Open Source Server and Client Installation
2.2 Linux installation, disk partitioning, logical volume manager
2.3 Boot Process and Startup Services: Xinetd/Inetd
2.4 Managing accounts: users, groups and other privileges
2.5 File Systems and Quota Management
2.6 Job Scheduling with cron, crontab, anacron and system log analysis
2.7 Process controlling and management
2.8 Online Server upgrade/update process
2.9 Administering Database, web, and proxy server
2.10 Shell programming fundamentals

Unit 3: Network Configuration Basics (7 Hrs.)
3.1 Network Interface Configuration
3.2 Diagnosing Network startup issues
3.3 Linux and Windows Firewall configuration
3.4 Network troubleshooting commands
3.5 Introduction to network programming with Mininet
3.6 SDN controller and dataplane communication
3.7 Routing configuration in SDN
3.8 Open source networking monitoring (e.g. Nagios)

Unit 4: Dynamic Host Configuration Protocol (DHCP) (3 Hrs.)
4.1 DHCP Principle
4.2 DHCP Options, Scope, Reservation and Relaying
4.3 DHCP Troubleshooting

Unit 5: Name Server and Configuration (7 Hrs.)
5.1 DNS principles and Operations
5.2 Basic Name Server and Client Configuration
5.3 Caching Only name server
5.4 Primary and Slave Name Server
5.5 DNS Zone Transfers
5.6 DNS Dynamic Updates
5.7 DNS Delegation
5.8 DNS Server Security
5.9 Troubleshooting

Unit 6: Web and Proxy Server Configuration (7 Hrs.)
6.1 HTTP Server Configuration Basics
6.2 Virtual Hosting
6.3 HTTP Caching
6.4 Proxy Caching Server Configuration
6.5 Proxy ACL
6.6 Proxy-Authentication Mechanisms
6.7 Troubleshooting

Unit 7: FTP, File, and Print Server (4 Hrs.)
7.1 General Samba Configuration
7.2 CUPS configuration basics
7.3 FTP Principles
7.4 Anonymous FTP Server
7.5 Troubleshooting

Unit 8: Mail Server basics (5 Hrs.)
8.1 SMTP, POP and IMAP principles
8.2 SMTP Relaying Principles
8.3 Mail Domain Administration
8.4 Basic Mail Server Configuration (Sendmail, postfix, qmail, exim..)
8.5 SPAM control and Filtering
8.6 Troubleshooting

Laboratory work:
The laboratory work includes all the features mentioned in the course.

Samples:
1. Server/Client Installation over VMware Environment
2. Packet Analysis by using TCPDUMP and WIRESHARK

3. Network Practice with Packet Tracer
4. System Administration: User/Group management, File System Management ….
5. Network Configuration: Start/Stop network Service, network interface configuration
6. Firewall Configuration
7. DNS and DHCP Configuration and Troubleshooting
8. Web and Proxy Server Configuration and Troubleshooting
9. Basic Mail Server Configuration and Troubleshooting
10. SAMBA, NFS, CUPS and FTP configuration and Troubleshooting
11. SDN controller installation and client network implementation (OpenDaylight)
12. Network topology programming with Mininet and visualization

Recommended Books:

1. The Practice of System and Network Administration, Second Edition
   Thomas A. Limoncelli, Christina J. Hogan, Strata R. Chalup
2. Advanced Linux Networking, Roderick W. Smith, Addison-Wesley Professional (Pearson Education), 2002.
3. Linux Network Administrator's Guide, Tony Bautts, Terry Dawson, Gregor N. Purdy, O'Reilly, Third Edition, 2005

Prerequisite: Computer Networking Course

Embedded Systems Programming

Course Title: Embedded Systems Programming
Course No: CSC487
Nature of the Course: Theory + Lab
Semester: VIII

Full Marks: 60+20+20
Pass Marks: 24 + 8 + 8
Credit Hrs: 3

Course Description:
The course covers ARM based embedded system overview – assembly level programming, efficient C programming and embedded OS.

Course Objective:
The main objective of this course is to introduce the underlying principle of embedded system programming in assembly language and C language for ARM based embedded processor.

Course Contents:

Unit 1: ARM Embedded System (4 Hrs.)
Introduction to Embedded Systems, Introduction to RISC Design Philosophy, The ARM Design Philosophy, Embedded System Hardware, Embedded System Software

Unit 2: ARM Processor Fundamentals (4 Hrs.)
The Acron RISC Machine, The ARM Programmer's Model, ARM Development Tools, Registers, Current Program Status Register, Pipeline, Exceptions, Interrupts, Vector Table, ARM Processor Families

Unit 3: Introduction to ARM Instruction Set (8 Hrs.)
Data Processing Instructions, Branch Instructions, Load – Store instructions, Software Interrupt Instructions, Program Status Register Instructions, Loading Constraints, Conditional Execution

Unit 4: Thumb Instruction Set (8 Hrs.)
The Thumb bit in the CPSR, The Thumb Programmer's Model, Thumb Branch Instructions, Thumb Software Interrupt Instructions, Thumb Data Processing Instructions, Thumb Single Register Data Transfer Instructions, Thumb Multiple Register Data Transfer Instructions, Thumb Breakdown Instruction, Thumb Implementation, Thumb Application

Unit 5: Efficient C Programming for ARM (8 Hrs.)
Basic Data Types, Expressions, Conditional Statements, Loops, Function Calls, Procedures, Use of Memory, Pointer Aliasing, Bit Field

Unit 6: Writing and Optimizing ARM Assembly Code (8 Hrs.)
Writing Assembly Code, Profiling and Cycle Counting, Instruction Scheduling, Register Allocation, Conditional Execution, Looping Constructs, Bit Manipulation, Efficient Switches, Handling Unaligned Data

Unit 7: Firmware and Embedded OS (5 Hrs.)

Firmware and Bootloader, Fundamental Components of Embedded OS, Embedded Linux, Android OS

Laboratory Works:
Programming in C and Assembly (KEIL and PROTEUS), GPIO Programming (LED, LCD, Keypad, Buzzer)

Text Book:
1. Andrew N. Sloss, Dominic Symes, Chris Wright "ARM System Developer's Guide: Designing and Optimizing System Software", Latest Edition, Morgan Kaufmann Publisher, An imprint of Elsevier

Reference Books:
1. Steve Furber "ARM System – on – Chip Architecture", Second Edition, Pearson Education Limited
2. Warwick A. Smith "C Programming for Embedded Micricontrollers"

International Business Management

Course Title: International Business Management
Course No: MGT488
Nature of the Course: Theory
Semester: VIII

Full Marks: 80 + 20
Pass Marks:32+ 8
Credit Hrs: 3

Course Description:
This course contains globalization and international business, global economy and regional, international trade and investment theories and practices, national difference in political, economic and socio-cultural environment, strategies for international business and international financial environment to provide the basic knowledge to students.

Course Objectives:
The objective of this course is to familiarize students with the environment and challenges of doing business abroad. The course presents students with the opportunities to explore a number of issues and concerns relating to international business.

Course Contents:

Unit 1: Globalization and International Business (8 Hrs.)
Concept of domestic, international and global business. Opportunities and challenges of IB. Globalization: Concept and drivers, Types of globalization:economic, cultural, political, environmental, production, market.International Business Environment: Economic, demographic, cultural and political-legal environment; Globalization debate: positive and negative impact.

Unit 2: Global Economy and Regional Economy (6 Hrs.)
Global economy: concept, features and structures; changing demographics of global business. MNCs: Concept, types, structures, strategies, and problems. Global economic integration: WTO (Origin, goals, structure, and functions). Regional economic integrationlevels: preferential trading, free trade areas, customs union, common market, economic union, and political union; International Economic Organizations: WTO, UNCTAD, World Bank, IMF EU, NAFTA, SAFTA, BIMSTEC (Origin, goals and structure).

Unit 3: National Differences in Socio-cultural Environment (3 Hrs.)
Socio-cultural implication on IB. Cultural differences: Determinants of culture: Awareness, values, norms, communication, language and religion. Dealing with cultural differences.

Unit 4: National Differences in Political Environment (3 Hrs.)
Political systems: Democracy & totalitarian spectrum. Business-government relations. Political risk: concept and types. Impact of political environment on international business. Implications of legal systems in business. Intellectual property rights.

Unit 5: National Differences in Economic Environment (3 Hrs.)
Economic system: market, command, mixed. Determinants of economic development: Inflation, Income (GDP, per capita income nominal & PPP, HDI). Level of economic development: developed, developing, and emerging economies (World Bank's Criteria).

Unit 6: International Financial Environment (8 Hrs.)

Foreign exchange markets, Spot market, spot rate quotations, bid-ask spreads, trading in spot markets, cross exchange rates, forward markets, forward rate, long and short forward positions, forwards premium and discount; Arbitrage, Hedging and Speculation; Types of exchange rate systems: fixed and floating, soft peg, crawling peg, free float, managed float; Factors affecting exchange rate- relative inflation rates, interest rates, relative interest rates, relative income levels, government controls, expectations; Mode of payment in international trade.

Unit 7: Strategies for IB (6 Hrs.)

International strategic management: Concept and importance; Modes of entry into a foreign market:Export and import; strategic alliances: equity based (wholly owned subsidiaries, acquisition, greenfield venture, equity alliances, joint venture) and contractual based (licensing, franchising, turnkey operations, BOT, management contract). FDI & portfolio investment: benefits and drawbacks.

Unit 8: Functional Management and Operation of IB (8 Hrs.)

Polycentric, ethnocentric, regiocentric and geocentric approach in functional management of IB. Global marketing strategies: Product strategy, distribution strategy, promotion strategy, pricing strategy. Global production strategies: location, outsourcing, managing global supply chain. Global finance strategies: sources of fund, tax practices, tax haven. Global human resource management strategies: Staffing policy, expatriate management, compensation, cultivating global mindsets.

Recommended Books:

1. Cavusgil S.T., Knight G. and Riesenberger J. (2017). *International Business.* Fourth Edition.England: Pearson Education Limited.
2. Hill, Charles and Hult, Tomas. (2019). *International Business.* Twelfth Edition. New York:McGraw Hill Education.
3. Daniel J.D., Radebaugh L.H., Sullivan D.P. (2015). *International business.* Fifteenth Edition.England: Pearson Education Limited.
4. Rugman A.M. and Collinson, S. (2012). *International business.* Sixth Edution. England:Pearson Education Limited.