Software Engineering

Course Title: Software Engineering
Course No: CSC364
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 familiarizes students with different concepts of software engineering mainly focusing on software process models, agile development, requirements engineering, models, design, implementation, testing, evolution, and software project management.

Course Objectives:
The main objective of this course is to provide knowledge of different concepts of software engineering so that students will be able to develop high quality software using different software management skills.

Course Contents:

Unit 1: Introduction (2 Hrs.)
Software and its Types; Attributes of Good Software; Software Engineering and its Importance; Fundamental Software Engineering Activities; Difference between Software Engineering and Computer Science; Difference between Software Engineering and System Engineering; Challenges and Cost of Software Engineering; Professional Software Development; Software Engineering Diversity; Internet Software Engineering; Software Engineering Ethics

Unit 2: Software Processes (5 Hrs.)
Software Process; Software Process Models (Waterfall Model; Incremental Development; Integration and Configuration); Software Process Activities (Software Specification, Software Design and Implementation; Software Validation; Software Evolution); Coping with Change (Prototyping, Incremental Delivery); Process Improvement

Unit 3: Agile Software Development (3 Hrs.)
Agile Development; Plan-Driven vs. Agile Development; Agile Methods; Agile Development Techniques; Introduction to Agile Project Management

Unit 4: Requirements Engineering (3 Hrs.)
Concept of User and System Requirements; Functional and Non-Functional Requirements; Requirements Engineering Process; Requirements Elicitation; Requirements Specification; Requirements Validation; Requirements Change

Unit 5: System Modeling (6 Hrs.)
Introduction to System Modeling; Context Models; Interaction Models; Structural Models; Behavioral Models; Model-Driven Architecture

Unit 6: Architectural Design (6 Hrs.)
Introduction; Architectural Design Decisions; Architectural Views; Architectural Patterns; Application Architectures

Unit 7: Design and Implementation (5 Hrs.)
Introduction; Object-Oriented Design using UML; Design Patterns; Implementation Issues; Open-Source Development

Unit 8: Software Testing (5 Hrs.)
Introduction; Validation and Verification Testing; Software Inspection; Software Testing Process; Development Testing; Test-Driven Development; Release Testing; User Testing

Unit 9: Software Evolution (3 Hrs.)
Evolution Process; Legacy Systems; Software Maintenance

Unit 10: Software Management (7 Hrs.)
Software Project Management; Project Management Activities (Project Planning, Risk Management, People Management, Reporting and Proposal Writing); Project Planning (Software Pricing, Plan-Driven Development, Project Scheduling, Estimation Techniques, COCOMO Cost Modeling); Introduction to Quality Management and Configuration Management

Laboratory / Project Work:
Students should prepare a project report along with software product using different concepts of software engineering. The project can be done in groups with at most four members in each group using any suitable database, programming, interfacing technologies, and project management concepts.

Text Book:
1. Software Engineering, 10th Edition, Ian Sommerville, Pearson Education 2016

References Books:
1. Software Engineering: A Practitioner's Approach, 8th Edition, Roger S. Pressman and Bruce R. Maxim, McGraw-Hill Education 2015
2. Beginning Software Engineering, Rod Stephens, John Wiley & Sons Inc 2015

Compiler Design and Construction

Course Title: Compiler Design and Construction **Full Marks:** 60 + 20 + 20
Course No: CSC365 **Pass Marks:** 24 + 8 + 8
Nature of the Course: Theory + Lab **Credit Hrs:** 3
Semester: VI

Course Description:
This course is designed to develop acquaintance with fundamental concepts of compiler design. The course starts with the basic concepts and also includes different phases of compilers like lexical analysis, syntax analysis, syntax-directed translation, type checking etc. in detail.

Course Objectives:

- To develop knowledge in compiler design
- To develop lexical analyzers, parsers, and small compilers using different tools
- To develop lexical analyzers, parsers, and small compilers by using general purpose programming languages.

Course Contents:

Unit 1: (3 hrs)

1.1 Compiler Structure: Analysis and Synthesis Model of Compilation, different sub-phases within analysis and synthesis phases
1.2 Basic concepts related to Compiler such as interpreter, simple One-Pass Compiler, preprocessor, macros, symbol table and error handler.

Unit 2: (22 hrs)

2.1 Lexical Analysis: Its role, Specification and Recognition of tokens, Input Buffer, Finite Automata relevant to compiler construction syntactic specification of languages, Optimization of DFA based pattern matchers
2.2 Syntax Analysis: Its role, Basic parsing techniques: Problem of Left Recursion, Left Factoring, Ambiguous Grammar, Top-down parsing, Bottom-up parsing, LR parsing
2.3 Semantic Analysis: Static & Dynamic Checks, Typical Semantic errors, Scoping, Type Checking; Syntax directed definitions (SDD) & Translation (SDT), Attribute Types: Synthesized & Inherited, Annotated Parse Tree, S-attributed and L-attributed grammar, Applications of syntax directed translation, Type Systems, Type Checking and Conversion

Unit 3: (4hrs)

3.1 Symbol Table Design: Function of Symbol Table, Information provided by Symbol Table, Attributes and Data Structures for symbol table
3.2 Run–time storage management

Unit 4: (16 hrs)

4.1 Intermediate Code Generator: High-level and Low-level Intermediate representation, Syntax tree & DAG representations, Three-address code, Quadruples, Triples, SDT for intermediate code, Intermediate code generation for Declarations, Assignments, Control Flow, Boolean Expressions and Procedure Calls; Back patching
4.2 Code Generator: Factors affecting a code generator, Target Language, Basic blocks and flow graphs, Dynamic programming code-generation algorithm

4.3 Code Optimization: Need and criteria of Code Optimization, Basic optimization techniques
4.4 Case Studies of some compilers like C compiler, C++ complier

Laboratory Works:
The laboratory work develops practical knowledge on different concepts of compiler design. Students should

- Create a project by using lexical analyzer generator or any high level language
- Create a parser by using parser generator or any high level language
- Write programs for intermediate code generation and machine code generation
- Create front end of a compiler and using general purpose programming languages

Recommended Books:

1. Compilers Principles, Techniques, and Tools, Alfred V. Aho, Ravi Sethi, Jeffrey D. Ullman; Pearson Education
2. Introduction to Automata Theory, Languages, and Computation, Johne E. Hopcroft, Rajeev Motwani, Jeffrey D. Ulman, Pearson Education
3. Advanced Compiler Design and Implementation, Steven Muchnick, Morgan Kaufman Publication

E-Governance

Course Title: E-Governance
Course No: CSC366
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 familiarizes students with different concepts of E-Government and E-Governance, different E-Governance models and infrastructure development, E-government security, and data warehousing and data mining for e-governance.

Course Objectives:

- To develop knowledge of e-governance and e-government
- To know different e-governance models and infrastructure development
- To implement security and use data warehousing and mining in e-governance

Course Detail:

Unit 1: Introduction to E-Government and E-Governance (5 Hrs.)
Difference between E-Government and E-Governance; E-Government as Information System; Benefits of E-Government; E-Government Life Cycle; Online Service Delivery and Electronic Service Delivery; Evolution, Scope and Content of E-Governance; Present Global Trends of Growth in E-Governance

Unit 2: Models of E-Governance (10 Hrs.)
Introduction; Model of Digital Governance: Broadcasting / Wider Dissemination Model, Critical Flow Model, Comparative Analysis Model, Mobilization and Lobbying Model, Interactive – Service Model / Government-to-Citizen-to-Government Model (G2C2G); Evolution in E-Governance and Maturity Models: Five Maturity Levels; Characteristics of Maturity Levels; Towards Good Governance through E-Governance Models

Unit 3: E-Government Infrastructure Development (10 Hrs.)
Network Infrastructure; Computing Infrastructure; Data centers; E-Government Architecture; Interoperability Framework; Cloud Governance; E-readiness; Data System Infrastructure; Legal Infrastructural Preparedness; Institutional Infrastructural Preparedness; Human Infrastructural Preparedness; Technological Infrastructural Preparedness

Unit 4: Security for e-Government (5 Hrs.)
Challenges and Approach of E-government Security; Security Management Model; E-Government Security Architecture; Security Standards

Unit 5: Applications of Data Warehousing and Data Mining in Government (5 Hrs.)
Introduction; National Data Warehouses: Census Data, Prices of Essential Commodities; Other Areas for Data Warehousing and Data Mining: Agriculture, Rural Development, Health, Planning, Education, Commerce and Trade, Other Sectors

Unit 6: Case Studies (10 Hrs.)
E-Government Initiatives in Nepal, Cyber Laws, Implementation in the Land Reform, Human Resource Management Software, NICNET, Collectorate , Computer-aided Administration of Registration Department (CARD), Smart Nagarpalika, National Reservoir Level and

Capacity Monitoring System, Computerization in Andra Pradesh, Ekal Seva Kendra, Sachivalaya Vahini, Bhoomi, IT in Judiciary, E-Khazana , DGFT, PRAJA, E-Seva, E-Panchyat, General Information Services of National Informatics, Centre E-Governance initiative in USA, E-Governance in China, E-Governance in Brazil and Sri Lanka

Laboratory Work:
The laboratory work includes implementing e-governance models and systems using suitable platform.

Text / Reference books:

1. Richard Heeks, Implementing and managing e-Government
2. C.S. R Prabhu, e-Governance: Concepts and Case studies, prentice hall of India Pvt. Ltd.
3. J. Satyanarayana, e-Government, , prentice hall of India Pvt. Ltd
4. Backus, Michiel, e-Governance in Developing Countries, IICD Research Brief, No. 1, March 2001

NET Centric Computing

Course Title: NET Centric Computing
Course No: CSC367
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 covers the concepts of cross-platform web application development using the ASP.NET Core MVC framework using C# programming Language.

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

Course Contents:

Unit 1: Language Preliminaries (8 Hrs.)
Introduction to .Net framework, Compilation and execution of .Net applications, Basic Languages constructs, Constructor, Properties, Arrays and String, Indexers, Inheritance, use of "base" keyword, Method hiding and overriding, applying polymorphism in code extensibility, structs and enums, abstract class sealed class, interface, Delegate and Events, Partial class, Collections, Generics, File IO, LINQ (Language Integrated Query) Fundamentals: Lambda Expressions, Try statements and Exceptions, Attributes: Attribute Classes, Named and Positional Attribute Parameters, Attribute Targets, Specifying Multiple Attributes, Asynchronous Programming: Principle of Asynchrony, Async/Await patterns in C#

Unit 2: Introduction to ASP.NET (3 Hrs.)
.NET and ASP.NET frameworks: .NET, .NET Core, Mono, ASP.NET Web Forms, ASP.NET MVC, ASP.NET Web API, ASP.NET Core, .NET Architecture and Design Principles, Compilation and Execution of .NET applications: CLI, MSIL and CLR, .NET Core in detail, .NET CLI: build, run, test and deploy .NET Core Applications

Unit 3: HTTP and ASP.NET Core (3 Hrs.)
HTTP, Request and Response Message Format, Common web application architectures, MVC Pattern, ASP.NET Core Architecture Overview, Projects, and Conventions, ASP.NET and ASP.NET MVC

Unit 4: Creating ASP.NET core MVC applications (10 Hrs.)
Setting up the Environment, Controllers and Actions: Create Controllers, Create Actions and Action Results Types, Rendering HTML with Views: Razor Syntax, Understanding Tag Helpers, Models: Binding and Validations, URL Routing and features, Web API Applications: API Controllers, JSON, Dependency Injection and IOC containers

Unit 5: Working with Database (6 Hrs.)
ADO.NET basics: Connection, Command, Reader and Adapter classes, Entity Framework (EF) Core, Object-Relational Mapper (ORM), Adding EF Core to an application: Choosing database provider, data models and data context, Querying and Saving data to database: Create, read, update and delete records

Unit 6: State Management on ASP.NET Core Application (4 Hrs.)
State Management on stateless HTTP, Server-side strategies: Session State, TempData, Using HttpContext, Cache Client-side strategies: Cookies, Query Strings, Hidden Fields

Unit 7: Client-side Development in ASP.NET Core (4 Hrs.)
Common client-side web technologies, JQuery, Forms and Validation, Single Page Application (SPA) Frameworks: Angular, React

Unit 8: Securing in ASP.NET Core Application (5 Hrs.)
Authentication: ASP.NET Core Identity, Adding authentication to apps and identity service configurations, Authorization: Roles, Claims and Policies, Securing Controllers and Action Methods, Common Vulnerabilities: Cross-site Scripting attacks, SQL Injection attacks, Cross-site Request Forgery (CSRF), Open Redirect Attacks

Unit 9: Hosting and Deploying ASP.NET Core Application (2 Hrs.)
App Servers and Hosting models: IIS, Nginx, Apache, ASP.NET Core Module, Kestrel, Docker and Containerization, Publish to Azure cloud

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

Text / Reference Books:

1. C# 8.0 and .NET Core 3.0 – Modern Cross-Platform Development, Fourth Edition, by Mark J. Price, 2019
2. ASP.NET Core in Action, by Andrew Lock, 2018
3. Learning ASP.NET Core 2.0, Michel Bruchet, Jason De Oliveira, 2017
4. Learn ASP.NET Core 3 - Second Edition, Kenneth Yamikani Fukizi, Jason De Oliveira, Michel Bruchet, 2019

Technical Writing

Course Title: Technical Writing
Course No: CSC368
Nature of the Course: Theory
Semester: VI

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

Course Description:
This course is designed for students to enhance their skills for workplace writing. It helps them in the process of 'listening, researching, planning, composing, revising, and editing' documents for use in business, science, hi-tech, and other practical fields. *Technical Writing for Success* provides students with practical approach to producing their own proposal content, manual instructions, informative briefs, news releases, and other pragmatic documents. Abundant in sample documents, critical thinking questions, and insightful writing advice on style and voice, this textbook prepares students for successful technical writing.

Course Objectives:
Enable students to identify the importance and characteristics of technical writing and produce some quality technical pieces of workplace writing.

Course Detail:

Unit 1: What Is Technical Writing (3 Hrs.)
Introduction; You Are a Technical Writer!; Characteristics of a Technical Writing; How Technical Writing Compares to Other Writing

Unit 2: Audience and Purpose (3 Hrs.)
Introduction; Meeting the Audience's Needs; Planning Your Document's Purpose, Scope, and Medium

Unit 3: Writing Process (4 Hrs.)
Introduction; A Process for Technical Writing; Planning; Drafting and Revising; Copyediting and Publishing; Writing Collaboratively

Unit 4: Brief Correspondence (4 Hrs.)
Introduction; Introduction to Text Messages; E-mails; Memos, and Letters; Audience; Prewriting; Formatting; Composing the Message

Unit 5: Document Design and Graphics (4 Hrs.)
Introduction; Designing the Document; Who Reads Graphics?; Designing Graphics; Constructing Graphics

Unit 6: Writing for the Web (4 Hrs.)
Introduction; Getting Started on Web Pages; Organizing and Designing Web Pages; Writing Text for the Web; Special Web Pages

Unit 7: Information Reports (5 Hrs.)
Introduction; Getting Started on Informative Reports; Summary and Abstract; Mechanism and Description; Periodic Reports; Progress Reports; News Releases

Unit 8: Employment Communication (5 Hrs.)
Introduction; Getting Started on Employment Communication; Formatting and Organizing Resumes; Types of Resumes; Composing Resumes; Composing Employment Letters

Unit 9: Presentations (5 Hrs.)
Introduction; Getting Started on Presentations; Planning; Organizing and Composing; Preparing; Rehearsing; Presenting; Organizing a Group Presentation

Unit 10: Recommendation Reports (3 Hrs.)
Introduction; What Is a Recommendation Report?; Starting a Recommendation Report; Formatting and Organizing Recommendation Reports; Composing Recommendation Reports

Unit 11: Proposals (3 Hrs.)
Introduction; What Is a Proposal?; Getting Started on Proposal; Composing Informal Proposals; Composing Formal Proposals

Unit 12: Ethics in the Workplace (2 Hrs.)
Introduction; What Is Ethics?; Creating a Culture of Ethics; What Do you When Faces with an Ethical Dilemma?; Why Is It So Difficult to Behave Ethically?

Inside Track (Ask students to go through the ideas discussed in this section as they make much sense to writing. Explain if necessary.)

Text Book:

1. Smith-Worthington, Daelene and Sue Jefferson. *Technical Writing for Success*. 3rd ed. USA: Cengage Writing, 2011.

Reference Books:

1. Anderson, Paul V. *Technical Communication: A Reader-Centered Approach*. 7th ed. USA: Wadsworth Publishing, 2010.
2. Markel, Mike and Stuart A. Selber. *Technical Communication.* 12th edition. USA: Bedford Books, 2017.
3. Tebeaux, Elizabeth and Sam Dragga. *The Essentials of Technical Communication*. 4th ed. London: Oxford University Press, 2010.

Applied Logic

Course Title: Applied Logic
Course No: CSC369
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 different concepts of logic including arguments, proposition and syllogism, symbolic logic, quantification, fallacies, and reasoning.

Course Objectives:
The objectives of this course are to

- Understand Concept of Validity and Invalidity
- Discuss argument and fallacy analysis techniques
- Demonstrate proof of validity and invalidity
- Understand Syllogistic rules and immediate inferences
- Discuss inductive and casual reasoning

Course Contents:

Unit 1: Argument Analysis (6 Hrs.)

1.1. Concept of Logic, Proposition and Arguments, Recognizing Arguments, Arguments vs Explanations, Validity and Truth, Deductive and Inductive Arguments
1.2. Paraphrasing Arguments, Diagramming Arguments, Complex Argumentative Passages, Problems in Reasoning

Unit 2: Categorical Propositions and Syllogisms (10 Hrs.)

2.1. Theory of Deduction, Classes of Categorical Propositions, Types Categorical Propositions, Quality, Quantity and Distribution, Square of Oppositions, Immediate Inferences, Venn Diagrams of Categorical Propositions.
2.2. Standard form of Categorical Syllogism, Mood and Figure, Testing Validity by Using Venn Diagrams, Syllogistic Rules and Fallacies
2.3. Syllogistic Arguments, Reducing Number of Terms, Translating Categorical Propositions into Standard Form, Enthymemes and Sorites

Unit 3: Symbolic Logic (12 Hrs.)

3.1. Modern Logic and Symbolic Language, Conjunction, Disjunction, negation, Material Implication, Material Equivalence
3.2. Argument Forms and Refutation by Analogy, Testing Validity of Arguments by using Truth Tables, Statement Forms, Logical Equivalences
3.3. Valid Argument Forms, Formal Proof of Validity, Replacement Rules, Proof of Invalidity, Inconsistency

Unit 4: Quantification Theory (6 Hrs.)

4.1. Need of Quantification, Singular Propositions, Types of Quantifiers, Representing Categorical Propositions in Quantification Theory
4.2. Generalization and Instantiation, Proving Validity, Proving Invalidity

Unit 5: Fallacies (6 Hrs.)

5.1. Concept and Classification of Fallacies, Fallacies of Relevance, Fallacies of Deductive Induction, Fallacies of Presumption, Fallacies of Ambiguity

Unit 6: Analogical and Casual Reasoning (5 Hrs.)

6.1. Review of Induction and Deduction, Arguments by Analogy, Analogical Arguments, Refutation by Logical Analogy

6.2. Cause and Effect, Casual Laws, Induction by Enumeration, Casual Analysis Methods, Limitations of Inductive Arguments

Laboratory Works:

The laboratory work includes realizing representation techniques and makes proper inferences. Student should be able to

- Represent complex argumentative Passages by using Symbolic Logic
- Generate proper reasoning and inferences to reach to the conclusion

Recommended Books:

1. Irving M. Copy, Carl Cohen, Priyadarshi Jetli, Monica Prabhakar, Introduction to Logic, Pearson Publication, 14th Edition, 2013
2. Patrick J. Hurley, A Concise introduction to Logic, Wadsworth Publication, 12th Edition, 2014
3. Peter Kreeft, Trent Doughherty, Socratic Logic: A Logic Text Using Socratic Method, Platonic Question, and Aristotelian Principles, St. Augustines Press, 3rd Edition 2010.

E-Commerce

Course Title: E-Commerce
Course No: CSC370
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: CSC371
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: CSC372
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: CSC373
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: CSC374
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