Sixth Semester:

Course Title: **Simulation and Modeling**
Course Code: COM**46**1
Semester: VI
Credit: **3**
Class Load: 6 Hrs. per Week (Theory: 3 Hrs, **Practical: 3 Hrs**)
Evaluation: External (60)+Internal (20+20)

Course Objectives:
To provide the knowledge of discrete and continuous system, generation of random variables, analysis of simulation output and simulation output and simulation languages

Course Contents:

1 Introduction to Modeling and Simulation (5 hrs)
System concepts, System modeling, Mathematical models: Nature and assumptions, Calibration and validation, Monte Carlo simulation method.

2 Continuous Systems (8 hrs)
Continuous system model, Differential equation, Analog method, Hybrid computers, Digital-analog simulators, Continuous System Simulation Languages (CSSLs), CSMP III, Hybrid simulation, Feedback systems, examples.

3 Discrete System Simulation (10 hrs)
Discrete events, Representation of time, Generation of arrival patterns, Simulation of a telephone system, Delay calls, Simulation of programming tasks, Gathering statistics, Counters and summary statistics, Measuring utilization and occupancy, Recording distribution and transit times, Discrete simulation languages.

4 Analysis of Simulation Output (10 hrs)
Estimation methods, Simulation run statistics, Replication of runs, Elimination of internal bias.

5 Simulation Languages (12 hrs)
Types of simulation languages, Discrete systems modeling and simulation with GPSS, Resources in GPSS, GPSS programs, applications, Structural data and control statements, hybrid simulation, Feedback systems : typical applications, SIMSCRIPT programs.

Laboratory Works:

Develop a simulation model, the topic could be either initiated by the student or selected from a list provided by the instructor. An oral presentation with a demonstration should be part of the laboratory project report.

Text Book:

- G. Gorden, "*System Simulation*", Pretice Hall of India.

Reference:

1 J.A Spriest and G.C Vansteenkiste, Computer-Aided Modeling and Simulation, Academic Press.

1 A.M Law and R.F. Perry, Simulation : A Problem-solving approach, Addison Wesley Publishing Company.

2 A.M Law and W.D. Kelton, Simulation Modeling and Analysis, McGraw Hill.

Course Title: **Software Engineering**
Course Code: **COM4**62
Semester: VI
Credit: **3**
Class Load: 6Hrs. per Week (Theory: 3 Hrs, **Practical: 3 Hrs**)
Evaluation: External (60) +Internal(20+20)

Course Objectives:

To introduce different types of software, developing process and maintaining the software.

Course Contents:

1. **Introduction to Software Engineering (11 hrs)**

1.1 Definition of software, Software engineering, Comparing between other engineering and software engineering.

1.2 System Engineering: Introduction to System, System properties, System and their environment, System modeling.

1.3 Software Process: Introduction, Software process model, Process iteration, Software specification, Software design and implementation, Software validation, Software evolution.

1.4 Project Management: Introduction, Management activities, Project planning, Project scheduling, Risk management.

2. **Software Requirements (12 hrs)**

2.1 Introduction, Types of requirements, Requirements engineering process: Feasibility study, Requirements elicitation and analysis, Requirement validation, Requirement management.

2.2 Software Prototyping: Introduction, Prototyping in the software process, Rapid prototyping techniques, User interface prototyping.
2.3 Formal Specification: Introduction, Formal specification in software process, Interface specification, Behavioral specification.

3. **Architectural Design**
(6 hrs)

3.1Introduction, System structuring, Control models, Modular decomposition, Domain specific architecture.
3.2 Object Oriented Design: Introduction, Features of object oriented design, Object oriented software engineering.

4. Verification & Validation (16 hrs)

4.1 Introduction, Verification and validation planning, Software inspection, Cleanroom software development.

4.2 Software Testing: Introduction, Types of testing, Testing work benches.

4.3 Critical system validation: Introduction, Formal methods and critical systems, Reliability validation, Safety assurance, Security assessment.

4.4 Software Cost Estimation: Introduction, Productivity, Estimation techniques.

4.5 Software engineering: Introduction, Source code translation, Reverse engineering.

Laboratory Works: Developing the software techniques explained in the course.

Text Book:

- Software Engineering, 7th Edition, Ian Sommerville, PEARSON EDUCATON ASIA

Reference:

- Software Engineering: A Practitioner's Approach, 6th Edition, Roger S. Pressman, McGraw Hill International Edition.

Course Title: **Web Technology**
Course Code: COM**46**3
Semester: VI
Credit: **3**
Class Load: 6 Hrs. per Week (Theory: 3 Hrs, **Practical: 3 Hrs**)
Evaluation: External (60) +Internal (20+20)

Course Objectives:

This course introduces the client-server web technology.

Course Contents:

1. Introduction (**4 hrs)**

Review of web technology, Review of HTML and JAVA Script

2. Issues of Web Technology **(6hrs)**

Architectural issues of web layer, HTTP & FTP Protocols, Tier Technology: 2-Tier, 3-Tier and n-Tier.

3. The Client Tier **(12 hrs)**

Representing content, XML, DTD's, Schemas, Style sheets and Transformation: CSS, XSL/ XSLT, SAX, and DOM, Client-side Programming.

4. The Server Tier **(20 hrs)**

Web Server Concept, Creating Dynamic Content, Using Control Flow to control Dynamic Control Generation, Sessions and State, Error handling, Authentication, Architecting web application, Using tag libraries, Writing tag libraries .

5. Introduction to Advanced Server Side Issues **(3 hrs)**

Server Side Languages, Protocols, Server APIs, Apache modules, AJAX Programming.

Laboratory Works: The laboratory work should cover all the topics mentioned above.

Text Book:

- Matt J. Crouch, "*ASP.NET and VB.NET Web Programming*", Pearson Education Asia, 2012

Reference:

- Rahul Banerjee, "*Internetworking Technologies"*, Prentice-Hall of India Limited, Fourth, 2010

Course Title: **Cryptography**
Course Code: COM**464**
Semester: VI
Credit: **3**
Class Load: 6 Hrs. per Week (Theory: 3 Hrs, **Practical: 3 Hrs**)
Evaluation: External (60) +Internal (20+20)

Course Objectives:

The course objective is to familiarize basic concepts of cryptography so as the students can use their understanding for information security purpose.

Course Contents:

1. **Introduction** (4 hrs)
Security, Attacks, Attack Types, Viruses, Worms, Trojan Horses, Classical Cryptography

2. **Basics of Modern Cryptography**(5 hrs)

Plaintext, Cipher text, Keys, Simple ciphers, Public key cryptography, Digital signatures

3. **Conventional Encryption / Secret Key Cryptography** (10 hrs)

Cryptography, Cryptanalysis, Cipher Structure, Encryption Algorithms, Data Encryption Standard (DES), International Data Encryption Algorithm (IDEA), Advanced Encryption Standard (AES), Modes of Operation, Symmetric Block Ciphers, Cipher Block Chaining (CBC), Multiple Encryption DES

4. **Public Key Cryptography** (6 hrs)

Basic Number Theory, Factorization, Diffie-Hellman Key Exchange, Public Key Cryptography Algorithms, RSA.

5. **Digital Signatures** (4 hrs)

One-time signatures, Digital Signature Standard (DSS).

6. **Hashing and Message Digests** (6 hrs)

Hashes, Motivation and applications. Cryptographically Secure Hashing, Secure Hash Algorithm (SHA), Encryption with Message Digest (MD), MD5.

7. **Authentication and Public Key Infrastructure (PKI)** (5 hrs)

Overview of Authentication Systems (Password, Address, Cryptographic), Security Handshake Pitfalls, Authentication Standards, Kerberos, PKI Trust Models.

8. **Network Security**(5 hrs)

IP Security, Web Security, Secure Socket Layer (SSL), Transport Layer Security (TLS), Different versions of SNMPs, PGP.

Text Book:

- D. R. Stinson. Cryptography: Theory and Practice. CRC Press
- William Stallings, Network Security Essentials-Applications & Standards, Pearson.

Reference:

- Charlie Kaufman, Radia Perlman, Mike Speciner, "*Nework Security Private Communication in a Public World"*, Second Edition, 2004,Pearson.
- Matt Bishop, "*Computer Security*", Art and Science, Pearson
- Bruce Schneier, *" Applied Cryptography*", Pearson

Elective (Any One)
Course Title: Information Retrieval
Course Code: COM**465A**
Course Title: Database Administration
Course Code: **COM465B**
Semester: VI
Credit: **3**
Class Load: 6 Hrs. per Week (Theory: 3 Hrs, Practical: **3 Hrs**)
Evaluation: External (60) +Internal (20+20)

Course Title: Information Retrieval

Course Title: Information Retrieval
Course Code: COM**465A**
Semester: VI
Credit: **3**
Class Load: 6 Hrs. per Week (Theory: 3 Hrs, Practical: **3 Hrs**)
Evaluation: External (60) +Internal (20+20)

Course Objectives:

To study advance aspects of information retrieval and working principle of search engine, encompassing the principles, research results and commercial application of the current technologies.

Course Contents:

1. Introduction (2hrs)

Introduction, History of Information Retrieval, The retrieval process, Block diagram and architecture of IR System, Web search and IR, Areas and role of AI for IR

2. Basic IR Models (4 hrs)

Introduction, Taxonomy of information retrieval models, Document retrieval and ranking, A formal characterization of IR models, Boolean retrieval model, Vector-space retrieval model, probabilistic model, Text-similarity metrics: TF-IDF (term frequency/inverse document frequency) weighting and cosine similarity.

3.Basic Tokenizing, Indexing, and Implementation of Vector-SpaceRetrieval (4 hrs)

Simple tokenizing, Word tokenization, Text Normalization, Stop-word removal, Word Stemming (Porter Algorithm), Case folding, Lemmatization, Inverted indices (Indexing architecture), Efficient processing with sparse vectors, Sentence segmentation and Decision Trees

4. Experimental Evaluation of IR(4 hrs)

Relevance and Retrieval, performance metrics, Basic Measures of text retrieval (Recall, Precision and F-measure)

5. Query Operations and Languages(3 hrs)
Relevance feedback and pseudo relevance feedback, Query expansion/reformulation (with a thesaurus or WordNet, Spelling correction like techniques), Query languages (Single-Word Queries, Context Queries, Boolean Queries, Natural Language)

6. Text Representation(3 hrs)
Word statistics (Zipf's law), Morphological analysis, Index term selection, Using thesauri, Metadata, Text representation using markup languages (SGML, HTML, XML)

7. Search Engine (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 (e.g. hubs and authorities, Page ranking, Google Page Rank), shopping agents

8. Text Categorization and Clustering (6 hrs)
Categorization algorithms (Rocchio, naive Bayes, decision trees and nearest neighbor), Clustering algorithms (agglomerative clustering, k-means, expectation maximization (EM)), Applications to information filtering,Organization

9. Recommender Systems(3 hrs)
Personalization, Collaborative filtering recommendation, Content-based recommendation

10. Information Extraction and Integration(3 hrs)
Information extraction and applications, Extracting data from text, Evaluating IE Accuracy, XML and Information Extraction, Semantic web (purpose, Relation to hypertext page), Collecting and integrating specialized information on the web.

11. Advanced IR Models with Indexing and Searching Text(4 hrs)
Probabilistic models, Generalized Vector Space Model, Latent Semantic Indexing (LSI), Efficient string searching, Pattern matching

12. Multimedia IR(3 hrs)
Introduction, multimedia data support in commercial DBMSs, Query languages, Trends and research issues

Laboratory Works: The laboratory should contain all the features mentioned in a course
Samples
1. Program to demonstrate the Boolean Retrieval Model and Vector Space Model
2. Program to find the similarity between documents
3. Tokenize the words of large documents according to type and token.
4. Segment the documents according to sentences
5. Implement Porter stemmer
6. Try to build a stemmer for Nepali language
7. Build a spider that tracks only the link of Nepali documents
8. Group the online news onto different categorize like sports, entertainment, politics

9. Build a recommender system for online music store

TextBook:

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

Course Title: **Database Administration**
Course Code: **COM465B**
Semester: VI
Credit: **3**
Class Load: 6 Hrs. per Week (Theory: 3 Hrs, Practical: **3 Hrs**)
Evaluation: External (60) +Internal (20+20)

Course Objectives:

The course covers about: principles of DBA Roles, DB backup, restoration and recovery, Tuning of database and overall DB administration which could be useful for administrator in the future.

Course Contents:

1.Introduction (5 hrs)
DBMS architecture and data independence, DBA roles and responsibilities, SQL *PLUS Overview: SQL Plus Fundamentals, Producing more readable outputs, Accepting values at runtime, Using iSQL *Plus.

2. Control and Redo Log Files (5hrs)
Managing the control files, Maintaining and monitoring redo log files.

3.Managing Users and Security (10 hrs)
Profiles, Managing users, Managing privileges, Managing roles, Querying role information, Database Security and Auditing, Creating and managing DB's , Tables, Indexes, Triggers, Views, Stored procedures, Advanced Stored Procedures, Analysis and integration services.

4.Backup and Recovery Overview (15 hrs)

Database backup, Restoration and recovery, Defining a backup and recovery strategy, Testing the backup and recovery plan, Parallel instance recovery, Recovering from non-critical loses Database corruption, Automatic database management, Automatic storage management, RMAN

5. Introduction to Performance Tuning (10 hrs)
Brief overview of Tuning methodology, General tuning concepts, AADM (Automatic Database Diagnostic Monitor) and SQL Tuning Advisor, Virtual Private Database: Policy types, Selective columns, column masking.

Laboratory Works: Labs should cover all the chapters using Oracle/SQL-Server or any other database server tools.

Text Book:
1. C.J. Date, Database Systems, Addison Wesley, 2000
2. Introduction to Database Administration, by O'reilly

Reference :
3. ORACLE DBA handbooks