CMP 331 Applied Operating System (3-0-3)

Evaluation:

	Theory	Practical	Total
Sessional	30	20	50
Final	50	-	50
Total	80	20	100

Course Objectives:

1. To introduce and apply the fundamentals of computer operating systems concepts including Process Management, Memory and I/O Management, Processor Scheduling,
   Synchronization, File System etc.
2. To familiarize the students with the design and implementation aspect of an Operating system.

Course Contents:

1. Operating Systems Types and Structure (5 hrs)

1.1 Introduction
1.1.1 Batch Systems
1.1.2 Time-Sharing Systems
1.1.3 Personal-Computer Systems
1.1.4 Parallel Systems
1.1.5 Real-Time Systems
1.1.6 Distributed Systems
1.2 Operating-System Structures
1.2.1 System Components
1.2.2 OS Services
1.2.3 System Calls
1.2.4 System Programs
1.2.5 System Structure
1.2.6 System Design and Implementation
1.2.7 System Generation.

2. Process/Thread Management (15 hrs)

2.1 Processes
2.1.1 Concept and Scheduling
2.1.2 Operations on Processes
2.1.3 Cooperating Processes

2.1.4 Inter process Communication
2.2 Threads
2.2.1 Overview
2.2.2 Benefits of Threads
2.2.3 User and Kernel Threads
2.2.4 Multithreading Models
2.3 Processor Scheduling
2.3.1 Concepts
2.3.2 Scheduling Criteria
2.3.3 Scheduling Algorithms
2.3.3.1 First Come First Served Scheduling (FCFS)
2.3.3.2 Optimal Scheduling
2.3.3.3 Round Robin Scheduling
2.3.3.4 Shortest Job First (SJF)
2.3.3.5 Shortest-Remaining-Time First scheduling (STRF)
2.3.3.6 Priority Scheduling
2.3.3.6 Multiple Queue Scheduling
2.3.3.7 Multilevel Feedback Queue Scheduling
2.3.4 Thread Scheduling
2.4 Process Synchronization
2.4.1 Background
2.4.2 Critical-Section Problem
2.4.3 Two-Tasks Solutions
2.4.4 Synchronization Hardware
2.4.5 Semaphores
2.4.6 Classical Synchronization
2.4.8 OS Synchronization
2.5 Deadlocks
2.5.1 Model of Deadlocks
2.5.2 Deadlock Characterization
2.5.3 Deadlock Handling Methods
2.5.3.1 Deadlock Prevention
2.5.3.2 Deadlock Avoidance
2.5.3.3 Deadlock Detection
2.5.3.4 Recovery from Deadlock

3. Memory Management **(8 hrs)**

3.1 Memory Management
3.1.1 Concept
3.1.2 Swapping
3.1.3 Contiguous Memory Allocation

3.1.4 Paging
3.1.5 Segmentation
3.1.6 Segmentation with Paging
3.2 Virtual Memory
3.2.1 Concept
3.2.2 Demand Paging
3.2.3 Page Replacement
3.2.4 Allocation of Frames
3.2.5 Thrashing

4. I/O Management **(12 hrs)**

4.1 I/O Sub-Systems
4.1.1 Concept
4.1.2 Application I/O Interface
4.2.2 Kernel I/O Subsystem
4.2.3 I/O Requests Handling
4.3.4 Performance
4.2 Mass-Storage Device
4.2.1 Disk Structure and Data Organization on Disk
4.2.2 Disk Scheduling
4.2.3 Disk Management
4.3.4 Swap-Space Management
4.3.5 Stable-Storage Implementation
4.3.6 Tertiary-Storage Structure
4.3.7 I/O in UNIX

5. File Systems **(5 hrs)**

5.1 Concept
5.2 File Access Methods
5.3 Writing and Seeking
5.4 Directory Structure
5.5 Protection
5.6 File-System Structure
5.7 Methods of Allocation
5.8 Free-Space Management
5.9 Directory Implementation
5.10 Recovery

Laboratory:

The laboratory work shall focus on the implementation aspect of the concepts covered in the lecture class using Java programming language and a particular platform/OS (e.g. Linux)

These include implementation of Threads, Scheduling of Threads, Synchronization, Deadlock handling in Java. Implementation of Memory, I/O and Resource Management schemes of an Operating System.

Text Book:

Silberschatz, A., Galvin, P.B., Gagne, G., *Applied Operating Systems Concepts*, 1st Edition, John Wiley & Sons, 2000, ISBN: 9971-51-284-X

Reference:

Silberschatz, A., Galvin, P.B., *Operating Systems Concepts*, 5th Edn., John Wiley & Sons, 1999, ISBN: 9971-51-275-0

CMP 350 Simulation and Modeling (3-1-3)

Evaluation:

	Theory	Practical	Total
Sessional	30	20	50
Final	50	-	50
Total	80	20	100

Course Objective:

- To introduce the details of modeling and simulation technologies to the students.
- To provide the students with the knowledge of discrete and continuous systems, generation of random variables, and analysis of simulation output and simulation languages.

Course Contents:

1. Introduction to Modeling and Simulation (4 hrs)

1.1 System concept
1.2 System Environment
1.3 Stochastic Activities
1.4 Continuous and Discrete System
1.5 System Modeling
1.6 Types of Models
1.7 Principles of Modeling
1.8 Area of application
1.9 Verification and Validation of model

2. System Simulation (8 hrs)

2.1 The Techniques of Simulation-Monte Carlo Method
2.2 Problems Depicting Monte Carlo Method
2.3 Comparison of simulation and analytical methods
2.4 Experimental nature of simulation
2.5 Types of system simulation
2.6 Distributed Lag Models
2.7 Cobweb Models
2.8 Steps of Simulation Study
2.9 Time advancement Mechanism
2.10 Queuing Models and its Characteristics
2.11 Queuing Discipline
2.12 Measures of queues, Single Server Queuing System

3. Continuous System **(8 hrs)**

- 3.1 Continuous system simulation and system dynamics
- 3.2 Continuous system models
- 3.3 Differential equations-Linear differential equation
- 3.4 Non linear differential equation
- 3.5 Partial differential equation
- 3.6 Analog computers
- 3.7 Components of analog computers
- 3.8 Analog methods
- 3.9 Hybrid computers
- 3.10 Digital analog simulators
- 3.11 Continuous system simulation language
- 3.12 CSMP III
  - 3.12.1 Structure Statements
  - 3.12.2 Data Statements
  - 3.12.3 Control Statements
  - 3.12.4 Hybrid Statements
- 3.13 Feedback System
- 3.14 Interactive system
- 3.15 Real time simulation
- 3.16 Predator pray model

4. Discrete System Simulation **(8 hrs)**

- 4.1 Discrete system simulation
- 4.2 Representation of time
- 4.3 Generation of arrival patterns
- 4.4 Simulation of telephone system
- 4.5 Gathering statistics
- 4.6 Counters and summary statistics
- 4.7 Measuring Utilization and Occupancy
- 4.8 Recording distribution and transit time
- 4.9 Discrete simulation languages

5. Probability Concepts and Random Number Generation **(5 hrs)**

- 5.1 Probability concepts in simulation- Stochastic variable
- 5.2 Discrete Probability function
- 5.3 Continuous Probability function
- 5.4 Random numbers
- 5.5 Properties of random numbers
- 5.6 Pseudo random number
- 5.7 Technique for generation of random number
- 5.8 Test for Random number generation
  - 5.8.1 Uniformity test (K-S test and Chi-square test)

5.8.2 Independence test (Runs test and Auto Correlation test

6. Simulation languages **(6 hrs)**

6.1 Types of simulation languages
6.2 Discrete systems modeling and simulation with GPSS
6.3 GPSS programs applications
6.4 SIMSCRIPT –Organization of a SIMSCRIPT program
6.5 SIMSCRIPT programs.

7. Analysis of Simulation Output **(6 hrs)**

7.1 Nature of the Problem
7.2 Estimation methods
7.3 Simulation run statistics
7.4 Replication of run
7.5 Elimination of Initial Bias

Laboratory:

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 Books:

1. G. Gorden, *System Simulation,* Prentice Hall of India.
2. A.M. Law and W.D. Kelton, *Simulation Modeling and Analysis*, McGraw Hill, 1991

References:

1. J.A. Spriest and G.C. Vansteenkiste, *Computer-Aided Modeling and Simulation,* Academic Press.
2. A.M Law and R.F. Parry, *Simulation*: A *Problem-solving approach*, Addison Wesley Publishing Company.
3. Narsingh Deo, "*System Simulation with Digital Computer*"

CMP 457 Artificial Intelligence and Neural Network (3-0-3)

Evaluation:

	Theory	Practical	Total
Sessional	30	20	50
Final	50	-	50
Total	80	20	100

Course Objectives:

1. To provide basic knowledge of Artificial Intelligence.
2. To provide the knowledge of Machine Learning, Natural Language, Expert Systems and Neural Network

Course Contents:

1. Goals in Problems- Solving (5 hrs)

1.1 Goal Schemas, Use in Planning
1.2 Concept of non-linear planning
1.3 Means-end analysis
1.4 Production Rule Systems
1.5 Forward and Backward chaining
1.6 Mycin-style probabilities and its application

2. Intelligence (5 hrs)

2.1 Introduction to Intelligence
2.2 Modeling human versus Engineering Performance
2.3 Representing intelligence using and acquiring knowledge

3. Knowledge Representation (5 hrs)

3.1 Logic
3.2 Semantic Networks
3.3 Predicate Calculus
3.4 Frames

4. Inference and Reasoning (7 hrs)

4.1 Inference Theorems
4.2 Deduction and truth maintenance
4.3 Heuristic search state-space representation
4.4 Game Playing
4.5 Reasoning about uncertainty probability
4.6 Bayesian Networks
4.7 Case-based Reasoning

5. Machine Learning (7 hrs)

5.1 Concepts of Learning (based on Wintson)
5.2 Learning by analogy
5.3 Inductive bias learning
5.4 Neural Networks
5.5 Genetic Algorithms
5.6 Explanations based learning
5.7 Boltzmann Machines

6. Application of Artificial Intelligence (16 hrs)

6.1 **Neural Networks**
Network Structure, Adaline, Madaline, Perceptron, Multi-layer Perceptron, Radial basis function, Hopfield Network, Kohonen Network, Elastic net model, Back-propagation

6.2 **Expert Systems**
Architecture of an expert systems, Knowledge acquisition, Induction, Knowledge Representation, Declarative knowledge, Procedural Knowledge, Knowledge elicitation techniques, Intelligent editing programs, development of expert systems

6.3 **Natural Language Processing:**
Levels of analysis, Phonetic, Syntactic, Semantic, Pragmatic, Machine vision: Bottom-up approach, Edge extraction, Line detection, Need for top-down, Hypothesis-driven approaches.

Laboratory:

Laboratory exercises should cover the design and development of artificial intelligence using the LISP and Prolog software.

Laboratory exercises must be designed to develop search, Inference including forward and backward chaining in Object – Oriented Language, Design and implementation of Artificial Neural Networks.

Text Books:

1. E. Rich & K. Knight, Artificial Intelligence, McGraw Hill, 1991.
2. E. Turban, Decision Support and Expert System, Macmillan, 1993.
3. Beale & Jackson, Neural Computing, Aam Higler, 1990.

References:

1. Haykin, Neural Networks: A Comprehensive Fundamental, Macmillan, 1994.
2. R. Shingal, Formal Concepts in Artificial Intelligence, Chapman & Hall, 1992.
3. G. Gazadar & C. Mellish, Natural Language Processing in Prolog: and Introduction to Computational Linguistics, Addison – Wesley, 1989.

4. D. Crookes, Introduction to Programming in Prolog, Prentice Hall, 1988.
5. P. H. Winston, Artificial Intelligence, Addison – Wesley, 1984.
6. Hecht – Neilson, Neurocomputing, Addison – Wesley, 1990.
7. G. F. Luger & W. A. Stubblefield, Artificial Intelligence, Benjamin Cummings, 1993.

MGT 321 Organization and Management (2-0-0)

Evaluation:

	Theory	Practical	Total
Sessional	50	-	50
Final	50	-	50
Total	100	-	100

Course Objectives:

To make the students able to understand and analyze the professional environment where they have to practice their profession. This course will also help them in bringing attitudinal as well as behavioral change.

Course Contents:

1 Introduction **(2 hrs)**

1.1 Meaning and concept of management
1.2 Functions of management
1.3 Scope and application of management
1.4 Importance of management

2 Organization **(4 hrs)**

2.1 Meaning and concept of organization
2.2 Characteristics of organization
2.3 Principles of organization
2.4 Formal and informal organizations
2.5 Organization chart
2.6 Types of organization-line
   2.6.1 Line and staff
   2.6.2 Functional and matrix.
2.7 Authority and responsibility and their interrelationships.

3 Motivation and Leadership **(6 hrs)**

3.1 Concept of motivation
3.2 Incentives
3.3 Theories of motivation: Need hierarchy, Dual Factoral, Expectancy and Achievement theories.
3.4 Leadership styles: Participative management, Management by objectives, management by exception,
3.5 Learning organizations

4 Human Resource Management (6 hrs)

4.1 Meaning and functions of human resource management
4.2 Recruitment
4.3 Job analysis, Job specification, Job description
4.4 Elements of compensation

4.5 Human resource development: Training (on the job and off the job) 4.6 Performance appraisal

5 Introduction to Industrial Relations (6 hrs)

5.1 Meaning of Industrial Relations
5.2 Trade union
 5.2.1 Collective bargaining
 5.2.2 Trade union movement in Nepal
5.3 Employee grievances
5.4 Employee Discipline
5.5 Employee health and safety
5.6 Compensation and its relation with industry
5.7 Challenges of industrial relations in Nepal
5.8 Methods of improving industrial relations in Nepal

6 Human Behavior and Conflict Management (7 hrs)

6.1 Concept of Human Behavior and Conflict Management
6.2 Types of Conflict Management
6.3 Conflict Management and its impact to the HRM
6.4 Modes of Conflict Management
 6.4.1 Negotiation
 6.4.2 Facilitation
 6.4.3 Mediation
 6.4.4 Arbitration
 6.4.5 Legal action

References:

1. Harold Koontz and Heinz Weihrich, Essentials of Mangement 2. Govinda Ram Agrawal, Organization and Management in Nepal.
3. C.B Mamoria, Personnel Managemnt
4. Fred Luthans Organizational Behavior, (McGraw Hill)

CMP 325 Analysis and Design of Algorithm (3-1-3)

Evaluation:

	Theory	Practical	Total
Sessional	50	-	50
Final	50	-	50
Total	100	-	100

Course Objectives:

1. To introduce the concept of algorithmic approach for solving real-life problems that arises frequently in computer applications and to teach basic principles and techniques of computational complexity.
2. To develop the habit of always responding to a new algorithm: with a problem at hand, helps Exploring one or more approaches for solving it, then develop a new algorithm, analyze it, and modify or rejects it until a satisfactory result is achieved.

Course Contents:

1. Principles of Analyzing Algorithms and Problems (6 hrs)

1.1 Introduction to Algorithm
1.2 Algorithm Specification
1.3 Performance Analysis (Space and Time Complexity)
1.4 Randomized Algorithms

2. Review of Abstract Data Types (6 hrs)

2.1 Stacks
2.2 Queues
2.3 Priority Queues
2.4 Binary Trees
2.5 Dictionaries
2.6 Sets and Disjoint Set Union

3. Sorting, Selection and Sequencing **(12 hrs)**

3.1 General Method of problem solving- Divide-and Conquer Method
3.2 Binary Search Technique
3.3 Finding the Minimum and Maximum
3.4 Merge Sort, Quick Sort, Selection
3.5 Strassen's Matrix Multiplication
3.6 General Method of problem solving- The Greedy Method
3.7 Knapsack Problem-Fractional knapsack problem
3.8 Tree Vertex Splitting
3.9 Job Sequencing with Deadlines
3.10 Minimum Cost Spanning Tree
3.11 Optimal Storage Allocation on Magnetic Tapes
3.12 Optimal Merge Patterns

4. Dynamic Programming **(9hrs)**

4.1 General Method of problem solving- Dynamic Programming
4.2 Multistage Graphs
4.3 All Pair Shortest Paths
4.4 Single Source Shortest Path: General Weights
4.5 Optimal Binary Search Trees
4.6 String Editing Problem
4.7 0/1-Knapsack Problem
4.8 Reliability Design
4.9 TSP

5. Graph Traversal and Search Techniques **(7hrs)**

5.1 Graphs
5.2 Binary Tree Traversal Techniques and Search
5.3 Graph Traversal Techniques and Search: BFS and DFS
5.4 Connected Components and Spanning Trees
5.5 Bi-connected Components and DFS

6. Backtracking **(5 hrs)**

6.1 Introduction to Backtracking Method of Problem Solving
6.2 The 8-Queens Problem
6.3 Sum of Sub-sets Problem
6.4 Graph Coloring Problem
6.5 Hamiltonian Cycle

Text Book:

Horowitz, E., Sahni, S., and Rajasekaran, S., *Computer Algorithms C++*, Galgotia Publications,
1999.

References:

1. Horowitz, E., Sahni, S., and Rajasekaran, S., *Computer Algorithms*, Galgotia Publications, 1999.
2. Baase, Sara., and Gelder, Allen Van, *Computer Algorithms – Introduction to Design and Analysis*, Third Edition, Addison-Wesley, Pearson Education Asia, 2000, ISBN: 81-7808-171-7

CMP 311 System Programming (3-0-3)

Evaluation:

	Theory	Practical	Total
Sessional	30	20	50
Final	50	-	50
Total	80	20	100

Course Objectives:

1. To provides a complete introduction to the design and implementation of various types of system software.
2. To gain knowledge to establish relationship between system software and the architecture of the machine it is designed to support
3. To provide conceptual clarity to understand the design of each type of software in a machineindependent way.
4. To gain conceptual clarity to realise the machine-dependent and independent aspects of system software.

Course Contents:

1. Introduction to System Software **6 hrs**

1.1. Introduction
1.2. System Software and Machine Structure
1.3. A Simple Architecture
  1.3.1. SIC Machine Architecture
  1.3.2. SIC/XE Machine Architecture
  1.3.3. SIC Programming Examples
1.4. CISC Architectures
  1.4.1. VAX Architecture
  1.4.2. Pentium Pro Architecture
1.5. RISC Architectures
  1.5.1. UltraSPARC Architecture
  1.5.2. Power PC Architecture
  1.5.3. Cray T3E Architecture

2. Assemblers **9 hrs**

2.1. Basic Assembler Concept
  2.1.1. A Simple SIC Assembler
  2.1.2. Assembler Algorithm and Data Structures
2.2. Machine Dependent Assembler Features
  2.2.1. Instruction Formats And Addressing Modes
  2.2.2. Program Relocation
2.3. Machine Independent Assembler Features
  2.3.1. Literals
  2.3.2. Symbol-Definition Statements

2.3.3. Expressions

2.3.4. Program blocks
2.3.5. Control Sections and Program Linking
2.4. Assembler Design Options
2.4.1. One-Pass Assemblers
2.4.2. Multi-Pass Assemblers
2.5. Implementation Examples
2.5.1. MASM Assembler
2.5.2. SPARC Assembler
2.5.3. AIX Assembler

3. Loading and Linkers **10 hrs**

3.1. Basic Loader Concept
3.1.1. Design of an Absolute Loader
3.1.2. A Simple Bootstrap Loader
3.2. Machine Dependent Loader Features
3.2.1. Relocation
3.2.2. Program linking
3.2.3. Algorithm and data structure for a Linking Loader
3.3. Machine Independent Loader Features
3.3.1. Automatic Library Search
3.3.2. Loader Options
3.4. Loader Design Options
3.4.1. Linkage Editors
3.4.2. Dynamic Linking
3.4.3. Bootstrap Loaders
3.5. Implementation Examples
3.5.1. MS-DOS Linker
3.5.2. SunOS Linker
3.5.3. Cray MPP Linker

4. Macro Processors **10 hrs**

4.1. Macro Processor Basics
4.1.1. Macro Definition and Expansion
4.1.2. Macro Processor Algorithm and Data Structures
4.2. Machine Independent Macro processors Features
4.2.1. Concatenation of Macro Parameters
4.2.2. Generation of Unique Labels
4.2.3. Conditional Macro Expansion

4.2.4. Keyword Macro Parameters
4.3. Macro Processor Design Options
4.3.1. Recursive Macro Expansion
4.3.2. General Purpose Macro processors
4.3.3. Macro Processor with in Language Translators
4.4. Implementation Examples
4.4.1. MASM Macro Processor
4.4.2. ANSI C Macro Language
4.4.3. The ELENA Macro Processor

5. Object-Oriented System Design **10 hrs**

5.1. Principal of Object Oriented Programming
5.1.1. Class, Method, Instances, Inheritances, Polymorphism
5.1.2. Relationship between Classes
5.2. Object-Oriented Design of an Assembler
5.2.1. Booch’s Macro Processes
5.2.2. Booch’s Micro Processes
5.2.3. Object diagram for Assembler
5.2.4. Interaction diagram for Assembler

Laboratory Exercises:

Laboratory exercise includes assignments on process scheduling, processor management, I/O management, File System, etc. in any multi-tasking OS environment, such as BSD Unix or SUN Solaris or Linux, Design and development of a small assembler.

Text Book:

Beck, Leland L., *System Software: An Introduction to Systems Programming*, Addison Wesley, 3rd Edition, 1999, ISBN: 020143581-0.