Third Semester:

Course Title: **Data Structure and Algorithms**
Course Code: COM4**3**1
Semester: III
Credit: **3**
Class Load: 6Hrs. per Week (Theory: 3 Hrs, **Practical: 3 Hrs**)
Evaluation: External (60) +Internal (20+20)

Course Objectives:

1 To provide fundamental knowledge on Data Structure and its implementation.
1. To provide the knowledge of various algorithms used in computer science.
2. To introduce time complexity analysis of problems.
3. To study the representation, implementation & applications of data structures.
4. To compare alternative implementations of data structures.
5. To choose the appropriate data structure for modeling a given problem.

Course Contents:

1.0 Introduction to data structure (2 hrs)
Concept of data structure, Abstract Data Type, Implementation of Data structure

1.0 The Stack (3 hrs)
Definition, Stack as an ADT, POP and PUSH operation, Stack application: Evaluation of Infix, Postfix, and Prefix expressions

2.0 Queue (3 hrs)
Definition, Queue as an ADT, Primitive operations in queue, Linear and circular queue and their application, Enqueue and Dequeue, Priority queue

3.0 List (2 hrs)
Definition, Static and dynamic list structure, Array implementation of lists, Queues as list

4.0 Linked Lists (5 hrs)
Definition and link list as an ADT, Dynamic implementation, Basic operations in linked list: node insertion, deletion, insertion and deletion after and before nodes, Linked stacks and Queues, Doubly linked lists and its advantages

5.0 Recursion (4 hrs)
Principle of recursion, Comparison between recursion and iteration, Recursion example: TOH and Fibonacci sequence, Applications of recursion, Search tree

6.0 Trees (5 hrs)

Concept and definitions, Basic operation in Binary tree, Tree search and insertion/deletions, Binary tree traversals (pre-order, post-order and in-order), Tree height, level, and depth, Balanced trees: AVL balanced trees, Balancing algorithm, The Huffman algorithm, Game tree, B-Tree

7.0 Sorting (5 hrs)

Internal and external sort, Insertion and selection sort, Exchange sort, Bubble and quick sort, Merge and Radix sort, Shell sort , Binary sort, Heap sort as priority queue, Efficiency of sorting, Big 'O' notation

8.0 Searching (5 hrs) Search technique; essential of search, Sequential search, Binary search, Tree search, General search tree, Hashing: Hash function and hash tables, Collision resolution technique, Efficiency comparisons of different search technique

10.0 Graphs (6 hrs)

Representation and applications, Graphs as an ADT, Transitive closure, Warshall's algorithm, Graphs types, Graph traversal and Spanning forests, Kruskal's and Round-Robin algorithms, Shortest-path algorithm, Greedy algorithm, Dijkstra's Algorithm

11.0 Algorithms (5 hrs)

Deterministic and no-deterministic algorithm, Divide and conquer algorithm, Series and parallel algorithm, Heuristic and Approximate algorithms

Laboratory Works:

There shall be 10 lab exercises based on C or C++

1. Implementations of stack
1. Implementations of linear and circular queues
2. Solutions of TOH and Finbonacci Recursion
3. Implementations of linked list: singly and doubly linked
4. Implementation of trees: AVL trees, Balancing of AVL
5. Implementation of Merge sort
6. Implementation of search: sequential, Tree and Binary
7. Implementation of Graphs: Graph traversals
8. Implementation of Hashing
9. Implementations of Heap

Text Book:

- Y. Langsam, M.J. Augenstein and A. M. Tanenbaum, "*Data Structures using C and C++*", PHI

References:

- G. W. Rowe, "*Introduction to Data Structure and Algorithms with C and C++*",PHI
- The Design and Analysis of Algorithm, Nitin Upadhyay, SK Kataria& Sons.

Course Title:**Computer Organization and Architecture**
Course Code: COM4**3**2
Semester: III
Credit: **3**
Class Load: 6 Hrs. per Week (Theory: 3 Hrs, **Tutorial: 3 Hrs**)
Evaluation: External (60) +Internal (20+20)

Course Objectives: Under going this course will help a student to build up a sound background in understanding the fundamentals of organization of the Computer System and the associated components. This course exposes a student to the modem trends and technology behind computer organization in a practical perspective with examples taken from real world.

Course Contents:

1. **Instruction Set Architecture** **(5 hrs)**
   Levels of Programming Language, Language Category, Compiling and Assembling Programs. Assembly Language Instructions, Instruction Type, Data Types, Addressing Modes, Instruction Formats. Instruction Set Architecture, Study of Intel 8085 Instruction, Writing Simple Programs for Intel 8085.

1. **Computer Organization** **(5hrs)**
   Basic Computer Organization, System Buses, Instruction Cycles. CPU Organization, Memory Sub-system Organization and Interfacing, I/O Sub-system Organization and interfacing, Intel 8085 Based computer as a Real World Example.

2. **RTL and HDL** **(5 hrs)**
   Micro-Operations and RTL, Using RTL to specify a Digital System, Specification of Digital Component, Specification and Implementation of Simple System. Introduction to VIIDL: Syntax, Levels of Abstraction in Design, Advance Capabilities of VHDL.

3. **CPU Design** **(5hrs)**
   Specification of a CPU, Design and Implementation of a Very Simple and Relatively Simple CPU: Instruction Execution, Fetch, Decode, Data Path, Hardwired Control Unit, Design Verification. Features of Simple CPU: Internal Registers and Cache, Internal Architecture of Intel 8085 Microprocessor as a Real World Example.

4. **Control Unit Design** **(4 hrs)**
   Basic Micro-sequencer (Control Unit) Design and Operations, Micro-instruction Formats, Design and Implementation of a Very Simple and Relatively Simple Control Unit: Layout, Control Sequence Generation, Generation of Micro-Operations, Control Signal Generation, Reducing tile Number of Micro-Instructions. Micro-programmed vs. Hardwired Control Unit. Intel Pentium Processor as a Real World Example of a Microcoded CPU.

5. Arithmetic Unit **(5 hrs)**

Representations of Binary Number and Arithmetic in Unsigned Notation, Signed Notation, andBinary Coded Decimal (BCD) . Specialized Arithmetic Hardware: Pipelining, Lookup Table, Intel Pentium Co-processor as a Real World Example. Real Number representation:Format, Characteristics and Arithmetic on Floating Point Numbers. IEFIE-754 Floating Point Standard as a Real World Example.

6. Memory Organization **(5 hrs)**Hierarchical Memory System, Cache Memory: Associative Memory: Cache memory with Associative, Direct and Set-Assoclative Mapping-Mapping Strategies in current CPUs. Virtual Memory: Paging, Segmentation, and Memory Protection. Example: Cache Hierarchy in Intel's Itanium Processor, Memory Management in Intel Pentium Processor as a Real World Example.

8. Input/Output Organization **(5 hrs)**

Asynchronous Data Transfer, Modes of Asynchronous Data Transfer, Programmed I/0, Interrupts, Interrupts Driven Data Transfer. Interrupts Processing, Interrupts Hardware and Priority, Implementation of Interrupt Hardware. Direct Memory Access (DMA), DMA Transfer Modes, I/O Processors. An Intel's Processor with Built-in DMA as a Real World example. Serial Communication, Universal Asynchronous Receiver/Transmitters (UART), Real World Example: RS-232-C as Serial Communication Standard and RS-422 as Standard For USB (Universal Serial Bus).

9. Introduction to RISC **(4hrs)**

RISC Fundamentals, RISC Instruction Set. Instruction Pipeline, Register Windows and Renaming, Real World Example. Conflicts in Instruction Pipeline: Data Conflicts, Branch Conflicts, RISC vs. CISC, Intel Itanium Processor as Real World Example.

10. Introduction to Parallel Processing **(2 hrs)**

Parallelism in Uni-Processor System, Organization of Multi-Processor System. Communication in Multi-Processor Systern, Memory Organization in Multi-processor System, Multi-Processor Operating System and Software.

Text Book:

- M. Morris Mano, "*Computer System Architecture*", Prentice-Hall of India, Pvt. Ltd., Third edition, 2007

References:

- Carpineili, John D., *Computer System Organization and Architecture*, Addison Wesley. Pearson Education Asia (LPE.), 2010.
- Hayes, John P., McGraw-Hill, Third Edition, 2009
- W.Stalling, and Architecture, Prentice Hall India Limited. New Delhi.
- Tanenbaum, A.S., *Structured Computer Organization*, Prentice Hall India Limited, New Delhi, Fourth Edition.

Course Title: **Numerical Methods**
Course Code: CO**M**4**3**3
Semester: III
Credit: **3**
Class Load: 6 Hrs. per Week (Theory: 3 Hrs, Practical:**3 Hrs**)
Evaluation: External (60) +Internal (20 +20)

Course Objectives: To be familiar with the theory of numerical analysis for solving algebraic and transcendental equations, solution of ordinary and partial differential equations related to engineering problems, numerical differentiation and integration.

Course Contents:

1. **Solution of Nonlinear Equations (10 hrs)**
   Review of calculus and Taylor's theorem, Errors in numerical calculations, Trial and error method, Bisection method, Newton's method, Secant method and their convergence, Fixed point iteration and convergence.

1. **Interpolation and Approximation (8 hrs)**
   Lagrange's polynomials, Newton's interpolation using difference and divided differences. Cubic spline interpolation, Least squares method for linear and nonlinear data.

2. **Numerical Differentiation and Integration (5hrs)**
   Newton's differentiation formulas, Maxima and minima of tabulated function, Newton-Cote's quadrature formulas, Gaussian integration algorithm, Romberg integration formulas.

3. **Solution of Linear Algebraic Equations (10 hrs)**
   Review of the existence of solutions and properties of matrices, Gaussian elimination method, Pivoting, ill-conditioning, Gauss-Jordan method, Inverse of matrix using Gauss elimination method, Method of factorization, Doolittle algorithm, Cholesky's factorization, Iterative solutions, Solving eigen value problems using power method.

4. **Solution of Ordinary Differential Equations (7 hrs)**
   Review of differential equations, Initial value problem, Taylor series method, Picard's method, Euler's method and its accuracy, Heun's method, Runge-Kutta methods, Solution of the higher order equations, Boundary value problems, Shooting method and its algorithm.

5. **Solution of Partial Differential Equations (5 hrs)**
   Review of partial differential equations, Deriving difference equations, Laplacian equation and Poisson's equation.

Laboratory Works:

The laboratory experiments will consist of program development and testing of non-linear equations, Interpolation, Numerical integration and differentiation, Linear algebraic equations, ordinary and partial differential equations.

TextBook:

- C.F. Gerald and P.O. Wheatley, *Applied Numerical Analysis*, 4th Edition, AddisonWesley Publishing Company, New York.
- W. Chency and D. Kinciad, *Numerical Mathematics and Computing*, 2nd edition, Brooks/ Cole Publishing Co.,1985

References:

- E Balagurusamy, *Numerical Methods,* McGRAW HILL
- W.H. Press, B.P. Flannery et. al., *Numerical Recipes in C*, 1st Edition, Cambridge Press, 1998
- S. Yakwitz and F. Szidarovszky, *An Introduction to Numerical Computations*, 2ndEdition, Macmillan Publishing Co., New York.

Course Title: **Principle of Management**
Course Code: MAN4**3**4
Semester: III
Credit: **3**
Class Load: 6 Hrs. per Week (Theory: 3 Hrs + Tutorial: 3Hrs)
Evaluation: External (60) +Internal (20+ 20)

Course Objectives:
The objective of this course is to provide fundamental understanding of management principles and their usefulness in operation and management of any system, institutions or processes.

Course Contents:

1. Introduction (4 hrs)
Definition, Characteristics, Principles and Functions of management.

2. Evolution of Management Theory (6 hrs)
Scientific management theory, Administrative management theory, Behavior science theories, Management science theory, System approach and Contingency approach.

3. The Environment of Management (6 hrs)
Concept of business environment, Internal and external environment, Components of political, economic, socio-cultural and technological environment.
Introduction to corporate social responsibility.
Ethics in management – meaning and significance, Approaches to ethical decision making – utilitarian, universalism, distributive justice and personal freedom.

4. Planning and Decision-making (9 hrs)
Meaning and importance of planning, Types of planning – Corporate, tactical and operational plans; Single use and standing plans; Specific and flexible plans, Hierarchy of planning, Methods, steps and process of planning.
Introduction to strategic planning and management – vision and mission statements and SWOT analysis.
Meaning of decision-making; Types of decision making – Programmed and non-programmed; Strategic, tactical and operational and Individual and group decision-making.

5. Organization and Human Resource Management (6hrs)
Definition and characteristics of organization; Types of organization – Line, Line and staff, Functional and Matrix type of organization; Learning organization; Centralization Vs. decentralization;
Meaning of HRM; Brief introduction to components of HRM – Acquisition, development, utilization and maintenance.

6. Motivation, Leadership and Conflict (6 hrs)
Meaning of motivation; Motivation theories - Hierarchy of needs theory; Motivation – hygiene theory; and Theory X - Theory Y.
Meaning of leadership; Leadership styles – Autocratic, democratic and free rein and Managerial grid theory.
Meaning and sources of conflict; Conflict resolution – Avoidance, diffusion, containment and confrontation.
7. Communication (4 hrs) Meaning and process of communication; Types of communication – Formal and informal communication and Interpersonal and non-verbal communication; Barriers to effective communication; Techniques for improving communication

8. QualityManagement (4 hrs)
Quality concept; Meaning of QC/QA; Factors affecting quality; Fundamentals of TQM

Text Book:

- Robbins, S.P.,DeCenzo,A.D., Bhattacharya,S. &Agrawal, M(2009).*Fundamental of Management*(6th ed.) New Delhi: Printice Hall.

References:

- Agrawal, Govind Ram, **Principles of Management in Nepal**, M. K. Publishers & Distributors, Kathmandu,
- Kreitner, Robert, **Management,** AITSB, Delhi

Course Title: **Computer Networks**
Course Code: COM4**3**5
Semester: III
Credit: **3**
Class Load: 6 Hrs. per Week (Theory: 3 Hrs, **Practical: 3 Hrs**)
Evaluation: External (60)+ Internal (20+20)

Objectives:

Computer Networks involves the study of computer systems, computer communications and computer networks. The course includes different kinds of networking topologies and their structure and design. This course also covers the telephone system, electronic email, data flows, networking protocols, and organization around ISO-OSI seven-layer architecture, with review of each layer.

Course Contents:

1. **Background Study and Revision** **(1 hrs)**
   Introduction and necessity of computer Networking, Different types of multiplexing: Simplex, Duplex, Half Duplex

2. **Introduction to Network Topologies** **(3 hrs)**
   Definition, use and prospect of LAN, Types of networking: LAN, WAN, MAN, Extra-Net, Intra-Net and Inter-Net

3. **Network Architecture** **(3 hrs)**
   Star, Clustered Star, Bus, Ring: Logical and Physical, Client Server Network Model, Peer-to-peer Network architecture model, Wireless LAN

4. **Reference Model** **(6 hrs)**
   Network software, Protocol Hierarchy and its need, Interfaces and Services, Introduction of OSI Reference Model

5. **Physical Layers and its Design Issues** **(5 hrs)**
   Twisted Pair Cable, Co-axial Cable, Base-band Cable, Broad-band Cable, Fiber Optics, Wireless Networking, Physical Layer Devices (Hub, Repeaters), Introduction of Frame Relay, ATM, ISDN, PSTN and X.25.

6. **Data Link Layers** **(6 hrs)**
   Services and Data Link Layer Devices (Switch, Bridge), Framing, Flow Control and Error Control, Elementary Data link Protocols, Sliding Window Protocols, HDLC, SLIP and PPP, Media Access Control Layer (Carrier Sense Multiple Access/Collision Detection)

7. **TCP / IP Reference Model** **(6 hrs)**

Introduction of TCP / IP Model, Comparison with OSI Reference Model, IPV4 Frame Format, IP Addresses and Classes, Subnet and Subnet mask, Introduction of IPV6

8. Network Layer and Internet Layer (6 hrs)

Network Layer and Design Issues, Virtual Circuit and Data grams Subject,Introduction of Routing- Shortest path Routing Algorithm, Flow Based Routing Algorithm, Distance Vector Routing Algorithm, Spanning Tree Routing, Congestion Control, Traffic Shaping and Leaky Bucket Algorithm

9. Network Severs and Protocols (3 hrs)

HTTP, DHCP; SMTP, DNS, PROXY, FTP, POP and IMAP; Examples of Clients, Servers Tools and Virtual private Networks

10. Network Management and Security (3 hrs)

Introduction to Network management, Internet Network-Management framework (SMI & HIB) & SNMP protocol; Data encryption, Data Encryption standard; Principles of Cryptography (Symmetric Key & public key Encryption), Integrity & firewalls

11. Introduction to Socket Programming (3 hrs)

Clint/Server Computing: - Distributed Applications (Web Technology), Distributed processing (Three-Tier Architecture); Introduction to socket calls & operating system calls; TCP socket calls & UDP Socket calls.

Laboratory Works:

1. Setting up Client /Server Architecture system using Microsoft product and Linux
1. Understanding Route interface and Basic Router using Route simulator.
2. Understanding the socket Interface and window Socket API.

Text Book:

- Andrew S. Tanenbaum, *Computer Networks.*

References:

- William Stalling*, Data and Computer communications*..
- Computer networking by James F. kurose, keith W. Ross.
- KNJ Jamsa and ken Cope, *Internet programming*.
- Stevens W.R- *Network Programming*.