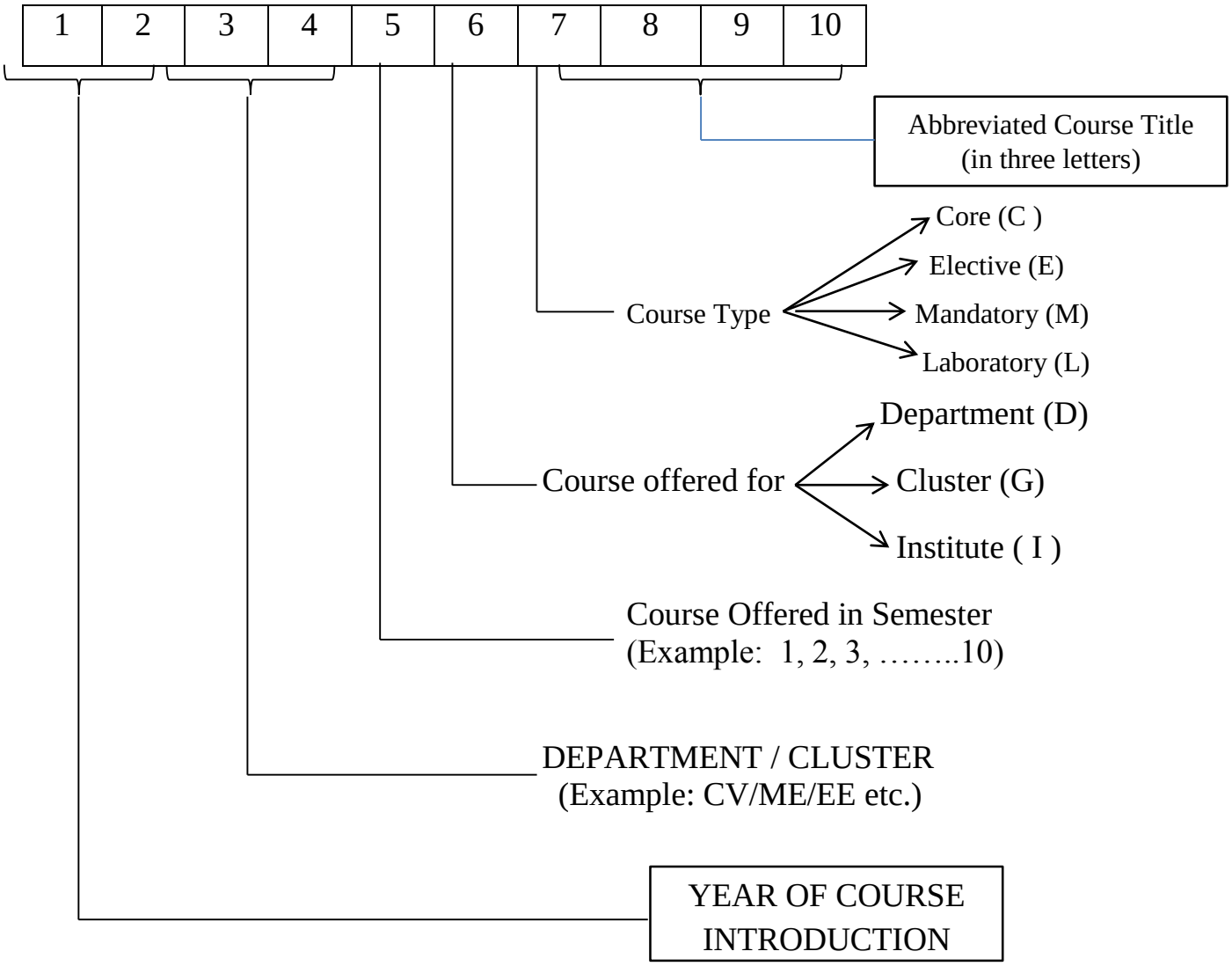
DEPARTMENT OF INFORMATION SCIENCE AND ENGINEERING

Scheme & Syllabus for UG Programme – III & IV Semesters

NOTATIONS

AY	Academic Year
AAT	Alternate Assessment Tools
BOE	Board of Examiners
BOS	Board of Studies
CBCS	Choice Based Credit System
CGPA	Cumulative Grade Point Averages
CIE	Continuous Internal Evaluation
CO	Course Outcomes
DC	Departmental Core
GC	Group Core
HSS	Humanity and Social Science courses
IC	Institutional Core
IE	Institutional Elective
IL	Institutional Lab
LTPS	Lecture-Tutorial-Practical-Selfstudy
NFTE	Not Fit for Technical Education
PCC	Professional Core Courses
PEO	Programme Educational Objective
PO	Programme Outcomes
PEC	Professional Elective Courses
SEE	Semester End Exam
SGPA	Semester Grade Point Average
ST	Studio

NOMENCLATURE FOR THE COURSE CODE



For example:

- Code for Engineering Mathematics-II Course in 2nd Semester is

  1 4 M A 2 I C M A T

- Code for Material Science and Metallurgy Course in 3rd Semester is

  1 5 M E 3 D C M S M

- Code for Concrete Technology Course in 4th Semester is

  1 5 C V 4 D C C O N

SCHEME OF INSTRUCTION FOR THIRD SEMESTER

Sl. No.	Course Code	Course Title	Credits				
			L	T	P	S	Total
1	15MA3CCDMS	Discrete Mathematics	3	1	0	0	4
2	15IS3DCCOE	Computer Organization and Embedded Systems	4	0	0	0	4
3	15IS3DCDSC	Data Structures with C	3	0	1	2	6
4	15IS3DCTFC	Theoretical Foundations of Computations	4	1	0	0	5
5	15CI3GCPCP	Programming with C++	3	0	1	2	6
	Total		**17**	**2**	**2**	**4**	**25**

SCHEME OF INSTRUCTION FOR FOURTH SEMESTER

Sl. No.	Course Code	Course Title	Credits				
			L	T	P	S	Total
1	15MA4CCLIA	Linear Algebra	3	1	0	0	4
2	15IS4DCUSP	Unix System Programming	4	1	0	0	5
3	15IS4DCADA	Analysis and Design of Algorithms	3	0	1	2	6
4	15IS4DCPSQ	Probability , Statistics and Queuing for Engineers	4	0	0	0	4
5	15IS4DCOPS	Operating System	3	0	1	2	6
	Total		**17**	**2**	**2**	**4**	**25**

DEPARTMENT OF INFORMATION SCIENCE AND ENGINEERING

COURSE TITLE	**DISCRETE MATHEMATICS**				
COURSE CODE	**15MA3GCDMS**	Credits	4	L-T-P-S	3-1-0-0
CIE	50 marks	SEE	100 Marks (50% weightage)		
Contact Hours	48 Hours (36L+12T)				

Prerequisites: Matrices, mathematical logic.

UNIT 1

SET THEORY AND RELATIONS **[11 Hrs]**

Introduction to sets and subsets, operations on sets, laws of set theory. Duality, Principle of duality for the equality of sets.Countable and uncountable sets.Addition Principle.

Introduction to Relations. Definition, Types of functions, operations on relations, matrix representation of relations, composition of relations, properties of relations, equivalence relations, partial orders, Hasse diagram. Posets- extremal elements on posets. **(8L+3T)**

Suggested Reading: Some particular functions- Floor and ceiling functions, Projection, Unary and Binary operations.

UNIT 2

ALGEBRAIC STRUCTURES-GROUPS **[10 Hrs]**

Groups, properties of groups.Some particular groups- The Klein 4-group, additive group of integers modulo *n*, multiplicative group of integers mod *p*, permutation groups.Subgroups, Cyclic groups, Coset decomposition of a group, homomorphism, isomorphism. **(7L+3T)**

Suggested Reading: Lagrange's theorem and its consequences.

UNIT 3

COMBINATORICS **[9 Hrs]**

Principles of counting: The rules of sum and product, permutations. Combinations- Binomial and multinomial theorems. Catalan numbers, Ramsey numbers. The Pigeon hole principle, the principle of inclusion and exclusion. Derangements, Rook polynomials. **(7L+2T)**

Suggested Reading: Ordinary Generating Functions, Partitions of integers and their generating functions, exponential generating functions.

UNIT 4

GRAPH THEORY **[9 Hrs]**

Basic concepts: Types of graphs, order and size of a graph, in-degree and out-degree, connected and disconnected graphs, Eulerian graph, Hamiltonian graphs, sub-graphs, dual graphs, isomorphic graphs. Matrix representation of graphs: adjacency matrix, incidence matrix. Trees: spanning tree, breadth first search. Minimal spanning tree: Kruskal's algorithm, Prim's algorithm, shortest path-Dijkstra's algorithm. **(7L+2T)**

Suggested Reading: Konigsberg bridge problem, Utilities problem, seating problem.

UNIT 5

NUMBER THEORY **[9 Hrs]**

Introduction: Integers, properties of integers. Primes**.**Congruences**-:** Introduction, Equivalence Relations, Linear Congruences, Linear Diophantine Equations and the Chinese Remainder Theorem, Modular Arithmetic: Fermat's Theorem, Wilson's Theorem and Fermat Numbers. Polynomial congruences, Pythagorean equations. **(7L+2T)**

Suggested Reading: Prime counting function, Test of primality by trial division, Sieve of Eratosthenes, Canonical factorization, Fundamental theorem of arithmetic, determining the Canonical factorization of a natural number**.**

Mathematics Lab

- Hasse diagram
- Rook Polynomials
- Minimal spanning tree- Kruskal's algorithm, Prim's algorithm.
- Shortest Path- Dijkstra's algorithm.

Text Books

1. Discrete Mathematical Structures, Dr. DSC, 4th edition, 2011-12, Prism Engineering Education Series.
2. **Discrete Mathematics**, Seymour Lipchitz. M. Lipson, 2005, Tata Mc. Graw Hill.
3. **Graph Theory and Combinatorics,**Dr. DSC, 4th edition, 2011-12, Prism Engineering Education Series.
4. Elementary Number Theory by David M Burton - Tata McGraw Hill Publ.-6th Edition 2006.

Reference Books

1. **Discrete Mathematics and its Applications**, Kenneth H Rosen, 2002, Mc. Graw Hill.
2. **Discrete Mathematics, Kolman,** Busby Ross, 5thedition, 2004, Prentice Hall.
3. **Discrete Mathematics,** J K Sharma, 3rd edition, 2013, Macmillan India Ltd

E -Books and Online Course Materials

1. **Discrete Mathematics with Algorithms**by M. O. Albertson, J. P. Hutchinson - J. 1988**,** Wiley.
2. **Discrete Mathematics for Computer Science**, Gary Haggard, John Schlipf, Sue Whitesides, Thomson Brooks/Cole, 2006.
3. http://ocw.mit.edu/courses/mathematics/ (online course material)

Online Courses and Video Lectures

1. http://www.nptelvideos.in/2012/11/discrete-mathematical-structures.html
2. https://www.khanacademy.org/
3. www.cs.berkeley.edu/~daw/teaching/cs70-s05/

COURSE OUTCOMES (COs)

At the end of the course the student will be able to

CO1	Use the notation of set theory
CO2	Construct a Hasse diagram for partial orderings
CO3	Differentiate between a relation and a function.
CO4	Recognize certain well known groups
CO5	Apply basic tools of Combinatorics such as sum and product rules, pigeon-hole principle.
CO6	Use graphs as representation tools in a network analysis.
CO7	Understand basic properties of integers, greatest common divisor, congruence relations and arithmetic of residue classes.

COURSE TITLE	**COMPUTER ORGANIZATION AND EMBEDDED SYSTEMS**				
COURSE CODE	15IS3DCCOE	Credits	4	L-T-P-S	4-0-0-0
CIE	50 marks	SEE	100 Marks (50% weightage)		

UNIT 1

Basic Structure of Computer: Computer Types, Functional Units, Basic Operational Concepts, Performance.

Instruction Set Architecture: Memory Locations and Addresses, Memory Operations, Instructions and Instruction Sequencing, Addressing Modes, Assembly Language, Stacks and Subroutines. **[10 Hrs]**

UNIT 2

Basic Processing Unit: Some fundamental concepts, Instruction Execution, Hardware components, Instruction fetch and execution steps, Control Signals, Hard-wired Control and CISC style processors. [**11 Hrs]**

UNIT 3

Input/output Organization: Accessing I/O Devices, Interrupts, Bus structure, Bus operation, Arbitration, Interface Circuits.

Exploiting Memory Hierarchy: Introduction,The Basics of caches, Measuring and Improving Cache Performance, Virtual Memory, A Common Framework For Memory Hierarchies **[12 Hrs]**

UNIT 4

Arithmetic: Addition and Subtraction of Signed Numbers, Design of Fast Adders, Multiplication of Unsigned Numbers, Multiplication of Signed Numbers, Fast Multiplication, Bit Pair recoding and Carry Save Addition of Summands, Integer Division, Floating-point Numbers and Operations. [**09 Hrs]**

UNIT 5

Embedded Systems: Examples of Embedded Systems, Microcontroller chips for Embedded Applications, A Simple Microcontroller, Sensors and Actuators, Case Study. [**10 Hrs]**

Text Books

1. **Computer Organization and Embedded Systems** by Carl Hamacher, ZvonkoVranesic, SafwatZaky, NaraigManjikian, Sixth Edition, McGrawHill, 2012

2. **Computer Organization And Design**. The Hardware/Software Interface by David A.Patterson And John L.Hennessy , ARM Edition, Morgan Kaufman Publishers(imprint of Elsevier), 2009

Reference Books

1. **Computer Architecture and Organization** by John P.Hayes, Third Edition, McGraw Hill, 2012.
2. **Computer Systems Design and Architecture** by Vincent P. Heuring& Harry F. Jordan, Ed2,Pearson Education, 2004
3. **Embedded Systems: Architecture, Programming and Design** by Raj Kamal, Second Edition, McGraw Hill, 2008

E-Books

1. Computer Organization and Architecture by William Stallings
2. First Steps with Embedded Systems by Byte Craft Limited

MOOCS

1. https://www.coursera.org/course/comparch
2. https://learn.saylor.org/course/view.php?id=71&section=2

COURSE OUTCOMES (COs)

At the end of the course the student will be able to

CO1	Understand the basic functional units of a computer, its operational concepts, addressing modes and to study the internal organization of a system through practicing with an assembly language.
CO2	Comprehend execution of instructions and the types of control units.
CO3	Study the different ways of communicating with input output devices, standard I/O interfaces and to explore the hierarchical memory system including cache memories and virtual memory.
CO4	Design adders, multiplication, division including the algorithms and to understand in detail the operation of floating point arithmetic unit.
CO5	Analyze embedded applications, microcontrollers, sensors and actuators.

COURSE TITLE	**DATA STRUCTURES WITH C**				
COURSE CODE	15IS3DCDSC	Credits	6	L-T-P-S	3-0-1-2
CIE	50 marks	SEE	100 Marks (50% weightage)		

UNIT 1

Introduction to Data Structures, Arrays and structures: Arrays, Structures and Unions, Polynomials, Sparse Matrices, Representation of Multidimensional Arrays. Dynamic Memory allocation. [**08 Hrs]**

UNIT 2

Stacks: Stacks, Stacks Using dynamic Arrays, Evaluation of Expression: Expressions, Evaluating Postfix Expressions, Infix to Postfix, Recursion [**08 Hrs]**

UNIT 3

Queues: Linear Queues, Circular queues using Dynamic Arrays, A Mazing Problem.
Linked Lists: Singly Linked lists and Chains, Representing Chains in C, Linked Stacks and Queues, Polynomials [**08 Hrs]**

UNIT 4

Linked List: Additional List operations, Circular Linked Lists, Doubly linked Lists.
Trees: Introduction, Binary Trees, Binary Tree Traversals [**07 Hrs]**

UNIT 5

Trees: Additional Binary Tree Operations, Threaded Binary Trees. Binary Search Trees, Selection Trees, Forests, Representation of Disjoint sets, Counting Binary Trees. [**08 Hrs]**

Text Books

1. **Fundamentals of Data Structures in C**, by Horowitz, Sahni, Anderson-Freed, 2nd Edition, Universities Press, 2007.
2. **Data Structures Using C and C++**, by Yedidyah, Augenstein, Tannenbaum, 2nd Edition, Pearson Education, 2003.

Reference Books

1. **Classic Data Structures**, by Debasis Samantha, 2nd Edition, PHI, 2009.
2. **Data Structures A Pseudocode Approach with C**, Richard F. Gilberg and Behrouz A. Forouzan,,Cengage Learning, 2005.

E-Books

1. **Data Structures Using C**, by R. Krishnamoorthy,Tata McGraw-Hill Education,2010
2**. C Programming: Data Structures and Algorithms**, by Jack Straub, Version 2.07,2006

MOOCs

1. https://www.mecr.org/home/coursedetails/8
2. https://www.coursera.org/course/algo

COURSE OUTCOMES (COs)

At the end of the course the student will be able to

CO 1	Implement various operations and applications of arrays, stack and queue
CO 2	Demonstrate the applications of various forms of linked lists
CO 3	Demonstrate the various operations of binary trees and its traversals
CO 4	Design and present solutions for applications using appropriate data structures

COURSE TITLE		THEORETICAL FOUNDATIONS OF COMPUTATION			
COURSE CODE	15IS3DCTFC	Credits	5	L-T-P-S	4-1-0-0
CIE	50 marks	SEE	100 Marks (50% weightage)		

UNIT 1

Introduction to Finite Automata: Introduction to Finite Automata, Central Concepts of Automata Theory, Deterministic Finite Automata (DFA), Nondeterministic Finite Automata (NFA), Equivalence of NFA and DFA. **[11 Hrs]**

UNIT 2

Regular Expressions and Regular Languages: Relation between Regular Expressions and Regular Languages, Regular grammars, Pumping Lemma, Equivalence and minimization of automata. Closure properties of regular languages. **[11 Hrs]**

UNIT 3

Context Free Grammars and Languages: Parse trees, Application of Context Free Grammars, Ambiguity in Grammars and Languages, Simplification of Context Free Grammar, Normal Forms – CNF and GNF, Pumping Lemma for CFG's. **[10 Hrs]**

UNIT 4

Push Down Automata: Languages of PDA: Acceptance by final state, empty stack and conversion. Equivalence of PDA's and CFG's, Deterministic Push Down Automata. **[10 Hrs]**

UNIT 5

Turing Machines : The standard turing machine, Combining Turing machines for complicated tasks ,Other models of turing machines-Minor variations on the turing machine, Turing machines with more complex storage, Non deterministic turing machine, universal turing machine. Introduction to undecidable problems, Post-correspondence Problem. **[10 Hrs]**

Text Books

1. **Introduction to Automata Theory, Languages and Computation** by John E. Hop croft, Rajeev Motwani, Jeffrey D.Ullman: 3rd Edition, Pearson education, 2007.
2. **An Introduction to formal Languages and Automata** by Peter Linz, Jones & Bartlett Learning , 5 edition, Feb 14,2011.

Reference Books

1**. Introduction to Languages and Automata Theory** by John C Martin, 3 Ed, Tata McGraw-Hill, 2009.
2.**Introduction to Theory of Computation**, Michael Sipser, Cengage Learning ,3rd edition,2012

E-Books

1. **Introduction to Theory of Computation**, by Anil Maheshwari, MichielSmid book.
2. Theory of Automata, Formal Languages and Computation by S.P. Euguene Xavier 5th edition 2008.

MOOCS

1. https://www.edx.org/course/li-lun-ji-suan-ji-ke-xue-ji-chu-pekingx-04830260x#!
2. https://www.coursera.org/course/automata

COURSE OUTCOMES (COs)

At the end of the course the student will be able to

CO 1	Understand the central concepts of automata theory, differentiate deterministic and non-deterministic automata and obtain equivalence of NFA and DFA.
CO 2	Design the regular languages, regular expressions, pumping lemma for regular languages.
CO 3	Demonstrate the context free grammars and languages, normal forms and closure properties of context free grammars.
CO 4	Design pushdown automata and obtain equivalence of push down automata and context free grammar.
CO 5	Illustrate different models of Turing machines.

COURSE TITLE		**PROGRAMMING WITH C++**			
COURSE CODE	15IS3DCPCP	Credits	6	L-T-P-S	3-0-1-2
CIE	50 marks	SEE	100 Marks (50% weightage)		

UNIT 1

Procedures, Programs and Computers: Computational procedures, details of computations, computer architecture, integer representation, elementary graphics and coordinate based graphics.

Sequential and Conditional Execution of Programs: Representing floating point numbers, Representing characters, strings, Booleans, structure of a simple C++ program, names and type declarations in C++, assignment statement and arithmetic expressions, assignment statement and logical expressions, sequential execution in C++ programs and conditional execution in C++ programs. **[7 Hrs]**

UNIT 2

Iterative Solutions and Functions: Iteration idioms, while and do while statements in C++, for statement in C++, loops and assignment expressions, iterative programs: putting it all together, reasoning about loops, introduction to functions in programming, flow of control in function call, parameter passing in function calls and recursive functions. **[8 Hrs]**

UNIT 3

Arrays and Matrices: Need for arrays, arrays in C++, using arrays for solving computational problems, solving simultaneous equations, Gaussian eliminations, more matrix applications, digital images and histograms, associative arrays for histogram equalization and histogram equalization program.

Sorting and Searching: Motivation, selection sort, analyzing selection sort, merge sort intuition, merge sort in C++ and its analysis, sorting strings, other data types and searching. **[8 Hrs]**

UNIT 4

Strings, Pointers, Software Engineering: Character strings, more on strings, separating multiple words in a line, introduction to pointers, use of pointers in C++ programs, pointers in function call, pointers and dynamic memory, introduction to software engineering and basic principles of software engineering **[8 Hrs]**

UNIT 5

Structures: Introduction to object – oriented programming structures, simple operation and on structures, programming using structures, more on structures and pointers and programming using structures.

File Processing: Introduction to file, opening files in C++ program, function for processing data in file, handling input output using files, handling text data using ‘scanf’ and ‘printf’, handling data in text file, creating a binary file, directly accessing files and updating records in a file. **[8 Hrs]**

Text Books

1. **An Introduction to Programming through C++,** by Abhiram G. Ranade, McGraw Hill Education, 2014.

2. **Schaum’s Outline of Theory and Problems of Programming with C++,** by John R Hubbard, Second Edition.

Reference Books

1. **Object-Oriented Programming in C++,** by Robert Lafore, Fourth Edition, Pearson Education.
2. **C++ Program Design: An Introduction to Programming and Object – Oriented Design**, by Cohoon and Davidson, 3rd Edition, Tata McGraw Hill.

E-Books

1. **Thinking in C++,** by Bruce Eckel, 2nd Edition.
2. **C++ A Beginner's Guide,** by Herbert Schildt, 2nd Edition.

MOOCs

1. https://www.edx.org/course/introduction-computer-programming-part-1-iitbombayx-cs101-1x-0
2. https://www.coursera.org/course/cplusplus4c

COURSE OUTCOMES (COs)

At the end of the course the student will be able to

CO1	Describe Computational procedures, architecture, their representations and differentiate between sequential and conditional execution of programs using C++
CO2	Analyze iterative solutions and the usage of functions in C++.
CO3	Apply arrays for solving computational problems, sorting and searching algorithms
CO4	Demonstrate Strings and Pointers using C++
CO5	Develop application programs using structures and files

COURSE TITLE		**LINEAR ALGEBRA**			
COURSE CODE	**15MA4GCLIA**	Credits	4	L-T-P-S	3-1-0-0
CIE	50 marks	SEE	100 Marks (50% weightage)		
Contact Hours	48 hours (36L+12T)				

Prerequisites:
Vector Algebra, Matrix computations.

UNIT 1

SYSTEM OF LINEAR EQUATIONS AND VECTOR SPACES [12 Hrs]

System of Linear Equations: Elementary row operations and echelon forms, invertible matrices. Consistency of a system of linear equations. Solution of a system of algebraic equations: Gauss elimination method, LU decomposition method, Gauss Seidel method.
Vector spaces; subspaces; computations concerning subspaces; summary of row-equivalence; Linear combination, linear dependence and linear Independence; spanning sets, Row spaces of a matrix, Column space of a matrix, bases and dimension; coordinates. **(9L+2T)**
Suggested Reading: Solution of a system of equations using Gauss Jordan method, inverse of a matrix using Gauss Jordan method.

UNIT 2

LINEAR TRANSFORMATIONS [12 Hrs]

Linear transformations; Algebra of Linear transformations, Matrix of linear transformations; Rank- Nullity theorem (no proof), problems on Rank-Nullity theorem, Singular and Non-singular Linear transformations, Eigenvalues and Eigenvectors of a linear transformation, Invertible operators. **(9L+2T)**

UNIT 3

EIGENVALUES AND EIGENVECTORS [10 Hrs]

Rayleigh power method, Gerschgorin circle method, Jacobi's method, invariant subspaces, Jordan canonical form. **(9L+2T)**
Suggested Reading: Cayley Hamilton theorem, Givens method, inverse Power method.

UNIT 4

INNER PRODUCT SPACES [10 Hrs]

Inner product, inner product spaces, length and orthogonality, orthogonal sets and Bases, projections, Gram-Schmidt process, QR-factorization, least squares problem. **(9L+2T)**
Suggested Reading: least square errors.

UNIT 5

SYMMETRIC MATRICES AND QUADRATIC FORMS [8 Hrs]

Power of a matrix, Diagonalization of Real symmetric matrices, quadratic forms, Reduction of quadratic form to canonical form, Nature of quadratic form, Singular value decomposition. **(9L+2T)**

• Gauss Seidel method
• LU decomposition method
• Largest, smallest eigenvalue and corresponding eigenvectors.
• Linear transformations

Text Books

1. **Schaum's outline series-Theory and problems of linear algebra,** Seymour Lipschutz, 5th edition, 2012, McGraw-Hill Education.
2. **Linear Algebra and its applications**, David C lay, Steven R lay, Judi J Mc. Donald, 5th Edition, 2015, Pearson Education.

Reference Books

1. **Linear Algebra and its applications,** Gilbert Strang, 4th edition, 2005, Brooks Cole.
2. **Linear Algebra and its applications**, Peter D Lax, 2nd edition, 2007, Wiley Interscience.
3. **Elementary Linear Algebra and its applications**, Bernard Kolman and David R Hill , 9th edition, 2007, Pearson.

E-Books and online course materials

1. https://www.math.ucdavis.edu/~linear/linear.pdf
2. http://ocw.mit.edu/courses/mathematics/ (online course material)

Online Courses and Video Lectures

1. http www.linear-algebra-Gilbert- Strangs-lectures-or-the-lectures-from-Khan-Academy
2. www.cs.berkeley.edu/~daw/teaching/cs70-s05/
3. nptel.ac.in/courses/111108066

COURSE OUTCOMES (COs)

At the end of the course the student will be able to

CO1	Solve system of linear algebraic equations.
CO2	Demonstrate competence with the ideas of vector spaces, subspaces, Basis and dimension.
CO3	Obtain the matrix associated with a linear transformation with respect to given bases.
CO4	Understand the relationship between the operations on linear transformations and their corresponding matrices.
CO5	Compute eigenvalues, eigenvectors and eigenspaces of matrices.
CO6	Apply Gram-Schmidt process to find an orthogonal base in a subspace of an inner product space, and to be able to characterize orthogonal matrices.
CO7	Use of Singular value decomposition that finds applications in signal processing.

COURSE TITLE	**UNIX SYSTEM PROGRAMMING**				
COURSE CODE	15IS4DCUSP	Credits	5	L-T-P-S	4-1-0-0
CIE	50 marks	SEE	100 Marks (50% weightage)		

UNIT 1

UNIX and ANSI Standards: ANSI C standard, ANSI/ISO C++ standards, Difference between ANSI C and C++, POSIX standards, POSIX.1 FIPS standard, X/Open standards.

UNIX and POSIX APIs : POSIX APIs, Unix and POSIX development Environment, API common characteristics

Files: File types, Unix and POSIX file system, Unix and POSIX file attributes, INODES in Unix System V, Application program interface to files, Unix kernel support for files, Relationship of C stream pointers and file descriptors, Directory Files, hard and Symbolic links. **[8 Hrs]**

UNIT 2

UNIX File APIs: General File APIs, File and record locking, Directory File APIs, Device file APIs, FIFO file APIs, Symbolic Link File APIs**.**

UNIX Processes: Environment of Unix process: Introduction to main function, Process Termination, Command Line Argument, Environment list. **[10 Hrs]**

UNIT 3

Process Control: Introduction, Process identifiers, fork, vfork, exit, wait, waitpid, wait3, wait4 functions, Race conditions, exec functions, changing Users IDs and Group IDs, Interpreter files, System function, Process accounting, User identification, Process times, I/O Redirection.

Process Relationship: Introduction, Terminal login, Network login, process groups, sessions, job control, Shell execution of programs, Orphaned process groups. **[14 Hrs]**

UNIT 4

Signals: Unix Kernel support for signals, signal, Signal mask, Sigaction, SIGCHLD signal and waitpid function, sigsetjmp and siglongjmp functions, Kill, Alarm, Interval Times, POSIX.lb timers,

Daemon processes: Introduction, Daemon characteristics, Coding Rules, Error logging, Client server model. **[10 Hrs]**

UNIT 5

Inter Process Communication: Overview of IPC methods, Pipes, Popen, Pclose functions, Co-processes, FIFOs system V IPC, Message Queues, Semaphores, Shared Memory, Client server properties, Stream pipes, Passing File descriptors, An open server version 1, Client server connections functions.

Network IPC and Sockets: Introduction, Socket descriptors, Addressing, Connection establishment, Data Transfer Socket Options, Out of band data, Non- blocking, asynchronous I/O. **[10 Hrs]**

Text Books

1. **Unix System Programming Using C++,** by Terrence Chan - Prentice Hall India, 1999.
2. **Advanced Programming in the UNIX Environment**, by Stephen A. Rago, W. Richard Stevens, 2nd Edition, Pearson Education / PHI, 2005

Reference Books

1. **Advanced Unix Programming,by Marc J. Rochkind**:, 2nd Edition, Pearson Education, 2005.
2. **The Design of the UNIX Operating System,** by Maurice.J.Bach:, Pearson Education / PHI, 1987. 3. Unix Internals – UreshVahalia:, Pearson Education, 2001.

E-Books

1. **UNIX Systems Programming** I Short Course Notes Alan Dix © 1996 http://alandix.com/academic/tutorials/courses/Prog-I.pdf
2. **Using C on the UNIX System A Guide to System Programming David A. Curry O'Reilly & Associates**, Inc. 981 Chestnut Street Newton, MA 02164

COURSE OUTCOMES (COs):

At the end of the course the student will be able to

CO 1	To understand POSIX API's, File System and Process
CO 2	To implement process creation, Control and Relationships using API's
CO 3	To Illustrate Signals and Daemon process
CO 4	To Analyse Interprocess Communication & its API's
CO 5	To design applications on IPC's

COURSE TITLE		ANALYSIS AND DESIGN OF ALGORITHMS			
COURSE CODE	15IS4DCADA	Credits	6	L-T-P-S	3-0-1-2
CIE	50 marks	SEE	100 Marks (50% weightage)		

UNIT 1

Fundamentals of Algorithm Analysis: Definition of algorithm, Algorithmic Problem Solving, Framework for Analysis of algorithm efficiency, Asymptotic Notations, Mathematical Analysis of Non recursive algorithms and Recursive algorithms. **[8 Hrs]**

UNIT 2

Brute Force: Bubble Sort, Selection Sort, Sequential Search, String Matching

Divide and Conquer: Master Theorem, Merge sort, Quicksort, Multiplication of large integers, Strassen's Matrix Multiplication **[9 Hrs]**

UNIT 3

Decrease and conquer: Depth First Search (DFS), Breadth First Search (BFS), Applications of DFS and BFS, Topological Sorting, Insertion Sort,

Transform and Conquer: Presorting, Balanced Search Trees, Heaps and Heapsort

[8 Hrs]

UNIT 4

Space and Time Tradeoffs: Horspool Algorithm, Hashing

Dynamic Programming: Computing a Binomial Coefficient, Floyd's Algorithm, Knapsack Problem. **[7 Hrs]**

UNIT 5

Greedy Technique: Introduction, Prim's Algorithm, Kruskal's Algorithm, Dijkstra's Algorithm, Huffman Trees.

Limitations of Algorithm Power - Decision Trees, P, NP and NP-Complete Problems.

[7 Hrs]

Text Books

1**. Introduction to the design and analysis of algorithms**, by AnanyLevitin, Pearson Education, 2005.

2. **Computer Algorithms**, by Horowitz E., Sahani S., Rajasekharan S., , Galgotia Publications, 2001

Reference Books

1. **Introduction to Algorithms**, Cormen T.H, Leiserson C. E, Rivest R.L, Stein C, 3rd Edition, PHI 2010.

2. **Data structures and algorithm analysis in C++,** by Mark Allen Weiss, Pearson Education, 2003.

E-Books

1. **Algorithms** byRobert Sedgewick& Kevin Wayne

2.**A Practical Introduction to Data Structures and Algorithm Analysis**by Clifford A Shaffer, 2010

MOOCs

1. https://www.coursera.org/course/algs4partI
2. https://www.mecr.org/

COURSE OUTCOMES (COs)

At the end of the course the student will be able to

CO 1	Examine the correctness and analyze the time efficiency of algorithms.
CO 2	Demonstrate awareness of different algorithm design techniques and related data structures.
CO 3	Design efficient algorithms for computational problems using the design techniques learnt.
CO 4	Apply algorithm design techniques to solve certain NP-complete problems

COURSE TITLE		**PROBABILITY, STATISTICS AND QUEUING FOR ENGINEERS**			
COURSE CODE	15IS4DCPSQ	Credits	4	L-T-P-S	4-0-0-0
CIE	50 marks	SEE	100 Marks (50% weightage)		

UNIT 1

Probability: Introduction, Sample spaces and events, Counting, Probability-The axioms of probability, some elementary theorems, Conditional probability, Baye's theorem.

[12hrs]

UNIT 2

Probability Distributions - Random variables**,** Binomial distribution. Probability Densities - Continuous random variables, Normal distribution. Sampling Distributions – Population and Samples. [10Hrs]

UNIT 3

Inferences Concerning Means - Point Estimation, Interval Estimation, Test of hypothesis, Null hypothesis and Test of hypothesis.

[08Hrs]

UNIT 4

Curve Fitting: The method of Least squares, Inferences based on least square estimators, Curve linear regression, Multiple regressions. [12Hrs]

UNIT 5

Markov Process ad Queuing Theory: Introduction, Markov process, Birth death process, Queuing theory, Little's theorem, M/M/1 Queue, M/M/r Queue.

[10Hrs]

Text Books:

1. **Miller and Freund's, Probability and Statistics for Engineers,** seventh edition, Richard A.Johnson, PHI.

2. **Probability, Random Variables and Stochastic Processes**, by A.Papoulis and S.Unnikrishnan Pillai, Fourth edition, McGrawHill.

Reference Books:

1. **Probability & Statistics with Reliability, Queuing and Computer Science Applications**, by Kishore S Trivedi, Wiley Publications, Second Edition, 2012.

2. Applied statistics and probability for engineers by Douglas C Montgomery, George C Runger, Fifth edition, Wiley India.

e-books:

1. http://www.sciencedirect.com/science/book/9780080571058
2. http://bayanbox.ir/view/2964535763283208541/DESS-JBanks-4thEd.pdf

MOOCs:

1. http://nptel.ac.in/courses/111105041/1

2.http://ocw.mit.edu/courses/electrical-engineering-and-computer-science/6-041-probabilistic-systems-analysis-and-applied-probability-fall-2010/video-lectures/

COURSE OUTCOMES (COs)

At the end of the course the student will be able to

CO 1	Compute probabilities by modeling sample spaces and applying rules of combinations, additive and multiplicative laws, conditional probability, Bayes rule.
CO 2	Compute random variables, continuous variables and sampling.
CO 3	Use the point and interval estimation, and to test statistical hypotheses and to compute confidence intervals.
CO 4	Calculate the inferences based on least square estimators, curve linear and multiple regressions.
CO5	Compute probabilities based on practical situations of discrete time Markov chain and network of queues

DEPARTMENT OF INFORMATION SCIENCE AND ENGINEERING

COURSE TITLE		**OPERATING SYSTEMS**			
COURSE CODE	15IS4DCOPS	Credits	6	L-T-P-S	3-0-1-2
CIE	50 marks	SEE	100 Marks (50% weightage)		

UNIT 1

Introduction: What operating systems do, Operating system operations, Operating systems services, System calls, Operating system Structure, System Boot. [**06 Hrs]**

UNIT 2

Processes, Threads and Synchronization: Process Concept, Process Scheduling, Inter-process communication, Threads: Overview, Multithreading models, Threading issues.
Process Synchronization: The critical section problem, Peterson's solution, Semaphores, Classical problems of synchronization. [**08 Hrs]**

UNIT3

Scheduling and Deadlocks: Process Scheduling: Basic concepts, Scheduling criteria, Scheduling algorithms.
Deadlocks: System Model, Deadlock characterization, Methods for handling deadlocks, Deadlock prevention, Deadlock avoidance, Deadlock detection and recovery from deadlock. [**09 Hrs]**

UNIT4

Memory Management: Main Memory: Background, swapping, Contiguous memory allocation, Segmentation, Paging, Structure of page table.
Virtual Memory: Background, Demand paging, Copy on write, Page replacement algorithms, Allocation of frames, Thrashing. **[09 Hrs]**

UNIT5

Disk performance optimization: Introduction, why disk scheduling is necessary, Disk scheduling strategies, rotational optimization.
File and Database Systems: Free space management, File access control.
Case study: Linux systems. **[07 Hrs]**

Text Books

1. **Operating System Concepts**, by Abraham Silberschatz, Peter Baer Galvin, Greg Gagne, 9th Edition, Wiley India, 2012.
2. **Operating systems,** by H.M.Deitel, D.J.Deitel, D.R.Choffnes, 3rd edition, Pearson.

Reference Books

1. **Operating Systems, A Concept-Based Approach,** by DM Dhamdhere, 3rd Edition, Tata Mcgraw-Hill, 2012.
2. **Modern Operating Systems**, by Andrew S. Tanenbaum and Herbert Bos, 4th Edition, Pearson, 2014.

E-Books

1. http://www.scribd.com/doc/246779379/ebook-pdf-Andrew-S-Tanenbaum-Distributed-Operating-Systems-pdf#scribd
2. http://sist.sysu.edu.cn/~isscwli/OSRef/Abraham%20Silberschatz-Operating%20System%20Concepts%20(9th,2012.12).pdf

MOOCs

1.http://ocw.mit.edu/courses/electrical-engineering-and-computer-science/6-828-operating-system-engineering-fall-2012/
2. https://www.mooc-list.com/tags/operating-systems?static=true

COURSE OUTCOMES (COs)

At the end of the course the student will be able to

CO 1	Understand the basics of operating system concepts.
CO 2	Understand the basics of process and synchronization concepts.
CO 3	Demonstrate the concepts of process scheduling algorithms and dead locks
CO 4	Analyse concepts of virtual memory and page replacement algorithms.
CO 5	Illustrate the knowledge about storage management and security and to acquire knowledge about Linux operating system.