



BMS COLLEGE OF ENGINEERING, BENGALURU - 19
Autonomous Institute, Affiliated to VTU

**DEPARTMENT OF
INFORMATION SCIENCE & ENGINEERING**

**SCHEME & SYLLABUS FOR
UG PROGRAMME III TO VII SEMESTERS
(2014 - 18)**

DEPARTMENT VISION

Promote Quality Human Resource Capital by inculcating in every student the art of Creativity and Productivity in the field of Information Technology.

DEPARTMENT MISSION

Offer High Quality Graduate, Post Graduate Programme in Information Technology to prepare students for higher studies and professional career in industry.

Provide good Teaching and Research environment for Quality Education in the field of Information Technology.

PROGRAMME EDUCATIONAL OBJECTIVES (PEOs)

PEO1: Excel as IT Professional with Proficiency in designing solutions to Information Engineering problems.

PEO2: Pursue higher studies with the sound knowledge of basic concepts and skills in science and IT disciplines.

PEO3: Exhibit professionalism, team work and expose to current trends towards continuous learning.

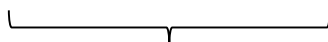
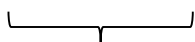
PROGRAMME OUTCOMES (POs)

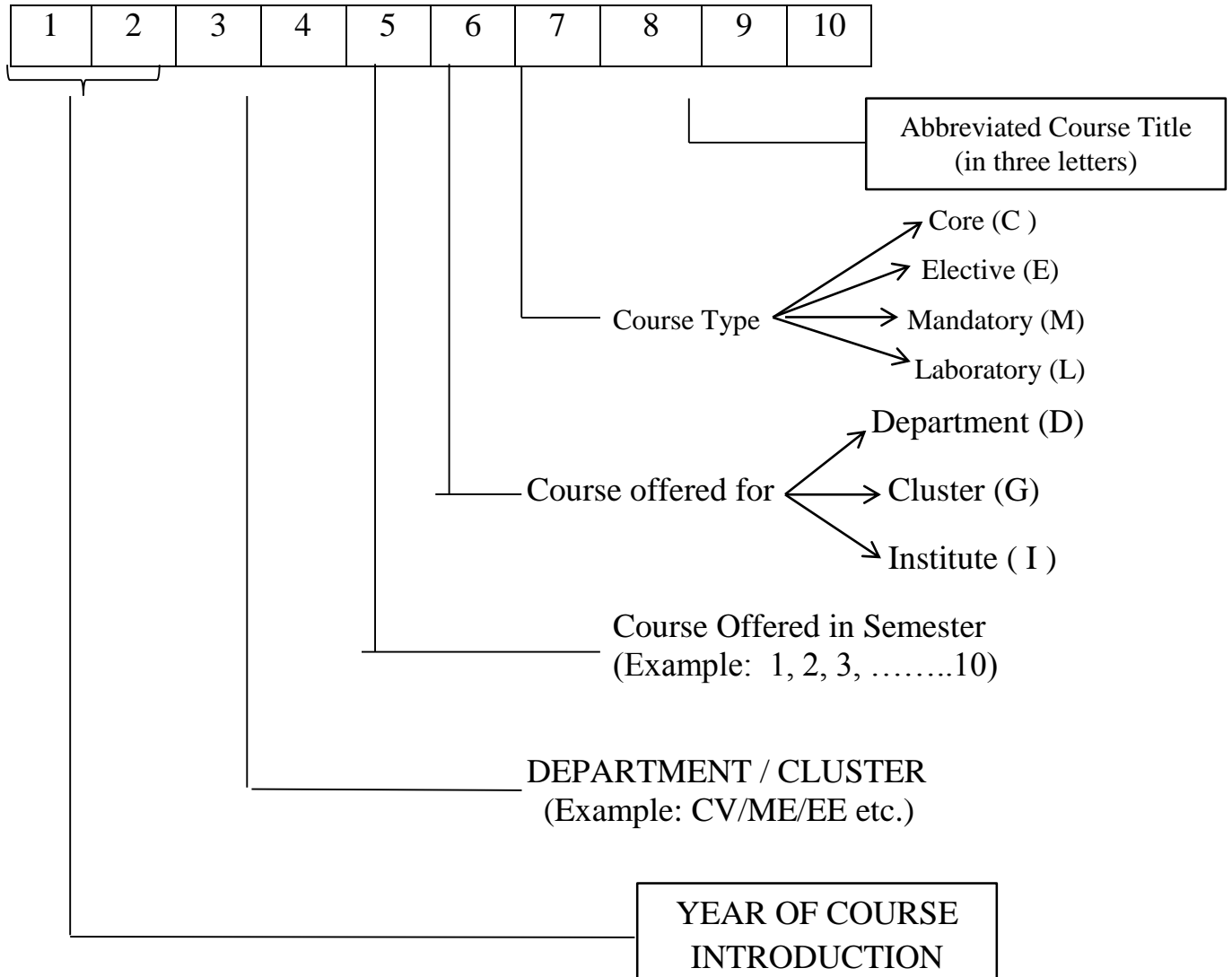
PO1	Engineering knowledge: Apply the knowledge of mathematics, science, engineering fundamentals, and an engineering specialization to the solution of complex engineering problems
PO2	Problem analysis: Identify, formulate, review research literature, and analyze complex engineering problems reaching substantiated conclusions using first principles of mathematics, natural sciences, and engineering sciences.
PO3	Design/development of solutions: Design solutions for complex engineering problems and design system components or processes that meet the specified needs with appropriate consideration for the public health and safety, and the cultural, societal, and environmental considerations.
PO4	Conduct investigations of complex problems: Use research-based knowledge and research methods including design of experiments, analysis and interpretation of data, and synthesis of the information to provide valid conclusions.
PO5	Modern tool usage: Create, select, and apply appropriate techniques, resources, and modern engineering and IT tools including prediction and modeling to complex engineering activities with an understanding of the limitations.
PO6	The engineer and society: Apply reasoning informed by the contextual knowledge to assess societal, health, safety, legal and cultural issues and the consequent responsibilities relevant to the professional engineering practice.
PO7	Environment and sustainability: Understand the impact of the professional engineering solutions in societal and environmental contexts, and demonstrate the knowledge of, and need for sustainable development.
PO8	Ethics: Apply ethical principles and commit to professional ethics and responsibilities and norms of the engineering practice.
PO9	Individual and team work: Function effectively as an individual, and as a member or leader in diverse teams, and in multidisciplinary settings.
PO10	Communication: Communicate effectively on complex engineering activities with the engineering community and with society at large, such as, being able to comprehend and write effective reports and design documentation, make effective presentations, and give and receive clear instructions.
PO11	Project management and finance: Demonstrate knowledge and understanding of the engineering and management principles and apply these to one's own work, as a member and leader in a team, to manage projects and in multidisciplinary environments.
PO12	Life-long learning: Recognize the need for, and have the preparation and ability to engage in independent and life-long learning in the broadest context of technological change.

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-Self study
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 Data Structures with C Course in 3rd Semester is 15IS3DCDSC

SCHEME OF INSTRUCTION

Department: INFORMATION SCIENCE AND ENGINEERING

Semester: III

Sl. No.	Course Code	Course Title	Credits				
			L	T	P	S	Total
1	15MA3GCDMS	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	16CI3GCPCP	Programming with C++	3	0	1	2	6
Total			17	2	2	4	25

Department: INFORMATION SCIENCE AND ENGINEERING

Semester: IV

Sl. No.	Course Code	Course Title	Credits				
			L	T	P	S	Total
1	15MA4GCLIA	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

Sl. No.	Course Code	Course Title	Credits				
			L	T	P	S	Total
1	16IS5DCJAV	Programming with Java	3	0	1	2	6
2	16IS5DCDBM	Database Management Systems	3	0	1	2	6
3	16IS5DCDCN	Data Communication and Networking	3	1	1	0	5
4	16IS5DCWEP	Web Programming	3	0	1	0	4
5	16IS5DEXXX	Department Elective-I	3	0	1	0	4
Total			15	1	5	4	25

Department Elective-I

1. 16IS5DEIOT – Internet of Things
2. 16IS5DEDMG - Data Mining
3. 16IS5DEPYP - Python Programming
4. 16IS5DEAIN - Artificial Intelligence

Sl. No.	Course Code	Course Title	Credits				
			L	T	P	S	Total
1	16IS6DCSEO	Software Engineering and Object Oriented Design	3	0	1	2	6
2	16IS6DCCNS	Computer Networks and Security	3	0	1	2	6
3	16IS6DCEAM	Entrepreneurship and Management	3	0	0	0	3
4	16IS6DCCDN	C# and .NET	3	0	1	0	4
5	16IS6DCSNA	Social Network Analysis	2	0	0	0	2
6	16IS6DEXXX	Department Elective-II	3	0	1	0	4
Total			17	0	4	4	25

Department Elective II

1. 16IS6DECGS - Computer Graphics
2. 16IS6DEVCS – Virtualization and Cloud Security
3. 16IS6DEMLG - Machine Learning
4. 16IS6DEPDC - Parallel and Distributed Computations through Java

Sl. No.	Course Code	Course Title	Credits				
			L	T	P	S	Total
1	16IS7DCMAD	Mobile Application Development	3	0	1	2	6
2	16IS7DCMCT	Mobile Computing	3	0	1	2	6
3	16IS7DCICL	Indian Cyber Law and IT	3	0	0	0	3
4	16IS7DEXXX	Department Elective-III	3	0	0	0	3
5	16IS7IE1XX	Institutional Elective-I	3	0	0	0	3
6	16IS7DCPRW	Project work	0	0	4	0	4
Total			15	0	6	4	25

Department Elective – III

1. 16IS7DEAWP - Advanced Web Programming
2. 16IS7DESAN - Storage Area Networks
3. 16IS7DECTS - Cryptographic Techniques and Security
4. 16IS7DEFDS - Foundations of Data Science
5. 16IS7DEACC - Advanced Cloud Computing
6. 16IS7DESTG - Software Testing

Institutional Elective – I

1. 16IS7IE1ML - Machine Learning
2. 16IS7IE1IS - Information Security

Sl. No.	Course Code	Course Title	Credits				
			L	T	P	S	Total
1	16IS8DCPRW	Project Work	0	0	11	0	11
2	16IS8DCGCT	Green Computing	3	0	0	1	4
3	16HS8DCSPF	HSS-Software Project Management and Finance	2	0	0	0	2
4	16IS8DCISC	Internship/Soft Computing Technical Seminar	0	0	2	0	2
5	16HS8DCFLG	HSS- Foreign Language	2	0	0	1	3
6	16IS8IE2XX	Institutional Elective-II	3	0	0	0	3
Total			10	0	13	2	25

Institutional Elective –II

1. 16IS8IE2WI - Web Programming and Internet Applications
2. 16IS8IE2BD - Big Data Analytics

Course Title	DISCRETE MATHEMATICS				
Course Code	15MA3GCDMS	Credits	04	L-T-P-S	3 – 1 – 0 - 0
CIE	50 Marks	SEE	100 Marks (50% Weightage)		
Contact Hours / Week	4	Total Lecture Hours	48 hours (36L+12T)		

Prerequisites: Matrices, mathematical logic.

Course Objectives: To acquaint the student with various concepts of discrete mathematics required in several streams of computing.

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)**

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)**

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)**

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)**

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)

Mathematics Lab

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

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.

Text Books

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

Reference Books

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

E-Books

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

MOOCs

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 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)		
Contact Hours / Week	4	Total Lecture Hours	52		

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 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, Zvonko Vranesic, Safwat Zaky, Naraig Manjikian, 6th Edition, McGrawHill, 2014
2. Computer Organization and Design. The Hardware/Software Interface by David A.Patterson and John L.Hennessy, fifth Edition, Morgan Kaufman Publishers(imprint of Elsevier), 2014.

Reference Books

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

E-Books

1. <http://www.technolamp.co.in/2011/04/computer-organization-carl-hamacher.html>
2. <http://www.geeksforgeeks.org/computer-organization-and-architecture-tutorials/>

MOOCs

1. <https://www.coursera.org/course/comparch>
2. <https://learn.saylor.org/course/view.php?id=71§ion=2>

COURSE OUTCOMES (COs)

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

CO1	Comprehend the concepts of basic architecture of a computer, instruction execution, interrupts, bus structures, memory, arithmetic unit operations and embedded systems.	
CO2	Apply the types of addressing modes, stack operations, subroutines, arithmetic operations and data transfer methods on various problems.	PO1
CO3	Analyse instruction set architecture, interface circuits, arithmetic and logic circuits, timing diagrams and memory circuits.	PO2
CO4	Identify the control signals, types of interrupts, bus structures, memory, arithmetic operations and microcontrollers.	PO2
CO5	Provide appropriate solutions for the design of memory and adders.	PO3
CO6	Make an effective communication and presentation in a team on the study of various digital components & architecture of the computer system.	PO9, PO10

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)		
Contact Hours / Week	5	Total Lecture Hours	39		

UNIT 1

Introduction to Data Structures: Arrays, Structures and Unions, Polynomials, Sparse Matrices, Representation of Multidimensional Arrays. Dynamic Memory allocation.

[08 Hrs]

UNIT 2

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 by Richard F. Gilberg and Behrouz A. Forouzan, Cengage Learning, 2005.

E-Books

1. <https://tinyurl.com/y9kdozyq>
2. <https://tinyurl.com/z8wln87>

MOOCs

1. <https://www.edx.org/course/introduction-data-structures-adelaidex-data101x>
2. <https://www.coursera.org/specializations/data-structures-algorithms>

COURSE OUTCOMES (COs)

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

CO1	Explore various operations on different data structures like arrays, lists, stacks, queues and trees.	
CO2	Develop and apply linear and non-linear data structures for solving computing problems.	PO1
CO3	Formulate various methods of organising and analysing data.	PO2
CO4	Design experiments to implement operations like searching, insertion, deletion, traversing mechanism on various data structures.	PO4
CO5	Make effective oral communication on advanced topics of data structures and their applications.	PO9, P10
CO6	Design solutions for applications using appropriate data structures and Prepare operational documentation with presentation.	PO3, PO9, PO10, PO12

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)		
Contact Hours / Week	6	Total Lecture Hours	52		

UNIT 1

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. Hopcroft, Rajeev Motwani, Jeffrey D.Ullman: 3rd Edition, Pearson Education, 2007.
2. An Introduction to Formal Languages and Automata by Peter Linz, Jones & Bartlett Learning, 5th Edition, 2011.

Reference Books

1. Introduction to Automata Theory, Formal Languages and Computation by Shyamalendu Kandar, 1st Edition, Pearson, 2013
2. Introduction to Theory of Computation by Michael Sipser, Cengage Learning, 3rd Edition, 2012.

E-Books

1. <http://www.utu.fi/en/units/sci/units/math/staff/Documents/karhumaki/automata05.pdf>
2. <https://www.iitg.ernet.in/dgoswami/Flat-Notes.pdf>

MOOCs

1. <http://online.stanford.edu/course/automata-theory>
2. <https://www.coursera.org/course/automata>

COURSE OUTCOMES (COs)

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

CO1	Comprehend the fundamental concepts of formal languages and automata theory.	
CO2	Provide solutions to problems in the computation theory by applying basic algorithms.	PO1
CO3	Identify and analyse computing language classes and their relationships.	PO2
CO4	Inspect various automata and their power to recognize languages.	PO2
CO5	Design grammars and automata for different levels of formal languages.	PO3
CO6	Design and simulate automata.	PO4, PO5

Course Title	PROGRAMMING WITH C++				
Course Code	16IS3DCPCP	Credits	6	L-T-P-S	3-0-1-2
CIE	50 Marks	SEE	100 Marks (50% Weightage)		
Contact Hours / Week	5	Total Lecture Hours	39		

UNIT 1

Overview of C++: What is Object Oriented Programming, Some C++ fundamentals Classes and Objects: Classes, Friend functions, Friend classes, Inline functions, Parameterized constructors, Static Class Members, The Scope resolution operator, nested and local classes, Passing Objects to functions, returning objects, object assignment. Arrays, Pointers, References: Array of Objects, Pointers to objects, This pointer, References. **[8 Hrs]**

UNIT 2

Function Overloading, Copy Constructors, and Default Arguments: Function Overloading, Overloading Constructors, Copy constructors, Default Function Arguments. Operator Overloading: Creating a member operator function, operator overloading using a friend function, overloading new and delete, overloading some special operators, and comma operator. **[8 Hrs]**

UNIT 3

Inheritance: Base Class Access Control, Inheritance and protected members, inheriting multiple base classes, constructors, destructors, and inheritance, granting access, virtual base classes. Virtual Functions and Polymorphism: Pointers to objects, Pointers to derived classes, Virtual Functions, Pure Virtual Functions. **[9 Hrs]**

UNIT 4

Templates: Generic functions, Applying Generic Functions. Exception Handling: Exception handling fundamentals, Handling derived class exceptions, Exception Handling options. **[7 Hrs]**

UNIT 5

C++ File I/O: <fstream> and the file classes, Opening and Closing the file, Reading and Writing text files, Unformatted and Binary I/O. Namespaces: Namespace fundamentals, the std namespace. Introducing the Standard Template Library: An overview of the STL. **[7 Hrs]**

Text Book

1. C++ - The Complete Reference by Herbert Schildt, 4th Edition, Tata McGraw Hill, 2015.

Reference Books

1. Object-Oriented Programmig in C++ by Robert Lafore, 4th Edition, Pearson Education.
2. Problem Solving with C++ by Walter Savitch, 9th edition, Pearson Education, 2015.

E-Books

1. <http://www.cplusplus.com/files/tutorial.pdf>
2. <http://mazonka.com/shared/Strastrup4th.pdf>

MOOCs

1. <https://www.coursera.org/learn/c-plus-plus-a#syllabus>
2. <https://www.udemy.com/free-learn-c-tutorial-beginners/>

COURSE OUTCOMES (COs)

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

CO1	Comprehend the basic concepts of object oriented programming with C++.	
CO2	Apply the concepts of data abstraction, encapsulation, operator overloading, namespaces, inheritance and files.	PO1
CO3	Identify the usage of reusability, exception handling and templates for solving problems.	PO2
CO4	Design solutions for real time computing problems using object oriented concepts.	PO3
CO5	Conduct experiments for the concepts of function overloading, operator overloading, exception handling, templates & file functionalities.	PO4
CO6	Make an effective oral presentation & perform in a team to prepare document on topics to object oriented programming.	PO9, PO10

Course Title	LINEAR ALGEBRA				
Course Code	15MA4GCLIA	Credits	04	L-T-P-S	3 – 1 – 0 – 0
CIE	50 Marks	SEE	100 Marks (50% Weightage)		
Contact Hours / Week	5 Hrs	Total Lecture Hours	48 hours (36L+12T)		

Perquisites

Vector Algebra, Matrix computations.

Course Objectives: To provide the students with a solid foundation with concepts in linear algebra that is essential in mathematical computations.

Course Description: The course aims at introducing students to fundamental concepts of linear algebra culminating in abstract vector spaces and linear transformations. The course starts with systems of linear equations and some basic concepts of the theory of vector spaces in the concrete setting of real linear n -space R^n . The course then goes on to introduce abstract vector spaces over arbitrary fields and linear transformations, matrices, matrix algebra, similarity of matrices, eigenvalues and eigenvectors.

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)**

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)**

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)

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)

Mathematics Lab

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

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 Eigen spaces 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.

Program Outcomes

1. Graduates will apply knowledge of Mathematics, Science and Engineering concepts to solve problems pertinent to Engineering.
2. Graduates will be able to identify problems related to engineering, analyse and derive valid conclusions with fundamental knowledge in Chemistry, Biology, Engineering and computation.
3. Graduates will be able to design, conduct experiments, analyse and interpret data for investigating problems in engineering and allied fields.

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

1. <https://www.math.ucdavis.edu/~linear/linear.pdf>
2. <http://ocw.mit.edu/courses/mathematics/>

MOOCs

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

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)		
Contact Hours / Week	6	Total Lecture Hours	52		

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 and 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. UNIX Systems Programming: Communication, Concurrency, and Threads by Kay A. Robbins and Steven Robbins, Prentice Hall; 2 edition, December 2015
2. UNIX Network Programming, Volume 2: Interprocess Communications (Paperback) (2nd Edition) by W. Richard Stevens, Addison-Wesley.

E-Books

1. <http://catb.org/~esr/writings/taoup/html/>
2. <http://oopweb.com/CPP/Documents/DebugCPP/VolumeFrames.html>

MOOCs:

1. <https://www.coursera.org/learn/unix>
2. <https://www.pluralsight.com/courses/linux-systems-programming>
3. <https://www.edx.org/course/introduction-linux-linuxfoundationx-lfs101x-1>

COURSE OUTCOMES (COs):

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

CO1	Comprehend POSIX API'S for files, process, signals, interprocess communication and sockets.	
CO2	Apply the API's for implementing UNIX commands and process control.	PO1
CO3	Analyse the usage of API's for solving problems.	PO2
CO4	Identify System call interface for process management, multitasking programs, IPC in UNIX.	PO4
CO5	Develop solutions for problems using appropriate API's and IPC methods.	PO4
CO6	Make an effective oral presentation in a team on files and process of UNIX system.	PO9, PO10

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)		
No. of Contact Hrs/Week	5	Total Lecture Hrs	39		

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 Heap sort. **[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 Anany Levitin, Pearson Education, Third Edition, 2014.
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, 4th edition, 2012.

E-Books

1. <https://www.cs.duke.edu/courses/fall08/cps230/Book.pdf>
2. <https://edutechlearners.com/download/books/Algorithms%20Design%20and%20Analysis%20by%20Udit%20Agarwal%20PDF.pdf>
3. https://www.tutorialspoint.com/design_and_analysis_of_algorithms/design_and_analysis_of_algorithms_tutorial.pdf

MOOCs

1. <https://www.coursera.org/course/algs4partI>
2. <https://www.mecr.org/home/coursedetails/19>

COURSE OUTCOMES (COs)

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

CO1	Acquire the knowledge on fundamentals of algorithmic design steps, analysis concepts and types of algorithm design techniques.	
CO2	Apply the algorithmic design paradigms such as divide and conquer greedy method, dynamic programming and methods of analysis.	PO1
CO3	Assess the performance and correctness of algorithms.	PO2
CO4	Design efficient algorithms in common engineering design situations.	PO3
CO5	Provide valid conclusions for efficient algorithms through design strategies.	PO4
CO6	Implement algorithms by applying appropriate design techniques for solving real world problems.	PO5
CO7	Make effective presentation and documentation to justify the performance of designed algorithms for the computing problems.	PO10

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)		
Contact Hours/Week	4	Total Lecture Hrs	52		

UNIT 1

Probability: Introduction, Sample spaces and events, Counting, Probability-The axioms of probability, some elementary theorems, Conditional probability, Baye's theorem. [12 Hrs]

UNIT 2

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

UNIT 3

Inferences Concerning Means - Point Estimation, Interval Estimation, Test of hypothesis, Null hypothesis and Test of hypothesis. [08 Hrs]

UNIT 4

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

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. [10 Hrs]

Text Books

1. Miller and Freund's, Probability and Statistics for Engineers, 7th Edition, Richard A.Johnson, PHI.
2. Probability, Random Variables and Stochastic Processes, by A.Papoulis and S.Unnikrishnan Pillai, 4th Edition, McGrawHill.

Reference Books

1. Probability & Statistics with Reliability, Queuing and Computer Science Applications, by Kishore S Trivedi, Wiley Publications, Second Edition, 2012.
2. Probability and statistics for Engineers and Scientists, by Walpole,Myers,Myers,Ye, Ninth edition, Pearson edition, 2013.

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. <https://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

CO1	Acquire knowledge on probability concepts, probability distribution, hypothesis, regression and queuing theory.	
CO2	Use probability axioms, conditional probability, probability distribution concepts to solve probability problems.	PO1
CO3	Estimate the mean of a population with different confidence interval by applying classical approach.	PO1
CO4	Perform statistical data analysis to make predictions, regressions and hypothesis testing for various levels of significance.	PO2
CO5	Develop probabilistic, statistical and queuing models to analyse real world problems.	PO3
CO6	Demonstrate basic functions of probability distribution, test of means, regression and correlation using modern tools.	PO5

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)		
Contact Hours / Week	5	Total Lecture Hours	39		

UNIT 1

Introduction: What operating systems do? Operating system operations, Operating systems services, System calls, Operating system Structure, System Boot. **[6 Hrs]**

UNIT 2

Processes, Threads and Synchronization: Process Concept, Process Scheduling, Interprocess communication, Threads: Overview, Multithreading models, Threading issues.
Process Synchronization: The critical section problem, Peterson's solution, Semaphores, Classical problems of synchronization. **[8 Hrs]**

UNIT 3

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. **[9 Hrs]**

UNIT 4

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. **[9 Hrs]**

UNIT 5

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. **[7 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 Education.

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. <https://www.amazon.com/Modern...Andrew-Tanenbaum-ebook/dp/B00JFFIHEC>
2. [http://sist.sysu.edu.cn/~isscwli/OSRef/Abraham%20Silberschatz-Operating%20System%20Concepts%20\(9th,2012.12\).pdf](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

CO1	Gain Knowledge on the basics of operating system and its functionalities	
CO2	Identify algorithms for process scheduling, memory management, disk scheduling and methods for synchronization issues	PO1
CO3	Acquaint concepts of multithreading and analyze sharing of system resources among users for interprocess communication	PO2
CO4	Solve problems related to resource management by analysing appropriate algorithms and methods	PO2
CO5	Implement the preliminary functionalities of operating system	PO5
CO6	Provide valid inferences by examining the current trends of operating system	PO4
CO7	Communicate effectively as an individual in diverse teams	PO9, PO10

Course Title	PROGRAMMING WITH JAVA				
Course Code	16IS5DCJAV	Credits	6	L-T-P-S	3-0-1-2
CIE	50 Marks	SEE	100 Marks (50% Weightage)		
Contact Hours / Week	5	Total Lecture Hours	39		

UNIT 1

An overview of Java: Object-oriented programming, Variables, Arrays, Introducing classes: Class fundamentals, Declaring objects, Assigning object reference variables, Introducing methods, Constructors, this keyword, finalize() method, A Stack class.

A closer look at methods and classes: Overloading methods, Objects as parameters, A closer look at argument passing, Returning objects, Recursion, Introducing access control, Understanding static, final, Arrays revisited, Nested and inner classes, String class, Command-line arguments, Varargs: Variable length arguments. **[8 Hrs]**

UNIT 2

Inheritance: Basics, super, Multilevel hierarchy, Why constructors are executed, Method overriding, Dynamic method dispatch, Abstract classes, Using final with inheritance, Object class.

Packages and Interfaces: Packages, Access protection, Importing packages, Interfaces, Default interface methods, Use static methods in an interface. **[9 Hrs]**

UNIT 3

Exception Handling: Fundamentals, types, Uncaught exceptions, Try and catch blocks, throw, throws and finally, Built-in exceptions, Creating own exceptions.

Multithreaded Programming: Java thread model, The main thread, Creating a thread and multiple threads, Using isAlive() and join(), Thread priorities, Synchronization, Interthread communication, Suspending, Resuming and stopping threads, Obtaining a Thread's state. **[8 Hrs]**

UNIT 4

Enumeration, Autoboxing, Annotations basics, I/O Basics, Reading console input, Writing console output, Printwriter class, reading and writing files, closing a file.

Generics: Example, Generic Class with two type parameters, Bounded types, Creating a Generic method and interfaces, Generic class hierarchies. **[7 Hrs]**

UNIT 5

Applets: Applet fundamentals, Applet class, Applet architecture, An applet skeleton, Simple applet display methods, Requesting repainting, A simple banner applet, Passing parameters, getDocumentBase() and getCodeBase(), AppletContext and showDocument. **[7 Hrs]**

Text Book

1. Java - The Complete Reference (JDK 8) by Herbert Schildt, 9th edition, Tata McGraw Hill, Edition 2014.

Reference Books

1. Java 8 Programming, Black book, Dreamtech Press, 2015.
2. Java 8 in Action, Raoul-Gabriel Urma, Mario Fusco and Alan Mycroft, Dreamtech Press, 2016.

E-Books

1. <http://math.hws.edu/javanotes/>
2. <https://docs.oracle.com/javase/specs/jls/se8/jls8.pdf>

MOOCS

3. <https://www.udemy.com/java-tutorial/>
4. <https://www.udacity.com/course/intro-to-java-programming--cs046>

COURSE OUTCOME (COs)

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

CO1	Comprehend the concepts of object oriented programming, packages and applets.	
CO2	Apply the concepts of encapsulation, inheritance, polymorphism, packages, interfaces, generics, files and applets	PO1
CO3	Analyze the usage of object oriented programming concepts, exception handling and multithreading	PO2
CO4	Design computer programs to solve problems using object oriented concepts	PO3
CO5	Conduct experiments using object oriented concepts to solve problems	PO4
CO6	Design and present solutions for applications using appropriate object oriented concepts	PO3, PO5, PO10, PO12

Course Title	DATABASE MANAGEMENT SYSTEMS				
Course Code	16IS5DCDBM	Credits	6	L-T-P-S	3-0-1-2
CIE	50 Marks	SEE	100 Marks (50% Weightage)		
Contact Hours / Week	5	Total Lecture Hours	39		

UNIT 1

Introduction; An example; Characteristics of Database approach; Actors on the scene; Workers behind the scene; Advantages of using DBMS approach; When not to use DBMS; Data models, schemas and instances; Three schema architecture and data independence; Database languages and Interfaces, Centralized and Client/Server architectures for DBMSs, Classification of Database management systems. **[6 Hrs]**

UNIT 2

Entity-Relationship model: Using High-Level Conceptual Data Models for database Design; An example Database Application; Entity types, Entity Sets, Attributes and Keys; Relationship types, Relationship Sets, Roles and structural Constraints; Weak Entity types; ER Diagrams, Naming Conventions and Design issues; Relational Database Design Using ER-to-Relational mapping. **[9 Hrs]**

UNIT 3

Relational Model Concepts; Relational Model constraints and Relational Database Schemas; update operations and dealing with constraint violations.
SQL data definition and data types, specifying constraints in SQL, Schema change statements in SQL, Basic queries in SQL; More complex SQL queries; Insert, Delete and Update statements in SQL; Views (Virtual Tables) in SQL. **[9 Hrs]**

UNIT 4

Relational Algebra: Unary Relational Operations; SELECT and PROJECT; Relational Algebra Operations from Set Theory; Binary Relational Operations: JOIN and DIVISION; Additional Relational Operations; Examples of Queries in Relational Algebra. **[7 Hrs]**

UNIT 5

Database Design: Informal Design Guidelines for Relation Schemas; Functional Dependencies; Normal Forms Based on Primary Keys; General Definitions of Second and Third Normal Forms; Boyce-Codd Normal form, Multivalued Dependencies and Fourth Normal Form.
Transaction Management: Transaction concept, A simple transaction model, Transaction Atomicity and Durability; Transaction Isolation, Serializability. **[8 Hrs]**

Text Books

1. Fundamental of Database Systems by Elmasri and Navathe, 6th Edition, Addison-Wesley, 2011.
2. Database System Concepts by Silberschatz, Korth and Sudharshan, 6th Edition, McGrawHill, 2015.

Reference Books

1. Fundamental of Database Systems by Elmasri and Navathe, 6th Edition, Addison-Wesley, 2016.
2. Database Systems: The Complete Book, Hector Garcia-Molina, Jeffrey D. Ullman, Jennifer Widom, Second edition, Pearson, 2013.
3. Database Management Systems-A Conceptual Approach, Seema Kedar, Technical Publications, 2014.

E-Books

1. Database Design - 2nd Edition, Adrienne Watt and Nelson Eng.
<https://opentextbc.ca/dbdesign01/>
2. <http://www.ebooks-for-all.com/bookmarks/detail/Database-Management-Systems/onecat/0.html>

MOOCs

1. <https://www.coursera.org/learn/database-management>
2. <https://lagunita.stanford.edu/courses/DB/2014/SelfPaced/about>

COURSE OUTCOMES (COs)

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

CO1	Comprehend the fundamentals of database management systems, ER model, relational algebra, SQL, design principles and Transaction management.	
CO2	Apply database management concepts, principles, Entity –Relationship model, relational algebra concepts, database design principles and Transaction management to describe DB to given scenario.	PO1
CO3	Analyse the concepts of database management principles, Entity –Relationship model, ER to Relational mapping, relational algebra and database design principles.	PO2
CO4	Design the given application without anomalies using ER modeling, Normalizations, transaction management properties.	PO3

CO5	Synthesize sophisticated queries to extract the information from the given database.	PO4
CO6	Usage of modern tools to implement the real world applications (database) popular databases.	PO5
CO7	Communicate effectively as a member in a diverse teams	PO9, PO10

Course Title	DATA COMMUNICATION AND NETWORKING				
Course Code	16IS5DCDCN	Credits	5	L-T-P-S	3-1-1-0
CIE	50 Marks	SEE	100 Marks (50% Weightage)		
Contact Hours / Week	7	Total Lecture Hours	39		

UNIT 1

Network Model: Protocol Layering, TCP/IP Protocol suite, The OSI Model, Layers in the OSI Model. Introduction to physical layer: Data and Signals. Digital Transmission: Digital-to-Digital conversion, Analog to digital conversion, Transmission modes. **[7 Hrs]**

UNIT 2

Data Link Layer: Design issues, Error and correction, Elementary data link protocols, Sliding window protocols. **[7 Hrs]**

UNIT 3

Medium access control sublayer: Channel allocation problem, Multiple access protocols. Wireless LAN: 802.11- architecture, Protocol stack, MAC sublayer protocol, frame structure. 802.16- architecture, protocol stack, MAC sublayer protocol, frame structure, Comparison with 802.11 and 3G. **[7 Hrs]**

UNIT 4

Network layer: Design issues, Routing algorithms: Optimality principle, shortest path algorithm, flooding, Distance vector routing, Link state routing, Hierarchical routing, Broadcast routing, Multicast routing, Anycast routing, Congestion control algorithms: Approaches of congestion control, Quality of Service. **[9 Hrs]**

UNIT 5

Internetworking: Tunneling, Internetwork routing, Packet fragmentation. The Network layer in the Internet: IP version 4, IP addresses, IP version 6, Internet control protocols, Label switching and MPLS, OSPF, BGP, Internet multicasting, Mobile IP. **[9 Hrs]**

Text Books

1. Data communications and Networking, Behrouz A Forouzan, Tata Mc Graw-Hill 5th edition, 2013.
2. Computer Networks, Andrew S Tannenbaum and David J Wetherall, Pearson, 5th edition, 2014.

Reference Books

1. Computer Network – Protocol, Standards and Interface, Uyless Black, Second edition, Pearson, 2015.
2. Computer and Communication Networks, Nader F Mir, Pearson, 2015.
3. Computer Networking-A Top-Down approach, James F Kurose, Keith W Ross, 5th edition, Pearson, 2016.

E-Books

1. <http://www.e-booksdirectory.com/details.php?ebook=3502>
2. <http://www.freetchbooks.com/data-communication-and-networks-f31.html>

MOOCs

1. <http://nptel.ac.in/courses/106105082/>
2. <http://ocw.mit.edu/courses/electrical-engineering-and-computer-science/6-263j-data-communication-networks-fall-2002/>

COURSE OUTCOME (COs)

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

CO1	Acquire the Knowledge about the various principles of data communication in datalink layer and network layer	
CO2	Analyze the need of for different protocols in datalink layer and network layer of TCP/IP protocol suite	PO1
CO3	Design network using internetworking concepts and related protocol by analysing the need various routing protocols for different scenarios.	PO2
CO4	Design wireless LAN, any network using internetworking concepts and protocols.	PO2
CO5	Conduct simulation on a given network for global addressing, subnetting, routing and protocol usage.	PO4
CO6	Conduct experiments on design of networking concepts using modern engineering tool.	PO5

Course Title	WEB PROGRAMMING				
Course Code	16IS5DCWEP	Credits	4	L-T-P-S	3-0-1-0
CIE	50 Marks	SEE	100 Marks (50% Weightage)		
Contact Hours / Week	5	Total Lecture Hours	39		

UNIT 1

XHTML, CSS and XML : Basic text markup; Images; Hypertext Links; Lists; Tables; Forms; HTML5 elements, Cascading Style Sheets: Style specification formats; Selector forms; Property value forms; Font properties; List properties; Alignment of text; Color, The Box model; Background images; span and div tags. **[7 Hrs]**

UNIT 2

JAVASCRIPT: Basics, Variables, String manipulation, Mathematical functions, Statements, Operators, Arrays, Functions, Data and objects in Javascript, Regular expressions, Exception handling, Built-in objects, Cookies, Events. **[8 Hrs]**

UNIT 3

Dynamic HTML with JavaScript – Data validation, Opening a new window, Messages and confirmations, status bar, Writing to a different frame, Rollover buttons, Moving images, Floating logos. **[8 Hrs]**

UNIT 4

An Introduction to PHP – PHP, Introducing PHP, Including PHP in a page, Data types, Program control, Arrays, User-defined functions, Built-in functions, Regular expressions, Using files. **[7 Hrs]**

UNIT 5

XML: Introduction, The syntax of XML, XML Document structure, Document Type Definition, Namespaces, XML Schema, XSLT style sheets. **[9 Hrs]**

Text Books

1. Programming the World Wide Web by Robert W. Sebesta, 7th Edition, Pearson Education, 2014.
2. Web Programming Building Internet Applications by Chris Bates, 3rd Edition, Wiley India, 2015.

Reference Books

1. Web Technologies: HTML, JAVASCRIPT, PHP, JAVA, JSP, ASP.NET, XML and Ajax, Kogent Learning Solutions Inc., Dreamtech Press, 2014.
2. Java Script, The Complete Reference, Third edition, Thomas A Powell, Fritz Schneider, McGraw Hill Education, 2013.
3. JavaScript, The Definitive Guide, David Flanagan, 6th Edition, Orielly, 2013.

E-Books

1. Build your own website the right way using HTML and CSS, 3rd Edition.
2. Beginning PHP6, Apache, and MySQL Web development. Timothy Boronczyk et. al.

MOOCs

1. <https://www.mooc-list.com/course/web-development-udacity?static=true>
2. <https://www.mooc-list.com/course/javascript-basics-udacity?static=true>
3. <https://www.mooc-list.com/course/intro-html-and-css-udacity?static=true>

COURSE OUTCOMES (COs)

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

CO1	Acquire the basic knowledge of scripting language to build web pages	
CO2	Use XHTML concepts to provide interactive websites for client-server systems	PO1
CO3	Validate user inputs based on constraints and requirements using javascript	PO2
CO4	Identify appropriate web elements to prepare dynamic pages	PO2
CO5	Interact with client-server systems on user specific mark-up language	PO3
CO6	Conduct experiments for the real time concepts of web programming	PO4, PO5

Course Title	INTERNET OF THINGS				
Course Code	16IS5DEIOT	Credits	4	L-T-P-S	3-0-1-0
CIE	50 Marks	SEE	100 Marks (50% Weightage)		
Contact Hours / Week	5	Total Lecture Hours	39		

UNIT 1

Introduction to Internet of Things –Definition and Characteristics of IoT, Physical Design of IoT- IoT Protocols, IoT communication models, IoT Communication APIs IoT enabled Technologies- Wireless Sensor Networks, Cloud Computing, Big data analytics, Communication protocols, Embedded Systems, Domain Specific IoTs-Home, City, Environment, Energy, Retail, Logistics, Agriculture, Industry, health and Lifestyle. **[7 Hrs]**

UNIT 2

M2M to IoT-The Vision-Introduction, From M2M to IoT, M2M towards IoT-the global context, A use case example, Differing Characteristics.
M2M to IoT-An Architectural Overview– Building an architecture, Main design principles and needed capabilities, An IoT architecture outline, standards considerations. **[8 Hrs]**

UNIT 3

M2M and IoT Technology Fundamentals- Devices and gateways, Local and wide area networking, Data management, Business processes in IoT, Everything as a Service (XaaS), M2M and IoT Analytics, Knowledge Management. **[7 Hrs]**

UNIT 4

IoT Architecture-State of the Art – Introduction, State of the art Architecture.
Reference Model- Introduction, Reference Model and architecture, IoT reference Model. **[8 Hrs]**

UNIT 5

IoT Reference Architecture- Introduction, Functional View, Information View, Deployment and Operational View, Other Relevant architectural views.
Real-World Design Constraints- Introduction, Technical Design constraints-hardware is popular again, Data representation and visualization, Interaction and remote control. **[9 Hrs]**

Text books

1. Internet of Things - A Hands-on Approach, Arshdeep Bahga and Vijay Madiseti, Universities Press, 2015, ISBN: 9788173719547.
2. Jan Holler, Vlasios Tsiatsis, Catherine Mulligan, Stefan Avesand, Stamatias Karnouskos, David Boyle, From Machine-to-Machine to the Internet of Things: Introduction to a New Age of Intelligence, 1st Edition, Academic Press, 2014.

Reference Books

1. Francis da Costa, Rethinking the Internet of Things: A Scalable Approach to Connecting Everything, 1st Edition, Apress Publications, 2013.
2. The Internet of Things in the Cloud: A Middleware Perspective - Honbo Zhou – CRC Press 2012.

E-Books

1. <https://tinyurl.com/y79nk7uf>
2. <http://www.zdnet.com/article/the-executives-guide-to-the-internet-of-things-free-ebook/>

MOOCs

1. <https://www.coursera.org/specializations/iot>
2. <https://www.futurelearn.com/courses/internet-of-things>

COURSE OUTCOMES (COs)

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

CO1	Familiarize with the fundamentals of Internet of Things for communication models.
CO2	Apply the concepts of sensors, cloud, data pushing and pulling mechanisms to develop IoT solutions.
CO3	Explore appropriate architectures, programmable interfaces and communication technologies to design IoT models.
CO4	Differentiate between the levels of the IoT stack, key technologies and protocols employed at each layer.
CO5	Program a controlled software for the desired IoT applications using sensors, wireless network connections, display/actuators and data analytics.
CO6	Create a working IoT prototype in teams involving design, programming and data analytics using appropriate hardware components and software tools.

Course Title	DATA MINING				
Course Code	16IS5DEDMG	Credits	4	L-T-P-S	3-0-1-0
CIE	50 Marks	SEE	100 Marks (50% Weightage)		
Contact Hours / Week	5	Total Lecture Hours	39		

UNIT 1

Data: Types of Data, Data Quality, Data Pre-processing, Measures of Similarity and Dissimilarity, OLAP and Multidimensional Data analysis. **[7 Hrs]**

UNIT 2

Classification: Preliminaries, General Approach to Solving Classification Problem, Decision Tree Induction, Rule Based Classifiers, Nearest-Neighbor Classifiers, Bayesian Classifiers. **[8 Hrs]**

UNIT 3

Association analysis: Problem Definition, Frequent Itemset Generation, Rule Generation, Compact Representation of Frequent Itemsets, Alternative Methods for Generating Frequent Itemsets, FP-Growth Algorithm. **[7Hrs]**

UNIT 4

Cluster Analysis: Basic Concepts and Algorithms: Overview, K-means, Agglomerative Hierarchical Clustering, DBSCAN and Cluster Evaluation. **[10 Hrs]**

UNIT 5

Cluster Analysis: Additional Issues and Algorithms: Characteristics of Data, Clusters and Clustering Algorithms, Density Based Clustering; Graph Based Clustering, Scalable Clustering Algorithms. **[7 Hrs]**

Text Book

1. Introduction to Data Mining, Pang-Ning Tan, Micheal Steinbach and Vipin Kumar, Pearson, 2015.

Reference Books

1. Data Mining and Predictive Analytics, Daniel T. Larose and Chantal D. Larose, Wiley publications, 2015.
2. Data Mining: The Textbook, Charu C. Aggarwal, Springer, 2015.

E-Books

1. <http://www.cs.rpi.edu/~zaki/PaperDir/DMABOOK.pdf>
2. [http://www.cse.hcmut.edu.vn/~chauvtn/data_mining/Texts/\[1\]%20Data%20Mining%20-%20Concepts%20and%20Techniques%20\(3rd%20Ed\).pdf](http://www.cse.hcmut.edu.vn/~chauvtn/data_mining/Texts/[1]%20Data%20Mining%20-%20Concepts%20and%20Techniques%20(3rd%20Ed).pdf)

MOOCs

1. <https://weka.waikato.ac.nz/dataminingwithweka/preview>
2. https://www.coursera.org/learn/data-patterns?siteID=.GqSdLGGurk-Ur_KLK5tcBMCCRbxVYx13Q&utm_content=10&utm_medium=partners&utm_source=linkshare&utm_campaign=*GqSdLGGurk

COURSE OUTCOMES (COs)

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

CO1	Comprehend the concepts of Data, Classification, Association and Cluster analysis.	
CO2	Apply the Concepts of pre-processing, classification and clustering for data extraction.	PO1, PO2
CO3	Arrive at valid predictions by analysing proximity measures, OLAP and multidimensionality.	PO2
CO4	Examine the association levels to generate rules for various item sets.	PO2
CO5	Interpret the substantial conclusions obtained by using clustering and classification mining techniques.	PO4
CO6	Conduct experiments using data mining techniques for Pre-processing, Association, Classification and Clustering using modern tools.	PO4, PO5

Course Title	PYTHON PROGRAMMING				
Course Code	16IS5DEPYP	Credits	4	L-T-P-S	3-0-1-0
CIE	50 Marks	SEE	100 Marks (50% Weightage)		
Contact Hours / Week	5	Total Lecture Hours	39		

UNIT 1

Introduction to Python, Python Concepts, Dynamic vs. Static Types, Interpreted vs. Compiled, Prototyping, Procedural vs. Object-Oriented Programming, The Python Interpreter, Using the Python Command Prompt, Commenting Python, Launching Python programs, Integrated Development Environments, Types and Operators, Python Syntax , Indentation, Multiple Line Spanning, Python Object Types, Python Numbers. Strings: Basic string operations, Indexing and slicing strings, String Formatting, Combining and Separating Strings, Regular Expressions. Lists: List usage, Adding List Elements, Mutability, Methods. Dictionaries: Making a dictionary, Basic operations, Dictionary details, Operation Tuples: Why Use Tuples? Sequence Unpacking, Methods. **[9 Hrs]**

UNIT 2

Files: File Operations, Files and Streams, Creating a File, Reading From a File, Iterating Through Files, Seeking, Serialization.
 Statements: Assignment, Expressions/Calls, Printing, if Tests, while Loops, for Loops, pass Statement, break and continue Statements .try, except, finally and raise Statements, import and from Statements, def and return Statements , Class Statements, Scope, Default Arguments.
 Exceptions: Exception Class Hierarchy, User-Defined Exceptions. **[7 Hrs]**

UNIT 3

Object Oriented Programming: Learning Python Classes, How Are Classes Better? , New-style classes, Inheritance, Operator Overloads, Class Methods.
 Databases: How to Use a Database, Working With a Database , Using SQL to Query a Database, Python and SQLite, Creating an SQLite DB, Pulling Data from a DB, SQLite Database Files, Distributing Your Program. **[7 Hrs]**

UNIT 4

System tools: The os.path to knowledge, System scripting overview, introducing the sys module, introducing the os module, Script execution context: Current working directory, command-line arguments, Shell environment variables. **[9 Hrs]**

UNIT 5

File tools, directory tools, Parallel system tools: Forking processes, Threads, Program exits.

[7 Hrs]

Text Books

1. Learning to Program using Python by Cody Jackson, Second Edition, 2014.
2. Programming Python, Mark Lutz, O'reilly Media, 2015.

Reference Books

1. Introducing Python by Bill Lubanovic, O'Reilly Media, 2014.
2. Python Essential Reference, 4th Edition by David M. Beazley, Pearson Education, 2009
3. Learning with Python: How to Think Like a Computer Scientist, Allen Downey, Jeffrey Elkner and Chris Meyers, Dreamtech Press, 2015.

E-Books

1. <http://www.onlineprogrammingbooks.com/learning-program-using-python/>
2. <http://www.greenteapress.com/thinkpython/thinkpython.pdf>

MOOCs

1. <https://www.coursera.org/learn/python>
2. <https://www.edx.org/course/introduction-computer-science-mitx-6-00-1x-8>
3. <https://www.class-central.com/mooc/4174/coursera-python-data-structures>

COURSE OUTCOMES (COs)

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

CO1	Understand the Python environment, basic operations, objects, files, exceptions, OOPs concepts, databases and System tools.	
CO2	Use operations and constructs of programming to implement solutions for engineering problems.	PO1
CO3	Provide an analysis for usage of file operations, exception hierarchy and connectivity to database.	PO2
CO4	Justify the importance of different programming constructs and system tools.	PO4
CO5	Implement control structures using appropriate techniques and resources.	PO5
CO6	Interpret various scenario based problems to provide feasible solutions.	PO3

Course Title	ARTIFICIAL INTELLIGENCE				
Course Code	16IS5DEAIN	Credits	4	L-T-P-S	3-0-1-0
CIE	50 Marks	SEE	100 Marks (50% Weightage)		
Contact Hours / Week	5	Total Lecture Hours	39		

UNIT 1

What is AI? , Intelligent agents: Agents and environments, Types of Agents, Problem Solving: Representation of problem in state-space, Uniformed-search strategies: Breadth-Frist Search, Depth-First Search, Uniform Cost Search, Depth Limited Search, Iterative Deepening search. **[7 Hrs]**

UNIT 2

Informed Search Strategies: Heuristic Search, Greedy Search, A*, AO*, Means-End Analysis, Heuristic Functions, Hill Climbing Search, Crypt Arithmetic **[10 Hrs]**

UNIT 3

Knowledge & Reasoning: Knowledge-Based Agent, The WUMPUS World Environment, Representation, Reasoning & Logic, Propositional Logic, First-Order Logic: Syntax & Semantics: Examples **[7 Hrs]**

UNIT 4

Predicate Logic: Forward and Backward Chaining, Resolution & Question and Answering: Representing knowledge using Rules, Procedural Vs Declarative Knowledge. **[7 Hrs]**

UNIT 5

Uncertain Knowledge & Reasoning: Handling Uncertain Knowledge, Prior Probabilities, Conditional Probabilities, Bayes Rules (Combining Evidences), Belief Network: Construction, Induction Learning, Learning from Decision Trees **[8 Hrs]**

Text Book

1. Artificial Intelligence - A Modern Approach, Stuart Russell and Peter Norvig, 3rd Edition, Pearson, 2014.

Reference Books

1. Introduction to Artificial Intelligence and Expert Systems, Dan W Patterson, Pearson, 2015.
2. Artificial Intelligence, Elaine Rich, Kevin Knight and Shivashankar B Nair, 3rd Edition, McGrawHill Education, 2015.

E-Books

1. <http://artint.info/html/ArtInt.html#cicontents>
2. <https://goo.gl/BNEbSJ>

MOOCs

1. <https://www.edx.org/course/artificial-intelligence-uc-berkeleyx-cs188-1x>
2. <https://www.udacity.com/course/intro-to-artificial-intelligence--cs271>

COURSE OUTCOMES (COs)

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

CO1	Understand the concept of agents, environments, search strategies, reasoning, logic and probabilities.	-
CO2	Solve problems using uninformed and informed search strategies.	PO1
CO3	Represent procedural and declarative knowledge by applying agent based rules.	PO1
CO4	Provide logic based analysis for question and answering techniques.	PO2
CO5	Formulate probabilities for handling uncertain knowledge.	PO2
CO6	Conduct experiments related to artificial intelligence using PROLOG programming tool.	PO4, PO5

Course Title	SOFTWARE ENGINEERING AND OBJECT ORIENTED DESIGN				
Course Code	16IS6DCSEO	Credits	6	L-T-P-S	3-0-1-2
CIE	50 Marks	SEE	100 Marks (50% Weightage)		
Contact Hours / Week	5	Total Lecture Hours	39		

UNIT 1

Introduction: Software Engineering, Software process models, Process activities, Requirements engineering: Functional and non-functional requirements, Software requirements document, Requirements-specification, engineering processes, elicitation & analysis, validation and management. Rational Unified process, Agile methods, Extreme programming. **[6 Hrs]**

UNIT 2

Architectural design - decisions, views, patterns. Application architectures, Implementation issues. Software testing-Development testing, Test-driven development, Release testing, User testing, Evolution Processes, Complex systems, Systems engineering, System procurement, System development. **[8 Hrs]**

UNIT 3

Object oriented design: The three models, Class Modelling – Object and class concepts, Link and association concepts, Generalization and inheritance, A sample class model, Navigation of class models, Advanced object and class concepts, N-ary associations, Aggregation, Abstract classes, Multiple inheritance, Metadata, Reification. **[8 Hrs]**

UNIT 4

State modeling-Events, States, Transitions & conditions, diagrams & diagram behavior, Nested state diagrams, Nested states, Concurrency, A sample state model, Interaction modeling-Use case models, Sequence models, Activity models, Use case relationships, Procedural sequence models, Special constructs for activity models. **[10 Hrs]**

UNIT 5

Pattern-Oriented Software Architecture: What is a pattern? What makes a pattern? Pattern categories, Architectural patterns- Layers, Model-View-Controller, Design patterns- Whole part, Forwarder-Receiver, Idioms. **[7 Hrs]**

Text Books

1. Software Engineering by Ian Somerville, Pearson Education, International Edition 9/E, 2010.

2. Object –Oriented Modeling and Design with UML, UML 2, by Michael R Blaha, James R Rumbaugh, 2nd Edition, Pearson Education, 2012.
3. Pattern-Oriented Software Architecture : A System of Patterns by Frank Buschmann, Regine Meunier, Hans Rohnert, Peter Sommerlad, Michael Stal, Volume 1, Wiley Publications, 2014.

Reference Books

1. Software Engineering Principles and Practice, Waman S Jawadekar, Tata McGrawHill, 2009.
2. Object-oriented analysis and design with applications, Grady Booch, Robert A. Maksimchuk, Michael W. Engle, Bobbi J. Young, Jim Conallen, Kelli A. Houston, Third edition, Pearson, 2013.
3. Object oriented analysis and design using UML, D Jeya Mala and S Geetha, McGrawHill, 2013.

E-Books

1. <http://kmvportal.co.in/Course/OOAD/object-oriented-analysis-and-design-with-applications-2nd-edition.pdf>
2. <http://www.onlineprogrammingbooks.com/agile-software-development-succinctly/>

MOOCs

1. <http://nptel.ac.in/courses/106105087>
2. <https://www.mooc-list.com/categories/computer-science-programming-software-engineering?static=true>
3. https://onlinecourses.nptel.ac.in/noc16_cs19/preview

COURSE OUTCOMES (COs)

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

CO1	Comprehend software life cycle, testing, UML notations and patterns.	
CO2	Apply appropriate associations, interaction modeling, predict patterns categories.	PO1, PO4
CO3	Analyze software architecture, design models, testing methods and business solutions.	PO2
CO4	Interpret requirements, test phases, modeling, transitions and architectural patterns.	PO1, PO2
CO5	Design UML models, patterns, traceability matrix.	PO3, PO4, PO5
CO6	Create models for a business solutions systems.	PO3, PO5, PO9, PO10, PO12

Course Title	COMPUTER NETWORKS AND SECURITY				
Course Code	16IS6DCCNS	Credits	6	L-T-P-S	3-0-1-2
CIE	50 Marks	SEE	100 Marks (50% Weightage)		
Contact Hours / Week	5	Total Lecture Hours	39		

UNIT 1

The Transport Layer: Services provided to the upper layers, Transport service primitives, Elements of transport protocols: Addressing, Connection establishment, Connection release, Error control and flow control, Introduction to UDP, Remote procedure call, and Real-time transport protocols. **[9 Hrs]**

UNIT 2

The Internet Transport Protocols: TCP - protocol, segment header, connection establishment, connection release, Sliding window. Application Layer: Domain name system - namespace, resource records, name servers, Electronic mail: Architecture and services, User agent, Message formats, Message transfer, Final delivery, Hyper Text Transfer Protocol, The mobile web. **[9 Hrs]**

UNIT 3

Transport-level Security: Web security considerations, Secure Socket layer, Transport Layer security, HTTPS, Secure Shell. **[7 Hrs]**

UNIT 4

Wireless network security: IEEE 802.11i Wireless LAN Security, Wireless Application Protocol overview, Wireless Transport Layer Security, WAP end-to-end security. **[7 Hrs]**

UNIT 5

Electronic mail security: Pretty Good Privacy, S/MIME. IP Security: IP Security overview, IP Security policy, Encapsulating security payload, Internet key exchange. Intruders, Intrusion detection. **[7 Hrs]**

Text Books

1. Computer Networks, Andrew S Tannenbaum and David J Wetherall, Pearson, 5th Edition, 2014.
2. Network Security Essentials Applications and Standards, William Stallings, Pearson, 4th Edition, 2012.

Reference Books

1. Computer Networking A Top-Down Approach, James F Kurose, Keith W Ross, 5th Edition, Pearson, 2016.
2. Computer and Communication Networks by Nader F Mir, Pearson Education, 2015.
3. Computer Network Protocols, Standards and Interface, Uyles Black, 2nd Edition, Pearson, 2015.
4. Network Security Private Communication in a Public world, Charlie Kaufman, Radia Perlman and Mike Speciner, 2nd Edition, PHI, 2013.
5. Network Security and Management, Brijendra Singh, 3rd Edition, PHI, 2013.

E-Books

1. <http://www.saylor.org/site/wp-content/uploads/2012/02/Computer-Networking-Principles-Bonaventure-1-30-31-OTC1.pdf>
2. <https://whc.es/Network/Fundamentals%20of%20Network%20Security.pdf.1.pdf>

MOOCs

1. <https://www.mooc-list.com/course/networking-introduction-computer-networking-stanford-university>
2. <https://www.mooc-list.com/course/network-security-wma>

COURSE OUTCOMES (COs)

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

CO1	Understand the working principles of Transport, Application and Security protocols.	
CO2	Solve problems concerned with end to end communication and security by applying the concepts of various protocols.	PO1
CO3	Review the functionalities of protocols at transport layer & application layer, security aspects.	PO2
CO4	Interpret network and security algorithms with appropriate methods to provide valid conclusions.	PO4
CO5	Formulate feasible solutions for practical applications using network simulators.	PO3, PO5
CO6	Communicate effectively as a member in diverse team.	PO9, PO10

Course Title	ENTREPRENEURSHIP AND MANAGEMENT				
Course Code	16IS6DCEAM	Credits	3	L-T-P-S	3-0-0-0
CIE	50 Marks	SEE	100 Marks (50% Weightage)		
Contact Hours / Week	3	Total Lecture Hours	39		

UNIT 1

The entrepreneurial perspective: The nature of entrepreneurship, How Entrepreneurs Think, Entrepreneur background and characteristics. Reasons for interest in corporate entrepreneurship, Managerial v/s entrepreneurial decision making, Generation of new entry opportunity, Entry strategy for new entry exploitation, Risk reduction for new entry exploitation. **[8 Hrs]**

UNIT 2

From idea to the opportunity: Sources of new ideas, methods of generating ideas, creative problem solving, Innovation, Opportunity recognition, Product planning and development process, e-commerce and business start-up, International v/s domestic entrepreneurship, Entrepreneurial entry strategies, Barriers to international trade, Legal issues in setting up the organization, Patents, Trademarks, Copyrights, Licensing. **[8 Hrs]**

UNIT 3

Writing the business plan, Implementing the business plan, Marketing research for the new venture, Preparing the marketing plan, Characteristics of a marketing plan, Steps in preparing marketing plan, Legal forms of business, S-Corporation, Limited Liability Company, Building the management team and a successful organization culture, Operating and capital budgets, Venture capital. **[8 Hrs]**

UNIT 4

Management-importance, definition, functions or the process. Roles of a senior manager, Managerial skills & effectiveness, Management and administration, Meaning of social responsibility, Business ethics and corporate governance. Importance of planning, Types of plans, Steps in planning, Strategic planning process, Meaning & types of decisions, Steps in rational decision making, Rationality & environment of decision making. **[8 Hrs]**

UNIT 5

Organization structure, Emerging organization structures, Committees, Teams, Manpower planning, Recruitment, Selection, Design and development of the training programme, Evaluation of training and development, Formal communication, Forms of communication, Principles of effective communication, Characteristics of leadership, Functions of a leader, Traditional approaches to leadership, Situational factors determining choice of leadership style, New approaches to leadership. **[7 Hrs]**

Text Books

1. Entrepreneurship by Robert D Hisrich, Mathew J Manimala, Micheal P Peters, Dean A Shepherd, McGrawHill education, 9th edition, 2014.
2. Principles of Management by P. C. Tripathi, P.N. Reddy – Tata McGraw Hill, 5th Edition, 2015.

Reference Book

1. Entrepreneurship Development-Small Business Enterprises by Poornima M Charantimath, Pearson Education, 2014.

E-Books

1. <http://www.saylor.org/site/textbooks/Principles%20of%20Management.pdf>
2. <http://www.intechopen.com/books/entrepreneurship-education-and-training>

MOOCs

1. <https://www.udacity.com/course/how-to-build-a-startup--ep245>
2. <https://www.mooc-list.com/course/entrepreneurship-openlearning>

COURSE OUTCOMES (COs)

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

CO1	Obtain an understanding of entrepreneurial characteristics business ideas, organization structure, management and administration.	
CO2	Recognise opportunities by applying ideas for product development, marketing and management.	PO1
CO3	Review strategic planning for entrepreneurial management and legal forms of business.	PO2
CO4	Develop business plans based on product and services in-line with the target market.	PO3
CO5	Provide analysis of organisation structures, business strategies, training and leadership models.	PO2
CO6	Prepare documents and communicate effectively on entrepreneurial ventures and opportunities.	PO9, PO10

Course Title	C# AND .NET				
Course Code	16IS6DCCDN	Credits	4	L-T-P-S	3-0-1-0
CIE	50 Marks	SEE	100 Marks (50% Weightage)		
Contact Hours / Week	5	Total Lecture Hours	39		

UNIT 1

The Philosophy of .NET: Building blocks, .NET-Aware programming languages, .NET assemblies, Understanding CTS, CLS, CLR, Assembly/namespace/ Type distinction, Exploring an assembly using ildasm.exe. Building C# applications using csc.exe. Core C# programming constructs – Anatomy of simple C# program, System. Console class, System data types and corresponding C# keywords, String data, C# iteration constructs, Decision constructs and relational/equality operators. **[7 Hrs]**

UNIT 2

Core C# programming constructs-Methods and parameter modifiers, Understanding C# arrays, enum type, structure type, value types, reference types and Nullable types. C# class type, constructors, this keyword, static keyword **[8 Hrs]**

UNIT 3

Encapsulation: Access modifiers, Encapsulation services, Automatic properties, Object initialization syntax, Constant field data, Partial types. Details of inheritance, containment/delegation, and Polymorphic support, base class/derived class casting rules, System.Object. **[8 Hrs]**

UNIT 4

Role of .NET exception handling, Simplest example, Configuring the state of an exception, System-level, Application-level and Multiple exceptions, Who is throwing What? Interface types, Implementing an interface, Invoking interface members at the Object level, Interfaces as parameters, Interfaces as return values, Array of interface types. **[8 Hrs]**

UNIT 5

System.Collections (Arraylist, Comparer, Hashtable, Stack, Queue), Generics, namespace, .NET delegate type, Simple example, Sending object state notifications using delegates, Defining custom namespaces, Role of .NET assemblies (Single file and Multi file Assembly). **[8 Hrs]**

Text Book

1. Pro C# 5.0 and the .NET 4.5 Framework, Sixth edition by Andrew Troelsen, Apress, 2015.

Reference Books

1. Professional C# 5.0 and .Net 4.5.1, Christian Nagel, Jay Glynn, Mrgan Skinner, Wrox publications, 2014.
2. C# 2012 Programming Covers .NET 4.5 Black Book, Kogent Learning Solutions Inc., Dreamtech publications, 2013.

E-Books

1. C# 4.0 - The Complete Reference - Herbert Schildt.pdf
2. Programmer's Heaven C# School –Faraz Rasheed, First Edition,
http://ebooks.programmersheaven.com/csharp_ebook.pdf

MOOCs

1. <https://www.edx.org/course/programming-c-microsoft-dev204x-1>
2. <https://www.microsoft.com/en-in/learning/course.aspx?cid=20483>

COURSE OUTCOMES (COs)

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

CO1	Comprehend .NET centric building blocks, syntactical constructs, concepts of OOP and Exception handling.	
CO2	Apply appropriate C# programming constructs, namespace ,Exception Handling and Object Oriented concepts to solve problems(L3)	PO1
CO3	Identify value types, reference types, read only, System. Collections and Interfaces.	PO2
CO4	Analyze C# programming constructs, nullable types, casting rules, Application level exception	PO2
CO5	Conduct experiments as per the specific requirements and constraints using integrated development tools	PO4, PO5
CO6	Create solutions for problems using appropriate constructs.	PO4

Course Title	SOCIAL NETWORK ANALYSIS				
Course Code	16IS6DCSNA	Credits	2	L-T-P-S	2-0-0-0
CIE	50 Marks	SEE	100 Marks (50% Weightage)		
Contact Hours / Week	2	Total Lecture Hours	26		

UNIT 1

Introduction to Social network analysis: Basics, Social Network data: Data Collection. **[5 Hrs]**

UNIT 2

Graphs and Matrices: Why Graphs? Types, Relations: Definitions, Properties, Matrices: Definition, properties. **[5 Hrs]**

UNIT 3

Structural and Location Properties: Basic properties of networks and actors, Cliques and Subgroups. **[6 Hrs]**

UNIT 4

Roles and Positions: Social Roles and Positions, Definition of structural equivalence and issues, Positional Analysis **[5 Hrs]**

UNIT 5

Future directions: Statistical Models, Generalizing to new kinds of data, Data collection, sampling, General propositions about structure, Computer technology. **[5 Hrs]**

Text Books

1. Social Network Analysis: Methods and Applications, Stanley Wasserman, Katherine Faust, Cambridge University Press, 2012.
2. Introduction to Social Network Methods by Robert A. Hanneman, and Mark Riddle, University of California, 2005.

Reference Books

1. Social Network Analysis by John Scott, 3rd edition, SAGE publications Ltd, 2012.
2. Understanding-Social-Networks-Theories-Concepts-and findings by Charles Kadushin, Oxford University press, 2012.

E-Books

1. <http://www.analytictech.com/networks.pdf>
2. <http://www.faculty.ucr.edu/~hanneman/nettext/>

MOOCs

1. <https://www.coursetalk.com/providers/coursera/courses/social-network-analysis>
2. <http://openscienceasap.org/education/courses/social-network-analysis/>

COURSE OUTCOME (COs)

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

CO1	Comprehend the basic knowledge of social network analysis, graphs, cliques, structural equivalence, positional analysis and data collection.	
CO2	Apply graphs and matrices to represent social networks	PO1
CO3	Analyze the usage of graphs, matrices and subgroups in social networks	PO2
CO4	Communicate effectively in a team and investigate on the topics related to Social Network Analysis	PO9, PO10

Course Title	COMPUTER GRAPHICS				
Course Code	16IS6DECGS	Credits	4	L-T-P-S	3-0-1-0
CIE	50 Marks	SEE	100 Marks (50% Weightage)		
Contact Hours / Week	5	Total Lecture Hours	39		

UNIT 1

Graphics Output primitives: Coordinate reference frames, Fill area primitives, Polygon fill areas, Pixel array primitives, Character primitives, Picture partitioning, OpenGL-specifying 2D world coordinate reference frame, point, line & curve functions, character functions, Display lists, Display window reshape function. Attributes of Graphics Primitives: Color and Grayscale, Point, line, curve, fill-area & character attributes. OpenGL-color functions, point attribute functions, line-attribute functions, fill-area attribute functions, character attribute functions, query functions, attribute groups. **[9 Hrs]**

UNIT 2

Implementation algorithms for graphics primitives and attributes: line-drawing algorithms, parallel line algorithms, setting frame-buffer values, circle-generating algorithms, pixel addressing and object geometry, attribute implementations for straight line segments and curves, Fill methods for areas with irregular boundaries, Implementation methods for fill styles. **[7 Hrs]**

UNIT 3

Two dimensional geometric transformations: Basic 2D geometric transformations, matrix representations and homogeneous coordinates, inverse transformations, 2D composite transformations, raster methods for geometric transformations, OpenGL raster transformations, transformations between two-dimensional coordinate system, OpenGL functions for 2D geometric transformations, programming example, Clipping window, Normalization and Viewport transformations, OpenGL 2D viewing functions, 2D point clipping, line clipping. **[9 Hrs]**

UNIT 4

3D geometric transformations: 3D translation, rotation, scaling, Composite 3D transformations, transformations between three-dimensional coordinate systems, affine transformations, OpenGL geometric transformation functions, Computer animation: Design of animation sequences, traditional animation techniques, Key frame systems, motion specifications, OpenGL animation procedures. **[7 Hrs]**

UNIT 5

Visible surface detection methods: Back-face detection, depth-buffer method, A-buffer method, Scan-line method, Wire-frame visibility methods, Color models, Standard primaries and Chromaticity diagram, RGB, YIQ, CMY, CMYK and HLS color models. [7 Hrs]

Text Book

1. Computer Graphics with OpenGL, Donald D Hearn, M. Pauline Baker and Warren Carithers, Fourth edition, Pearson, 2016.

Reference Books

1. Computer Graphics Principles and Practice in C, James D Foley, Andries van Dam, Steven K Feiner, F. Hughes John, Second edition, Pearson, 2012.
2. OpenGL Programming Guide, Dave Shreiner, 8th Edition The Official Guide to Learning OpenGL, Version 4.3, Addison Wesley, 2015.

E-Book

1. <http://math.hws.edu/graphicsbook/>

MOOCs

1. <https://www.mooc-list.com/course/interactive-computer-graphics-coursera>
2. <https://www.class-central.com/mooc/548/edx-cse167x-computer-graphics>

COURSE OUTCOMES (COs)

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

CO1	Gain proficiency of computer graphics algorithms like modeling, transformations and rendering
CO2	Perform simple 2D and 3D graphic transformations by applying graphics primitives.
CO3	Recognize different techniques for analysing 2D, 3D and visible surface detection object geometry.
CO4	Design algorithms for various graphics shapes including ellipse, hyperbola and triangle.
CO5	Experiment various graphic primitives using OpenGL programming.
CO6	Create effective OpenGL functions to solve graphics programming issues in 2D & 3D Object modeling.

Course Title	VIRTUALIZATION AND CLOUD SECURITY				
Course Code	16IS6DEVCS	Credits	4	L-T-P-S	3-0-1-0
CIE	50 Marks	SEE	100 Marks (50% Weightage)		
Contact Hours/ Week	5	Total Lectures	39		

UNIT 1

Network centric computing and network centric content, Peer-to-peer systems, Cloud computing: an old idea whose time has come, Cloud computing delivery models and services, Ethical issues, cloud vulnerabilities, Major challenges, Parallel computing, Cloud infrastructure: cloud computing - at Amazon, Google perspective, Microsoft windows Azure and online services, Open source software platforms for private clouds, Cloud storage diversity and vendor lock-in, Cloud computing interoperability: the Intercloud, Responsibility sharing between user and cloud service provider. **[8 Hrs]**

UNIT 2

Architectural styles for cloud applications, workflows: Coordination of multiple activities, Coordination based on a state machine model: The ZooKeeper, The MapReduce programming model, Virtualization, Layering, Virtual machines, Full virtualization & paravirtualization, Hardware support for virtualization. **[8 Hrs]**

UNIT 3

Cloud information security objectives, Cloud security services, Relevant cloud security design principles, Secure cloud software requirements, Secure cloud software testing, Cloud computing and business continuity planning/disaster recovery. **[8 Hrs]**

UNIT 4

Security policy implementation, Virtualization security management, Architectural considerations, Identity management and access control, Autonomic security. **[7 Hrs]**

UNIT 5

Cloud computing risk issues - The CIA Triad, Threats to infrastructure, data and access control, Cloud service provider risks. Cloud security risks, Privacy and privacy impact assessment, Trust, Operating system security, Virtual machine security, Security risks posed by a management OS. Cloud computing life cycle issues – Encryption and key management, Retirement. **[8 Hrs]**

Text Books

1. Cloud Computing – Theory and Practice, Dan C Marinescu, First Edition, Elsevier, 2014.
2. Cloud Security, Ronald L Krutz and Russell Dean Vines, Wiley, 2014.

Reference Books

1. Cloud Computing: Architecting Next - Gen Transformation Paradigms, Dr. Kumar Saurabh, Fourth Edition, Wiley, 2014.
2. Michael Miller, “Cloud Computing: Web-Based Applications That Change the Way You Work and Collaborate Online”, First Edition, Pearson Education, New Delhi, 2009.

E-Books

1. <http://www.fujitsu.com/sg/Images/white-book-of-cloud-security.pdf>
2. <http://www.hp.com/techreports/2012/HPL-2012-80R1.pdf>

E-Resource

1. www.drsvn.com/cloud.html
2. <https://www.youtube.com/watch?v=QYzJl0Zrc4M>

COURSE OUTCOMES (COs)

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

CO1	Understand computing systems, cloud-paradigms, security and privacy issues in cloud environments.	
CO2	Apply the different computing principles using cloud environment.	PO1
CO3	Analyse the importance of virtualization in distribute computing and how this has enabled the development of cloud computing.	PO2
CO4	Design cloud environment for different real time requirements.	PO3
CO5	Implement virtualization and cloud scenarios.	PO5
CO6	Develop applications on cloud environments.	PO3, PO7

Course Title	MACHINE LEARNING				
Course Code	16IS6DEMLG	Credits	4	L-T-P-S	3-0-1-0
CIE	50 Marks	SEE	100 Marks (50% Weightage)		
Contact Hours / Week	5	Total Lecture Hours	39		

UNIT 1

Well-posed learning problems, Designing a learning system, A concept learning task, Concept learning as search, Find-S: Finding a maximally specific hypothesis, Version spaces and candidate-elimination algorithm & Remarks, Inductive Bias. **[8 Hrs]**

UNIT 2

Decision tree learning: Representation, Appropriate problems for decision tree learning, Basic decision tree learning algorithm, Hypothesis space search, Inductive bias, Issues **[7 Hrs]**

UNIT 3

Artificial Neural Networks: Representation, Appropriate problems for neural network learning, Perceptrons, Multilayer networks and Backpropagation algorithm and Remarks. **[7 Hrs]**

UNIT 4

Evaluating hypotheses - Motivation, Estimating hypothesis accuracy, Basics of Sampling theory, Bayes theorem, Concept learning, Maximum likelihood and Least-Squared error hypotheses, Maximum Likelihood hypotheses for predicting probabilities, Bayes Optimal Classifier, Naive Bayes Classifier. **[11 Hrs]**

UNIT 5

Instance based learning: k-nearest neighbor learning, Locally weighted regression, Radial basis functions, Analytical learning: Introduction, Reinforcement Learning: Introduction **[6 Hrs]**

Text Book

1. Machine Learning by Tom M Mitchell, McGrawHill education, Indian Edition, 2016.

Reference Books

1. Introduction to Machine Learning 3rd Edition by Ethem Alpaydin, PHI, 2015.
2. Machine Learning in Action by Peter Harrington, Manning Publications, 2012.

E-Books

1. <http://www.cs.huji.ac.il/~shais/UnderstandingMachineLearning/understanding-machine-learning-theory-algorithms.pdf>
2. <http://alex.smola.org/drafts/thebook.pdf>

MOOCs

1. <https://www.coursera.org/learn/machine-learning>
2. <https://www.udacity.com/course/intro-to-machine-learning--ud120>

COURSE OUTCOMES (COs)

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

CO1	Comprehend on machine learning algorithms based on concept learning, decision trees, neural networks, hypothesis and classifiers.	
CO2	Apply specific principles to obtain solutions for appropriate problems in learning tasks and instances.	PO1
CO3	Identify the challenges to analyze different approaches for training intelligent systems.	PO2
CO4	Evaluate hypothesis with suitable considerations for design of solutions to specific tasks.	PO3
CO5	Investigate the strategies in well-posed and instance based problems to arrive at valid conclusions.	PO4
CO6	Conduct experiments to demonstrate applicable techniques in machine learning.	PO5

Course Title	PARALLEL AND DISTRIBUTED COMPUTATIONS THROUGH JAVA				
Course Code	16IS6DEPDC	Credits	4	L-T-P-S	3-0-1-0
CIE	50 Marks	SEE	100 Marks (50% Weightage)		
Contact Hours / Week	5	Total Lecture Hours	39		

UNIT 1

Introduction to event handling, Events classes, Event listener interfaces, Capabilities and limitations of applets, Java applet security, Life cycle of an applet, HTML and Java applets, Passing parameters to applets, Applets with UI components, Applet with event handling, Creating a threaded applet. **[7 Hrs]**

UNIT 2

Files: Overview of I/O package, Streams overview, Character stream, Byte stream, File class, Streamtokenizer class, Product components of JDBC, Establishing a connection, Transactions, Introducing JDBC Rowsets, Types of parallelism in database processing, **[8 Hrs]**

UNIT 3

Overview of High performance computing and Java framework, Concurrent techniques, Basic layers of Concurrent technique, Parallel computer memory architectures, SMPs, MPPs and Parallel processing, Parallel and distributed programming models, Shared memory model, Threads model, Data parallel model, Flynn's programming models, Pipelined computations. **[8 Hrs]**

UNIT 4

Automatic vs Manual parallelization, Partitioning, Communications, Synchronization, Data dependencies, Load balancing, Granularity, Parallel Input and Output, Limits and Costs of parallel programming, Introduction to Java socket programming, Socket class, Serversocket class, Datagrampacket class, DatagramSocket class, InetAddress class, Remote method invocation, CORBA Programming Model. **[8 Hrs]**

UNIT 5

Overview of EJB, Session Beans, Entity Bean, JavaMessagingServices, Web based distributed programming: Java Server Pages, Java Server Faces, Facelets. **[8 Hrs]**

Text Book

1. An Introduction to Parallel and Distributed Computations through JAVA, Bala Dhandayuthapani Veerasamy, Penram International Publishing, 2014.

Reference Books

1. Murach's Java Servlets and JSP by Joel Murach and Michael Urban, 3rd edition, SPD, 2016.
2. Java - The Complete Reference (JDK 8) by Herbert Schildt, 9th edition, Tata McGraw Hill, Edition 2014.
3. Java Programming: A Practical Approach by Xavier, McGrawHill, 2011.

E-Books

1. <https://www.redbooks.ibm.com/redbooks/pdfs/sg245755.pdf>
2. [http://www.freebookcentre.net/Java-Books-Download/Java-Distributed-Computing-\(Jim-Farley\).html](http://www.freebookcentre.net/Java-Books-Download/Java-Distributed-Computing-(Jim-Farley).html)
3. <http://www.freebookcentre.net/Java-Books-Download/Java-Server-Side-Programming.html>

MOOCs

1. <https://www.class-central.com/tag/java>
2. <https://www.coursetalk.com/providers/udemy/courses/java-database-connection-jdbc-and-mysql>

COURSE OUTCOMES (COs)

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

CO1	Understand the basics of parallel and distributed computing environments.	
CO2	Design event listener interfaces and applets.	PO1
CO3	Assess the concepts of issues and tasks in parallel and distributed computing, different parallel architectures, programming models and algorithms for common operations.	PO1
CO4	Analyse connectivity and parallelism in database processing using files.	PO2
CO5	Design parallel and distributed programming models for pipelined computations.	PO2
CO6	Demonstrate parallel programming applications using CORBA.	PO2

Course Title	MOBILE APPLICATION DEVELOPMENT				
Course Code	16IS7DCMAD	Credits	3	L-T-P-S	3-0-1-2
CIE	50 Marks	SEE	100 Marks (50% Weightage)		
Contact Hours / Week	5	Total Lecture Hours	39 Hours		

UNIT 1

Setting up Android studio environment, Learning Android's fundamental components, Defining UI through layout files, Implementing programming logic, Updating AndroidManifest.xml, Placing files in Android project, Android activity life cycle, More on resources and intents, UI development in Android, Android's common controls: Text, Button, Imageview, Date & Time, Mapview. **[8 Hrs]**

UNIT 2

Understanding Adapters, Using adapters with AdapterViews: Listview, Gridview, Spinner, Gallery, Creating custom adapters, Understanding layout managers, Working with menus through XML files and Java code, expanded menus, Icon menus, Submenus, Context menus, Dynamic menus, Exploring action bars, Implementing standard action bar, Tabbed action bar, List-based action bar, Styles and Themes. **[8 Hrs]**

UNIT 3

Structure and life cycle of fragment, Understanding dialog fragments, Exploring preferences framework, Packages and processes, Code pattern for sharing data, Understanding library projects, components & threads, handlers. **[8 Hrs]**

UNIT 4

Consuming HTTP services: Using HTTPClient for GET and POST requests, Essentials of a simple AsyncTask, Sending a broadcast, Using notifications from a receiver, Setting up a simple alarm. **[8 Hrs]**

UNIT 5

Understanding the mapping package: Obtaining and adding Maps API key to application, Saving state using internal files, Storing data using SQLite: Creating database, defining database through DDLs, Inserting, updating, deleting, reading rows, Applying transactions. **[7 Hrs]**

Textbook

1. Pro Android 5, Dave MacLean, Satya Komatineni and Grant Allen, Apress, 2015.

References Books

1. Expert Android Studio, Murat Yener, Onur Dunder, Wrox publications, 2017.
2. Enterprise Android, Zigurd Mednieks, G Blake Meike, Laird Dornin, Zane Pan, Wrox publications, 2014.

E-Books

1. http://www.techotopia.com/index.php/Android_Studio_Development_Essentials_-_Android_6_Edition
2. <http://www.kmvportal.co.in/Course/MAD/Android%20Book.pdf>
3. <http://www.e-booksdirectory.com/details.php?ebook=10932>

MOOCs

1. <https://www.coursera.org/specializations/android-app-development>
2. <https://in.udacity.com/course/android-basics-user-interface--ud834>

COURSE OUTCOMES (COs)

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

CO1	Understand the components, controls, adapters, menus, packages, services and related functionalities of Android for mobile application development.	
CO2	Apply the knowledge of constructs in Java and XML to obtain feasible modules as a solution for engineering problems.	PO1
CO3	Analyse packages, project libraries and services to obtain a framework for solving problems in development of mobile applications.	PO2
CO4	Obtain the code patterns by investigating resources to arrive at valid conclusions.	PO4
CO5	Create GUI programs based on common controls, themes, actions, components, handlers and mapping packages using Android Studio/SDK.	PO5
CO6	Design mobile Apps to provide solutions for real world problems by incorporating multidisciplinary settings.	PO3, PO9, PO10

Course Title	MOBILE COMPUTING				
Course Code	16IS7DCMCT	Credits	6	L-T-P-S	3-0-1-2
CIE	50 Marks	SEE	100 Marks (50% Weightage)		
Contact Hours / Week	5	Total Lecture Hours	39 Hours		

UNIT 1

Introduction: PCS Architecture, Cellular Telephony, Cordless Telephony and Low-Tier PCS, Third-Generation Wireless Systems, Mobility Management: Handoff, Roaming Management, Roaming Management under SS7, Roaming Management for CT2, Handoff Management: Detection and Assignment -Handoff Detection, Strategies for Handoff Detection, Channel Assignment. **[9 Hrs]**

UNIT 2

Mobile Computing Architecture: Internet, Ubiquitous network, Architecture of mobile computing, Mobile computing through internet. GSM System for mobile communications: GSM System for mobile communications, GSM Architecture, GSM entities, Call routing in GSM, PLMN interfaces, GSM addresses and identifiers, Network aspects in GSM, Mobility management. **[9 Hrs]**

UNIT 3

GSM Network Signaling: MAP Service Framework, MAP protocol Machine. Short Message Service-Mobile computing over SMS, SMS. VoIP Service for Mobile Networks: VOIP, H.323 framework for VOIP, SIP, Comparison between VOIP and SIP. **[7 Hrs]**

UNIT 4

General Packet Radio Service (GPRS)-GPRS and PDN, GPRS Network Architecture, GPRS Network operations, Enhanced Data Rates for GSM Evolution. Wireless Application Protocol (WAP) -WAP Model, WAP Gateway, WAP Protocols. **[7 Hrs]**

UNIT 5

Third-Generation Mobile Services-Paradigm Shifts in Third-Generation Systems, W-CDMA and cdma2000 ,Improvements on Core Network ,Quality of Service in 3G, Advances in 4G communication networks: A 5G perspective, Wireless Local Loop: Wireless Local Loop Architecture ,Deployment Issues, TR-45 Service Description, Wireless Local Loop Technologies. **[7 Hrs]**

Text Books

1. Mobile Computing-Technology, Applications and Service Creation by Asoke K Talukder, Hasan Ahmed, Roopa R Yavagal, 2nd Edition, 2014, Mc Graw Hill Education.
2. Wireless and Mobile Network Architectures, by Yi-Bing Lin, Imrich Chlamtac, WILEY-INDIA Edition
3. Advances in Mobile Computing and Communications, by M.Bala Krishna, Jaime Lloret Mauri

Reference Books

1. Mobile Communications, Jochen Schiller, 2nd Edition
2. Wireless Communication Systems, Ke-Lin Du and M.N.S.Swamy

E-Books

1. [http://faculty.petra.ac.id/resmana/private/wireless/Handbook_of_Wireless_Networks_and_Mobile_Computing_\(Wiley-2002\).pdf](http://faculty.petra.ac.id/resmana/private/wireless/Handbook_of_Wireless_Networks_and_Mobile_Computing_(Wiley-2002).pdf)
2. <http://www.ee.iitm.ac.in/~giri/pdfs/EE5141/book2-rapaport.pdf>

MOOCs

1. <https://www.mooc-list.com/course/wireless-communication-emerging-technologies-coursera>
2. <https://www.coursera.org/learn/wireless-communication-technologies>

COURSE OUTCOMES (COs)

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

CO1	Gain the knowledge about the fundamentals of Mobility Management, Computing Architecture, communications, Network Signalling, Services.	
CO2	Formulate the mobile communication services, signals, protocols by applying various technologies such as GSM, Wimax and GPRS.	PO1
CO3	Analyse the strategies used in the implementation of mobile computing architecture.	PO2
CO4	Demonstrate the properties of communication system components and processes by designing sample wireless networks.	PO3
CO5	Ascertain the technological growth to interpret various types of mobile generation services.	PO4
CO6	Simulate wireless communication network by using modern tools like Qualnet/Matlab and analyse the obtained results to arrive at substantial conclusions by communicating effectively as a member of diverse team.	PO2, PO5, PO9, PO10

Course Title	INDIAN CYBER LAW AND IT				
Course Code	16IS7DCICL	Credits	3	L-T-P-S	3-0-0-0
CIE	50 Marks	SEE	100 Marks (50% Weightage)		
Contact Hours / Week	3	Total Lecture Hours	39		

UNIT 1

Understanding computers, Internet and Cyber laws: Modern Era, Need for cyber Laws, Historical Perspective, The Character and Use of Internet technologies.

Conceptual Framework of E-Commerce : E-Governance : What is E-Commerce, growth and Development,, Various modes, Mechanism involved in the operation of Internet, Type of Players, Web Development and hosting Agreements, Web Hosting, The Problem of Internet Jurisdiction, Illustrative cases about Cyberspace Jurisdiction, Types of Websites.

The Role of Electronic Signatures in E-Commerce with Reference to Free Market Economy in India: Introduction, basic Laws of Digital and Electronic Signature in India, Authentication of Electronic Signatures and Electronic Records, UNCITRAL Model on Electronic Commerce, Securing Electronic Transactions Cryptography and Securing, The Concept of Hash Function, Utility of Digital Signature's Verification, certification, Certifying Authorities and Status of Electronic signature under Indian Law, The Appointment of controllers and Other Officers and their functions, Authentication and Verification of electronic /Digital Signatures, The cost and Benefits of implementing electronic /digital signatures in E-commerce in India, Security privacy of electronic/digital signatures, private key escrow and key recovery systems, obligation of a certifying authority and certificate management, security threats to cyberspace and e-commerce, international efforts to enact laws relating to electronic/digital signatures, Different approaches to digital signatures. [8 Hrs]

UNIT 2

Legal aspects of Electronic Records/Digital Signatures: Recognition of electronic records, Positions in US, Australia , The Legal recognition of electronic /digital signatures, electronic records and electronic signatures/digital signatures and their use by the government and its agencies in India, retention of electronic records in India, UNCITRAL Model Law on attribution of data Messages, Positions in US, India, The central government's power to make rules in India, Electronic records, Attribution acknowledgement and dispatch in India, Acknowledgement of receipt of electronic record in India, UNCITRAL Model Law relating to Acknowledgement of Data Messages, the time and place of dispatch and receipt of electronic records in India, securing electronic record and electronic/digital signatures in India, Verification of electronic signatures in India,

The roles and regulations of certifying authorities in India : Scenario, The role of certifying authority, Appointment of controller and his functions, obtaining license to issue electronic/digital signature certificates in India, Renewal and suspension of license of the certifying authority, procedure for the grant or rejection of license to the CA's, Some procedures and security guidelines for CA's, procedures and prior requirements for surrender of license, and Cessation as CA's, Duties of CA for disclosure of Information , Electronic signature certificate to be issued by CA's,

Suspension, Archiving and revocation, rules of compromise and revocation of Electronic/Digital Signature Certificate, The rules of confidential information and Access to confidential information, Duties of subscribers under the law, the concept of acceptance of electronic/digital certificate by subscriber. **[8 Hrs]**

UNIT 3

Protection of Intellectual Property Rights in Cyberspace in India: The cyberspace, the relevance of domain names in intellectual property rights, deception by squatting in cyberspace, bad faith in relation to domain name infringement, some leading cases involving complaints from India before WIPO, protection of copyright on cyberspace, rights of software copyright owners, infringement of copyright on cyberspace, cyberspace, the internet, websites and the nature of the copyright, linking, hyperlinking and framing, remedies for infringement of copyright on cyberspace, the liabilities of an Internet Service Provider (ISP) in cyberspace, cyberspace and protection of patents in India, patents as a form of Intellectual Property. **[6 Hrs]**

UNIT 4

Penalties compensation and adjudication of violations of provisions of IT ACT and judicial review: Penalty and compensation for damage to computer, computer system, compensation for failure to protect data, penalty for failure to furnish information, return or any other penalty, adjudication of disputes under the IT Act, cyber appellate tribunal, its functions and powers under the IT act, compounding of contraventions and recovery of penalty or compensation, appeal to the high court under the IT act and judicial review under the constitution of India Some important offences under the Cyberspace Law and the Internet in India: Obscenity and Pornography on Cyber space, Hacking on the Cyberspace and Internet, Other Offences – computer resource, Violation of the Right of Privacy on Cyberspace Internet, Punishment for Violation of Privacy, Breach of Confidentiality and Privacy under the IT Act, Terrorism on Cyber Space/Internet. **[8 Hrs]**

UNIT 5

Other Offences under the Information Technology Act in India : A brief overview of cybercrimes, Offences by Intermediaries, power of the controller to give directions to CA's , Power to Issue directions for interception or monitoring or decryption of information, Power to issue directions for blocking for public access of any information, Power to authorize to monitor and collect traffic data or information for cyber security, Offences relating to Protected system, The offence of misrepresentation, offence of publishing electronic signature certificate with false particulars, confiscation as penalty for contravention of the provisions of the act, compounding of offences under the IT Act, Cognizance of Offences and Bail under the IT Act, Punishment for Abetment and Attempt to Commit Offences under the IT Act, Commission of Offences by Companies under the IT Act, The Power of Police Officer and other Officers to Enter and Search, Protection of Actions taken in a good faith, Some Amendments made under the Indian penal Code by IT(Amendment) Act, 2008.

Role of electronic evidence and the miscellaneous provisions of the IT act: Indian evidence act, examiner of electronic evidence, amendments introduced in the Indian Evidence Act, 1872, the appointment of National Nodal Agency, Indian computer emergency response team, law regarding electronic cheques and truncated cheques, the information technology act to have overriding effect, power of central government to make rules under the act. Constitution of advisory committee,

powers of the controller and the state government to make rules, reasonable security practices and procedures and sensitive personal information rules, 2011. [9 Hrs]

Text Book

1. Cyber Laws and IT Protection by Harish Chander, Eastern Economy Edition, PHI Learning Private Limited, 2012.

Reference Books

1. Textbook on Cyber Law by Pavan Duggal, Universal Publications, 2nd edition , 2016.
2. Cyberlaw-The Indian Perspective by Pavan Duggal, Saakshar Law Publications, 2002.

E-books

1. https://www.tutorialspoint.com/information_security_cyber_law/information_security_cyber_law_tutorial.pdf
2. <http://www.cyberpolicebangalore.nic.in/pdf/Cyber%20law%20IPC.pdf>
3. <http://osou.ac.in/eresources/introduction-to-indian-cyber-law.pdf>

MOOCs

1. <https://www.coursera.org/learn/cyber-security-domain>
2. http://www.leapcourses.com/course_details.php?course_code=tech_law_int_ecom

COURSE OUTCOMES (COs)

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

CO1	Understand IT Act and its Amendments, Cyber Law, Legal issues, Intellectual property rights and Certifying Authorities.	
CO2	Make use of IPR and its practices to commit towards social responsibilities.	PO6
CO3	Identify various cybercrimes penalties and compensation with the knowledge of IT Act.	PO7
CO4	Infer the impact of cybercrimes on society.	PO8
CO5	Adapt UNCITRAL Model Law for lifelong learning.	PO12
CO6	Communicate effectively and make effective presentation on recent cybercrimes cases.	PO8, PO9, PO10, PO12

Course Title	ADVANCED WEB PROGRAMMING				
Course Code	161S7DEAWP	Credits	3	L-T-P-S	3-0-0-0
CIE	50 Marks	SEE	100 Marks (50%Weightage)		
Contact Hours	3	Total Lecture Hours	39 Hours		

UNIT 1

Introducing jQuery: About JavaScript Libraries, Getting jQuery, Adding jQuery to a Page, Modifying Web Pages: An Overview, Understanding the Document Object Model, Selecting Page Elements: The jQuery Way, Adding Content to a Page Setting and Reading Tag Attributes, Reading, Setting, and Removing HTML Attributes Acting on Each Element in a Selection Automatic Pull Quotes. **[8 Hrs]**

UNIT 2

Action/Reaction: Making Pages Come Alive with Events: What Are Events? Using Events the jQuery Way, Introducing Events, More jQuery Event Concepts, Advanced Event Management Animations and Effects: jQuery Effects, Login Slider, Animations, Performing an Action after an Effect Is Completed. **[8 Hrs]**

UNIT 3

Common jQuery Tasks :Swapping Images, Adding Rollover Images, Photo Gallery with Effects, Controlling How Links Behave, Opening External Links in a New Window, Creating New Windows, Introducing jQuery Plug-ins, Build a Responsive Navigation Bar. **[7 Hrs]**

UNIT 4

Ajax with jQuery: Ajax the jQuery Way, JSON, Introducing JSONP, Adding a Flickr Feed to Your Site Case Study: Adding Flickr Images to Your Site.
Case study: Building a To-Do List Application: Add a Button, Add a Dialog Box, Adding Tasks, Marking Tasks as Complete, Deleting Tasks. **[8 Hrs]**

UNIT 5

Introduction to Ruby: Origins and Uses of Ruby, Scalar Types and Their Operations, Simple Input and Output, Control Statements, Fundamentals of Arrays, Hashes, Methods, Classes, Blocks and Iterators, Pattern Matching.
Introduction to Rails: Overview of Rails, Document Requests, Rails Applications with Databases. **[8 Hrs]**

Text Books

1. Robert W Sebesta, “Programming the World Wide Web”, 8th Edition, Pearson Publication, 2015.
2. David Sawyer Mcfarland, “JavaScript & jQuery: The Missing Manual”, 3rd edition, O’Reilly Media, 2014.

Reference Books

1. Callum Macrae, “Learning from jQuery, Building on Core Skills”, O’Reilly Media, 2013
2. Steven Holzner: Ajax: A Beginner’s Guide, Tata McGraw Hill, 2009.
3. Yukihiro Matsumoto, “The Ruby programming language”, O’Reilly Media, 2008

E-Books

1. <http://ruby-doc.com/docs/ProgrammingRuby/>
2. <http://jqfundamentals.com/legacy/>

MOOCs

1. <https://www.udacity.com/course/intro-to-ajax--ud110>
2. <https://www.udacity.com/course/intro-to-jquery--ud245>

COURSE OUTCOMES (COs)

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

CO1	Paraphrase the basic structure and syntax of Ruby, Rails, Ajax and JQuery	
CO2	Apply the concepts of Ruby, Rails, Ajax and JQuery to add dynamicity and animations to web pages.	PO1
CO3	Correlate the events and analyse the document modeling in establishing database connections through web pages.	PO2
CO4	Integrate the interactive web applications using jQuery, Json, Ajax.	PO3
CO5	Incorporate the information to provide valid conclusion on usage of various scripting frameworks.	PO4
CO6	Demonstrate the implementation of scripting programs using modern web frameworks and tools.	PO5, PO9, PO10

Course Title	STORAGE AREA NETWORKS				
Course Code	16IS7DESAN	CREDITS	3	L-T-P-S	3-0-0-0
CIE	50 Marks	SEE	50 Marks		
Contact Hours/Week	03	Total Lecture Hours	39 Hours		

UNIT 1

Introduction: Server Centric IT Architecture and its Limitations; Storage – Centric IT Architecture and its advantages. The Data Storage and Data Access problem; The Battle for size and access.

Intelligent Disk Subsystems: Architecture of Intelligent Disk Subsystems; Hard disks and Internal I/O Channels; JBOD, Storage virtualization using RAID and different RAID levels; Caching: Acceleration of Hard Disk Access; Intelligent disk subsystems, Availability of disk subsystems. **[8 Hrs]**

UNIT 2

I/O Techniques: The Physical I/O path from the CPU to the Storage System; SCSI; Fibre Channel Protocol Stack; Fibre Channel SAN; IP Storage. **[7 Hrs]**

UNIT 3

Network Attached Storage: The NAS Architecture, The NAS hardware Architecture, The NAS Software Architecture, Network connectivity, NAS as a storage system.

File System and NAS: Local File Systems; Network file Systems and file servers; Shared Disk file systems; Comparison of fibre Channel and NAS. **[8 Hrs]**

UNIT 4

Storage Virtualization: Definition of Storage virtualization, Implementation Considerations, Storage virtualization on Block or file level, Storage virtualization on various levels of the storage Network, Symmetric and Asymmetric storage virtualization in the Network. **[8 Hrs]**

UNIT 5

Management of Storage Network: System Management, Requirement of management System, Support by Management System, Management Interface, Standardized Mechanisms, Property Mechanisms, In-band Management, Use of SNMP, CIM and WBEM, Storage Management Initiative Specification (SMI-S), CMIP and DMI, Optional Aspects of the Management of Storage Networks. **[8 Hrs]**

Text Book

1. Ulf Troppens, Rainer Erkens and Wolfgang Muller: Storage Networks Explained, Wiley India, 2015.
2. Robert Spalding: “Storage Networks The Complete Reference”, Tata McGraw-Hill, 2013.

Reference Books

1. Marc Farley: Storage Networking Fundamentals – An Introduction to Storage Devices, Subsystems, Applications, Management and File Systems, Cisco Press, 2005.
2. Richard Barker and Paul Massiglia, Storage Area Network Essentials A Complete Guide to understanding and Implementing SANs, Wiley India, 2006.

E-Book

1. <http://bio.gsi.de/DOCS/www.redbooks.ibm.com/redbooks/pdfs/sg245470.pdf>

MOOCs

1. <http://www.virtualnuggets.com/emcs--storage-area-network.html>
2. <https://www.udemy.com/storageintro/>

COURSE OUTCOMES (COs)

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

CO1	Acquire the fundamental Knowledge of server centric, storage centric IT architecture, Intelligent disk subsystems, I/O techniques, NAS system and storage virtualization.	
CO2	Identify the need of different RAID levels, I/O techniques, Virtualization and management of storage networks.	PO2
CO3	Apply the concepts of RAID, SAN, NAS, file systems in storage area networks.	PO1
CO4	Determine the use of SNMP, CIM, WBEM and SMI-S by identifying its need in management of storage networks.	PO1, PO2
CO5	Compare different RAID levels and analyze the benefits of virtualization in SAN.	PO2
CO6	Extract information and make effective presentation and documentation on the benefits of the different network storage options for various application environments.	PO9, PO10

Course Title	CRYPTOGRAPHIC TECHNIQUES AND SECURITY				
Course Code	16IS7DECTS	Credits	3	L-T-P-S	3-0-0-0
CIE	50 Marks	SEE	100 Marks (50% Weightage)		
Contact Hours / Week	3	Total Lecture Hours	39 Hours		

UNIT 1

Overview: The OSI Security Architecture, Security Attacks, Security Services, Security Mechanisms, A Model for Network Security. Classical encryption techniques: Symmetric Cipher Model Cryptography Cryptanalysis and Brute-Force Attack, Substitution Techniques, Transposition Techniques, Steganography. **[7 Hrs]**

UNIT 2

Block cipher and DES: Block Cipher Principles, The Data Encryption Standard, A Des Example, The Strength of Des, Differential and Linear Cryptanalysis, Block Cipher Design Principles. Basic concepts in number theory and finite fields: Divisibility and The Division Algorithm, The Euclidean Algorithm, Modular Arithmetic, Finite Fields of the Form $GF(p)$, Polynomial Arithmetic, Fermat's and Euler's theorems, Chinese remainder theorem. **[9 Hrs]**

UNIT 3

AES: AES Structure General Structure, AES Transformation Functions, AES Key Expansion, An AES Example, AES Implementation. Block Cipher Operation, Multiple Encryption and Triple DES, Electronic Codebook Mode, Cipher Block Chaining Mode, Cipher Feedback Mode, Output Feedback Mode, Counter Mode. **[9 Hrs]**

UNIT 4

Asymmetric ciphers: Public-Key Cryptography and RSA - Principles of Public-Key Cryptosystems, The RSA Algorithm. Other Public-Key Cryptosystems: Diffie-Hellman Key Exchange, ElGamal Cryptosystem, Elliptic Curve Arithmetic, Elliptic Curve Cryptography. **[7 Hrs]**

UNIT 5

Cryptographic hash functions. Introduction: SHA 512, Digital signatures, Elgamal Digital signature scheme, Key management: Symmetric key distribution, Kerberos, Symmetric key Distribution using Symmetric Encryption, Symmetric key distribution using Asymmetric Encryption. **[7 Hrs]**

Text Books

1. Cryptography and network security principles and practice, William Stallings, Pearson, 6th Edition, 2014.
2. Cryptography and network security, Behrouz A Ferouzan, Special Indian Edition.

Reference Books

1. Cryptography: Theory and Practice", Douglas R. Stinson, CRC Press, Taylor and Francis, 3rd Edition.
2. Network security essentials, Application and standards, William Stallings, Pearson, 4th Edition, 2010.

E-Books

1. <http://fac.ksu.edu.sa/sites/default/files/cryptography-network-security>
2. <http://www.freetechbooks.com/a-course-in-cryptography-t1068.html>

MOOCs

1. <https://www.coursera.org/learn/crypto>
2. <https://www.mooc-list.com/tags/cryptography>

COURSE OUTCOMES (COs)

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

CO1	Comprehend the foundational theory of cryptographic techniques, principles and practices.
CO2	Effectively apply various cryptographic techniques to solve security threats.
CO3	Compare various cryptographic techniques that cause security risks in networks.
CO4	Identify the elements of security protocols and methods to solve problems.
CO5	Use appropriate public cryptosystem to evaluate information security risks.
CO6	Develop security solutions of standard cryptographic algorithms using modern tools.

COURSE NAME	FOUNDATIONS OF DATA SCIENCE				
COURSE CODE	16IS7DEFDS	CREDITS		L-T-P-S	3-0-0-0
CIE	50 Marks	SEE	50 Marks		
Contact Hours/Week	3	Total Lecture Hours	39 Hours		

UNIT 1

Introduction to Data Science: The data science process: the roles in a data science project, stages of a data science project; Loading data into R: working with data from files, exploring data: Spotting problems using graphics and visualization; managing data: Cleaning and sampling for modeling and validation. **[9 Hrs]**

UNIT 2

Modeling Methods: Choosing and evaluating models - Mapping problems to machine learning tasks, evaluating models, validating models. Memorization methods – building single variable models, building models using many variables. **[7 Hrs]**

UNIT 3

Modeling Methods: Using Linear regression, Using logistic regression, Unsupervised methods - cluster analysis: Hierarchical clustering, K-means algorithm, Association rules: Overview, mining association rules with the arules package, association rule takeaways. **[8 Hrs]**

UNIT 4

Recommendation Systems and Dimensionality Reduction: Recommendation systems: A model for recommendation systems, content-based recommendations, collaborative filtering; Dimensionality reduction: Eigenvalues and eigenvectors of symmetric matrices, Principal Component Analysis, Singular Value Decomposition; **[7 Hrs]**

UNIT 5

Delivering Results: Documentation and deployment: using knitr to produce milestone documentation, using comments and version control for running documentation, deploying models; producing effective presentations: presenting your results to the project sponsor, presenting your model to end users, presenting your work to other data scientists. **[8 Hrs]**

Text Books

1. Nina Zumel, John Mount, Practical Data Science with R, Manning Publications, 2014.
2. W. N Venables, D. M. Smith and the R Core Team, An introduction to R: Notes on R

Reference Books

1. Jure Leskovec, Anand Rajaraman, Jeffrey D. Ullman, “Mining of Massive Datasets”, Cambridge University Press, 2014.
2. Avrim Blum, John Hopcroft, and Ravindran Kannan, “Foundations of Data Science “, Cornell education, 2016.

E–Books

1. http://www.johndcook.com/R_language_for_programmers.html
2. <http://bigdatauniversity.com/>
3. <http://home.ubalt.edu/ntsbarsh/stat-data/topics.htm#rintroduction>

COURSE OUTCOMES (COs)

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

CO1	Acquire knowledge on data science using R tool, managing data, modeling methods, recommendation system and delivering the results.	
CO2	Apply machine learning concepts for data modeling, data evaluation and validation.	PO1
CO3	Examine predictive data model analysis and the method for dimensionality reduction.	PO2
CO4	Develop a model for content based systems and recommendation systems.	PO3
CO5	Effective presentations, documentations and models are designed to end users.	PO3
CO6	Demonstrate the data science process using modern tools.	PO5

Course Title	ADVANCED CLOUD COMPUTING				
Course Code	16IS7DEACC	CREDITS	3	L-T-P-S	3-0-0-0
CIE	50 Marks	SEE	50 Marks		
Contact Hours/Week	3	Total Lecture Hours	39 Hours		

UNIT 1

Cloud Computing Technologies and Applications: Cloud Computing: IT as a Service, Cloud Computing Model Application Methodology, Cloud Computing in Development/Test, Cloud-Based High Performance Computing Clusters, Use cases of Cloud Computing for Software Parks, an Enterprise with Multiple Data Centres. **[8 Hrs]**

UNIT 2

The Role of Networks in Cloud Computing: Cloud Deployment Models and the Network, Unique Opportunities and Requirements for Hybrid Cloud Networking, Network Architecture for Hybrid Cloud Deployments.
Migrating into a Cloud: Introduction, Broad Approaches to Migrating into the Cloud, Seven-Step Model of Migration into Cloud. **[8 Hrs]**

UNIT 3

Secure Distributed Data Storage in Cloud Computing: Cloud storage from LANs to WANs, Technologies for Data Security in Cloud Computing, Open Questions and Challenges. Vertical Load Distribution for Cloud Computing via Multiple Implementation options: Introduction, Overview, Scheduling Composite Services. **[8 Hrs]**

UNIT 4

Writing Web Service Clients: Web Services are Web Sites, The sample application, Making the Request: HTTP Libraries, Processing the Response: XML Parsers, JSON Parsers: Handling Serialized Data, Clients Make Easy with WADL. **[8 Hrs]**

UNIT 5

Ajax Applications as REST Clients: From AJAX to Ajax, The Ajax Architecture, A del.icio.us example, The advantages of Ajax, The Disadvantages of Ajax, REST Goes Better, Making the Request Handling the Response , JSON , Don't Bogart the Benefits of REST, Cross-Browser Issues and Ajax Libraries, Subverting the Browser Security Model. **[7 Hrs]**

Text Books

1. Handbook of Cloud Computing-ISBN 9781441965233-Springer
2. Cloud Computing –Principles and paradigms, Edited by Rajkumar Buyya, James Broberg, Andrzej Goscinski.
3. REST ful Web Services- Leonard Richardson and Sam Ruby, O'REILLY

Reference Books

1. Cloud Computing for Dummies-Judith Hurwitz, Robin Bloor, Marcia kaufman, Fern Halper.
2. Microsoft Private Cloud Computing-Aidan Finn, Hans Vredevoort, Patrick Lownds, Damian Flynn-Wiley Pulishing, Inc.
3. Service Level Agreements for Cloud Computing-Foreword by Jessica McCarthy, Springer, ISBN 0781461416135

E-Book

1. <http://www.informationweek.com/cloud/10-online-cloud-computing-courses-to-get-ahead/d/d-id/1320865>

MOOCs

1. <https://www.coursetalk.com/providers/udemy/courses/introduction-to-virtualization-Withvmware>.

COURSE OUTCOMES (COs)

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

CO1	Comprehend the fundamentals of cloud computing technologies, role of networks, migration, distribution, security, web services.
CO2	Apply the knowledge of cloud computing load distribution schemes, scheduling composite services, secure distribution of data for migrating applications to a cloud environment.
CO3	Analyse the concepts of cloud computing such as vertical load distribution, scheduling composite services, secure distribution of data, various representation of data, open questions and challenges facing in current information technology.
CO4	Design a cloud based applications by using the principles of cloud virtualization, cloud storage, security management, data management, load distribution for giving solutions to Information Technology services.
CO5	Synthesize the data handling using XML parsers, JSON parsers, and REST services to investigate the status of remote object.
CO6	Use modern tools to implement the cloud application using popular cloud technologies.

Course Title	SOFTWARE TESTING				
Course Code	16IS7DESTG	Credits	3	L-T-P-S	3-0-0-0
CIE	50 Marks	SEE	100 Marks		
Contact Hours	3	Total Lecture Hours	39		

UNIT 1

Basics of Software testing and examples: Basic definitions of software testing – Test cases – Identifying test cases – Examples: Generalized pseudo code- The triangle problem. Decision table-based testing: Decision Tables, Test cases for the triangle problem, Test cases for the Next Date function. **[7 Hrs]**

UNIT 2

Data Flow testing: Definition of Use testing, Slice-based testing. Life Cycle-Based Testing: Traditional Waterfall Testing, Testing in Iterative Life Cycles, Agile Testing, Agile Model-Driven Development. Integration Testing: Decomposition-Based Integration, Call Graph-Based Integration, Path-Based Integration, Example- integration Nextdate. System testing: Basic concepts of Threads, requirement specification, Model-Based Threads, Use Case-Based Threads. **[9 Hrs]**

UNIT 3

Issues in object-oriented testing: Units for object-oriented testing, Implications of composition and encapsulation, inheritance and polymorphism. Object-oriented integration testing: UML support for integration testing, MM-paths for object-oriented software. **[8 Hrs]**

UNIT 4

Object-Oriented System Testing: Currency converter UML description, UML-Based System Testing. Exploratory testing: Exploratory testing Explored, Exploring a Familiar Example, Observations and Conclusions. **[7 Hrs]**

UNIT 5

Model-Based Testing for Systems of Systems: Characteristics of Systems of Systems, Sample Systems of Systems. Test-Driven Development: Test-Then-Code cycles, Automation Test Execution, Java and Junit Example. Pros and Cons of TDD. Retrospective on MDD versus TDD. **[8 Hrs]**

Text Book

1. Software Testing, A Craftsman's Approach, C Paul C. Jorgensen, Auerbach Publications, 4th Edition, 2014.

Reference Books

1. Foundations of Software Testing, Aditya P Mathur, Pearson, 2008.
2. Software Testing and Analysis – Process, Principles and Techniques, Mauro Pezze, Michal Young, John Wiley & Sons, 2008.

E-Book

1. http://www.cs.ubbcluj.ro/~cretu/VVSS2014_2015/Bibliography/Springer.Verlag.Practical.Software.Testing.eBook-KB.pdf

MOOCs

1. https://onlinecourses.nptel.ac.in/noc16_cs16
2. <https://www.udacity.com/course/software-testing--cs258>

COURSE OUTCOMES (COs)

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

CO1	Understand the importance of software testing fundamentals and methodologies.
CO2	Apply the knowledge of software testing strategies and methodologies for testing performance.
CO3	Analyse various criteria's and specification for testing a software product.
CO4	Design effective test cases to achieve requirement specification.
CO5	Investigate various testing strategies to find bugs in the software.
CO6	Demonstrate the usage of modern testing tools to write automation scripts.

Course Title	MACHINE LEARNING				
Course Code	16IS7IE1ML	Credits	3	L-T-P-S	3-0-0-0
CIE	50 Marks	SEE	100 Marks (50% Weightage)		
Contact Hours / Week	5	Total Lecture Hours	39		

UNIT 1

Well-posed learning problems, Designing a learning system, A concept learning task, Concept learning as search, Find-S: Finding a maximally specific hypothesis, Version spaces and candidate-elimination algorithm & Remarks, Inductive Bias. **[8 Hrs]**

UNIT 2

Decision tree learning: Representation, Appropriate problems for decision tree learning, Basic decision tree learning algorithm, Hypothesis space search, Inductive bias, Issues **[7 Hrs]**

UNIT 3

Artificial Neural Networks: Representation, Appropriate problems for neural network learning, Perceptrons, Multilayer networks and Backpropagation algorithm & Remarks. **[7 Hrs]**

UNIT 4

Evaluating hypotheses - Motivation, Estimating hypothesis accuracy, Basics of Sampling theory, Bayes theorem, Concept learning, Maximum likelihood and Least-Squared error hypotheses, Maximum Likelihood hypotheses for predicting probabilities, Bayes Optimal Classifier, Naive Bayes Classifier. **[11 Hrs]**

UNIT 5

Instance based learning: k-nearest neighbor learning, Locally weighted regression, Radial basis functions, Analytical learning: Introduction, Reinforcement Learning: Introduction. **[6 Hrs]**

Text Book

1. Machine Learning, Tom M Mitchell, McGrawHill education, Indian edition, 2016.

Reference Books

1. Introduction to Machine Learning 3rd Edition, Ethem Alpaydin, PHI, 2015.
2. Machine Learning in Action, Peter Harrington, Manning Publications, 2012.

E-Books

3. <http://www.cs.huji.ac.il/~shais/UnderstandingMachineLearning/understanding-machine-learning-theory-algorithms.pdf>
4. <http://alex.smola.org/drafts/thebook.pdf>

MOOCs

3. <https://www.coursera.org/learn/machine-learning>
4. <https://www.udacity.com/course/intro-to-machine-learning--ud120>

COURSE OUTCOMES (COs)

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

CO1	Comprehend on machine learning algorithms based on concept learning, decision trees, neural networks, hypothesis and classifiers.	
CO2	Apply specific principles to obtain solutions for appropriate problems in learning tasks and instances.	PO1
CO3	Identify the challenges to analyse different approaches for training intelligent systems.	PO2
CO4	Evaluate hypothesis with suitable considerations for design of solutions to specific tasks.	PO3
CO5	Investigate the strategies in well-posed and instance based problems to arrive at valid conclusions.	PO4
CO6	Predict probabilities for machine learning applications.	PO4

Course Title	INFORMATION SECURITY				
Course Code	16IS7IE1IS	Credits	3	L-T-P-S	3-0-0-0
CIE	50 Marks	SEE	100 Marks (50% Weightage)		
Contact Hours / Week	3	Total Lecture Hours	39 Hours		

UNIT – 1

Introduction, What is security, CNSS security model, Components of information system, Systems development life cycle. Need for security: Threats, attacks. Legal, Ethical and Professional Issues in information security: Introduction, Laws and Ethics, International laws and legal bodies. **[7 Hrs]**

UNIT –2

Risk Management: An overview of risk management, Risk Identification, Risk Assessment-Introduction, Likelihood, Risk determination, Risk control strategies, Selecting a Risk control strategy, Quantitative vs Qualitative risk control practices-Benchmarking and best practices. **[7 Hrs]**

UNIT –3

Security Technology: Firewalls and VPNs – Introduction, Access control, Firewalls- Firewall processing modes, firewall structure, firewall architectures, selecting the right firewall, configuring and managing firewalls, Protecting Remote connections. **[9 Hrs]**

UNIT –4

Security technology: Intrusion detection and prevention systems and other security tools: Introduction, Intrusion detection and prevention systems, Honeypots, honeynets and padded cell systems, scanning and analysis tools, Biometric access controls. **[9 Hrs]**

UNIT –5

Information security Maintenance: Security Maintenance model, Monitoring External environment, Monitoring Internal environment, planning and risk assessment, Vulnerability assessment and remediation. Digital forensics: Digital forensics methodology **[7 Hrs]**

Text Book

1. Principles of Information Security Paperback , Michael E Whitman , Herbert J Mattord, 4th Edition, Cengage learning, 2012.

Reference Books

1. Network security essentials, William Stallings, 4th Edition, PHI, 2011.
2. Micki Krause, Harold F. Tipton, Handbook of Information Security Management, Vol. 1-3 CRC Press LLC, 2004.

E-Books

1. <http://faculty.kfupm.edu.sa/COE/marwan/richfiles/misc/Network-security-essentials-4th-edition-william-stallings.pdf>
2. <http://files.gu.edu.ge:8008/.../Principles%20of%20Information%20Security>

MOOCs

1. <https://www.mooc-list.com/course/information-security-and-risk-management-context-coursera>
2. <https://www.coursera.org/learn/cyber-security-domain/lecture/FLyKS/information-security-governance-and-risk-management>

COURSE OUTCOMES (COs)

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

CO1	Obtain knowledge on the fundamentals of information security, risk management, firewalls and security management.
CO2	Explore the various attacks, threats, access control, IDPS and risks.
CO3	Protect remote connections, access risks, detect intrusions using security principles.
CO4	Provide analysis for various risk controls, firewall detections and prevention systems.
CO5	Use suitable security technologies and VPNs to protect data.
CO6	Communicate effectively and make presentation on modern techniques for intrusion detection and prevention system of information security.

COURSE Title	PROJECT WORK				
Course Code	16IS7DCPRW	CREDITS	4	L-T-P-S	0-0-4-0
CIE	50 Marks	SEE	50 Marks		
Contact Hours/Week	0	Total Lecture Hours			

Rules and regulation

- A team should comprise of one or two members.
- Each team has to do a mini project.
- Internship projects are not allowed.
- Mobile / web apps or data base projects are not considered.

Scheme of Evaluation

The project is evaluated in two phases.

Review-1 will be conducted for 25 marks and review-2 for 25 marks.

Review -1 will be conducted based on the following parameters: Preliminary study, Literature survey, problem formulation and learning necessary modern tools, Software Requirement Specification, functional and non-functional requirements, high level design, documentation and presentation.

Review -2 will be conducted based on the parameters: Low level design, implementation, testing, experiment results and analysis, environmental and social context, documentation and presentation.

Marks spilt up are as follows:

Review1	25
Review2	25
Final CIE = SUM(Review1+Review2)	

SEE will be conducted for 50 marks.

COURSE OUTCOME (COs)

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

CO1	Review the existing systems to formulate the problem.
CO2	Select the modern tools for solving the identified engineering problem.
CO3	Design a solution for the chosen problem.
CO4	Analyze results of experiments conducted to arrive at valid conclusions and its impact on societal and environmental context.
CO5	Communicate effectively through presentation and demonstration of the project and write effective Report.
CO6	Function effectively in the team and contribute to the team.

Course Title	PROJECT WORK				
Course Code	16IS8DCPRW	Credits	11	L-T-P-S	0-0-11-0
CIE	50 Marks	SEE	50 Marks		
Contact Hours / Week	0	Total Lecture Hours	0		

**Rules and Regulations for UG Project work
VIII Semester Project work**

- Project work may be allotted to a single student or to a group of students not exceeding 3 per group.
- Project work would be done in two formats
Internship->Single student per team
OR
College Project- >single student or a group of students not exceeding 3 per group.
- Students are asked to make a team and register the batch with the Project Coordinator.
- Student Batches are allotted with faculty as guides.
- Students who do Internships have external guides in the Company.
- For Internship batch, Internal and External guide both should communicate to know the performance of the student.
- Problem Statement needs to be fixed after discussion with their respective guides.
- The Head of the Department shall form a review committee for project work.
- There shall be three reviews during the semester for evaluating the CIE.

Review-1: Shall be reviewed by the respective Guides and Project Coordinator.

At the time of Project Work Review 1, the students should be able to satisfy the below outcomes:

Sl. No.	Parameters	Marks (Max)
PR1.1	Preliminary Study	5
PR1.2	Research Review/Literature Survey	5
PR1.3	Existing System	5
Total		15

Review-2: Shall be reviewed by the respective Guides

At the time of Project Work Review 2, the students should be able to satisfy the below outcomes:

Sl. No.	Parameters	Marks (Max)
PR2.1	Identification, formulation and analysis of problem	5
PR2.2	Requirement specification	5
PR2.3	Design, implementation and Coding	10
PR2.4	Test case results	5
PR2.5	Analysis of Experimental results	10
Total		35

Review-3: Panel Review

The Panel review committee should include:

1. Senior faculty Member
2. Respective Guides of the students
3. Industry Person or Alumni who is working in Industry with minimum experience of 3 years.

Parameters for Evaluation of Panel Review:

1) Originality of the project (5 Marks)
2) Relevance of the project (5 Marks)
3) Improvement of technology through usage of modern tools, choice of SDLC/Financial Management (5 Marks)
4) Engagement level of each team member (5 Marks)
5) Presentation Skills (5 Marks)
6) Report Writing (5 Marks)
7) Completion of project on time (5 Marks)
8) Contribution to society, concern for environment (5 Marks)
9) Research component in the project (5 Marks)
10) viva-voce (5 Marks)
Total: 50 marks

Based on the Panel Review member's decision Best Project will be selected

Parameters for measuring Best Project are:

1) Originality of the project
2) Relevance of the project for the social needs
3) Improvement of technical skills through usage of modern tools
4) Measure of scalability of the project
5) Engagement level of each team member
6) Presentation skills and research component in the project

- The student shall make presentation on the progress made by him / her before the committee for every week and to be presented to their respective guides for Review-1 and Review-2.
- The student shall present the Complete Project to the Panel members for Panel Review.
- The total marks obtained in the three reviews shall be reduced for 50 marks and rounded to the nearest integer.
- The project report shall be submitted as per the approved guidelines as given by Head of the Institution.
- Same mark shall be awarded to every student within the project group for the project report.
- The viva- voce external examination shall carry 50 marks.
- Marks are awarded to each student of the project group based on the individual performance in the viva-voce external examination.

- If a candidate fails to submit the project report on or before the specified deadline, he/she is deemed to have failed in the Project Work and shall re-enroll for the same in a subsequent semester.

CIE Marks Distribution			SEE Marks Distribution
Review I	Review II	Review III (Panel Review)	Identification of Problem Domain and Detailed Analysis:10 marks Demonstration and Technical Skills:15 marks Project Report Writing & Presentation:15 marks Team Work/individual(internship):5 marks Ethics / Plagiarism:5 marks
15 marks	35 marks	50 marks	
Total : 50 marks		Total : 50 marks	
Average of both : 50 marks			
			Total : 50 marks

COURSE OUTCOMES (COs)

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

CO1	Formulate the significant aspects perceived from literature survey which helps in problem analysis.
CO2	Applying the Knowledge of problem analysis to identify the required design constraints to achieve solutions.
CO3	Select the platform/tools in the set of alternatives identified for the project synopsis.
CO4	Develop software to provide solution for the identified project.
CO5	Investigating for arriving towards optimum valid results for implemented software project.
CO6	Communicate effectively through presentation and demonstration of the project and write effective report.
CO7	Identify the community that shall benefit through the solution to the identified software problem and demonstrate concern for environment.
CO8	Function effectively in the team, contribute to the team and mentor/lead the team.
CO9	Demonstrate compliance to the prescribed standards/safety norms through implementation of the identified software problem.

COURSE TITLE	GREEN COMPUTING				
Course Code	16IS8DCGCT	Credits	4	L-T-P-S	3-0-0-1
CIE	50 Marks	SEE	100 Marks (50% Weightage)		
Contact Hours / Week	3	Total Lecture Hours	39 Hours		

UNIT 1

Green IT Overview: Introduction, Environmental Concerns and Sustainable Development, Environmental Impacts of IT, Green I , Holistic Approach to Greening IT, Greening IT, Applying IT for Enhancing Environmental Sustainability, Green IT Standards and Eco- Labelling of IT, Enterprise Green IT Strategy, Green Washing, Green IT: Burden or Opportunity?

Green Devices and Hardware: Introduction , Life Cycle of a Device or Hardware, Reuse, Recycle and Dispose **[8 Hrs]**

UNIT 2

Green Software: Introduction, Processor Power States, Energy-Saving Software Techniques, Evaluating and Measuring Software Impact to Platform Power.

Sustainable Software Development: Introduction, Current Practices, Sustainable Software, Software Sustainability Attributes, Software Sustainability Metrics, Sustainable Software Methodology, Defining Actions. **[8 Hrs]**

UNIT 3

Green Data Centres: Data Centres and associated energy challenges, Data centre IT infrastructure, Data Centre facility infrastructure: Implications for energy efficiency, IT infrastructure management, Green Data centre metrics, Green data storage: Introduction, Storage media power characteristics, energy management techniques for Hard disks, System-level energy management. **[8 Hrs]**

UNIT 4

Green Networks and Communications: Introduction, Objectives of Green Network Protocols, Green Network Protocols and Standards

Enterprise Green IT Strategy: Introduction, Approaching Green IT Strategies, Business Drivers of Green IT Strategy, Business Dimensions for Green IT Transformation, Organizational Considerations in a Green IT Strategy, Steps in Developing a Green IT Strategy, Metrics and Measurements in Green Strategies. **[8 Hrs]**

UNIT 5

Sustainable Information Systems and Green Metrics: Introduction, Multilevel Sustainable Information, Sustainability Hierarchy Models, Product Level Information, Individual Level Information, Functional Level Information, Organizational Level Information, Measuring the Maturity of Sustainable ICT.

Sustainable IT Services: Creating a Framework for Service Innovation: Introduction, Factors Driving the Development of Sustainable IT, Sustainable IT Services (SITS), SITS Strategic Framework. [7 Hrs]

Text Book

1. Harnessing Green IT: Principles and Practices, San Murugesan, G. R. Gangadharan, Wiley & IEEE, 2012.

Reference Books

1. Green Computing: Tools and Techniques for Saving Energy, Money, and Resources Bud E.Smith CRC Press.
2. Green Communications: Principles, Concepts and Practice- Samdanis et al, J. Wiley.

E-Books

1. <https://tinyurl.com/yb5tutng>
2. <http://dsc.soic.indiana.edu/publications/11-greenit-bookch.pdf>

MOOCs

1. <http://www.athabascau.ca/syllabi/comp/comp635.php>
2. <https://www.apus.edu/schedule-classes/schedule/course/issc387>

COURSE OUTCOMES (COs)

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

CO1	Create awareness about Green Software, Sustainable Software Development and Enterprise Green IT Strategy in the IT working environment leading to green computing.	
CO2	Apply the various methodologies to measure the sustainable performance of software projects.	PO1
CO3	Analyse sustainability challenges associated with data centre and strategies to mitigate energy consumption.	PO2
CO4	Analyse information requirements and methods utilized at multilevel sustainable information.	PO2, PO7
CO5	Propose solutions for various case studies in Green Computing.	PO6, PO7
CO6	Effective documentation and presentation of the technical paper with proposed sustainable solution for green computing	PO8, PO10, PO12

Course Title	SOFTWARE PROJECT MANAGEMENT AND FINANCE				
Course Code	16HS8DCSPF	CREDITS	2	L-T-P-S	2-0-0-0
CIE	50 Marks	SEE	100 Marks (50% Weightage)		
Contact Hours/Week	02	Total Lecture Hours	26 Hours		

UNIT 1

Project Management Framework: Introduction – What is a Project? What is Project Management? Project Lifecycle & Organization – Project lifecycle, Project Stakeholders, Organizational Influences.

Project Management Processes for a Project - Project Management Processes, Project Management Process Groups. **[4 Hrs]**

UNIT 2

Requirements Engineering: Functional and non-functional requirements, The software requirements document, Requirements specification, Requirements engineering processes, Requirements elicitation and analysis, Requirements validation, Requirements management, Software Deployment Scenarios. **[4 Hrs]**

UNIT 3

Project Management Knowledge Areas: Introduction, Project Integration Management, Project Scope Management, Project Time Management, Project Risk Management, Project Stakeholder Management. **[7 Hrs]**

UNIT 4

Financial and Quality Management: Financial Management – Cost Estimating, Cost Budgeting, Cost Control.

CMMI for Quality Management: Overview, Models, Representations, Maturity Levels, Capability Levels, Process Areas, Appraisals, Major Players, Best Practices. **[6 Hrs]**

UNIT 5

Entrepreneurship

Vision – Start, Define, Learn, Experiment Steer – Leap, Test, Measure, Pivot

Accelerate – Batch, Grow, Adapt, Innovate. **[5 Hrs]**

Text Books

1. A Guide to the Project Management Body of Knowledge (PMBOK® Guide) by Project Management Institute, 5th Edition, 2013.
2. The Lean Start up, Eric Ries, Crown Publishing Group, 1st Edition, 2011.
3. Software Engineering, Ian Sommerville, Addison-Wesley, 9th Edition, 2011.

Reference Books

1. Software Project Management in Practice by Pankaj Jalote, Addison-Wesley, 2002.

2. Software Engineering Principles and Practice, Waman S Jawadekar, Tata McGrawHill, 2009.
3. Principles of Software Project Management, Er. Rishabh Anand,2014

E-Books

1. <http://www.stpia.ir/files/The%20Lean%20Startup%20.pdf>
2. <http://www.cs.bilkent.edu.tr/~cagatay/cs413/PMBOK.pdf>

MOOCs

1. <https://www.mooc-list.com/course/project-management-techniques-development-professionals-edx>
2. <https://www.mooc-list.com/course/fundamentals-project-planning-and-management-coursera>
3. <https://www.mooc-list.com/course/project-management-basics-success-coursera>

COURSE OUTCOME (COs)

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

CO1	Acquire knowledge on software project management facets, phases, knowledge areas, financial management and entrepreneurship	
CO2	Apply the project management knowledge areas associated with software managerial activities and requirements engineering	PO1
CO3	Identify theories of financial management, quality management and entrepreneurship with related analysis	PO2
CO4	Interpret cost estimation and budgets for the given case studies	PO4
CO6	Demonstration of projects in terms of software managerial activities and requirements engineering	PO11
CO5	Recognize the impact of software project management principles on society through industry interaction	PO12, PO7

Course Title	FOREIGN LANGUAGE				
Course Code	16HS8DCFLG	Credits	3	L-T-P-S	2-0-0-1
CIE	50 Marks	SEE	100 Marks (50% Weightage)		
Contact Hours / Week	2	Total Lecture Hours	26		

UNIT 1

Basics in French: Introduction- purpose of learning French - pronunciation guide - alphabetic - vowels sounds Consonants sounds - English sound – nasal sound. **[4 Hrs]**

UNIT 2

France in the world: First step in FRANCE - General knowledge about FRANCE – basics French words – to know France culture – currency of France – flag of France – additional informations **[4 Hrs]**

UNIT 3

Communication skills-Special Focus: Salutations - Greeting formula in French - Self-presentation- Personals pronouns - Conjugaison of auxiliary verbs (to be and to have) - 1st group conjugaison (manger,danser,parler) – conjugaison of aller-Numbers(1 to 20) - Plural in French - arithmetical operations (addition, subtraction, division, multiplication) **[8 Hrs]**

UNIT 4

Grammar: Days of weeks - Numbers (20 to 100) - articles - prepositions -Nationalities-Adjectives- difference between male and female - presentation of an object. **[5 Hrs]**

UNIT 5

Conversation skills: Conversation - Colors - description verbs (habiter, aimer, parler, connaitre) Global overview, Verbs (etre, avoir, aller, aimer) - General revision – additional grammar-vocabulary. **[5 Hrs]**

Text Books

1. Apprenons Le Francais: Methods De Francais (Volume – 1) by Ms. Mahitha Ranjit and Ms. Monica Singh, Educational Publishers.
2. Easy French Step-by-step by Myrna Bell Rochester, McGraw-Hill Education, 1 edition.

E-Books:

1. <https://upload.wikimedia.org/wikipedia/commons/6/63/French.pdf>

MOOCs

1. <http://www.learner.org/resources/series83.html>
2. <http://oli.cmu.edu/courses/all-oli-courses/french-i-course-details/>
3. <https://www.duolingo.com/course/fr/en/Learn-French-Online>

COURSE OUTCOMES (COs)

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

CO1	Understand the basics of French with respect to SRW
CO2	Comprehend on a subject
CO3	Understand most speech on a familiar topic.
CO4	Communicate common and formal discourse.
CO5	Gratify requirement of everyday salutations and situations.

Course Title	WEB PROGRAMING AND INTERNET APPLICATIONS				
Course Code	16IS8IE2WI	Credits	3	L-T-P-S	3-0-0-0
CIE	50 Marks	SEE	100 Marks (50% Weightage)		
Contact Hours / Week	3	Total Lecture Hours	39		

UNIT 1

Programming in Perl 5: Why Perl?, On-line documentation, The basic perl program, Scalars, Arrays, Hashes, Control structures, Processing text, Regular expressions, Using files. **[7 Hrs]**

UNIT 2

CGI Scripting: What is CGI? Developing CGI applications, Processing CGI, Introduction to CGI .pm, CGI.pm Methods, Creating HTML pages dynamically, Using CGI.pm –An example. Building Web applications with Perl: Uploading files, Tracking users with hidden data, using relational databases. **[9 Hrs]**

UNIT 3

Introduction to Ajax: overview of Ajax, The basics of Ajax, Return Document forms, Ajax toolkits, Security and Ajax. **[9 Hrs]**

UNIT 4

Java web software: Introduction to servlets, Netbeans integrated development environment, storing information on clients, java server pages, java beans. **[7 Hrs]**

UNIT 5

Introduction to ASP.NET: Overview of the .NET framework, A Bit of C#, Introduction to ASP.NET, ASP.NET controls, ASP.NET AJAX, Web services. **[7 Hrs]**

Text Books

1. Web Programming: Building Internet Applications by Chris bates, 3rd Edition, Wiley India, 2015.
2. Programming World Wide Web by Robert w. Sebesta, 8th Edition, Pearson education, 2014.

Reference Books

1. Web Programming: Building Internet Applications, Chris Bates, Wiley India, 3rd Edition, 2006.
2. Internet Programming with Visual Basic, Budi Kurniawan, Imported edition.

E-Books

1. <http://www.webstepbook.com/>
2. <http://www.deital.com/books/coursesmart/>

MOOCs

1. <http://nptel.ac.in/courses/106105084/13>
2. <https://www.mooc-list.com/course/introduction-html5-coursera>

COURSE OUTCOMES (COs)

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

CO1	Understand the basic structure and syntax of Perl, Ajax, servlets and ASP.NET.
CO2	Identify the knowledge of scripting language to add dynamicity to web pages.
CO3	Formulate the various scripting languages in establishing data base connections through web pages.
CO4	Analyse the client and server side web application using Perl, CGI scripting and Ajax.
CO5	Compare and contrast various client/server side scripting frameworks.
CO6	Demonstrate the implementation of web applications using modern web frameworks and tools.

Course Title	BIG DATA ANALYTICS				
Course Code	16IS8IE2BD	Credits	3	L-T-P-S	3-0-0-0
CIE	50 Marks	SEE	100 Marks (50% Weightage)		
Contact Hours / Week	3	Total Lecture Hours	39 Hours		

UNIT 1

Introduction to Big Data& Hadoop: Data!, Data Storage and Analysis, Querying data, Beyond batch, Comparison with Other Systems, Analyzing data with Hadoop, Scaling out, Hadoop streaming. **[8 Hrs]**

UNIT 2

Hadoop Distributed File System: The Design of HDFS, HDFS Concepts, Command Line Interface, Hadoop File Systems, Java Interface, Data Flow. **[7 Hrs]**

UNIT 3

Map Reduce: Developing a MapReduce application: Configuration API, Setting up the development environment, Writing unit test with MRUnit, Running locally on Test data, Running on a cluster, Tuning a job, Mapreduce Workflows, How Map Reduce Works, Map Reduce Types and Formats- Map Reduce Features. **[9 Hrs]**

UNIT 4

YERN and Hadoop I/O: Anatomy of YARN application run, Yarn compared to Mapreduce, Scheduling in YARN, Hadoop I/O: Data integrity, Compression, Serialization, File-based data structures. **[8 Hrs]**

UNIT 5

Hadoop operations: Cluster specification, Cluster setup and installation, Hadoop configuration, Security, Benchmarking a Hadoop cluster. **[7 Hrs]**

Text Book

1. Hadoop: The Definitive Guide by Tom White, 4th Edition, O'Reilley, 2015.

Reference Books

1. Big Data Black Book, DreamTech publication, 2016.
2. Hadoop Operations by Eric Sammer, O'Reilley, 3rd Edition, 2016

E-Books

1. https://www.datameer.com/pdf/big-data-analytics-ebook.pdf?mkt_tok
2. <http://barbra-coco.dyndns.org/student/hadoop/Big-Data-Analytics-with-R-and-Hadoop.pdf>.

MOOCs

1. <https://www.coursera.org/learn/bigdata-analytics>
2. <https://www.udacity.com/course/intro-to-hadoop-and-mapreduce--ud617>

COURSE OUTCOMES (COs)

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

CO1	Understand the concepts of data storage, Hadoop, HDFS, Map Reduce, YARN, Hadoop I/O and operations for analytics of big data.
CO2	Apply the knowledge of data streaming, distributed file system, scheduling and cluster specification to obtain solutions for huge storage.
CO3	Analyse the data storage problems and arrive at substantiated conclusions with Hadoop features and operations.
CO4	Design strategies for storage and analytics by investigating Hadoop benchmark & YARN configurations to arrive at valid conclusions.
CO5	Create appropriate techniques using features and operations of MapReduce & YARN for modelling data analytics.
CO6	Design a framework to incorporate file based data structures for Hadoop/Yarn setup and installation to meet the storage requirements.