



B.M.S. COLLEGE OF ENGINEERING, BENGALURU - 19
Autonomous Institute, Affiliated to VTU

DEPARTMENT OF
INFORMATION SCIENCE & ENGINEERING

SCHEME & SYLLABUS FOR
UG PROGRAMME III TO VIII 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.

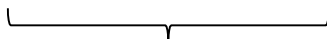
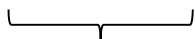
PROGRAMME OUTCOMES (POs)

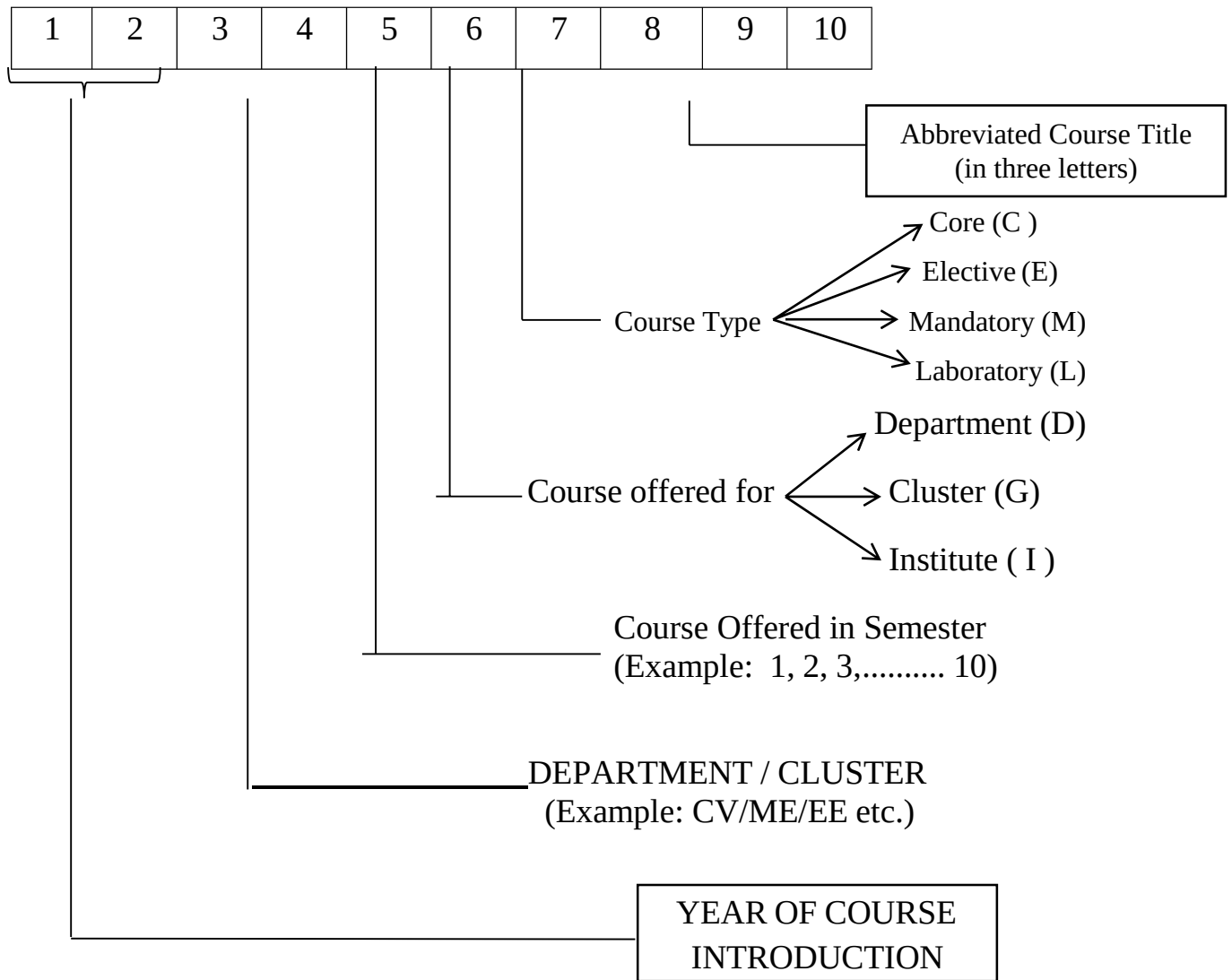
PO1	Engineering knowledge: Apply the knowledge of mathematics, science, engineering fundamentals, and an engineering specialization to the solution of complex engineering problems
PO2	Problem analysis: Identify, formulate, review research literature, and analyze complex engineering problems reaching 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	16IS3DCPCP	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: spanningtree, 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.	PO1
CO2	Construct a Hasse diagram for partial orderings.	PO1
CO3	Differentiate between a relation and a function.	PO1
CO4	Recognize certain well known groups.	PO1
CO5	Apply basic tools of Combinatorics such as sum and product rules, pigeon-hole principle.	PO1
CO6	Use graphs as representation tools in a network analysis.	PO1
CO7	Understand basic properties of integers, greatest common divisor, congruence relations and arithmetic of residue classes.	PO1

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	Apply principles of Data Structures for solving problems.	PO1
CO2	Analyse and Develop operations on linear and non-linear data structures.	PO2
CO3	Design effective algorithms for efficient management of data.	PO3
CO4	Design experiments to implement operations like searching, insertion, deletion, traversal mechanism on various data structures.	PO4
CO5	Demonstrate data structure coding skills on a competitive programming platform	PO1, PO12
CO6	Design solutions for applications using appropriate data structures and prepare effective documentation and 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.	PO8,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.	PO1
CO2	Demonstrate competence with the ideas of vector spaces, subspaces, Basis and dimension.	PO1
CO3	Obtain the matrix associated with a linear transformation with respect to given bases.	PO1
CO4	Understand the relationship between the operations on linear transformations and their corresponding matrices.	PO1
CO5	Compute eigenvalues, eigenvectors and Eigen spaces of matrices.	PO1
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.	PO1
CO7	Use of Singular value decomposition that finds applications in signal processing.	PO1

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.	PO8, 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	Apply algorithmic design paradigms to basic computing problems	PO1
CO2	Analyze the time complexity of different algorithms	PO2
CO3	Design efficient algorithms using appropriate algorithm design techniques	PO3
CO4	Conduct experiments to implement algorithms and provide valid conclusions.	PO4
CO5	Make effective presentations and documentation to justify the performance of designed algorithms for the computing problem	PO10, PO12

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, Queuingtheory, 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, Interprocesscommunication, 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 Dhamdhare, 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	PO3
CO5	Implement the preliminary functionalities of operating system	PO4
CO6	Provide valid inferences by examining the current trends of operating system	PO5
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, PO8, PO9 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 and Normalization concepts.	PO3

CO5	Synthesize sophisticated queries to extract the information from the given database using SQL	PO4
CO6	Develop and demonstrate Database Management System for Real Time Problem in a diverse team using appropriate tools	PO2,PO3,PO5, PO9,PO10,PO12

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, Uyles 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 Knowledge about the various principles of communication	
CO2	Apply the data link layer and Network Layer Protocols to solve real life problems	PO1
CO3	Analyze the protocols used in MAC and IP layer	PO2
CO4	Design network using internetworking concepts and protocols	PO3
CO5	Conduct experiments on network design, packets transmission and protocols working using modern engineering tool	PO4, 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-serversystems	PO1
CO3	Validate user inputs based on constraints and requirements using JavaScript	PO2
CO4	Identify appropriate web elements to prepare dynamic pages	PO2
CO5	Design user's specific mark-up language and interact with the database	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 Madisetti, Universities Press, 2015, ISBN: 9788173719547.
2. Jan Holler, Vlasios Tsiatsis, Catherine Mulligan, Stefan Avesand, Stamatis 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	PO1
CO3	Analyze the usage of measures of similarity and dissimilarity, OLAP and Multidimensional data analysis, classification clustering	PO2
CO4	Identify the concepts of association, classifier and clustering algorithms	PO2
CO5	Synthesize clustering and classification mining techniques	PO2
CO6	Conduct experiments using data mining techniques for Pre-processing, Association, Classification and Clustering	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-styleclasses, 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.	PO1
CO2	Apply appropriate associations, interaction modeling, predict patterns categories.	PO1
CO3	Analyze software architecture, design models, testing methods and business solutions.	PO2
CO4	Interpret requirements, test phases, modeling, transitions and architectural patterns.	PO4
CO5	Design UML models, patterns, traceability matrix.	PO3, PO4, PO5
CO6	Create models for a business solutions system.	PO5, PO8, PO9, PO10, PO11, 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.	PO8, PO9, PO10, PO12

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, McGraw-Hill 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.	PO6,PO8,PO9, PO10,PO12

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	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 on various C# programming constructs, Exception Handling and object-oriented concepts to solve problems.	PO4, PO5
CO6	Create solution for problems using appropriate constructs.	PO3, PO5, PO9, PO10

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	PO5, PO9, PO10, PO11, PO12

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.hpl.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, Datagram packet 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, PO5
CO5	Create GUI programs based on common controls, themes, actions, components, handlers and mapping packages using Android Studio/SDK.	PO4, PO5
CO6	Design mobile Apps to provide solutions for real world problems by incorporating multidisciplinary settings.	PO3, PO6, PO8, PO9, PO12

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 Signaling, 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, various types of mobile generation services can be interpreted.	PO4
CO6	Simulate wireless communication network by using modern tools like Qualnet/Matlab and obtained results to arrive at substantial conclusions by communicating effectively as a member of diverse team.	PO2, PO4, PO5, PO6, PO8, 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 YourSite 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.freetchbooks.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.	PO1
CO3	Compare various cryptographic techniques that cause security risks in networks.	PO1
CO4	Identify the elements of security protocols and methods to solve problems.	PO2
CO5	Use appropriate public cryptosystem to evaluate information security risks.	PO2
CO6	Develop security solutions of standard cryptographic algorithms using modern tools.	PO3

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, PO4, PO5
CO5	Effective presentations, documentations and models are designed to end users.	PO3
CO6	Demonstrate the data science process using modern tools.	PO5, PO9, PO10

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 Publishing, 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 compositeservices, secure distribution of data for migrating applications to a cloud environment.	PO1
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.	PO2
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.	PO3
CO5	Synthesize the data handling using XML parsers, JSON parsers, and REST services to investigate the status of remote object.	PO4
CO6	Use modern tools to implement the cloud application using popular cloud technologies.	PO5

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.	PO1
CO3	Analyse various criteria's and specification for testing a software product.	PO2
CO4	Design effective test cases to achieve requirement specification.	PO3
CO5	Investigate various testing strategies to find bugs in the software.	PO4
CO6	Demonstrate the usage of modern testing tools to write automation scripts.	PO5

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 basisfunctions, 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.	PO1
CO3	Protect remote connections, access risks, detect intrusions using security principles.	PO1
CO4	Provide analysis for various risk controls, firewall detections and prevention systems.	PO2
CO5	Use suitable security technologies and VPNs to protect data.	PO2
CO6	Communicate effectively and make presentation on modern techniques for intrusion detection and prevention system of information security.	PO5, PO10

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.	PO2
CO2	Select the modern tools for solving the identified engineering problem.	PO1, PO4, PO5
CO3	Design a solution for the chosen problem.	PO3
CO4	Analyze results of experiments conducted to arrive at valid conclusions and its impact on societal and environmental context.	PO6, PO7, PO11
CO5	Communicate effectively through presentation and demonstration of the project and write effective Report.	PO8, PO10, PO12
CO6	Function effectively in the team and contribute to the team.	PO9, PO12

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.	PO2
CO2	Applying the Knowledge of problem analysis to identify the required design constraints to achieve solutions.	PO1
CO3	Select the platform/tools in the set of alternatives identified for the project synopsis.	PO5, PO11
CO4	Develop software to provide solution for the identified project.	PO3, PO1
CO5	Investigating for arriving towards optimum valid results for implemented software project.	PO4
CO6	Communicate effectively through presentation and demonstration of the project and write effective report.	PO10
CO7	Identify the community that shall benefit through the solution to the identified software problem and demonstrate concern for environment.	PO6, PO7
CO8	Function effectively in the team, contribute to the team and mentor/lead the team.	PO9
CO9	Demonstrate compliance to the prescribed standards/safety norms through implementation of the identified software problem.	PO8, PO12

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 center 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, PO9, 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
CO5	Recognize the impact of software project management principles on society through industry interaction	PO12, PO7
CO6	Demonstration of projects in terms of software managerial activities and requirements engineering	PO11

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, connaître) Global overview, Verbs (être, 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.	PO1
CO3	Formulate the various scripting languages in establishing data base connectionsthrough web pages.	PO2
CO4	Analyse the client and server side web application using Perl, CGI scripting andAjax.	PO3
CO5	Compare and contrast various client/server side scripting frameworks.	PO1
CO6	Demonstrate the implementation of web applications using modern web frameworks and tools.	PO4,PO5

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.	PO2
CO3	Analyse the data storage problems and arrive at substantiated conclusions with Hadoop features and operations.	PO3
CO4	Design strategies for storage and analytics by investigating Hadoop benchmark & YARN configurations to arrive at valid conclusions.	PO4, PO5
CO5	Create appropriate techniques using features and operations of MapReduce & YARN for modelling data analytics.	PO4, PO9, PO10
CO6	Design a framework to incorporate file-based data structures for Hadoop/Yarn setup and installation to meet the storage requirements.	PO3

VISVESVARAYA TECHNOLOGICAL UNIVERSITY, BELGAUM

SCHEME OF TEACHING AND EXAMINATION FOR M.TECH (COMPUTER NETWORK ENGINEERING)

I Semester

Total Credits: 23

Subject Code	Name of the Subject	Teaching hours/week		Duration of Exam in Hours	Marks for		Total Marks	CREDITS
		Lecture	Practical / FieldWork / Assignment / Tutorials		I.A.	Exam		
14SCN11	Wireless Adhoc Networks	4	2 *	03	50	100	150	4
14SCN12	Advanced in Computer Networks	4	2 *	03	50	100	150	4
14SCN13	Information and Network Security	4	--	03	50	100	150	4
14SCN14	Advanced in Storage Area Network	4	2	03	50	100	150	4
14SCN15x	Elective – I	4	2	03	50	100	150	4
14SCN16	Information and Network Security Laboratory	0	3	03	25	50	75	2
14SCN17	Seminar #	0	3	--	25	--	25	1
Total		20	13	18	300	550	850	23

Elective I

- 14SCN151 Advanced Algorithms
- 14SCN152 Computer Systems Performance Analysis
- 14SCN153 Multi Core Architecture and Programming
- 14SCN154 Soft Computing

VISVESVARAYA TECHNOLOGICAL UNIVERSITY, BELGAUM
SCHEME OF TEACHING AND EXAMINATION FOR
M.TECH (COMPUTER NETWORK ENGINEERING)

II Semester

Total Credits: 23

Subject Code	Name of the Subject	Teaching hours/week		Duration of Exam in Hours	Marks for		Total Marks	CREDITS
		Lecture	Practical / Field Work / Assignment/ Tutorials		I.A.	Exam		
14SCN21	Multimedia Communications	4	2 *	03	50	100	150	4
14SCN22	Distributed Computing	4	--	03	50	100	150	4
14SCN23	Network Management	4	2 *	03	50	100	150	4
14SCN24	Switching & Statistical Multiplexing In Telecommunications	4	2	03	50	100	150	4
14SCN25 _x	Elective – II	4	2	03	50	100	150	4
14SSCN26	Distributed Computing Laboratory	0	3	03	25	50	75	2
14SCN27	Seminar #	0	3	--	25	--	25	1
	** Project Phase I (6 Week Duration)	--	--	--	--	--	--	--
Total		20	13	18	300	550	850	23

ELECTIVE- II

14SCN251 Cloud Computing
14SCN252 Wireless Sensor Networks
14SCN253 Optical networks
14SCN254 Advances in VLSI Design & Algorithm

**** Between the II Semester and III Semester after availing a vacation of 2 weeks.**

VISVESVARAYA TECHNOLOGICAL UNIVERSITY, BELGAUM

SCHEME OF TEACHING AND EXAMINATION FOR M.TECH (COMPUTER NETWORK ENGINEERING)

III Semester: INTERNSHIP

Total Credits: 20

Subject Code	Name of the Subject	No. of Hrs./Week		Duration of the Exam in Hours	Marks for		Total Marks	CREDITS
		Lecture	Practical / Field Work		I.A.	Exam		
14SCN31	Seminar / Presentation on Internship (After 8 weeks from the date of commencement)	--	--	-	25	--	25	1
14SCN32	Report on Internship	--	--	-	--	75	75	15
14SCN33	Evaluation and Viva-voce	--	--	3	--	50	50	4
	Total	--	--	3	25	125	150	20

***The student shall make a midterm presentation of the activities undertaken during the first 8 weeks of internship to a panel comprising Internship Guide, a senior faculty from the department and Head of the Department.**

The College shall facilitate and monitor the student internship program.

The internship report of each student shall be submitted to the University.

****Between the III Semester and IV Semester after availing a vacation of 2 weeks.**

VISVESVARAYA TECHNOLOGICAL UNIVERSITY, BELGAUM

SCHEME OF TEACHING AND EXAMINATION FOR M.TECH (COMPUTER NETWORK ENGINEERING)

IV Semester

Total Credits: 28

Subject Code	Name of the Subject	Teaching hours/week		Duration of Exam in Hours	Marks for		Total Marks	CREDITS
		Lecture	Fieldwork / Assignment / Tutorials		I.A.	Exam		
14SCN41	Client Server Programming *	4	2 *	03	50	100	150	4
14SCN42x	Elective-III	4	2	03	50	100	150	4
14SCN43	Evaluation of Project Phase-II	0	--	--	25	--	25	1
14SCN44	Evaluation of Project Phase-III	0	--	--	25	--	25	1
14SCN45	Evaluation of Project Work and Viva-voce	--	3	03	--	100 + 100	150	18
Total		08	07	09	150	400	550	28
Grand Total (I to IV Sem.)		Marks: 2400; Credits : 94						

L- Lecture , T- Tutorial, P- Practical

Note:

***Lab Classes for these Core Subjects are Compulsory (Practical will be Evaluated for 20 marks and Internal assessment for 30 marks). Lab journals Should be Maintained.**

Seminar: Topics should be chosen from IEEE/ACM/Elsevier/Springer/any Refereed - Journals /Transactions. Encourage students to convert these seminar topics into a good survey paper or technical paper.

1).**Project Phase – I**: 6 weeks duration shall be carried out between II and III Semester. Candidates in consultation with guide shall carryout literature survey / visit to Industries to finalize the topic of dissertation.

2) **Internship**:- 24 weeks Duration in 3rd Semester, Evaluation of Marks - Presentation : 25 marks, Report writing and Submission :75 marks and At the end of Internship Viva-Voce Exams shall be conducted for 50 marks.

3).**Project Work** : 20 weeks duration in IV Semester carries total marks of 250.

4)**Project Phase II**: 4 days for project work in a week during IV Semester. Evaluation shall be taken during the 8th week of the IV Semester. Total Marks shall be 25.

5).**Project Phase – III** : Evaluation shall be taken up at the end of the IV Semester for 25 marks. After the Project report is submitted, Project Work Evaluation and Viva-Voce Examination shall be conducted. Total Marks Shall be $50+50+100=200$ (50 Marks for Internal Guide, 50 Marks for External and 100 for Viva-Voce)

Marks of Evaluation of Project:

- I) The I.A. Marks of Project Phase – II & III shall be sent to the University along with Project Work report at the end of the Semester.
- II) The Project Valuation and Viva-Voce will be conducted by a committee consisting of the following:
 - a) Head of the Department (Chairman)
 - b) Guide
 - c) Two Examiners appointed by the university.(out of two external examiners at least one should be present).

Course Title: Wireless Ad-hoc Networks	Course Code: 14SCN11
Credits(L:T:P): 3:0:1	Core/Elective: Core
Type of Course: Lecture and practical	Total Contact Hours:50

COURSE OBJECTIVES

- To explore the design space and conduct trade-off analysis between performance and resources.
- To Determine suitable medium access protocols and radio hardware.
- To learn Provision quality of service, fault-tolerance, security and other dependability requirements while coping with resource constraints.
- To explore the Ad-hoc network concepts by using network simulators.

TOPICS

MODULE I

Ad hoc Wireless Networks: Introduction, Issues in Ad hoc Wireless Networks, Ad hoc Wireless Internet;
MAC Protocols for Ad hoc Wireless Networks: Introduction, Issues in Designing a MAC Protocol, Design Goals of MAC Protocols, Classification of MAC protocols, Contention-Based Protocols, Contention-Based Protocols with Reservation Mechanisms, Contention-Based Protocols with Scheduling Mechanisms, MAC Protocols that Use Directional Antennas
 (Chapter 5: 5.1-5.3, Chapter 6: 6.1-6.8)

10 Hours

MODULE II

Routing Protocols for Ad Hoc Wireless Networks: Introduction, Issues in Designing a Routing Protocol for Ad hoc Wireless Networks; Classification of Routing Protocols; Table Driven Routing Protocols; On-Demand Routing Protocols, Hybrid Routing Protocols, Hierarchical Routing Protocols and Power-Aware Routing Protocols
 (Chapter 7: 7.1-7.6, 7.8, 7.9)

10 Hours

MODULE III

Multicast Routing in Ad hoc Wireless Networks: Introduction, Issues in Designing a Multicast Routing Protocol, Operation of Multicast Routing Protocols, An Architecture Reference Model for Multicast Routing Protocols, Classifications of Multicast Routing Protocols, Tree-Based Multicast Routing Protocols and Mesh-Based Multicast Routing Protocols.
 (Chapter 8: 8.1-8.7)

10 Hours

MODULE IV

Transport Layer and Security Protocols for Ad hoc Networks: Introduction, Issues in Designing a Transport Layer Protocol; Design Goals of a Transport Layer Protocol; Classification of Transport Layer Solutions; TCP over Transport Layer Solutions; Other Transport Layer Protocols for Ad hoc Networks; Security in Ad hoc Wireless Networks, Issues and Challenges in Security Provisioning, Network Security Attacks, Key Management and Secure Routing Ad hoc Wireless Networks.
 (Chapter 9: 9.1-9.6, 9.7-9.12)

10 Hours

MODULE V

Quality of Service and Energy Management in Ad hoc Wireless Networks

Introduction, Issues and Challenges in Providing QoS in Ad hoc Wireless Networks, Classification of QoS Solutions, MAC Layer Solutions, Network Layer Solutions; Energy Management in Ad hoc Wireless Networks: Introduction, Need for Energy Management in Ad hoc Wireless Networks, Classification of Energy Management Schemes, Battery Management Schemes, Transmission Management Schemes, System Power Management Schemes.

(Chapter 10: 10.1-10.5, Chapter 11: 11.1-11.6)

10 Hours

LABORATORY WORK

Note: Standard Network Parameters and supporting protocols may be assumed for simulation. Any suitable network simulator may be used. (Preferably NS2 or NS3 Simulator)

1. Develop unicast routing protocols using any suitable Network Simulator for (Mobile Ad hoc Networks) MANET to find the best route using the any one of routing protocols from each category from table-driven (e.g., link state or DSDV) on demand (e.g., DSR, AODV, TORA), hybrid (e.g., ZRP, contact-based architectures) and hierarchical (e.g., cluster based.) The efficient path/route should be established for source and destination data transmission using routing protocols. Understand the advantages and disadvantages of each routing protocol types by observing the performance metrics of the routing protocol. In that way the best application/environment suitable routing protocol can be identified in each category.
- 2: Develop multicast routing protocols using any suitable Network Simulator for MANET in which session nodes are connecting through either tree(MAODV, MCEDAR) or mesh (ODMRP, CAMP, FGMP) structure. Analyze the performance metrics of multicast routing protocols with unicast routing protocols.
3. Develop MAC Protocol using any suitable Network Simulator for MANETs to send the packet without any contention through wireless link using the following MAC protocols; (CSMA/CA (802.11), MACA, MACAW, PAMAS, SMAC). Analyze its performance with increasing node density and mobility.
4. Develop and Analyze the performance of TCP connection when it is used for wireless networks. You will find performance of TCP decreases dramatically when a TCP connection traverses a wireless link on which packets may be lost due to wireless transmission errors. Make use of Active Queue Management Technique to control congestion on Wireless Networks. Evaluate the performance of FIFO, RED and WFQ over wireless networks using suitable Network Simulator.
5. Simulate MANET environment using suitable Network Simulator and test with various mobility model such as Random way point, group mobility, highway model, Manhattan model, hybrid models) (Spatial correlation, temporal correlation, relative speed, link durations). Analyze throughput, PDR and delay with respect to different mobility models.

COURSE OUTCOMES

Students will be able to

- Apply knowledge of wireless Ad-hoc networks to various application areas.
- Design, implement and maintain wireless Ad-hoc networks.
- Formulate and solve problems creatively.
- Practical knowledge acquired by hands-on session.

TEXT BOOKS:

1. C. Siva Ram Murthy & B. S. Manoj: Ad hoc Wireless Networks, 2nd Edition, Pearson Education, 2011

REFERENCES:

1. Ozan K. Tonguz and Gianguigi Ferrari: Ad hoc Wireless Networks, John Wiley, 2007.
2. Xiuzhen Cheng, Xiao Hung, Ding-Zhu Du: Ad hoc Wireless Networking, Kluwer Academic Publishers, 2004.

Semester I

Year: 2014-2015

Course Title: Advances in Computer Networks	Course Code: 14SCN12
Credits(L:T:P): 3:0:1	Core/Elective: Core
Type of Course: Lecture and practical	Total Contact Hours:50

COURSE OBJECTIVES

- To become familiar with the basics of Computer Networks.
- To learn Network architectures.
- To learn Concepts of fundamental protocols.
- To gain the knowledge of internetworking concepts.
- To understand the knowledge of internetworking concepts in various applications.
- To acquire knowledge of implementation concepts in congestion control and error detections.

TOPICS

MODULE I

Foundation

Building a Network, Requirements, Perspectives, Scalable Connectivity, Cost-Effective Resource sharing, Support for Common Services, Manageability, Protocol layering, Performance, Bandwidth and Latency, Delay X Bandwidth Product, Perspectives on Connecting, Classes of Links, Reliable Transmission, Stop-and-Wait, Sliding Window, Concurrent Logical Channels.

T1:Chapter 1.1, 1.2, 1.5.1, 1.5.2., 2.1, 2.5 T2:Chapter 4

10 Hours

MODULE II

Internetworking- I

Switching and Bridging, Datagrams, Virtual Circuit Switching, Source Routing, Bridges and LAN Switches, Basic Internetworking (IP), What is an Internetwork ?, Service Model, Global Addresses, Datagram Forwarding in IP, subnetting and classless addressing, Address Translation(ARP), Host Configuration(DHCP), Error Reporting(ICMP), Virtual Networks and Tunnels.

T1: Chapter 3.1, 3.2.

10 Hours

MODULE III

Internetworking- II

Network as a Graph, Distance Vector(RIP), Link State(OSPF), Metrics, The Global Internet, Routing Areas, Routing among Autonomous systems(BGP), IP Version 6(IPv6), Mobility and Mobile IP

T1: Chapter 3.3, 4.1.1, 4.1.3 **T2:** Chapter 13.1 to 13.18, Chapter 18.

10 Hours

MODULE IV

End-to-End Protocols

Simple Demultiplexer (UDP), Reliable Byte Stream(TCP), End-to-End Issues, Segment Format, Connecting Establishment and Termination, Sliding Window Revisited, Triggering Transmission, Adaptive Retransmission, Record Boundaries, TCP Extensions, Queuing Disciplines, FIFO, Fair Queuing, TCP Congestion Control, Additive Increase/ Multiplicative Decrease, Slow Start, Fast Retransmit and Fast Recovery.

T1: Chapter 5.1, 5.2.1 to 5.2.8, 6.2, 6.3

10 Hours

MODULE V

Congestion Control and Resource Allocation

Congestion-Avoidance Mechanisms, DEC bit, Random Early Detection (RED), Source-Based Congestion Avoidance.

The Domain Name System(DNS), Electronic Mail(SMTP, POP, IMAP, MIME), World Wide Web(HTTP), Network Management(SNMP) .

T1: Chapter 6.4 **T2:** Chapter 23.1 to 23.16, Chapter 24, Chapter 25, Chapter 27.1 to 27.8

10 Hours

LABORATORY WORK

PART A: Implement the following using C/C++ or equivalent with LINUX/Windows environment:

1. Write a program to transfer the contents of a requested file from server to the client using TCP/IP Sockets (using TCP/IP Socket programming).
2. Write a program to archive Traffic management at Flow level by implementing Closed Loop Control technique. (Leaky Bucket Algorithm)
3. Write a program to implement dynamic routing strategy in finding optimal path for data transmission. (Bellman ford algorithm).
4. Write a program to implement Link State Routing (Dijkstra Algorithm).
5. Write a program for implementing the error detection technique while data transfer in unreliable network code using CRC (16-bits) Technique.
6. Write a program for providing security for transfer of data in the network. (RSA Algorithm)
7. Write a program for encrypting 64 bit playing text using DES algorithm.

PART B: Simulation Programs using OPNET /NS2 or any other equivalent software

1. Simulate a 3 node point to point network with duplex links between them. Set the Queue size and vary the bandwidth and find the number of packets dropped.
2. Simulate a four-node point-to-point network, and connect the links as follows: n0->n2, n1->n2 and n2->n3. Apply TCP agent changing the parameters and determine the number of packets sent/received by TCP/UDP

3. Simulate the different types of internet traffic such as FTP and TELNET over network and analyze the throughput.

COURSE OUTCOMES

Students will be able to

- Classify network services, protocols and architectures, explain why they are layered.
- Knowledge on key Internet applications and their protocols, and ability to develop their own applications (e.g. Client Server applications, Web Services) using the sockets API.
- Practical knowledge gained by hands-on sessions.
- Gain the knowledge of application layer protocol.

Text books:

1. **T1: Larry Peterson and Bruce S Davis** “Computer Networks :A System Approach” 5th Edition , Elsevier -2014
2. **T2: Douglas E Comer,** “Internetworking with TCP/IP, Principles, Protocols and Architecture” 6th Edition, PHI - 2014

References:

1. **Uyless Black** “Computer Networks, Protocols , Standards and Interfaces” 2nd Edition - PHI
2. **Behrouz A Forouzan** “TCP/IP Protocol Suite” 4th Edition – Tata McGraw-Hill.

Semester I

Year: 2014-2015

Course Title: Information and Network Security	Course Code: 14SCN13
Credits(L:T:P): 4:0:0	Core/Elective: Core
Type of Course: Lecture	Total Contact Hours:50

Course Objectives:

- To understand the fundamentals of Cryptography
- To acquire knowledge on standard algorithms used to provide confidentiality, integrity and authenticity.
- To understand the various key distribution and management schemes.
- To understand how to deploy encryption techniques to secure data in transit across data networks
- To design security applications in the field of Information technology.

TOPICS

MODULE I

Classical Encryption Techniques

Symmetric Cipher Model, Cryptography, Cryptanalysis and Brute-Force Attack, Substitution Techniques, Caesar Cipher, Monoalphabetic Cipher, Playfair Cipher, Hill Cipher, Polyalphabetic Cipher, One Time Pad.

Block Ciphers and the data encryption standard: Traditional block Cipher structure, stream Ciphers and block Ciphers, Motivation for the feistel Cipher structure, the feistel Cipher, The data encryption standard, DES encryption, DES decryption, A DES example, results, the avalanche effect, the strength of DES, the use of 56-Bit Keys, the nature of the DES algorithm, timing attacks, Block cipher design principles, number of rounds, design of function F, key schedule algorithm.

10 Hours

MODULE II

Public-Key Cryptography and RSA: Principles of public-key cryptosystems. Public-key cryptosystems. Applications for public-key cryptosystems, requirements for public-key cryptosystems. public-key cryptanalysis. The RSA algorithm, description of the algorithm, computational aspects, the security of RSA. **Other Public-Key Cryptosystems:** Diffie-hellman key exchange, The algorithm, key exchange protocols, man in the middle attack, Elgamal Cryptographic systems, Elliptic curve arithmetic, abelian groups, elliptic curves over real numbers, elliptic curves over $\mathbb{Z}_p$, elliptic curves over $\text{GF}(2^m)$, Elliptic curve cryptography, Analog of Diffie-hellman key exchange, Elliptic curve encryption/ decryption, security of Elliptic curve cryptography, Pseudorandom number generation based on an asymmetric cipher, PRNG based on RSA.

10 Hours

MODULE III

Key Management and Distribution: Symmetric key distribution using Symmetric encryption, A key distribution scenario, Hierarchical key control, session key lifetime, a transparent key control scheme, Decentralized key control, controlling key usage, Symmetric key distribution using asymmetric encryption, simple secret key distribution, secret key distribution with confidentiality and authentication, A hybrid scheme, distribution of public keys, public announcement of public keys, publicly available directory, public key authority, public keys certificates, X-509 certificates. Certificates, X-509 version 3, public key infrastructure. **User Authentication:** Remote user Authentication principles, Mutual Authentication, one way Authentication, remote user Authentication using Symmetric encryption, Mutual Authentication, one way Authentication, Kerberos, Motivation, Kerberos version 4, Kerberos version 5, Remote user Authentication using Asymmetric encryption, Mutual Authentication, one way Authentication, federated identity management, identity management, identity federation, personal identity verification.

10 Hours

MODULE IV

Wireless network security: Wireless security, Wireless network threats, Wireless network measures, mobile device security, security threats, mobile device security strategy, IEEE 802.11 Wireless LAN overview, the Wi-Fi alliance, IEEE 802 protocol architecture. Security, IEEE 802.11i services, IEEE 802.11i phases of operation, discovery phase, Authentication phase, key management phase, protected data transfer phase, the IEEE 802.11i pseudorandom function, ..

Web Security Considerations: Web Security Threats, Web Traffic Security Approaches. **Secure Sockets Layer** :SSL Architecture, SSL Record Protocol, Change Cipher Spec Protocol, Alert Protocol, and shake Protocol, Cryptographic Computations. **Transport Layer Security:** Version Number, Message Authentication Code, Pseudorandom Functions, Alert Codes, Cipher Suites, Client Certificate Types, Certificate Verify and Finished Messages, Cryptographic Computations, and Padding. **HTTPS** Connection Initiation, Connection Closure. **Secure Shell (SSH)** Transport Layer Protocol, User Authentication Protocol, Connection Protocol.

10 Hours

MODULE V

Electronic Mail Security: Pretty good privacy, notation, operational; description, S/MIME, RFC5322, Multipurpose internet mail extensions, S/MIME functionality, S/MIME messages, S/MIME certificate processing, enhanced security services, Domain keys identified mail, internet mail architecture, E-Mail threats, DKIM strategy, DKIM functional flow. **IP Security:** IP Security overview, applications of IPsec, benefits of IPsec, Routing applications, IPsec documents, IPsec services, transport and tunnel modes, IP Security policy, Security associations, Security associations database, Security policy database, IP traffic processing, Encapsulating Security payload, ESP format, encryption and authentication algorithms, Padding, Anti replay service, transport and tunnel modes, combining security associations, authentication

plus confidentiality, basic combinations of security associations, internet key exchange, key determinations protocol, header and payload formats, cryptographic suits. **10 Hours**

Course Outcomes:

Students will be able to:

- Analyze the vulnerabilities in any computing system and hence be able to design a security solution.
- Identify the security issues in the network and resolve it.
- Evaluate security mechanisms using rigorous approaches, including theoretical.

Text Books:

1. William Stallings: Cryptography and Network Security, Pearson 6th edition.

References

1. V k Pachghare: Cryptography and Information Security. PHI Learning. ISBN 978-81-203-3521-9

Semester I

Year: 2014-2015

Course Title: Advances in Storage area Network	Course Code: 14SCN14
Credits(L:T:P): 4:0:0	Core/Elective: Core
Type of Course: Lecture	Total Contact Hours:50

Course Objectives:

- To understand the fundamentals of storage centric and server centric systems
- To understand the metrics used for Designing storage area networks
- To understand the RAID concepts
- To enable the students to understand how data centre's maintain the data with the concepts of backup mainly remote mirroring concepts for both simple and complex systems
- To appreciate the use of cables technologies used in SAN technology.

TOPICS

MODULE I

Introduction: Server Centric IT Architecture and its Limitations; Storage – Centric IT Architecture and its advantages. Case study: Replacing a server with Storage Networks 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. **10 Hours**

MODULE II

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. **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. **10 Hours**

MODULE III

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.

10 Hours

MODULE IV

SAN Architecture and Hardware devices: Overview, Creating a Network for storage; SAN Hardware devices; The fibre channel switch; Host Bus Adaptors; Putting the storage in SAN; Fabric operation from a Hardware perspective. **Software Components of SAN:** The switch's Operating system; Device Drivers; Supporting the switch's components; Configuration options for SANs.

10 Hours

MODULE V

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, Summary

10 Hours

Course Outcomes:

Students will be able to:

- Identify the need for performance evaluation and the metrics used for it
- Have Knowledge on various RAID levels.
- Apply the techniques used for data maintenance.
- Develop techniques for evaluating policies for LUN masking, file systems.

Text Book:

1. Ulf Troppens, Rainer Erkens and Wolfgang Muller: Storage Networks Explained, Wiley India, 2013.

Reference Books:

1. Robert Spalding: "Storage Networks The Complete Reference", Tata McGraw-Hill, 2011.
2. Marc Farley: Storage Networking Fundamentals – An Introduction to Storage Devices, Subsystems, Applications, Management, and File Systems, Cisco Press, 2005.
3. Richard Barker and Paul Massiglia: "Storage Area Network Essentials A Complete Guide to understanding and Implementing SANs", Wiley India, 2006.

Semester I

Year: 2014-2015

Course Title: Advanced algorithms	Course Code: 14SCN151
Credits(L:T:P): 4:0:0	Core/Elective: Elective
Type of Course: Lecture	Total Contact Hours:50

COURSE OBJECTIVES

- To learn the graph search algorithms.
- To learn the hill climbing and dynamic programming design techniques.
- To develop recursive backtracking algorithms.
- To get an awareness of NP completeness and randomized algorithms.
- To get an awareness of probabilistic and randomize algorithms.

TOPICS

MODULE I

Review of Analysis Techniques: Growth of Functions: Asymptotic notations; Standard notations and common functions; Recurrences and Solution of Recurrence equations- The substitution method, The recurrence – tree method, The master method; Amortized Analysis: Aggregate, Accounting and Potential Methods.

10 Hours

MODULE II

Graph Algorithms: Bellman - Ford Algorithm; Single source shortest paths in a DAG; Johnson's Algorithm for sparse graphs; Flow networks and Ford-Fulkerson method; Maximum bipartite matching. **Polynomials and the FFT:** Representation of polynomials; The DFT and FFT; Efficient implementation of FFT.

10 Hours

MODULE III

Number -Theoretic Algorithms: Elementary notions; GCD; Modular Arithmetic; Solving modular linear equations; The Chinese remainder theorem; Powers of an element; RSA cryptosystem; Primality testing; Integer factorization.

10 Hours

MODULE IV

String-Matching Algorithms: Naïve string Matching; Rabin - Karp algorithm; String matching with finite automata; Knuth-Morris-Pratt algorithm; Boyer – Moore algorithms.

10 Hours

MODULE V

Probabilistic and Randomized Algorithms: Probabilistic algorithms; Randomizing deterministic algorithms, Monte Carlo and Las Vegas algorithms; Probabilistic numeric algorithms.

10 Hours

COURSE OUTCOMES:

The students will be able to

- Design and apply iterative and recursive algorithms.
- Design and implement optimization algorithms in specific applications.
- Design appropriate shared objects and concurrent objects for applications.
- Get knowledge about different application based algorithm.

TEXT BOOKS:

1. T. H Cormen, C E Leiserson, R L Rivest and C Stein: Introduction to Algorithms, 3rd Edition, Prentice-Hall of India, 2010.
2. Kenneth A. Berman, Jerome L. Paul: Algorithms, Cengage Learning, 2002.

REFERENCE BOOKS:

1. Ellis Horowitz, Sartaj Sahni, S.Rajasekharan: Fundamentals of Computer Algorithms, 2nd Edition, Universities press, 2007

Course Title: Computer Systems Performance Analysis	Course Code: 14SCN152
Credits(L:T:P): 4:0:0	Core/Elective: Elective
Type of Course: Lecture	Total Contact Hours:50

COURSE OBJECTIVES

- To understand the mathematical foundations needed for performance evaluation of computer systems
- To understand the metrics used for performance evaluation
- To understand the analytical modeling of computer systems
- To enable the students to develop new queuing analysis for both simple and complex systems
- To understand the concept of planning and design in computer system.

TOPICS

TOPICS:

MODULE I

Introduction: The art of Performance Evaluation; Common Mistakes in Performance Evaluation, A Systematic Approach to Performance Evaluation, Selecting an Evaluation Technique, Selecting Performance Metrics, Commonly used Performance Metrics, Utility Classification of Performance Metrics, Setting Performance Requirements.

10 Hours

MODULE II

Workloads, Workload Selection and Characterization: Types of Workloads, addition instructions, Instruction mixes, Kernels; Synthetic programs, Application benchmarks, Popular benchmarks. Work load Selection: Services exercised, level of detail; Representativeness; Timeliness, Other considerations in workload selection. Work load characterization Techniques: Terminology; Averaging, Specifying dispersion, Single Parameter Histograms, Multi Parameter Histograms, Principle Component Analysis, Markov Models, Clustering.

10 Hours

MODULE III

Monitors, Program Execution Monitors and Accounting Logs: Monitors: Terminology and classification; Software and hardware monitors, Software versus hardware monitors, Firmware and hybrid monitors, Distributed System Monitors, Program Execution Monitors and Accounting Logs, Program Execution Monitors, Techniques for Improving Program Performance, Accounting Logs, Analysis and Interpretation of Accounting log data, Using accounting logs to answer commonly asked questions.

10 Hours

MODULE IV

Capacity Planning and Benchmarking: Steps in capacity planning and management; Problems in Capacity Planning; Common Mistakes in Benchmarking; Benchmarking Games; Load Drivers; Remote- Terminal Emulation; Components of an RTE; Limitations of RTEs. **Experimental Design and Analysis: Introduction:** Terminology, Common mistakes in experiments, Types of experimental designs, 2k Factorial Designs, Concepts, Computation of effects, Sign table method for computing effects; Allocation of variance; General 2k Factorial Designs, General full factorial designs with k factors: Model, Analysis of a General Design, Informal Methods.

10 Hours

MODULE V

Queuing Models: Introduction: Queuing Notation; Rules for all Queues; Little's Law, Types of Stochastic Process. Analysis of Single Queue: Birth-Death Processes; M/M/1 Queue; M/M/m Queue; M/M/m/B Queue with finite buffers; Results for other M/M/1 Queuing Systems. Queuing Networks: Open and Closed Queuing Networks; Product form networks, queuing Network models of Computer Systems. Operational Laws: Utilization Law; Forced Flow

Law; Little's Law; General Response Time Law; Interactive Response Time Law; Bottleneck Analysis; Mean Value Analysis and Related Techniques; Analysis of Open Queuing Networks; Mean Value Analysis; Approximate MVA; Balanced Job Bounds; Convolution Algorithm, Distribution of Jobs in a System, Convolution Algorithm for Computing $G(N)$, Computing Performance using $G(N)$, Timesharing Systems, Hierarchical Decomposition of Large Queuing Networks: Load Dependent Service Centers, Hierarchical Decomposition, Limitations of Queuing Theory.

10 Hours

COURSE OUTCOMES

Students will be able to:

- Identify the need for performance evaluation and the metrics used for it
- Define Little's law and other operational laws
- Apply the operational laws to open and closed systems
- Use discrete-time and continuous-time Markov chains to model real world systems
- Develop analytical techniques for evaluating scheduling policies

Text Book:

1. Raj Jain: The Art of Computer Systems Performance Analysis, John Wiley and Sons, 2013.

Reference Books:

1. Paul J Fortier, Howard E Michel: computer Systems Performance Evaluation and prediction, Elsevier, 2003.
2. Trivedi K S: Probability and Statistics with Reliability, Queuing and Computer Science Applications, 2nd Edition, Wiley India, 2001.

Semester I

Year: 2014-2015

Course Title: Multi-core Architecture and Programming	Course Code: 14SCN153
Credits(L:T:P): 4:0:0	Core/Elective: Elective
Type of Course: Lecture	Total Contact Hours:50

COURSE OBJECTIVES

- To understand the recent trends in the field of Computer Architecture and identify performance related parameters
- To expose the students to the problems related to multiprocessing
- To understand the different types of multi core architectures
- To expose the students to warehouse-scale and embedded architectures

TOPICS

MODULE I

Introduction to Multi-core Architecture: Motivation for Concurrency in software, Parallel Computing Platforms, Parallel Computing in Microprocessors, Differentiating Multi-core Architectures from Hyper-Threading Technology, Multi-threading on Single-Core versus Multi-Core Platforms Understanding Performance, Amdahl's Law, Growing Returns: Gustafson's Law. **System Overview of Threading:** Defining Threads, System View of Threads, Threading above the Operating System, Threads inside the OS, Threads inside the Hardware, What Happens When a Thread Is Created, Application Programming Models and Threading, Virtual Environment: VMs and Platforms, Runtime Virtualization, System Virtualization.

10 Hours

MODULE II

Fundamental Concepts of Parallel Programming: Designing for Threads, Task Decomposition, Data Decomposition, Data Flow Decomposition, Implications of Different Decompositions, Challenges You'll Face, Parallel Programming Patterns, A Motivating Problem: Error Diffusion, Analysis of the Error Diffusion Algorithm, An Alternate Approach: Parallel Error Diffusion, Other Alternatives.

10 Hours

MODULE III

Threading and Parallel Programming Constructs: Synchronization, Critical Sections, Deadlock, Synchronization Primitives, Semaphores, Locks, Condition Variables, Messages, Flow Control- based Concepts, Fence, Barrier, Implementation-dependent Threading Features. **Threading APIs :** Threading APIs for Microsoft Windows, Win32/MFC Thread APIs, Threading APIs for Microsoft .NET Framework, Creating Threads, Managing Threads, Thread Pools, Thread Synchronization, POSIX Threads, Creating Threads, Managing Threads, Thread Synchronization, Signaling, Compilation and Linking.

10 Hours

MODULE IV

OpenMP: A Portable Solution for Threading: Challenges in Threading a Loop, Loop-carried Dependence, Data-race Conditions, Managing Shared and Private Data, Loop Scheduling and Portioning, Effective Use of Reductions, Minimizing Threading Overhead, Work-sharing Sections, Performance-oriented Programming, Using Barrier and No wait, Interleaving Single-thread and Multi-thread Execution, Data Copy-in and Copy-out, Protecting Updates of Shared Variables, Intel Task queuing Extension to OpenMP, OpenMP Library Functions, OpenMP Environment Variables, Compilation, Debugging, performance.

10 Hours

MODULE V

Solutions to Common Parallel Programming Problems: Too Many Threads, Data Races, Deadlocks, and Live Locks, Deadlock, Heavily Contended Locks, Priority Inversion, Solutions for Heavily Contended Locks, Non-blocking Algorithms, ABA Problem, Cache Line Ping-ponging, Memory Reclamation Problem, Recommendations, Thread-safe Functions and Libraries, Memory Issues, Bandwidth, Working in the Cache, Memory Contention, Cache-related Issues, False Sharing, Memory Consistency, Current IA-32 Architecture, Itanium Architecture, High-level Languages, Avoiding Pipeline Stalls on IA-32, Data Organization for High Performance.

10 Hours

COURSE OUTCOMES

Students will be able to:

- Identify the limitations of ILP and the need for multi-core architectures.
- Point out the salient features of different multi-core architectures and how they exploit parallelism.
- Critically analyze the different types of inter connection networks.
- Knowledge on architecture of GPUs, warehouse-scale computers and embedded processors.

Text Book

1. Multicore Programming , Increased Performance through Software Multi-threading by Shameem Akhter and Jason Roberts , Intel Press , 2006.

Semester I

Year: 2014-2015

Course Title: Soft Computing	Course Code: 14SCN154
Credits(L:T:P): 4:0:0	Core/Elective: Elective
Type of Course: Lecture	Total Contact Hours:50

Course Objectives:

- To learn the key aspects of Soft computing
- To know about the components and building block hypothesis of Genetic algorithm.
- To understand the features of neural network and its applications
- To study the fuzzy logic components
- To gain insight onto Neuro Fuzzy modeling and control.
- To gain knowledge in machine learning through Support vector machines.

Topics:

MODULE I

Introduction to Soft computing, Neural networks, Fuzzy logic, Genetic algorithms, Hybrid systems and its applications. Fundamental concept of ANN, Evolution, basic Model of ANN, Terminologies used in ANN, MP model, Hebb model.

10 Hours

MODULE II

Perceptron Network, Adaptive linear neuron, Multiple adaptive linear neurons, Back propogation Network (Theory, Architecture, Algorithm for training, learning factors, testing and applications of all the above NN models)

10 Hours

MODULE III

Introduction to classical sets and fuzzy sets, Classical relations and fuzzy relations, Membership functions,

10 Hours

MODULE IV

Defuzzification, Fuzzy decision making, and applications

10 Hours

MODULE V

Genetic algorithms: Introduction, Basic operations, Traditional algorithms, Simple GA
General genetic algorithms, The schema theorem, Genetic programming, applications

10 Hours

Course Outcomes:

The student will be able to:

- Implement machine learning through neural networks.

- Write Genetic Algorithm to solve the optimization problem
- Develop a Fuzzy expert system.
- Model Neuro Fuzzy system for clustering and classification.

Text book:

1. Principles of Soft computing, Shivanandam, Deepa S. N Wiley India, Jun-2007
(Chapters 1, 2, 3(Upto 3.5), 7, 8, 9, 10, 13, 15 (upto 15.6 & 15.9,15,10)

Reference Books:

1. Neuro-fuzzy and soft computing, J.S.R. JANG, C.T. SUN, E. MIZUTANI, PHI (EEE edition) ISBN: 978-81-203-2243-1

Semester I

Year: 2014-2015

Course Title: Information and Network security Lab	Course Code: 14SCN16
Credits(02)(L:T:P): 0:0:3	Core/Elective: Core
Type of Course: Practical	Total Contact Hours:42

Course Objectives:

- To understand the fundamentals of Cryptography through practical implementation.
- To implement standard algorithms used to provide confidentiality, integrity and authenticity.
- To understand the various key distribution and management schemes.
- To understand how to use cutting edge simulation tools
- To design security applications in the field of Information technology.

LABORATORY WORK

Note: Use C/C++/Java or equivalent tool to implement the following experiment

1. Consider a file with composite data, substitute the content and transpose the ciphers.
2. Consider an alphanumeric data, encrypt and Decrypt the data using advanced encryption standards and verify for the correctness.
3. Apply the RSA algorithm on a text file to produce cipher text file.
4. Develop a mechanism to setup a security channel using Diffie-Hellman Key Exchange between client and server
5. Implementation of Message Authentication Code using cryptography VMAC function.
6. Implement secure hash algorithm for Data Integrity. Implement MD5 and SHA-1 algorithm, which accepts a string input, and produce a fixed size number - 128 bits for MD5; 160 bits for SHA-1, this number is a hash of the input. Show that a small change in the input results in a substantial change in the output
7. Using any simulation tool: demonstrate packet filtering firewalls, create the ACL, create VLAN [Subnetting].
8. Develop a mechanism to setup(configure) a port scanner and identify the intrusion.

Course Outcomes:

Students will be able to:

- Analyze the vulnerabilities in any computing system and hence be able to design a security solution.

- Identify the security issues in the network and resolve it.
- Evaluate security mechanisms using rigorous approaches, including theoretical.

Semester II

Year: 2014-2015

Course Title: Multimedia Communications	Course Code: 14SCN21
Credits(L:T:P): 3:0:1	Core/Elective: Core
Type of Course: Lecture and practical	Total Contact Hours:50

Course Objectives:

- To understand the Multimedia Communication Models
- To study the Multimedia Transport in Wireless Networks
- To solve the Security issues in multimedia networks
- To explore real-time multimedia network applications.
- To explore different network layer based application.

TOPICS

MODULE I

Introduction to Multimedia Communications: Introduction, Human communication model, Evolution and convergence, Technology framework, Standardization framework. **10 Hours**

MODULE II

Framework for Multimedia Standardization: Introduction, Standardization activities, Standards to build a new global information infrastructure, Standardization processes on multimedia communications, ITU-T mediacom2004 framework for multimedia, ISO/IEC MPEG-21 multimedia framework, IETF multimedia Internet standards. **10 Hours**

MODULE III

Application Layer: Introduction, ITU applications, MPEG applications, Mobile servers and applications, Universal multimedia access. **10 Hours**

MODULE IV

Middleware Layer: Introduction to middleware for multimedia, Media coding, Media Streaming, Infrastructure for multimedia content distribution. **10 Hours**

MODULE V

Network Layer: Introduction, QoS in Network Multimedia Systems. **10 Hours**

LABORATORY WORK

The following experiments should be practiced (Tools such as HTML/Frontpage/Dreamweaver/ equivalent, Multimedia application enabling software ,System software support for multimedia, Performance measurement tools for multimedia ,Multimedia authoring tools, Web tools and applications)

1. Audio and video editing
2. Image editing
3. 2D and 3D animation.

.The case studies are:

- Video on-demand
- Interactive TV
- Home shopping
- Remote home care
- Electronic album
- Personalized electronic journals.

COURSE OUTCOMES:

Students will be able to:

- Deploy the right multimedia communication models.
- Apply QoS to multimedia network applications with efficient routing techniques.
- Solve the security threats in the multimedia networks.
- Develop the real-time multimedia network applications.

TEXT BOOKS:

1. K.R. Rao, Zoran S. Bojkovic, Dragorad A. Milovanovic: Introduction to Multimedia Communications – Applications, Middleware, Networking, Wiley India, 2006.

REFERENCE BOOKS:

1. Fred Halsall: Multimedia Communications – Applications, Networks, Protocols, and Standards, Pearson, 2001.
2. Nalin K Sharad: Multimedia information Networking, PHI, 2002.

Semester II

Year:2014-2015

Course Title: Distributed Computing	Course Code: 14SCN22
Credits(L:T:P): 4:0:0	Core/Elective: Core
Type of Course: Lecture	Total Contact Hours:50

Course Objectives

- To learn Basic Concepts of DSM, Hardware DSM
- To understand File Sharing, DFS Implementation, Replication in DFS,
- To understand the concepts of Cryptanalysis, Secure channels, Access control.
- To understand some of the security concepts in distributed computing.

TOPICS

MODULE I

Distributed System management: Introduction, Resource management, Task Assignment Approach, Load-Balancing Approach, Load-Sharing Approach, Process management in a Distributed Environment, Process Migration, Threads, Fault Tolerance.

10 hours

MODULE II

Distributed Shared Memory :Introduction, Basic Concepts of DSM, Hardware DSM, Design Issue in DSM Systems, Issue in Implementing DSM Systems, Heterogeneous and Other DSM Systems, Case Studies.

10 hours

MODULE III

Distributed File System: Introduction to DFS, File Models, Distributed File System Design, Semantics of File Sharing, DFS Implementation, File Caching in DFS, Replication in DFS, Case studies. **Naming:** Introduction, Desirable features of a good naming system, Basic concepts, System-oriented names, Object-locating mechanisms, Issues in designing human-oriented names, Name caches, Naming and security, Case study: Domain name service.

10 hours

MODULE IV

Security in distributed systems: Introduction, Cryptography, Secure channels, Access control, Security Management, Case studies.

10 hours

MODULE V

Real-Time Distributed operating Systems: Introduction, Design issues in real-time distributed systems, Real-time communication, Real-time scheduling, Case study: Real-time communication in MARS. **Emerging Trends in distributed Computing:** Introduction to emerging trends, Grid Computing, SOA, Cloud computing, the future of emerging Trends.

10 hours

COURSE OUTCOMES:

The student will be able to

- Realize shared memory concept.
- Realize Advantages of DFS.
- Implement mechanisms to manage security in DS

Text Book.

1. Sunitha Mahajan, Seema Shah: Distributing Computing, Published by Oxford University press 2010

Semester II

Year:2014-2015

Course Title: Network Management	Course Code: 14SCN23
Credits(L:T:P): 3:0:1	Core/Elective: Core
Type of Course: Lecture and practical	Total Contact Hours:50

COURSE OBJECTIVES

- To understand the need for interoperable network management.
- To learn to the concepts and architecture behind standards based network management.
- To understand the concepts and terminology associated with SNMP and TMN.
- To understand network management as a typical distributed application

TOPICS

MODULE I

Introduction: Analogy of Telephone Network Management, Data and Telecommunication Network Distributed computing Environments, TCP/IP-Based Networks: The Internet and Intranets, Communications Protocols and Standards- Communication Architectures, Protocol Layers and Services; Case Histories of Networking and Management – The Importance of topology , Filtering Does Not Reduce Load on Node, Some Common Network Problems; Challenges of Information Technology Managers, Network Management: Goals, Organization, and Functions- Goal of Network Management, Network Provisioning, Network Operations and the NOC, Network Installation and Maintenance; Network and System Management, Network Management System platform, Current Status and Future of Network Management.

10 Hours

MODULE II

Basic Foundations: Standards, Models, and Language: Network Management Standards, Network Management Model, Organization Model, Information Model – Management Information Trees, Managed Object Perspectives, Communication Model; ASN.1- Terminology, Symbols, and Conventions, Objects and Data Types, Object Names, An Example of ASN.1 from ISO 8824; Encoding Structure; Macros, Functional Model.

10 Hours

MODULE III

SNMPv1 Network Management: Managed Network: The History of SNMP Management, Internet Organizations and standards, Internet Documents, The SNMP Model, The Organization Model, System Overview. The Information Model – Introduction, The Structure of Management Information, Managed Objects, Management Information Base. The SNMP Communication Model – The SNMP Architecture, Administrative Model, SNMP Specifications, SNMP Operations, SNMP MIB Group, Functional Model

SNMP Management – RMON: Remote Monitoring, RMON SMI and MIB, RMON1- RMON1 Textual Conventions, RMON1 Groups and Functions, Relationship Between Control and Data Tables, RMON1 Common and Ethernet Groups, RMON Token Ring Extension Groups, RMON2 – The RMON2 Management Information Base, RMON2 Conformance Specifications.

10 Hours

MODULE IV

Broadband Network Management: Broadband Access Networks and Technologies: Broadband Access Networks, Broadband Access Technology; HFCT Technology: The Broadband LAN, The Cable Modem, The Cable Modem Termination System, The HFC Plant, The RF Spectrum for Cable Modem; Data Over Cable, Reference Architecture; HFC Management – Cable Modem and CMTS Management, HFC Link Management, RF Spectrum Management, DSL Technology; Asymmetric Digital Subscriber Line Technology – Role of the ADSL Access Network in an Overall Network, ADSL Architecture, ADSL Channeling Schemes, ADSL Encoding Schemes; ADSL Management – ADSL Network Management Elements, ADSL Configuration Management, ADSL Fault Management, ADSL Performance Management, SNMP-Based ADSL Line MIB, MIB Integration with Interfaces Groups in MIB-2, ADSL Configuration Profiles.

10 Hours

MODULE V

Network Management Applications: Configuration Management- Network Provisioning, Inventory Management, Network Topology, Fault Management- Fault Detection, Fault Location and Isolation

Techniques, Performance Management – Performance Metrics, Data Monitoring, Problem Isolation, Performance Statistics; Event Correlation Techniques – Rule-Based Reasoning, Model-Based Reasoning, Case-Based Reasoning, Codebook correlation Model, State Transition Graph Model, Finite State Machine Model, Security Management – Policies and Procedures, Security Breaches and the Resources Needed to Prevent Them, Firewalls, Cryptography, Authentication and Authorization, Client/Server Authentication Systems, Messages Transfer Security, Protection of Networks from Virus Attacks, Accounting Management, Report Management, Policy- Based Management, Service Level Management. **10 Hours**

LABORATORY WORK:

1. Capture packets transferred while browsing a selected website (e.g. a page from the course website, a search engine home page). Investigate the protocols used in each packet, the values of the header fields and the packet sizes.
2. Explore at least the following features of Wireshark: filters, Flow Graphs (TCP), statistics, protocol hierarchies.
3. Create several example files for your Apache web server to serve. Configure your web server, and then ask a friend to test your web server by accessing the files. Capture the packets and observe the log file.
4. Configure authentication for a specific directory on your web server. Test, captured packets and observe the log file.
5. Login to another computer in the lab, capture and investigate the data exchanged.
6. Trace the path between several pairs of source/destination nodes.
7. Create fire wall rule(s) that will drop TCP packets destined to a specific computer on the lab network (e.g. yours neighbors computer).
8. Using the supplied client/server sockets programs, implement a third proxy server.

Note: NS2 or equivalent tool to be used.

Course Outcomes:

Upon completion of this course, the students will be able to

- Analyze the issues and challenges pertaining to management of emerging network technologies such as wired/wireless networks and high-speed internets.
- Apply network management standards to manage practical networks.
- Formulate possible approaches for managing OSI network model.
- Use on SNMP for managing the network
- Use RMON for monitoring the behavior of the network
- Identify the various components of network and formulate the scheme for the managing them

TEXT BOOKS:

1. Mani Subramanian: Network Management- Principles and Practice, 2nd Pearson Education, 2010.

REFERENCE BOOKS:

1. J. Richard Burke: Network management Concepts and Practices: a Hands-On Approach, PHI, 2008.

Semester II

Year:2014-2015

Course Title: Switching & Statistical Multiplexing in Telecommunications	Course Code: 14SCN24
Credits(L:T:P): 4:0:0	Core/Elective: Core
Type of Course: Lecture	Total Contact Hours:50

Course Objectives:

- To understand Switching and multiplexing.
- To understand the transmission technology.
- To understand the transmission control.
- To understand basic knowledge on telecommunication.

Topics:

MODULE I

Introduction: Evolution of Telecommunication, Simple Telephone Communication, Basics of a Switching System, Manual Switching System, Major Telecommunication Networks. **Why Digital:** Advantages of Digital Voice Networks, Digital Signal Processing, Disadvantages of Digital Voice Networks.

10 Hours

MODULE II

Switching: Crossbar Switching, Principles of Common Control, Touch Tone Dial Telephone, Principles of Crossbar Switching, Crossbar Switch Configurations, Crosspoint Technology, Crossbar Exchange Organization.

10 Hours

MODULE III

Electronic Space Division Switching: Stored Program Control, Centralized SPC, Distributed SPC, Software Architecture, Application Software, Enhanced Services, Two-stage, Three-stage and n-stage Networks. **Digital Transmission and Multiplexing:** Sampling, Quantization and Binary Coding, Quantization Noise, Companding, Differential Coding, Vocoders, Pulse Transmission, Line Coding, Time Division Multiplexing.

10 Hours

MODULE IV

Time Division Switching: Basic Division Space and Time Switching, Time Multiplexed Space and Time Switching, Combination Switching, Three-stage and n-stage Combination Switching.

10 Hours

MODULE V

Traffic Engineering: Network Traffic Load and Parameters, Grade of Service and Blocking Probability, Modeling Switching Systems, Incoming Traffic and Service Time Characterization, Blocking Models and Loss Estimates, Delay Systems.

10 Hours

Course Outcomes:

The student will be able to:

- Gain the knowledge about switching and multiplexing
- Gain the knowledge about telecommunication.
- Learn transmission control in telecommunication.

TEXT BOOKS:

1. Thiagarajan Viswanathan: Telecommunication Switching Systems and Networks, PHI, 1992.
2. John.C.Bellamy: Digital Telephony, 3rd Edition, John Wiley and Sons Inc., 2002.

Semester II

Year: 2014-2015

Course Title: Cloud Computing	Course Code: 14SCN251
Credits(L:T:P): 4:0:0	Core/Elective: Elective
Type of Course: Lecture	Total Contact Hours:50

COURSE OBJECTIVES

- To learn how to use Cloud Services.
- To gain knowledge Virtualization
- To gain knowledge Task Scheduling algorithms.
- Apply Map-Reduce concept to applications.
- To build Private Cloud.
- To gain knowledge in cloud resource virtualization and scheduling.

TOPICS:

MODULE I

Introduction, Cloud Infrastructure

Cloud computing, Cloud computing delivery models and services, Ethical issues, Cloud vulnerabilities, Cloud computing at Amazon, Cloud computing the Google perspective, Microsoft Windows Azure and online services, Open-source software platforms for private clouds, Cloud storage diversity and vendor lock-in, Energy use and ecological impact, Service level agreements, User experience and software licensing. Exercises and problems.

10 Hours

MODULE II

Cloud Computing: Application Paradigms.

Challenges of cloud computing, Architectural styles of cloud computing, Workflows: Coordination of multiple activities, Coordination based on a state machine model: The Zookeeper, The Map Reduce programming model, A case study: The GrepTheWeb application, Cloud for science and engineering, High-performance computing on a cloud, Cloud computing for Biology research, Social computing, digital content and cloud computing.

10 Hours

MODULE III

Cloud Resource Virtualization.

Virtualization, Layering and virtualization, Virtual machine monitors, Virtual Machines, Performance and Security Isolation, Full virtualization and paravirtualization, Hardware support for virtualization, Case Study:Xen a VMM based

paravirtualization, Optimization of network virtualization, vBlades, Performance comparison of virtual machines, The dark side of virtualization, Exercises and problems.

10 Hours

MODULE IV

Cloud Resource Management and Scheduling.

Policies and mechanisms for resource management, Application of control theory to task scheduling on a cloud, Stability of a two-level resource allocation architecture, Feedback control based on dynamic thresholds, Coordination of specialized autonomic performance managers, A utility-based model for cloud-based Web services, Resourcing bundling: Combinatorial auctions for cloud resources, Scheduling algorithms for computing clouds, Fair queuing, Start-time fair queuing, Borrowed virtual time, Cloud scheduling subject to deadlines, Scheduling Map Reduce applications subject to deadlines, Resource management and dynamic scaling, Exercises and problems.

10 Hours

MODULE V

Cloud Security, Cloud Application Development.

Cloud security risks, Security: The top concern for cloud users, Privacy and privacy impact assessment, Trust, Operating system security, Virtual machine Security, Security of virtualization, Security risks posed by shared images, Security risks posed by a management OS, A trusted virtual machine monitor, Amazon web services: EC2 instances, Connecting clients to cloud instances through firewalls, Security rules for application and transport layer protocols in EC2, How to launch an EC2 Linux instance and connect to it, How to use S3 in java, Cloud-based simulation of a distributed trust algorithm, A trust management service, A cloud service for adaptive data streaming, Cloud based optimal FPGA synthesis .Exercises and problems.

10 Hours

Course Outcomes:

The student will be able to:

- Demonstrate simple Cloud Applications
- Apply resource allocation, scheduling algorithms.
- Implement Map-Reduce concept.
- Create virtual machines from available physical resources.
- Setup a private cloud.

Text Book:

1. Dan C Marinescu: Cloud Computing Theory and Practice. Elsevier(MK) 2013.

REFERENCES:

1. Rajkumar Buyya , James Broberg, Andrzej Goscinski: Cloud Computing Principles and Paradigms, Willey 2014.
2. John W Rittinghouse, James F Ransome:Cloud Computing Implementation, Management and Security, CRC Press 2013.

Semester II

Year:2014-2015

Course Title: Wireless Sensor Networks	Course Code: 14SCN252
Credits(L:T:P): 4:0:0	Core/Elective: Elective
Type of Course: Lecture	Total Contact Hours:50

COURSE OBJECTIVES

- Architect sensor networks for various application setups.
- Explore the design space and conduct trade-off analysis between performance and resources.
- Devise appropriate data dissemination protocols and model links cost.
- Determine suitable medium access protocols and radio hardware.
- Prototype sensor networks using commercial components.

- Provision quality of service, fault-tolerance, security and other dependability requirements while coping with resource constraints.

TOPICS:

MODULE I

Introduction, Overview and Applications of Wireless Sensor Networks

Introduction, Basic overview of the Technology, **Applications of Wireless Sensor Networks:** Introduction, Background, Range of Applications, Examples of Category 2 WSN Applications, Examples of Category 1 WSN Applications, Another Taxonomy of WSN Technology

(Chapter 1: 1.1, 1.2, Chapter2: 2.1-2.6)

10 Hours

MODULE II

Basic Wireless Sensor Technology and Systems: Introduction, Sensor Node Technology, Sensor Taxonomy, WN Operating Environment, WN Trends, Wireless Transmission Technology and Systems: Introduction, Radio Technology Primer, Available Wireless Technologies

(Chapter3: 3.1-3.5, Chapter 4: 4.1-4.3)

10 Hours

MODULE III

MAC and Routing Protocols for Wireless Sensor Networks: Introduction, Background, Fundamentals of MAC Protocols, MAC Protocols for WSNs, Sensor-MAC case Study, IEEE 802.15.4 LR-WPANs Standard Case Study. **Routing Protocols for Wireless Sensor Networks:** Introduction, Background, Data Dissemination and Gathering, Routing Challenges and Design Issues in WSNs, Routing Strategies in WSNs.

(Chapter 5: 5.1-5.6, Chapter 6: 6.1-6.5)

10 Hours

MODULE IV

Transport Control and Middleware for Wireless Sensor Networks

Traditional Transport Control Protocols, Transport Protocol Design Issues, Examples of Existing Transport Control Protocols, Performance of Transport Control Protocols. **Middleware for Wireless Sensor Networks:** Introduction, WSN Middleware Principles, Middleware Architecture, Existing Middleware.

(Chapter 7: 7.1-7.4, Chapter 8: 8.1-8.4)

10 Hours

MODULE V

Network Management and Operating System for Wireless Sensor Networks

Introduction, Network Management Requirements, Traditional Network Management Models, Network Management Design Issues. **Operating Systems for Wireless Sensor Networks:** Introduction, Operating System Design Issues, Examples of Operating Systems.

(Chapter 9: 9.1-9.5, Chapter 10: 10.1-10.3)

10 Hours

COURSE OUTCOMES

The student will be able to:

- Develop applications of wireless sensor actuator networks
- Implement the elements of distributed computing and network protocol .

- Explore various hardware, software platforms that exist for sensor networks

TEXT BOOKS:

1. KAZEM SOHRABY, DANIEL MINOLI, TAIEB ZNATI, “Wireless Sensor Networks: Technology, Protocols and Applications”, WILEY , Second Edition (Indian) , 2014

REFERENCE BOOKS:

1. Ian F. Akyildiz, Mehmet Can Vuran "Wireless Sensor Networks", Wiley 2010
2. Feng Zhao & Leonidas J. Guibas, “Wireless Sensor Networks- An Information Processing Approach”, Elsevier, 2007.

Semester II

Year: 2014-2015

Course Title: Optical Networks	Course Code: 14SCN253
Credits(L:T:P): 4:0:0	Core/Elective: Elective
Type of Course: Lecture	Total Contact Hours:50

Course Objectives:

- To learn the basic elements of optical fiber transmission link, fiber modes configurations and structures
- To understand the different kind of losses, signal distortion in optical wave guides and other signal degradation factors
- To learn the various optical source materials, LED structures, quantum efficiency, Laser diodes
- To learn the fiber optical receivers such as PIN APD diodes, noise performance in photo detector, receiver operation and configuration
- To learn the fiber optical network components, variety of networking aspects, FDDI, SONET/SDH and operational principles WDM
- To acquire knowledge about fault and congestion management.

Topics

MODULE I

Client Layers of the Optical Layer: SONET/SDH: Multiplexing, CAT and LCAS, Sonnet/SDH Layers, SONET Frame Structure, SONET/SDH Physical Layer , Elements of a SONET/SDH Infrastructure, **Optical Transport Network:** Hierarchy, Frame Structure, Multiplexing, Generic Framing Procedure Ethernet: Frame Structure, Switches, Ethernet Physical Layer, Carrier Transport IP: Routing and Forwarding, Quality of Service. **Multiprotocol Label Switching:** Labels and Forwarding, Quality of Service, Signaling and Routing, Carrier Transport, Resilient Packet Ring: Quality of Service, Node Structure, Fairness Storage-Area Networks: Fiber Channel.

10 Hours

MODULE II

WDM Network Elements: Optical Line Terminals, Optical Line Amplifiers, Optical Add/Drop Multiplexers: OADM Architectures, **Reconfigurable OADMs Optical Cross connects:** All-Optical OXC Configurations.

10 Hours

MODULE III

Control and Management

Network Management Functions: Management Framework, Information Model, Management Protocols. Optical Layer Services and Interfacing, Layers within the Optical Layer, Multivendor Interoperability. **Performance and Fault Management:** The Impact of Transparency, BER Measurement, Optical Trace, Alarm Management, Data Communication Network (DCN) and Signaling, Policing, Optical Layer Overhead, Client Layers. **Configuration Management:** Equipment Management, Connection Management, Adaptation Management. Optical Safety: Open Fiber Control Protocol

10 Hours

MODULE IV

Protection in SONET/SDH: Point-to-Point Links, Self-Healing Rings, Unidirectional Line-Switched Rings, Bidirectional Line-Switched Rings, Ring Interconnection and Dual Homing. **Protection in the Client Layer:** Protection in Resilient Packet Rings, Protection in Ethernet, Protection in IP, Protection in MPLS, Why Optical Layer Protection: Service Classes Based on Protection. Optical Layer Protection Schemes: 1+1 OMS Protection, 1:1 OMS Protection, OMS-DPRing, OMS-SPRing, 1:N Transponder Protection, 1+1 OCh Dedicated Protection, OCh-SPRing, OCH-Mesh Protection, GMPLS Protection, Interworking between Layers.

10 Hours

MODULE V

WDM Network Design: Cost Trade-OFFS: A Detailed Ring Network Example LTD and RWA Problems, Light path Topology Design, Routing and Wavelength Assignment, Wavelength Conversion. Dimensioning Wavelength- Routing Networks, **Statistical Dimensioning Models:** First-Passage Model, Blocking Model, Maximum **Load Dimensioning Models:** Offline Light path Requests, Online RWA in Rings.

10 Hours

COURSE OUTCOMES

The student will be able to:

- Design a system, component or process as per needs and specification.
- Gain knowledge on optical network architectures ranging from optical access networks to backbone optical transport networks.
- Gain the knowledge on methodologies of optical network design optimization;
- Explore techniques of optical network survivability.
- Solve the Problems in the discipline of optical networks.

Text Books:

1. Optical Networks by Rajeev Ramaswamy, Kumar N Sivarajan, Galen H Sasaki, Elsevier Publication 3rd Edition, 2009.

References:

1. Uylless Black, Optical Networks-Third generation transport system: Pearson 2013.

Course Title: Advances in VLSI Design and Algorithms	Course Code: 14SCN254
Credits(L:T:P): 4:0:0	Core/Elective: Elective
Type of Course: Lecture	Total Contact Hours:50

Course Objectives:

- Able to understand the fundamentals of CMOS VLSI and associated technologies.
- Able to solve problems in the design of CMOS logic circuits, with particular reference to speed and power consumption.
- Able to appreciate the design process in VLSI, GALS.
- Able to explain basic operation principles of diodes and MOS FPGAs; PLA.
- Able to design the fundamental blocks of a VLSI circuits, both by circuit schematic and physical layout

TOPICS:**MODULE I**

Introduction to Digital systems and VLSI: Why Design Integrated Circuits? Integrated Circuits manufacturing; Integrated Circuit Design Techniques; IP-Based Design.

Fabrication and Devices: Introduction; Fabrication processes; Fabrication theory and practice; Reliability.

10 Hours**MODULE II**

Sequential Machines: Introduction; Latches and Flip-flops; Sequential systems and clocking disciplines; Performance analysis; Clock generators; Sequential systems design, Power optimization, Design validation, Sequential testing.

10 Hours**MODULE III**

Subsystem Design: Introduction; Combinational shifters; Adders; ALUs; Multipliers; High-density memory; Image sensors; FPGAs; PLA; Buses and networks on chips; Data paths; Subsystems as IP.

10 Hours**MODULE IV**

Architecture Design: Introduction; Hardware description languages; Register Transfer design; Pipelining; High-level synthesis; Architecture for low power; GALS systems; Architecture testing; IP components; Design methodologies; Multiprocessor system-on-Chip design.

10 Hours**MODULE V**

Simulations: General remarks; Gate-level modeling and simulations; Switch-level modeling and simulation.

10 Hours

Course Outcomes:

The student will be able to:

- Clear understanding of important concepts in CMOS technology and fabrication that affect design.
- Apply two-level and multi-level logic minimization techniques to the given Boolean logic function.
- Design and develop Layout a gate in CMOS VLSI technology.

TEXT BOOKS:

1. Wayne Wolf: “Modern VLSI design”, 4th Edition, PHI Learning, 2007.
2. Sabih H Gerez: “Algorithms for VLSI Design Automation”, Wiley India, 2007.

Semester II

Year: 2014-2015

Course Title: Distributed Computing Lab	Course Code: 14SCN26
Credits(02)(L:T:P): 0:0:3	Core/Elective: Core
Type of Course: Practical	Total Contact Hours:42

Course Objectives

- To understand the main ideas and concepts on web services.
- Studying and working on a related topic of internet applications such as information hiding, system security and E-learning.
- To understand the concepts of UDDI, SOAP, JMS remote procedure calls.

LIST OF EXPERIMENTS:

Note: Use appropriate tools/language to implement the following experiment:

1. Design and implement client server application using RMI (Remote Method Invocation) to invoke a service to calculate the income tax.
2. Design and implement EJB (Entity Java Beans) session bean business logic to calculate income tax and invoke the service using stub, i.e., client side proxy object.
3. Design and implement an EJB entity bean to persist the client submitted data into an enterprise information system.
4. Design and implement an offline database communication system using JMS (Java Message Service) to service the client request.
5. Design and implement the client code to call the Micro soft service like free service from UDDI (Universal Description Discovery Protocol).
6. Design and implement business logic and bind it as service using SOAP (Simple Object Access Protocol), also implement client to call service.

NOTE: Use EJB 3.X or any equivalent tool.

COURSE OUTCOMES:

The student will be able to

- Develop and debug RPC based client-Server programs in UNIX.
- Realize the partial implementation of UDDI, SOAP, JMS in Web applications.

Semester IV

Year: 2014-2015

Course Title: Client-Server Programming	Course Code: 14SCN41
Credits(L:T:P): 3:0:1	Core/Elective: Core
Type of Course: Lecture and practical	Total Contact Hours:50

COURSE OBJECTIVES

- To understand **Client-Server software**, Context Switching and Protocol Software, I/o.
- To understand System Calls, Basic I/O Functions available in UNIX
- To understand the Socket interface, TCP, UDP in detail.
- Various client software applications and their issues.
- To understand the concept of Socket interface in client server programming.

TOPICS:

MODULE I

The Client Server Model and Software Design: Introduction, Motivation, Terminology and Concepts

Concurrent Processing in Client-Server software: Introduction, Concurrency in Networks, Concurrency in Servers, Terminology and Concepts, An example of Concurrent Process Creation, Executing New Code, Context Switching and Protocol Software Design, Concurrency and Asynchronous I/O. **Program Interface to Protocols:** Introduction, Loosely Specified Protocol Software Interface, Interface Functionality, Conceptual Interface Specification, System Calls, Two Basic Approaches to Network Communication, The Basic I/O Functions available in UNIX, Using UNIX I/O with TCP/IP. **10 Hours**

MODULE II

The Socket Interface: Introduction, Berkeley Sockets, Specifying a Protocol Interface, The Socket Abstraction, Specifying an End Point Address, A Generic Address Structure, Major System Calls used with Sockets, Utility Routines for Integer Conversion, Using Socket Calls in a Program, Symbolic Constants for Socket Call Parameters. **Algorithms and Issues in Client Software Design:** Introduction, Learning Algorithms instead of Details, Client Architecture, Identifying the Location of a Server, Parsing an Address Argument, Looking up a Domain Name, Looking up a well-known Port by Name, Port Numbers and Network Byte Order, Looking up a Protocol by Name, The TCP Client Algorithm, Allocating a Socket, Choosing a Local Protocol Port Number, A fundamental Problem in choosing a Local IP Address, Connecting a TCP Socket to a Server, Communicating with the Server using TCP, Reading a response from a TCP Connection, Closing a TCP Connection, Programming a UDP Client, Connected and Unconnected UDP Socket, Using Connect with UDP, Communicating with a Server using UDP, Closing a Socket that uses UDP, Partial Close for UDP, A Warning about UDP Unreliability. **10 Hours**

MODULE III

Example Client Software: Introduction, The Importance of Small Examples, Hiding Details, An Example Procedure Library for Client Programs, Implementation of Connect TCP, Implementation of Connect UDP, A Procedure that Forms Connections, Using the Example Library, The DAYTIME Service, Implementation of a TCP Client for DAYTIME, Reading from a TCP Connection, The Time Service, Accessing the TIME Service, Accurate Times and Network Delays,

A UDP Client for the TIME Service, The ECHO Service, A TCP Client for the ECHO Service, A UDP Client for the ECHO Service.

10 Hours

MODULE IV

Algorithms and Issues in Server Software Design: Introduction, The Conceptual Server Algorithm, Concurrent Vs Iterative Servers, Connection-Oriented Vs Connectionless Access, Connection-Oriented Servers, Connectionless Servers, Failure, Reliability and Statelessness, Optimizing Stateless Servers, Four Basic Types of Servers, Request Processing Time, Iterative Server Algorithms, An Iterative Connection-Oriented Server Algorithm, Binding to a Well Known Address using INADDR_ANY, Placing the Socket in Passive Mode, Accepting Connections and using them. An Iterative Connectionless Server Algorithm, Forming a Reply Address in a Connectionless Server, Concurrent Server Algorithms, Master and Slave Processes, A Concurrent Connectionless Server Algorithm, A concurrent Connection-Oriented Server Algorithm, Using separate Programs as Slaves, Apparent Concurrency using a Single Process, When to use each Server Types, The Important Problem of Server Deadlock, Alternative Implementations.

10 Hours

MODULE V

Iterative, Connectionless Servers (UDP): Introduction, Creating a Passive Socket, Process Structure, An example TIME Server. **Iterative, Connection-Oriented Servers (TCP):** Introduction, Allocating a Passive TCP Socket, A Server for the DAYTIME Service, Process Structure, An Example DAYTIME Server, Closing Connections, Connection Termination and Server Vulnerability.

Concurrent, Connection-Oriented Servers (TCP): Introduction, Concurrent ECHO, Iterative Vs Concurrent Implementations, Process Structure, An example Concurrent ECHO Server, Cleaning up Errant Processes.

10 Hours

LABORATORY WORK:

1. Design, develop, and execute a program in C under UNIX / LINUX environment to implement a simple iterative connectionless server and demonstrate its functioning.
2. Design, develop, and execute a program in C under UNIX / LINUX environment to implement a simple iterative connection-oriented server and demonstrate its functioning.
3. Design, develop, and execute a program in C under UNIX / LINUX environment to implement a simple concurrent connection-oriented server and demonstrate its functioning.
4. Design, develop, and execute a program in C under UNIX / LINUX environment to implement a simple Day / Time Server and demonstrate its functioning.
5. Design, develop, and execute a program using JAVA networking facilities to implement a simple Day / Time Server and demonstrate its functioning. Repeat the above problems.

COURSE OUTCOMES

The student will be able to:

- Gain in depth knowledge about Client-Server software, Context Switching and Protocol Software, I/o.
- Programming System Calls, Basic I/O Functions available in UNIX
- Gain the knowledge on Socket interface, TCP, UDP in details.
- Pros and cons of Client Software Various applications and their issues.

TEXT BOOK:

1. Douglas E.Comer, David L. Stevens: Internetworking with TCP/IP – Vol. 3, Client-Server Programming and Applications, BSD Socket Version with ANSI C, 2nd Edition, Pearson, 2001

Course Title: Analysis of Computer Networks	Course Code: 14SCN421
Credits(L:T:P): 4:0:0	Core/Elective: Elective
Type of Course: Lecture	Total Contact Hours:50

COURSE OBJECTIVES

- To Become familiar with the concepts of computer networks
- What is a computer network and what are the fundamental protocols.
- To analyze network architectures in stochastic and deterministic way.
- RSVP, Principles of TCP
- To explore more on different network protocols.
- To understand the knowledge of multiplexing, streaming sessions in computer network.

TOPICS:**MODULE I**

Introduction: Two examples of analysis: Efficient transport of packet voice calls, Achievable throughput in an input-queuing packet switch; the importance of quantitative modeling in the Engineering of Telecommunication Networks.

10 Hours**MODULE II**

Multiplexing: Network performance and source characterization; Stream sessions in a packet network: Delay guarantees; Elastic transfers in a packet network; Packet multiplexing over Wireless networks.

10 Hours**MODULE III**

Stream Sessions: Deterministic Network Analysis: Events and processes in packet multiplexer models: Universal concepts; Deterministic traffic models and Network Calculus; Scheduling; Application to a packet voice example; Connection setup: The RSVP approach; Scheduling (continued).

10 Hours**MODULE IV**

Stream Sessions: Stochastic Analysis: Deterministic analysis can yield loose bounds; Stochastic traffic models; Additional notation; Performance measures; Little's theorem, Brumelle's theorem, and applications; Multiplexer analysis with stationary and ergodic traffic; The effective bandwidth approach for admission control; Application to the packet voice example; Stochastic analysis with shaped traffic; Multihop networks; Long-Range-Dependent traffic.

10 Hours**MODULE V**

Adaptive Bandwidth Sharing for Elastic Traffic: Elastic transfers in a Network; Network parameters and performance objectives; sharing a single link; Rate-Based Control; Window-Based Control: General Principles; TCP: The Internet's Adaptive Window Protocol; Bandwidth sharing in a Network.

10 Hours**Course Outcomes:**

On completion, student will be able to:

- List and classify network services, protocols and architectures, explain why they are layered.
- Implement key Internet applications and their protocols, and will apply to develop their own applications (e.g. Client Server applications, Web Services) using the sockets API.

TEXT BOOKS:

1. Anurag Kumar, D. Manjunath, Joy Kuri: Communication Networking An Analytical Approach, Elsevier, 2004.

REFERENCE BOOKS:

1. M. Schwartz: Broadband Integrated Networks, Prentice Hall PTR, 1996.

2. J. Walrand, P. Varaiya: High Performance Communication Networks, 2nd Edition, Morgan Kaufmann, 1999

Semester IV

Year:2014-2015

Course Title: Service Oriented Architecture	Course Code: 14SCN422
Credits(L:T:P): 4:0:0	Core/Elective: Elective
Type of Course: Lecture	Total Contact Hours:50

Course Objectives:

- To understand various architecture for application development
- To understand the importance of SOA in Application Integration
- To learn web service and SOA related tools.
- To learn the concepts of SOA governance.

Topics:

MODULE I

SOA BASICS: Software Architecture – Types of IT Architecture – SOA – Evolution – Key components – perspective of SOA – Enterprise-wide SOA – Architecture – Enterprise Applications – Solution Architecture for enterprise application – Software platforms for enterprise Applications – Patterns for SOA – SOA programming models

10 Hours

MODULE II

SOA ANALYSIS AND DESIGN: Service-oriented Analysis and Design – Design of Activity, Data, Client and business process services – Technologies of SOA – SOAP – WSDL – JAX – WS – XML WS for .NET – Service integration with ESB – Scenario – Business case for SOA – stakeholder OBJECTIVES – benefits of SPA – Cost Savings

10 Hours

MODULE III

SOA GOVERNANCE :SOA implementation and Governance – strategy – SOA development – SOA governance – trends in SOA – event-driven architecture – software as a service – SOA technologies – proof-of-concept – process orchestration – SOA best practices

10 Hours

MODULE IV

SOA IMPLEMENTATION: SOA based integration – integrating existing application – development of web services – Integration - SOA using REST – RESTful services – RESTful services with and without JWS – Role of WSDL, SOAP and Java/XML mapping in SOA – JAXB Data binding.

10 Hours

MODULE V

APPLICATION INTEGRATION: JAX –WS 2.0 client side/server side development – Packaging and Deployment of SOA component – SOA shopper case study –WSDL centric java WS with SOA-J – related software – integration through service composition (BPEL) – case study - current trends.

10 Hours

COURSE OUTCOMES

The student will be able to:

- Compare the different IT architecture
- Analysis and design of SOA based applications
- Implementation of web service and realization of SOA
- Implementation of RESTful services
- Design and implementation of SOA based Application Integration using BPEL

Textb Book:

1. Shankar Kambhampaly, “Service–Oriented Architecture for Enterprise Applications”, Wiley 2008.

REFERENCES:

2. Mark D. Hansen, “SOA using Java Web Services”, Practice Hall, 2007.
3. Waseem Roshen, “SOA-Based Enterprise Integration”, Tata McGraw-HILL, 2009.

Semester IV

Year: 2014-2015

Course Title: Mobile Application Development	Course Code: 14SCN423
Credits(L:T:P): 4:0:0	Core/Elective: Elective
Type of Course: Lecture	Total Contact Hours:50

Course Objectives:

- To Understand system requirements for mobile applications
- To Generate suitable design using specific mobile development frameworks
- To Generate mobile application design
- To Implement the design using specific mobile development frameworks
- To acquire knowledge of android applications development.

Topics:

MODULE I

Introduction to mobile communication and computing; Introduction to mobile computing, Novel applications, limitations and GSM architecture, Mobile services, System architecture, Radio interface, protocols, Handover

and security. Smart phone operating systems and smart phones applications.

10 Hours

MODULE II

Fundamentals of Android Development: Introduction to Android., The Android 4.1 Jelly Bean SDK, Understanding the Android Software Stack, Installing the Android SDK, Creating Android Virtual Devices, Creating the First Android Project, Using the Text View Control, Using the Android Emulator, The Android Debug Bridge (ADB), Basic Widgets Understanding the Role of Android Application Components, Event Handling , Displaying Messages Through Toast, Creating and Starting an Activity, Using the EditText Control .

10 Hours

MODULE III

The Android Debug Bridge (ADB), Basic Widgets Understanding the Role of Android Application Components, Event Handling , Displaying Messages Through Toast, Creating and Starting an Activity, Using the EditText Control Building Blocks for Android Application Design, Laying Out Controls in Containers, Utilizing Resources and Media, Using Selection Widgets and Debugging Displaying and Fetching Information Using Dialogs and Fragments

10 Hours

MODULE IV

Using Selection Widgets and Debugging Displaying and Fetching Information Using Dialogs and Fragments Advanced Android Programming: Internet, Entertainment, and Services, Implementing drawing and animations,

10 Hours

MODULE V

Displaying web pages and maps, communicating with sms and emails,. creating and using content providers: Creating and consuming services, Publishing android applications.

10 Hours

Course Outcomes:

The student will be able to:

- Describe the requirements for mobile applications
- Explain the challenges in mobile application design and development
- Develop and design for mobile applications for specific requirements
- Implement the design using Android SDK
- Implement the design using Objective C and iOS

Text Books:

1. Mobile Computing: Technologies and Applications- N. N. Jani S chand,2009.
2. B.M.Hirwani- Android programming Pearson publications-2013

Course Title: Cybercrime and Digital Forensic	Course Code: 14SCN424
Credits(L:T:P): 4:0:0	Core/Elective: Elective
Type of Course: Lecture	Total Contact Hours:50

Course Objectives

- To understand Accounting Forensics
- To analyze the nature and effect of cyber crime in society.
- To understand Sarbanes-Oxley Financial and Accounting Disclosure Information
- To understand Computer Crime and Criminals
- To understand Liturgical Procedures

Topics:**MODULE I**

INTRODUCTION: Introduction and Overview of Cyber Crime, Nature and Scope of Cyber Crime, Types of Cyber Crime: Social Engineering, Categories of Cyber Crime, Property Cyber Crime.

10 Hours**MODULE II**

CYBER CRIME ISSUES: Unauthorized Access to Computers, Computer Intrusions, White collar Crimes, Viruses and Malicious Code, Internet Hacking and Cracking, Virus Attacks, Pornography, Software Piracy, Intellectual Property, Mail Bombs, Exploitation, Stalking and Obscenity in Internet, Digital laws and legislation, Law Enforcement Roles and Responses.

10 Hours**MODULE III**

INVESTIGATION: Introduction to Cyber Crime Investigation, Investigation Tools, e-Discovery, Digital Evidence Collection, Evidence Preservation, E-Mail Investigation, E-Mail Tracking, IP Tracking, E-Mail Recovery, Hands on Case Studies. Encryption and Decryption Methods, Search and Seizure of Computers, Recovering Deleted Evidences, Password Cracking.

10 Hours**MODULE IV**

DIGITAL FORENSICS: Introduction to Digital Forensics, Forensic Software and Hardware, Analysis and Advanced Tools, Forensic Technology and Practices, Forensic Ballistics and Photography, Face, Iris and Fingerprint Recognition, Audio Video Analysis, Windows System Forensics, Linux System Forensics, Network Forensics.

10 Hours

MODULE V

LAWS AND ACTS: Laws and Ethics, Digital Evidence Controls, Evidence Handling Procedures, Basics of Indian Evidence ACT IPC and CrPC , Electronic Communication Privacy ACT, Legal Policies.

10 Hours

Course Outcomes

The student will be able to:

- Understand financial and accounting forensics, and explain their role in preventing various forms of fraud.
- Distinguish various types of computer crime, and use computer forensic techniques to identify the digital fingerprints associated with criminal activities.
- Know how to apply forensic analysis tools to recover important evidence for identifying computer crime.
- Develop a custom computer forensic analysis tool.

Text:

1. Nelson Phillips and Enfinger Steuart, “Computer Forensics and Investigations”, Cengage Learning, New Delhi, 2009.
2. Kevin Mandia, Chris Prosise, Matt Pepe, “Incident Response and Computer Forensics “, Tata McGraw -Hill, New Delhi, 2006.

References:

3. Robert M Slade,” Software Forensics”, Tata McGraw - Hill, New Delhi, 2005.
4. Bernadette H Schell, Clemens Martin, “Cybercrime”, ABC – CLIO Inc, California, 2004.



BMS COLLEGE OF ENGINEERING, BENGALURU-19

(Autonomous Institute, Affiliated to VTU)

Department of Information Science and Engineering

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.



BMS COLLEGE OF ENGINEERING, BENGALURU-19

(Autonomous Institute, Affiliated to VTU)

Department of Information Science and Engineering

POST GRADUATE PROGRAMME IN COMPUTER NETWORK ENGINEERING

Programme Outcomes (POs):

PO1	Scholarship of Knowledge: Acquire in-depth knowledge of specific discipline or professional area, including wider and global perspective, with an ability to discriminate, evaluate, analyze and synthesize existing and new knowledge, and integration of the same for enhancement of knowledge.
PO2	Critical Thinking: Analyze complex engineering problems critically, apply independent judgment for synthesizing information to make intellectual and/or creative advances for conducting research in a wider theoretical, practical and policy context.
PO3	Problem Solving: Think laterally and originally, conceptualize and solve engineering problems, evaluate a wide range of potential solutions for those problems and arrive at feasible, optimal solutions after considering public health and safety, cultural, societal and environmental factors in the core areas of expertise.
PO4	Research Skill: Extract information pertinent to unfamiliar problems through literature survey and experiments, apply appropriate research methodologies, techniques and tools, design, conduct experiments, analyze and interpret data, demonstrate higher order skill and view things in a broader perspective, contribute individually/in group(s) to the development of scientific/technological knowledge in one or more domains of engineering.
PO5	Usage of modern tools: Create, select, learn and apply appropriate techniques, resources, and modern engineering and IT tools, including prediction and modelling, to complex engineering activities with an understanding of the limitations.
PO6	Collaborative and Multidisciplinary work: Possess knowledge and understanding of group dynamics, recognize opportunities and contribute positively to collaborative-multidisciplinary scientific research, demonstrate a capacity for self-management and teamwork, decision-making based on open-mindedness, objectivity and rational analysis in order to achieve common goals and further the learning of themselves as well as others.
PO7	Project Management and Finance: Demonstrate knowledge and understanding of engineering and management principles and apply the same to one's own work, as a member and leader in a team, manage projects efficiently in respective disciplines and multidisciplinary environments after consideration of economical and financial factors.
PO8	Communication: Communicate with the engineering community, and with society at large, regarding complex engineering activities confidently and effectively, such as, being able to comprehend and write effective reports and design documentation by adhering to appropriate standards, make effective presentations, and give and receive clear instructions.
PO9	Life-long Learning: Recognize the need for, and have the preparation and ability to engage in life-long learning independently, with a high level of enthusiasm and commitment to improve knowledge and competence continuously.
PO10	Ethical Practices and Social Responsibility: Acquire professional and intellectual integrity, professional code of conduct, ethics of research and scholarship, consideration of the impact of research outcomes on professional practices and an understanding of responsibility to contribute to the community for sustainable development of society.
PO11	Independent and Reflective Learning: Observe and examine critically the outcomes of one's actions and make corrective measures subsequently, and learn from mistakes without depending on external feedback.

PROGRAMME EDUCATIONAL OBJECTIVES (PEOs):

PEO1	Excel in their professional career in computer network engineering and allied disciplines
PEO2	Achieve Proficiency in Industry or Academia and Research for Development.
PEO3	Exhibit professionalism, team work and adapt to the latest technologies through continuous learning.



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SCHEME OF INSTRUCTION

Programme: Computer Network Engineering

Semester: I

Course Code	Name of the Course	Credits					Contact Hours	Marks			SEE Duration in Hours
		L	T	P	S	Total		CIE	SEE	Total	
16ISCNPCWN	Wireless Adhoc Network	3	0	1	0	4	5	50	50	100	3
16ISCNPCCN	Advanced Computer Network	3	0	0	0	3	3	50	50	100	3
16ISCNPCIN	Information and Network Security	3	0	0	0	3	3	50	50	100	3
16ISCNPCCS	Client Server Programming	3	0	1	0	4	5	50	50	100	3
16ISCNPXXX	Elective – I	3	1	0	0	4	4	50	50	100	3
16ISCNPYYY	Elective – II	3	0	0	0	3	3	50	50	100	3
16APRDICRM	Research Methodology	2	0	0	0	2	2	50	50	100	3
16ISCNPCS1	Technical Seminar - I	0	0	0	2	2	0	50	50	100	3
Total		20	1	2	2	25	25				

Elective - I - XX

16ISCNPESA	Advanced Storage Area Network
16ISCNPECA	Computer System Performance Analysis
16ISCNPESN	Social Network Analysis
16ISCNPEPR	Protocol Engineering

Elective – II – YY

16ISCNPEPQ	Probability Statistics and Queuing Theory
16ISCNPEAA	Advanced Algorithms
16ISCNPEMA	Multicore Architecture and Programming
16ISCNPESC	Soft Computing



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SCHEME OF INSTRUCTION

Programme: Computer Network and Engineering

Semester: II

Course Code	Name of the Course	Credits					Contact Hours	Marks			SEE Duration in Hours
		L	T	P	S	Total		CIE	SEE	Total	
16ISCNPCCL	Cyber Security and Law	3	0	1	0	4	5	50	50	100	3
16ISCNPCDC	Distributed Computing	3	0	0	0	3	3	50	50	100	3
16ISCNPCNM	Network Management	3	0	0	0	3	3	50	50	100	3
16ISCNPEZZ	Elective III	3	0	0	0	3	3	50	50	100	3
16ISCNPEAA	Elective IV	3	0	1	0	4	5	50	50	100	3
16XXXXIEXX	Institution Elective	4	0	0	0	4	4	50	50	100	3
16ISCNPCPF	Software Project Management and Finance	2	0	0	0	2	2	50	50	100	3
16ISCNPCGP	Group Project	0	0	2	0	2	4	50	50	100	3
Total		21	0	4	0	25	29				

Elective III - ZZ

16ISCNPEON	Optical Network
16ISCNPENR	Network Routing Algorithms
16ISCNPEMC	Multimedia Communications
16ISCNPESD	Software Defined Network

Elective IV – AA

16ISCNPECC	Cloud Computing
16ISCNPEIO	Internet of Things
16ISCNPEWT	Web Technologies
16ISCNPEMD	Mobile Application Development



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LIST OF INSTITUTIONAL ELECTIVES OFFERED BY VARIOUS M.TECH. PROGRAMMES FOR 2ND SEMESTER 2017

SNo	Name of the M.Tech. Programme	Course details	
		Code	Name
1	<i>Biochemical Engineering</i>	16CHBC2ITQ	Total Quality Management
2		16CHBC2IPM	Project Engineering Management
3		16CHBC2IFT	Fermentation Technology
4		16CHBC2IBM	Biomaterials
5	<i>Biomedical Signal Processing & Instrumentation</i>	16MLBI2EMD	Medical device development
6		16MLBI2ENN	Neural Networks & Fuzzy logic applications
7		16MLBI2EPR	Pattern recognition and applications
8	<i>Computer Science & Engineering</i>	16CSCS2EBD	Big Data Analytics
9		16CSCS2EIT	Internet of Things
10	<i>Construction Technology</i>	-	-
11	<i>Digital Communication</i>	16 CDC2EQRE	Quality and Reliability of Engineering systems
12	<i>Electronics</i>	16ECEL2ESM	Simulation, Modelling and Analysis
13	<i>Environmental Engineering</i>	-	-
14	<i>Machine Design</i>	16MEMD2ECA	Computer Applications in Design
15		16MEMD2ECG	Computer Graphics
16		16MEMD2ESS	Smart Materials and Structures
17	<i>Manufacturing Science & Engineering</i>	16MEMS2ECM	Computational methods in Engineering analysis



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18		16MEMS2EDE	Design of Experiments
19		16MEMS2EDM	Design for Manufacture
20	<i>Power Electronics</i>	16EEPE2ERE	Renewable Energy & Photovoltaics
21		16EEPE2EMS	Micro & Smart Systems
22	<i>Transportation Engineering & Management</i>	-	-
23	<i>VLSI Design & Embedded System</i>	16ECVE2IMN	Advanced Micro and Nano devices
24		16ECVE2IRB	Robotics
25	<i>Computer Network Engineering</i>	16ISCNIECN	Computer Network
26		16ISCNIEWN	Wireless Network
27		16ISCNIECP	Computer System Performance Analysis



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SCHEME OF INSTRUCTION

Programme: Computer Network and Engineering

Semester: III

Course Code	Name of the Course	Credits					Contact Hours	Marks			SEE Duration in Hours
		L	T	P	S	Total		CIE	SEE	Total	
16ISCNPCIT	Internship/Industrial Training	0	0	0	21	21	0	100	100	200	3
16ISCNPCP1	Project Work (Phase – I)	0	0	0	4	4	4	100	100	200	3
Total		0	0	0	25	25	4				

SCHEME OF INSTRUCTION

Programme: Computer Network and Engineering

Semester: IV

Course Code	Name of the Course	Credits					Contact Hours	Marks			SEE Duration in Hours
		L	T	P	S	Total		CIE	SEE	Total	
16ISCNPCP2	Project Work (Phase – II)	0	0	23	0	23	0	100	100	200	3
16ISCNPCS2	Technical Seminar - II	0	0	0	2	2	0	100	100	200	3
Total		0	0	23	2	25	0				



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General Guidelines:

- **Theory Core:** would be evaluated for 30 Marks as a part of Internal Assessment. Remaining 20 marks would be evaluated using alternative assessment tools. CIE for the theory courses would be $30+20=50$ Marks. SEE for will be conducted for 50 Marks. The final would be CIE+SEE $(50+50) = 100$ Marks.
- **Integrated Core:** would be evaluated for 30 Marks as a part of Internal Assessment. Laboratory Work would be evaluated for 20 Marks. The corresponding Lab Journals must be prepared as part of the assessment. Total internal assessment (CIE) for the comprehensive courses would be $30+20=50$ Marks. SEE for will be conducted for 50 Marks. The final would be CIE+SEE $(50+50) = 100$ Marks.
- **Elective courses:** would be evaluated for 30 Marks as a part of Internal Assessment. Remaining 20 marks would be evaluated using alternative assessment tools for courses without lab. Otherwise, the elective course with lab work would be evaluated for 20 Marks. The corresponding Lab Journals must be prepared as part of the assessment. CIE for the theory courses would be $30+20=50$ Marks. SEE will be conducted for 50 Marks. The final would be CIE+SEE $(50+50) = 100$ Marks.
- **Tutorial Classes:** for any course included would be evaluated for 20 Marks using only alternative assessment tools. Assessment would be part of theory or elective course.



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SEMESTER –I

Course Title	WIRELESS ADHOC NETWORK				
Course Code	16ISCNPCWN	Credits	04	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

Ad-hoc Wireless Networks : Introduction, Issues in Ad-hoc Wireless Networks, Ad-hoc Wireless Internet; MAC Protocols for Ad-hoc Wireless Networks: Introduction, Issues in Designing a MAC Protocol, Design Goals of MAC Protocols, Classification of MAC protocols, Contention-Based Protocols, Contention-Based Protocols with Reservation Mechanisms, Contention-Based Protocols with Scheduling Mechanisms, Reservation Mechanisms, Contention-Based Protocols with Scheduling Mechanisms, MAC Protocols that Use Directional Antennas.

9 Hours

UNIT – 2

Routing Protocols for Ad-hoc Wireless Networks: Introduction, Issues in Designing a Routing Protocol for Ad-hoc Wireless Networks; Classification of Routing Protocols; Table Driven Routing Protocols.

7 Hours

UNIT – 3

On-Demand Routing Protocols, Hybrid Routing Protocols, Hierarchical Routing Protocols and Power-Aware Routing Protocols. Multicast Routing in Ad-hoc Wireless Networks: Introduction, Issues in Designing a Multicast Routing Protocol, Operation of Multicast Routing Protocols, An Architecture Reference Model for Multicast Routing Protocols.

8 Hours

UNIT – 4

Classifications of Multicast Routing Protocols, Tree-Based Multicast Routing Protocols and Mesh-Based Multicast Routing Protocols. Transport Layer and Security Protocols for Ad-hoc Networks: Introduction, Issues in Designing a Transport Layer Protocol; Design Goals of a Transport Layer Protocol; Classification of Transport Layer Solutions.

8 Hours



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UNIT – 5

TCP over Transport Layer Solutions; Other Transport Layer Protocols for Ad-hoc Networks; Security in Ad-hoc Wireless Networks, Issues and Challenges in Security Provisioning, Network Security Attacks, Key Management and Secure Routing Ad-hoc Wireless Networks.

7 Hours

TEXT BOOK:

1. C. Siva Ram Murthy & B. S. Manoj: Ad-hoc Wireless Networks, 2nd Edition, Pearson Education, 2011

REFERENCE BOOKS:

1. Ozan K. Tonguz and Gianguigi Ferrari: Ad-hoc Wireless Networks, John Wiley, 2007.
2. Xiuzhen Cheng, Xiao Hung, Ding-Zhu Du: Ad-hoc Wireless Networking, Kluwer Academic Publishers, 2004.
3. C.K. Toh: Ad-hoc Mobile Wireless Networks- Protocols and Systems, Pearson Education, 2002.

COURSE OUTCOMES (COs):

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

CO1	Enumerate the concept of wireless ad-hoc networks and issues in different layers of protocols in network.
CO2	Articulate routing protocols of ad-hoc networks.
CO3	Prioritize table-driven, on-demand and hybrid protocols and identify appropriate attributes for routing.
CO4	Infer performance of various unicast and multicast routing protocols.
CO5	Evaluate on security attacks and secure routing.
CO6	Learn measurements of protocol performance in wireless ad-hoc networks using MATLAB.



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Course Title	ADVANCED COMPUTER NETWORK				
Course Code	16ISCNPCCN	Credits	03	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

Foundation: Building a Network, Requirements, Perspectives, Scalable Connectivity, - Cost Effective Resource sharing, Support for Common Services, Manageability, Protocol layering, Performance, Bandwidth and Latency, Delay X Bandwidth Product, Perspectives on Connecting, Classes of Links, Reliable Transmission, Stop-and-Wait , Sliding Window, Concurrent Logical Channels.

8 Hours

UNIT – 2

Internetworking I: Switching and Bridging, Datagram's, Virtual Circuit Switching, Source Routing, Bridges and LAN Switches, Basic Internetworking (IP), What is an Internetwork?, Service Model, Global Addresses, Datagram Forwarding in IP, Subnetting and classless addressing, Address Translation (ARP) Host Configuration(DHCP), Error Reporting(ICMP), Virtual Networks and Tunnels

8 Hours

UNIT – 3

Internetworking- II: Network as a Graph, Distance Vector(RIP), Link State(OSPF), Metrics, The Global Internet, Routing Areas, Routing among Autonomous systems(BGP), IP Version 6(IPv6), Mobility and Mobile IP

7 Hours

UNIT – 4

End-to-End Protocols: Simple Demultiplexer (UDP), Reliable Byte Stream(TCP), End-to-End Issues, Segment Format, Connecting Establishment and Termination, Sliding Window Revisited, Triggering Transmission, Adaptive Retransmission, Record Boundaries, TCP Extensions, Queuing Disciplines, FIFO, Fair Queuing, TCP Congestion Control, Additive Increase/ Multiplicative Decrease, Slow Start, Fast Retransmit and Fast Recovery.

8 Hours



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UNIT – 5

Congestion Control and Resource Allocation: Congestion-Avoidance Mechanisms, DEC bit, Random Early Detection (RED), Source-Based Congestion Avoidance. The Domain Name System(DNS),Electronic Mail(SMTP,POP,IMAP,MIME),World Wide Web(HTTP),Network Management(SNMP)

8 Hours

TEXT BOOKS:

1. **T1: Larry Peterson and Bruce S Davis** “Computer Networks :A System Approach” 5th Edition , Elsevier -2014
2. **T2: Douglas E Comer,** “ Internetworking with TCP/IP, Principles, Protocols and Architecture” 6th Edition, PHI - 2014

REFERENCE BOOKS:

1. **Uyless Black** “Computer Networks, Protocols , Standards and Interfaces” 2nd Edition - PHI
2. **Behrouz A Forouzan** “TCP /IP Protocol Suite” 4th Edition – Tata McGraw-Hill

COURSE OUTCOMES (COs):

The students should be able to:

CO1	Apply the knowledge of networking architectures and technologies in designing/building a computer network and evaluating its performance.
CO2	Demonstrate various protocols, global addressing, Subnetting, VLAN, forwarding and routing in Internetworking.
CO3	Design various Internetworking applications (e.g. Client Server applications, Web Services)
CO4	Perform in a team to implement network applications using networking tool.



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Course Title	INFORMATION AND NETWORK SECURITY				
Course Code	16ISCNPCIN	Credits	03	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

Classical Encryption Techniques: Symmetric Cipher Model, Cryptography, Cryptanalysis and Brute-Force Attack, Substitution Techniques, Caesar Cipher, Monoalphabetic Cipher, Playfair Cipher, Hill Cipher, Polyalphabetic Cipher, One Time Pad. **Block Ciphers and the data encryption standard:** Traditional block Cipher structure, stream Ciphers and block Ciphers, Motivation for the feistel Cipher structure, the feistel Cipher, The data encryption standard, DES encryption, DES decryption, A DES example, results, the avalanche effect, the strength of DES, the use of 56-Bit Keys, the nature of the DES algorithm, timing attacks, Block cipher design principles, number of rounds, design of function F, key schedule algorithm

8 Hours

UNIT – 2

Public-Key Cryptography and RSA: Principles of public-key cryptosystems. Public-key cryptosystems. Applications for public-key cryptosystems, requirements for public-key cryptosystems. Public-key cryptanalysis. The RSA algorithm, description of the algorithm, computational aspects, the security of RSA. **Other Public-Key Cryptosystems:** Diffie-hellman key exchange, The algorithm, key exchange protocols, man in the middle attack, Elgamal Cryptographic systems, Elliptic curve arithmetic, abelian groups, elliptic curves over real numbers, elliptic curves over $\mathbb{Z}_p$, elliptic curves over $\text{GF}(2^m)$, Elliptic curve cryptography, Analog of Diffie-hellman key exchange, Elliptic curve encryption/decryption, security of Elliptic curve cryptography, Pseudorandom number generation based on an asymmetric cipher, PRNG based on RSA.

8 Hours

UNIT – 3

Key Management and Distribution: Symmetric key distribution using Symmetric encryption, A key distribution scenario, Hierarchical key control, session key lifetime, a transparent key control scheme, Decentralized key control, controlling key usage, Symmetric key distribution using asymmetric encryption, simple secret key distribution, secret key distribution with confidentiality and authentication, A hybrid scheme, distribution of public keys, public announcement of public keys, publicly available directory, public key authority, public keys certificates, X-509 certificates. Certificates, X-509 version 3, public key infrastructure

7 Hours



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UNIT – 4

Wireless network security: Wireless security, Wireless network threats, Wireless network measures, mobile device security, security threats, mobile device security strategy, IEEE 802.11 Wireless LAN overview, the Wi-Fi alliance, IEEE 802 protocol architecture. Security, IEEE 802.11i services, IEEE 802.11i phases of operation, discovery phase, Authentication phase, key management phase, protected data transfer phase, the IEEE 802.11i pseudorandom function.

8 Hours

UNIT – 5

Web Security Considerations: Web Security Threats, Web Traffic Security Approaches. **Secure Sockets Layer:** SSL Architecture, SSL Record Protocol, Change Cipher Spec Protocol, Alert Protocol, and shake Protocol, Cryptographic Computations. **Transport Layer Security:** Version Number, Message Authentication Code, Pseudorandom Functions, Alert Codes, Cipher Suites, Client Certificate Types, Certificate Verify And Finished Messages, Cryptographic Computations, Padding **HTTPS** Connection Initiation, Connection Closure. **Secure Shell (SSH)** Transport Layer Protocol, User Authentication Protocol, Connection Protocol.

8 Hours

TEXT BOOK:

1. William Stallings: Cryptography and Network Security, Pearson 6th edition. 2013

REFERENCE BOOK:

1. V K Pachghare: Cryptography and Information Security, PHE ,2013.

COURSE OUTCOMES (COs):

The students should be able to:

CO1	Apply knowledge of classical encryption technique to analyze, solve and evaluate crypto problems.
CO2	Evaluate and synthesize public key crypto systems.
CO3	Demonstrate key management and distribution schemes in the field of Information Security.
CO4	Identify the threats and counter measures in network security domain.
CO5	Design security applications in the field of Information Security.



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Course Title	CLIENT SERVER PROGRAMMING				
Course Code	16ISCNPPCS	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 Client Server Model and Software Design: Introduction, Motivation, Terminology and Concepts. **Concurrent Processing in Client-Server software:** Terminology and Concepts. **Concurrent Processing in Client-Server software:** Introduction, Concurrency in Networks, Concurrency in Servers, Terminology and Concepts, An example of Concurrent Process Creation, Executing New Code, Context Switching and Protocol Software Design, Concurrency and Asynchronous I/O. **Program Interface to Protocols:** Introduction, Loosely Specified Protocol Software Interface, Interface Functionality, Conceptual Interface Specification, System Calls, Two Basic Approaches to Network Communication, The Basic I/O Functions available in UNIX, Using UNIX I/O with TCP/IP.

7 Hours

UNIT – 2

The Socket Interface: Introduction, Berkley Sockets, Specifying a Protocol Interface, The Socket Abstraction, Specifying an End Point Address, A Generic Address Structure, Major System Calls used with Sockets, Utility Routines for Integer Conversion, Using Socket Calls in a Program, Symbolic Constants for Socket Call Parameters. **Algorithms and Issues in Client Software Design:** Introduction, Learning Algorithms instead of Details, Client Architecture, Identifying the Location of a Server, Parsing an Address Argument, Looking up a Domain Name, Looking up a well-known Port by Name, Port Numbers and Network Byte Order, Looking up a Protocol by Name, The TCP Client Algorithm, Allocating a Socket, Choosing a Local Protocol Port Number, A fundamental Problem in choosing a Local IP Address, Connecting a TCP Socket to a Server, Communicating with the Server using TCP, Reading a response from a TCP Connection, Closing a TCP Connection, Programming a UDP Client, Connected and Unconnected UDP Socket, Using Connect with UDP, Communicating with a Server using UDP, Closing a Socket that uses UDP, Partial Close for UDP, A Warning about UDP Unreliability.

8 Hours



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UNIT- 3

Example Client Software: Introduction, The Importance of Small Examples, Hiding Details, An Example Procedure Library for Client Programs, Implementation of Connect TCP, Implementation of Connect UDP, A Procedure that Forms Connections, Connect TCP, Implementation of Connect UDP, A Procedure that Forms Connections, Using the Example Library, The DAYTIME Service, Implementation of a TCP Client for DAYTIME, Reading from a TCP Connection, The Time Service, Accessing the TIME Service, Accurate Times and Network Delays, A UDP Client for the TIME Service, The ECHO Service, A TCP Client for the ECHO Service, A UDP Client for the ECHO Service.

8 Hours

UNIT – 4

Algorithms and Issues in Server Software Design: Introduction, The Conceptual Server Algorithm, Concurrent Vs Iterative Servers, Connection-Oriented Vs Connectionless Access, Connection-Oriented Servers, Connectionless Servers, Failure, Reliability and Statelessness, Optimizing Stateless Servers, Four Basic Types of Servers, Request Processing Time, Iterative Server Algorithms, An Iterative Connection-Oriented Server Algorithm, Binding to a Well Known Address using INADDR_ANY, Placing the Socket in Passive Mode, Accepting Connections and using them. An Iterative Connectionless Server Algorithm, Forming a Reply Address in a Connectionless Server, Concurrent Server Algorithms, Master and Slave Processes, A Concurrent Connectionless Server Algorithm, A concurrent Connection- Oriented Server Algorithm, Using separate Programs as Slaves, Apparent Concurrency using a Single Process, When to use each Server Types, The Important Problem of Server Deadlock, Alternative Implementations.

8 Hours

UNIT- 5

Iterative, Connectionless Servers (UDP): Introduction, Creating a Passive Socket, Process Structure, An example TIME Server. **Iterative, Connection-Oriented Servers(TCP):** Introduction, Allocating a Passive TCP Socket, A Server for the DAYTIME Service, Process Structure, An Example DAYTIME Server, Closing Connections, Connection Termination and Server Vulnerability. **Concurrent, Connection-Oriented Servers (TCP):** Introduction, Concurrent ECHO, Iterative Vs Concurrent **Servers (TCP):** Introduction, Concurrent ECHO, Iterative Vs Concurrent

8 Hours

TEXT BOOK:

1. Douglas E.Comer, David L. Stevens: Internetworking with TCP/IP – Vol. 3, Client-Server Programming and Applications, BSD Socket Version with ANSI C, 2nd Edition, Pearson, 2001.



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PRACTICAL WORK:

1. Designing, developing and executing various client and server programs in C for different services and demonstrating its functioning.
2. Designing, developing and executing client and server software for different services using JAVA/Python networking facilities and demonstrate its functioning.

COURSE OUTCOMES (COs):

The students should be able to:

CO1	Apply the knowledge of various Client-Server Models, protocol Software and network communication approaches in designing client and server software.
CO2	Identify the appropriate socket interfaces and Client-Server Models required to design TCP/ UDP Client and server software for a specific service.
CO3	Analyse the issues to be faced while designing efficient client and server software with required modules to handle the same.
CO4	Design application specific concurrent/ iterative, connection oriented/ connectionless Client- Server models.
CO5	Develop and demonstrate concurrent/ iterative, connection oriented/ connectionless Client-Server software for providing a specific service using System Calls and I/O Functions available in C, Java and Python.



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ELECTIVE-I

Course Title	ADVANCED STORAGE AREA NETWORK				
Course Code	16ISCNPESA	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	39		

UNIT – 1

Introduction: Server Centric IT Architecture and its Limitations; Storage – Centric IT Architecture and its advantages 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 Hours

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. Network SCSI; Fibre Channel Protocol Stack; Fibre Channel SAN; IP Storage. Network SCSI; Fibre Channel Protocol Stack; Fibre Channel SAN; IP Storage.

8 Hours

UNIT – 3

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 Hours

UNIT – 4

NAS Architecture: 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 Hours



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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, Summary

7 Hours

TEXT BOOK:

1. Ulf Troppens, Rainer Erkens and Wolfgang Muller: Storage Networks Explained, Wiley India, 2013.

REFERENCE BOOKS:

1. Robert Spalding: “Storage Networks The Complete Reference”, Tata McGraw-Hill, 2011.
2. Marc Farley: Storage Networking Fundamentals – An Introduction to Storage Devices, Subsystems, Applications, Management, and File Systems, Cisco Press, 2005.
3. Richard Barker and Paul Massiglia: “Storage Area Network Essentials A Complete Guide to understanding and Implementing SANs”, Wiley India, 2006.

COURSE OUTCOMES (COs):

The students should be able to:

CO1	Ascertain the concepts on storage architectures to provide new possibilities for data management distinguish with server centric IT infrastructures.
CO2	Analyze storage needs on technological scales to implement intelligent subsystems, Fiber channel protocol stack and I/O techniques.
CO3	Develop an awareness on implementation considerations for various levels of storage virtualization.
CO4	Assess the performance issues of file servers and design strategies of Network attached storage.
CO5	Deduce standardized mechanisms and optional aspects for realization of storage management functions on interfaces.
CO6	Acquire technical know-how on industry-standard protocol suite for growing business needs and investigate features of storage networking using software tools.



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Course Title	COMPUTER SYSTEMS PERFORMANCE ANALYSIS				
Course Code	16ISCNPECA	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	39		

UNIT – 1

Introduction: The art of Performance Evaluation; Common Mistakes in Performance Evaluation, A Systematic Approach to Performance Evaluation, Selecting an Evaluation Technique, Selecting Performance Metrics, Commonly used Performance Metrics, Utility Classification of Performance Metrics, Setting Performance Requirements.

7 Hours

UNIT – 2

Workloads, Workload Selection and Characterization: Types of Workloads, addition instructions, Instruction mixes, Kernels; Synthetic programs, Application benchmarks, popular benchmarks. Work load Selection: Services exercised, level of detail; Representativeness; Timeliness, Other considerations in workload selection. Work load characterization Techniques: Terminology; Averaging, Specifying dispersion, Single Parameter Histograms, Multi Parameter Histograms, Principle Component Analysis, Markov Models, Clustering.

8 Hours

UNIT – 3

Monitors, Program Execution Monitors and Accounting Logs: Monitors: Terminology and classification; Software and hardware monitors, Software versus hardware monitors, Firmware and hybrid monitors, Distributed System Monitors, Program Execution Monitors and Accounting Logs, Program Execution Monitors Techniques for Improving Program Performance. **Capacity Planning and Benchmarking:** Steps in capacity planning and management; Problems in Capacity Planning; Common Mistakes in Benchmarking; Benchmarking Games

8 Hours

UNIT – 4

The Art of Data Representation: Guidelines for drawing good graphic charts, common mistakes in preparing charts, Pictorial games, Gantt Charts, Kiviatic charts.



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Summarizing Measured Data: Basic Probability and Statistics Concepts, Summarizing Data by a Single Number, Selecting among the Mean, Median and Mode, Common misuses of Means, Geometric Mean, Harmonic Mean, Mean of a Ratio, Summarizing Variability, Selecting the Index of Dispersion, Determining Distribution of Data.

8 Hours

UNIT – 5

Experimental Design and Analysis: Terminology, Common mistakes in experiments, Types of experimental designs, 2k Factorial Designs, Computation of effects, Sign table method for computing effects, Allocation of variance, General 2k Factorial Designs.

Queuing Models: Queuing Notation; Rules for all Queues; Little's Law, Types of Stochastic Process. Analysis of Single Queue: Birth-Death Processes; M/M/1 Queue; M/M/m Queue; Limitations of Queuing Theory

8 Hours

TEXT BOOK:

1. Raj Jain: The Art of Computer Systems Performance Analysis, John Wiley and Sons, 2013.

REFERENCE BOOKS:

1. Paul J Fortier, Howard E Michel: Computer Systems Performance Evaluation and prediction, Elsevier, 2003.
2. Trivedi K S: Probability and Statistics with Reliability, Queuing and Computer Science Applications, 2nd Edition, Wiley India, 2001

COURSE OUTCOMES (COs):

The students should be able to:

CO1	Apply different evaluation techniques to computer system performance problems
CO2	Analyse diverse evaluation techniques and performance metrics for performance evaluation of Computer Systems
CO3	Recognize techniques to characterize the workloads of Computer Systems and articulate of how monitors are used to observe, analyse and report system performance
CO4	Analyse collections of measured performance data and present it in a meaningful manner
CO5	Design approaches for conduction of experiments and analytical techniques to predict the performance of future loads



BMS COLLEGE OF ENGINEERING, BENGALURU-19

(Autonomous Institute, Affiliated to VTU)

Department of Information Science and Engineering

Course Title	SOCIAL NETWORK ANALYSIS				
Course Code	16ISCNPESN	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	39		

UNIT – 1

Introduction to social network analysis and Descriptive network analysis: Introduction to new science of networks. Networks examples. Graph theory basics. Statistical network properties. Degree distribution, clustering coefficient. Frequent patterns. Network motifs. Cliques and k-cores

7 Hours

UNIT – 2

Network structure, Node centralities and ranking on network: Nodes and. edges, network diameter and average path length. Node centrality metrics: degree, closeness and betweenness centrality. Eigenvector centrality and PageRank. Algorithm HITS

8 Hours

UNIT – 3

Network communities and Affiliation Graph partitioning and cut metrics. Edge Affiliation network and bipartite graphs. 1-mode projections. Recommendation systems

8 Hours

UNIT – 4

Information and influence propagation on networks and Network visualization: Social Diffusion. Basic cascade model. Influence maximization. Most influential nodes in network. Network visualization and graph layouts. Graph sampling. Low –dimensional projections

8 Hours

UNIT – 5

Social media mining and SNA in real world: FB/VK and Twitter analysis: Natural language processing and sentiment mining. Properties of large social networks: friends, connections, likes, re-tweets

8 Hours



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TEXT BOOKS:

1. David Easley and John Kleinberg. "Networks, Crowds, and Markets: Reasoning About a Highly Connected World." Cambridge University Press 2010.
2. Eric Kolaczyk, Gabor Csardi. "Statistical Analysis of Network Data with R (Use R!)". Springer, 2014.
3. Stanley Wasserman and Katherine Faust. "Social Network Analysis. Methods and Applications." Cambridge University Press, 1994

COURSE OUTCOMES (COs):

The students should be able to:

CO1	Analyze social media network.
CO2	Measure, map and model collection of connections.
CO3	Visualize and calculate network metrics.
CO4	Analyze email, YouTube, Facebook, Wiki and Twitter.
CO5	Use modern tools to analyze email, YouTube, Facebook, Wiki and Twitter.



BMS COLLEGE OF ENGINEERING, BENGALURU-19

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Department of Information Science and Engineering

Course Title	PROTOCOL ENGINEERING				
Course Code	16ISCNPEPR	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	39		

UNIT – 1

Introduction, Communication Model, Software, Subsystems, Protocol, Communication protocol development methods, Protocol Engineering Process, Layered Architecture, Network services and interfaces, Protocol functions, OSI, TCP/IP, Wireless Protocol Challenges, Application Protocols.

8 Hours

UNIT – 2

Protocol Specification, Components, Services, Protocol Entity, Interface, Interactions, Multimedia, Internet. Protocol Specification Languages, SDL, SPIN, Estelle, E-Lotus, CPN, Uppal, UML.

8 Hours

UNIT – 3

Protocol Verification and Validation, Finite State Machines, Design Errors, Approaches, SDL based, Communication Protocol Conformance Test Principle, Test Execution, Methodology and Framework, Architectures, Generation Methods

7 Hours

UNIT – 4

Protocol Performance Testing, SDL based TCP and OSPF, Interoperability, SDL based CSMA/CD and CSMA/CA, Scalability, Protocol Synthesis, Interactive and Automatic, SDL from MSC, Re-synthesis.

8 Hours

UNIT – 5

Protocol implementation, requirement, Object based, compilers, Tool for Protocol Engineering

8 Hours



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TEXT BOOK:

1. Pallapa Venkataram, Sunil Kumar S Manvi, B. Sathish Babu “ Communication Protocol Engineering, PHI, Learning, 2014.

REFERENCE BOOK:

1. Mohammed G. Gouda: Elements of Protocol Design, Wiley Student Edition, 2004.

COURSE OUTCOMES (COs):

The students should be able to:

CO1	Understand the communication protocol development methods
CO2	Apply protocol specification languages for the given problems
CO3	Validate and verify using tools
CO4	Demonstrate protocol performance testing
CO5	Implement protocol based on the tools



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Department of Information Science and Engineering

ELECTIVE-II

Course Title	PROBABILITY STATISTICS AND QUEUING THEORY				
Course Code	16ISCNPEPQ	Credits	03	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

Axioms of probability, Conditional probability, Total probability, Baye's theorem, Discrete Random variable, Probability mass function, Continuous Random variable Probability density function, Cumulative Distribution Function, and its properties, Two-dimensional Random variables

8 Hours

UNIT – 2

Probability Distributions / Discrete distributions: Binomial, Poisson Geometric. Continuous distributions: Uniform, Normal, exponential distributions and their properties.

8 Hours

UNIT – 3

Random Processes: Classification, Methods of description, Special classes, Average values of Random Processes, Analytical representation of Random Process, Markov Process, Markov chain.

8 Hours

UNIT – 4

Testing Hypothesis: Testing of Hypothesis: Formulation of Null hypothesis, critical region, level of significance, errors in testing, Tests of significance for Large and Small Samples, t-distribution, its properties and uses, Chi-square distribution, its properties and uses, χ^2 – test for goodness of fit

8 Hours

UNIT – 5

Symbolic Representation of a Queuing Model, Poisson Queue system, Little Law, Independence Types of Stochastic Processes, Birth-Death Process, The M/M/1 Queuing System, The M/M/s Queuing System, The M/M/s Queuing with Finite buffers.

7 Hours



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TEXT BOOK:

1. Probability, Statistics and Random Processes, 3rd Edition by T. Veerarajan, Tata McGraw Hill, 2009

REFERENCE BOOKS:

1. Probability & Statistics with Reliability, Queuing and Computer Applications, 2nd Edition by Kishor S. Trivedi , Prentice Hall of India ,2004
2. Probability, Statistics and Random Processes, 1st Edition by P Kausalya, Pearson Education, 2013.

COURSE OUTCOMES (COs):

The students should be able to:

CO1	Understand the basics of probability theory, random variables, probability distributions & queuing models.
CO2	Apply the knowledge of probability theory to compute posterior likelihood Information.
CO3	Analyze and solve problems using right probability distributions and hypothesis testing.
CO4	Synthesize the information using random processes and translate real-world problems into probability models.
CO5	Conduct experiments using computer programs to facilitate the analysis and representation of data.



BMS COLLEGE OF ENGINEERING, BENGALURU-19

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Department of Information Science and Engineering

Course Title	ADVANCED ALGORITHMS				
Course Code	16ISCNPEAA	Credits	03	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

Review of Analysis Techniques: Growth of Functions: Asymptotic notations; Standard notations and common functions; Recurrences and Solution of Recurrence equations- The substitution method, The recurrence – tree method, The master method; Amortized Analysis: Aggregate, Accounting and Potential Methods.

8 Hours

UNIT – 2

Graph Algorithms: Bellman - Ford Algorithm; Single source shortest paths in a DAG; Flow networks and Ford-Fulkerson method; Maximum bipartite matching. **Polynomials and the FFT:** Representation of Maximum bipartite matching. Representation of polynomials; The DFT and FFT

8 Hours

UNIT – 3

Number -Theoretic Algorithms: Elementary notions; GCD; Modular Arithmetic; Solving modular linear equations; The Chinese remainder theorem; Powers of an element; RSA cryptosystem; Primality testing

8 Hours

UNIT – 4

String-Matching Algorithms: Naïve string Matching; Rabin - Karp algorithm; Knuth-Morris-Pratt algorithm; Boyer – Moore algorithms.

8 Hours

UNIT – 5

Probabilistic and Randomized Algorithms: Probabilistic algorithms; Randomizing deterministic algorithms, Monte Carlo and Las Vegas algorithms

7 Hours



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TEXT BOOKS:

1. T. H Cormen, C E Leiserson, R L Rivest and C Stein: Introduction to Algorithms, 3rd Edition, Prentice-Hall of India, 2010.
2. Kenneth A. Berman, Jerome L. Paul: Algorithms, Cengage Learning, 2002.

REFERENCE BOOK:

1. Ellis Horowitz, Sartaj Sahni, S.Rajasekharan: Fundamentals of Computer Algorithms, 2nd Edition, Universities press, 2007

COURSE OUTCOMES (COs):

The students should be able to:

CO1	Understand Graph and Number theoretic based algorithms
CO2	Understand String matching and Probabilistic oriented algorithms
CO3	Design and apply iterative and recursive algorithms
CO4	Design and implement optimization algorithms in specific applications
CO5	Design appropriate shared objects and concurrent objects for applications



BMS COLLEGE OF ENGINEERING, BENGALURU-19

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Department of Information Science and Engineering

Course Title	MULTI-CORE ARCHITECTURE AND PROGRAMMING				
Course Code	16ISCNPEMA	Credits	03	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

Introduction to Multi-core Architecture: Motivation for Concurrency in software, Parallel Computing Platforms, Parallel Computing in Microprocessors, Differentiating Multi-core cloud computing Architectures from Hyper- Threading Technology, Multi-threading on Single-Core versus Multi-Core Platforms Understanding Performance, Amdahl's Law, Growing Returns: Gustafson's Law.

System Overview of Threading: Defining Threads, System View of Threads, Threading above the Operating System, Threads inside the OS, Threads inside the Hardware, What Happens When a Thread Is Created, Application Programming Models and Threading, Virtual Environment: VMs and Platforms, Runtime Virtualization, System Virtualization.

5 Hours

UNIT -2

Fundamental Concepts of Parallel Programming: Designing for Threads, Task Decomposition, Data Decomposition, Data Flow Decomposition, Implications of Different Decompositions, Challenges You'll Face, Parallel Programming Patterns, A Motivating Problem: Error Diffusion, Analysis of the Error Diffusion Algorithm, An Alternate Approach: Parallel Error Diffusion, Other Alternatives.

Threading and Parallel Programming Constructs: Synchronization, Critical Sections, Deadlock, Synchronization Primitives, Semaphores, Locks, Condition Variables, Messages, Flow Control- based Concepts, Fence, Barrier, Implementation-dependent Threading Features.

8 Hours

UNIT -3

Threading APIs : Threading APIs for Microsoft Windows, Win32/MFC Thread APIs, Threading APIs for Microsoft .NET Framework, Creating Threads, Managing Threads, Thread Pools, Thread Synchronization, POSIX Threads, Creating Threads, Managing Threads, Thread Synchronization, Signaling, Compilation and Linking.

8 Hours



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UNIT -4

OpenMP: A Portable Solution for Threading: Challenges in Threading a Loop, Loop-carried Dependence, Data-race Conditions, Managing Shared and Private Data, Loop Scheduling and Portioning, Effective Use of Reductions, Minimizing Threading Overhead, Work-sharing Sections, Performance-oriented Programming, Using Barrier and No wait, Interleaving Single-thread and Multi-thread Execution, Data Copy-in and Copy-out, Protecting Updates of Shared Variables, Intel Task queuing Extension to OpenMP, OpenMP Library Functions, OpenMP Environment Variables, Compilation, Debugging, performance.

9 Hours

UNIT -5

Solutions to Common Parallel Programming Problems: Too Many Threads, Data Races, Deadlocks, and Live Locks, Deadlock, Heavily Contended Locks, Priority Inversion, Solutions for Heavily Contended Locks, Non-blocking Algorithms, ABA Problem, Cache Line Ping-ponging, Memory Reclamation Problem, Recommendations, Thread-safe Functions and Libraries, Memory Issues, Bandwidth, Working in the Cache, Memory Contention, Cache-related Issues, False Sharing, Memory Consistency, Current IA-32 Architecture, Itanium Architecture, High-level Languages, Avoiding Pipeline Stalls on IA-32, Data Organization for High Performance.

9 Hours

TEXT BOOK :

1. Multicore Programming, Increased Performance through Software Multi-threading by Shameem Akhter and Jason Roberts , Intel Press , 2006

REFERENCE BOOKS:

1. Calvin Lin, Lawrence Snyder: Principles of Parallel Programming, Pearson Education, 2009.
2. Michael J. Quinn: Parallel Programming in C with MPI and OpenMP, Tata McGraw Hill, 2004.

COURSE OUTCOMES (COs):

The students should be able to:

CO1	Understand the basics of parallel computing like ILP, Multicore, hyper threading and need for parallel computing
CO2	Identify parts of the programme that can be parallelized, examine different techniques for achieving multithreading and estimate their performance benefits
CO3	Apply threading APIs for exploiting parallelism in multicore environment
CO4	Design and Implement parallel algorithm using multithreading in Open MP
CO5	Able to Identify and Analyse solutions to common parallel programming problems



BMS COLLEGE OF ENGINEERING, BENGALURU-19

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Course Title	SOFT COMPUTING				
Course Code	16ISCNPESC	Credits	03	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

Introduction to Soft computing: Neural networks, Fuzzy logic, Genetic algorithms, Hybrid systems and its applications.

ANN: Evolution, basic Model of ANN, Terminologies used in ANN, MP model-Theory and Architecture, Linear Separability, Hebb Network.

8 Hours

UNIT – 2

Supervised Learning Network: Perceptron Networks, Adaptive linear neuron, Multiple adaptive linear neurons, Back propagation Network (Theory, Architecture, Algorithm for training, learning factors, testing and applications of all the above NN models).

8 Hours

UNIT – 3

Unsupervised Learning Networks: Introduction, Fixed weight competitive nets, Kohonen Self-Organizing Feature Maps, Learning Vector Quantization, Adaptive Resonance Theory Network.

8 Hours

UNIT – 4

Introduction to classical sets and fuzzy sets: Classical sets – Operations and properties, Fuzzy sets-Operations and properties, Fuzzy relations – Cardinality, operations, properties, fuzzy composition, Tolerance and equivalence relations – Fuzzy equivalence relation, Fuzzy tolerance relation.

8 Hours



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UNIT – 5

Membership functions and Defuzzification: Features of membership functions, Fuzzification, Methods of membership value assignment, Lambda-Cuts for fuzzy sets, relations, Defuzzification methods.

7 Hours

TEXT BOOK:

1. Principles of Soft computing, Shivanandam, Deepa S. N Wiley India, ISBN 13: 9788126527410, 2011 (Chapters 1, 2, 3(Upto 3.5), 7, 8, 9, 10, 13, 15 (upto 15.6 & 15.9,15,10)

REFERENCE BOOK:

1. Neuro-fuzzy and soft computing, J.S.R. JANG, C.T. SUN, E. MIZUTANI, Phi (EEE edition), 2012.

COURSE OUTCOMES (COs):

The students should be able to:

CO1	Implement machine learning through soft computing techniques.
CO2	Analyze soft computing algorithms to solve the optimization problems
CO3	Apply supervised and unsupervised learning for classification and clustering.
CO4	Design fuzzy systems based on fuzzy composition and membership functions.



BMS COLLEGE OF ENGINEERING, BENGALURU-19

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Department of Information Science and Engineering

Course Title	RESEARCH METHODOLOGY				
Course Code	16APRDICRM	Credits	02	L-T-P-S	2-0-0-0
CIE	50 Marks	SEE	100 Marks (50% Weightage)		
Contact Hours / Week	2	Total Lecture Hours	26		

Meaning, Objectives and Characteristics of research : Research methods Vs. Methodology-Types of research-Descriptive Vs. Analytical , Applied Vs. Fundamental, Quantitative Vs. Qualitative, Conceptual Vs. Empirical-Research process –Criteria of good research-Developing a research plan.

Defining the research problem : Selecting the problem-Necessity of defining the problem-Techniques involved in defining the problem-Importance of literature review in defining a problem-Survey of literature-primary and secondary sources-Reviews, treatise, monographs patents-web as a source-searching the web-Identifying gap areas from literature review – Development of working hypothesis.

IPR's : Invention and Creativity-Intellectual Property –Importance and Protection of Intellectual property Rights(IPRs)-A brief summary of : Patents, Copyrights, Trademarks, Industrial Designs-Integrated Circuits-Geographical Indications-Establishment of WIPO-Application and Procedures.

Aim of this part of the course : is to strengthen student's minds towards high quality research through publications, patents and also to learn research ethics.

Publications : Research concepts Research importance on economy, Research in India and abroad, Importance of publications, Why, Where, When to publish?

Publication ethics, plagiarism (how to use turn it in effectively), International ethics on research, what and what not to publish, Ethical guidelines, Case studies.

Quality Vs. quantity Searching literature with high quality, Impact factor, Citations (Google scholar Vs. web of Science), H-Index, Case Studies.



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How to write paper in high quality Journals, Conference Articles, Poster preparation, PhD thesis, Inclusion of references.

Journal reviewing process, Selection of the good journal, knowledge about journal template , Refereeing process, Research topics selection, Research today and tomorrow, Lab scale to Industry, Traditional Research to technology based research.

Self-Study : Interpretation and report writing-Techniques of Interpretation- Structure and components of scientific reports-different steps in preparation –Layout, Structure and language of the report- Illustrations and tables-types of report-technical reports and Thesis.

REFERENCES :

1. Garg, B.L., Karadia, R., Agarwal, F. and Agarwal, U.K., 2002. An introduction to Research Methodology, RBSA Publishers.
2. Kothari, C.R., 1990. Research Methodology: Methods and Techniques. New Age International. 418p.
3. Anderson, T. W., An Introduction to Multivariate Statistical Analysis, Wiley Eastern Pvt., Ltd., New Delhi
4. Sinha, S.C. and Dhiman, A.K., 2002. Research Methodology, Ess Ess Publications. 2 volumes.
5. Trochim, W.M.K., 2005. Research Methods: the concise knowledge base, Atomic Dog Publishing. 270p.
6. Day, R.A., 1992. How to Write and Publish a Scientific Paper, Cambridge University Press.
7. Fink, A., 2009. Conducting Research Literature Reviews: From the Internet to Paper. Sage Publications
8. Coley, S.M. and Scheinberg, C. A., 1990, "Proposal Writing", Sage Publications.
9. Intellectual Property Rights in the Global Economy: Keith Eugene Maskus, Institute for International Economics, Washington, DC, 2000
10. Subbarau NR-Handbook on Intellectual Property Law and Practice-S Viswanathan Printers and Publishing Private Limited.1998



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Department of Information Science and Engineering

SEMESTER I

Technical Seminar-1--16ISCNPCS1

Guidelines

Technical Seminar 1 : topics should be Chosen form Scientific Citation Index based (SCI) /IEEE/ACM/Springer/Elsevier/Science Direct/ Transactions/ Any Peer-reviewed Nonpaid Journals. The students could convert the chosen seminar topic either into a Survey Paper or Technical Paper. The students must make a presentation on the scheduled dates and this will be evaluated by the committee for 50 Marks. Finally, the students must submit a technical seminar report and it will be evaluated for 50 Marks by the internal guide based on the seminar rubrics. Total internal assessment for the seminar would be 50+50=100 Marks. SEE will be conducted for 100 Marks. The final would be CIE+SEE (100+100) = 200 Marks.

COURSE OUTCOMES (COs):

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

CO1	Identify the problem through literature survey by applying depth knowledge of the chosen domain.
CO2	Analyze, synthesize and conceptualize the identified problem.
CO3	Communicate clearly, write effective reports and make effective presentations following the professional code of conduct and ethics.
CO4	Comprehensively study the domains and reflect the same towards the future enhancements of the work.



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SEMESTER –II

Course Title	CYBER SECURITY AND LAW				
Course Code	16ISCNPCCL	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 Cybercrime: Cybercrime: Definition and Origins of the Word, Cybercrime and Information Security, Who are Cybercriminals?, Classifications of Cybercrimes, Cybercrime: The Legal Perspectives, Cybercrimes: Perspective, Cybercrime and the Indian ITA 2000, A Global Perspective on Cybercrimes, Cybercrime Era: Survival Mantra for the Netizens. **Cyber offenses: How Criminals Plan Them:** How Criminals Plan the Attacks, Social Cyber stalking Cyber cafe and Cybercrimes, Botnets: The Fuel for Cybercrime, Attack Vector, Cloud Computing.

7 Hours

UNIT – 2

Cybercrime: Mobile and Wireless Devices: Introduction, Proliferation of Mobile and Wireless Devices, Trends in Mobility, Credit Card Frauds in Mobile and Wireless Computing Era, Security Challenges Posed by Mobile Devices, Registry Settings for Mobile Devices, Authentication Service Security, Attacks on Mobile/Cell Phones, Mobile Devices: Security Implications for organizations, Organizational Measures for Handling Mobile, Organizational Security Policies and Measures in Mobile Computing Era, Laptops.

8 Hours

UNIT – 3

Tools and Methods Used in Cybercrime: Introduction, Proxy Servers and Anonymizers, Phishing, Password Cracking, Key loggers and Spywares, Virus and Worms, Trojan Horses and Backdoors, Steganography, DoS and DDoS Attacks, SQL Injection, Buffer Overflow, Attacks on Wireless Networks. **Phishing and Identity Theft:** Introduction, Phishing, Identity Theft (ID Theft).

8 Hours

UNIT – 4



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Understanding Computer Forensics: Introduction, Historical Background of Cyber forensics, Digital Forensics Science, The Need for Computer Cyber forensics and Digital Evidence, Forensics Analysis of E-Mail, Digital Forensics Life Cycle, Chain of Custody Concept, Network Forensics, Approaching a Computer Forensics Investigation, Setting up a Computer Forensics Laboratory: Understanding the Requirements, Computer Forensics and Steganography, Relevance of the OSI 7 Layer Model to Computer Forensics, Forensics and

Social Networking Sites: The Security/Privacy Threats, Computer Forensics from Compliance Perspective, Challenges in Computer Forensics, Special Tools and Techniques, Forensics Auditing, Anti forensics.

8 Hours

UNIT – 5

The Legal Perspectives on Cybercrimes and Cyber security: The legal landscape around the world. Need of Cyber laws in the Indian context. The Indian IT Act. Digital signatures and The Indian IT Act. Amendments to The Indian IT Act. Cybercrime and Punishment.

8 Hours

TEXT BOOKS:

1. Sunit Belapure and Nina Godbole, “Cyber Security: Understanding Cyber Crimes, Computer Forensics And Legal Perspectives”, Wiley India Pvt Ltd, ISBN: 978-81-265-21791, Publish Date 2013
2. Dr. Surya Prakash Tripathi, Ritendra Goyal, Praveen Kumar Shukla, KLSI. “Introduction to information security and cyber laws”. Dreamtech Pre ss. ISBN: 9789351194736, 2015

REFERENCE BOOKS:

1. Thomas J. Mowbray, “Cybersecurity: Managing Systems , Conducting Testing, and Investigating Intrusions”, Copyright © 2014 by John Wiley & Sons, Inc, ISBN: 91-118 - 84965 -1
2. James Graham, Ryan Olson, Rick Howard, “Cyber Security Essentials”, CRC Press, 15-Dec-2010

COURSE OUTCOMES (COs):

The students should be able to:

CO1	Discriminate and analyze problems involved in cybercrime.
CO2	Synthesize cybercrime issues on wireless and mobile devices.
CO3	Use and apply modern cyber forensics tools.
CO4	Analyze the computer forensic problems for a feasible solution.



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CO5	Develop cyber security policies for given type of organization.
CO6	Apply cyber law for a given type of cyber issues.

Course Title	DISTRIBUTED COMPUTING				
Course Code	16ISCNPCDC	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

Distributed System management: Introduction, Resource management, Task Assignment Approach, Load-Balancing Approach, Load-Sharing Approach, Process management in a Distributed Environment, Process Migration, Threads, Fault Tolerance.

6 Hours

UNIT – 2

Distributed Shared Memory: Introduction, Basic Concepts of DSM, Hardware DSM, Design Issue in DSM Systems, Issue in Implementing DSM Systems, Heterogeneous DSM Systems.

8 Hours

UNIT – 3

Distributed File System: Introduction to DFS, File Models, Distributed File System Design, Semantics of File Sharing, DFS Implementation, File Caching in DFS, Replication in DFS.
Naming: Introduction, Desirable features of a good naming system, Basic concepts, System-oriented names, Object-locating mechanisms, Issues in designing human-oriented names.

9 Hours

UNIT – 4

Security in distributed systems: Introduction, Cryptography, Secure channels, Access control, Security Management.

8 Hours

UNIT – 5

Real-Time Distributed operating Systems: Introduction, Design issues in real-time distributed systems, Real-time communication, Real-time scheduling.

Emerging Trends in distributed Computing: Grid Computing, SOA, Cloud computing.

8 Hours

TEXT BOOK:

1. Sunitha Mahajan , Seema Shah: Distributing Computing, Oxford University



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press 2010.

REFERENCE BOOKS:

1. George Couloris, Jean Dollimore, Tim Kindberg, Gordon Blair, Distributed Systems: Concepts and Design, 5th Edition, Pearson, 2012.
2. Andrew S. Tanenbaum, Maarten Van Steen, Distributed Systems: Principles and Paradigms, 2nd Edition, Pearson 2007.

COURSE OUTCOMES (COs):

The students should be able to:

CO1	Apply the concepts of operating system and networking to realize distributed systems.
CO2	Apply the techniques in distributed computing to support transparency, scalability, security and fault tolerance.
CO3	Analyze the existing large distributed system architectures that have been designed in terms of synchronization, communication, security and fault tolerance.
CO4	Analyze the alternatives for devising distributed computing solutions considering the various design issues.
CO5	Make effective oral presentation on past and current research issues in the field of distributed computing.



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Course Title	NETWORK MANAGEMENT				
Course Code	16ISCNPCNM	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

Introduction: Analogy of Telephone Network Management, Data and Telecommunication Network Distributed computing Environments, TCP/IP- Based Networks: The Internet and Intranets, Communications Protocols and Standards- Communication Architectures, Protocol Layers and Services; Case Histories of Networking and Management – The Importance of topology, Filtering Does Not Reduce Load on Node, Some Common Network Problems; Challenges of Information Technology Managers, Network Management: Goals, Organization, and Functions- Goal of Network Management, Network Provisioning, Network Operations and the NOC, Network Installation and Maintenance; Network and System Management, Network Management System platform, Current Status and Future of Network Management.

9 Hours

UNIT – 2

Basic Foundations: Standards, Models and Language: Network Management Standards, Network Management Model, Organization Model, Information Model – Management Information Trees, Managed Object Perspectives, Communication Model.

7 Hours

UNIT – 3

ASN.1- Terminology, Symbols, and Conventions, Objects and Data Types, Object Names, An Example of ASN.1 from ISO 8824; Encoding Structure; Macros, Functional Model. SNMPv1
Network Management: Managed Network: The History of SNMP Management, Internet Organizations and standards, Internet Documents, The SNMP Model, The Organization Model, System Overview. The Information Model – Introduction, The Structure of Management Information, Managed Objects, Management Information Base.

7 Hours

UNIT – 4

The SNMP Communication Model – The SNMP Architecture, Administrative Model, SNMP



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Specifications, SNMP Operations, SNMP MIB Group, Functional Model. SNMP Management – RMON: Remote Monitoring, RMON SMI and MIB, RMON1- RMON1 Textual Conventions, RMON1 Groups and Functions, Relationship Between Control and Data Tables,

RMON1 Common and Ethernet Groups, RMON Token Ring Extension Groups, RMON2 – The RMON2 Management Information Base, RMON2 Conformance Specifications. Broadband Network Management: Broadband Access Networks and HFCT Technology.

6 Hours

UNIT – 5

Network Management Applications: Configuration Management- Network Provisioning, Inventory Management, Network Topology, Fault Management Fault Detection, Fault Location and Isolation Techniques, Performance Management – Performance Metrics, Data Monitoring, Management – Performance Metrics, Data Monitoring, Problem Isolation, Problem Isolation, Performance Statistics; Event Correlation Techniques – Rule-Based Reasoning, Model-Based Reasoning, Case-Based Reasoning, Codebook correlation Model, State Transition Graph Model, Finite State Machine Model, Security Management – Policies and Procedures, Security Breaches and the Resources Needed to Prevent Them, Firewalls, Cryptography, Authentication and Authorization, Client/Server Authentication Systems, Messages Transfer Security, Protection of Networks from Virus Attacks, Accounting Management, Report Management, Policy- Based Management, Service Level Management

10 Hours

TEXT BOOK:

1. Mani Subramanian: Network Management- Principles and Practice, 2nd Pearson Education, 2010.

REFERENCE BOOK:

1. J. Richard Burke: Network management Concepts and Practices: a Hands-On Approach, PHI, 2008.

COURSE OUTCOMES (COs):

The students should be able to:

CO1	Enumerate the applications of NM and challenges pertaining to security management of an IT Manager.
CO2	Articulate network management standards, models and language.
CO3	Prioritizing network management functional groupings.
CO4	Infer the performance of RMON groups and functions.



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CO5	Evaluate on event correlation techniques, TLV formats and parameters of SNMP model groups.
CO6	Learn the network management models using ASN.1 notation and latest RFCs update.

ELECTIVE -III

Course Title	OPTICAL NETWORK				
Course Code	16ISCNPEON	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

Client Layers of the Optical Layer: SONET/SDH: Multiplexing, CAT and LCAS, Sonnet/SDH Layers, SONET Frame Structure, SONET/SDH Physical Layer , Elements of a SONET/SDH Infrastructure, Optical Transport Network: Hierarchy, Frame Structure, Multiplexing, Generic Framing Procedure Ethernet: Frame Structure, Switches, Ethernet Physical Layer, Carrier Transport IP: Routing and Forwarding, Quality of Service Multiprotocol Label Switching: Labels and Forwarding, Quality of Service, Signaling and Routing, Carrier Transport.

8 Hours

UNIT – 2

WDM Network Elements: Optical Line Terminals, Optical Line Amplifiers, Optical Add/Drop Multiplexers: OADM Architectures, Reconfigurable OADMs Optical Cross connects: All-Optical OXC Configurations.

8 Hours

UNIT – 3

Control and Management: Network Management Functions: Management Framework, Information Model, Management Protocols. Optical Layer Services and Interfacing, Layers within the Optical Layer, Multivendor Interoperability, Performance and Fault Management: The Impact of Transparency, BER Measurement, Optical Trace, Alarm Management, Data Communication Network (DCN) and Signaling, Policing, Optical Layer Overhead, Client Layers.

8 Hours

UNIT – 4



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Basic Concepts: Protection in SONET/SDH: Point-to-Point Links, Self-Healing Rings, Unidirectional Line-Switched Rings, Bidirectional Line-Switched Rings, Ring Interconnection and Dual Homing. Protection in the Client Layer: Protection in Resilient Packet Rings,

Protection in Ethernet, Protection in IP, Protection in MPLS, Why Optical Layer Protection: Service Classes Based on Protection.

7 Hours

UNIT – 5

WDM Network Design: Cost Trade-OFFS: A Detailed Ring Network Example LTD and RWA Problems, Light path Topology Design, Routing and Wavelength Assignment, Wavelength Conversion. Dimensioning Wavelength-Routing Networks, Statistical Dimensioning Models: First-Passage Model, Blocking Model.

8 Hours

TEXT BOOK:

1. Optical Networks by Rajeev Ramaswamy, Kumar N Sivarajan, Galen H Sasaki, Elsevier Publication 3rd Edition, 2009.

REFERENCE BOOK:

1. Uyless Black, Optical Networks-Third generation transport system: Pearson 2013.

COURSE OUTCOMES (COs):

The students should be able to:

CO1	Acquire in depth knowledge on fundamentals of optical network.
CO2	Analyze the various optical network architectures like optical access networks and backbone optical transport networks.
CO3	Analyze the control and management methodologies of optical network used in designing effective framework.
CO4	Make effective presentation and documentation on optical network models.
CO5	Develop problem solving skills and critical thinking in the designing of optical networks.



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Course Title	NETWORK ROUTING ALGORITHMS				
Course Code	16ISCNPENR	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

NETWORK ROUTING: BASICS AND FOUNDATIONS: Networking and Network Routing: An Introduction: Addressing and Internet Service: An Overview, Network Routing: An Overview, IP Addressing, On Architectures, Service Architecture, Protocol Stack Architecture, Router Architecture, Network Topology Architecture, Network Management Architecture, Public Switched Telephone Network, Communication Technologies,.

Routing Algorithms: Shortest Path and Widest Path: Bellman–Ford Algorithm and the Distance Vector Approach, Dijkstra’s Algorithm, Comparison of the Bellman–Ford Algorithm and Dijkstra’s Algorithm, Shortest Path Computation with Candidate Path Caching, Widest Path Computation with Candidate Path Caching, Widest Path Algorithm, k-Shortest Paths Algorithm

Routing Protocols: Framework and Principles: Routing Protocol, Routing Algorithm, and Routing Table, Routing Information Representation and Protocol Messages, Distance Vector Routing Protocol, Link State Routing Protocol, Path Vector Routing Protocol, Link Cost

8 Hours

UNIT – 2

ROUTING IN IP NETWORKS: IP Routing and Distance Vector Protocol Family : Routers, Networks, and Routing Information: Some Basics, Static Routes, Routing Information Protocol, Version 1 (RIPv1), Routing Information Protocol, Version 2 (RIPv2), Interior Gateway Routing Protocol (IGRP), Enhanced Interior Gateway Routing Protocol (EIGRP), Route Redistribution

OSPF and Integrated IS-IS : From a Protocol Family to an Instance of a Protocol, OSPF: Protocol Features, OSPF Packet Format, Examples of Router LSAs and Network LSAs, Integrated IS-IS, Similarities and Differences Between IS-IS and OSPF **Internet Routing**



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Architectures: Internet Routing Evolution, Addressing and Routing: Illustrations, Current Architectural View of the Internet, Allocation of IP Prefixes and A S Number, Policy-Based Routing, Point of Presence, Traffic Engineering Implications, Internet Routing Instability

9 Hours

UNIT – 3

Router Architectures: Functions of a Router, Types of Routers, Elements of a Router, Packet Flow, Packet Processing: Fast Path versus Slow Path, Router Architectures. **IP Address**

Lookup Algorithms: Impact of Addressing on Lookup, Longest Prefix Matching, Naïve Algorithms, Binary Tries, Multibit Tries, Compressing Multibit Tries, Search by Length Algorithms, Search by Value Approaches, Hardware Algorithms, Comparing Different Approaches. **IP Packet Filtering and Classification:** Importance of Packet Classification, Packet Classification Problem, Packet Classification Algorithms, Naïve Solutions, Two-Dimensional Solutions, Approaches for Dimensions, Extending Two-Dimensional Solutions, Divide and Conquer Approaches, Tuple Space Approaches, Decision Tree Approaches, Hardware-Based Solutions.

8 Hours

UNIT – 4

ADVANCED ROUTING PROTOCOLS FOR WIRELESS NETWORKS: Wireless networking basic aspects, Basic routing concepts, AD hoc routing, Mesh routing, Vehicular routing, Sensor routing

6 Hours

UNIT – 5

Toward NEXT GENERATION ROUTING: Quality of Service Routing: QoS Attributes, Adapting Shortest Path and Widest Path Routing: A Basic Framework, Update Frequency, Information Inaccuracy, and Impact on Routing, Lessons from Dynamic Call Routing in the Telephone Network, Heterogeneous Service, Single-Link Case, A General Framework for Source-Based QoS Routing with Path Caching, Routing Protocols for QoS Routing **MPLS and GMPLS:** Traffic Engineering Extension to Routing Protocols, Multiprotocol Label Switching, Generalized MPLS, MPLS Virtual Private Networks. **Routing and Traffic Engineering with MPLS:** Traffic Engineering of IP/MPLS Networks, VPN Traffic Engineering, Routing/Traffic Engineering for Voice Over MPLS. **VoIP Routing: Interoperability through IP and PSTN :** PSTN Call Routing Using the Internet, PSTN Call Routing: Managed IP Approach, IP-PSTN Interworking for VoIP, IP Multimedia Subsystem, Multiple Heterogeneous Providers Environment and All-IP Environment of VoIP Services

8 Hours

TEXT BOOKS:

1. Deepankar Medhi and Karthikeyan Ramasamy, “Network Routing: Algorithms,



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Protocols, and Architectures”, (The Morgan Kaufmann Series in Networking), Elsevier Inc 2007

2. Miguel Elias M. Campista and Marcelo G. Rubinstein, “Advanced Routing Protocols for Wireless Networks”, John Wiley & Sons , Inc, © ISTE Ltd 2014

REFERENCE BOOKS:

1. William Stallings, “High speed networks and Internets Performance and Quality of Service”, 2nd Edition, Pearson Education Asia. Reprint India 2002.
2. M. Steen Strub, “Routing in Communication network,” Prentice –Hall International, Network, 1995.
3. James D. McCabe, “Network Analysis, Architecture, and Design”, 3rd Edition, 2007 Elsevier Inc.

COURSE OUTCOMES (COs):

The students should be able to:

CO1	Comprehend Network Topology architecture, Routing, Management Architecture, Communication Technologies and compare various routing algorithms also compute shortest Path with Candidate Path Caching
CO2	Identify and Implement suitable routing algorithm for a given network with user requirements and the type of channel over which the network has to operate and analyze its performance
CO3	Design a new algorithm or modify an existing algorithm to satisfy the evolving demands in the network and by the user applications
CO4	Classify packet problems using two dimensional solution
CO5	Develop quality of service for next generation routing protocols



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Course Title	MULTIMEDIA COMMUNICATIONS				
Course Code	16ISCNPEMC	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

Introduction, multimedia information representation, multimedia networks, multimedia applications, Application and networking terminology, network QoS and application QoS, Digitization principles, text, images, audio and video

7 Hours

UNIT – 2

Text and image compression, compression principles, text compression- Run length, Huffman, LZW, Document Image compression using T2 and T3 coding, image compression- GIF, TIFF and JPEG

8 Hours

UNIT – 3

Audio compression: DPCM, ADPCM, Adaptive and Linear predictive coding, MPEG and Dolby coders video compression,

8 Hours

UNIT – 4

Video compression standards: H.261, H.263, MPEG 2, MPEG-4 and Reversible VLCs, MPEG 21 multimedia framework

8 Hours

UNIT – 5

Notion of synchronization, presentation requirements, reference model for synchronization, Introduction to SMIL, Multimedia operating systems, Resource & Process management techniques.

8 Hours

TEXT BOOKS:

1. Fred Halsall, “**Multimedia Communications**”, Pearson education, 2001.
2. Raif steinmetz, Klara Nahrstedt, “**Multimedia: Computing, Communications and Applications**”, Pearson education, 2002.



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REFERENCE BOOKS:

1. K. R. Rao, Zoran S. Bojkovic, Dragorad A. Milovanovic, “**Multimedia Communication Systems**”, Pearson education, 2004.
2. John Billamil, Louis Molina, “**Multimedia : An Introduction**”, PHI, 2002.

COURSE OUTCOMES (COs):

The students should be able to:

CO1	Apply depth knowledge of multimedia communications
CO2	Synthesize and analyse the frameworks of various multimedia standardization
CO3	Analyse various multimedia applications used in application layer
CO4	Synthesize existing knowledge of multimedia middleware layer
CO5	Use Modern Engineering tools to evaluate QoS in network multimedia systems



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Course Title	SOFTWARE DEFINED NETWORK				
Course Code	16ISCNPESD	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

Introduction: Control plane, Data plane, Moving information between planes, Why can separation be important? Distributed control planes: IP and MPLS, Creating the IP underlay, Convergence time, Load balancing, High availability, Creating the MPLS overlay, Replication. Centralized control planes: Logical versus Literal, ATM/LANE, Route servers.

7 Hours

UNIT – 2

OpenFlow: Wire protocol, Replication, FAWG, Config and Extensibility, Architecture, Hybrid approaches: Ships in the night, Dual Function switches, SDN Controllers: General concepts-VMware, Nicira.

8 Hours

UNIT – 3

Network Programmability: Management interface, Application-Network divide: Command line interface, NETCONF & NETMOD, SNMP, Modern programmatic interfaces: Publish and Subscribe interfaces, XMPP, Google's Protocol buffers, Thrift, JSON, Modern orchestration: Openstack, Cloudstack.

8 Hours

UNIT – 4

Network Function Virtualization: Virtualization and data plane I/O, Services engineered path, Service locations and chaining: Metadata, an application level approach, Scale, NFV at ETSI, Non-ETSI NFV Work: Middlebox studies, Embrace/LineRate.

8 Hours

UNIT – 5

Data Center concepts and constructs: Multitenant Data center, Virtualized multitenant data center: Orchestration, Connecting a tenant to the internet/VPN, Virtual machine migration and elasticity, Data center Interconnect, Fallacies of Data center distributed computing, Data center distributed computing pitfalls to consider, SDN solutions for the data center network, Building an SDN Framework: Open Daylight Controller/Framework.

8 Hours



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TEXT BOOK:

1. SDN: Software Defined Networks, An Authoritative Review of Network Programmability Technologies, By Thomas D. Nadeau, Ken Gray Publisher: O'Reilly Media, August 2013, ISBN: 978-1-4493-4230-2, ISBN 10: 1-4493-4230-2.

REFERENCES:

1. Software Defined Networks: A Comprehensive Approach, by Paul Goransson and Chuck Black, Morgan Kaufmann, June 2014, Print Book ISBN: 9780124166752, eBook ISBN : 9780124166844
2. SDN and OpenFlow for Beginners by Vivek Tiwari, 2013.
3. Network Innovation through OpenFlow and SDN: Principles and Design, Edited by Fei Hu, CRC Press, ISBN-10: 1466572094, 2014.
4. Open Networking Foundation (ONF) Documents, <https://www.opennetworking.org>, 2015.
5. OpenFlow standards, <http://www.openflow.org>, 2015.
6. Online Reading Lists, including: <http://www.nec-labs.com/~lume/sdn-reading-list.html>, 2015.

COURSE OUTCOMES (COs):

The students should be able to:

CO1	Conceptualize on data and control plane separation, Openflow, network programmability, virtualization, data center constructs and SDN Framework.
CO2	Apply plane-models, protocols, programmatic interfaces and framework notion for engineering deployments.
CO3	Analyze paradigm shift in the functionality of network models, controllers and constructs.
CO4	Assess the strategies used for development of software defined operations and infrastructure.
CO5	Possess knowledge on industry-scale operations for network virtualization, data center design and modern orchestration.
CO6	Ascertain practical implementation of SDN and learn controller application programs using simulation software.



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ELECTIVE –IV

Course Title	CLOUD COMPUTING				
Course Code	16ISCNPECC	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, Cloud Infrastructure: Cloud computing, Cloud computing delivery models and services, Ethical issues, Cloud vulnerabilities, Cloud computing at Amazon, Cloud computing the Google perspective, Microsoft Windows Azure and online services, Open-source software platforms for private clouds, Cloud storage diversity and vendor lock-in, Energy use and ecological impact, Service level agreements, User experience and software licensing.

8 Hours

UNIT – 2

Cloud Computing: Application Paradigms: Challenges of cloud computing, Architectural styles of cloud computing, Workflows: Coordination of multiple activities, Coordination based on a state machine model: The Zookeeper, The Map Reduce programming model, A case study: The GrepTheWeb application , Cloud for science and engineering, High-performance computing on a cloud, Cloud computing for Biology research, Social computing, digital content and cloud computing.

8 Hours

UNIT – 3

Cloud Resource Virtualization: Virtualization, Layering and virtualization, Virtual machine monitors, Virtual Machines, Performance and Security Isolation, Full virtualization and paravirtualization, Hardware support for virtualization, Case Study: Xen a VMM based paravirtualization, Optimization of network virtualization, vBlades, Performance comparison of virtual machines, The dark side of virtualization.

8 Hours

UNIT - 4

Python for Cloud: Python for Amazon Web services, Python for Google Cloud platform, Python for Windows Azure, python for map Reduce

8 Hours

UNIT – 5



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Cloud Security: Introduction, CSA - Cloud Security Architecture, authentication, authorization, Identity and Access Management, data security, Key Management, Auditing

7 Hours

TEXT BOOKS:

1. Dan C Marinescu: Cloud Computing Theory and Practice. Elsevier(MK) 2013.
2. Arshdeep Bahga, vijay Madiseti “ Cloud Computing – A Hands-on approach”, Universities Press, 2014

REFERENCE BOOKS:

1. Rajkumar Buyya , James Broberg, Andrzej Goscinski: Cloud Computing Principles and Paradigms, Willey 2014.
2. John W Rittinghouse, James F Ransome:Cloud Computing Implementation, Management and Security, CRC Press 2013

COURSE OUTCOMES (COs):

The students should be able to:

CO1	Understand and apply the knowledge of Cloud computing delivery models and services in developing applications on Cloud platform and in creating private cloud
CO2	Analyse various application paradigms, programming and coordination models of Cloud computing
CO3	Apply the knowledge of cloud resource virtualization, management and scheduling with Virtual machine monitors
CO4	Analyse the security issues with various cloud platforms while developing applications



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Course Title	INTERNET OF THINGS				
Course Code	16ISCNPEIO	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: Introduction: Definition and Characteristics of IoT, Physical Design of IoT: Things in IoT, IoT Protocols, Logical Design of IoT: IoT Functional Blocks, IoT Communication Models, IoT Communication APIs, IoT Enabling Technologies: Wireless Sensor Networks, Cloud Computing, Big Data Analytics, Communication protocols, Communication Protocols, Embedded Systems, IoT Levels and Deployment Templates Internet of Things Applications: Introduction, Home Automation, Smart Metering/Advanced Metering Infrastructure-Health/Body Area Networks, City Automation, Smart Cards, Tracking, Surveillance system, Environment, Energy, Retail, Logistics, Agriculture, Industry and Health care and Lifestyle

9 Hours

UNIT – 2

IoT Systems Logical Design using Python: Introduction, Installing Python, Data types and Data structures, Control flow, Functions, Modules, Packages, File handling, Classes, Python packages for IoT. What is an IoT device, Exemplary Device: Raspberry Pi, about the board, Linux on Raspberry Pi, Raspberry Pi Interfaces, and Programming Raspberry Pi with Python

7 Hours

UNIT – 3

Layer ½ Connectivity: Wireless Technologies for the IoT-WPAN Technologies for IoT/M2M, Cellular and Mobile Network Technologies for IoT/M2M, Layer 3 Connectivity :IPv6 Technologies for the IoT: Overview and Motivations. Address Capabilities, IPv6 Tunneling, IPsec in IPv6, Header Compression Schemes, Quality of Service in IPv6, Migration Strategies to IPv6.

8 Hours

UNIT – 4

Case Studies illustrating IoT Design-Introduction, Home Automation, Cities, Environment, Agriculture, Productivity Applications using different IoT devices, platform and software.

8 Hours

UNIT – 5

Data Analytics for IoT – Introduction, Apache Hadoop, MapReduce Programming Model, Hadoop MapReduce Job Execution, MapReduce Job Execution workflow, Hadoop Cluster Setup, Starting and Stopping Hadoop Cluster Using Hadoop MapReduce for Batch Data Analysis.

7 Hours



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TEXT BOOKS:

1. Daniel Minoli, "Building the Internet of Things with IPv6 and MIPv6: The Evolving world of M2M Communications", Wiley, 2013
2. Arshdeep Bahga, Vijay Madisetti, "Internet of Things : A Hands on Approach" Universities Press., 2015

REFERENCE BOOKS:

1. Michael Miller, "The Internet of Things", First Edition, Pearson, 2015.
2. Claire Rowland, Elizabeth Goodman et.al., "Designing Connected Products", First Edition, O'Reilly, 2015

COURSE OUTCOMES (COs):

The students should be able to:

CO1	Apply the knowledge of Sensors, Cloud and Communication technologies of IoT in analyzing and solving real time problems.
CO2	Identify the appropriate APIs, models and Enabling Technologies required to develop schemes for the applications of IoT.
CO3	Analyze the wireless and IPV6 technologies for IoT applications.
CO4	Design IoT applications for real life problems.
CO5	Develop and demonstrate IoT solutions for various real time problems in a team.
CO6	Perform IoT data Analysis using Apache Hadoop MapReduce.



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Course Title	WEB TECHNOLOGIES				
Course Code	16ISCNPEWT	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 HTML: HTML5 Document structure, HTML forms, Working with Video and Audio, **Cascading Style Sheets:** Introduction, Levels of style sheets, Style specification formats, Selector forms, Property value forms, Font properties, List properties, Alignment of text, Colour, The Box model, Background images, transitions and animations. Case Study : Twitter Bootstrap

7 Hours

UNIT - 2

Java Script: program structure in JavaScript (Datatypes, functions, objects , events), Java script, JQuery, JSON, AJAX.

8 Hours

UNIT – 3

PHP/MYSQL: What is Scripting, Client Side Scripting Vs Server Side Scripting, Features of PHP (data types, strings, functions, arrays, form handling and validation, Date Time, PHP include, Error handling). Introduction to MYSQL, Database Operations, Connecting MYSQL and PHP

8 Hours

UNIT – 4

Introduction to MVC, Benefits of MVC over conventional ASP.NET, Microsoft Razor framework.

8 Hours

UNIT – 5

Java Web Technologies : Creating JSP Pages, Session Management, JSP and JDBC, Database Accessing, Web services.

8 Hours



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TEXT BOOKS:

1. Achyut Godbole, Atul Khathe: Web Technologies 3/e, McGraw Hill Education, 2013.
2. Robert W. Sebesta, Programming the World Wide web, 7th Edition, Pearson Education, 2013.

REFERENCE BOOK:

1. Paul J. Deitel, Harvey M. Deitel, Abbey Deitel, , Internet & World Wide Web How to Program, 5/e , Prentice Hall, , 2013.

COURSE OUTCOMES (COs):

The students should be able to:

CO1	Apply the knowledge of modern web languages, scripting languages and latest Web frameworks to develop interactive web applications.
CO2	Analyze front-end web coding languages to add dynamic content, animation and effects to websites.
CO3	Differentiate client side and server side scripting technologies.
CO4	Design an interactive website(s) with regard to issues of usability, accessibility and Standards.
CO5	Create device independent web pages based on user specific requirements and constraints using integrated development tools (Webstrom/ VS Code/ Atom/ CMS)
CO6	Ability to perform in a team to create web applications using modern web programming frameworks (Webstorm).



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Course Title	MOBILE APPLICATION DEVELOPMENT				
Course Code	16ISCNPEMD	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 mobile communication and computing, Introduction to mobile computing, Novel applications, limitations and GSM architecture, Mobile services, System architecture, Radio interface, protocols, Handover and security. Smart phone operating systems and smart phones applications

7 Hours

UNIT – 2

Fundamentals of Android Development: Introduction to Android., The Android 4.1 Jelly Bean SDK, Understanding the Android Software Stack, Installing the Android SDK, Creating Android Virtual Devices, Creating the First Android Project, Using the Text View Control, Using the Android Emulator, The Android Debug Bridge (ADB), Basic Widgets Understanding the Role of Android Application Components, Event Handling , Displaying Messages Through Toast, Creating and Starting an Activity, Using the Edit ext Control

8 Hours

UNIT – 3

The Android Debug Bridge (ADB), Basic Widgets Understanding the Role of Android Application Components, Event Handling , Displaying Messages Through Toast, Creating and Starting an Activity, Using the Edit ext Control Building Blocks for Android Application Design, Laying Out Controls in Containers, Utilizing Resources and Media, Using Selection Widgets and Debugging Displaying and Fetching Information Using Dialogs and Fragments

8 Hours

UNIT – 4

Widgets and Debugging Using Selection Widgets and Debugging Displaying and Fetching Information Using Dialogs and Fragments Advanced Android Programming: Internet, Entertainment, and Services, Implementing drawing and animations

8 Hours



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UNIT – 5

Displaying web pages and maps: Displaying web pages and maps communicating with sms and emails,. creating and using content providers: Creating and consuming services, Publishing android applications

8 Hours

TEXT BOOK:

1. Mobile Computing: technologies and Applications- N. N. Jani S chand 2009.

REFERENCE BOOK:

1. B.M.Hirwani- Android programming Pearson publications-2013.

COURSE OUTCOMES (COs):

The students should be able to:

CO1	Understand mobile computing architecture
CO2	Develop design for mobile applications for specific requirements
CO3	Implement the design using Android SDK
CO4	Implement the design using Widgets
CO5	Deploy mobile applications in Android marketplace for distribution



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Course Title	SOFTWARE PROJECT MANAGEMENT AND FINANCE				
Course Code	16ISCNPCPF	Credits	02	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

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 Hours

UNIT -2

Project Management : Introduction, Project Integration Management, Project Scope Management, Project Time Management, Project Risk Management, Project Stakeholder Management.

7 Hours

UNIT- 3

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

4 Hours

UNIT- 4

Requirements Engineering and CMMI for Quality Management, 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. CMMI for Quality Management - Overview, Models, Representations, Maturity Levels, Capability Levels, Process Areas, Appraisals, Major Players, Best Practices.

6 Hours



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UNIT- 5

Entrepreneurship : Vision – Start, Define, Learn, Experiment, Steer – Leap, Test, Measure, Pivot, Accelerate – Batch, Grow, Adapt, Innovate.

5 Hours

Text Books :

1. A Guide to the Project Management Body of Knowledge (PMBOK® Guide) by Project Management Institute, 5th Edition, 2013.
2. The Lean Startup by Eric Ries, Crown Publishing Group, 1st Edition, 2011.
3. Software Engineering by 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.

COURSE OUTCOMES (COs):

The students should be able to:

CO1	Apply the concepts of project management framework and processes in project life cycle.
CO2	Examine the knowledge areas of software project management.
CO3	Prepare a cost estimate and budget for case studies of software projects.
CO4	Apply CMMI for quality management.
CO5	Model an entrepreneurship management for startups.

E-Books

1. <https://goo.gl/ykiYQb>
2. <http://www.stpia.ir/files/The%20Lean%20Startup%20.pdf>
3. <https://goo.gl/G4IpL5>

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>



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SEMESTER II

Group Project--16ISCNPCGP

Guidelines

- **Group Project** must be implemented in a team of not more than three students and not less two students on a trending topic. The students must make a regular presentation of their work to the internal guides and report their progress of the project. The students must make a presentation on the scheduled dates and this will be evaluated by the committee for 50 Marks. Finally, the students must submit a group project report and it will be evaluated for 50 Marks by the internal guide. All the evaluation shall be done based on group project rubrics. Total internal assessment for the group project would be $50+50=100$ Marks. SEE will be conducted for 100 Marks. The final would be CIE+SEE ($100+100$) = 200 Marks

COURSE OUTCOMES (COs):

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

CO1	Identify the feasible solutions for the identified problem in a team.
CO2	Conduct experiments, analyze and interpret results.
CO3	Demonstrate the project in a team.
CO4	Use of modern engineering tools.
CO5	Communicate clearly, write effective reports and make effective presentations following the professional code of conduct and ethics.
CO6	Continuous improvisation and reflect the same towards the future enhancements of the project work.



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SEMESTER III

Internship/Industrial Training---16ISCNPCIT

Guidelines

- **Internship/ Industrial Training:** The student shall undergo internship for 16 weeks.
 - **Preliminary Report** submission and evaluation after 8 week of Internship carried out, which shall be evaluated for 50 marks by the committee constituted for the purpose.
 - **Final Report** submission and evaluation after 16 week of Internship carried out, which shall be evaluated for 50 marks by the internal guide.
 - **Viva-Voce on Internship** – The SEE shall be conducted by the Internship Guide (from the college) and the External Guide (from the internship company) within 2 weeks of submission for 50 marks.

The final would be CIE+SEE (100+100) = 200 Marks.

COURSE OUTCOMES (COs):

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

CO1	Understand the problem in the given domain meticulously through literature survey by acquiring the depth knowledge of the chosen domain.
CO2	Critically analyze the problem in the given domain.
CO3	Apply latest modules and modern engineering tools.
CO4	Understand project management skills by demonstrating self-management, group dynamics and team work.
CO5	Communicate clearly, write effective reports and make effective presentations following the professional code of conduct and ethics.
CO6	Comprehensively study the given domain and reflect the same towards the future work.



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SEMESTER III

Project Work(Phase -I)--16ISCNPCP1

Guidelines

- **Project Phase – I**

- **Problem formulation** and submission of **synopsis** within 8 weeks from the commencement of 3rd semester, which shall be evaluated for 50 marks by the committee constituted for the purpose.
- **Literature survey and progress** done after 16 weeks, which shall be evaluated for 50 marks by the committee constituted for the purpose.

All the evaluation shall be done based on the rubrics of project phase – I. Total internal assessment for the project phase - I would be 50+50=100 Marks. SEE will be conducted for 100 Marks. The final would be CIE+SEE (100+100) = 200 Marks.

CO1	Problem identification with survey of related work.
CO2	Compare the state-of-art work with analysis.
CO3	Comprehend the suitable tools and techniques.
CO4	Apply project management principles to identify the milestones & schedule
CO5	Communicate, presentation & report writing



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SEMESTER IV

Guidelines

- **Project Phase - II:** The student should have satisfied Project Phase – I in their III semester before starting their Project Phase II. The student shall continue their project in the Internship Company they are offered or shall work on their project in the PG laboratory of the college. The student doing their project in the college must mandatorily published their work in a referred or non-paid journal. However, the students doing their project in the company would publish their work in a referred or non-paid journal subject to the preapproval of the company.
 - **Midterm Report** submission and evaluation after 8 week of project phase – II, which shall be evaluated for 50 marks by the committee constituted for the purpose.
 - **Plagiarism Check:** Before submission of the report, all the students must clear plagiarism check. The certificate along with plagiarism report shall be submitted to their guide before printing the report. Maximum acceptable plagiarism shall be 25%, beyond that the students must resubmit the report after some modification. A due care shall be taken by the students to follow the professional code of ethics and conduct. After which, the reports shall be prepared and printed as per the guidelines of MTech dissertation format.
 - **Project Presentation:** After plagiarism checking process, the students shall make a presentation in the department, which shall be evaluated for 50 marks by the committee constituted for the purpose.
 - **Final Report** submission and evaluation after 16 week of project phase - II, which shall be evaluated for 50 marks by the internal guide. This would be part of SEE.
 - **Viva-Voce on Project** – The SEE shall be conducted by the Internal Guide (from the college) and the External Guide (company or nominated) within 2 weeks of submission for 50 marks.
- All the evaluation shall be done based on the rubrics of project phase – II. The final would be CIE (Midterm + Presentation)(50+50) + SEE (Report + VIVA)(50+50) = 200 Marks.

COURSE OUTCOMES (COs):

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

CO1	Identify the problem through literature survey by applying depth knowledge of the chosen domain.
CO2	Analyze, synthesize and conceptualize the identified problem with a set of potential solutions.



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CO3	Design, Develop and implement an effective solution to achieve the objectives of the identified problem.
CO4	Apply latest modules and modern engineering tools.
CO5	Apply project management principles by demonstrating self-management, group dynamics and team work.
CO6	Communicate clearly, write effective reports and make effective presentations following the professional code of conduct and ethics.
CO7	Comprehensively study the domains and reflect the same towards the future enhancements of the project.



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SEMESTER IV

Technical Seminar-2-16ISCNPCS2

Guidelines

- **Technical Seminar 2:** topics should be Chosen form Scientific Citation Index based (SCI) /IEEE/ACM/Springer/Elsevier/Science Direct/ Transactions/ Any Peer-reviewed Nonpaid Journals. The students could convert the chosen seminar topic either into a Survey Paper or Technical Paper. The students must make a presentation on the scheduled dates and this will be evaluated by the committee for 50 Marks. Finally, the students must submit a technical seminar report and it will be evaluated for 50 Marks by the internal guide based on the seminar rubrics. Total internal assessment for the seminar would be 50+50=100 Marks. SEE will be conducted for 100 Marks. The final would be CIE+SEE (100+100) = 200 Marks.

COURSE OUTCOMES (COs):

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

CO1	Identify the problem through literature survey by applying depth knowledge of the chosen domain.
CO2	Analyze, synthesize and conceptualize the identified problem.
CO3	Communicate clearly, write effective reports and make effective presentations following the professional code of conduct and ethics.
CO4	Comprehensively study the domains and reflect the same towards the future enhancements of the work.