B.M.S. COLLEGE OF ENGINEERING

(Autonomous Institute, Affiliated to VTU)

Department of Computer Science & Engineering

UG Scheme and Syllabus
(3rd and 8th semester)
2014-2018

DEPARTMENT OF COMPUTER SCIENCE AND ENGINEERING
BMSCE, BANGALORE.

DEPARTMENT VISION

To be a model centre for education and training in the frontier areas of Computer Science and Engineering.

DEPARTMENT MISSION

The Mission of Computer Science and Engineering department is to educate students in the areas of computer science by providing best practices of teaching learning process for careers in software industry/higher education/research.

Programme Educational Objectives(PEO)

PEO1: Graduates of the program will have successful professional career in IT industry.

PEO2: Graduates of the program will pursue higher education.

PEO3: Graduates of the program will develop computing systems for real life problems.

Programme Specific Outcomes(PSO)

PSO1: Apply Software Engineering Principles and Practices to provide software solutions.

PSO2: Design and Develop Network, Mobile and Web based Computational systems under realistic constraints.

PSO3: Design efficient algorithms and develop effective code.

	PROGRAM OUTCOMES
PO1	Ability to apply the knowledge of Mathematics, Science and Engineering Fundamentals with the domain knowledge of computer science to solve engineering problems.
PO2	Identify, formulate and analyze engineering problems using the knowledge of mathematics, Science and Engineering with the domain knowledge of Computer Science to arrive at substantiated conclusions.
PO3	Ability to design and develop computer based solutions for practical Engineering problems under realistic constraints.
PO4	Ability to design, conduct experiment, analyze, interpret data and arrive at valid conclusions.
PO5	Ability to select and use modern tools and techniques for computing practice.
PO6	Ability to reason by assessing the societal, health, safety, legal, cultural issues and exhibit responsibility relevant to professional engineering practice.
PO7	Ability to understand the impact of Engineering solutions in societal and Environmental aspects and exhibit sustainable development.
PO8	Ability to apply ethical principles and commit to norms of professional Engineering practice.
PO9	Ability to function effectively as an individual and as a team member or leader in diverse teams and multidisciplinary settings.
PO10	Ability to communicate effectively, design good documentations and make clear presentations.
PO11	Ability to understand and apply the engineering, finance and management principles to manage multidisciplinary projects.
PO12	Ability to recognize the need and engage in lifelong learning for professional growth.

SCHEME OF INSTRUCTIONS FOR THIRD SEMESTER

Sl. No	Course Code									Course Title	Credit Hours/Week				
											L	T	P	S	Total
1	1	5	M	A	3	C	C	D	M	S	Discrete Mathematics	3	1	-	-	4
2	1	5	C	S	3	D	C	D	S	T	Data Structures	4	-	1	-	5
3	1	5	C	I	3	G	C	P	C	P	Programming with C++	3	-	1	2	6
4	1	5	C	S	3	D	C	W	E	P	Web Programming	3	-	1	2	6
5	1	5	C	S	3	D	C	C	O	A	Computer Organization and Architecture	4	-	-	-	4
											Total				4	25

SCHEME OF INSTRUCTIONS FOR FOURTH SEMESTER

Sl. No	Course Code									Course Title	Credit Hours/Week				
											L	T	P	S	Total
1	1	5	M	A	4	C	C	L	I	A	Linear Algebra	3	1	-	-	4
2	1	5	C	S	4	D	C	O	O	J	OOPS with Java	3	-	1	2	6
3	1	5	C	S	4	D	C	D	B	M	Data Base Management Systems	3	-	1	2	6
4	1	5	C	S	4	D	C	O	P	S	Operating Systems	4	-	-	-	4
5	1	5	C	S	4	D	C	D	C	M	Data Communication	4	-	1	-	5
											Total				4	25

SCHEME OF INSTRUCTIONS FOR 5TH SEMESTER

Course Code										Course Title	Credit Hours/Week					Contact hrs/wk	Marks		
											L	T	P	S	Total		CIE	SEE	Total
1	6	C	S	5	D	C	C	O	N	Computer Networks	4	-	1	-	5	6	50	50	100
1	6	C	S	5	D	C	A	D	A	Analysis and Design of Algorithms	3	1	1	-	5	7	50	50	100
1	6	C	S	5	D	C	I	O	T	Internet of Things	3	-	1	2	6	5	50	50	100
1	6	C	S	5	D	C	S	W	E	Software Engineering	3	-	-	-	3	3	50	50	100
1	6	C	S	5	D	E	D	E	1	Department Elective - 1	3	-	1	2	6	5	50	50	100
Total											16	1	4	4	25	26			500

Course Code										Department Elective - 1	Credit Hours/Week					Contact hrs/wk	Marks		
											L	T	P	S	Total		CIE	SEE	Total
1	6	C	S	5	D	E	P	I	P	Programming in Python	3	-	1	2	6	5	50	50	100
1	6	C	S	5	D	E	A	J	V	Advanced Java	3	-	1	2	6	5	50	50	100
1	6	C	S	5	D	E	C	D	N	C#.Net	3	-	1	2	6	5	50	50	100

SCHEME OF INSTRUCTIONS FOR 6TH SEMESTER

Course Code										Course Title	Credit Hours/Week					Contact hrs/wk	Marks		
											L	T	P	S	Total		CIE	SEE	Total
1	6	C	S	6	D	C	T	F	C	Theoretical Foundations of Computations	3	1	-	-	4	5	50	50	100
1	6	C	S	6	D	C	M	A	D	Mobile Application Development	3	-	1	2	6	5	50	50	100
1	6	C	S	6	D	C	O	O	M	Object Oriented Modeling and Design	3	-	1	0	4	5	50	50	100
1	6	C	S	6	H	S	H	S	1	HSS - 1 [Project Management]	2	-	-	-	2	2	50	50	100
1	6	C	S	6	D	E	D	E	2	Department Elective - 2	3	-	1	2	6	5	50	50	100
1	6	C	S	6	D	E	D	E	3	Department Elective - 3	3	-	-	-	3	3	50	50	100
Total											17	1	3	4	25	25			600

Course Code										Department Elective - 2	Credit Hours/Week					Contact hrs/wk	Marks		
											L	T	P	S	Total		CIE	SEE	Total
1	6	C	S	6	D	E	M	A	N	Mobile Adhoc Networks	3	-	1	2	6	5	50	50	100
1	6	C	S	6	D	E	C	C	T	Cloud Computing	3	-	1	2	6	5	50	50	100
1	6	C	S	6	D	E	A	I	N	Artificial Intelligence	3	-	1	2	6	5	50	50	100

Course Code										Department Elective - 3	Credit Hours/Week					Contact hrs/wk	Marks		
											L	T	P	S	Total		CIE	SEE	Total
1	6	C	S	6	D	E	S	S	D	System Software & Compiler Design	3	-	-	-	3	3	50	50	100
1	6	C	S	6	D	E	C	N	S	Cryptography and Network Security	3	-	-	-	3	3	50	50	100
1	6	C	S	6	D	E	S	A	N	Storage Area Networks	3	-	-	-	3	3	50	50	100
1	6	C	S	6	D	E	F	L	N	Fuzzy Logic and Neural Networks	3	-	-	-	3	3	50	50	100

SCHEME OF INSTRUCTIONS FOR 7TH SEMESTER

Course Code										Course Title	Credit Hours/Week					Contact hrs/wk	Marks		
											L	T	P	S	Total		CIE	SEE	Total
1	6	C	S	7	D	C	P	S	Q	**Probability , Statistics And Queuing**	2	1	-	-	3	3	50	50	100
1	6	C	S	7	D	E	D	E	4	**Department Elective - 4**	3	-	1	2	6	5	50	50	100
1	6	C	S	7	H	S	H	S	1	**Professional Ethics for Engineers**	2	-	-	-	2	2	50	50	100
1	6	C	S	7	D	C	P	P	1	**Project Phase-1**	-	-	2	-	2	2	50	50	100
1	6	C	S	7	C	E	D	E	1	**Cluster Elective -1**	3	-	1	2	6	5	50	50	100
1	6	C	S	7	C	E	D	E	2	**Cluster Elective -2**	3	-	1	2	6	5	50	50	100
1	6	C	S	7	I	E	I	E	1	**Institutional Elective - 1**	3	-	-	-	3	3	50	50	100
Total											16	1	3	6	25	25			600

Course Code										Department Elective - 4	Credit Hours/Week					Contact hrs/wk	Marks		
											L	T	P	S	Total		CIE	SEE	Total
1	6	C	S	7	D	E	S	W	T	**SOFTWARE TESTING**	3	-	1	2	6	5	50	50	100
1	6	C	S	7	D	E	C	Y	F	**CYBER FORENSICS**	3	-	1	2	6	5	50	50	100
1	6	C	S	7	D	E	M	C	P	**Multicore Programming**	3	-	1	2	6	5	50	50	100
1	6	C	S	7	D	E	B	D	A	**Big Data and Analytics**	3	-	1	2	6	5	50	50	100

Course Code										Department Elective - 5	Credit Hours/Week					Contact hrs/wk	Marks		
											L	T	P	S	Total		CIE	SEE	Total
1	6	C	S	7	D	E	A	W	T	**Advanced Web Technologies**	3	-	1	2	6	5	50	50	100
1	6	C	S	7	D	E	C	G	R	**Computer Graphics**	3	-	1	2	6	5	50	50	100
1	6	C	S	7	D	E	D	S	C	**Data Science using R**	3	-	1	2	6	5	50	50	100

1	6	C	S	7	D	E	D	I	P	Digital Image Processing	3	-	1	2	6	5	50	50	100

Course Code										Cluster Elective-1	Credit Hours/Week					Contact hrs/wk	Marks		
											L	T	P	S	Total		CIE	SEE	Total
1	6	C	S	7	C	E	D	O	S	Distributed Operating System	3	-	-	-	3	3	50	50	100
1	6	C	S	7	C	E	M	M	C	Multimedia Communications	3	-	-	-	3	3	50	50	100
1	6	C	S	7	C	E	S	Q	M	Software Quality Metrics	3	-	-	-	3	3	50	50	100
1	6	C	S	7	C	E	B	I	A	Bio Inspired Algorithms	3	-	-	-	3	3	50	50	100

Course Code										Institutional Elective-1	Credit Hours/Week					Contact hrs/wk	Marks		
											L	T	P	S	Total		CIE	SEE	Total
1	6	C	S	7	I	E	J	A	P	Java Programming	3	-	-	-	3	3	50	50	100
1	6	C	S	7	I	E	C	C	T	Cloud Computing	3	-	-	-	3	3	50	50	100
1	6	C	S	7	I	E	A	I	N	Artificial Intelligence	3	-	-	-	3	3	50	50	100

SCHEME OF INSTRUCTIONS FOR 8TH SEMESTER

Course Code										Course Title	Credit Hours/Week					Contact hrs/wk	Marks		
											L	T	P	S	Total		CIE	SEE	Total
1	6	C	S	8	D	C	G	C	T	**Green Computing**	3	1	-	-	4	4	50	50	100
1	6	C	S	8	H	S	M	A	E	**Management And Entrepreneurship**	3	-	-	-	3	3	50	50	100
1	6	C	S	8	D	C	P	P	2	Project Phase-2	-	-	12	-	12	12	50	50	100
1	6	C	S	8	D	C	I	N	T	**Internship**	-	-	2	-	2	2	50	50	100
1	6	C	S	7	I	E	I	E	2	Institutional Elective - 2	3	-	-	-	3	3	50	50	100
Total											9	1	14	-	24	24			600

Course Code										Institutional Elective-2	Credit Hours/Week					Contact hrs/wk	Marks		
											L	T	P	S	Total		CIE	SEE	Total
1	6	C	S	8	I	E	P	I	P	**Programming In Python**	3	-	-	-	3	3	50	50	100
1	6	C	S	8	I	E	I	O	T	**Internet of Things**	3	-	-	-	3	3	50	50	100
1	6	C	S	8	I	E	S	E	W	**Semantic Web**	3	-	-	-	3	3	50	50	100

The mapping of Department Core Courses to POs/PSOs through the COs

Sl. no.	SEM	COURSE	Course Title	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO 11	PO 12	PSO 1	PSO 2	PSO 3	AAT
1	III	15CS3DCCOA	Computer Organization and Architecture	3	3	3											1.5		
2	III	15CS3DCDST	Data Structures	3	3	3	3											3	
3	III	15CI3GCPCP	Programming with C++	3	3	3	2	3	2			3	3		1	1	2.75	2	
4	III	15CS3DCWEP	Web Programming	3	3	3	2	3	2			3	3		1	1	2.4	2	Mini Project
5	IV	15CS4DCOPS	Operating System	3	3			3				3	3						Design programs using Linux Operating system
6	IV	15CS4DCDCM	Data Communications	3	3	3		3									2		
7	IV	15CS4DCDBM	DataBase Management System	3	3	3	2	3	2			3	3		1	1	2.5		

8	IV	15CS4DCOOJ	OOPS with Java	3	3	3	2	3	2			3	3		1	1	2.4	2	Mini Project
9	V	16CS5DCADA	Analysis and Design of Algorithm	3	3	3	3											3	
10	V	16CS5DCSWE	Software Engineering	3	3	3					2			3		3			Model development
11	V	16CS5DCIOT	Internet Of Things		2		3	2	2	2		3	3	2				3	
12	V	16CS5DCCON	Computer Networks	3	2.5	2.5		3									2	2	Think-pair share activity
13	VI	16CS6DCMAD	Mobile Application Development	3	3	3	2	3	2			3	3		1	1	2.4	2	
14	VI	16CS6GCOOM	Object-Oriented Modeling and Design	3	3	3	3	3								3			
15	VI	16CS6DCAIN	Artificial Intelligence	3	2	2.5	2.5	3	2			3	3		1	1		1.8	
16	VI	16CS6HSHS1	Software Project Management and Finance	3	3	3		3							3		3			Technical Seminar
17	VI	16CS6DCTFC	Theoretical Foundations of Computation	3	2	2											2		

#	Sem	Course Code	Course Name																Remarks
18	VII	16CS7DCPSQ	Probability Statistics and Queuing	3	2	1											1		
19	VII	16CS7HSHS2	Professional Ethics for Engineers	3	3					3	3								
20	VII	16CS7DCPP1	Project Phase I	3	3	2.5		3	3		3	3	3	3	3	3		2	
21	VIII	16CS8DCGCT	Green Computing	3	3		3		3		3	3							
22	VIII	16CS8DCPP2	Project Phase -2	3	3	3	3	3	3	3	3	3	3	3	2.333	3	3	3	
23	VIII	16CS8HSMAE	Management and Entrepreneurship	3	3	3							2	3	2.333	2			Business Plan preparation
24	VIII	16CS8DCINT	Internship	3	1	3		3			3	3	3	3					

III SEMESTER SYLLABUS

Contact Hours/Week: 05	**L-T-P-S: 3-1-0-0**
Total Lecture Hours: 39	**CIE Marks: 50**
Subject Code: 15MA3GCDMS	**SEE Marks: 50**

UNIT-1

SET THEORY AND RELATIONS   **11 Hours**
Introduction to sets and subsets, operations on sets, laws of set theory. Duality, Principle of duality for the equality of sets.Countable and uncountable sets.Addition Principle.
Introduction to Relations. Definition, Types of functions, operations on relations, matrix representation of relations, composition of relations, properties of relations, equivalence relations, partial orders, Hasse diagram. Posets- extremal elements on posets.
(8L+3T)
Suggested Reading: Some particular functions- Floor and ceiling functions, Projection, Unary and Binary operations.

UNIT-2

ALGEBRAIC STRUCTURES-GROUPS   **10 Hours**
Groups, properties of groups.Some particular groups- The Klein 4-group, additive group of integers modulo *n*, multiplicative group of integers mod *p*, permutation groups.Subgroups, Cyclic groups, Coset decomposition of a group, homomorphism, isomorphism.(7L+3T)
Suggested Reading: Lagrange's theorem and its consequences.

UNIT-3

COMBINATORICS   **09 Hours**
Principles of counting: The rules of sum and product, permutations. Combinations- Binomial and multinomial theorems. Catalan numbers, Ramsey numbers. The Pigeon hole principle, the principle of inclusion and exclusion. Derangements, Rook polynomials.
(7L+2T)
Suggested Reading: Ordinary Generating Functions, Partitions of integers and their generating functions, exponential generating functions.

UNIT-4

GRAPH THEORY   **09 Hours**
Basic concepts: Types of graphs, order and size of a graph, in-degree and out-degree, connected and disconnected graphs, Eulerian graph, Hamiltonian graphs, sub-graphs, dual graphs, isomorphic graphs. Matrix representation of graphs: adjacency matrix, incidence matrix. Trees: spanning tree, breadth first search. Minimal spanning tree: Kruskal's algorithm, Prim's algorithm, shortest path-Dijkstra's algorithm.   (7L+2T)
Suggested Reading: Konigsberg bridge problem, Utilities problem, seating problem.   .

UNIT-5

NUMBER THEORY   **09 Hours**

Introduction: Integers, properties of integers. Primes.Congruences-: Introduction, Equivalence Relations, Linear Congruences, Linear Diophantine Equations and the Chinese Remainder Theorem, Modular Arithmetic: Fermat's Theorem, Wilson's Theorem and Fermat Numbers. Polynomial congruences, Pythagorean equations.(7L+2T)Suggested Reading:Prime counting function, Test of primality by trial division, Sieve of Eratosthenes, Canonical factorization, Fundamental theorem of arithmetic, determining the Canonical factorization of a natural number.

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

Text Books:

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

Reference Books:

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

E books and online course materials:

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

Online Courses and Video Lectures:

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

COURSE OUTCOMES:

Course Code	CO #	COURSE OUTCOMES (CO)	PO	Bloom's level
15MA3CCDMS		CO 1: Use the notation of set theory	2, 3	3
		CO 2: Construct a Hasse diagram for partial orderings	2, 3, 4	4
		CO 3: Differentiate between a relation and a function.	2, 3, 4	4
		CO 4: Recognize certain well known groups	2, 3, 4	4
		CO 5: Apply basic tools of Combinatorics such as sum and product rules, pigeon-hole principle.	2, 3, 4	4
		CO6:Use graphs as representation tools in a network analysis.	2, 3	3
		CO 7: Understand basic properties of integers, greatest common divisor, congruence relations and arithmetic of residue classes.	2, 3	3

ASSESSMENT:

1. Each unit consists of one full question.
2. Each full question consists of three or four subdivisions.
3. Five full questions to be answered.
4. To set one question in Units 1, 3, 5 and two questions each in unit 2 and unit 4.

Questions for CIE (50%) and SEE(50%) will be designed to evaluate the various educational components (Blooms taxonomy) such as:
- Remembering and understanding the course contents (weightage: 40%)
- Applying the knowledge acquired from the course (weightage: 35%)
- Designing and analyzing various engineering problems (weightage: 15%)
- Understanding of various system models (weightage: 10%)

DATA STRUCTURES

Contact Hours/Week: 06   **L-T-P-S: 4-0-1-0**

Total Lecture Hours: 52   **CIE Marks: 50**

Subject Code: 15CS3DCDST   **SEE Marks: 50**

UNIT-1

Introduction: Structures and Pointersrevisited, Introduction to Data Structures.

Stacks: Definition, Representation and operations on stack, Implementation of stack using array.

Applications of stack: Recursion: Definition, Sum of n numbers, factorial of given number, Fibonacci Series, GCD, Tower of Hanoi, Infix, Prefix, Postfix expressions, Conversions: Infix to postfix, Evaluation of postfix expression, Iteration v/s recursion techniques.

Queues: Definition, Representation and operation on Linear queues**,** Implementation of queue using array, Circular Queue, Priority Queue: Ascending PQ, Descending PQ, Multi-Level   PQ,   Application   of   Queue.
12 Hours

UNIT-2

Linked List: Dynamic Memory Allocation Revisited, Introduction to Linked List, Arrays v/s Linked List, Operation on Linked List: Insert, Delete, Display, Doubly Linked List, Circular Linked List, Circular Doubly LinkedList.

Applications on LinkedList: Reversing, Concatenation, Merging, Searching, Sorting, Addition of two polynomial, Evaluation of Polynomials, Addition of two long integers, Linked Implementation of Stacks, Linked Implementation of Queues.**11 Hours**

UNIT-3

Trees: Definition, Types of Trees, Representation of trees using array and Linked List, Operation on Binary Trees: Create, Display, Insert, Delete. Binary Search Tree: Definition, Operation on Binary Search Trees: Create, Display, Insert, Delete.

Tree Traversal: Preorder, Post order, Implementing tree traversal using recursion. Applications of Binary Trees and Binary Search Trees.   **10Hours**

UNIT-4

Variations of BST: Threaded Binary Tree and its types, B-Tree and its operations, Red-Black and its operations, Splay Tree, AVL Tree,2-3 Trees,2-3-4 Trees, Huffman Tree, Introduction to Binomial Heaps and Fibonacci Heaps. **10 Hours**

UNIT-5

Sorting: Bubble Sort, Selection Sort, Insertion Sort**,**Radix Sort, Sorting by Counting, Distribution Sorting.

Searching: Linear Search, Binary Search, Hashing: Introduction, Hash Function, Collision

Resolution Techniques: Linear Probing, Quadratic Probing, Double Hashing, Rehashing, Separate Chaining, Extendible Hashing**.** **09 Hours**

Text Books:

1. **Data Structures: A Pseudocode Approach with C** by Richard.F.Gilberg, Behrouz.A.Forouzan, 2nd edition 2007. (Latest Edition)
2. **Introduction to Algorithms** by T. H Cormen, C. E. Leiserson and R. L. Rivest, 2nd Edition, Prentice Hall India 2009. (Latest Edition)

Reference Books:

1. **Data Structures using C and C++** by YedidyahLangsam and Moshe J. Augenstein and Aaron M.Tenanbaum, PHI / Pearson 2008 Reprint.(Latest Edition)
2. **Introduction to the design and analysis of algorithms** by AnanyLevitin, Pearson Education, 2005. (Latest Edition)
3. **Data Structures and Program Design** by C R.Kruse, C.L Tondo and B.Leung, Second Edition, Pearson Education, 2007. (Latest Edition)
4. **Data Structures using** C by A.M.Padma Reddy, 2013 Revised Edition. (Latest Edition)

E- Books:

1. Data Structures and algorithm analysis in C++ by Marks Allen Wesis, Pearson Education, 3rd Edition, 2007.
2. Data Structures Using C by R. Krishnamoorthy, Tata McGraw-Hill Education, 2010
3. Principles of Data Structures Using C and C++ by Vine V Das, New age International Publishers.
4. "C Programming: Data Structures and Algorithms" by Jack Straub, Version 2.07, 2006

MOOCs:

1. NPTEL: http://nptel.ac.in/courses/106102064/1
2. UC Berkeley Data Structures: https://www.youtube.com/playlist?list=PLBB2FC97598A3B254
3. Algorithms, Part I(Princeton University): https://www.coursera.org/course/algs4partI

COURSE OUTCOMES:

CO1	Ability to apply knowledge of choosing an appropriate data structure for given problem requirement
CO2	Ability to design various operations on linear and non-linear data structures for specified problem definition
CO3	Ability to analyze searching and sorting techniques for effective management of data
CO4	Ability to conduct practical experiments for demonstrating the operations of different data structures and sorting techniques.

ASSESSMENT:

CIE Scheme:

Assessment	Weightage in Marks
1 Quiz /AAT	5
2 Internals	20 (10+10)
Lab Internals	25 (10+10+5)
Total	50

Best 2 out of 3 Tests and 1 Quiz and Lab Internals will be considered for CIE marks

SEE Scheme:

Semester End Examination (SEE) is a written examination of three hours duration for 100 marks. Students have to answer 5 questions from five units, three units to carry one question each(mandatory) two units to carry two questions each (internal choice).

Both CIE and SEE have equal (50:50) weightages. The Student's performance in a course shall be judged individually and together based on the results of CIE and SEE.

PROGRAMMING WITH C++

Contact Hours/Week: 05   **L-T-P-S: 3-0-1-2**

Total Lecture Hours: 39   **CIE Marks: 50**

Subject Code: 15CI3GCPCP   **SEE Marks: 50**

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, the This pointer, References.

8 Hours

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 Hours

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 Hours

UNIT 4

Templates: Generic functions, Applying Generic Functions.

Exception Handling: Exception Handling fundamentals, Handling derived class exceptions, Exception Handling options.

7 Hours

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 Hours

Text Book:

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

Reference Books:

1. C++ Program Design: An introduction to Programming and object – Oriented Design by Cohoon and Davidson, 3rd Edition, Tata McGraw Hill, 2003
2. Object-Oriented Programmig in C++ by Robert Lafore, 4th edition, Pearson Education.
3. 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/Straustrup4th.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:

CO 1	Ability to **apply** various features of object oriented programming paradigm
CO 2	Ability to **analyze** a given c++ program to identify bugs and write the appropriate code.
CO 3	Ability to **implement**solution for a given scenario using appropriate OOP concepts
CO 4	Ability to **conduct practical** experiments for demonstrating the features of OOP concepts
CO 5	Ability to **develop** a **project** by applying OOP concepts to solve a given real world problem.

ASSESSMENT:

CIE Scheme:

Assessment	Weightage in Marks
1 Quiz/AAT	5
2 Internals	20
1 Lab Internals	15
1 Self Study	10
Total	50

Best 2 out of 3 Tests and 1 Quiz will be considered for CIE marks

SEE Scheme:

Semester End Examination (SEE) is a written examination of three hours duration for 100 marks. Students have to answer 5 questions from five units, three units to carry one question each(mandatory) two units to carry two questions each (internal choice).

Both CIE and SEE have equal (50:50) weightages. The Student's performance in a course shall be judged individually and together based on the results of CIE and SEE.

WEB PROGRAMMING

Contact Hours/Week: 05   **L-T-P-S: 3-0-1-2**

Total Lecture Hours: 39   **CIE Marks: 50**

Subject Code: 15CS3DCWEP   **SEE Marks: 50**

UNIT-1
XHTML: Basic syntax, Standard XHTML document structure; Basic text markup, Images; Hypertext Links, Lists, Tables, Forms, The Audio Element, The Video Element, Organization Elements, The Time Element, Syntactic differences between HTML and XHTML.

Cascading Style Sheets: Introduction, Levels of style sheets, Style specification formats, Selector forms, Property value forms, Font properties, List properties, Alignment of text, Color, The Box model, Background images, The <span> and <div> tags, Conflict resolution.
10 Hours

UNIT-2
JAVASCRIPT: Overview of JavaScript, Object orientation and JavaScript, General syntactic characteristics, Primitives, Operations and Expressions, Screen output and keyboard input, Control statements, Object creation and modification, Arrays, Functions, Constructor, Pattern matching using regular expressions.

JavaScript and HTML Documents: The JavaScript execution environment, The Document Object Model, Element access in JavaScript, Events and event handling,Handling events from the Body elements,   Button elements, Text box and Password elements.

Dynamic documents with JavaScript: Introduction, Positioning elements, Moving elements, Element visibility, Changing colors and fonts, Dynamic content, Stacking elements, Locating the mouse cursor, Reacting to a mouse click, Slow movement of elements.**10 Hours**

UNIT-3
PHP Programming
Creating PHP Pages Using PHP6 : Overview of PHP Structure and Syntax, Creating Your First Program, Using HTML to Spice Up Your Pages, Using Constants and Variables to Add Functionality, Passing Variables between Pages, Using if/else Arguments, Using Includes for Efficient Code, Using Functions for Efficient Code, All about Arrays, OOP Dreams.
09 Hours

UNIT-4
Using PHP with MySQL: Overview of MySQL Structure and Syntax, How PHP Fits with MySQL, Connecting to the MySQL Server, Looking at a Ready-Made Database, Querying the Database,

Form Elements- Letting the User Work with Data: Your First Form, Driving the User Input, Linking Forms Together.

XML: Introduction to XML, Uses of XMLSyntax, The Syntax of XML, Document structure, Namespaces, XML schemas, Displaying raw XML documents, Displaying XML documents with CSS, XSLT style sheets..**10 Hours**

Text Books:

1. **Programming the World Wide Web** by Robert W. Sebesta, 8thEdition,Pearson, 2015.

2. **Beginning PHP6, Apache, MySQL® Web Development**By Timothy Boronczyk, Elizabeth Naramore, Jason Gerner, Yann Le Scouarnec, Jeremy Stolz, Michael K. Glass,John Wiley &Sons, 2009.

Reference Books:

1. **Internet & World Wide Web How to program** by Paul Deitel, Harvey Deitel, Abbey Deitel, 5th Edition, Pearson Education / PHI, 2012.

2. **Learning PHP, MySQL, JavaScript, CSS & HTML5** by Robin Nixon, 3rd Edition, O'REILLY, 2014.

E- Books:

1. The Web Book: How to create Web sites and applications with HTML, CSS, JavaScript, PHP and MySQL by Robert Schifreen, 2010.

2. Sams Teach Yourself PHP, MySQL® and Apache All in One by Meloni, Julie C, 2012.

3. Build your own Website The Right Way Using HTML & CSS, 3rd edition by Ian Lloyd, SitePoint publication, 2011

4. Creating Web Pages All-in-One For Dummies by Richard Wagner, 4th Edition, Wiley Publication, 2011

MOOCs:

1. World Wide Web School , URL : http://www.w3schools.com/html

2. NPTEL : http://nptel.ac.in/video.php?subjectId=106105084

3. http://www.creativebloq.com/web-design/training-online-resources-812225

COURSE OUTCOMES:

CO 1	Ability to **apply** theknowledge of front-end and back-end web technologies for the given requirement.
CO 2	Ability to**analyze** the given web program to identify bugs and to write correct code.
CO 3	Ability to **design** web applications for the given specifications.
CO 4	Ability to **conduct practical** experiments for demonstrating the features of web applications using MySQL and Apache web server.

CO 5	Ability to **develop** a **project** using web technologies to solve societal problems.

ASSESSMENT:

CIE Scheme:

Assessment	Weightage in Marks
1 Quiz/AAT	5
2 Internals	20
1 Lab Internals	10
1 Self Study	15
Total	50

Best 2 out of 3 Tests and 1 Quiz will be considered for CIE marks

SEE Scheme:

Semester End Examination (SEE) is a written examination of three hours duration for 100 marks. Students have to answer 5 questions from five units, three units to carry one question each(mandatory from Unit 3 and Unit 4) two units to carry two questions each (internal choice from Unit 1 and Unit 2).

Self-Study Scheme:

Students will be carrying out a project work covering the concepts for learning practical applications.

Both CIE and SEE have equal (50:50) weightages. The Student's performance in a course shall be judged individually and together based on the results of CIE and SEE.

COMPUTER ORGANIZATION AND ARCHITECTURE

Contact Hours/Week: 04   **L-T-P-S: 4-0-0-0**

Total Lecture Hours: 52   **CIE Marks: 50**

Subject Code: 15CS3DCCOA   **SEE Marks: 50**

UNIT-1

Basic Structure of Computers: Computer Types, Functional Units, Basic Operational Concepts, Bus Structures, Performance - Processor Clock, Basic Performance Equation, Pipelining and Superscalar, Clock Rate, Instruction set: CISC &RISC, Compiler, Performance Measurement, Historical Perspective.

Machine Instructions and Programs: Numbers, Arithmetic Operations and Characters, Memory Location and Addresses, Memory Operations, Instructions and Instruction Sequencing, Addressing Modes, Assembly Language, Basic Input and Output Operations, Stacks and Queues, Subroutines, Additional Instructions, Encoding of Machine Instructions.
12 Hours

UNIT-2

Input/Output Organization: Accessing I/O Devices, Interrupts - Interrupt Hardware, Enabling and Disabling Interrupts, Handling Multiple Devices, Controlling Device Requests, Exceptions, Direct Memory Access, Buses

Interface Circuits, Standard I/O Interfaces - PCI Bus, SCSI Bus, USB.   **10 Hours**

UNIT-3

Memory System: Basic Concepts, Semiconductor RAM Memories, Read Only Memories, Speed, Size, and Cost, Cache Memories - Mapping Functions, Replacement Algorithms, Performance Considerations, Virtual Memories, Secondary Storage.   **10Hours**

UNIT-4

Arithmetic: Addition and Subtraction of Signed Numbers, Design of Fast Adders, Multiplication of Positive Numbers, Signed Operand Multiplication, Fast Multiplication, Integer Division, Floating-point Numbers and Operations.   **10 Hours**

UNIT-5

Basic Processing Unit: Some Fundamental Concepts, Execution of a Complete Instruction, Multiple Bus Organization, Hard-wired Control and Micro programmed Control(only Architecture).

Parallel Computer Architecture: Processor Architecture and Technology Trends,Flynn's Taxonomy of Parallel Architectures,Memory Organization of Parallel Computers,Thread-Level Parallelism (Example:Architecture of the Intel Core i7).   1**0 Hours**

Text Books:

1.ComputerOrganizationbyCarlHamacher, ZvonkoVranesic, SafwatZaky, 5[th]Edition, Tata McGraw Hill, 2009. (Latest Edition)

2.Parallel Programming For Multicore & Cluster Systems by Thomas Rauber, GudulaRunger, 2[nd]Edition,Springer, 2013.

Reference Books:

1.Computer Organization and Design - The Hardware/Software Interface by David A. Patterson, John L. Hennessy, 4th Edition, Elsevier, 2008. (Latest Edition)

2.Computer Organization & Architecture by William Stallings, 7th Edition, PHI.

3.Computer Systems Design and Architecture by Vincent P. Heuring& Harry F. Jordan, 2[nd]Edition,Pearson Education.

E- Books:

1. Computer Organization:TMH,Ace series.

2. Computer Organization and Architecture by William Stallings*.*

MOOCs:

1.NPTEL:http://nptel.ac.in/courses/106106092/

2. http://freevideolectures.com/Course/2277/Computer-Organization#

COURSE OUTCOMES:

CO1	Ability to apply the concepts of basic functional units to demonstrate the working of computational system
CO2	Ability to analyze the design issues in the development of processor and other components to articulate improvement in computer design
CO3	Ability to design memory modules and Arithmetic Logic unit by analyzing performance issues

ASSESSMENT:

CIE Scheme:

Assessment	Weightage in Marks
2 Quiz	10
2 Internals	40
Total	50

Best 2 out of 3 Tests and 2 Quiz will be considered for CIE marks

SEE Scheme:

Semester End Examination (SEE) is a written examination of three hours duration of 100 marks. Students have to answer 5 questions from five units, three units to carry one question each(mandatory) two units to carry two questions each (internal choice).

Both CIE and SEE have equal (50:50) weightages. The Student's performance in a course shall be judged individually and together based on the results of CIE and SEE.

SEE Scheme:

IV SEMESTER SYLLABUS

Contact Hours/Week: 05   **L-T-P-S: 3-1-0-0**

Total Lecture Hours: 39   **CIE Marks: 50**

Subject Code: 15MA4GCLIA   **SEE Marks: 50**

UNIT-1

SYSTEM OF LINEAR EQUATIONS AND VECTOR SPACES   12 Hours
System of Linear Equations: Elementary row operations and echelon forms, invertible matrices. Consistency of a system of linear equations. Solution of a system of algebraic equations: Gauss elimination method, LU decomposition method, Gauss Seidel method.
Vector spaces; subspaces; computations concerning subspaces; summary of row-equivalence; Linear combination, linear dependence and linear Independence; spanning sets, Row spaces of a matrix, Column space of a matrix, bases and dimension; coordinates.
(9L+2T)
Suggested Reading: Solution of a system of equations using Gauss Jordan method, inverse of a matrix using Gauss Jordan method.

UNIT-2

LINEAR TRANSFORMATIONS   12 Hours
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 Hours
Rayleigh power method, Gerschgorin circle method, Jacobi's method, invariant subspaces, Jordan canonical form.
(9L+2T)
Suggested Reading: Cayley Hamilton theorem, Givens method, inverse Power method.

UNIT-4

INNER PRODUCT SPACES   10 Hours
Inner product, inner product spaces, length and orthogonality, orthogonal sets and Bases, projections, Gram-Schmidt process, QR-factorization,   least   squares   problem.
       (9L+2T) Suggested Reading: least square errors.

UNIT-5

SYMMETRIC MATRICES AND QUADRATIC FORMS   08 Hours
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

Text Books :

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

Reference Books:

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

E books and online course materials:

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

Online Courses and Video Lectures:

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

ASSESSMENT:

1. Each unit consists of one full question.
2. Each full question consists of two, three or four subdivisions.
3. Five full questions to be answered.
4. To set one question each in Units 2, 3, 4 and two questions each in Unit 1 and Unit 4.

Questions for CIE (50%) and SEE(50%) will be designed to evaluate the various educational components (Blooms taxonomy) such as:
   • Remembering and understanding the course contents (weightage: 40%)
   • Applying the knowledge acquired from the course (weightage: 35%)
   • Designing and analyzing various engineering problems (weightage: 15%)
   • Understanding of various system models (weightage: 10%)

COURSE OUTCOMES:

Course Code	COURSE OUTCOME (CO)	PO	Bloom's level
15MA4GCLIA	CO 1: Solve system of linear algebraic equations.	2	2
	CO 2: Demonstrate competence with the ideas of vector spaces, subspaces, Basis and dimension.	2	2
	CO 3: Obtain the matrix associated with a linear transformation with respect to given bases.	2,3	3
	CO 4: Understand the relationship between the operations on linear transformations and their corresponding matrices.		
	CO 5: Compute eigenvalues, eigenvectors and eigenspaces of matrices.	2,3	3
	• CO6: Apply Gram-Schmidt process tofind an orthogonal base in a subspace of an inner product space, and to be able to characterize orthogonal matrices.	2,3	3
	CO7: Use of Singular value decomposition that finds applications in signal processing.	2,3	3

Contact Hours/Week: 05   **L-T-P-S: 3-0-1-2**

Total Lecture Hours: 39   **CIE Marks: 50**

Subject Code: 15CS4DCOOJ   **SEE Marks: 50**

UNIT-1

Introduction of Java: Java and Java applications, java Development kit (JDK), Java is interpreted, Byte code, JVM, simple java Programs.

Data types and other tokens: Boolean Variables, int, long, char, operators, arrays, white spaces, literals, assigning values, creating and destroying objects, access specifiers.

Control Statements: Selection statements, iteration statements, Jump statements, Classes in Java, declaring a class, class name, Super classes, constructors, creating instances of a class, Inner classes.

Inheritance: Simple, Multiple, multilevel inheritance, overriding, overloading, using super, multilevel hierarchy, dynamic method dispatch, abstract class, using final with inheritance.
10 Hours

UNIT-2

Process Description And Control

Packages: Defining a package, Finding packages and class path, Example, Access protection, importing packages

Interfaces: Defining Interface, Implementing Interface, Nested Interfaces, Applying interfaces, Variables in interfaces.

Enumeration, Autoboxing: Enumeration, Type Wrappers, Autoboxing

Generics: Introduction toGenerics.A Simple Generics Example, A generics Class with two type parameters, The General form of a Generic Class.**09 Hours**

UNIT-3

String handling: Special string operators, character extraction, string comparison, searching strings, modifying a string, string buffer, additional string methods.

Exception handling: Fundamentals, Exception types, uncaught exceptions, using try and catch, multiple catch clauses, nested try statements, throw, throws, finally, Java's built-in exceptions. Creating your own exception subclasses.

Multithreaded Programming: Introduction to Process,Difference between Process and Threads, Java thread model, main thread, creating thread, creating multiple threads, using isalive() and Join(), thread priorities, synchronization, Interthreadcommunication, suspending, resuming and stopping threads.**10 Hours**

UNIT-4

Input/Output: Exploring java.io: The Java I/O Classes and Interfaces. File, The Closable and the Flushable Interfaces, The Stream classes, The Byte Streams, The Character Streams,Console Class files.

Applets Fundamentals: Applet class, two types of applets, Applet basics, Applet architecture, An Applet skeleton, display methods, requesting repainting, using status window, HTML applet tag, Passing parameters to Applets, getDocumentbase(),

getCodebase().

Abstract window toolkit: Introducing the AWT working with windows, Event Handling, Using AWT controls,Layout Managers and Menus, working with graphics and Text.

10 Hours

Text Books:

1. Java the Complete ReferencebyHerbertSchildt, 9th edition, Tata McGraw-hill Edition 2014.

2**. Programming with Java A Primer** by E.BalaGuruSwamy,5thedition,McGraw Hill Education 2014.

Reference Books:

1.**Introduction to JAVA Programming** by Y. Daniel Liang, 9th edition, pearson education, 2012.

2.**Programming in JAVA 5.0**, James P Cohoon, Jack W Davidson; TATA McGraw hill. Cay S Horstmann, Gary Cornell: Core Java2, Volume 1 and 2, Seventh Edition, Pearson Education.

E-Books:

1. Oracle Technology Network.
2. Essentials of the Java Programming Language Hands-On Guide.
3. Building Object-Oriented, Multi-Threaded Applications with Java by Bill Venners.
4. Java Reference Guide by Stevens Haines.
5.Getting Started with Java.

MOOC:

1. https://www.edx.org/course/introduction-programming-java-part-1-uc3mx-it

2. http://www.learnerstv.com/video/Free-video-Lecture-226-Computer-Science.htm

COURSE OUTCOMES:

CO1	Apply knowledge ofJava constructs for developing different programs/applications.
CO2	Analyse the given Java program to identify bugs and to write correct code.
CO3	Design Java program/ applications for a given requirement.
CO4	Conduct practical experiments for demonstrating features of Java using eclipse.

CO5	Develop a project using Java for real world applications.

ASSESSMENT:

CIE Scheme:

Assessment	Weightage in Marks
1 Quiz/AAT	5
2 Internals	20
1 Lab Internals	10
1 Self Study	15
Total	50

Best 2 out of 3 Tests and 1 Quiz will be considered for CIE marks

SEE Scheme:

Semester End Examination (SEE) is a written examination of three hours duration for 100 marks. Students have to answer 5 questions from five units, three units to carry one question each(mandatory) two units to carry two questions each (internal choice).

Self-Study Scheme:

Students will be carrying out a project work covering the concepts for learning practical applications.

Both CIE and SEE have equal (50:50) weightages. The Student's performance in a course shall be judged individually and together based on the results of CIE and SEE.

DATABASE MANAGEMENT SYSTEMS

Contact Hours/Week: 05   **L-T-P-S: 3-0-1-2**

Total Lecture Hours: 39   **CIE Marks: 50**

Subject Code: 15CS4DCDBM   **SEE Marks: 50**

UNIT-1

Introduction to Databases: Introduction, An Example, Characteristics of Database approach, Advantages of using DBMS approach, When not to use a DBMS.

Database System Concepts and Architecture: Data models, Schemas and instances, Three schema architecture and data independence, Database languages and interfaces, The database system environment.

SQL: SQL Data Definition and Data Types specifying basic constraints in SQL, Basic retrieval queries in SQL, Insert, Delete and Update statements in SQL, Additional features of SQL, More complex SQL Queries, Specifying Constraints as Assertion and Trigger, Views (Virtual Tables) in SQL, Schema Change Statement in SQL.   **11 Hours**

UNIT-2

Relational Data Model and Relational Database Constraints: Relational Model Concepts, Relational Model Constraints and Relational Database Schemas, Update Operations, Transactions and Dealing with Constraint Violations.

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.

Data Modeling using the Entity-Relationship(ER) model: Using High-Level conceptual Data Models for Database Design, A sample Database Application, Entity types, Entity Sets, Attributes and Keys, Relationship Types, Relationship Sets, Roles and Structural Constraints, Weak Entity types, Refining the ER Design, ER Diagrams, Naming Conventions and Design Issues, Relationship Types of Degree Higher than Two, Database Design using ER-to-Relational Mapping.   **11 Hours**

UNIT-3

Database Design Theory and Normalization: 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, Multi-valued Dependencies and Fourth Normal Form, Join Dependencies and Fifth Normal Form.
09 Hours

UNIT-4

Transaction Processing, Concurrency Control, and Recovery: Introduction to Transaction Processing, Transaction and System Concepts, Desirable Properties of Transactions,Characterizing Schedules Based on Recoverability, Characterizing Schedules Based on Serializability, Two-Phase Locking Techniques for Concurrency Control, Recovery Concepts, NO-UNDO/REDO Recovery Techniques based on Deferred Update, Recovery Techniques Based on Immediate Update, Shadow Paging, The ARIES Recovery Algorithm.**08 Hours**

Text Books:

1. **Fundamental of Database Systems** by RamezElmasri and Shamkant B Navathe, Sixth Edition, Addison Wesley, 2011.

2. **Database System Concepts**, Sixth Edition,AbrahamSilberschatz, Henry F. Korth, S. Sudarshan : Tata McGraw-Hill,2010

Reference Books:

1. **An Introduction to Database Systems** by C.J. Date, A.Kannan, S.Swamynathan, 8th Edition, Pearson Education, 2006.

2.**Database Systems: The Complete Book**, Second Edition, Hector Garcia-Molina,Jeffrey D.Ullman, Jennifer Widom , Pearson Education, 2001

E- Books:

1. Introduction to structured Query Language (SQL)

2. An Introduction to Relational Database Theory by Hugh Darwen

3. Database Management System by Raghu Ramakrishnan

MOOCs:

1. http://nptel.ac.in/courses/IIT-MADRAS/Intro_to_Database_Systems_Design

2.http://www.iitg.ernet.in/awekar/teaching/cs344fall11/

3. www.w3schools.com/sql/

COURSE OUTCOMES:

CO1	Ability to apply the concepts of database management system for various applications.
CO2	Ability to analyse the given database concepts to its correctness.
CO3	Ability to design and demonstrate conceptual models, query and optimization.
CO4	Ability to conduct experiments to demonstrate the various SQL query processing and to develop the front end using Microsoft visual studio.
CO5	Ability to perform in a team to design and develop DBMS applications that addresses various real world problems.

ASSESSMENT:

CIE Scheme:

Assessment	Weightage in Marks
1 Quiz/AAT	5
2 Internals	20
1 Lab Internals	10
1 Self Study	15
Total	50

Best 2 out of 3 Tests and 1 Quiz will be considered for CIE marks

SEE Scheme:

Semester End Examination (SEE) is a written examination of three hours duration of 100 marks. Students have to answer 5 questions from four units. Two units to carry one question each(mandatory from Unit 3 and Unit 4), two units to carry two questions each (internal choice from Unit 1 and Unit 2) and one question from the entire syllabus.

Self-Study Scheme:

Students will be carrying out a project covering the concepts for learning practical applications. Academic projects will be developed by students.

Both CIE and SEE have equal (50:50) weightages. The Student's performance in a course shall be judged individually and together based on the results of CIE and SEE.

OPERATING SYSTEM

Contact Hours/Week: 04   **L-T-P-S: 4-0-0-0**

Total Lecture Hours: 52   **CIE Marks: 50**

Subject Code: 15CS4DCOPS   **SEE Marks: 50**

UNIT-1

Operating System Overview

Operating System Objectives and Functions, The Evolution of Operating Systems, Developments Leading to Modern Operating Systems, Virtual Machines, OS Design Considerations for Multiprocessor and Multicore architectures, Modern UNIX Systems, Linux, Android, User Operating system interface, system Calls, Types of System calls, System   programs,   System   boot.
08 Hours

UNIT-2

Process Description And Control
Process Concept, Process Scheduling, Operations on Processes, Interprocess Communication.
Threads: Overview, Multicore Programming, Multithreading Models, Implicit Threading, Threading Issues, Linux process and thread management.
Scheduling: Basic concepts, Scheduling Criteria, Scheduling Algorithms Thread Scheduling, Multiple-Processor Scheduling, Real-Time CPU Scheduling, Linux Scheduling.   **12 Hours**

UNIT-3

Concurrency: Mutual Exclusion AndSynchronization
The critical section problem, Semaphores, Classical problems of synchronization,Critical regions.
Deadlocks: System Model, Deadlock characterization, Methods for handling deadlocks, Deadlock prevention, Deadlock avoidance, Deadlock detection and recovery from deadlock, Linux kernel concurrency mechanisms.   **11Hours**

UNIT-4

Memory management strategies
Background, Swapping, Contiguous memory allocation, Paging, Structure of page table, Segmentation.
Virtual memory management: Background, Demand paging, Copy on write, Page replacement algorithms, Allocation of frames, Thrashing,
Linux Memory Management.   **11 Hours**

UNIT-5

Input/ Output and Files
Implementing File system: File System structure, File system implementation, Directory Implementation, Allocation methods, Free space management, Linux Virtual File System.
Mass storage structures: Disk structure, Disk attachment, Disk scheduling methods, Linux I/O.
Protection: Goals of protection, Principles of protection, Domain of protection, Access matrix,   Implementation   of   access   matrix.
10 Hours

Text Books:

1. **Operating System: Internals and Design Principles** by William Stallings, Prentice Hall, 8th Edition, 2014.

2. **Operating System Concepts** by Abraham Silberschatz, Peter Baer Galvin and Greg Gagne, John Wiley &Sons,Inc., 9th Edition,2012.

Reference Books:

1. **Linux System Administration** by Tom Adelstein and Bill Lubanovic, O'Reilly Media, Inc., 1st Edition, 2007.

2. **Modern Operating System** by Andrew S. Tanenbaum, Prentice Hall, 3rd Edition, 2007.

3. **Schaum's Outline of Operating Systems** (Schaum's Outline Series), by J. Archer Harris, Publisher: McGraw-Hill, 2001.

E-Books:

5. Operating Systems Guide :by Tim Bower

6. Operating Systems Course Notes: by Dr. John T.Bell

7. Schaum's Outline of Operating Systems (Schaum's Outline Series) [Kindle Edition] by J. Archer Harris.

MOOCs:

1. http://onlinevideolecture.com/?course=computer-science&subject=operating-systems

2. http://www.nptel.ac.in/courses/106108101/

COURSE OUTCOMES:

CO1	Ability to **Apply** Various Process Scheduling Algorithms, Disk Scheduling algorithms, Page replacement algorithms and Deadlock detection and avoidance techniques for providing Operating System functionalities
CO2	Ability to **Analyze** various process management concepts (including scheduling, synchronization, deadlocks), Memory Management strategies and Design considerations of file system.

CO3	Ability to Demonstrate and present features of Linux Operating System.

ASSESSMENT:

CIE Scheme:

Assessment	Weightage in Marks
2 Quiz /AAT	10
2 Internals	40
Total	50

Best 2 out of 3 Tests and 2 Quiz/AAT will be considered for CIE marks

SEE Scheme:

Semester End Examination (SEE) is a written examination of three hours duration of 100 marks. Students have to answer 5 questions from five units, three units to carry one question each(mandatory) two units to carry two questions each (internal choice).

Both CIE and SEE have equal (50:50) weightages. The Student's performance in a course shall be judged individually and together based on the results of CIE and SEE.

DATA COMMUNICATION

Contact Hours/Week: 06   **L-T-P-S: 4-0-1-0**

Total Lecture Hours: 52   **CIE Marks: 50**

Subject Code: 15CS4DCDCM   **SEE Marks: 50**

UNIT-1
DataCommunications,Networks,TheInternet,Protocolsand   standards,NetworkModels-ReferencemodelsOSI,TCP/IPModel,Addressing,Data&Signal-AnalogandDigital,   Periodic Analog Signals, Digital Signals, Transmissionimpairment, Data RateLimits,Performance.
09 Hours

UNIT-2
DigitalTransmissions:
DigitaltoDigitalConversions,AnalogtoDigitalConversions,TransmissionModes,Analog Transmission-DigitaltoAnalogconversion,AnalogtoAnalogconversion,Multiplexing-FDM,WDM,STDM,StatisticalTDM,SpreadSpectrum,GuidedMedia-Twistedpaircable,Co-axialcable,Fiberopticcable,Unguidedmedia-Wireless-Radiowaves,Microwaves,Infrared**.**
12 Hours

UNIT-3
Circuitswitchednetworks,Datagram   networks,   Virtualcircuitnetworks,StructureofaSwitch-StructureofCircuitSwitches&PacketSwitches,DataLinkLayer-DetectionandCorrection-Introduction,BlockCoding-Error
DetectionandCorrection,HammingDistance,MinimumHammingDistance,LinearBlockCodes, CyclicCodes- CRC,Polynomials,Checksum.**10Hours**

UNIT-4
Data   Link   Layer–DataLinkControl-Framing,Flowanderrorcontrol,Protocols,NoiselessChannels,NoisyChannels,HDLC,Point-to-PointProtocol- Framing, Transition phases, Multiple Access- Randomaccess-Aloha,CSMA,CSMA/CD,CSMA/CA,Controlledaccess-
reservation,polling,tokenpassing,Channelization - FDMA,TDMA,CDMA.**12 Hours**

UNIT-5
Wired LANs: Ethernet – Standard Ethernet, Fast Ethernet, Gigabit Ethernet, Wireless LANs-IEEE 802.11, Bluetooth - Architecture, Bluetooth layers, Radio layer, Baseband layer, L2CAP Connecting Devices–Hub, Repeater, Bridges, Transparent Bridges, Switches, Router, and Gateway.   **09 Hours**

Text Books:

  1.DataCommunicationandNetworking,BehrouzA.Forouzan**,**McGrawHill, 5thEdition,2012.
  2.DataandComputerCommunication, WilliamStallings,10thEdition,PearsonEducation,2014.

Reference Books:
  1.IntroductiontoDataCommunicationsandNetworking–Wayne   Tomasi,   Pearson

Education,2009.(Latest Edition)

2.CommunicationNetworks-FundamentalConceptsandkey Architectures,AlbertoLeon-GarciaandIndraWidjaja,TataMc-Graw-Hill 2ndEdition,Pearson Education,2007.

E-Books:
1.Data Communications by Brian Brown
2. Introduction to Data Communicationsby Eugene Blanchard

MOOCs:
1. http://nptel.ac.in/courses/106105082/
2. http://nptel.ac.in/video.php?subjectId=106105081
3. http://www.computerscienceonline.org/courses/
4. https://www.youtube.com/view_play_list?p=32DBC269EF768F74

COURSE OUTCOMES:

CO1	Ability to apply the functionalities of physical and data link layers for network applications.
CO2	Ability to analyze various mechanisms associated with physical and data link layers and the relevant protocols.
CO3	Ability to develop programs that demonstrate the functionalities of physical and data link layers.

ASSESSMENT:

CIE Scheme:

Assessment	Weightage in Marks
1 Quiz /AAT	5
2 Internals	20 (10+10)
Lab Internals	25 (10+10+5)
Total	50

Best 2 out of 3 Tests and 1 Quiz and Lab Internals will be considered for CIE marks

SEE Scheme:
Semester End Examination (SEE) is a written examination of three hours duration for 100 marks. Students have to answer 5 questions from five units, three units to carry one question each(mandatory) two units to carry two questions each (internal choice).

Both CIE and SEE have equal (50:50) weightages. The Student's performance in a course shall be judged individually and together based on the results of CIE and SEE.

V SEMESTER

SYLLABUS

COMPUTER NETWORKS

Contact Hours/Week: 04   L-T-P-S: 4-0-1-0

Total Lecture Hours: 52   CIE Marks: 50

Subject Code: 16CS5DCCON   SEE Marks: 50

UNIT 1:

Application Layer: Principles of Network Applications: Network Application Architectures Processes Communicating, Transport Services Available to Applications, Transport Services Provided by the Internet, Application-Layer Protocols,The Web and HTTP: Overview of HTTP, Non-Persistent and Persistent Connections, HTTP Message Format, User-Server Interaction-Cookies, Web Caching, The Conditional GET. File Transfer-FTP: FTP Commands and Replies, Electronic Mail in the Internet: SMTP, Comparison with HTTP, Mail Message Formats, Mail Access Protocols.

10 hours

UNIT 2:

Application Layer: DNS—The Internet's Directory Service: Services Provided by DNS, Overview of How DNS Works, DNS Records and Messages, Socket Programming: Creating Network Applications, Socket Programming with TCP, Socket programming with UDP

Transport layer: Introduction and Transport-Layer Services: Relationship Between Transport and Network Layers, Overview of the Transport Layer in the Internet, Multiplexing and Demultiplexing.

10 hours

UNIT 3:

Transport layer: Connectionless Transport-UDP: UDP Segment Structure, UDP Checksum, Connection-Oriented Transport-TCP: The TCP Connection, TCP Segment Structure, Round-Trip Time Estimation and Timeout, Reliable Data Transfer, Flow Control, TCP Connection Management.

10 hours

UNIT 4:

Transport layer: Principles of Congestion Control: The Causes and the Costs of Congestion, Approaches to Congestion Control, Network-Assisted Congestion-Control Example: ATM ABR Congestion Control, TCP Congestion Control: Fairness.

Network Layer: Introduction: Forwarding and Routing, Network Service Models, What's Inside a Router? : Input Processing, Switching, Output Processing, Where Does Queuing Occur?The Routing Control Plane.   **10 hours**

UNIT 5:

Network Layer: The Internet Protocol (IP): Forwarding and addressing in the Internet, Datagram Format,IPv4 Addressing, ICMP, IPv6

Routing Algorithms: The Link-State Routing Algorithm, The Distance-Vector Routing Algorithm, Hierarchical Routing, Routing in the internet: RIP, OSPF, BGP.   **12 hours**

Text books:
1. Computer Networking: A Top - Down Approach by James F. Kurose and Keith W. Ross, Pearson Education, Sixth Edition Inc, 2013.

Reference Books:

1. Data Communications and Networking by Behrouz A. Forouzan, 5th Edition, Tata McGraw-Hill, 2012.

2. Data and Computer Communication by William Stallings: 10th Edition, Pearson Education, 2013.

3. Computer Networks – A Systems Approach by Larry L. Peterson and Bruce S. David:, 4th Edition, Elsevier, 2014.

E-Books:

1. An Introduction to Computer Networks Release 1.8.17 by Peter L Dordal, 2016.

2. Networking all in one for dummies- 4th edition by Doug Lowe

MOOCs:

http://nptel.ac.in/courses/106105081/1

https://www.coursera.org/course/comnetworks

Course Outcomes:

CO Number	Course Outcome
CO1	Ability to apply conceptual and implementation aspects for network applications.
CO2	Ability to analyse the various protocols in network, transport and application layers and their mechanisms.
CO3	Ability to design functional aspects for network applications.
CO4	Ability to develop programs that demonstrate the operations of network, transport and application layers

ANALYSIS AND DESIGN OF ALGORITHMS

Contact Hours/Week: 05   **L-T-P-S: 3-1-1-0**

Total Lecture Hours: 39   **CIE Marks: 50**

Subject Code: 16CS5DCADA   **SEE Marks: 50**

UNIT 1:

Introduction

Algorithms, Fundamentals of Algorithmic Problem Solving, Space Complexity, Time Complexity, Asymptotic notations, Mathematical Analysis of Non- recursive algorithms, Mathematical Analysis of Recursive Algorithms. Introduction to Brute Force Technique, Exhaustive Search.**8 Hours**

UNIT 2:

Divide and Conquer Technique

Introduction, Merge Sort, Quick Sort, Strassen's Matrix Multiplication.Sorting Networks: Comparison networks, Zero-one principle, A bitonic sorting network, Merging network.   **5 Hours**

Decrease and Conquer Technique

Introduction, Depth First Search [DFS], Breadth First Search [BFS], Topological Sorting, Analysis of Insertion Sort Algorithm. **4 Hours**

Backtracking

Introduction, Sum of Subsets,N-Queens Problem, Knapsack Problem. **3 Hours**

UNIT 3:

Dynamic Programming Technique

Introduction, Binomial Coefficient, Floyd's Algorithm, Knapsack Problem, Travelling Salesman Problem, Multistage Graphs, Longest Common Subsequence.**6 Hours**

Transform and Conquer Technique

Introduction, Presorting, Heap sort, Horner's Rule for Polynomial Evaluation.   **3Hours**

UNIT 4:

Greedy Technique

Introduction, Spanning Tree, Finding MST using Prims' and Kruskals' Algorithm, Dijkstra's Algorithm, Job Sequencing with Deadline, Knapsack Problem, Activity-selection problem. **7 Hours**

Complexity Classes

P and NP classes: Introduction, Comparison, Approximation Algorithm for NP hard: Hamiltonian Cycle Problem, Algorithm for NP Complete Problems: Vertex Cover Problem.   **3 Hours**

Text Books:

1. "**Introduction to the Design and Analysis of Algorithms**" by AnanyLevitin, Pearson Education, 2nd Edition,2011.
2. **"Introduction to Algorithms"**, Revised second edition, T.H. Cormen, C.E.Leiserson, R.L. Rivest and C. Stein, PHI Pvt. Ltd./ Pearson Education, 2009.

Reference books:

1. **"Fundamentals of Computer Algorithms",** Ellis Horowitz, SatrajSahni and Rajasekharam, University Press Pvt. Ltd, 2nd Edition, 2009.
2. **"Analysis and design of Algorithms"**, Padma Reddy, Sri Nandi Publications, 2009.

E-Books:

1. **"Introduction to Design & Analysis of Algorithms"** by K. Raghava Rao, Smashwords 2013.
2. **"Data structures and Algorithm Analysis in C++"**, Allen Weiss, Fourth edition, Pearson education, 2014

MOOCs:

1. http://www.nptelvideos.in/2012/11/design-analysis-of-algorithms.html
2. http://openclassroom.stanford.edu/MainFolder/CoursePage.php?course=IntroToAlgorithms
3. http://ocw.mit.edu/courses/electrical-engineering-and-computer-science/6-006-introduction-to-algorithms-fall-2011/lecture-videos/

Course Outcomes:

CO Number	Course Outcome
CO1	Ability to analyze time complexity of recursive and non-recursive algorithms using asymptotic notations.
CO2	Ability to design efficient algorithms using various design techniques.
CO3	Ability to apply the knowledge of complexity classes P, NP, and NP-Complete and prove certain problems are NP-Complete
CO4	Ability to conduct practical experiments to solve problems using an appropriate designing method and find time efficiency.

INTERNET OF THINGS

Contact Hours/Week: 05   **L-T-P-S: 3-0-1-2**

Total Lecture Hours: 39   **CIE Marks: 50**

Subject Code: 16CS5DCIOT   **SEE Marks: 50**

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, IoT Levels and Templates. Overview of Microprocessor and Microcontroller, Basics of Sensors and actuators.

9 hours

UNIT 2:

PROTOTYPING IOT OBJECTS USING MICROPROCESSOR/MICROCONTROLLER

Working principles of sensors and actuators – Setting up the board - Programming for IOT – Reading from Sensors, Communication**:** Connecting microcontroller with mobile devices – communication through Bluetooth, Wi-Fi, Ethernet, Zigbee, RFID, NFC.   **10 hours**

UNIT 3:

IOT ARCHITECTURE AND PROTOCOLS

Architecture Reference Model- Introduction, Reference Model and architecture, IoT reference Model. Protocols- 6LowPAN, RPL, CoAP, MQTT , XAMP

DEVICE DISCOVERY MANAGEMENT

Device Discovery capabilities – Registering a device, De-register a device, Querying for devices. , Intel IOTivitiy, XMPP Discovery extension.   **11 hours**

UNIT 4:

CLOUD SERVICES FOR IOT

Introduction to Cloud Storage models and communication APIs Webserver – Web server for IoT, Cloud for IoT, Python web application framework designing a RESTful web API, Amazon Web services for IOT.   **9 hours**

Text Books:

1. Vijay Madisetti and ArshdeepBahga, **"Internet of Things (A Hands-on-Approach)",** 1st Edition, VPT, 2014. (UNIT 1 AND UNIT 4)

Note : Hand Notes will be provided to the students for UNITS 2 & 3

Reference Books:

1. Olivier Hersent, David Boswarthick, Omar Elloumi , "The **Internet of Things – Key applications and Protocols**", Wiley, 2012
2. **Internet of Things with Arduino: Build Internet of Things Projects With the Arduino Platform** by Marco Schwartz
3. **Enabling Things to Talk - Designing IoT solutions with the IoT Architectural Reference**

E-Books:

1. Designing for the Internet of Things, O'Reilly, February 2015
2. Getting Started with the Internet of Things, O'Reilly 4th edition, October, 2015

MOOCs:

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

Course Outcomes:

CO Number	Course Outcome
CO1	Ability to apply various protocols, device discovery and cloud services in resource constraint network for IoT applications
CO2	Ability to analyse the various IoT architectural components.
CO3	Ability to develop IOT systems using with Arduino development board by interfacing sensors, communication modules and actuators.
CO4	Ability to conduct experiments to demonstrate the working of sensors, actuators, communication modules using Arduino IDE.
CO5	Ability to perform in a team to design and develop IoT applications that address various real time problems.

SOFTWARE ENGINEERING

Course code: 16CS5DCSWE   L-T-P-S: 3-0-0-0

Contact hours: 3   CIE Marks: 50

Teaching Hours: 39   SEE Marks: 50

UNIT 1:

OVERVIEW: Introduction: FAQs about software engineering, Professional and ethical responsibility. Software Process Models,ProcessIteration,Process Activities.

REQUIREMENTS: Software requirements: Functional and Non-functional requirements, User requirements, System requirements, Interface specification, The software requirements document, Requirements engineering process, Feasibility studies, Requirements elicitation and analysis, Requirements validation, Requirements management.**10 hours**

UNIT 2:

SYSTEM MODELS: System models: Context models, Behavioral models, Data models, Object models, structured methods.

SOFTWARE DESIGN: Architectural Design: Architectural Design Decisions, system organizations, Modular decomposition styles, control Styles. Object-Oriented Design: Objects and Object classes, An object oriented design process, Design evolution.**9 hours**

UNIT 3:

Software   Project   Management:The   Management   spectrum,Management   of people,product,processAndproject,The W5HH Principle,Critical practices.

Estimation   for   Software   Project:Software   Project estimation;Decompositiontechniques,Examples,EmpiricalEstimationmodels.Software   Project Scheduling:Basis concept and principles of Project scheduling,Defining task set and task Network;Scheduling.RiskManagement:Reactive   versus   proactive strategies;SoftwareRisks,Riskidentification,Riskmitigation,monitoring and management.The RMMM Plan.**10 hours**

UNIT4:

DEVELOPMENT: Rapid software development, Agile methods, Extreme programming, Rapid application development, Software evolution, Legacy system evolution.

VERIFICATION AND VALIDATION: Verification and validation: Planning, Software inspections, Automated static analysis, Verification and formal methods. Software testing: System Testing, Component testing, Test case design, test automation.**10 hours**

Text Books:

1. Software Engineering: Ian Somerville, 8th edition, Pearson Education, 2007

2. Software Engineering: A Practitioners Approach-Rogers S Pressman, 7th edition, MCGrawHill, 2007

Reference Books:

1. Software Engineering theory and Practice-shari Lawrence Pfleeger, Joanne m Atlec, 3rd edition, Pearson Education, 2006.

2. Software Engineering Principles and Practice – Waman S Jawadekar, Tata McGraw Hill, 2004

MOOCs:

1. www.nptel**videos**.com/**software-engineering**/Software Engineering_video_lectures.php

2. **http://onlinevideolecture.com/?subject=Software%20Engineering**

3. www.courseera.org/learn/Software-Processes-and Agile Practices

E-Books:

1. Fundamentals of Software Engineering by Rajib Mall

2. Software Engineering E-book by Roger.S.Pressman A practitioner's Approach

3. An Integrated approach to Software Engineering by Pankaj Jalote.

Course Outcomes:

CO Number	Course Outcome
CO1	Ability to apply Software Engineering Design Techniques and practices for developing Software.
CO2	Ability to analyze the various requirements, design and Testing Techniques to select the appropriate techniques for the software system.
CO3	Ability to Design Models for different phases of software development to solve real world problems.
CO4	Ability to Manage Projects by Estimating cost and time required for developing the Software Product.

PROGRAMMING IN PYTHON

Contact Hours/Week: 05

Total Lecture Hours: 39

Subject Code: 16CS5DEPIP

L-T-P-S: 3-0-1-2

CIE Marks: 50

SEE Marks: 50

UNIT 1:

Introduction to Python, Python Concepts, Dynamic vs. Static Types, Interpreted vs. Compiled, Prototyping, Procedural vs. Object-Oriented Programming, Comparing Programming Languages-C, C++, JAVA,C#, Python, The Python Interpreter, Python Versions, 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

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.**10 hours**

UNIT 2:

Files: File Operations, Files and Streams, Creating a File, Reading From a File, Iterating Through Files, Seeking, Serialization.

Exceptions: Exception Class Hierarchy, User-Defined Exceptions.

Object Oriented Programming: Learning Python Classes, How Are Classes Better? , "New-style" classes, Inheritance , Operator Overloads, Class Methods.

Databases: How to Use a Database, Working With a Database , Using SQL to Query a Database, Python and SQLite, Creating an SQLite DB, Pulling Data from a DB, SQLite Database Files, Distributing Your Program.   **10 hours**

UNIT 3:

GUI development – examining GUI, understanding event driven programming, root window, labels, buttons, creating a GUI using a class, binding widgets and event handlers, text and entry widgets and Grid layout manager, check buttons, radio buttons, mad lib program.

Graphics – Pizza panic game, creating a graphics window, setting background image, understanding the graphics coordinate system, displaying sprite, text, message, moving sprites, dealing with screen boundaries, mouse input, collisions. **10 hours**

UNIT 4:

Sound, animation and program development – reading keyboard, rotating a sprite, creating an animation, working with sound and music, astrocrash game, asteroids, rotating the ship, moving the ship, firing missiles, controlling the missile rate, collisions and explosions, adding levels, store keeping and theme music. **09 hours**

Text books:

1. Learning to Program using Python by Cody Jackson, Second Edition, 2014.
2. Python Programming, Michael DAWSON, 3rd Edition, Course technology PTR, 2010

Reference Books:

1. **Introducing Python** by Bill Lubanovic, O'Reilly Media, Edition 2014.
2. **Learning Python Network Programming by** Dr. M. O. FaruqueSarker and Sam Washington, Packt Publishing, 2015.
3. *Python Essential Reference, 4th Edition* by David M. Beazley, Pearson Education, Inc., Edition – 2009
4. Python Crash Course: A Hands-on, Project Based Introduction to Programming by Eric Matthes, No Starch Press Inc, San Francisco, 2016.

E-books:

1. **Learning Python**, Fifth Edition by Mark Lutz, 2013
2. **Programming in Python 3: A Complete Introduction to the Python Language 1st Edition**

MOOCS:

1. **https://www.coursera.org/course/interactivepython1**
2. **https://www.coursera.org/course/interactivepython2**

Course Outcomes:

CO Number	Course Outcome
CO1	Ability to apply the knowledge of Python programming to develop different

	applications.
CO2	Ability to analyze the given Python program to identify bugs and to rectify it.
CO3	Ability to design GUI and Graphics applications for a given requirement using Python programming.
CO4	Ability to conduct practical experiments for given requirements using Python.
CO5	Ability to develop a project using Python for a given requirement and make effective Oral Presentation and documentation.

ADVANCED JAVA

Contact Hours/Week: 05   **L-T-P-S: 3-0-1-2**

Total Lecture Hours: 39   **CIE Marks: 50**

Subject Code: 16CS5DEJAV   **SEE Marks: 50**

UNIT 1

Swings: Swings, The origins of Swing, Two key Swing features, Components and Containers, The **10Hrs**
Swing Packages,A simple SwingApplication,Create a Swing Applet, Jlabel and ImageIcon,
JTextField, TheSwing Buttons, JTabbedpane, JScrollPane,JList; JComboBox, JTable.

UNIT 2:   **10Hrs**

The Concept of JDBC, JDBC Driver Types, JDBC Packages, A Brief Overview of the JDBC
process, Database Connection, Associating the JDBC/ODBC Bridge with the Database, Statement
Objects, ResultSet, Transaction Processing, Metadata, Data types, Exceptions.

Servlets: Background, The Life Cycle of a Servlet, Using Tomcat for Servlet Development, A
simple Servlet, The Servlet API.TheJavax.servlet Package, Reading Servlet Parameter, The
Javax.servlet.http package, Handling HTTPRequests and Responses, Using Cookies, Session
Tracking.

UNIT 3:   **10Hrs**

JSP, RMI: Java Server Pages (JSP): JSP, JSP Tags, Tomcat, Request String,User Sessions,
Cookies, Session Objects.

Java Remote Method Invocation: Remote Method Invocation concept, ServerSide, Client side.

Enterprise Java Beans: Enterprise java Beans, Deployment Descriptors, Session Java Bean, Entity
Java Bean, Message-Driven Bean, The JAR File.

UNIT 4:   **9 Hrs**

Networking Basics: The Networking Classes and Interfaces, InetAddress, Factory Methods,
Instance Methods, Inet4Address and Inet6Address, TCP/IP Client Sockets
URL, URLConnection, HttpURLConnection, The URI Class, Cookies, TCP/IP Server Sockets,
Datagrams, DatagramSocket, DatagramPacket, A Datagram Example

Text Books:

2. **Java the Complete Reference** by Herbert Schildt, 9th edition, Tata McGraw-hill Edition 2014
2. **J2EE - The Complete Reference** by Jim Keogh ,Tata McGraw Hill, 2007

Reference Books:

1.Introduction to JAVA Programming by Y. Daniel Liang, 6th edition, pearson education, 2007

2. **Programming in JAVA 5.0**, James P Cohoon, Jack W Davidson; TATA McGraw hill. Cay
   S H orstmann, Gary Cornell: Core Java2, Volume 1 and 2 , Seventh Edition, Pearson Education.

3. **The J2EE Tutorial** by Stephanie Bodoff ,2nd Edition, Pearson Education, 2004.

4. Head First Servlets and JSPby Shroff,2nd Edition, O,Reilly Publications ,2008

E-Books:

5. Oracle Technology Network

6. Essentials of the Java Programming Language: A Hands-On Guide

7. Building Object-Oriented, Multi-Threaded Applications with Java by Bill Venners,

8. Java Reference Guide by Stevens Haines

5.Getting Started with Java

OOCs:

1.https://www.edx.org/course/introduction-programming-java-part-1-uc3mx-it

2. http://www.learnerstv.com/video/Free-video-Lecture-226-Computer-Science.htm

Course Outcomes:

CO Number	Course Outcome
CO1	Demonstrate and develop the different applications using Swings
CO2	Develop the java applications to use database connection using JDBC Package
CO3	Demonstrate and develop servlet application
CO4	Demonstrate the concepts JSP, RMI and Java beans
CO5	Demonstrate & develop the basic Network concepts in Java

C# AND .NET

Contact Hours/Week: 05   **L-T-P-S: 3-0-1-2**

Total Lecture Hours: 39   **CIE Marks: 50**

Subject Code: 16CS5DECDN   **SEE Marks: 50**

UNIT 1:

Introducing the Building Blocks of the .NET Platform (the CLR, CTS, and CLS); Additional .NET-Aware Programming Languages; An Overview of .NET Assemblies; Building C# Applications Using csc.exe; The Anatomy of a Simple C# Program ;The System.ConsoleClass;System Data Types and Corresponding C# Keywords;Working with String Data; Method Parameter Modifiers; Understanding Value Types and Reference Types; Arrays; Understanding C# Nullable Types;

The First Pillar: C#'s Encapsulation Services; The Second Pillar of OOP: The Details of Inheritance; The Third Pillar of OOP: C#'s Polymorphic Support; Understanding the .NET Delegate Type; The Simplest Possible Delegate Example; Understanding C# Events.**10 Hours**

UNIT 2:

Understanding Structured Exception Handling:The Role of .NET Exception Handling; The Simplest Possible Example; Configuring the state of an Exception; System-Level Exceptions (System.SystemException); Application-Level Exceptions (System.ApplicationException); Understanding Object Lifetime:Classes, Objects, and References; The Basics of Object Lifetime; The Role of Application Roots; Understanding Object Generations; The System.GC Type; Building Finalizable Objects; Building Disposable Objects.   **9Hours**

UNIT 3:

A High-Level Definition of ADO.NET; Understanding ADO.NET Data Providers; Understanding the Connected Layer of ADO.NET; Working with Data Readers; Understanding the Disconnected Layer of ADO.NET; Understanding the Role of the DataSet; Working with DataColumns; Working with DataRows; Working with DataTables; Working with Data Adapters.

The Role of HTTP; Understanding Web Applications and Web Servers; The Role of HTML; The Role of Client-Side Scripting; Posting Back to the Web Server; Building a Single-File ASP.NET Web Page; Building an ASP.NET Web Page Using Code Files; ASP.NET Web Sites vs. ASP.NET Web Applications; The ASP.NET Web Site Directory Structure. **10 Hours**

UNIT 4:

Understanding the Nature of Web Controls; The Control and WebControl Base Classes; Major Categories of ASP.NET Web Controls; The Role of the Validation Controls; The Issue of State; ASP.NET State Management Techniques; Understanding the Role of ASP.NET View State; The Role of the Global,asax File; Understanding the Application/Session Distinction; Working with the Application Cache; Maintaining Session Data; Understanding Cookies; The Role of the <sessionState> Element; Introducing the ASP.NET Profile API.   **10 Hours**

Text Books:
1. **Pro C# 5.0 and the .NET 4.5 Framework** by Andrew Troelsen (SixthEdition) Apress 2012.

Reference Books:
1. **Pro ASP.NET 4 in VB 2010**By Matthew MacDonald, Dan Mabbutt, Adam Freeman
1. **Programming C# 4.0, 6th Edition, Ian Griffiths, Jesse Liberty, Matthew Adams , 6th edition ,O'Reilly Media 2010.**

E-Books:
1.Pro C# 5.0 and the .NET 4.5 Framework by Andrew Troelsen (Sixth Edition) Apress 2012.
2.**Programming C# 4.0, 6th Edition**, Ian Griffiths, Jesse Liberty, Matthew Adams , 6th edition , O'Reilly Media 2010

MOOCs:
1. https://www.edx.org/course/programming-c-microsoft-dev204x-1
2. http://www.homeandlearn.co.uk/csharp/csharp.html
3. https://mva.microsoft.com/en-us/training-courses/c-fundamentals-for-absolute-beginners-8295
4. http://www.tutorialspoint.com/csharp/

Course Outcomes:

CO Number	Course Outcome
CO1	Develop Applications using C# Programming Language.
CO2	Design & Demonstrate the use of Exception Handling, Garbage collection, delegate and Events in C# Programs.
CO3	Design and Develop Web Applications using ADO.NET.
CO4	Design and Develop Web Applications using ASP.NET.
CO5	Designing and developing a web based project.

VI SEMESTER

SYLLABUS

VI SEMESTER

THEORETICAL FOUNDATIONS OF COMPUTATION

Course code: 16CS6DCTFC   **L-T-P-S: 3-1-0-0**

Contact hours: 5   **CIE Marks: 50**

Teaching Hours: 39   **SEE Marks: 50**

UNIT 1:

Introduction to Finite Automata

Introduction to Finite Automata, Central Concepts of Automata Theory, Deterministic Finite Automata (DFA), Nondeterministic Finite Automata (NFA), Equivalence of NFA and DFA. Text search using automata. **8 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. Applications of RE –RE in Unix, Lexical analysis, finding patterns in text.**8 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, Closure properties of CFG's. Applications of CFG- Parsers, YACC, Mark up languages, XML. **8 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.   **8 Hrs**

UNIT 5:

Turing Machines

Definition, Notation, Instantaneous Description and Languages, Design of TM's, Extension of Basic TM: Multitape TM, Restricted TM, Semi-infinite tape Machines, Multi-stack TM. Introduction to undecidable problems, Post-correspondence Problem.   **7 Hrs**

Text Books:

1. **Introduction to Automata Theory, Languages and Computation** by John E. Hop croft, Rajeev Motwani, Jeffrey D.Ullman: 3rd Edition, Pearson education, 2007.

Reference Books:

1. **Introduction to Languages and Automata Theory** by John C Martin, 3rd Ed, Tata McGraw-Hill, 2007.
2. **An Introduction to formal Languages and Automata** by Peter Linz,Narosa publishing house, II edition, 1997.
3. **Introduction to Computer Theory** by Daniel I.A. Cohen, John Willy & Sons, Inc, 2nd Edition, 2000.

E- Books:

1. Foundations of Computation-CAROL CRITCHLOW, DAVID ECK

2. Introduction to Theory of Computation- Anil Maheshwari,Michielsmid-carleton University-2012

MOOCs:

   1. www.nptel/videos.in/2012/11/theory-of-computation.html
   2. nptel.ac.in/courses/106104028/theory of computation.

Course Outcomes:

CO Number	Course Outcome
CO1	Able to apply the knowledge of Automata Theory, Grammars & Regular Expressions for solving the Problem.
CO2	Ability to analyze the given Automata, Regular Expression & Grammar to know the Language it represents .
CO3	Ability to design Automata & Grammar for pattern recognition and syntax checking.

<div align="center">

MOBILE APPLICATION DEVELOPMENT

</div>

ContactHrs/Week: 05   **L-T-P: 3-0-1-2**
Total Lecture Hrs: 39   **CIE Marks: 50**
Subject Code: 16CS6DCMAD   **SEE Marks: 50**

UNIT 1:

HELLO, ANDROID: A Little background, Android: An Open Platform for Mobile Development, Native Android Applications, Android SDK Features: Access to Hardware including Camera, GPS, and Sensors, Data Transfers Using Wi-Fi, Bluetooth, and NFC, Maps, Geocoding, and Location-Based Services, Background Services, SQLite Database for Data Storage and Retrieval, Shared Data and Inter-Application Communication, Using Widgets and Live Wallpaper to Enhance the Home Screen, Extensive Media Support and 2D/3D Graphics, Cloud to Device Messaging, Optimized Memory and Process Management, Introducing the open handset alliance.

Introducing the Development Framework: What Comes in the Box, Understanding the Android Software Stack, TheDalvik Virtual Machine, Android Application Architecture, Android Libraries. Developing for Android, Android Development Tools.   **8 Hrs**

UNIT 2:

Creating Applications and Activities: What Makes an Android Application?, Introducing the Application Manifest, Using the Manifest Editor, Externalizing Resources, The Android Application Life Cycle, Understanding Application Priority and Process States. Introducing the Android Application Class, A Closer Look at Android Activities.

Building User Interfaces: Fundamental Android U I Design, Introducing Layouts, To-Do List Example, Introducing Fragments. Creating New Views, Introducing Adapters.

Introducing Intents: Introducing Pending Intents

Using Internet Resources: Connecting to an Internet Resource, Creating an Earthquake Viewer.
                                                                 14 Hrs

UNIT 3:

Files, Saving State, and Preferences: Saving Simple Application Data, Creating and Saving Shared Preferences, Retrieving Shared references, Creating a Settings Activity for the Earthquake Viewer, Introducing the Preference Framework and Preferences Activity, Creating a Standard Preference Activity for the Earthquake Viewer, Including Static Files as Resources, Working with the File System: File Management Tools.

DATABASES AND CONTENT PROVIDERS: Introducing Android Databases, Introducing SQLite, Content Values and Cursers, Working with SQLite Databases, Creating a Content Providers,

Using Content Providers, Creating a Searchable Earthquake Content Provider, Native Android Content Providers. **8 Hrs**

UNIT 4:

MAPS, GEOCODING, AND LOCATION-BASED SERVICES: Using Location-Based Services, Using the Emulator with Location-Based Services, Selecting a Location Provider, Finding Your Current Location, Using Proximity Alerts, Using the Geocoder, Creating Map-Based Activities, Mapping Earthquakes Example.

AUDIO, VIDEO, AND USING THE CAMERA: Playing Audio and Video, Manipulating Raw Audio, Using the Camera and Taking Pictures, Using Media Effects, Adding Media to the Media Store,

BLUETOOTH, NFC, NETWORKS, AND WI-FI: Using Bluetooth, Managing Network and Internet Connectivity, Managing Wi-Fi, Near Field Communication **9 Hrs**

Text Books:

1. **Professional Android 4 Application Development** by Reto Meier**,** Wiley Publishing, 2012. ISBN: 978-1-118-10227-5

Reference Books:

1. **Pro Android** by Sayed Y. Hashimi, SatyaKomatineni, Apress, 2009.

2. **Professional Android Application Development** by Reto Meier**,** Wiley Publishing, 2009.

3. **Beginning Android** by Mark Murphy, Apress, 2009.

4. **The Android Developer's Cookbook: Building Applications with the Android SDK** by James Steele, Nelson To, Addison-Wesley Professional; 2010.

MOOCS:

1. https://www.coursera.org/learn/posacontent
2. https://www.edx.org/xseries/java-android-beginners

Course Outcomes:

CO Number	Course Outcome
CO1	Ability to apply knowledge of mobile app development using android packages and resources for different applications.
CO2	Ability to analyze the given android program to identify bugs and to write correct code.
CO3	Ability to design android mobile applications for a given requirement.
CO4	Ability to conduct practical experiments for demonstrating features of mobile applications using android studio platform
CO5	Ability to develop a project using android studio platform to solve societal problems.

OBJECT-ORIENTED MODELING AND DESIGN

Course code: 16CS6DCOOM   **L-T-P-S: 3-0-1-0**

Total Lecture Hrs: 39   **CIE Marks: 50**

Teaching Hours: 39hrs   **SEE Marks: 50**

UNIT 1:

Class Modeling: Object and class concepts; Link and associations concepts; Generalization and   **11 Hrs**
inheritance;

Advanced Class Modeling: Advanced object and class concepts; Association ends; N-ary
associations; Aggregation; Abstract classes; Multiple inheritance; Metadata; Reification;
Constraints; Derived data; Packages.

State Modeling: Events, States, Transitions and Conditions; State diagrams; State diagram behavior.

UNIT 2:   **10 Hrs**

Advanced State Modeling: Nested state diagrams; Nested states; Signal generalization;
Concurrency;

Interaction Modeling: Use case models; Sequence models; Activity models.

Advanced interaction modeling: Use case relationships; Procedural sequence models; Special
constructs for activity models.

UNIT 3:

System Conception: Devising a system concept; elaborating a concept; preparing a problem   **10 Hrs**
statement.

Domain Analysis: Overview of analysis; Domain class model;

Application Analysis: Application interaction model; Application class model;

UNIT 4:   **8Hrs**

System Design: Overview of system design; Estimating performance; Making a reuse plan;
Breaking a system in to sub-systems; Choosing a software control strategy; Common architectural
styles; Architecture of the ATM system.

Class Design: Realizing use cases; Recurring downwards, Refactoring; Design optimization;
Reification of behavior; Organizing a class design; ATM example. Implementation Modeling:
Overview of implementation; Fine tuning classes; Fine-tuning generalizations; Realizing
associations.

Text Books:

1. Object - Oriented Modeling and Design With UML, 2/e by Michael Blaha and James Rumbaugh, Pearson Education, 2007.

2. Pattern-Oriented Software Architecture: A System of Patterns by Frank Buschmann, RegineMeunier, Hans Rohnert, Peter Sommerlad, Michael Stal, Volume 1, John Wiley and Sons, 2006.

Reference Books:

1. Object Oriented Systems Development by Ali Bahrami, Irwin/McGraw-Hill, 1999
2. Object-oriented Analysis and Design with Applications by Grady Booch, Addison-Wesley, 2007

E-books:

1. Head First Object-Oriented Analysis and Design, www.headfirstlabs.com/books/hfooad/.../HeadFirstOOAD_as05.pdf

MOOCs:

1. Software Architecture & Design, https://www.udacity.com/course/software-architecture-design--ud821

Course Outcomes:

CO Number	Course Outcome
CO1	Ability to apply the knowledge of class, State & Interaction Modelling using Unified Modeling Language to solve a given problem.
CO2	Ability to analyze a System for a given requirement using Unified Modeling language.
CO3	Ability to design a given system using high level strategy.
CO4	Ability to conduct practical experiment to solve a given problem using Unified Modeling language.

SOFTWARE PROJECT MANAGEMENT AND FINANCE

Contact Hours/Week : 2   **L-T-P-S:2-0-0-0**

Total Lecturehours : 26   **CIE Marks : 50**

Subject Code :16CS6HSHS1   **SEE Marks : 50**

UNIT 1:

Projects and their Environments: What is a Project?Project management, Project Manager, Benefits of Project Management.

The Project Environment: Internal and External Environment, Programs, Mission, Goals, Objectives and Strategy, Portfolios Management, Scoring Matrix, Financial Evaluation Criteria. **5 Hrs**

UNIT 2:

Software project planning, understand project needs, create and diagnose project plan.**4 Hrs**

UNIT 3:

Integration: The Charter, Project Management Plan.

Scope: Beginning the Scope, Scope Contents, Triple Constraints, Priority Matrix, Scope Issues Sample Scope Statement.   **4 Hrs**

UNIT 4:

Estimation, Project schedules

Managing project cost, Estimation project cost, calculating total project cost ,monitoring and controlling project cost   **5 Hrs**

UNIT 5:

Project quality management: Key Concepts, Quality Planning, Quality Assurance, Quality Control.

Risks: Risks, Risks Strategies, Planning Risk Management, Identify Risks, Risk Assessment, Risk Monitoring and Control.   **5 Hrs**

Text Books:

4. Applied software project management: Andrew Stellman and Jennifer Green, Oriely publications, 2012

5. Roger Warburton and Vijay Kanabar, "The Art and Science of Project Management", RW Press Newport, 2nd Edition, 2013.

Reference Books:

1. Nicholas, J. and Steyn, H., "Project Management for Business, Engineering and Technology", ELSEVIER.
2. Prasanna Chandra, "Project Planning, Analysis, Selection, Implementation and Review", New Delhi, Tata McGraw Hill Publications, 2000.

E-books:

1. http://www.free-management-ebooks.com/skills-project.htm
6. A Guide to the Project Management Body of Knowledge (PMBOK Guide), Project Management Institute, http://www.pmi.org/en/PMBOK-Guide-and-Standards/Standards-Library-of-PMI-Global-Standards.aspx

MOOCs:

1. http://nptel.ac.in/syllabus/110101009/

Course Outcomes:

CO Number	Course Outcome
CO1	Ability to identify and apply Software Project management concepts for software development.
CO2	Ability to analyze and estimate the Scope, cost and outline the project plan.
CO3	Ability to develop project planning using Gantt chart and identify issues with project life cycle.

MOBILE ADHOC NETWORKS

Contact Hours/Week: 05   **L-T-P-S-:3-0-1-2**

Total Lecture Hours: 39   **CIE Marks: 50**

Subject Code: 16CS6DEMAN   **SEE Marks: 50**

UNIT 1:
INTRODUCTION
Introduction to adhoc networks–definition, characteristics features, applications. Characteristics of Wireless channel, Adhoc Mobility Models:-Indoor and outdoor models.   **09 hrs**

UNIT 2:
MEDIUM ACCESS PROTOCOLS
MAC Protocols: design issues, goals and classification. Contention based protocols- with reservation, scheduling algorithms, protocols using directional antennas. IEEE standards: 802.11a, 802.11b, 802.11g, 802.15. HIPERLAN.   **10 hrs**

UNIT 3:
NETWORK PROTOCOLS
Routing Protocols: Design issues, goals and classification. Proactive Vs reactive routing, Unicast routing algorithms, Multicast routing algorithms, hybrid routing algorithm, Energyaware routing algorithm, Hierarchical Routing, QoS aware routing.   **10 hrs**

UNIT 4:
END-END DELIVERY AND SECURITY
Transport layer: Issues in designing- Transport layer classification, adhoctransportprotocols. Security issues in adhoc networks: issues and challenges, network securityattacks, secure routing protocols.

10 hrs

Text Books:

1. C.Siva Ram Murthy and B.S.Manoj, Ad hoc Wireless Networks Architectures and protocols, 2nd edition, Pearson Education. 2007
2. Charles E. Perkins, Ad hoc Networking, Addison – Wesley, 2000

Reference Books:

1. Stefano Basagni, Marco Conti, Silvia Giordano and Ivan stojmenovic, Mobile ad hoc
networking, Wiley-IEEE press, 2004

2.MohammadIlyas, The handbook of adhoc wireless networks, CRC press, 2002.

E-Books:

1. Handbook of Mobile Ad Hoc Networks for Mobility Models by RadhikaRanjan Roy
2. Adhoc Networks: Technologies and Protocols- PrasantMohapatra, Srikanth Krishnamurthy

MOOCs:

1.**http://nptel.ac.in/courses/117104099/**

2.http://nptel.ac.in/syllabus/syllabus.php?subjectId=106104124

Course Outcomes:

CO Number	Course Outcome
CO1	Analyze basics of adhoc networks and different mobility models
CO2	Analyze and apply different types of Medium access protocols used in adhoc networks
CO3	Analyze and apply different types of routing protocols
CO4	Analyse transport layer protocols and security issues of adhoc networks

CLOUD COMPUTING

Course code: 16CS6DECCT   **L-T-P-S: 3-0-0-0**

Contact hours: 3   **CIE Marks: 50**

Teaching Hours: 39   **SEE Marks: 50**

UNIT 1:

Introduction to Cloud Computing: Cloud Computing in a nutshell, Roots of cloud computing, Layers and Types of cloud, Features of cloud, Cloud Infrastructure Management , Challenges and Risk, Benefits: Economic, Operational and Staffing, Hardware and Infrastructure: Client, Security , Network , Services.   **9 hrs**

UNIT 2:

Infrastructure as a service provider: Features, Platform as a service provider: Features, Cloud Computing with the Titans: Google, Microsoft, Amazon , Salesforce. Sofware as a service: Overview, Driving Forces, Case Studies of Company Offerings. Software Plus Services: Overview

                                                                                 10 hrs

UNIT 3:

Cloud Storage: Basics, Storage as a service, Providers, Security, Reliability, Advantages, Cautions, Outages, Theft.   **2 hrs**

Virtualization for Cloud: Need for Virtualization – Pros and cons of Virtualization – Types of Virtualization – System VM, Process VM, Virtual Machine monitor – Virtual machine properties - Interpretation and binary translation, HLL VM - Hypervisors – Xen, KVM , VMWare, Virtual Box, Hyper-V.   **8 hrs**

UNIT 4:

Cloud Applications: Exploring online calendar applications, Online scheduling applications , Web Based Spread Sheets ,Contact Management &CRM applications, Collaborating on databases – Understanding database management, exploring web based data bases.

Map Reduce Programming Model and Implementation: Introduction, Map Reduce Programming Model, Major Map Reduce Implementation for Cloud: Hadoop   **10 hrs**

Text Books:

1. "CLOUD COMPUTING – Principles and Paradigms" by Rajkumar Buyya, James Broberg, Andrzej Goscinski, WILEY: A JOHN WILEY & SONS, INC., PUBLICATION, 2011

2. "Cloud Computing: A practical Approach" by Anthony T. Velte, Toby J. Vetle and Robert Elsenpeter, McGrawHill, 2010.

3. "Virtual Machines", James E Smith, Ravi Nair, Morgan Kaufmann Publishers, 2006

4. "CLOUD COMPUTING Web Based Application That Change the Way You Work and Collaborate Onlne" by Michael Miller, Que

E-books:

1. Cloud Services for Dummies"byJudwith Hurwitz, Marcia Kaufman, Dr Fern Halper, WILEY: A JOHN WILEY & SONS, INC., PUBLICATION

2**.** "CLOUD COMPUTING – Theory and Practice" by Dan C Marinescu, MK Publication,2012

Reference Books:

1. "CLOUD COMPUTING" by Dr. Kumar Saurabh, Second Edition, WILEY INDIA

MOOCs:

1. http://nptel.ac.in/courses/106106129/21
2. https://alison.com/courses/Introduction-to-Cloud-Computing

Course Outcomes:

CO Number	Course Outcome
CO1	Ability to apply the knowledge of cloud technology to demonstrate the working principles of cloud
CO2	Ability to analyse cloud services extended by various cloud providers to build a cloud
CO3	Ability to conduct practical experiments for demonstrating the features of cloud computing services
CO4	Ability to explore cloud simulator and come up with a new resource sharing module for various requirements

ARTIFICIAL INTELLIGENCE

ContactHrs/Week: 05   **L-T-P-S:3-0-1-2**

Total Lecture Hrs: 39   **CIE Marks: 50**

Subject Code: 16CS6DEAIN   **SEE Marks: 50**

UNIT 1:

What is AI? Intelligent Agents: Agents and environment; Rationality; the nature of environment; the structure of agents. Problem-solving: Problem-solving agents; Example problems;
Knowledge representation issues: Representations and mappings Approaches to knowledge representation, Issues in knowledge representation.   **10Hrs**

UNIT 2:

Logical Agents: Knowledge based agents, The Wumpus world, Logic-Propositional logic Propositional theorem proving, Effective propositional model checking, Agents based on propositional logic.Using predicate logic: Representing simple facts in logic. **10 Hrs**

UNIT 3:

Resolution, Natural Deduction, Learning: Forms of Learning; Inductive learning; Learning decision trees; Ensemble learning; Computational learning theory.   **10 Hrs**

UNIT 4:

Statistical learning, Maximum likelihood parameter learning, Bayesian parameter learning, passive reinforcement learning, active reinforcement learning.   **9 Hrs**

Text Books:

1. **Artificial Intelligence: A Modern Approach** by Stuart Russel, Peter Norvig, 2nd Edition, Pearson Education, 2003.
2. **Artificial Intelligence**, by Elaine Rich, Kevin Knight, Shivashankar B Nair: Tata MCGraw Hill 3rd edition. 2013

Reference Books:

1. **Artificial Intelligence** by George F Luger, 5th Edition Pearson Education, 2009.

E Books:

1. **Practical Artificial Intelligence Programming With Java,**Third Edition ,Mark Watson

2. **Artificial Intelligence Lecture Notes MIT**.

MOOCs:

1. Artificial Intelligence -http://www.nptelvideos.in/2012/11/artificial-intelligence.html

Course Outcomes:

CO Number	Course Outcome
CO1	Ability to apply knowledge of agent architecture, searching and learning techniques for different applications.
CO2	Ability to analyze Inference and Learning Techniques.
CO3	Ability to design a reasoning system for a given requirement.
CO4	Ability to conduct practical experiments for demonstrating agents, searching and inferencing.
CO5	Ability to develop a project using Artificial Intelligence techniques to solve real world problems.

SYSTEM SOFTWARE

Contact Hrs/Week: 03
Teaching Hours: 39hrs
Course code: 16CS6DESSD

L-T-P-S: 3-0-0-0
CIE Marks: 50
SEE Marks: 50

UNIT 1:

Machine Architecture: Introduction, System software and machine architecture, Simplified instructional computer (SIC) - SIC Machine architecture, SIC/XE machine architecture, SIC programming example.

Assemblers-1: Basic Assembler Function – A simple SIC assembler, Assembler algorithm and data structures, Machine Dependent Assembler features – Instruction formats and addressing modes, Program relocation.**10 hours**

UNIT 2:

Assembler-2: Machine independent assembler features – Literals, symbol definition statements, expression, program blocks, control sections and programming linking, assembler design operations –one pass assembler, Multi pass assembler.

Loaders and Linkers: Basic loader functions, Design of an absolute loader, A simple bootstrap loader,machine dependent loader features – Relocation, program linking, algorithm and Data structures for linking loader, machine independent loader features**. 10 hours**

UNIT 3:

Macro Processors: Basic macro processors Functions, macro definitions and expansion, macro processor algorithm and data structures, machine Independent Macro processor features- Concatenation of macro parameters, Generation of Unique labels, Conditional Macro expansion, Keyword macro parameters, macro processor design options, Recursive macro Expansion, General purpose macroprocessors.**9 hours**

UNIT 4:

Compilers

Basic Compiler Functions, Grammars, Lexical Analysis, Syntactic Analysis, Operator Precedence Parsing,Code Generation. Machine dependent Compiler Features, Intermediate form of the programs,Machine dependent Code Optimization.

Machine Independent Compiler Features,StructuredVariables,Machine Independent Code Optimization,

Storage Allocation.**10 hours**

Text Books:

1. Leland L Beck,D.Manjula : System Software, 3rd Edition, Addison Wesley,Pearson Education,2012

Reference Books:

1.Afred.V.aho,JeffreyD.Ullman:Compiler Principles Techniques and Tools,2nd Edition,2014

2.D.M.Dhamdhere: System programming and operating systems2nd Edition, TataMcGraw Hill,2011

E-books:

1.Introduction to System Software by Dhamdhere

2.System Programming by Srimanta Pal.

MOOCs:

1. http://nptel.ac.in/courses/106108052/1
2. http://ocw.mit.edu/courses/electrical-engineering-and-computer-science/6-035-computer-language-engineering-sma-5502-fall-2005

Course Outcomes:

CO Number	Course Outcome
CO1	Identify the appropriate data structures for various system software's like assemblers, linkers, and loaders
CO2	Design systemsoftwares like assemblers, linkers, and loaders.
CO3	Illustrate the changes/extensions to be made for system softwares by considering machine architecture and different requirements.
CO4	Describe the Machine Dependent and Machine Independent compiler features.

CRYPTOGRAPHY AND NETWORK SECURITY

Contact Hrs/Week: 03   **L-T-P-S: 3-0-0-0**

Total Lecture Hrs: 39   **CIE   Marks: 50**

Course Code: 16CS6DECNS   **SEE   Marks: 50**

UNIT 1:

Introduction: Security Goals, Attacks, Services and Mechanism, Techniques, Mathematics of Cryptography, Integer arithmetic, Modular Arithmetic, Matrices, Linear Congruence, Primes, Primality Testing, Factorization, Chinese Remainder Theorem.   **09 Hrs**

UNIT 2:

Traditional Symmetrickey Ciphers: Introduction, Substitution Ciphers, Transposition Ciphers, Streams and Block Ciphers, Introduction to Modern Symmetric Key Ciphers Modern Block Ciphers, Modern Stream Ciphers.   **10 Hrs**

UNIT 3:

Data Encryption Standard: Introduction, DES Structure, DES Analysis, Multiple DES, Security of DES, Differential Cryptanalysis, Linear Cryptanalysis of DES, Encipherment Using Modern Symmetric Key Ciphers Use of Modern Block Ciphers, Use of Stream Ciphers.**10 Hrs**

UNIT 4:

Asymmetric Key Cryptography and Message Integrity: Introduction, RSA Cryptosystem, Message Integrity, Message Authentication Cryptographic Hash Functions, Introduction, SHA-512, Digital Signature Comparison, Attacks on Digital Signature.

User Authentication Protocols: Remote User Authentication Principles, Remote User Authentication using Symmetric Encryption,   Kerberos

Electronic Mail Security: PGP   **10 Hrs**

Text Books:

1. **Cryptography and Network Security** by BehrouzA.Forouzan, Special Indian Edition, 2008
2.**Cryptography and Network Security** by William Stallings, 6th Edition, Pearson Education/PHI, 2014

Reference Books:

1. **Cryptography and Network Security** by AtulKahate, Tata McGraw Hill, 2003.
2. Steve Burnett, Stephene Paine, "RSA Security's official guide to cryptography", RSA Pren, Tata McGraw Hill Edition, 2001

E-books:

1. Online resources of Stallings's Cryptography and Network Security. Principles and Practice http://williamstallings.com/Crypto3e.html
2. Online resources of Menez, van Oorschot, Vanstone's Handbook of Applied Cryptography available at http://www.cacr.math.uwaterloo.ca/hac/

MOOCs:

1. NPTEL Course on http://nptel.ac.in/courses/106105031/
2. CryptographyI on Coursera, https://www.coursera.org/course/crypto

Course Outcomes:

CO Number	Course Outcome
CO1	Ability to apply knowledge of number theory and cryptography to demonstrate the techniques for data security
CO2	Ability to analyze the encryption algorithms for their strengths and weaknesses
CO3	Ability to design and implement basic algorithms in cryptography

STORAGE AREA NETWORKS

Contact Hrs/Week: 03   **L-T-P-S: 3-0-0-0**

Teaching Hours: 39hrs   **CIE Marks: 50**

Course code: 16CS6DESAN   **SEE Marks: 50**

UNIT 1:

Introduction to Storage Technology: Information Storage, Evolution of Storage Technology and Architecture, Data Center Infrastructure, Key Challenges in Managing Information, Information Lifecycle.

Storage System Environment: Components of a Storage System Environment , Disk Drive Components.

10Hrs

UNIT 2:

Storage System Environment: Disk Drive Performance, Fundamental Laws Governing Disk Performance, Logical Components of the Host.

Data Protection: RAID: Implementation of RAID,RAID Array Components, RAID Levels,RAID Comparison , RAID Impact on Disk Performance.

Intelligent Storage System: Components of an Intelligent Storage System,Intelligent Storage Array.

10Hrs

UNIT 3:

Introduction to SCSI: Introduction to Parallel SCSI.

Storage Area Networks: Fibre Channel: Overview, The SAN and Its Evolution , Components of SAN,FC Connectivity,Fibre Channel Ports, Fibre Channel Architecture,Zoning, Fibre Channel Login Types , FC Topologies.

Software Components of SAN: The switch's Operating system; Device Drivers; Supporting the switch's components; Configuration options for SANs.

Network-Attached Storage: General-Purpose Servers vs. NAS Devices, Benefits of NAS, NAS File I/O,Components of NAS, NAS Implementations,NAS File-Sharing Protocols, NAS I/O Operations.

IP SAN:iSCSI.

09Hrs

UNIT 4:

Content-Addressed Storage:Fixed Content and Archives, Types of Archives, Features and Benefits of CAS, CAS Architecture.

Storage Virtualization: Forms of Virtualization,SNIA Storage Virtualization Taxonomy, Storage Virtualization Configurations, Storage Virtualization Challenges,Types of Storage Virtualization.

Text Books:

1. G.Somasundaram, AlokShrivastava, EMC Education Series, " Information Storage and Management", Wiley, Publishing Inc., 2011.

2. Robert Spalding, "Storage Networks: The Complete Reference", Tata McGraw Hill, Osborne, 2003.

Reference Books:

1. Marc Farley, "Building Storage Networks", Tata McGraw Hill, Osborne. 2001.

2. Meeta Gupta, Storage Area Network Fundamentals, Pearson Education Limited, 2002.

E- Books:

1. Storage Area Networks For Dummies, 2nd Edition : by Christopher Poelker, Alex Nikitin.

2. Storage Area Network : by Kumar V.

MOOCs:

1. http://www.virtualnuggets.com/emcs--storage-area-network.html

2. http://nptel.ac.in/syllabus/106108058/

Course Outcomes:

CO Number	Course Outcome
CO1	Describe the Storage Technology and Storage System Environment.
CO2	Analyse the various RAID and Intelligent Storage System.
CO3	Describe SCSI,Storage Area Networks and Network-Attached Storage.
CO4	Explain Content-Addressed Storage and storage virtualization.

FUZZY LOGIC AND NEURAL NETWORKS

Contact Hours/Week :03   **L-T-P-S: 3-0-0-0**

Total Lecture Hours :39   **CIE Marks :50**

Subject Code : 16CS6DEFLN   **SEE Marks :50**

UNIT 1:

Basic Concepts of Neural Networks, Models of an Artificial Neuron, Neural Network Architecture – Single Layer Feedforward Network, Multilayer Feedforward Network, Recurrent Networks, Characteristics of Neural Networks, Learning Methods, Taxonomy of Neural Network. Early Neural Network Architecture**.**   **09 Hrs**

UNIT 2:

Architecture of a Backpropagation Network, Backpropagation Learning, Effect of tuning parameters of the Backpropagation Neural Network, Selection of Various Parameters in Backpropagation Network, Variations of Standard Backpropagtion Algorithm.   **09 Hrs**

UNIT 3:

Fuzzy versus Crisp, Crisp sets- Operations on Crisp Sets, Properties, Partition and Covering, Fuzzy Sets –Membership Function, Basic Fuzzy Set Operations, Properties of Fuzzy Sets, Crisp Relations – Cartesian Product, Other Crisp Relation, Operations of Relations, Fuzzy Relations – Fuzzy Cartesian Product, Operations on Fuzzy Relations.   **11 Hrs**

UNIT 4:

Crisp Loigic, Predicate Logic, Fuzzy Logic, Fuzzy Rule based System, Defuzzification Methods Neuro-Fuzzy Hybrids, Fuzzy –Backpropagation Network – Fuzzy Neuron, Fuzzy Back Propagation Architecture, Learning in Fuzzy Backpropagation.**10 hrs**

Text Books:

1. S. Rajasekaran and G.A.V.Pai, "Neural Networks, Fuzzy Logic and Genetic Algorithms", PHI,2003.

Reference Books:

1. J.S.R.Jang, C.T.Sun and E.Mizutani, "Neuro-Fuzzy and Soft Computing", PHI, 2004, Pearson Education 2004

E-Books:

1. Timothy J.Ross, "Fuzzy Logic with Engineering Applications"

MOOCs:

1. Ahmad Ibrahim, "Introduction to Neural Networks" in TechOnLine Courses http://www.techonline.com/learning/course/100106
2. Marcelo Godoy Simoes, "Introduction to Fuzzy Control" in TechOnLine Courses http://www.techonline.com/learning/course/100261
3. http://nptel.ac.in/syllabus/syllabus.php?subjectId=108104049

Course Outcomes:

CO Number	Course Outcome
CO1	Ability to apply concepts of Neural Networks and Fuzzy logic for learning and knowledge representation.
CO2	Ability to analyze neural networks and fuzzy systems
CO3	Ability to make effective Oral presentation on current trends in Neural Networks and Fuzzy logic .

VII

SYLLABUS

INSTITUTIONAL ELECTIVE-1

COURSE TITLE	Java Programming		
COURSE CODE	16CS7IEJAP	L-T-P-S	3-0-0-0
Total Lecture Hours:	39	CIE/SEE Marks	50/50

SYLLABUS:

UNIT – 1

Java and Java applications, java Development kit (JDK); Java is interpreted, Byte code, JVM, Objected Oriented Programming; simple java programs. Data types and other tokens: Boolean Variables, int, long, char, operators, arrays, white spaces, literals, assigning values, creating and destroying objects, access specifiers. Classes in Java, declaring a class, class name, super classes, constructors, creating instances of class, inner classes.simple, multiple, multilevel inheritance, overriding, overloading, using super, multilevel hierarchy, dynamic method dispatch, abstract class, using final with inheritance.   **10 Hours**

UNIT – 2

Packages and Interfaces Packages:Defining a package, Finding packages and class path, Example; Access protection; importing packages Interfaces:Defining an Interface, Implementing Interface, Nested Interfaces Applying Interfaces, variables in interfaces.

Type Wrappers, Auto boxing, Enumeration. Generics:What are Generics?, A Simple Generics Example, A Generics Class with two Type Parameters, The General Form of a Generic Class.

Special string operators, character extraction, string comparison, searching strings, modifying a string, string buffer, additional string methods.   **9 Hours**

UNIT – 3

Fundamentals, Exception types, uncaught exceptions, using try and catch, multiple catch clauses, nested try statements, throw, throws, finally, Java's built-in exceptions, creating your own exception subclasses, chained exceptions.

Multithreaded programming:Java thread model, main thread creating thread, creating multiple threads, using isalive() and join(), thread priorities, synchronization, Interthread communication, suspending, resuming and stopping threads.   **10 Hours**

UNIT – 4

Exploring java.io: The Java I/O Classes and Interfaces, File, The Closable and Flushable Interfaces, The Stream Classes, The Byte Streams, The Character Streams, The Console Class files.

Applets:Fundamentals, Applet class two types of Applets, Applet Basics, Applet architecture, An applet skeleton, display methods, requesting repainting, using status window, HTML Applet Tag, Passing parameter to applets, getDocumentbase(), getCodebase().

Abstract window toolkit:AWT classes, window fundamentals, working with frame windows, creating a frame window in an applet, creating a windowed program, displaying information, working with graphics, working with color. **10 Hours**

Text Books:

1. **Java the Complete Reference,** HerbertSchildt, 7th edition, Tata Mcgraw-Hill.

Reference Books:
1. **Introduction to JAVA programming** Y.Daniel Liang, 6th edition, Pearson education.
2. **The Java Hand Book,** Patrick Naughton, Tata Mcgraw-Hill, Eleventh Reprint 2002
3. **Programming in JAVA 5.0,** James P Cohoon, Jack W Davidson: TATA McGraw HILL.
4. **Core Java 2**, Volume I and II, Cay S Horstmann, Gary Cornell: Seventh Edition, Pearson Education

E-books:

1..Essentials of the Java Programming Language
   2. Java Reference Guide by Stevens Haines
   3. Building Object Oriented,MultiThreaded Applications with Java by Bill Venners
4. Getting Started with Java

COURSE OUTCOMES:

Course Outcomes	Description
CO1	Ability to **apply** knowledge of java constructs for developing different programs/applications.
CO2	Ability to**analyze** the given java program to identify bugs and to write correct code.
CO3	Ability to **design** java program/ applications for a given requirement.

ASSESSMENT:

CIE Scheme:

Assessment	Weightage in Marks
2 Quiz/AAT	10
2 Internals	40
Total	50

Best 2 out of 3 Tests and 1 Quiz will be considered for CIE marks

SEE Scheme:

Semester End Examination (SEE) is a written examination of three hours duration for 100 marks. Students have to answer 5 questions from four units, three units to carry one question each(mandatory from Unit 1 and Unit2), two units to carry two questions each (internal choice from Unit 3 and Unit 4) and last question is from the entire syllabus.

Both CIE and SEE have equal (50:50) weightages. The Student's performance in a course shall be judged individually and together based on the results of CIE and SEE.

COURSE TITLE	Cloud Computing		
COURSE CODE	16CS7IECCT	L-T-P-S	3-0-0-0
Total Lecture Hours:	39	CIE/SEE Marks	50/50

SYLLABUS:

UNIT – 1

Introduction to Cloud Computing: Cloud Computing in a nutshell, Roots of cloud computing, Layers and Types of cloud, Features of cloud, Cloud Infrastructure Management. Infrastructure as service providers: Features. Platform as service providers: Features, Challenges and Risk. Software as a Service: Overview and Driving Forces, Case Studies of Company Offerings. Software Plus Services: Overview, Mobile Device Integration **10 Hours**

UNIT – 2

Cloud Storage: Basics, Storage as a Service, Providers, Security, Reliability, Advantages, Cautions, Outages, Theft. Benefits: Economic, Operational and Staffing

Hardware and Infrastructure: Client, Security, Network, Services. Cloud Computing with the Titans: Google, EMC, Microsoft, Amazon, Salesforce.com, IBM: Services, Movement to the Cloud, Security **10 Hours**

UNIT – 3

Local Clouds and Thin Clients: Virtualization in your organization, Server Solutions, Thin Client, Migrating to the Cloud: Cloud Services for the Individuals, Enterprise Class Cloud Offerings
9 **Hours**

UNIT – 4

Map Reduce Programming Model and Implementation: Introduction, Map Reduce Programming Model, Major Map Reduce Implementation for Cloud: Hadoop, Disco, Map Reduce.NET**10 Hours**

Text Books:

1. "CLOUD COMPUTING – Principles and Paradigms" by RajkumarBuyya, James Broberg, Andrzej

Goscinski, WILEY: A JOHN WILEY & SONS, INC., PUBLICATION, 2011

2. "Cloud Computing: A practical Approach" by Anthony T. Velte, Toby J. Vetle and Robert Elsenpeter,
McGrawHill, 2010.

Reference Books:
1. CLOUD COMPUTING" by Dr. Kumar Saurabh, Second Edition, WILEY INDIA

E-books:

1. Cloud Services for Dummies"byJudwith Hurwitz, Marcia Kaufman, Dr Fern Halper, WILEY:
A JOHN WILEY & SONS, INC., PUBLICATION
2**.** "CLOUD COMPUTING – Theory and Practice" by   Dan C   Marinescu, MK Publication,2012

COURSE OUTCOMES:

Course Outcomes	Course Description
CO 1.	Ability to apply the knowledge of cloud technology to demonstate the working principles of cloud
CO 2.	Ability to analyze cloud services extended by various cloud providers to build a cloud
CO 3.	Ability to conduct practical experiments for demonstrating the features of cloud computing services
CO 4.	Ability to explore cloud simulator and come up with a new resource sharing module for various requirements

ASSESSMENT:

CIE Scheme:

Assessment	Weightage in Marks
2 Quiz/AAT	10
2 Internals	40
Total	50

Best 2 out of 3 Tests and 1 Quiz will be considered for CIE marks

SEE Scheme:

Semester End Examination (SEE) is a written examination of three hours duration for 100 marks. Students have to answer 5 questions. One question from each unitand last question is from the entire syllabus.

Both CIE and SEE have equal (50:50) weightages. The Student's performance in a course shall be judged individually and together based on the results of CIE and SEE.

COURSE TITLE	ARTIFICIAL INTELLIGENCE		
COURSE CODE	16CS7IEAIN	L-T-P-S	3-0-0-0
Total Lecture Hours:	39	CIE/SEE Marks	50/50

SYLLABUS:

UNIT–1

What is AI? Intelligent Agents: Agents and environment; Rationality; the nature of environment; the structure of agents.   **9 Hours**

UNIT–2

Problem-solving: Problem-solving agents; Example problems; Searching for Solutions;Uninformed Search Strategies: Breadth First search, Depth First Search, Iterative deepening depth first search;Informed Search Strategies: Heuristic functions, Greedy best first search, A*search.   **10 Hours**

UNIT–3

Logical Agents: Knowledge –based agents, The Wumpus world, Logic-Propositional logic, Propositional theorem proving, Effective propositional model checking Agents based on propositional logic.
Using predicate logic: Representing simple facts in logic, Computable functions and predicates, Resolution, Forward reasoning, Backward reasoning.   **11 Hours**

UNIT–4

Learning: Forms of Learning; Inductive learning; Learning decision trees; Ensemble learning.
                                                          9 Hours

Text Books:

3. **Artificial Intelligence: A Modern Approach** by Stuart Russel, Peter Norvig, 2nd Edition, Pearson Education, 2003.
4. **Artificial Intelligence**, by Elaine Rich, Kevin Knight, Shivashankar B Nair: Tata MCGraw Hill 3rd edition. 2013

Reference Book:
   1. **Artificial Intelligence** by George F Luger, 5th Edition Pearson Education, 2009.

E-books:

3. **Practical Artificial Intelligence Programming With Java,**Third Edition ,Mark Watson

4. **Artificial Intelligence Lecture Notes MIT**

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MOOCs
2. Artificial Intelligence -http://www.nptelvideos.in/2012/11/artificial-intelligence.html

COURSE OUTCOMES:

CO1	Ability to **apply** knowledge of agent architecture, searching and learning techniques for different applications.
CO2	Ability to**analyze** various Searching Techniques .
CO3	Ability to **design** a reasoning system for a given requirement.
CO4	Ability to **conduct** practical experiments for demonstrating agents, searching and inferencing.
CO5	Ability to **develop** a **project** using Artificial Intelligence techniques to solve real world problems.

ASSESSMENT:

CIE Scheme:

Assessment	Weightage in Marks
2 Quiz/AAT	10
2 Internals	40
Total	50

Best 2 out of 3 Tests and 1 Quiz will be considered for CIE marks

SEE Scheme:

Semester End Examination (SEE) is a written examination of three hours duration for 100 marks. Students have to answer 5 questions from four units, three units to carry one question each(mandatory from Unit 1 and Unit2), two units to carry two questions each (internal choice from Unit 3 and Unit 4) and last question is from the entire syllabus.

Both CIE and SEE have equal (50:50) weightages. The Student's performance in a course shall be judged individually and together based on the results of CIE and SEE.

COURSE TITLE	Probability , Statistics And Queuing		
COURSE CODE	16CS7DCPSQ	**L-T-P-S**	2-1-0-0
Total Lecture Hours:	26	**CIE/SEE Marks**	50/50

SYLLABUS:

UNIT-1
Probability: Sample space and events, The axioms of Probability, Conditional Probability, Independence of Events, Baye's theorem, Combinatorial Problems, Bernoulli trials.
Random variables and their properties, Discrete Random variable, Probability Mass Function and properties **6Hours**

UNIT-2
Continuous Random variables, Probability Density function and Properties, Joint probability distributions and their properties, Mathematical expectations, Moments.
Probability Distributions: Discrete distributions: Binomial, Poisson ,Negative binominal distributions and their properties. **7Hours**

UNIT-3
Continuous distributions: Uniform, Normal, exponential distributions and their properties.
Statistical Inference: Parameter estimation, Hypothesis testing, Curve fitting using Principle of Least Squares, Coefficient of determination, Confidence Intervals. **7Hours**

UNIT-4
Queuing Theory: Queuing notations, Rules for all Queues, Little Law, Types of Stochastic Processes, Birth-Death Process, The M/M/1 Queuing System, The M/M/m Queuing System, The M/M/m/B Queuing with Finite buffers. **6Hours**

Text Books:
5. **Probability & Statistics with Reliability, Queuing and Computer Applications** by Kishor S. Trivedi , 2nd edition, John Wiley & sons,2008.
6. **The Art of Computer Systems Performance Analysis**" by Raj Jain, Wiley India pvt ltd,2010.

Reference Books:
2. **Probability and Statistics for Computer Scientists,** by M. Baron, Chapman & Hall, Second edition CRC Press ,2013.
3. **A first course in Probability,** By Sheldon Ross, 8th edition, Prentice hall, 2010.

E-Books:

1. **A Compendium of Common Probability Distributions**By Michael P. McLaughlin.
2. **A first course in Probability,** By Sheldon Ross, 8th edition, Prentice hall, 2010.

MOOCs:
1. **Probability and statistics**-http://nptel.ac.in/courses/111105041
2. **Introduction to Probability- The Science of Uncertainty**
   https://www.edx.org/course/introduction-probability-science-mitx-6-041x-1

COURSE OUTCOMES (COs):

CO1	Ability to apply knowledge of probability, random variables and queuing theory to find probabilities of events.
CO2	Ability to analyze data distributions through statistical inference and performance of queuing systems.
CO3	Ability to design solutions to problems with the knowledge of probability, random variables and queuing theory.

ASSESSMENT:

CIE Scheme:

Assessment	Weightage in Marks
2 Quiz/AAT	10
2 Internals	40
Total	50

Best 2 out of 3 Tests and 2 Quiz will be considered for CIE marks

SEE Scheme:

Semester End Examination (SEE) is a written examination of three hours duration for 100 marks. Students have to answer 5 questions from four units, two units to carry one question each(mandatory), two units to carry two questions each (internal choice) and one question from the entire syllabus.

Both CIE and SEE have equal (50:50) weightages. The Student's performance in a course shall be judged individually and together based on the results of CIE and SEE.

DEPARTMENT ELECTIVE-4

COURSE TITLE	SOFTWARE TESTING		
COURSE CODE	16CS7DESWT	L-T-P-S	3-0-1-2
Total Lecture Hours:	39	CIE/SEE Marks	50/50

SYLLABUS:

UNIT-1

Fundamentals of Software Testing : Introduction, Definition of Testing, Testing during development life cycle, Requirements traceability matrix, Essentials of software testing, Workbench, Important features of Testing Process, Misconceptions about Testing, Principles of Testing, Salient features of Good testing, Test policy, Test strategy of Test approach, Test Planning, Testing process and number of defects found in Testing, Test team approach, Process problems faced by Testing, Cost aspects of Testing, Establishing Testing policy, Methods, Structured approach to Testing, Categories of Defect, Defect, Error or mistakes in software, Developing test strategy, Developing Testing methodologies, Testing Process, Test Methodologies/approaches, People challenges in software testing, , Skills required by tester.

Configuration Management: Introduction,configuration management,cycle of configuration management Configuration management process, Auditing configuration Library **10 Hours**

UNIT-2

Levels of Testing: Introduction, Proposal testing , Requirement testing, Design Testing, code Review, UNIT Testing, Module testing, Integration testing, Big-Bang testing, Sandwich testing ,Critical path first , Subsystem testing, System testing, testing stages.

Acceptance testing: Introduction, Acceptance testing criteria, Importance of Acceptance criteria, Some famous Acceptance criteria, Alpha testing, Beta testing , gamma testing, Acceptance testing during each phase of software development, Consideration of Alpha and Beta Acceptance testing process, What does software Acceptance enable?, customer's responsibilities in Acceptance testing, Fits for Acceptance testing, Define Acceptance criteria, Criticality of requirements, Factors affecting criticality of the requirements, Developing Acceptance test plan, Software Acceptance plan, User responsibilities in Acceptance test plan, Executing Acceptance plan.   **9 Hours**

UNIT-3

Testing Tools: Introduction, Features of Test tool, Guidelines for selecting a tool, Tools and skills of tester, Static Testing tools, Dynamic Testing tools, Advantages of using tools, Disadvantages of using tools, when to use automated test tools, Testing using automated tools, Difficulties while introducing new tools.

Test Planning: Introduction, Test policy, Content of test policy in general, Test Planning, Test plan, Quality plan and Test plan, Quality plan template, Test plan template, Guidelines for developing the test plan, Test administration definition, Test Estimation, Test standards, Building Test data and test cases, Test scenarios, Test cases, Essential activities in testing, Template for test cases, Test scripts, Test management software, Test log documents, Effective test cases, Test file, Building test data, Generation of test data, Tools used to build test data, Roles and responsibilities in testing life cycle, Test progress monitoring. **10 Hours**

UNIT-4

Test Metrics and Test Reports: Introduction, Testing related data, Defect data, Efficiency/Productivity data Categories of the Product/Project test Metrics, Estimated Budgeted approval and actual, Resources consumed in Testing ,Effectiveness of Testing, Defect Density, Defeat Leakage Ratio, Residual Defect Density, Test Team Efficiency, Test case Efficiency,Rework,MTBF/MTTR,Implementing Measurement Reporting system in an Organization,Test Reports, Project Test status Reports, Integrated Test Report,System Test Report, Acceptance Test Report, Guidelines for Writing and Using Report, Final Test Reporting, Test status Report, Benchmarking.   **10 Hours**

Text BookS:
1. **Software Testing Principles, Techniques and Tools** by M.G. LIMAYE, Tata McGraw- Hill Publication.

Reference Books:
1. **Software Testing Principles and Practice** by SrinivasanDesikan, Gopalaswamy Ramesh, Pearson Education.
2. **Software Testing concepts and Tools** by NageshwarRaopusuluri, Greentech Press.

E-Books:

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

Useful links:

1. **https://github.com/ligurio/free-software-testing-books/blob/master/free-software-testing-books.md**
2. **http://www.softwaretestinggenius.com/download/bgstpadmini.pdf**

MOOCS:

1. http://nptel.ac.in/courses/106105150/
2. http://nptel.ac.in/courses/106101061/18

COURSE OUTCOMES:

Course Outcomes	Description
CO1	Define Test policy and test strategy
CO2	Analyze various levels of testing.
CO3	Design and develop test plans.
CO4	Apply software testing techniques for proposed application

ASSESSMENT:

CIE Scheme:

Assessment	Weightage in Marks
1 Quiz/AAT	5
2 Internals	20
1 Lab Internals	15
1 Self Study	10
Total	50

Best 2 out of 3 Tests and 1 Quiz will be considered for CIE marks

SEE Scheme:

Semester End Examination (SEE) is a written examination of three hours duration for 100 marks. Students have to answer 5 questions from four units, two units to carry one question each(mandatory), two units to carry two questions each (internal choice) and one question from the entire syllabus.

Self-Study Scheme:

Under Self-study component of Software Testing, students should define test plans and test cases for real-world applications.

Both CIE and SEE have equal (50:50) weightages. The Student's performance in a course shall be judged individually and together based on the results of CIE and SEE.

COURSE TITLE	CYBER FORENSICS		
COURSE CODE	16CS7DECYF	L-T-P-S	3-0-1-2
Total Lecture Hours:	39	CIE/SEE Marks	50/50

SYLLABUS:

UNIT I

Computer Forensics Fundamentals: What is Computer Forensics?, Use of Computer Forensics in Law Enforcement, Computer Forensics Assistance to Human Resources/Employment Proceedings, Computer Forensics Services, Benefits of Professional Forensics Methodology, Steps taken by Computer Forensics Specialists

Understanding Computer Investigations: Preparing a Computer Investigation, Taking aSystematic Approach, Procedures for Corporate High-Tech Investigations, UnderstandingData Recovery Workstations and Software
7 Hours

UNIT II

Working with Windows and DOS Systems: Understanding File Systems, ExploringMicrosoft File Structures, Examining NTFS Disks, Understanding Whole Disk Encryption,Understanding the Windows Registry, Understanding Microsoft Startup Tasks,Understanding MS-DOS Startup Tasks, Understanding Virtual Machines.

Macintosh and Linux Boot Processes and File Systems: Understanding the Macintosh FileStructure and Boot Process, Examining UNIX and Linux Disk Structures and Boot Processes,Understanding Other Disk Structures. **10 Hours**

UNIT III

Data Acquisition: Understanding Storage Formats for Digital Evidence, Determining thebest Acquisition Method, Contingency Planning for Image Acquisitions, Using AcquisitionTools, Validating Data Acquisitions, Performing RAID Data Acquisitions, Using RemoteNetwork Acquisition Tools, Using Other Forensic Acquisition Tools.

Computer Forensics Analysis: Determining What Data to CollectandAnalyze, Validating Forensic Data, Addressing Data-Hiding Techniques, Performing RemoteAcquisitions.

Current Computer Forensics Tools: Evaluating Computer Forensic Tool Needs, ComputerForensics Software Tools, Computer Forensics Hardware Tools, Validating and TestingForensics Software. **10 Hours**

UNIT IV

Recovering Graphics Files: Recognizing a Graphics File, Understanding Data Compression,Locating and Recovering Graphics Files, Identifying Unknown File Formats, UnderstandingCopyright Issues with Graphics

Network Forensics: Network Forensic Overview, Performing Live Acquisitions, DevelopingStandard Procedures for Network Forensics, Using Network Tools.

E-mail Investigations: Exploring the Role of E-mail in Investigations, Exploring the Roles of theClient and Serverin E-mail, Investigating E-mail Crimes and Violations, Understanding E-mail Servers, UsingSpecialized E-mail Forensics Tools. **12 Hours**

Text books:

1. Amelia Phillips, Bill Nelson, Christopher Steuart,Guide to Computer Forensics and

   Investigations,4th Edition, Cengage Learning, 2013.
(http://www.flipkart.com/guide-computer-forensics-investigations-english-
4th/p/itme8p5va7hepgsu?pid=9788131519462&ref=L%3A7904021404010956609&srno=p_
2&query=Computer+Forensics+and+Investigations&otracker=from-search)

2. Computer Forensics, Computer Crime Invistigation by Jhon R. Vacca, Firewall Media,
   New Delhi.

Reference Books:
   1. Cyber Forensics: from Data to Digital Evidence , Albert J. Marcella Jr., Wiley,1st
      Edition,2012
   2. Marjie T. Britz: Computer Forensics and Cyber Crime - An Introduction, 2ndEdition,
      Pearson Education, 2012.
   3. Computer Forensics: Investigating Network Intrusions and Cyber Crime (Ec-Council
      Press Series:Computer Forensics), 2010

Online Resources:
   1. http://www.cyberforensics.in/
   2. http://news.asis.io/sites/default/files/Investigating_Intrusions_Network_CyberCrime.p
      df

MOOCs:
   1. MOOCs Course on Coursera "Introduction to Forensic Science",
      https://www.coursera.org/course/ntufsc
   2. Computer and Hacking Forensics", https://www.cybrary.it/course/computer-hacking-
      forensics-analyst/

COURSE OUTCOMES:

Course Outcomes	Description
CO1	Able to describe various cyber forensics fundamentals and working with windows and linux systems
CO2	Able to identify and apply cyber forensics for data acquisition and analyze forensics analysis for hidden information
CO3	Able to identify and apply current forensics tools and recovering graphics files
CO4	Able to Apply Network Forensic tools for network forensic and perform Email investigation.
CO5	Able to analyze& evaluate the data acquisition and investigation using cyber forensic tools.

ASSESSMENT:

CIE Scheme:

Assessment	Weightage in Marks
1 Quiz/AAT	5
2 Internals	20
1 Lab Internals	15
1 Self Study	10
Total	50

Best 2 out of 3 Tests and 1 Quiz will be considered for CIE marks

SEE Scheme:

Semester End Examination (SEE) is a written examination of three hours duration for 100 marks. Students have to answer 5 questions from four units, two units to carry one question each(mandatory), two units to carry two questions each (internal choice) and one question from the entire syllabus.

Self-Study Scheme:

Under Self study component of Cyber Security course, students should carry out a project work/Assignment on real-world constraint to explore the practical applications of the concepts learned.

Both CIE and SEE have equal (50:50) weightages. The Student's performance in a course shall be judged individually and together based on the results of CIE and SEE.

COURSE TITLE	Multicore Programming		
COURSE CODE	16CS7DEMCP	L-T-P-S	3-0-1-2
Total Lecture Hours:	39	CIE/SEE Marks	50/50

SYLLABUS:

UNIT-1
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.
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**

UNIT-2
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 :**ThreadingAPls for Microsoft Windows, Win32/MFC Thread APls, Threading APls 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**

UNIT-3
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

UNIT-4

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 ShameemAkhter and Jason Roberts , Intel Press , 2006.

Reference Books:
1. Parallel Programming in C with MPI and OpenMP, Michael J. Quinn, McGraw-Hill Higher Education, 2004.
2. Introduction to Parallel Computing – AnanthGramaet. al., PearsonEducation, 2009.

E- Books:
1. Parallel Programming in C with MPI and OpenMP, Michael J. Quinn, McGraw-Hill Higher Education, 2004.
2. Introduction to Parallel Computing, *Blaise Barney, Lawrence Livermore National Laboratory.*

MOOCs:

1. http://nptel.ac.in/courses/106102114/
2. https://software.intel.com/en-us/videos/introduction-to-parallel-programming-video-lecture-series-part-01-why-parallel-why-now

COURSE OUTCOMES:

Course Outcomes	Description
CO1	Identify the Basic needs for parallelism, examine different techniques for achieving multithreading and estimate their performance benefits.
CO2	Explain the fundamental concepts of parallel programming and how they enable parallel software development.
CO3	Apply multi-core programming constructs and threading implementations using API's on different platforms.
CO4	Apply and implement programs using Open-MP API.
CO5	Identify and learn solutions to common parallel programming problems.

ASSESSMENT:

CIE Scheme:

Assessment	Weightage in Marks
1 Quiz /AAT	05
2 Internals	20
Laboratory test	10
Parallel implementation of a problem	15
Total	50

Best 2 out of 3 Tests and 1 Quiz will be considered for CIE marks

SEE Scheme:

Semester End Examination (SEE) is a written examination of three hours duration for 100 marks. Students have to answer 5 questions from four units, two units to carry one question each(mandatory), two units to carry two questions each (internal choice) and one question from the entire syllabus.

Self-Study Scheme:

Under Self study component of Multicore Programming course, students should carry out a project work of developing a parallel implementation of a problem to explore the practical applications of the concepts learned.

Both CIE and SEE have equal (50:50) weightages. The Student's performance in a course shall be judged individually and together based on the results of CIE and SEE.

COURSE TITLE	Big Data and Analytics		
COURSE CODE	16CS7DEBDA	L-T-P-S	3-0-1-2
Total Lecture Hours:	39	CIE/SEE Marks	50/50

UNIT-1

Types of Digital Data– Classification of Digital Data. Introduction to Big Data– Characteristics of Data, Evolution of Big Data, Definition of Big Data, Challenges with Big Data, What is Big Data? Big Data Analytics–What is Big Data Analytics? Classification of Analytics, Top Challenges Facing Big Data, Data Science, Data Scientist…Your New Best Friend!!!, Terminologies Used in Big Data Environments, Basically Available Soft State Eventual Consistency (BASE).

The Big Data Technology Landscape– NoSQL (Not Only SQL), Hadoop.   **9 Hours**

UNIT-2

Introduction to Hadoop– Introducing Hadoop, Why Hadoop?, Why not RDBMS?, RDBMS versus Hadoop, Distributed Computing Challenges, History of Hadoop, Hadoop Overview, Use Case of Hadoop,HadoopDistributors,HDFS (Hadoop Distributed File System), Processing Data with Hadoop, Managing Resources and Applications with Hadoop YARN (Yet another Resource Negotiator), Interacting with Hadoop Ecosystem.

MAPREDUCE Programming – Mapper, Reducer, Combiner, Partitioner, Searching, Sorting,Compression   **10 Hours**

UNIT-3

MongoDB– What is MongoDB? Why MongoDB? Terms Used in RDBMS and MongoDB, Data Types in MongoDB ,MongoDB Query Language.

Cassandra – Apache Cassandra - An Introduction , Features of Cassandra, CQL Data types, CQLSH, Keyspaces, CRUD (Create, Read, Update and Delete) Operations, Collections, Using a Counter, Time to Live (TTL), Alter Commands, Import and Export, Querying System Tables, Practice Examples.

Hive – What is Hive?,Hive Architecture, Hive Data Types, Hive File Format, Hive Query Language (HQL), RCFile Implementation, SerDe, User-defined Function(UDF).   **10 Hours**

UNIT-4

Introduction to Pig – What is Pig? The Anatomy of Pig, Pig on Hadoop, Pig Philosophy, Use Case for Pig: ETL Processing, Pig Latin Overview, Data Types in Pig,Running Pig, Execution Modes of Pig, HDFS Commands, Relational Operators, Eval Function, Complex Data Types, Piggy Bank, User-Defined Functions (UDF), Parameter Substitution, Diagnostic Operator, Word Count Example using Pig, When to use Pig?, When not to use Pig?, Pig at Yahoo!, Pig versus Hive

Spark – Installing Spark, An Example, Spark Applications, Jobs, Stages, and Tasks, A Scala Standalone Application, A Java Example, A Python Example, Resilient Distributed Datasets Creation, Transformations and Actions, Persistence, Serialization, Shared Variables, Broadcast Variables, Accumulators, Anatomy of a Spark Job Run, Job Submission, DAG Construction, Task Scheduling, Task Execution, Executors and Cluster Managers, Spark on YARN. **10 Hours**

Text Books:

1. SeemaAcharya,SubhashiniChellappan, Big data and Analytics, Wiley publications, 2014.
2. Tom White, Hadoop: The Definitive Guide, Fourth Edition, O'Reilley, 2015.

References:

1. Eric Sammer, Hadoop Operations, O'Reilley, 2012.
2. VigneshPrajapati, Big data analytics with R and Hadoop, SPD 2013.

MOOC Courses:

3. https://bigdatauniversity.com/courses/spark-overview-scala-analytics/
4. https://bigdatauniversity.com/courses/introduction-to-hadoop/
5. https://bigdatauniversity.com/courses/mapreduce-and-yarn/

COURSE OUTCOMES:

Course Outcomes	Description
CO1	Ability to apply the concepts of Big data characteristics and its data models
CO2	Ability to analyze a given application requirement to solve the same using various architectural components of hadoop framework
CO3	Ability to design solutions using NoSQL databases such as MongoDB, Cassandra, Pig and Hive for processing and aggregating logs in the database.
CO4	Ability to demonstrate the usage of MongoDB, Cassandra database models and experiment conduction using HDFS and MapReduce
CO5	Ability to design and implement big data analytics for real time dataset available on big data application
CO6	Ability to make an effective oral presentation and documentation on the data analytics implemented

ASSESSMENT:
CIE Scheme:

Assessment	Weightage in Marks
1 Quiz /AAT	05
2 Internals	20
Laboratory test	15

Self Study	10
Total	50

Best 2 out of 3 Tests and 1 Quiz will be considered for CIE marks

SEE Scheme:

Semester End Examination (SEE) is a written examination of three hours duration for 100 marks. Students have to answer 5 questions from four units, two units to carry one question each(mandatory), two units to carry two questions each (internal choice) and one question from the entire syllabus.

Self-Study Scheme:

Under Self study component of big Data analyticscourse, students should carry out a project work of developing practical implementation of a problem to explore the practical applications of the concepts learned.

Both CIE and SEE have equal (50:50) weightages. The Student's performance in a course shall be judged individually and together based on the results of CIE and SEE.

DEPARTMENT ELECTIVE-5

COURSE TITLE	Advanced Web Technologies		
COURSE CODE	16CS7DEAWT	L-T-P-S	3-0-1-2
Total Lecture Hrs:	39	CIE/SEE Marks	50/50

SYLLABUS:

UNIT-1

JQuery: Introducing 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.
Action/Reaction: Making Pages Come Alive with Events; What Are Events?; Using Events the jQuery Way, Tutorial: Introducing Events; More jQuery Event Concepts.**10 Hours**

UNIT-2

Common jQuery Tasks : Controlling How Links Behave, Opening External Links in a New Window, Creating New Windows
Enhancing Web Forms : Understanding Forms, Form Validation **Introducing Ajax:**What is Ajax, Ajax: Basics, Ajax the jQuery Way, JSON.**8 Hours**

UNIT-3

The Programmable Web and Its Inhabitants: HTTP- Documents in Envelopes, Method Information, Scoping Information, The Competing Architectures, Technologies on the Programmable Web;**Writing Web Service Clients:** Web Services Are Web Sites, del.icio.us: The Sample Application ,Making the Request: HTTP Libraries (only PHP: libcurl, JavaScript: XMLHttpRequest), Processing the Response: XML Parsers (PHP, JavaScript: responseXML), JSON Parsers: Handling Serialized Data;**What Makes RESTful Services Different?:** Introducing the Simple Storage Service,Resources,HTTP Response Codes;**The Resource-Oriented Architecture:** Resource-Oriented What Now?, What's a Resource?, URIs,Addressability,Statelessness,Representations, Links and Connectedness, The   Uniform   Interface.
10 Hours

UNIT-4

Designing Read-Only ResourceOriented Services: Resource Design, Turning Requirements Into Read-Only Resources, Figure Out the Data Set, Split the Data Set into Resources, Name the Resources, Design Your Representations, Link the Resources to Each Other. The HTTP Response. **Designing Read/Write ResourceOriented Services:** User Accounts as Resources, Custom Places. **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.
11 Hours

Text Book:

1. JavaScript &jQuery: The Missing Manual, 3rd Edition, By David Sawyer McFarland, Publisher: O'Reilly Media, September 2014
2. RESTful Web APIs, By Leonard Richardson, Mike Amundsen, Sam Ruby, Publisher: O'Reilly Media, September 2013.

Reference Book:

1. Professional Ajax, 2nd Edition by Nicholas C. Zakas (Author), Jeremy McPeak (Author), Joe Fawcett (Author) 2007.
2. RESTful Web APIs, Leonard Richardson, Mike Amundsen, Sam Ruby, O'Reilly Media (September 27, 2013)
3. jQuery in Action, Second Edition by Bear Bibeault, 2010.

E-Book:

1. Ajax Creating Web Pages with Asynchronous JavaScript and XML Edmond Woychowsky
2. RESTful Web APIs, By Leonard Richardson, Mike Amundsen, Sam Ruby, Publisher: O'Reilly Media, September 2013.

MOOCs:

1. https://alison.com/courses/Understanding-the-Functionality-of-JavaScript-jQuery-and-AJAX
2. https://www.udacity.com/course/intro-to-ajax--ud110
3. https://sites.google.com/site/introsdeunitn/home/rest-tutorial

COURSE OUTCOMES:

CO 1	Ability to **apply** theknowledge of jQuery, AJAX and web services for the given requirement.
CO 2	Ability to **analyze** the given Advanced Web Technologies code to identify bugs and to write correct code.
CO 3	Ability to **design** web applications with advanced technologies (jQuery, AJAX and web services) for the given specifications.

CO 4	Ability to **conduct practical** experiments/implementation for demonstrating the features of web applications using jQuery, AJAX and Web Services.
CO 5	Ability to **develop** a **project** using Advanced Web Technologies to solve societal problems.

ASSESSMENT:

CIE Scheme:

Assessment	Weightage in Marks
1 Quiz/AAT	5
2 Internals	20
1 Lab Internals	15
1 Self Study	10
Total	50

Best 2 out of 3 Tests and 1 Quiz will be considered for CIE marks

SEE Scheme:

Semester End Examination (SEE) is a written examination of three hours duration for 100 marks. Students have to answer 5 questions from four units, two units to carry one question each(mandatory), two units to carry two questions each (internal choice) and one question from the entire syllabus.

Self-Study Scheme:

Under Self study component of Advanced Web programming course, students should carry out a project work of developing a Website to explore the practical applications of the concepts learned.

Both CIE and SEE have equal (50:50) weightages. The Student's performance in a course shall be judged individually and together based on the results of CIE and SEE.

COURSE TITLE	Computer Graphics		
COURSE CODE	16CS7DECGR	L-T-P-S	3-0-1-2
Total Lecture Hours:	39	CIE/SEE Marks	50/50

SYLLABUS:

UNIT- 1

Introduction: Applications of computer graphics, A graphics system Images: Physical and synthetic Imaging Systems, The synthetic camera model, The programmer's interface, Graphics architectures, Programmable Pipelines, Performance Characteristics.
The OpenGL: The OpenGL API, Primitives and attributes : Color, Viewing, Control functions ,The Sierpinski gasket, Programming Two Dimensional Applications, The Gasket program, Polygons and recursion, The three dimensional gasket.**9 Hours**

UNIT -2

Interactive lnput Methods and Graphical User Interfaces: Graphical input Data, Logical Classification of Input Devices, lnput Functions for Graphical data, Open GL Interactive input functions, OpenGL menu functions, Designing Graphical User Interface. **10Hours**

UNIT -3

Geometric Transformations: Basic two dimensional Geometric Transformations, Matrix Representations
and Homogeneous Coordinates, Inverse Transformations, Composite Transformations, Other two dimensional Transformations, Raster Methods forGeometric Transformations, OpenGL raster Transformations, Transformations between two dimensional coordinate systems.
Geometric Transformations in three dimensional space, There dimensional Translation, Three dimensional Rotation,Three dimensional scaling,Composite 3D Transformations,, Other three dimensional Transformations,Transformations between three dimensional coordinate systemsAffine Transformations , OpenGL geometric Transformation Functions.**10 Hours**

UNIT -4

Viewing: Two dimensional viewing pipeline, Clipping Window, Normalization and Viewport transformations, OpenGL Two-Dimensional Viewing Functions, Clipping algorithms, Point Clipping Line Clipping, Polygon fill area clipping
Overview of three dimensional viewing concepts, Three dimensional viewing pipeline Three dimensional viewing coordinate parameters, Transformations between World to Viewing coordinates ,Projection transformations, Orthogonal Projections, Perspective projections, OpenGL Three-Dimensional Viewing Functions. **10 Hours**

Text Books:
1. **Interactive Computer Graphics - A Top-Down Approach with OpenGL by** Edward Angel**,** 5th Edition, Pearson Education, 2008.

2. **Computer Graphics- OpenGL Version** by Donald Hearn and Pauline Baker**,** 3rd Edition, Pearson Education, 2009.

Reference Books:
1. **ComputerGraphics** by JamesDFoley,AndriesVanDam,StevenKFeiner,JohnFHughes, Addison-Wesley 1997.
2. **Computer Graphics Using OpenGL by** Francis S Hill Stephen M Kelle 3rd Edition

E-books:

1. **Graphics Programming Black Book** by Michael Abrash.

MOOCs:
1. **Computer Graphics** -http://www.nptelvideos.in/2012/11/computer-graphics.html

COURSE OUTCOMES (COs):

CO1	Apply concepts of mathematics and science in computer graphics..
CO2	Implement event handling using OpenGL.
CO3	Identify the different transformations required for animation and implement them.
CO4	Demonstrate clipping and viewing techniques.
CO5	Design graphics projects with different viewing conditions, lighting and shading effects using OpenGL.

ASSESSMENT:

CIE Scheme:

Assessment	Weightage in Marks
1 Quiz/AAT	5
2 Internals	20
1 Lab Internals	15
1 Self Study	10
Total	50

Best 2 out of 3 Tests and 1 Quiz will be considered for CIE marks

SEE Scheme:

Semester End Examination (SEE) is a written examination of three hours duration for 100 marks. Students have to answer 5 questions from four units, two units to carry one question each(mandatory), two units to carry two questions each (internal choice) and one question from the entire syllabus.

Self-Study Scheme:

Under Self study component of ComputerGraphicscourse, students should carry out a project work of developing a graphics system for real-world applications to explore the practical applications of the concepts learned.

Both CIE and SEE have equal (50:50) weightages. The Student's performance in a course shall be judged individually and together based on the results of CIE and SEE.

COURSE TITLE	Data Science using R		
COURSE CODE	16CS7DEDSC	L-T-P-S	3-0-1-2
Total Lecture Hours:	39	CIE/SEE Marks	50/50

SYLLABUS:

UNIT-1

Introduction to Data Science: Data Analytics Life Cycle –Overview, Discovery, Data preparation, Model planning, Model building, Communicate results, Operationalize. Case study –Global Innovation Network and Analysis   **9 hours**

UNIT-2

Data Analytics Using R: Introduction to R –R Graphical User Interfaces, Data Import and Export, Attribute and Data types, Descriptive Statistics. Exploratory Data Analysis – Visualization before analysis, Dirty data, visualizing a single variable, Examining multiple variable, Data exploration versus presentation. Statistical Methods for Evaluation – Hypothesis testing, Difference of Means, Rank-sum test, Type I and II errors, Power and Sample Size   **11 hours**

UNIT-3

Analytical Methods: Regression - Linear Regression, Logistic Regression, Reasons to Choose and Cautions, Additional Regression Models, Classification – Decision tree, Naive Bayes, Diagnostics of classifiers, Clustering –K-means, Text analysis- steps, example, collecting raw text, representing text

11 hours

UNIT-4

Delivering Results: Documentation and deployment – producing effective presentations – Introduction to graphical analysis – plot () function – displaying multivariate data – matrix plots – multiple plots in one window - exporting graph - using graphics parameters.Case studies. **8 hours**

Text Books:
1. Data Science and Big Data Analytics: Discovering, Analyzing, Visualizing and Presenting Data July by EMC Education Services 2015
2. NINA ZUMEL , "Practical Data Science with R", Manning Publications Co 2014

MOOCS:

1. **nptel**.ac.in/courses/110106064/

E-Books:

1. An Introduction to Data Science. By J. Stanton, 2013.
2. https://drive.google.com/file/d/0B6iefdnF22XQeVZDSkxjZ0Z5VUE/edit

COURSE OUTCOMES:

Course Outcomes	Description
CO1	Ability to apply the concepts of Big data characteristics and its data models
CO2	Ability to analyze a given application requirement to solve the same using various architectural components of hadoop framework
CO3	Ability to design solutions using NoSQL databases such as MongoDB, Cassandra, Pig and Hive for processing and aggregating logs in the database.
CO4	Ability to demonstrate the usage of MongoDB, Cassandra database models and experiment conduction using HDFS and MapReduce

ASSESSMENT:

CIE Scheme:

Assessment	Weightage in Marks
Test	20
Lab	15
Self-Study	10
Quiz/AAT	05
Total	50

Best 2 out of 2 Tests and 1 Quiz will be considered for CIE marks

SEE Scheme:
Semester End Examination (SEE) is a written examination of three hours duration for 100 marks. Students have to answer 4 questions from 4 units, 2 units to carry one question each(mandatory), two units to carry two questions each (internal choice), and one question from the entire syllabus.

Self-Study Scheme:

Under Self study component of Data Science course, students should carry out a project work of developing an Data Analytics of real-world applications to explore the practical applications of the concepts learned.

Both CIE and SEE have equal (50:50) weightages. The Student's performance in a course shall be judged individually and together based on the results of CIE and SEE.

COURSE TITLE	Digital Image Processing		
COURSE CODE	16CS7DEDIP	L-T-P-S	3-0-1-2
Total Lecture Hours:	39	CIE/SEE Marks	50/50

SYLLABUS:

UNIT-1

Introduction to Image Processing: Introduction, Type of Image Processing-analog versus Digital Image Processing, Applications of DIP, Fundamental steps in DIP,Components of DIP system, A simple image formation model, Image sampling andquantization, Basic relationship between pixels, Arithmetic and Logical operations onimages, Image file formats**. 9 Hours**

UNIT-2

Image Enhancement in Spatial Domain and Frequency Domain:
Image Enhancement in the Spatial Domain: Some Basic Gray Level Transformations, Histogram Processing, Enhancement Using Arithmetic/Logic Operations, Basics of Spatial Filtering, Smoothing Spatial Filters, Sharpening Spatial Filters, Combining Spatial Enhancement Methods. Image Enhancement in the Frequency Domain: Introduction to the Fourier Transform and the Frequency Domain, Smoothing Frequency-Domain Filters, Sharpening Frequency-Domain Filters, Homomorphic Filtering**. 11 Hours**

UNIT-3

Image Restoration: Image enhancement versus Image restoration**,** Image degradation/restoration model, Inverse filter, Noise models, Restoration using spatial filtering: Arithmetic Mean filters, Geometricmean filters, Harmonic mean filters, Order Statistics filters: Median filter, Max & min filters, Midpoint filter, Adaptive filters, Wiener filter, Constrained Least squares filter.**10 Hours**

UNIT-4

Color Image Processing: Fundamentals of color image processing, Color models,Conversion of color models from one form to other form, Pseudo color image processing,Full color image processing, Color Image Quantization, Histogram of color Image.
Basic Image Transforms: Discrete Cosine and Sine transform, Z-transform, Fourier transform, Laplacian transform, Two-dimensional orthogonal unitary transforms, Properties of Unitary Transforms, K-L Transform, Introduction to Wavelet Transform.
9 Hours

Text Books:

1. Digital Image Processing by Rafael C. Gonzalez & Richard E. Woods, Third Edition, Pearson Education, 2009.
2. Fundamentals of Digital Image Processing by Anil.K.Jain, Prentice Hall, 4th Edition, 2014.

Reference Books:
1. Digital Image Processing by S.Jayaraman, S.Esakkirajan, T.Veerakumar, TMH, 2009.

E-Books:

1. Digital Image Processing by Rafael C. Gonzalez & Richard E. Woods, Third Edition, Pearson Education, 2009.

MOOCS:

3. http://www.nptelvideos.in/2012/12/digital-image-processing.html
4. http://in.mathworks.com/discovery/digital-image-processing.html?s_tid=srchtitle

COURSE OUTCOMES:

Course Outcomes	Description
CO1	Perform simple operations on images.
CO2	Analyze and apply spatial domain and/or frequency domain for image enhancement.
CO3	Analyze various noise models and apply appropriate filtering techniques.
CO4	Perform color image processing and various transformations on images.
CO5	Design and develop an Image Processing system for real-world applications.

ASSESSMENT:

CIE Scheme:

Assessment	Weightage in Marks
1 Quiz/AAT	5
2 Internals	20
1 Lab Internals	15

1 Self Study	10
Total	50

Best 2 out of 3 Tests and 1 Quiz will be considered for CIE marks

SEE Scheme:

Semester End Examination (SEE) is a written examination of three hours duration for 100 marks. Students have to answer 5 questions from four units, two units to carry one question each(mandatory), two units to carry two questions each (internal choice) and one question from the entire syllabus.

Self-Study Scheme:

Under Self study component of Digital Image Processing course, students should carry out a project work of developing an Image processing system for real-world applications to explore the practical applications of the concepts learned.

Both CIE and SEE have equal (50:50) weightages. The Student's performance in a course shall be judged individually and together based on the results of CIE and SEE.

CLUSTER ELECTIVE-1

COURSE TITLE	Distributed Operating System		
COURSE CODE	16CS7CEDOS	**L-T-P-S**	**3-0-0-0**
Total Lecture Hours:	39	**CIE/SEE Marks**	**50/50**

SYLLABUS:

UNIT-1

Fundamentals: What is Distributed Computing Systems? Evolution of Distributed Computing System; Distributed Computing System Models; What is Distributed Operating System? Issues in Designing a Distributed Operating System; **Message Passing**: Introduction, Desirable features of a Good Message Passing System, Issues in IPC by Message Passing, Synchronization.

9Hours

UNIT-2

Remote Procedure Calls: Introduction, The RPC Model, Transparency of RPC, Implementing RPC Mechanism, Stub Generation, RPC Messages, Marshaling Arguments and Results, Server Management, Parameter-Passing Semantics, Call Semantics, Communication Protocols for RPCs, Complicated RPCs, Client-Server Binding,.
10 Hours

UNIT-3

Distributed Shared Memory: Introduction, General Architecture of DSM Systems, Design and Implementation Issues of DSM, Granularity, Structure of Shared Memory Space, Consistency Models, Replacement Strategy, Thrashing, Other approaches to DSM, Heterogeneous DSM, Advantages of DSM. **10 Hours**

UNIT-4

Process and File Management: Introduction, Process Migration, Threads.

Distributed File Systems: Introduction, Desirable Features of a Good Distributed File System, File models, File–Accessing Models, File – Sharing Semantics, File – Caching Schemes, File Replication, Fault Tolerance, Atomic Transactions, Design Principles.   **10 Hours**

Text Books:

1. Pradeep. K. Sinha: Distributed Operating Systems: Concepts and Design, PHI Fundamentals

Reference Books:

1. Andrew S. Tanenbaum: Distributed Operating Systems, Pearson Education.

E-Books:

1. Distributed Operating System by Andrew.S.TanenBaum
2. Distributed Concepts and Design by George Couloruis
3. Distributed Operating Systems by Ing. Tom ́aˇsSeidmann
4. http://nptel.ac.in/downloads/106106107/

MOOCS:

1. http://video.mit.edu/watch/lecture-20-distributed-systems-1845/
2. https://www.youtube.com/watch?v=C5I3e9c2v4

COURSE OUTCOMES:

Course Outcomes	Description
CO1	Ability to apply the concepts of Big data characteristics and its data models
CO2	Ability to analyze a given application requirement to solve the same using various architectural components of hadoop framework
CO3	Ability to design solutions using NoSQL databases such as MongoDB, Cassandra, Pig and Hive for processing and aggregating logs in the database.

ASSESSMENT:

CIE Scheme:

Assessment	Weightage in Marks
2 Quiz/AAT	10
2 Internals	40
Total	50

Best 2 out of 3 Tests and 1 Quiz will be considered for CIE marks

SEE Scheme:

Semester End Examination (SEE) is a written examination of three hours duration for 100 marks. Students have to answer 5 questions from four units, two units to carry one question each(mandatory), two units to carry two questions each (internal choice) and one question from the entire syllabus.

Both CIE and SEE have equal (50:50) weightages. The Student's performance in a course shall be judged individually and together based on the results of CIE and SEE.

COURSE TITLE	Multimedia Communications		
COURSE CODE	16CS7CEMMC	L-T-P-S	3-0-0-0
Total Lecture Hours:	39	CIE/SEE Marks	50/50

SYLLABUS:

UNIT-1

Multimedia communications: multimedia information representation, multimedia networks, multimedia applications, network QoS and application QoS.

Information representation: text, images, audio and video.

Text and image compression: compression principles, text compression, image compression. Audiocompression**.   10Hours**

UNIT-2

Video compression: Video compression, video compression principles, **video compression standards:** H.261, H.263

Detailed Study of MPEG 4: coding of audio-visual objects, MPEG 4 systems, MPEG 4 audio and video, profiles and levels.
12Hours

UNIT-3

MPEG 7 standardization process of multimedia content description, MPEG 21 multimedia framework.

Multimedia Communication Across Networks: Layered video coding, error resilient video coding techniques, multimedia transport across IP networks and relevant protocols such as RSVP, RTP, RTCP, DVMRP, multimedia in mobile networks, multimedia in broadcast networks.**9 Hours**

UNIT-4

Multimedia communication system: Application subsystem, Transport subsystem, Quality of Service and Resource Management.

Multimedia Applications:

Introduction, Media preparation, Media composition, Media Integration, Media communication.

8 Hours

Text Books:

1. "Multimedia communications-Applications, Networks, Protocols and Standards", Pearson education, 2011 by Fred Halsall.

2. "Introduction to Multimedia Communications: Applications, Middleware, Networking, 2009By K.R.Rao, Zoran s bojkovic, Dragorad a Milovanovic.

3. "Multimedia- Computing , Communications and Applications", Pearson education, 2011 by Ralf Steinmetz, KlaraNahrstedt.

Reference Books
1. Principles of Multimedia, Tata McGrawHill, 2011 by Ranan Parekh.
2. Multimedia: Systems Design by Prabhat K Andleigh, KiranThakrar, Prentice Hall of India 2004.

E-Books:
1. Multimedia: Making it Work , Eighth edition, 2014 McGrawHill by Tay Vaughan.
2. ACM Transactions on Multimedia Computing, Communications and Applications, 2011 edited by Ralf Steinmetz.

MOOC:
1. http://nptel.ac.in/courses/106105081/1
2. http://nptel.ac.in/courses/117105083/

COURSE OUTCOMES:

Course Outcomes	Description
CO1	Understand the various ways of representing multimedia information using digital media, standardization process and frameworks
CO2	Apply the various text, image, audio and video compression techniques
CO3	Analyze the text, image, audio and video compression techniques
CO4	Integrate the various components of media

ASSESSMENT:

CIE Scheme:

Assessment	Weightage in Marks
2 Quiz/AAT	10
2 Internals	40

Total	50

Best 2 out of 3 Tests and 2 Quiz will be considered for CIE marks

SEE Scheme:

Semester End Examination (SEE) is a written examination of three hours duration for 100 marks. Students have to answer 5 questions from four units, two units to carry one question each(mandatory), two units to carry two questions each (internal choice) and one question from the entire syllabus.

Both CIE and SEE have equal (50:50) weightages. The Student's performance in a course shall be judged individually and together based on the results of CIE and SEE.

COURSE TITLE	Software Quality Metrics		
COURSE CODE	16CS7CESQM	L-T-P-S	3-0-0-0
Total Lecture Hours:	39	CIE/SEE Marks	50/50

SYLLABUS:

UNIT-1

Basics of measurement: Measurement in everyday life, measurement in software engineering, scope of software metrics, representational theory of measurement, measurement and models, measurement scales, meaningfulness in measurement, classifying software measures, determining what to measure, software measurement validation. **9 hours**

UNIT-2

Software-metrics data collection and analysis: What is good data, how to define the data, how to collect the data.

Measuring internal product attributes: Measuring size – Software size, Code Size, Functional size measures and estimators, Applications of size measures. Measuring structure – Aspects of structural measure, control flow structure of program units, Design level attributes, Object oriented structural attributes and measures. Metrics tools – CCCC, CKJM, JMetric **10 hours**

UNIT-3

Measuring external product attributes: Modeling software quality, measuring aspects of software quality, software reliability, basics of software reliability, software reliability problem, parametric reliability growth models, predictive accuracy, recalibration of software-reliability growth predictions, importance of operational environment, and wider aspects of software reliability. **10 hours**

UNIT-4

Metric Data Analysis in the Relationship Domain: A Fertile domain, Search for relationships, perceiving relationships, Strength of relationship, Casual relationship and statistical Correlation, Linear Regression, Example, Multiple Linear Regression. **10 hours**

Text Books:

1. Norman Fenton and James Bieman, "software metrics: a rigorous and practical approach", 3rdedition 2015
2. RavindranathPandian, software metrics: A guide to planning, analysis and application, CRC Press, 2003

Reference Books:

1. Stephen H.Kan, "Metric and Models in software Quality Engineering", Addison QWesley 2002

MOOCS:

1. https://www.coursera.org/learn/reviews-and-metrics-for-software-improvements

COURSE OUTCOMES:

Course Outcomes	Description
CO1	Ability to apply software metrics and measurements to the internal and external attributes of software product to assess software quality
CO2	Ability to analyse and predict the quality of the software using Software quality metrics and models
CO3	Ability to evaluate the quality of the software system using metrics tools

ASSESSMENT:

CIE Scheme:

Assessment	Weightage in Marks
Test-1	20
Test-2	20
Quiz/AAT	10
Total	50

Best 2 out of 2 Tests and 2 Quiz will be considered for CIE marks

SEE Scheme:

Semester End Examination (SEE) is a written examination of three hours duration for 100 marks. Students have to answer 5 questions from four units, two units to carry one question each(mandatory), two units to carry two questions each (internal choice) and one question from the entire syllabus.

Both CIE and SEE have equal (50:50) weightages. The Student's performance in a course shall be judged individually and together based on the results of CIE and SEE.

COURSE TITLE	Bio Inspired Algorithms		
COURSE CODE	16CS7CEBIA	L-T-P-S	3-0-0-0
Total Lecture Hours:	39	CIE/SEE Marks	50/50

SYLLABUS:

UNIT-1

Introduction: What is Life? - Life and Information - The Logical Mechanisms of Life - What is Computation? Universal Computation and Computability - Computational Beauty of Nature (fractals, L-systems, Chaos) - Bio-inspired computing - Natural computing -Biology through the lens of computer science. Complex Systems and Artificial Life - Complex Networks - Self-Organization and Emergent Complex Behavior - Cellular Automata - Boolean Networks - Development and Morphogenesis - Open-ended evolution   **10 hours**

UNIT-2

Natural Computation And Neural Networks: Biological Neural Networks- Artificial Neural Nets and Learning - pattern classification & linear separability - single and multilayer perceptron, back propagation - associative memory - Hebbian learning - Hopfield networks - Stochastic Networks – Unsupervised learning.   **9 hours**

UNIT-3

Evolutionary Systems And Algorithms: Evolutionary Programming: biological adaptation & evolution - Autonomous Agents and Self-Organization: termites, ants, nest building, flock, herds, and schools.Genetic algorithms: Schema theorem - Reproduction-Crossover-Mutation operators   **10 hours**

UNIT-4

Competition, Cooperation And Swarm Intelligence: Collective Behavior and Swarm Intelligence - Social Insects - Stigmergy and Swarm Intelligence; Competition and Cooperation - zero- and nonzero-sum games - iterated prisoner's dilemma - stable strategies - ecological & spatial models - Communication and Multi-Agent simulation – Immunocomputing   **10 hours**

Text Books:

1. Leandro Nunes De Castro, Fernando Jose Von Zuben, "Recent Developments in Biologically Inspired Computing", Idea Group Publishing, 2005.
2. Leandro Nunes De Castro, "Fundamentals of Natural Computing: Basic concepts, Algorithms and Applications", Chapman & Hall/ CRC Computer & Information Science Series, 2006.

Reference Books:
1. Dario Floreano, Claudio Mattiussi, "Bio-Inspired Artificial Intelligence: Theories, Methods and Technologies", MIT Press, 2008.

Websites:

1. http://informatics.indiana.edu/rocha/i-bic/
2. http://web.eecs.utk.edu/~mclennan/Classes/420/
3. http://www.cs.stir.ac.uk/courses/31YB/

MOOCS:

1. http://www.nptel.ac.in/syllabus/110104026/

COURSE OUTCOMES:

Course Outcomes	Description
CO1	Describe how biological system exploits natural processes.
CO2	Visualize how complex and functional high-level phenomena can emerge from low-level interactions.
CO3	Analyze group of agents and its self-organization and adaptation.
CO4	Design and implement simple bio-inspired algorithms for a given application.

ASSESSMENT:

CIE Scheme:

Assessment	Weightage in Marks
Test-1	20
Test-2	20
Quiz/AAT	10
Total	50

Best 2 out of 2 Tests and 2 Quiz will be considered for CIE marks

SEE Scheme:
Semester End Examination (SEE) is a written examination of three hours duration for 100 marks. Students have to answer 5 questions from four units, two units to carry one question each(mandatory), two units to carry two questions each (internal choice) and one question from the entire syllabus.

Both CIE and SEE have equal (50:50) weightages. The Student's performance in a course shall be judged individually and together based on the results of CIE and SEE.

COURSE TITLE	Professional Ethics for Engineers

COURSE CODE	16CS7HSHS1	L-T-P-S	2-0-0-0
Total Lecture Hours:	26	CIE/SEE Marks	50/50

UNIT-1

Engineering Ethics: Senses of 'Engineering Ethics' – Variety of moral issues – Types of inquiry – Moral dilemmas – Moral Autonomy – Models of professional roles - Theories about right action – Self-interest

Engineering as Social Experimentation: Engineering as Experimentation – Engineers as responsible Experimenters – Codes of Ethics – A Balanced Outlook on Law.   **13 Hours**

UNIT-2

Safety, Responsibilities and Rights: Safety and Risk – Assessment of Safety and Risk – Risk Benefit Analysis and Reducing Risk – The Professional Rights – Employee Rights – Intellectual Property Rights (IPR) – Discrimination

Global Issues: Multinational Corporations – Environmental Ethics – Computer Ethics – Weapons Development – Engineers as Managers – Consulting Engineers – Engineers as Expert Witnesses and Advisors – Moral Leadership – Sample Code of Conduct.   **13 Hours**

Text Book:

1. Mike W. Martin and Roland Schinzinger, "Ethics in Engineering", Tata McGraw Hill, New Delhi, 2nd Edition, 2009.

References:

1. Charles B. Fleddermann, "Engineering Ethics", Pearson Prentice Hall, New Jersey, 2004.
2. Charles E. Harris, Michael S. Pritchard and Michael J. Rabins, "Engineering Ethics – Concepts and Cases", Thompson Wadsworth, A Division of Thomson Learning Inc., United States, 2000
3. John R Boatright, "Ethics and the Conduct of Business", Pearson Education, New Delhi, 2003
4. Edmund G Seebauer and Robert L Barry, "Fundametals of Ethics for Scientists and Engineers", Oxford University Press, Oxford, 2001

Web sources:
   1. www.onlineethics.org
   2. www.nspe.org
   3. www.globalethics.org
   4. www.ethics.org

COURSE OUTCOMES:

Course Outcomes	Description
CO1	Ability to apply the knowledge of professional ethics required to be followed in different organisation structures.
CO2	Ability to analyse and address ethical problems arising from various case studies.
CO3	Ability to resolve moral and ethical issues concerning environment and society.

ASSESSMENT:

CIE Scheme:

Assessment	Weightage in Marks
2 Quiz/AAT	10
2 Internals	40
Total	50

Best 2 out of 3 Tests and 2 Quiz will be considered for CIE marks

SEE Scheme:

Semester End Examination (SEE) is a written examination of three hours duration for 100 marks. Students have to answer 5 questions from two units from the entire syllabus.

Both CIE and SEE have equal (50:50) weightages. The Student's performance in a course shall be judged individually and together based on the results of CIE and SEE.

COURSE TITLE	Project Phase-1

COURSE CODE	16CS7DCPP1	L-T-P-S	0-0-2-0
Total Lecture Hours:	----	**CIE/SEE Marks**	**50/50**

MARKS SPLIT UP

CRITERIA	MARKS	RUBRIC
1.Problem Formulation(Guide)	5	1
2. Planning(Guide)	8	2
3. Technical: (Panel)		3
❖ Literature Survey (Publication of Literature Review)	10	3a
❖ High Level Design	10	3b
4. Communication: (Panel)		4
❖ Presentation	7	4a
❖ Documentation	4	4b
5. Team Work		5
❖ Group Participation(Guide)	2	5a
❖ Peer Review	2	4b
6. Societal / Ethical / Environmental issues(Guide)	2	6
CIE	50	
SEE	50	SEE Rubrics

External audition to be done at the end of the first month after the problem is formulated by the students. The External Audit Committee should comprise of a panel of three members from the industry and alumni of our college.This committee will audit the projects for approval.

Evaluation by the project <u>Guide</u>: Total 31 Marks

Evaluation by the <u>CIE Panel</u>: Total 17 Marks

Peer Evaluation by the project <u>team members</u>: 2 Marks

PROBLEM FORMULATION: RUBRIC1 (5Marks)

	USN
Criteria 1: Problem	

Formulation (1Mark each)				
Proposed an engineering problem that is relevant to present day scenario(current).				
Proposed problem is innovative in nature.				
Appropriate to the discipline and practically achievable.				
Justification for the choice of problem selected.				
Has identified the functional and nonfunctional requirement.				
Total				

PLANNING: RUBRIC 2 (8 Marks)

Criteria 2 : Planning (2Marks each)	USN			
Project schedule: Progress, milestones and deliverables with realistic estimates of the time(Gant chart).				
Identify resources (hardware and software) required to accomplish the development effort.				
Identification of skills needed.				
Cost estimates of hardware and software.				
Total				

TECHNICAL : RUBRIC 3a (10Marks)

TECHNICAL : Literature Survey

Criteria 3a : Literature Survey	USN			
Exhaustive/substantial Literature Survey done.(2Marks)				
Reviewed credible/quality literatures.(2Marks)				
Clearly summarized the ideas of sources by a				

thorough review of academic literature.(2Marks)				
Publication of Literature Review paper. (4Marks)				
Total				

TECHNICAL : RUBRIC 3b (10Marks)

TECHNICAL : High Level Design

Criteria 3b :	USN			
High Level Design (2Marks each)				
Design is as per problem formulation.				
Architectural design/ System design: identifying the sub-systems.				
Abstract specification of the sub-systems				
Interface design				
Carefully chosen a methodology or approach that is well-suited to the research question				
Total				

COMMUNICATION : RUBRIC 4a (7Marks)

Criteria 4a : Presentation (1Mark each)				
Presentation begins with a clear focus [defines background, state the problem and objectives].				
Presentation includes appropriate contents and is clearly organized [Material/content are logically sequenced, related to the topic and not repetitive].				
Subject knowledge [shows full grasp and understanding of the topic].				
Presentation highlights key ideas and closes with a strong conclusion.				
Answer questions/queries professionally.				
Visual aids [Quality of slides / Text readable / Figures / Graphs].				
Delivery [Language skills / Posture / Within time limits].				
Total				

COMMUNICATION : RUBRIC 4b(4Marks)

Criteria 4b: Documentation (1Mark each)				

Excellent Organization, No technical or Grammar errors, Concise and Precise, Complete documentation,				
The project's objectives are clearly stated. The motivation for pursuing the project and its relevance are clear and convincingly established by relating the project to current engineering problems.				
All figures, graphs, charts, and drawings are accurate, consistent with the text, and of good quality. They enhance understanding of the text. All are labelled correctly.				
The report is organized following the prescribedreporting format.				

TEAM WORK : RUBRIC 5a (2Marks)

Team Work :Group Participation

Criteria 4a : Group Participation	Level of Participation		
	Distinguished (2)	**Basic(1)**	**Unacceptable(0)**
Workload	Did a full share of the work or more and volunteers to help others.	Did almost as much work as others and seldom asks for help.	Did less work than others and doesn't ask for help.
Getting Organized	Took the initiative for proposing meeting times and getting group organized.	Worked agreeably with partner(s) concerning the time and place to meet.	Did not meet partner(s) as organized.
Participation in Discussions	Provided many good ideas; inspired others; clearly communicated ideas, needs, and feelings.	Participated in discussions; on some occasions, made suggestions.	Listened mainly; Rarely spoke up, and ideas were off the mark.
Meeting Deadlines	Completed assigned work ahead of time.	Completed assigned work on time.	Needed much reminding; submission was late.
Showing up for Meetings	Showed up for meetings punctually, sometimes ahead of time.	Showed up for meetings on time.	Showed up extremely late; no excuse offered.

TEAM WORK : RUBRIC 5b(2Marks)

Team Work : Peer Review

Please rate YOUR TEAM MEMBERS using the provided table. Please fill in the table below honestly, and as accurately as possible. Please use the following rating scale: **0 - NEVER; 1 – SELDOM; 2 - SOMETIMES: 3 - USUALLY: 4 - ALWAYS**

Criteria 4: Peer Review		USN Member1	USN Member2	USN Member3
Commitment	Demonstrates commitment to the project by attending the group meeting and being prepared for each group meeting.			
	Follows up on ideas andsuggestions from previousmeetingsand reports findings tothe group.			
Contributions	Offers helpful ideas orsuggestions that contribute toproblem-solving.			
	Contributes to writing the projectreport or presentation.			
Time Management	Completes assigned work in atimely and acceptable manner.			
Group Effectiveness	Monitors the team's progress and works to make the team more effective.			
Leadership	Resolves team "conflict" throughopen discussion & compromise.			
	Listens actively and shows respect to all groupmembers and gives recognition &encouragement.			
	Is comfortable and confidentwhen exercising leadership duties within the group.			
	Ensures that all members of theteam are involved in decision-making.			
TOTAL				
FINAL = (TOTAL/20)				

ETHICS : RUBRIC 6 (2Marks)

Criteria 5 : Ethics (1Mark each)	USN			
Upholds the standards of honesty and integrity.				

Addressed the societal and environmental issues and responsibilities.				
Total				

Course Outcomes:

7th	16CS7DCPP1 Project Phase I
CO1	Ability to identify a real life/engineering problem, utilize prior knowledge and conduct extensive investigation, across diverse sources, in addressing the
CO2	Competence in applying the software engineering principles in planning, formulating an innovative design/ approach and computing the requirements
CO3	Ability to plan, monitor, and manage project schedule, resources, and work assignments to ensure timely completion
CO4	Perform professionally—as a team member, accepting responsibility, taking initiative, and providing leadership necessary to ensure project success.
CO5	Ability to use formal and informal communications with team members and guide, make presentations and prepare technical document.
CO6	Ability to provide solution within the context of leagal framework addressing the societal and environmental concerns and upholding ethical issues.

VIII SEMESTER SYLLABUS

INSTITUTIONAL ELECTIVE-2

COURSE TITLE	Programming In Python		
COURSE CODE	16CS8IEPIP	L-T-P-S	3-0-0-0
Total Lecture Hours:	39	CIE/SEE Marks	50/50

SYLLABUS:

<div align="center">

UNIT 1

</div>

Introduction to Python, Python Concepts, Dynamic vs. Static Types, Interpreted vs. Compiled, Prototyping, Procedural vs. Object-Oriented Programming, Comparing Programming Languages-C, C++, JAVA,C#, Python, The Python Interpreter, Python Versions, 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, MethodsDictionaries: Making a dictionary, Basic operations, Dictionary details, OperationTuples: Why Use Tuples? Sequence Unpacking, Methods   **10 hours**

UNIT 2

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.Files: File Operations, Files and Streams, Creating a File, Reading From a File, Iterating Through Files, Seeking, Serialization.   **10 hours**

UNIT 3

Exceptions: Exception Class Hierarchy, User-Defined Exceptions.Object Oriented Programming: Learning Python Classes, How Are Classes Better? , "New-style" classes, Inheritance , Operator Overloads, Class Methods.**9 hours**

UNIT 4

GUI development – examining GUI, understanding event driven programming, root window, labels, buttons, creating a GUI using a class, binding widgets and event handlers, text and entry widgets and Grid layout manager, check buttons, radio buttons, mad lib program. Graphics – Pizza panic game, creating a graphics window, setting background image, understanding the graphics coordinate system, displaying sprite, text, message, moving sprites, dealing with screen boundaries, mouse input, collisions.**10 hours**

Text books:
3. Learning to Program using Python by Cody Jackson, Second Edition, 2014.
4. Python Programming, Michael DAWSON, 3rd Edition, Course technology PTR, 2010

Reference Books:

5. **Introducing Python** by Bill Lubanovic, O'Reilly Media, Edition 2014.

6. **Learning Python Network Programming by** Dr. M. O. FaruqueSarker and Sam Washington, Packt Publishing, 2015.

7. *Python Essential Reference, 4ᵗʰ Edition* by David M. Beazley, Pearson Education, Inc., Edition – 2009

8. Python Crash Course: A Hands-on, Project Based Introduction to Programming by Eric Matthes, No Starch Press Inc, San Francisco, 2016.

E-books:

3. **Learning Python**, Fifth Edition by Mark Lutz, 2013

4. **Programming in Python 3: A Complete Introduction to the Python Language 1st Edition**

MOOCS:

3. **https://www.coursera.org/course/interactivepython1**

4. **https://www.coursera.org/course/interactivepython2**

Course Outcomes:

CO Number	Course Outcome
CO1	Demonstrate the basic programming constructs in Python
CO2	Apply the data structures using Python
CO3	Apply regular expressions and OO concepts using Python
CO4	Demonstrate applications related to Network Programming, Web Services and Databases in Python.

ASSESSMENT:

CIE Scheme:

Assessment	Weightage in Marks
2 Quiz/AAT	10
2 Internals	40
Total	50

Best 2 out of 3 Tests and 1 Quiz will be considered for CIE marks

SEE Scheme:

Semester End Examination (SEE) is a written examination of three hours duration for 100 marks. Students have to answer 5 questions from four units, two units to carry one question each(mandatory), two units to carry two questions each (internal choice) and one question from the entire syllabus.

Both CIE and SEE have equal (50:50) weightages. The Student's performance in a course shall be judged individually and together based on the results of CIE and SEE.

COURSE TITLE	Internet of Things		
COURSE CODE	16CS8IEIOT	L-T-P-S	3-0-0-0
Total Lecture Hours:	39	CIE/SEE Marks	50/50

SYLLABUS:

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, IoT Levels and Templates, Domain Specific IoTs – Home, City, Environment, Energy, Retail, Logistics, Agriculture, Industry, Health and Lifestyle.   **10 hours**

UNIT-2

Embedded System, Arduino board – Architecture, setting up the board, Introduction to sensors and actuators, implementing simple program by interfacing with sensors and actuators   **10 hours**

UNIT-3

IoT Reference Architecture, Wireless Communication Technology for IoT - Wi-Fi, Storing the sensor data to the cloud using WiFi, GSM, Bluetooth, ZigBee, NFC, RFID   **10 hours**

UNIT-4

IoT Protocol - Constrained Application Protocol (CoAP), MQ Telemetry Transport (MQTT), Advanced Message Queuing Protocol (AMQP) 6LoWPAN, Extensible Messaging and Presence Protocol (XMPP)   **09 hours**

Text Books:
- Internet of Things - A Hands-on Approach, ArshdeepBahga and Vijay Madisetti, Universities Press, 2015.
- Julien Bayle, C Programming for Arduino, PACKT Publishing 2013
- Jean-Philippe Vasseur, Adam Dunkels, "Interconnecting Smart Objects with IP", 2010

Reference books:

- Michael Miller," The Internet of Things", First Edition, Pearson, 2015.
- DanielMinoli, "Building the Internet of Things with IPv6 and MIPv6:The Evolving World of M2M Communications", Wiley, 2013

COURSE OUTCOMES:

Course Outcomes	Description
CO1	Ability to analyse the various IoT architectural components
CO2	Ability to develop programs to interface Sensor and Actuator with Arduino development board.
CO3	Ability to apply various protocols, device discovery and cloud services in resource constraint network for IoT applications.

ASSESSMENT:

CIE Scheme:

Assessment	Weightage in Marks
Test-1	20
Test-2	20
Quiz/AAT	10
Total	50

Best 2 out of 2 Tests and 1 Quiz will be considered for CIE marks

SEE Scheme:

Semester End Examination (SEE) is a written examination of three hours duration for 100 marks. Students have to answer 5 questions from four units, two units to carry one question each(mandatory), two units to carry two questions each (internal choice) and one question from the entire syllabus.

Both CIE and SEE have equal (50:50) weightages. The Student's performance in a course shall be judged individually and together based on the results of CIE and SEE.

COURSE TITLE	MANAGEMENT and ENTREPRENEURSHIP		
COURSE CODE	16CS8HSMAE	L-T-P-S	3-0-0-0
Total Lecture Hours:	39	CIE/SEE Marks	50/50

UNIT 1:

Introduction - Definition of Management, Managing: Science or Art, Patterns of Management Analysis: A management theory jungle, The system approach to management process, The functions of managers.

Planning: Essentials of Planning and Managing by Objectives, **Decision Making**.**9 Hours**

UNIT 2:

Organizing: Formal and informal organization, Organizational Division, Organizational Levels and the span of management, Reengineering the organization, Structure and process of organizing; Line/Staff Authority, Empowerment and Decentralization.

Staffing: Definition of staffing, The system approach to human resource management: An overview of staffing function, Situational factors affecting staffing, the system approach to selection: An overview.

Leadership: Nature and Definitions of Leadership: Functions of Leader; Characteristics of Leaders; The concept of Leadership Effectiveness; Leadership Styles.   **10 Hours**

UNIT 3:

Entrepreneurship: Importance of entrepreneurship, concepts of entrepreneurship, characteristics of a successful entrepreneur, classification of entrepreneurs, myths of entrepreneurship, entrepreneurial development models, problems faced by entrepreneurs and capacity building for entrepreneurship. Women Entrepreneurs: Women entrepreneurship defined, women entrepreneurship environment, challenges in the path of women entrepreneurship, strategies for development of women entrepreneurs.   **10 Hours**

UNIT 4:

Creativity and business idea: Ideas from Trends analysis: Trends, sources of new ideas, methods of generating ideas.

Innovation: Entrepreneurial innovation, opportunity recognition, product planning and development process, e-Commerce and business start-up.

The business plan: What is business plan, who should write the plan, scope and value of business plan, Writing the business plan, Using and implementing the business plan.   **10 Hours**

Text Books:

1. **Management : A Global and Entrepreneurial Perspective–** Heinz weihrich,Mark V Cannice, Harold Koontz Tata McGraw Hill, 13th Edition, 2011.

2. **Entrepreneurship Development-Small Business Enterprises –** Poornima M. Charantimath, Pearson Education, 2009.
3. **ENTREPRENEURSHIP:** Robert D Hisrich, Mathew J Manimala, Michael P Peters, Dean A Shepherd,Tata McGraw Hill, 9e, 2014

Reference books:

1. **Principles of Management** – P.C.Tripathi, P.N.Reddy, Tata McGraw Hill, 4th Edition, 2010.
2. **Dynamics of Entrepreneurial Development & Management –** Vasant Desai, Himalaya Publishing House, 2011
3. **3.Entrepreneurship Development –** S. S. Khanka, S Chand & Co., 2007.

MooCs

1.https://www.coursera.org/specializations/wharton-entrepreneurship

2. https://www.edx.org/course/subject/business-management/innovation-entrepreneurship

Course Outcomes:

CO Number	Course Outcome
CO1	Ability to apply Engineering knowledge to effectively exhibit managerial skills at different levels of management in a global context
CO2	Ability to demonstrate the critical awareness of the principles and importance of entrepreneurship
CO3	Ability to Examine the process of creating and managing a new business venture and prepare a business plan for any identfied business problem

ASSESSMENT:

CIE Scheme:

Assessment	Weightage in Marks
2 Quiz/AAT	5
2 Internals	40
Total	50

Best 2 out of 3 Tests and 2 Quiz/AAT will be considered for CIE marks

SEE Scheme:

Semester End Examination (SEE) is a written examination of three hours duration for 100 marks. Students have to answer 5 questions from five units, three units to carry one question each(mandatory), two units to carry two questions each (internal choice) and the last question is from the entire syllabus.

Both CIE and SEE have equal (50:50) weightages. The Student's performance in a course shall be judged individually and together based on the results of CIE and SEE.

Course Title	Semantic Web		
COURSE CODE	**16CS8IESEW**	**L-T-P-S**	**3-0-0-0**
Total Lecture Hours:	**39**	**CIE/SEE Marks**	**50/50**

SYLLABUS:

<center>UNIT-1</center>

INTRODUCTION

Introduction to the Syntactic web and Semantic Web, Evolution of the Web, The visual and syntactic web, Levels of Semantics, Metadata for web information, The semantic web architecture and technologies, Contrasting Semantic with Conventional Technologies, Semantic Modeling, Potential of semantic web solutions and challenges of adoption.
9 hours

UNIT-2
ONTOLOGICAL ENGINEERING
Ontologies, Taxonomies, Topic Maps, Classifying Ontologies, Terminological aspects: concepts, terms, relations between them, Complex Objects, Subclasses and Sub-propertiesdefinitions, Upper Ontologies, Quality, Uses, Types of terminological resources for ontologybuilding, Methods and methodologies for building ontologies, Multilingual Ontologies, Ontology Development process and Life cycle, Methods for Ontology Learning, OntologyEvolution, Versioning.
10 hours

UNIT-3
STRUCTURING AND DESCRIBING WEB RESOURCES
Structured Web Documents, XML –Structuring, Namespaces, Addressing, Querying, Processing, RDF – RDF Data Model, Serialization Formats, RDF Vocabulary, Inferencing, RDFS, basic Idea, Classes, Properties, Utility Properties, RDFS Modelling for Combinations and Patterns, Transitivity.   **10 hours**

UNIT-4
WEB ONTOLOGY LANGUAGE
OWL, Sub-Languages, Basic Notions, Classes, Defining and Using Properties, Domain and Range, Describing Properties, Data Types, Counting and Sets, Negative Property Assertions, Advanced Class Description, Equivalence , Owl Logic**.**   **10 hours**

Text Books:
1. Liyang Yu, A Developer's Guide to the Semantic Web, Springer; 1st Edition. Edition, 2011.
2. John Hebeler, Matthew Fisher, Ryan Blace and Andrew Perez-Lopez, Semantic Web Programming, Wiley; 1 edition, 2009.
3. Grigoris Antoniou, Frank van Harmelen, A Semantic Web Primer, Second Edition (Cooperative Information Systems) (Hardcover), MIT Press, 2008
4. Robert M. Colomb, Ontology and the Semantic Web: Volume 156 Frontiers in Artificial Intelligence and Applications (Frontier in Artificial Intelligence and Applications), IOS Press, 2007.
5. Dean Allemang and James Hendler, Semantic Web for the Working Ontologist: Effective Modeling in RDFS and OWL, Morgan Kaufmann; 2 edition, 2011.

References:
1. Michael C. Daconta, Leo J. Obrst and Kevin T. Smith, The Semantic Web: A Guide to the Future of XML, Web Services, and Knowledge Management, Wiley; 1 edition 2003
2. Karin Breitman, Marco Antonio Casanova and Walt Truszkowski, Semantic Web: Concepts, Technologies and Applications (NASA Monographs in Systems and Software Engineering), Springer; Softcover, 2010.
3. VipulKashyap, ChristophBussler and Matthew Moran, The Semantic Web: Semantics

for Data and Services on the Web (Data-Centric Systems and Applications), Springer, 2008.

COURSE OUTCOMES:

Course Outcomes	Description
CO1	Ability to apply the knowledge of semantic web in creating web pages.
CO2	Ability to analyze the code written in semantic web to debug and correct the code.
CO3	Ability to design the structured web page using semantic web technologies.

ASSESSMENT:

CIE Scheme:

Assessment	Weightage in Marks
2 Quiz/AAT	10
2 Internals	40
Total	50

Best 2 out of 3 Tests and 1 Quiz will be considered for CIE marks

SEE Scheme:

Semester End Examination (SEE) is a written examination of three hours duration for 100 marks. Students have to answer 5 questions from four units, two units to carry one question each(mandatory), two units to carry two questions each (internal choice) and one question from the entire syllabus.

Both CIE and SEE have equal (50:50) weightages. The Student's performance in a course shall be judged individually and together based on the results of CIE and SEE.

COURSE TITLE	Green Computing		
COURSE CODE	**16CS8DCGCT**	**L-T-P-S**	**3-1-0-0**
Total Lecture Hours:	**39**	**CIE/SEE Marks**	**50/50**

SYLLABUS:

UNIT-1

Green IT Fundamentals: Business, IT and the Environment, Green computing: carbon foot print, scoop on power, Green IT Strategies: Drivers, Dimensions and Goals, Environmentally Responsible Business: Policies, Practices, and Metrics. **9 Hours**

UNIT-2

Green Assets: Buildings, Data Centers, Networks, and Devices, Green Business Process Management: Modeling, Optimization, and Collaboration, Green Enterprise Architecture, Environmental Intelligence, Green Supply Chains, Green Information Systems: Design and Development Models. **10 Hours**

UNIT-3

Virtualizing of IT systems, Role of electric utilities, Telecommuting, teleconferencing and teleporting, Materials recycling, Best ways for Green PC, Green Data center, Green Grid framework.**10 Hours**

UNIT-4

Socio-cultural aspects of Green IT, Green Enterprise Transformation Roadmap, GreenCompliance: Protocols, Standards, and Audits, Emergent Carbon Issues: Technologies and Future. **10 Hours**

Text Books:

1. BhuvanUnhelkar, "Green IT Strategies and Applications-Using Environmental Intelligence", CRC Press, June 2011
2. Woody Leonhard, Katherrine Murray, "Green Home computing for dummies", August 2009.

References:

1. Alin Gales, Michael Schaefer, Mike Ebbers, "Green Data Center:steps for the Journey", Shoff/IBM rebook, 2011.
2. John Lamb, "The Greening of IT", Pearson Education, 2009.
3. Jason Harris, "Green Computing and Green IT- Best Practices on regulations & industry", Lulu.com, 2008.
4. Carl speshocky, "Empowering Green Initiatives with IT", John Wiley & Sons, 2010.
5. Wu Chun Feng (editor), "Green computing: Large Scale energy efficiency", CRC Press, 2012.

COURSE OUTCOMES:

Course Outcomes	Description
CO1	Ability to **apply** knowledge of fundamentals of Green Computing for various Business Assets

CO2	**Analyse** various strategies that can reduce the environmental impact of usage of computers to make business more energy efficient and green compliant.
CO3	**Demonstate/Conduct investigation** on Novel Green Computing Frameworks for various Business assets
CO4	Ability to make effective **Oral presentation** on various Green IT statergies

ASSESSMENT:

CIE Scheme:

Assessment	Weightage in Marks
2 Quiz/AAT	10
2 Internals	40
Total	50

Best 2 out of 3 Tests and 1 Quiz will be considered for CIE marks

SEE Scheme:

Semester End Examination (SEE) is a written examination of three hours duration for 100 marks. Students have to answer 5 questions from four units, two units to carry one question each(mandatory), two units to carry two questions each (internal choice) and one question from the entire syllabus.

Both CIE and SEE have equal (50:50) weightages. The Student's performance in a course shall be judged individually and together based on the results of CIE and SEE.

COURSE TITLE	Project Phase-2		
COURSE CODE	16CS8DCPP2	**L-T-P-S**	**0-0-12-0**
Total Lecture Hours:	----	**CIE/SEE Marks**	**50/50**

MARKS SPLIT UP

CRITERIA	MARKS	RUBRIC
1. Planning (Guide)	2	1
2. Technical:		2
❖ Detail Design (Guide)	5	2a
❖ Implementation (Panel)	10	2b
❖ Testing and Validation (Guide)	4	2c
❖ Technical Paper on the project work (Guide)	4	2d
3. Communication:		3
❖ Presentation (Panel)	10	3a

❖ Documentation (Guide)	4	3b
4. Team Work		4
❖ Group Participation (Guide)	5	4a
❖ Peer Review	2	4b
5. Societal / Ethical / Environmental issues (Guide)	4	5
CIE	50	
SEE	50	

Evaluation by the project Guide: 28 Total Marks

Peer Evaluation by the project team members: 2 Marks

Evaluation by the CIE Panel: Total 20 Marks

PLANNING:

RUBRIC 1(2Marks)

Criteria 1 : Planning	USN			
Planned schedule with step-wise progress and identification of milestones. Ganttchart used for monitoring the project's progress.				

TECHNICAL :

Detail Design: RUBRIC 2a (5Marks)

Criteria 2a :	USN			
High Level Design (1Marks each)				
Design is as per problem formulation.				
Architectural design/ System design: identifying the sub-systems.				
Abstract specification of the sub-systems				
Interface design				
Carefully chosen a methodology or approach that is well-suited to the research question				
Total				

Implementation:RUBRIC 2b (10Marks)

The student should demonstrate the implementation of core functionalities with respect to the project work.

Criteria 2b : Implementation	Marks
Completed implementation for all set objectives as per the design and specification; justifying latest tools and techniques used.	1-5
Implementation of methodology/approaches/technique is innovative and is specific to the needs of the project and robust to cater to future enhancements.	1-3
Showed competency in developing the system and fulfilled the objectives in the given timeline.	1-2

RUBRIC 2c(4Marks)

Criteria 2c : Testing & Results, Conclusions	Marks
Data interpretation, integration, analysis and test results interpretation communicated clearly.	2
Included high quality charts, tables, graphs, images, etc. to assist in interpreting the resultsand closes with a strong conclusion.	2

RUBRIC 2d: Technical Paper on the project work (4Marks)

Marks	Publication
4	Implementation Paper published
0	Not attempted to publish

COMMUNICATION :

Presentation: RUBRIC 3a (10Marks)

Criteria 3a : Presentation (10Marks)

	Marks
Presentation begins with a clear focus [defines background, state the problem and objectives], Highlights key ideas and closes with a strong conclusion.	2
Presentation includes appropriate contents and is clearly organized [Material/content are logically sequenced, related to the topic and not repetitive] and has Visual aids [Quality of slides / Text readable / Figures / Graphs].	2
Subject knowledge [shows full grasp and understanding of the topic].	3
Answer questions/queries professionally. Good delivery [Language skills / Posture / Within time limits].	3
Total	10

Documentation : RUBRIC 3b (4Marks)

Criteria 3b: Documentation (1Mark each)	USN			
Excellent Organization, No technical or Grammar errors, Concise and Precise, Complete documentation,				
The project's objectives are clearly stated. The motivation for pursuing the project and its relevance are clear and convincingly established by relating the project to current engineering problems.				
All figures, graphs, charts, and drawings are accurate, consistent with the text, and of good quality. They enhance understanding of the text. All are labelled correctly.				
The report is organized following the prescribedreporting format.				

Group Participation : RUBRIC 4a (5Marks)

Criteria 4a: Group Participation (5Marks)	Distinguished (1)	Unacceptable(0)
Workload .	Did a full share of the work or more and volunteers to help others. Student showed commitment and sense of responsibility	Did less work than others and doesn't ask for help. Student does not participate actively and does not take responsibility.
Getting Organized	Took the initiative for proposing meeting times and	Did not meet partner(s) as organized.

	getting group organized.	
Participation in Discussions	Provided many good ideas; inspired others; clearly communicated ideas, needs, and feelings.	Listened mainly; Rarely spoke up, and no significant contribution.
Meeting Deadlines	Completed assigned work ahead of time.	Needed much reminding; submission was late.
Showing up for Meetings	Showed up for meetings punctually, sometimes ahead of time.	Showed up late; no excuse offered.

Peer Review: RUBRIC4b(2Marks)

Team Work (Peer Review)

Please rate YOUR TEAM MEMBERS using the provided table. Please fill in the table below honestly, and as accurately as possible. Please use the following rating scale: **0 - NEVER; 1 – SELDOM; 2 - SOMETIMES: 3 - USUALLY: 4 - ALWAYS**

Criteria 5: Team Work		USN Member1	USN Member2	USN Member3
Commitment	Demonstrates commitment to the project by attending the group meeting and being prepared for each group meeting.			
	Follows up on ideas andsuggestions from previousmeetingsand reports findings tothe group.			
Contributions	Offers helpful ideas orsuggestions that contribute toproblem-solving.			
	Contributes to writing the projectreport or			

	presentation.			
Time Management	Completes assigned work in atimely and acceptable manner.			
Group Effectiveness	Monitors the team's progress and works to make the team more effective.			
Leadership	Resolves team "conflict" throughopen discussion & compromise.			
	Listens actively and shows respect to all groupmembers and gives recognition &encouragement.			
	Is comfortable and confidentwhen exercising leadership duties within the group.			
	Ensures that all members of theteam are involved in decision-making.			
TOTAL				
FINAL = (TOTAL/20)				

Societal / Ethical / Environmental issues:

RUBRIC 5(4Marks)

Criteria 5 : Ethics	Marks	USN			
Upholds the standards of honesty and integrity. Report is written in their own words and appropriately referenced when required. **(2 Marks)**	2				
Implementation of the project done with an understanding of the impact of the engineering solution in a global/societal and environmental context. **(1 Mark)**	1				
Project implementation done within the legal and social framework. **(1 Mark)**	1				
Total	4				

Course Outcome

CO1	Ability to apply the software engineering principles in planning, formulating an innovative design/ approach and computing the requirements appropriate to chosen topic within the context of legal, societal and environment constraint.
CO2	Ability to apply the concepts of mathematics, science and engineering to implement the project and draw conclusions out of the results, while exhibiting integrity and ethical behavior in engineering practice
CO3	Ability to monitor, manage project schedules, resources and work assignments to ensure timely completion.
CO4	Ability to test and defend performance of the implemented project and understand the implication of the solution.
CO5	Ability to perform individually as well as in a team, accepting responsibility, taking initiative, and providing leadership ,necessary to ensure project success.
CO6	:Ability to use formal and informal communications with team members and guide, make presentations and prepare technical document.

COURSE TITLE	Internship		
COURSE CODE	16CS8DCINT	L-T-P-S	0-0-2-0
Total Lecture Hours:	----	CIE/SEE Marks	50/50

COURSE OUTCOMES

Course Outcomes	
CO 1	Ability to apply domain knowledge during the course of internship
CO 2	Ability to develop/implement the solutions with appropriate techniques, resources and contemporary tools.
CO 3	Ability to work independently and in a collaboration/multidisciplinary environment.
CO 4	Ability to allocate time effectively and manage to complete the work allotted within appropriate time
CO 5	Ability to exhibit integrity and ethical behavior while carrying out the internship and for the preparation of internship report.
CO 6	Ability to demonstrate effective oral and written communication skills

CO-PO MAPPING

COURSE OUTCOMES		PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11
CO1	Ability to Apply domain knowledge in design and development of IT problem.	3	3		1			1		3		
CO2	Ability to develop/implement the design with appropriate techniques, resources and contemporary tools and deliver solution with stipulated planning.			3		3		1		3		3
CO3	Ability to work independently.											3
CO4	Ability to work in collaboration/multidisciplinary environment.						2					
CO5	Ability to exhibit integrity and ethical behavior during preparation of Technical document/Report.										3	
CO6	Ability to use formal and informal communications with guide, make presentations and prepare technical document.								3			

RUBRICS

Criteria	Excellent	Good	Average
Domain Knowledge / Technical Skills CO 1 : 1,2,4,7,9 CO2 : 3,5,7,9	• Apply domain knowledge in design and development of IT problem effectively	• Acquired domain knowledge and applying the domain knowledge in solving most of the IT problems	• Shallow acquisition of domain knowledge • Guidance is required to apply the knowledge in solving IT problems
Ability to work independently and reflective learning CO 3: 11	• Student worked independently with minimal guidance. • Student able to identify mistakes and learn from mistakes	• Student worked independently with minimal guidance	• Student worked with more dependence on guide

Working in collaboration/multidisciplinary environment. CO 4: 6	• Demonstrated proficiency in interacting and communicating with co-intern/team managed and resolved conflicts in an effective manner	• Demonstrated an acceptable ability to interact and communicate with co-intern/team; adequately managed and resolved conflicts	• Exhibited little ability or willingness to interact and communicate with co-intern/team; could manage or resolve conflicts, and/or often antagonized others

RUBRICS

Criteria	Excellent	Good	Average
Written Communication CO 5: 10	• All the necessary information is included. • Report organized according to the given template and submitted within the deadline. • Adhered ethical and code of conduct of the organization	Necessary information is included with some irrelevant information. Report partially follows the given template and submission exceeds the given deadline. Mostly Adhered ethical and code of conduct of the organization	• Important information is left out. • Not followed the template guidelines. • Not followed the ethics and code of conduct of the organization

| Oral communication CO 6 : 8 | • Work assignments were presented in a logical, interesting, and effective sequence
• Presentations used effective graphics to explain and reinforce the information presented
• Spoke in a clear voice and used correct, precise, informative | • Work assignments were presented in a sequence that the audience could follow
• Graphics supported and were related to the work assignments, intern used good voice dynamics and clearly enunciated terms;
• Was comfortable for the most part and adequately answered questions | • Presentations could not be understood because there was no logical sequencing of information
• Used superfluous or no graphics, mumbled/spoke too quickly
• Could not answer basic questions |